EXCHANGE RATE APPRECIATION, COMPETITIVENESS AND EXPORT PERFORMANCE:
THE UK EXPERIENCE IN THE INTER-WAR PERIOD

by

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ABSTRACT

Title: Exchange Rate Appreciation, Competitiveness, and Export Performance: the UK Experience in the Inter-War Period

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This thesis principally studies the determination of UK export performance between the wars. Several improvements to the measurement of sterling's nominal and real effective exchange rate in the period are implemented, and the path of the exchange rate is related to UK and foreign exchange rate policies. The nature of competitiveness and the demand and supply mechanisms by which it may influence exports are discussed. In the light of this, and the commodity and geographical breakdown of UK exports, we suggest alternative measures of competitiveness which may appropriately be tested in econometric work.

Aggregate UK export volume and price equations for the inter-war period are then estimated. Competitiveness, which is in turn influenced by the exchange rate, and the economic position of primary producing countries, are found to have had significant effects on UK export performance. Similarly specified equations are estimated for UK exports in eight industrial sectors. Distinctive characteristics of sectors may lead to substantial divergences between sectoral and aggregate behaviour. This is confirmed in further work on UK coal exports. Nevertheless, measures of the price of UK exports relative to the price of exports of other industrial countries generally give explanations of UK export performance which are superior to other competitiveness measures.

A substantial statistical appendix containing data on, inter alia, UK and foreign exchange rates, trade volumes and values (with geographcial and commodity breakdown), labour costs and prices, together with the sources and methods used in their construction, is provided both for historical interest and to facilitate replication of results and further research.

CONTENTS

Chapter One

INTRODUCTION

I. Summary

This is principally a study of the determination of UK aggregate export performance between the wars. The main initial hypothesis is that "competitiveness"[1] had an important impact on export volumes. In turn, the main exchange rate fluctuations in the period, especially the return to the Gold Standard at £1 = $4.86 in 1925, and also the departure from gold in 1931, were significant influences upon export competitiveness. In addition, we suggest that the deterioration in the economic position of primary producing countries in the late 1920s/early 1930s affected the UK particularly adversely.

Several other matters of historical interest are discussed. Based on theoretical and empirical discussion, we suggest various improvements to the measurement of sterling's "effective" exchange rate in this period. The precise nature of competitiveness is discussed further, suggesting various alternative measures for inclusion in econometric testing and the demand and supply mechanisms by which competitiveness may take effect.

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1. "A change in industrial competitiveness is defined as occurring when costs in the domestic economy rise or fall in relation to costs in the economies of its major trading partners." (McAleese (1981) p.1), or "competitiveness may be defined as the advantage in price, speed of delivery, design, etc., which enables a company or country to gain sales at the expense of its competitors." (Enoch (1978) p.181).

Following the estimation of aggregate export volume and price equations, similarly specified equations are tested on UK exports in eight major industrial sectors. This was intended both to provide results of independent usefulness and to test whether evidence supportive of the aggregate export volume equation is available. The latter objective was only partially met; export performance in different sectors appears to have been responsive to changes in world demand and competitiveness to widely divergent degrees. Further work on UK coal exports again suggested that key characteristics of the sector distinguished sectoral behaviour from the aggregate, and provided data on unit costs and prices which may be of use in future research. Finally, we return to the estimated volume and price equations and, using these as a framework, we quantify, roughly, the importance of the changes in key independent variables which we measured as occurring during the period for exports and employment. We begin, however, by putting the central part of the study in two contexts; current economic debates, and those of inter-war economic history.

II. General Issues

This study was initially motivated by observation of the appreciation of sterling between 1977 and 1981. The appreciation did not coincide with any improvement in the relative cost or price position of the UK measured in local currency (the reverse was the case) so that a substantial loss of competitiveness occurred.[1] Throughout the post-war period up to 1972, sterling had struggled to maintain its fixed parity. The last examples of substantial and prolonged rises in the sterling exchange rate may be found in the inter-war period; in association with the return to the Gold Standard in 1925, and again in 1933-4.

Several commentators believed, both at the time and subsequently,[2] that the high valuation of sterling was in part responsible for the level of unemployment in the later 1920s. This study focuses upon UK export performance, using some of the conceptual apparatus - in particular the construction of effective exchange rates, measures of competitiveness, and similarly specified export equations - employed in current analysis. Exchange rate policy also probably influenced UK imports,[3] but the break in behaviour caused by the introduction of general import protection in 1932 made a similar equation-based study very difficult.[4]

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1. Between 1977 and 1981, the effective exchange rate for sterling appreciated by 17%. Competitiveness weakened by 25% (according to a relative export price measure), and by some 58% according to a measure of relative unit labour costs adjusted for cyclical fluctuations in productivity ("normalised"). See IMF (1986) pp.106 and 682.

2. See Keynes (1931) and the introduction to Pollard (1970). See in particular the Report of the Committee on Finance and Industry (Macmillan Committee) (1931) pp.94 and 106, and, inter alia, in the Minutes of Evidence, vol.II, the exchanges between the Chairman, Keynes and Stewart (pp.184 et seq.), and between Keynes, Sprague and Norman (pp.303 et seq.).

3. Equations for imports, particularly of manufactures, typically contain competitiveness terms: see e.g. Bank of England (1979) pp.26-32; Thomas (1981) p.342. However, Matthews (1985) p.12. failed to find a significant effect.

4. For discussion of the measurement of "effective" protection in this period, see Capie (1978), Foreman-Peck (1981) and Capie (1981).

Two broad groups of issues lie within our sphere of interest: those of interest to economic historians, and those of principal interest to modern economists.

The first historical issue is the extent to which the return to the Gold Standard may have been responsible for unemployment. We calculate the consequent loss of competitiveness and export volume, and calculate the direct implications for employment in Chapter 8.[1]

In a wider perspective, we join the debates on the causes of the slump after 1929,[2] and the factors underlying the UK economic recovery in the 1930s.[3] We estimate the influence of fluctuations in worldwide activity and, in the latter case, the (temporary) improvement in UK competitiveness after 1931.

The study is also a contribution to the widespread efforts to construct macroeconomic models for the inter-war period. Those extant at present do not have fully satisfactory trade sectors;[4] improved specification in this area would contribute to discussion of historical/counterfactual questions (e.g. Thomas' examination of the practicality of the Liberal proposals at the 1929 General Election to expand public expenditure).[5]

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1. Exchange rate changes may affect employment through a variety of mechanisms; see section III below.

2. See e.g. Wright (1981) pp.291-298.

3. See Bank of England Panel of Academic Consultants (1984), Dimsdale (1984b) and Worswick (1984b).

4. See for example Thomas (1976) and (1981), Matthews (1985) and the less detailed equations in Hatton (1985b). Broadberry (1986) presents a variety of equations in key sectors. See also pp.174-178 below.

5. See Thomas (1976) chapter VII.

The principal economic issue to which we contribute is the extent to which changes in measured price or cost competitiveness affect export performance. Estimates using alternative measures for the UK from the inter-war period form a useful addition to post-war estimates for the UK and other countries.[1]

A second issue concerns the extent to which UK prices relative to those abroad could be changed by government policy, in particular by exchange rate changes. Scandinavian-type models assume that the world prices of tradeables in foreign currency are given to a small country.[2] We would not expect such a model to be strictly applicable to the UK in the inter-war period, and in chapter 5 report both other evidence from the post-war period and estimates from inter-war suggesting that UK export prices were not wholly determined by world prices.

Both issues are relevant to the more general debate concerning the applicability of Purchasing Power Parity (PPP). PPP as a positive theory of exchange rate determination on the period of floating exchange rates prior to 1925 has already been investigated.[3] Here we attempt to measure the effects of predetermined exchange rate changes on trade performance and prices. But if PPP is reinterpreted as a theory of price determination, the results in chapters 2 and 5

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1. See chapter 3 for a survey of results obtained in this area.

2. Brown and Bond (1980) describe results obtained in terms of this type of model on UK trade prices. Scandinavian, or perfect substitutes, models still permit an exchange rate to change competitiveness if the relationship between prices of domestic tradeables and non-tradeables can be altered, via the supply side: cf. pp.95-97.

3. See, for instance, Clements and Frenkel (1980) and Hodgson (1972).

chapters 2 and 5 are of particular interest.[1]

The "weak" form of the theory suggests that "relative" PPP is an equilibrium condition,[2] and that the process by which equilibrium is reached is of importance. "Microeconomic" accounts allow for arbitrage in international goods markets; exporters from relatively high-price countries may eventually be forced to cut prices to achieve sales. Alternatively, or additionally, lost demand for exports resulting from high prices may lead to outflows on current account and entail a depressing macroeconomic influence on prices. In either case, the link between observed competitiveness and trade performance plays a central role.

III. The Context of Exchange Rate Policy: Activity and Unemployment Between the Wars

Persistent unemployment formed a key criterion by which policy decisions taken in the inter-war period were and are judged. The relationship between unemployment and the depression in the exporting

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1. In particular, the observed tendency of relative prices to adjust following a shock; see pp. 62 et seq.

2. For definition and discussion of "strong" and "weak" forms of PPP, see Williamson (1983) pp.212-217. Williamson notes that PPP will not give an equilibrium if economies between which the comparison is made experience real, rather than monetary, shocks. It may be argued that the UK experienced a number of unfavourable shocks in the 1920s, e.g. that its industrial structure was less appropriate to post-war than pre-1914 patterns of demand, and that a lower exchange rate was appropriate than that given by strict PPP comparisons with 1913 or 1924. We do not use PPP in this prescriptive sense in this study, although the association of weaker competitiveness with weaker trade performance may be suggestive.

staple industries was noted at the time.[1] The exchange rate was of especial relevance to four aspects of inter-war activity and unemployment, while the performance of the external sector more generally related particularly to (i), (ii)(a) and (iv) below.

(i) Direct Macroeconomic and Global Implications of Exchange Rate Policy

A return to the Gold Standard, at the pre-war parity of 77s 9 3/4d per ounce of gold,[2] was an early objective of post-war economic policy.[3] This necessitated a degree of deflation (in the sense of policy designed to reduce prices); Keynes feared that the process by which wage costs were to be reduced relative to those of the United States would entail substantial unemployment.[4]

There are several counter-arguments to this view. First, various calculations have been presented suggesting that sterling was overvalued by rather less than the often-quoted figure of 10%.[5] A

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1. See e.g. Chapter 5 of the Report of the Committee on Finance and Industry (1931).

2. The Bank of England bought gold for 77s 9d an ounce and sold it for 77s.10½d (See Committee on Finance and Industry Final Report (1931), p.18).

3. See p.50 and Committee on Currency and Foreign Exchanges after the War (1918) p.11.

4. See Keynes: "The Economic Consequences of Mr.Churchill" (1931) (reprinted in Keynes (1951)), and "The Committee on the Currency" (1925). See also Committee on the Currency and Bank of England Note Issues (1925) p.5, which warned of "temporary but possibly severe" inconveniences and of deflation.

5. Cf. Howson (1975) p.30 and Moggridge (1969), p.73.

smaller burden of adjustment could be eased by rising prices in the US resulting from gold inflows.[1] Second, it was argued that increased stability of the global trading and financial environment would stimulate world trade and hence UK exports.[2] Although the difficulties of adjustment might have been reduced by returning to gold at a lower parity, this could have reduced confidence in the currency in trade and in financial markets, and would have reduced the value of debts owed to Great Britain in sterling.[3] Furthermore, other countries which stabilised their currencies later than the UK might have done so at even lower rates had sterling been more competitive.[4]

The potential conflict between easing domestic adjustment and promoting a more stable world environment is also relevant in consideration of the departure from the Gold Standard in 1931. Although UK competitiveness improved in the short-term,[5] the British action contributed to the chain of devaluations which followed, most notably the US in 1933/4 and France in 1936.[6] It is, however,

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1. See Moggridge (1969) p.30 and p.64.

2. Moggridge (1969) p.4 reports this as Niemeyer's view. Committee on Finance and Industry Final Report (1931) pp.19 et seq notes that the international Gold Standard system had a role in preserving reasonable stability of international prices. See also Tomlinson (1981) chapter 4.

3. See Committee on Finance and Industry, Minutes of Evidence, vol.II, pp.96 et seq. for Niemeyer's defence of the return at the pre-war par.

4. See e.g. Norman's view in Committee on Finance and Industry, Minutes of Evidence, vol.II, p.304.

5. See chapter 2, Table 2.4.

6. Cf. Table SA.1. See also League of Nations Report on Exchange Controls (1938) pp.10-11.

difficult to disentangle any depressing effect on world trade which may have been brought about by financial disruption from the effects of the swing to protection, in which the UK also played an important role.[1] Moreover, the devaluation was insufficient to prevent further falls in UK wages and wholesale prices after 1931.[2]

Quantification of the level of unemployment (or the extent to which demand had to be lowered relative to potential output) required to achieve a given fall in prices and wage costs lies outside the scope of this study. The possible consequences of higher interest rates are discussed further in section (ii) below, while the direct contribution of the exchange rate on employment via export performance is a recurrent theme. Moggridge (1969) calculates the rise in unemployment necessary to maintain balance of payments equilibrium, rather than price equilibrium, but obtains an answer which appears implausibly large both in terms of the actual level of unemployment in the 1920s and the weaker trade performance/higher interest rates which ensued.[3]

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1. Lewis (1949) p.85 claimed that Britain "must bear the blame for setting the fashion". Foreman-Peck (1983) p.213 and Kindleberger (1973) pp.133-4 attribute some importance to the US Smoot-Hawley tariff of 1930.

2. See Tables SA.2, SA.8 and SA.9.

3. See Chapter 8, pp.355-8, and Moggridge (1969) pp.91 et seq. Foreman-Peck (1983), pp.234 and 257, provides a lower estimate (1.03 million loss of employment).

(ii) The macroeconomic role of deficient demand

The extent to which inter-war unemployment was a product of deficient demand has been much debated.[1] We may subdivide the possible sources of the defiency thus:

(a) the foreign sector (demand for UK exports - imports);

(b) domestic demand:

- (b1) the personal sector (consumption; residential investment);
- (b2) the corporate sector (business investment);
- (b3) government.

(a) The Foreign Sector

We discuss extensively the role of movements in competitiveness, and in particular the loss of competitiveness associated with the return to the Gold Standard, in influencing unemployment.[2] Another external shock, the world slump after 1929, has several relevant aspects. We consider in detail the implications for the UK of the slump in the value of primary producing countries' exports brought about by the fall in primary product prices in this period.[3]

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1. Some alternative supply-side arguments are discussed in sectin (iii) below. Hatton (1982) and Broadberry (1986), p.106, among others, broadly belong in the "Keynesian" camp, while Howson (1981) pp.284-5 takes an eclectic view. For Keynes' own view on the role and behaviour of wages, see Keynes (1936) chapter 19.

2. See in particular pp.355-9 and Tables 8.1 to 8.3, 8.7 and 8.9.

3. See pp.359-363, Tables 8.1 to 8.3, 8.8 and 8.9. Cf. Latham (1981) pp.87-94. Lewis (1949) noted that the crash in primary product prices prolonged the slump by inducing bank failures, forcing the primary producers off gold, and generally reducing confidence (see his Chapter IV).

Beenstock, Capie and Griffiths (BCG) (1984) argued that the fall in world prices which resulted was the proximate cause of a rise in real wages to which they attached much of the blame for sharply higher unemployment.[1] Capie, Mills and Wood (CMW) (1985) interestingly examine (but reject) a financial, as against real economy, effect of the slump in primary product export values: the possibility that lower Empire sterling balances held in London helped force the UK off the Gold Standard in 1931.[2]

(b) Domestic Demand

Here the focus of attention has been on the capacity of government policy to influence demand either directly or through the personal or corporate sectors. The actual and prospective role of fiscal policy was probably limited in this period by the overall size of government expenditure relative to GDP.[3] Prior to 1931, exchange rate considerations would have constrained a markedly looser fiscal policy.[4] After 1931, fiscal expansion, had it occurred, might have had unfavourable side effects, by reducing overseas confidence and hampering the "cheap money" strategy in the 1930s,[5]

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1. BCG (1984) p.66. See also the Introduction to Bank of England (1984).

2. CMW (1985) p.12.

3. Feinstein (1972) Table 5, p.T16.

4. See e.g. Thomas (1976) chapter VII.

5. Worswick (1984a) p.18 notes the first argument. He argues that the second was less important (p.20), though a higher budget deficit combined with higher interest rates might have altered the consumption/investment mix in the recovery.

but fiscal policy appears instead to have exerted a neutral or contractionary influence.[1]

Most of the discussion on government policy has centred on monetary policy. The change in exchange rate regime in 1931 marked a turning point. The UK experienced generally high nominal interest rates in the 1920s,[2] implying even higher real rates given the downward trend in prices.[3] A high level of Bank Rate supported sterling both by attracting foreign funds and exerting a depressing influence on the domestic economy and thence on prices and costs.[4] After the departure from the Gold Standard, the need to defend the exchange rate disappeared, and Bank Rate was rapidly reduced to 2%.[5] This contributed to a reduction in long rates as well, though there is some debate as to whether the Conversion of War Loan from 5% to 3.5% in 1932 had an independent influence.[6]

Worswick (1984a) argued that departure from the Gold Standard was crucial in the "cheap money" strategy, and suggests that certain interest-sensitive items of expenditure were important in the UK recovery. Consumption, Private fixed investment and Residential

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1. Middleton (1981) argued that there was a tightening of policy in the depression. Broadberry (1986) pp.151-2 suggests that, adjusting for price changes as well as the economic cycle, fiscal policy was broadly neutral in the 1930s.

2. See Broadberry (1986), p.28; Sheppard (1971) Table (A) 3.7.

3. See e.g. Statistical Appendix, Table SA.2.

4. See e.g. the discussion between Keynes and Norman in Committee on Finance and Industry (1931) Minutes of Evidence, vol.I, pp.212 et seq. Keynes claimed the domestic mechanism was important; Norman stressed the international mechanism.

5. Worswick (1984a) p.19.

6. Sedgwick (1984) p.45.

investment could all fall in this category. But despite favourable developments in the terms of trade, the share of consumption in GDP fell during the recovery.[1] Worswick attaches considerable importance to the revival in housebuilding in 1932 in advance of the wider recovery, which could have had a considerable multiplier effect.[2] Business fixed invetment also staged a steady revival.[3]

There were, however, other factors which contributed to the revivals in business and residential investment. As regards the latter, easier mortgage terms (and higher real incomes for those in work) facilitated house purchase, while downward stickness in private rents provided an increased incentive to purchase.[4] Mortgage interest rates were relatively slow to decline.[5] Non-interest rate factors may therefore have been more important than lower interest rates and hence monetary policy.

Business investment was also subject to other stimulatory influences. Protection, securing the home market, may have been helpful. Some have argued that structural change may have provided an unusually wide array of investment opportunities.[6] Profitability

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1. Feinstein (1972) Table 5, p.T16.
2. Worswick (1984a) pp.12-13.
3. Feinstein (1972) Table 5, p.T16.
4. Sedgwick (1984) p.47.
5. Sedgwick (1984) p.47.
6. For example the opportunities created in the electrical industry by the National Grid; Catterall (1982) p.244. But Alford (1981) tends to play down the role of new industries; pp.314-317.

improved in the 1930s.[1] The gradual recovery in activity, and the turnround from falling to gently rising prices, may also have contributed to stronger business expectations.

We therefore conclude that although the departure from the Gold Standard contributed to "cheap money",[2] the role of this in the recovery is difficult to quantify, since both housebuilding and business fixed investment, which revived strongly, were subject to other helpful factors; the timing of the rise in housebuilding does not support the primacy of interest rate factors.

(iii) The macro-economic role of "excessive" real wages

The original[3] but contentious[4] contribution of BCG (1984) was to suggest that a sharp rise in real wages in 1929-31 lay behind the simultaneous rise in unemployment. The subsequent moderation of real wages, and associated rise in profits, was crucial in the subsequent recovery. The economic theory underlying this proposition is outlined in Michael and Urwin (1986)[5]. However Worswick countered

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1. See for example Hart (1965) p.21. This development also relates to the "supply-side" type arguments in section (iii) below.

2. Eichengreen and Sachs (1984) suggest a more general international link between devaluation and lower interest rates.

3. Although even in the 1930s there was debate as to whether wage cuts would be helpful. See, e.g. Keynes (1936) (Appendix to Chapter 19).

4. Bank of England (1984) p.1 notes that the BCG paper "generated much discussion".

5. Michael and Urwin (1986) pp.1-18.

that it was difficult to explain why real wages were too high and why they subsequently moderated.[1]

The external sector could help explain both phenomena. The world depression from 1929 administered a severe downward shock to prices as well as activity;[2] this downward movement in prices could then have contributed to adverse supply-side effects via lower profitability. The devaluation of 1931 probably reduced own product real wages below what they would otherwise have been,[3] notwithstanding rises in living standards associated with improvements in the terms of trade. The fall in UK relative unit labour costs in 1931/2 also suggests that devaluation was effective in this sense (and the subsequent rise probably stemmed from devaluation elsewhere rather than real wage stickiness in the UK).[4]

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1. See Worswick (1984), pp.13-15.

2. See BCG (1984) p.69; they suggest that the fall in manufactures prices was unanticipated.

3. Eichengreen and Sachs (1984) found a positive relationship between exchange rates and real wages in a cross section of countries in the 1930s.

4. See Table SA.13. BCG (1984) attached little importance to the exchange rate change (see e.g. p.70).

(iv) Microeconomic aspects: sectoral and regional unemployment

There was a powerful sectoral/regional dimension to unemployment between the wars. Table 4.2 (in chapter 4) shows the dramatic increase in unemployment in several of the traditional exporting industries, notably steel and coal in the early and mid-1920s and textiles later in the decade. These industries remained relatively depressed in the 1930s,[1] while employment recovered in a broader range of manufacturing, construction and service industries. The implications for regions in which the depressed industries were centred, notably Wales and the North East, were serious. Table 1.T1 shows the massively unfavourable shift in the position of Wales in the period.

Table 1.T1: Unemployment in Selected Regions, 1923-27
(% of insured people, annual averages)

	1923	1924	1925	1926	1927
South-East	9.2	7.5	5.9	5.4	5.0
Wales	6.4	8.6	16.5	18.0	19.5
North-East	12.2	10.9	15.0	17.2	13.7
Northern Ireland	18.2	16.6	23.9	23.2	13.2
Great Britain and Northern Ireland	11.7	10.3	11.3	12.5	9.7

Source: Abstract of Labour Statistics (1936/7) p.59.

1. Except iron and steel post-1935.

Various interpretations of the influence of the exchange rate on the structure of the economy may be advanced. The rise in the exchange rate in the 1920s probably contributed to the shake-out in the older industries (what might be termed the "cold bath" hypothesis).[1] The results in chapters 6 and 8 in general suggest that the competitiveness advantage gained in the 1930s was in most sectors of insufficient size and duration to have a lasting impact; growth in the more successful sectors tended to be "home grown".[2] Conversely, even a lasting and sizeable real devaluation would have been unlikely to reverse the decline in the coal and cotton textile industries.[3]

IV A Note on Methodology

Although we present a considerable quantity of econometric work in chapters 4 to 7, we retain a degree of scepticism concerning econometric results which is amply justified by the nature of the data available to economic historians.[4] We accept as principal duties of the economist the measurement of economic phenomena, and the provision of data to replicate and build upon research results obtained.

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1. Andrews (1980a) and (1980b) also discussed the relationship between competitiveness and sectoral performance.

2. Perhaps aided by easier monetary policy and protection - the "feather bed" hypothesis.

3. See e.g. Table 6.1 and equation (7.5), suggesting that both industries were subject to strong adverse time trends.

4. See for example Mayer (1980) and Wardley (1985).

It is of interest in economic history to assemble and experiment with new measures (or more modern measures which were not constructed by contemporaries), and to use previously unused data. Hence, for example, in chapter 2, the earlier work of Redmond and Dimsdale[1] on "effective" exchange rates is confronted with the most modern conventions. The measurement of "competitiveness" is central to this study. Measures of unit labour costs have been constructed, both for the economy as a whole and for the coalmining sector, relative to other countries, and both with and without adjustment for cyclical variations in productivity.[2] The measures were constructed from various alternative data sources on earnings, output and productivity. Similarly, a variety of measures of domestic price and cost pressures on UK export prices (in turn a key competitiveness variable) were constructed and tested in chapter 5. Our approach to choice of measures is derived in part from that of Enoch (1978); where alternative measures can each be shown to have theoretical advantages and disadvantages, they should be tested for their empirical merits in helping to explain that which they are supposed to affect - for example trade performance. Alternative measures may, however, be of separate use in mutually corroborating trends - or, where divergent, in indicating historical episodes which may be used to distinguish between hypotheses.

A few additional points should be made concerning the data

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1. See Redmond (1980), Dimsdale (1981) and pp.42-44 below.

2. On the importance of the last point, see Enoch (1978). See also Tables SA.13, SA.29 and SA.30.

constructed here. First, data published between the wars may not have been constructed with modern theoretical and practical concepts in mind - naturally, since the theory of construction of effective exchange rates and competitiveness indices has grown considerably.

Second, it was much more difficult between the wars than at present to construct international series: single data series combining comparable separate series for individual countries. The weighting schemes used in this process are of considerable importance.[1] In particular, measures of international activity and world trade weighted according to UK trade patterns can now usefully be built up from inter-war raw data.[2]

Third, several of the existing primary and secondary data sources have not previously been connected. For example, we link League of Nations data on distribution by country (% shares) of countries' exports and imports to data from Maddison (1962) on total trade volumes to provide a simple matrix of world trade,[3] which could be useful in further quantitative research.

The process of data construction yields several important conclusions. For example, we show in chapter 2 that the appreciation of sterling implied by the return to the Gold Standard at the pre-war parity in 1925 was small relative to that which had occurred in the previous few years (although the appreciation from 1920 onwards was based in large part on the expectation of a return to the Gold

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1. Cf. chapter 2 and Table 2.1

2. Cf. pp.415-8, 473-81.

3. Table SA.6 provides a simplified version of this.

Standard.[1] Nor was it obviously true that, in price or cost competitiveness terms, the UK failed to adjust to the higher exchange rate.[2]

The econometric results which we report in chapters 4 to 8 are inevitably conducted with data of variable quality over a limited observation period.[3] This severely limited the techniques which could usefully be applied, the dynamics which could be examined, and the "nested" hypotheses which could be tested. The results, like those from other modelling work on the inter-war period, should therefore be treated with handfuls of salt. We have, however, placed considerable emphasis on prior examination of the data and the historical context to guide choice of specifications. The most important econometric results are in general tested in considerable detail, using alternative measures of explanatory variables. We aim at widespread corroboration of what in isolation would be frail quantitative results. Moreover, the results obtained enable us to claim a considerable advance in explanatory power over previous work,[4] although this frequently serves mainly to illustrate scope for further research.

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1. See e.g. Moggridge (1969) pp.61-2; Aliber (1962) especially pp.194-197; Redmond (1984); and on the implications of the rapid appreciation in 1921, Broadberry (1986) pp.121 et seq.

2. See Tables 2.3 and 2.4, which suggest that by most measures the UK was more "competitive" in 1930 than in 1924.

3. For example, the estimation work on UK aggregate export volumes in chapter 4 had to be carried out on annual data from 1924 to 1938.

4. E.g. comparing the results obtained in chapter 4 with those of other researchers reported on pp.174-78.

V. Plan of Study

We begin by charting the course taken by the UK exchange rate. Chapter 2 discusses recent attempts at measuring sterling's "effective", or average, exchange rate against other currencies. The theory underlying these measures is considered, and an alternative measure which improves on existing indices in several important respects is developed. After construction of the nominal effective exchange rate, we examine various possible measures of the "real" effective exchange rate, adjusting the nominal rate for movements in relative costs and prices.

Chapter 3 surveys some of the literature on the theoretical links between exchange rate changes, competitiveness and export performance, and discusses empirical work in this field for the UK and other countries in the post-war period. Chapter 4 then provides an empirical analysis of UK export volumes between the wars, relating UK exports to changes in world trade and UK competitiveness. The elasticities obtained suggest that exchange rate and export price changes were of particular importance in this period. We also focus on the effects of changes in the trading position of primary producing countries, which constituted important markets for UK goods.

Chapter 5 examines part of the process by which competitiveness itself is determined by analysis of UK export price formation. We find evidence that UK domestic prices had a significant influence on UK export prices, confirming the result suggested in chapter 2 that variations in the nominal exchange rate were likely to affect UK competitiveness by changing the relationship between domestic and foreign prices, hence influencing foreign demand for UK exports.

In chapters 6 and 7, we examine exports in key industrial sectors, and coal in particular, using equation specifications derived from the best-fitting aggregate equations, although also allowing for patterns of trade and competition specific to each sector. This analysis did not provide strong corroboration of the aggregate equations, but produced interesting results in some individual sectors together with a variety of new data. Some of the variations in results could be explained by reference to individual characteristics of the sectors, notably the importance of foreign industrial production, rather than world trade, in determining UK coal exports.

Chapter 8 draws out some further implications of the results obtained in the previous four chapters. Given the preferred equations obtained, we quantify the effects on aggregate exports, export prices, and exports in certain key sectors, of the major changes in exchange rates and other explanatory variables that occurred in the period. We tentatively estimate[1] the consequence of some of these changes for employment in the UK. In chapter 9, we summarise more general conclusions arising, ending with some suggestions for related further research.

The Statistical Appendix which follows gives the methodology and sources used in construction of the data series. The series used in regression work are discussed and tabulated approximately in the order in which they are used in the remainder of the study.

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1. Cf. Moggridge (1969) pp.91 et seq. and Wright (1981) pp.304-305.

Chapter Two

THE UK EXCHANGE RATE IN THE INTER-WAR PERIOD

I. Introduction

The role of the sterling exchange rate in several economic mechanisms important in the inter-war period suggests that the extent of the sterling appreciation in the 1920s and the fluctuations in the 1930s should be measured. The principal difficult to be confronted is the volatility of other currencies during this period; we therefore gauge movements of sterling against a number of foreign currencies in a single measure, the Effective Exchange Rate (EER).

First, the current literature concerning the construction of EERs is reviewed, in order to select the most appropriate methods of construction. Various weighting schemes are then used to construct EERs for sterling for the inter-war period. Comparison is made with two recent studies using annual data. In this study, additional information is obtained from quarterly data, and indeed monthly series are calculated. The history of the nominal exchange rate is then recounted briefly, focussing on points at which the sterling/dollar and EER narratives differ. Finally, the courses of measures of competitiveness or the real exchange rate, some derived from the discussions in chapters 3, 4 and subsequently are examined.

The principal conclusions are as follows;

(1) In constructing an EER measure for sterling in the inter-war period which is primarily concerned with gauging the effects of exchange rate changes upon export competitiveness, a simple procedure is to accord weights to foreign countries in the index according to

their share of global manufactured exports. (Some additional, more technical, conclusions are also drawn.)

(2) "The Return to Gold" at the pre-1914 parity of $4.86 21/32 per £1 at the end of April 1925 did not imply a large step change in the exchange rate. Monetary policy had, as Donald Moggridge (1969) and Susan Howson (1975) have described, been geared for some time towards deflating the economy, appreciating the exchange rate and accumulating the gold reserves needed to maintain it. In addition, there was frequent exchange market speculation on the prospects of a Return to Gold. The Budget decision of 1925 entailed a rise of only 5 or 6 cents (less than 2%) in the value of the £.

(3) It is inadequate to look only at the sterling-dollar rate in the inter-war period: the exercise of constructing various EERs is amply justified. There were considerable fluctuations in exchange rates in Europe with serious implications for UK competitiveness; in particular, the overall appreciation of sterling between 1920 and 1926 was several times greater than its appreciation against the dollar alone. In the 1930s, although sterling stood at or above its 1925-31 parity against the dollar from the end of 1933 until 1938 Q3, its overall level remained below that prior to the departure from the gold standard by the measures compared here. [Redmond (1980) disagrees with this last result].

(4) Conflicting results are obtained when the various measures of competitiveness are compared. Surprisingly, the "wholesale price" measure suggests that the UK gained in "competitiveness" in the 1920s

despite the substantial nominal appreciation that occurred, although we indicate various explanations of this result. The various measures agree, however, that the rise in sterling in 1925 implied at least a short-term loss of competitiveness, and that devaluation in 1931 entailed at least temporary gains.

II. Effective Exchange Rates

1. Introduction

This section first introduces the very general concepts and notation involved in EER construction. The most sophisticated modern basis for constructing EERs, the IMF MERM[1] is then discussed briefly, after which the theoretical problems entailed by using simpler systems are discussed.

2. Notation

e_h, e_i denote the exchange rates of the home currency and of currency i against the numeraire.

e_h/e_i is the exchange rate of the home currency against currency i.

We adopt the "British" convention that e_h is the number of units of the numeraire which equal one of home currency. A rise in e_h, or e_h/e_i, represents an appreciation in h relative to the numeraire or to i.

A bar superscript [e.g. $\bar{e}_h$] denotes the value of a particular exchange rate at the base period. Note that $\overline{\left(\frac{e_h}{e_i}\right)} \equiv \left(\frac{\bar{e}_h}{\bar{e}_i}\right)$;

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1. Multilateral Exchange Rate Model.

EE_h, EE_i denote the effective exchange rate indices for h and i respectively; $\overline{EE}_h$, $\overline{EE}_i = 1$.

m_{hi} = imports into country h from country i

x_{hi} = exports from country h to country i

t_{hi} = total trade between country h and country i

$$t_{hi} \equiv x_{hi} + m_{hi}$$

m_{hi}, x_{hi}, t_{hi} are all in a common (numeraire) currency, and are measured at some common base period.

w_{hi} is the weight attached to currency i in a particular effective exchange rate index for h.

* represents multiplication.

3. An EER defined

EER indices may be defined using either "arithmetic" averaging or "geometric" averaging, as follows:

Arithmetic:

$$(2.1) \quad EE_h = \sum_{i=1}^{h-1} w_{hi} \left(\frac{e_h}{e_i} \Big/ \frac{\bar{e}_h}{\bar{e}_i}\right)$$

$$\text{where } \sum_{i=1}^{h-1} w_{hi} = 1$$

Geometric

$$(2.2) \quad EE_h = \prod_{i=1}^{h-1} \left[\left(\frac{e_h}{e_i} \Big/ \frac{\bar{e}_h}{\bar{e}_i}\right)^{w_{hi}}\right]$$

$$\text{where } \sum_{i=1}^{h-1} w_{hi} = 1$$

Contrary to the practice in Redmond (1984) and Dimsdale (1981), we have preferred geometric weighting in this study. The following arguments for geometric weighting derive both from economic theory and from mathematical properties.

(i) The choice of reference base[1] period is immaterial when geometric weighting is used.[2] A given percentage change in the EER index for sterling between any two dates has the same interpretation whether or not the base period is one of those dates. This property does not hold in general when arithmetic weighting is used. This is a valuable property when a long run of historical data is examined, as in this study, with more than one sub-period of interest.

(ii) Geometric averaging produces the same index figures whether exchange rates are defined as the price of foreign currency in terms of domestic currency or the price of domestic currency in terms of foreign currency (assuming that appreciation is always associated with a rise in the index).

(iii) The key results obtained in chapter 4 estimate UK export volumes in a log-linear specification, requiring the implicit assumption that the elasticity of export volumes with respect to

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1. Reference base period is here defined as that period for which the EER index is defined equal to 100 or 1; it should be distinguished from the weighting base period, i.e. that period used to derive the w_{hi} using e.g. x_{hi}, m_{hi} and other relevant available information.

2. See Annex 2.1. The result is asserted without proof in Maciejewski (1983) pp.523-4.

relative prices (or costs) is constant. If any 10% change in competitiveness has an equivalent effect on trade performance, it is desirable that the property discussed in (i) above holds.

Geometric weighting, using equation (2.2), is accordingly used in calculating all the alternative EER indices discussed in this study. We now consider various alternative weighting schemes, begining with the most ambitious and general conceptual framework - IMF MERM.

4. The IMF MERM

The MERM (Multilateral Exchange Rate Model) attempts to model the effects of exchange rate changes on countries' trade balances, prices, wages, output and employment. In practice, output and employment are assumed held constant by fiscal policy. The original version (MERM1) was expounded in Artus and Rhomberg (1973) and discussed by Dixon (1976). In response to various criticisms, MERM2 was developed and is described in Artus and McGuirk (1981). The underlying philosophy is, however, unchanged.

Summary

The model is medium-term, and compares two states of the world, two to three years apart, neither of which are necessarily equilibria. In the most recent version, 20 countries or country groups are considered along with six types of commodity. Products of the same commodity type produced in different countries are assumed imperfect substitutes in demand.[1] Direct and cross-price elasticities of demand for both intermediate and final products are obtained in each market. Supply elasticities are also included, allowing for costs of production inferred from input-output data. Many of the values taken by the demand and supply elasticities have to be assumed, but empirical evidence is incorporated where available. The model also allows for some feedback from domestic prices onto costs, and in particular wage costs.

Deriving EER index Weights

Within this framework, the weights assigned to each currency in calculating one country's EER are such as to ensure that a set of exchange rate changes bringing about a given change in the EER index have (according to the model) the same effect on the country's trade balance as an equivalent change in its own currency against the numeraire, other exchange rates being held constant.

Suppose we wish to construct an EER index for the UK. MERM tells us that if Germany devalues by 5%, this will worsen the UK trade balance by \$x million; if France devalues by 5%, the UK trade balance will deteriorate by \$y million; and so on for all countries in the model. The sum of effects of a 5% devaluation by all the foreign countries included in the model is assumed equivalent to the effect of a 5% revaluation by the UK, let us say a trade balance deterioration of \$q million. The weight of Germany in the UK EER index is then $\frac{x}{q}$, that of France is $\frac{y}{q}$, etc.

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1. This assumption was first used as the basis for the substantial theoretical work on which MERM came to be founded in Armington (1969a) and (1969b).

Some Practical Problems and Applications

The data requirements to construct a "MERM" for the inter-war period would evidently be impossibly large. But it is useful to consider the conceptual framework a little further, to ascertain how much is lost by using simpler weighting schemes, and what residual faults in the MERM can be ameliorated. To deal first with the criticisms of MERM:

(i) Dixon (1976) points out that invisible trade flows and the capital account are not modelled; the MERM concentrates on trade in goods. The difficulties in modelling such flows are of course considerable. This study has a still narrower focus, excluding specific consideration of UK imports: 1930s-type protection would pose additional complications for MERM.

(ii) The MERM was originally constructed to assess an equilibrium exchange rate structure in 1971. The basic assumption that the process of exchange rate determination is exogenous - in the hands of governments - is not really appropriate for periods of floating rates such as the early 1920s, the 1930s, and indeed the later 1970s. Where exchange rates movements can be anticipated from observable economic variables, agents' behaviour - e.g. in wage demands or export pricing or purchasing - may be very different from the fixed exchange rate case.[1]

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1. Compare the view of Lucas (1976) that models with fixed parameters may not be useful in assessing alternative policy strategies.

(iii) Neither the "initial" nor the "final" position of the international economy need be an "equilibrium" position. It is unclear that the effects of a set of exchange rate changes measured after "two or three years" should be of greater interest than effects after a shorter or longer period. Preferable, though a greater data burden, might be to examine the total effect on trading performance over the full duration of the changes in competitiveness brought about by a given set of exchange rate changes. Of course, where exchange rates are floating, it is difficult to delineate the effects of one particular set of changes.

(iv) The period which separates the states of the world compared by MERM, a fortiori the longer period for study suggested above, is a long one from the perspective of governments. They may not be indifferent to developments (e.g. changes in output, employment and prices as well as the trade balance) within that period.

(v) While an EER index constructed using MERM weights may be a useful summary measure reflecting existing knowledge about the relevant parts of the domestic and world economies, it is not an appropriate index for use in further econometric work on trade determination. MERM includes estimates or guesses of a number of trade elasticities, so that the use of MERM weights (or other model-based weights) in constructing EER or competitiveness indices to be used in this estimation work could build in inconsistencies.

(vi) Since the MERM takes the geographical peculiarities of a particular country's trade into account, it is possible for a given country to have a much higher weight in one country's EER index than in another's. E.g. the UK has a higher weight in Ireland's EER index than in Japan's.[1] Thus, supposing sterling fell sharply, it would be possible for Ireland's EER index to have risen more over a given period than Japan's while at the same time the bilateral rate of the punt against the yen might have declined. Relative movements of MERM-weighted indices are therefore not reliable indicators of the asset-values of currencies. This is not, however, a crucial problem for this study.

Some Contributions of the MERM

Despite these criticisms, it should be clear that MERM1 and MERM2 have made both an invaluable empirical contribution in the 1970s and 1980s and offered more general conceptual insights. Some of these should be highlighted.

(i) The model provides a framework for assessing the relative importance of competition between, e.g., U.K. exports and exports of foreign countries in third markets, and between UK exports and domestic production in foreign countries. These are not easily allowed for in simpler weighting schemes.

(ii) The "feedback" mechanism of prices onto costs incorporated in MERM2, although based on crude assumptions, emphasises that the changes in competitiveness brought about by exchange rate changes are not permanent. Indeed prices and wages may adjust to exchange rate

1. See Bank of England (1981) p.70.

changes more rapidly in some countries than others - so that the same bilateral exchange rate change by two countries against a numeraire may have different implications for their competitiveness.

(iii) The complexity of elasticity and cross-elasticity parameters, demand and supply constraints, input-output data etc. employed by the MERM illustrates some of the simplifications which are to be made in this study. In particular, simpler weighting schemes must be examined to ensure that both sources of competition and sources of demand for (e.g.) UK producers are reasonably approximated.

5. Some Simple Trade-Based Weighting Schemes[1]

Weighting schemes (i) and (ii) below are based on the assumption that the effect on the home country's trade balance of a change in the exchange rate of a foreign currency vis a vis the home currency is solely a function of the foreign country's importance in trade (either with the home country alone, or in the world as a whole).

(i) Bilateral Trade Weights

This scheme assigns weights according to each foreign country's share in the home country's trade:

$$(2.3) \quad w_{hi} = t_{hi} / \sum_{i=1}^{h-1} t_{hi} \qquad \sum_{i=1}^{h-1} w_{hi} = 1$$

These weights can then be inserted into either equation (2.1) or

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1. See Honohan (1979), Rhomberg (1976) and World Financial Markets (April 1979).

equation (2.2). For bilateral weights to capture correctly the impact on trade of a set of exchange rate changes, it is necessary that:

(i) All foreign countries have the same price elasticity of demand for the home country's exports, and the home country has the same price elasticity of demand for its imports from each foreign country.

(ii) Competition between the home country and other countries in third markets can be ignored. If country B devalues against the home currency, country B's exports to and from the home country are affected, but the home country does not lose out to country B in competition in market C.

These assumptions are clearly restrictive. Consider the British inter-war trading pattern, with manufactures dominating goods exports and primary products dominating imports. An appreciation of sterling vis a vis e.g. the mark might affect British exports to primary producing countries (who might increase imports of German goods at Britain's expense) to a greater degree than any shift in bilateral trade between Germany and the UK. Conversely, a devaluation of sterling against the currency of a primary producer might make very little difference to trade volumes; imports of primary products might continue.

To deal with the problems created by (ii) above, the Federal Reserve Board[1] favoured:

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1. See Hooper and Morton (1978)

(ii) Multilateral Trade Weights

Let total exports of country j be

$$\sum_{i=1}^{h} x_{ij} \qquad x_{ij} = 0 \qquad \text{if } i = j$$

Total world exports (or the total of the group of countries to be included in the index) are

$$\sum_{j=1}^{h-1} \sum_{i=1}^{h-1} x_{ij}$$

We exclude exports by the home country from the total, but not exports to it; so the total becomes

$$\sum_{i=1}^{h-1} \sum_{j}^{h} x_{ij}$$

Now

$$(2.4) \qquad w_{hi} = \frac{\sum_{j=1}^{h} x_{ij}}{\sum_{i=1}^{h-1} \sum_{j=1}^{h} x_{ij}} \qquad \left(\sum_{i=1}^{h-1} w_{hi} = 1\right)$$

defines the formula for multilateral export weights.

For a multilateral export-weighted index to forecast correctly the effect on the home country's trade of a set of exchange rate changes, it is necessary that: (i) on the world market the price elasticity of demand for each country's exports is identical: if countries B and C have the same initial share of world trade, a devaluation of 10% by either of them increases their share to the same extent and in each case home country exports are reduced by the same amount;

(ii) If B and C have an identical share of world markets, a devaluation of, say, 10% by either of them against the home currency produces the same overall increase in home country imports, regardless of the initial shares of B and C in home country imports.

Comparing multilateral with bilateral weighting:

(i) If countries have shares in the home country's trade that differ substantially from shares in world trade, bilateral weighting might be more appropriate, particularly on the import side, especially if these differences are due to special factors (e.g. geographical proximity, political ties, or tariff preferences).

(ii) Multilateral weighting schemes will be very similar for different countries; hence EERs constructed with multilateral weights will generally be good measures of asset value (cf. (vi), p.31).

It has been suggested that foreign countries' initial shares in home country imports would be appropriate weights when capturing the effects on imports (and as domestic prices) of a set of exchange rate changes, but given the importance of competition in third markets, some variant of multilateral weighting may be superior in explaining the response of exports to exchange rate changes. Honohan (1979) suggests:

(iii) <u>A Double-Weighted Index</u>

Here, an "import-based" EER index is calculated (assuming geometric averaging) as

$$(2.5) \qquad EE_h^m \quad \prod_{i-1}^{h-1} \left[\left(\frac{e_h}{e_i} \Big/ \frac{\bar{e}_h}{\bar{e}_i} \right)^{w_{hi}^m} \right]$$

with

$$(2.6) \qquad w_{hi}^m = \frac{m_{hi}}{\sum_{i=1}^{h-1} m_{hi}}$$

The "export-based" EER is calculated as

$$(2.7) \qquad EE_h^x = \sum_{i=1}^{h-1} \left[\left(\frac{e_h}{e_i} \Big/ \frac{\bar{e}_h}{\bar{e}_i} \right)^{w_{hi}^x} \right]$$

Weights $w_{hi}{}^x$ are derived from a formula used by the EEC.[1]

Let us first introduce the notation:

$w_{hik}{}^x$ = the weight of currency i in currency h's export-based exchange rate index derived from considering country k's absorption.

$$(2.8) \qquad w_{hi}^x = \sum_{k=1}^{h-1} w_{hik}^x$$

Country h's largest export markets are to be of most importance in $EE_h{}^x$, but in these markets it is competing with all other suppliers to that market - domestic and foreign. Consider the share of France in total UK exports. This share is apportioned between each supplier to the French market (including France itself but excluding the UK) in proportion to their share of total French domestic expenditure (i.e. total French imports plus French domestic production for domestic use). The procedure is repeated for

1. See Robinson et al (1979) and European Economy (1981).

each country importing UK goods; the sum of the shares apportioned to each supplier is that country's weight in EE_h^x (cf. equation 2.7).

Representing the procedure formally, we have

$$(2.9)\quad w_{h.k} = \frac{x_{hk}}{\sum_{k=1}^{h-1} x_{hk}}$$

(the share of British export going to k determines $w_{h.k}$, which is to be apportioned among the suppliers)

$$(2.10)\quad w_{hik} = \frac{x_{hk}}{\sum_{k=1}^{h-1} x_{hk}} \left[\frac{\mu_{ik}}{A_{k}-m_{kh}}\right] \qquad i = 1 \ldots h-1$$

A_k = Total domestic absorption of country k

$A_k - m_{kh} = \sum_{i=1}^{h-1} \mu_{ik}$ where $\mu_{ik} = m_{ki}$ $\qquad i \neq k$

where $i = k$, μ_{kk} = domestic production for domestic consumption.

This double-weighted index postulates consistent behaviour in response to an exchange rate change in home and foreign countries - an attractive theoretical property. Suppose the franc rises relative to all other currencies. The weighting scheme implies that the effect for Britain will be made up as follows:

(i) The switch in Britain out of French products into those of other countries in the proportions which those other countries have of the British market.

(ii) The switch in France out of French production into imports from all countries. The key parameters for Britain are (a) the share which French production has of the French market and (b) the importance of the French market to Britain.

(iii) In all other countries, as in Britain, there is a switch out of importing French goods into purchasing goods produced by other countries in the proportions which they hold of each given market. Again, the key parameters for Britain are (a) the share which the French have of the given market (b) the importance of that market to Britain.

Nevertheless, Honohan (1979) suggests that the result is rather arbitrary given the quantity and quality of the data input required. This problem is even more severe for our historic period.

6. <u>GDP or Trade-Based Weights?</u>

There is a case for giving foreign countries weight in an EER index according to their GDP, as in the ECU basket (see Bank of England (1979)).

(i) Assuming that prices across the world remain fixed, an EER index based on GDP would reflect the average goods purchasing power of the home currency abroad.

(ii) If the output velocity of circulation is equal in all countries, a GDP-weighted index would best reflect the "average price of national monies".

Trade weights will be used in the current study, since:

(i) Foreign currencies have little purchasing power over goods which do not enter world trade;

(ii) Where the composition of countries' GDPs differ, their comparability in common currency is difficult to achieve.[1]

7. <u>Commodity Disaggregation in the Simple Weighting Schemes</u>

One substantial advantage conferred by using MERM-based weights in constructing EER indices in the 1970s as against simple weighting schemes is that the MERM takes account of the commodity composition of countries' tradeable products. My own EER index is constructed so as to take into account only manufactured exports by the foreign countries included; the differences between this index (and the similar index in Dimsdale (1981)) and those constructed without taking account of the commodity composition of trade will be pointed up. Some justification of the principle should be offered:

(i) In the UK case in the inter-war period, other countries' exports of manufactures competed most closely with UK production;[2] UK exports may be characterised as being primarily of manufactured goods. Hirsch and Higgins (1970) indeed assume this to be generally true in constructing EERs for industrialised countries.

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1. For a recent discussion of international purchasing power parities and possible biases and misunderstandings involved, see Hill (1986).

2. Cf. Table SA.14.

(ii) Trade in primary products may be affected by different economic forces. Armington-style product differentiation is less applicable, so that a given world price is more likely to be faced by individual countries. A devaluation may therefore not be effective in altering foreign demand for domestic primary products, although there may still be a supply side effect (Cf. chapter 3).

8. Existing Empirical Studies

Prior to summarising the features of the EER index to be constructed for the UK in this study, we consider further the existing empirical work on EERs in examining the floating exchange rate periods in the 1970s and between the wars.

Comparative Studies of Effective Exchange Rates in the 1970s

Rhomberg (1976) and World Financial Markets (1979) examined movements in differently constructed indices over a common period. Neither could include MERM2 in the comparison. Two features are noteworthy:

(i) If the objective is to replicate the MERM by using either bilateral or multilateral weighting, the decision is close, but for the UK a multilateral scheme was becoming preferable in the mid-1970s.[1]

(ii) The difference made by the choice of bilateral or multilateral trade weights is frequently largest when two countries are very closely linked, or small countries are closely linked to one large country.

1. Rhomberg (1976) pp.105-112.

Previous Work on EERs Between the Wars

Redmond (1980) and (1984) has already devoted some attention to the UK EER between the wars, and (1981) to similarly constructed EERs for other countries. His original UK "composite" EER index considered aggregate goods trade by 28 countries. Bilateral and multilateral weights were averaged using data for 1928, 1935 and 1938 to form "average bilateral" and "average multilateral" sets of weights. These were in turn geometrically averaged to form a composite set of weights; the sum of these weights was made up to 100 by adding the deficiency caused by geometric averaging to the US weight.

While this represents a considerable feat of data collection, and the wide country coverage lends Redmond's results considerable interest, several criticisms may be made:

(i) The procedure used to obtain the "composite" weights is somewhat arbitrary, in particular the augmentation of the US weight (this intuitively seemed low, but the intuition may be based on post-war circumstances). No very clear interpretation can therefore be given to Redmond's composite index.

(ii) Although an attempt is made, by using trade data from three distinct years, to take account of the changing relative importance of different countries in world trade over the period, the fact that the data from different years are averaged means that the weights are not wholly appropriate at any given time. A superior method would be to use chain-indexing, splicing successive portions of a time series calculated using weights appropriate to each sub-period.[1]

(iii) Redmond concentrates upon series using arithmetic averaging (though the (1980) article reports that series had also been constructed using geometric averaging).

In addition, since Redmond uses data referring to all trade of foreign countries, rather than "industrial" or "manufactured" trade, it might be argued that his index does not closely approximate the UK export competitiveness position. Other interesting objectives may be served, of course: given that UK imports inter-war were still principally of primary products, and hence not greatly in direct competition with UK products, the all-trade (and wide country coverage) approach may capture the effect of exchange rate changes on UK import values and on import prices better than an approach based on industrial countries' manufactured trade.

Dimsdale's (1981) study entailed the construction of an EER index more closely related to that introduced in this paper; eleven foreign countries are considered, and weights are assigned to them according to their share of exports of manufactures of the whole group of eleven in 1929. The data on trade in manufactures are taken from Maizels (1963). Only annual changes are considered; by contrast, we picked up considerably greater fluctuations in the exchange rate and in competitiveness when quarterly data were examined. Furthermore, the series is once again calculated using arithmetic rather than geometric averaging; as discussed earlier, this reduces its value

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1. The general theory of chain-linked indices is discussed by Allen (1975), pp.27-33.

considerably in analysing periods of sharp exchange rate changes (especially involving more than two currencies) far removed from the reference base period. Also, 1929 is the only weighting base used, which should induce caution when interpreting results from the early 1920s.

Despite the various criticisms of both these studies, they are of considerable value; both tend to confirm that the general exercise of EER construction is worthwhile. Redmond (1980) found that his various EER indices for sterling were not as divergent as might have been feared, and although the indices reported here which take account only of manufactured exports do diverge somewhat from Redmond's index at points, they are nevertheless closer to each other and to Redmond's indices than to any given single currency comparison. All these indices confirm that an exchange rate policy based around a parity against a single other currency is liable to produce variable results depending on the exchange rate policies of third countries.

9. The "Andrews" EER Index and others

Table 2.1 reports five EER indices quarter by quarter between 1920 and 1938, in addition to an index of the sterling-dollar exchange rate. The weighting schemes used are shown in Table 2.2 and described below.

The exchange rates of a maximum of thirteen countries in addition to the UK are considered in constructing all the series, as follows:

Austria	Italy
Belgium-Luxembourg	Japan

Canada	Netherlands
Czechoslovakia	Sweden
France	Switzerland
Germany	USA
India	

These were the thirteen leading industrial exporters in 1929. It might be objected that to narrow the country coverage in this way is contrary to the spirit of the first two indices, in which no account is taken of the importance of countries' manufactured trade and where data covering more countries are available. However, the principle individual divergent exchange rates are included within this group.

All the indices have been constructed using geometric weighting. This is contrary to the practice of Dimsdale (1981) and Redmond, but in comparing results from alternative country weighting schemes, it is pointless to build in extraneous differences.

(i) Bilateral Weights

This index is constructed with weights given to all the thirteen foreign countries according to their share of UK trade in 1929; the data used are taken from League of Nations Memoranda on Trade etc. One general problem should be noted here: hyperinflation in Germany and Austria combined with extremely rapid depreciation of their exchange rates up to the end of 1923 makes their inclusion problematical.[1] Moreover, the relevance of these exchange rates to the competitive position of the UK would have been very limited. These currencies were frequently not used in international trade, and

1. Even more so if arithmetic averaging is employed; geometric averaging mutes the influence of outlying observations.

various countries developed different practices for alternative valuations of German and Austrian exports.[1] Therefore, up to January 1924, Germany and Austria are excluded, and the weights accorded to the other eleven countries scaled up. The same procedure to deal with the Germany/Austria problem has been adopted for the "League of Nations", "Maddison" and "Maizels-Dimsdale" series.

(ii) League of Nations Network Weights

This index uses multilateral export weights. All thirteen foreign countries are assigned weights according to the share of world trade which they had in 1928; data are from the League of Nations Network of World Trade (1942). An adjustment analogous to that described for the bilateral weighted index was carried out to exclude Germany and Austria before 1924.

Redmond's (1980) composite EER index averages weighting schemes similar to (i) and (ii) above. He constructs multilateral indices based on 1928, 1935 and 1938 data for twenty-eight foreign countries, but the essential characteristic of weighting according to exports of all goods is present. Examination of the bilateral and "League of Nations Network" series should yield an understanding of the behaviour of Redmond's composite.

(iii) "Maddison" Weights

Much of the econometric work on UK exports described in chapters 4 to 7 considers UK costs and prices relative to a

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1. The League of Nations Memoranda on Balance of Payments etc. give details. In 1923, around 60-70% of German exports were paid for in foreign currency (1910-24 Memorandum p.133).

group of nine foreign industrial countries.[1] For eight of these, detailed trade data were available in Maddison (1962). For many purposes in our later econometric work, trade data for Japan were also incorporated.[2] However, here we used "strict" Maddison weights, as used in constructing the "Maddison-weighted" unit labour cost series.[3]

The index assigns weights to the eight foreign countries according to the value of their exports in 1929 (in current dollars), with the usual adjustment to exclude Germany before 1924. The chief sources of difference between this index and the "League of Nations Network" index are therefore:

(a) Narrower country coverage in Maddison: key omissions are India and Japan;

(b) Different weighting base year;

(c) Maddison's adjustments to the raw country trade data.

(iv) Maizels-Dimsdale Weights

The EER index published by Dimsdale (1981) assigned weights to competitor countries according to importance in manufactured exports. Data are from Maizels (1963), referring to 1929, for eleven countries (the thirteen on pp.44-45 above excluding Canada and Czechoslovakia). Dimsdale excluded Germany and Austria before 1925, and also India

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1. The thirteen on pp.44-45 above minus India, Austria, Canada and Czechoslovakia.

2. For details, see pp.409-414.

3. These weights are as given in Table SA.T3, p.437. Despite the exclusion of Japan, "Maddison" - weighted unit labour cost series generally gave best results in regression.

in 1920 only.[1] The "Maizels-Dimsdale" index given here also excludes India in 1920, but only excludes Germany and Austria prior to 1924.

(v) The "Andrews" index

The construction of this index is best understood in terms of the differences between it and the "Maizels-Dimsdale" index. First, Czechoslovakia and Canada are included. Second, India is included in 1920; some inaccuracy may thereby be caused in 1920 Q1. Finally, noting that the pattern of trade and competition in the early 1920s was very different to that later in the period, two different weighting schemes are employed. One index is constructed using weights according to the foreign countries' manufactured exports in 1922 (excluding Germany and Austria); another index is constructed using 1929 weights. Both have January 1924 as the reference base, and the two are spliced at this point.[2]

Table 2.2 shows that the "Andrews" 1929 weights correspond fairly closely to the Maizels-Dimsdale weights. The 1922 data and weights are less reliable than the 1929 weights. But differences from the "Andrews" 1929 weights are still principally the result of changing patterns of trade, and the results are consequently of

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1. The League of Nations Monthly Bulletins of Statistics does not give an exchange rate figure for India in January 1920; that used in other indices in this study has been calculated from the Statist. See p.393.

2. Details of the trade data used in this construction are given on pp.403-407.

considerable interest.

To summarise, the index has the following features:

(a) Thirteen foreign currencies are included;

(b) Germany and Austria are excluded prior to 1924;

(c) Weights are assigned according to the foreign countries' exports of manufactures in 1922 (for 1920 to Jan.1924) and 1929 (Jan.1924 to 1938).

(d) Data principally from the BISC Bulletin.

(e) Geometric weighting.

III EXCHANGE RATE CHANGES BETWEEN THE WARS

1. Policy and Practice: (A) The 1920s

The major features of UK exchange rate policy (and the implied domestic fiscal and monetary policy) are narrated in various places; by Sayers (1976) from the Bank of England viewpoint following on Clay (1957),[1] and by Susan Howson (1975), (1976), (1980) and Donald Moggridge (1969), (1972) from, inter alia, the Treasury documents. Dimsdale (1981) also recounts developments. Nevertheless, the principal features should be recapitulated briefly.

UK prices were largely decontrolled in 1919, and Bank of England intervention maintaining £1 at $4.76 ceased. The full extent of inflation suppressed during the First World War became apparent, and the exchange rate fell to a low point of $3.40 in February 1920. Nevertheless, the Cunliffe Committee, meeting in 1918-19, had recommended that a return to the Gold Standard should be a goal of policy. This goal was accepted by the Authorities, while recognising that some degree of deflation would be necessitated:

> "The prerequisites for the restoration of an effective Gold Standard are
>
> (a) the cessation of government borrowing as soon as possible after the war ...., and (b) the recognised machinery, namely, the raising and making effective of the Bank of England discount rate."(2)

A tight fiscal policy was indeed pursued, and by mid-1922 the Bank of England had recovered control of bond markets and was able to pursue

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1. Sayers (1976) vol.I, chapters 7 and 9; Clay (1957) chapter IV.

2. Committee on Currency and Foreign Exchanges after the War (1918) p.11.

active open-market operations. By early 1923, sterling had been raised to over \$4.60.[1]

A sequence of Bank Rate reductions "... owing to domestic conditions",[2] allied to a movement of funds from Europe to America in the sterling exchange as a result of the collapse of the mark, produced a falling £/\$ exchange rate in 1923. In 1924, the serious deliberation (in the Chamberlain-Bradbury Committee) of the timing of a return to gold began. The fact that the enabling legislation prohibiting the export of gold was due to expire at the end of 1925, together with the return of a majority Conservative government in October 1924, encouraged a speculative rise in sterling very close to the old par level by the turn of the year.[3] This was further encouraged by Central Bank policy on both sides of the Atlantic. An interest differential in London's favour prevailed in the second half of 1924, and credit arrangements to provide a "cushion" for Bank of England intervention were made with New York. The decision to make the return to par was finalised in March 1925 (by which time sterling already stood at \$4.80), and the return was effected by the Budget in April 1925.

Thereafter, the value of sterling was maintained within a narrow band until the crisis in September 1931. The gold standard parity against the dollar implied an exchange rate roughly 10% above the level of 1924 Q2, when the Chamberlain-Bradbury discussions

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1. Returning to Table 2.1, the January 1924 £/\$ rate, representing an index of 100, was £1 = \$4.2591. The gold parity of \$4.8665 represents an index figure of 114.3.

2. Clay (1957) p.140.

3. See e.g. Aliber (1962).

began. The par level was 35% above the level of 1920 Q1.

The UK EER (and competitiveness), as measured here, were powerfully influenced by movements of other currencies. Immediately after the First World War, four groups of major currencies could be distinguished:[1] those on gold (principally the US dollar); those which had depreciated by up to about 25%, for which there was a prospect of returning to the Gold Standard at the old parity (e.g. UK, Netherlands, Sweden and Switzerland); those which had depreciated to a small fraction of their pre-1914 value (notably France, Belgium and Italy); and those suffering from hyperinflation. Germany and Austria, in the fourth group, were stable against the dollar after 1924. In the second group, Sweden regained par in 1922, and the Dutch, Swiss and Canadian exchange rates were all around par by 1925; for each of these countries, an appreciation against the dollar similar to that of the UK in 1921-5 was required.

The key determinant of divergences between the £/$ rate and the UK EER was the behaviour of the third group. Table SA.1 includes annual average values (cents per unit) of the French and Belgian francs and the lira for the inter-war period. Note the decline in value of all these currencies in 1923, when capital was leaving Europe; the further depreciation in 1926 after the UK had returned to gold; and the low levels at which the French and Belgian francs were stabilised.[2]

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1. Cf. Lewis (1949) chapter I.

2. For comparison, the pre-war parity for these two currencies was 19.3 cents to 1 unit.

2. Policy and Practice: (B) The 1930s

The narrative for the 1930s is qualified by various considerations. First, the exchange rates quoted are official exchange rates. In practice, many countries, notably Germany, pursued exchange rate policies which entailed different transactions taking place at different exchange rates. Tight exchange controls ensured that foreigners' accumulated balances of marks could only be used to buy German goods.[1] Several other countries imposed exchange control regimes of various kinds.

Second, the breakdown of the multilateral trading regime in the 1930s, and its substitution by a regime characterised by bilateral trading relationships, tariff controls and bilaterally negotiated tariff concessions, casts some doubt upon the multilateral trade weighting approach. Industrial countries clearly did not compete on equal terms in a single world market. However, the approach used here may indirectly be justified by the results in chapter 4; single equations were successful in modelling UK aggregate exports over the full period, and the data rejected the hypothesis of a change in behaviour after 1931.

The financial crisis in the summer of 1931 forced the National Government off the Gold Standard, and by the beginning of 1932, sterling had fallen by about 30% against the dollar. The exchange rate and balance of payments became less pressing concerns

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1. Nurkse (1944) chapter VII gives a fuller description of the German scheme. See League of Nations (1938a), and pp.54-55 here, for elaboration of foreign exchange rate and exchange control policies.

than in the 1920s. Low interest rates were employed, partly with the intention of facilitating the conversion of War Loan from 5% to 3.5%.[1] Protection could be seen as much as an attempt to safeguard employment in domestic industries as to maintain the balance of payments. The UK ran a current account deficit in every year in the 1930s except 1935, having run a surplus almost continuously during the 1920s.[2] Nevertheless, the rate for sterling was directly managed by interventions financed by the Exchange Equalization Account. As Howson (1980) documents, the principal effect was to check rapid movements in the rate rather than to fix the pound at a substantially different level to that which would otherwise have prevailed.

The sterling-dollar rate and the EER for sterling were in general determined by events abroad after 1932. The Roosevelt administration took the dollar off the Gold Standard shortly after taking office in March 1933, and subsequently fixed it in January 1934 at just over 59% of its previous value, or $35 per ounce. As is shown in Table 2.1, sterling was fairly stable against the dollar thereafter until 1938.

Of particular interest in the 1930s were the widely varied exchange rate policies pursued elsewhere in the world.[3] Most of the Empire followed sterling off gold in 1931, and pegged their exchange rates against the pound in the "Sterling Area". Sweden

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1. See Howson (1981) p.276 based on Howson (1975).

2. See Foot (1972) and Ware (1974).

3. See Nurkse (1944) and League of Nations (1938a). Redmond (1981) calculates EER indices for six foreign countries for this period.

followed suit, and Japan also devalued in line with sterling although not participating in the full Sterling Area arrangements entailing keeping reserves in London. Canada, though also leaving gold in 1931, depreciated much less against the dollar than did sterling, and $C again roughly equalled $US after 1934.

Of the industrial European countries, Germany and Austria both maintained their old gold parities with the aid of complex exchange control regimes. France remained at her 1927 par against gold until 1936; the Popular Front government then permitted a rapid downward float. Czechoslovakia, the Netherlands, and Switzerland also abandoned the Gold Standard in 1936, while Belgium had done so a year earlier. Italy, engaged in war in Abyssinia, also began a downward float in 1935, but, in common with most of the European countries, rapidly stabilized its exchange rate after the end of 1936. The French depreciation, accompanied by rapid inflation, continued up to the outbreak of war. There was thus almost continuous change in the foreign exchange rates included in the EER calculations here,with wide-ranging implications.

3. The Effective Exchange Rate for Sterling 1920-38

Introduction

The following narrative relates principally to the "Andrews" and "Maizels-Dimsdale" indices. However, the points at which the narrative told by these two differs from other EER indices shown in Table 2.1 indicate the importance of the issues of EER construction discussed thus far. The points at which the EER narratives differ from that told by the sterling-dollar rate are of particular importance, since in the 1920s at least the dollar rate was the prime focus of policy-makers' attention.[1]

The Return to Gold and Stability: 1920-31

From 1920 Q1 to the restoration of the old parity in 1925 Q2, the "Andrews" and "Maizels-Dimsdale" EER indices both show rises in excess of 50%. This was a much larger increase than in the sterling-dollar rate. Moreover, the other EER indices illustrated in Table 2.1 also suggest that the overall appreciation was of similar magnitude.

There are some interesting differences in the time profile of the pound's rise; in particular, although sterling declined against the dollar in 1923, it is shown by all the EER indices to have appreciated overall. This appreciation is most marked in the Andrews and Maizels-Dimsdale indices. These two indices accord lower weight to the dollar than the alternative indices, which consider trade in all commodities rather than solely in manufactures. The economic interpretation would be that EER indices constructed specifically to show changes in UK export competitiveness reveal a possible worsening in 1923 which is not indicated by indices constructed with other objectives.

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1. Although Norman's evidence to the Macmillan Committee claimed the subsequent levels at which France and Belgium stabilised as a reason for the difficulties of the UK; see Committee on Finance and Industry (1931) Minutes of Evidence, vol.I, pp.212 et seq.

The contrary movements in the EER indices as compared with the dollar in 1923 are shown in Table 2.1 to have been somewhat offset in 1924. The return of capital to Europe after the stabilisation of the mark produced a recovery in several European currencies against the dollar (cf.Table SA1); hence, sterling's appreciation against the dollar in 1924 was more marked than shown by any EER index.

We note two further points from the EER measures in the 1920s. First the final stage of the return to the 1913 parity, from 1924 Q2 to 1925 Q2, involved an appreciation of around 10% by whatever measure is used; the rise in the sterling-dollar rate is very similar to that of all the EER indices. Second, exchange rate instability on the continent entailed a substantial further appreciation in the EER indices for sterling after the pound had been fixed against gold and therefore the dollar. According to the "Andrews" index, a further rise of 9% occurred between 1925 Q2 and 1926 Q2 - the alternative EER indices all show similar increases - while the sterling-dollar rate was virtually fixed. The franc and lira recovered after July 1926; but even so, the steady level at which the "Andrews" and "Maizels-Dimsdale" indices settled was around 5% above the level immediately upon the return to gold. Table 2.3 suggests that this was associated with a further weakening of the UK's competitive position.

The Departure from Gold and the Recovery of Sterling: 1931-38

When Ramsay Macdonald's National Government finally decided to abandon the $4.86 parity for sterling in September 1931, the result was an immediate fall in the value of sterling against the dollar, of 28% between 1931 Q3 and 1932 Q2, and 32% from 1931 Q3 to the low point in 1932 Q4. However, most of the other countries included in the EER indices also devalued simultaneously or subsequently. The extent to which the UK's initial potential advantage was eroded is important in analysing trade performance in the 1930s, and has provoked controversy. Redmond's (1980) indices in general show sterling as having recovered completely from the 1931 devaluation by late 1936. Dimsdale's (1981) "average" exchange rate does not produce the same result, and nor do any of the EER indices given here. In 1938 Q2, the late 1930s maximum for sterling by all the measures in Table 2.1 (except the sterling-dollar rate), sterling stood 7.7% below its 1931 Q2 level according to the "Andrews" index, 7.5% lower according to the "Maizels-Dimsdale" index. The bilateral trade-weighted index, however, shows sterling only 4.3% lower, and the "League of Nations Network" series also suggests that most of sterling's potential competitive advantage had been eroded: the depreciation 1931 Q2 to 1938 Q2 was 4.7% by this measure. The "Maddison" index produces a 9% sterling depreciation over the same period; the exclusion of Japan, which had a weak exchange rate in the 1930s, is relevant here.

Conclusions based on comparing two index values seven years apart, with substantial fluctuations intervening, must necessarily be tentative. This applies particularly to the Redmond (1980) indices given the arithmetic averaging used. Nevertheless, the evidence presented here suggests that the EER for sterling could reasonably be considered to be lower even at the end of the 1930s than immediately prior to the 1931 crisis. In the next section, the extent to which this entailed a competitive advantage is investigated using various alternative measures. Firstly, however, we return to consideration of the earlier decade.

4. Constructing "Real" Exchange Rate Measures and Measures of Competitiveness

The initial focus of this section is upon indices of UK "wholesale price competitiveness". Indices of countries' nominal exchange rates against the dollar are deflated by their wholesale price indices relative to the US; the foreign countries' "real" exchange rate indices are then assigned weights as in the nominal EER calculations.[1]

"Real exchange rate" comparisons on this basis are open to several criticisms. Firstly, wholesale price indices have generally related to tradeable goods. If the conditions for perfect international arbitrage obtain, one would expect the prices of such goods to be equal everywhere. Where indices of wholesale prices adjusted for currency changes diverge for different countries, leaving aside problems in the construction of these indices, one may simply be measuring trading imperfections (transport costs, tariffs, etc.) rather than any genuine difference in competitiveness.[2] Moreover, in the inter-war period, wholesale

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1. See equation (2.11).

2. *Any* index constructed from prices of goods actually transacted is open to a similar criticism (see pp.95-97).

price indices published by the League of Nations for most countries included only or mainly prices of raw materials.[1] These are unlikely to produce a useful direct measure of the export competitiveness of UK manufactures.[2]

Some further specific problems connected with the particular series used will be discussed later, in interpreting some of the curious results obtained. But various points may be made in justification of this exercise:

(i) Bilateral "purchasing power parity" comparisons involving UK and US wholesale prices, and indeed individual other countries' wholesale prices in dollars, were made at the time. Moggridge documents points during the deliberations of the Chamberlain-Bradbury Committee in 1924 (e.g. the evidence of Sir Charles Addis),[3] and in particular in the report of the Committee,[4] when estimates of the extent of price reductions needed to achieve parity seem to be based on comparisons of UK and US wholesale prices. Notably, though, Keynes preferred to look at costs,[5]

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1. More details on the series used are given in the League of Nations Memorandum on Currency 1913-23, "Notes to Table VII" [Indices of Wholesale Prices] pp.204-290.

2. Furthermore, raw materials tend to be traded in competitive international markets; the problem that prices may differ little between countries is likely to be acute.

3. Moggridge (1969) p.28.

4. Moggridge (1972) p.62.

5. Moggridge (1969) p.10 and pp.28-9. Addis conceded on the wholesale price comparison that a 10% relative price change would be necessary. See also Redmond (1984) pp.522-523.

arguing that sterling would be some 10%-12% overvalued at the old parity: a fall in costs "largely wages, of about 12%" would be needed.

(ii) Some more recent empirical work testing purchasing power parity theories of the determination of exchange rates in the 1920s has used wholesale price indices;[1] Frenkel obtained[2] what he regarded as satisfactory equations for Mark/£, Franc/£ and $/£ rates between 1921 and 1925; in an earlier paper,[3] he claimed that using wholesale price indices gave the best-fitting results in empirical work on the inter-war period.

(iii) For the sample of countries included here, wholesale price data published by the League of Nations[4] are most readily available and comparable. Retail price indices, used by Dimsdale (1981)[5], and it seems preferred by Keynes,[6] are not available on a monthly

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1. See Hodgson (1972).

2. Frenkel (1981).

3. Frenkel (1978).

4. For details, see pp.395-400 and Table SA.2.

5. Redmond (1984) produced exchange-rate-adjusted relative wholesale and retail price indices for the 1920s on an annual basis. But the detailed statistical merits of the price indices in the 1920s are (very reasonably!) not discussed, and the paper does not deal with the period before 1924.

6. Moggridge (1969) p.72 suggests that, although the indices tended to be heavily weighted towards workers' expenditure, they would be relatively immune to divergent structural changes over time and would be representative of a wide class of expenditure. But he found no clearer indication than when using wholesale prices of sterling's overvaluation in the 1920s.

basis throughout the period for all the countries quoted; and those that are available are in several cases primitive, based on price quotations for very few items. Foodstuffs are the predominant items in most of the indices, but the major non-tradeable items are included are rent - which was subject to control in several countries - and heat and light, where rapid technical progress (electrification) was taking place.[1] Wholesale prices were widely believed to be more reliable, and detailed information about the construction of the wholesale price indices for all the countries in the study is available in the League of Nations Memorandum on Currency, 1913-23.

Wholesale Price Competitiveness: Construction

Most of the monthly country series from which Table 2.3 was constructed were not continuous through the period 1920-38, so that sub-series had to be "spliced".[2] Further splicing, on the overall real exchange rate (RER) series obtained, was necessitated by the absence of complete wholesale price data for 1920 for Belgium, Czechoslovakia and Switzerland.

The RER, or wholesale price competitiveness index,[3] for the UK was constructed as:

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1. League of Nations Memorandum on Currency 1913-23, p.7, indicates the rent problem. For more details, see ILO (1925), pp.48-64 and the preface; the rent problem is discussed further in ILO (1934) pp.107-110.

2. For individual details, see pp.396-400.

3. Maciejewski (1983) p.492 argues that indices constructed in this way should be described as indices of relative prices expressed in a common currency, or adjusted for nominal effective exchange rate movements.

$$(2.11)\quad RER_h = \frac{\dfrac{e_h}{\bar{e}_h} \cdot \dfrac{P_h}{\bar{P}_h}}{\prod_{i=1}^{h-1} \left(\dfrac{e_i}{\bar{e}_i} \cdot \dfrac{P_i}{\bar{P}_i}\right)^{w_i}} \qquad \text{with} \quad \sum_{i=1}^{h-1} w_i = 1$$

The base period for P_h, P_i, the wholesale price indices, and for e_h and e_i (the dollar exchange rate indices) is January 1924, and the weighting schemes are as for the nominal EER indices.

5. UK Wholesale Price "Competitiveness": 1920-1938

The following observations refer to Table 2.3.

Through the period as a whole, there was a marked trend towards improving UK wholesale price "competitiveness". According to all the multilateral indicators, the UK real exchange rate was at its highest in 1921 Q1; 1921 Q2 was the peak for the UK real exchange rate against the dollar. Between 1921 Q1 and 1938 Q4, according to the index employing "Andrews" weights, the real exchange rate fell - "competitiveness" improved - by 25%, while the EER rose by 21%. 1921 was certainly not an "equilibrium" year; much of Europe was still recovering from the war and producing well below subsequent capacity, so that poor UK competitiveness may not have been too meaningful.[1] As an alternative comparison, from 1924 Q2, when the pound began its final ascent to the Gold Standard parity, through to 1938 Q4, the real exchange rate fell by 13%; the nominal EER rose by 4% using the "Andrews"-weighted indices.

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1. Although Broadberry (1986) (see pp.121,125) argues that 1920-1 was the period when exchange rate appreciation had its peak effect, and argues that the adoption of the strategy for the return to gold was responsible.

Making the simple, bilateral comparison with the dollar yields a real exchange rate fall from 1924 Q2 - 1938 Q4 of 5%, and a rise in the sterling exchange rate of 9%.

There is evidence, particularly from the 1930s, that major nominal exchange rate changes affected the "real" exchange rate as expected (i.e. a rise in nominal EER produced a short-term rise in the "real" exchange rate). Consider the major episodes. First, the substantial rise in the EER for sterling from mid-1922 to late 1923, of around 16% (1922 Q2 to 1923 Q4), was associated with a rise of nearly 5% in the real exchange rate (Andrews weighting). Against the dollar over the same period, sterling declined very slightly (about ½%); the inflation-adjusted comparison shows an improvement in UK competitiveness of over 3%.

The effects of the rise in the value of sterling in connection with the return to the gold parity in 1925 is of particular interest. From 1924 Q2 through to 1925 Q2, there was a rise in both sterling's EER ("Andrews"-weighted) and in the sterling-dollar rate of 11%. This appreciation was associated with a rise of only 3% in the "Andrews"-weighted "real" exchange rate, and only 1½% when a bilateral comparison is made with the US.

The attainment of the gold parity at $4.8665 = £1 in the spring of 1925 did not prevent a further rise in sterling's nominal EER (Table 2.1). For example, using the "Andrews"-weighted index, there was a rise in the sterling EER of 8% between 1926 Q1 and 1926 Q3, as the French and Belgian francs and the Italian lira fell sharply. In the same period, there was a rise of 5% in the "Andrews-weighted" real exchange rate. However, even this episode may not be interpreted as a straightforward loss of wholesale price competitiveness produced by an exchange rate rise. There was a rise of 4½% in the "real exchange rate" of sterling against the dollar between 1926 Q1 and Q3 with sterling virtually fixed in nominal terms. Moreover, between 1925 Q2 and 1926 Q1 (in which period sterling's nominal EER was also rising), the real exchange rate fell, back to the 1924 Q2 level or just below according to the various RERS; to over 4% below the 1924 Q2 level when the comparison is made solely against the US. Table 2.3 shows that the loss of wholesale price "competitiveness" in the first half of 1926 was offset by the beginning of 1927, and the gentle downward trend in the index was then resumed.

The fall in the exchange rate following the departure from gold (25% against the dollar between 1931 Q2 and Q4, slightly less in nominal EER terms) was much more rapid than the appreciation in the 1920s. The devaluation was associated with a fall in the "real exchange rate" against the US of over 20% (again slightly less if other countries are included). From early 1933, the nominal EER recovered (although the recovery only became substantial in 1936 as the French departed from the Gold Standard). The two significant periods of appreciation, 1933 (against most currencies) and 1936-8 (in EER terms only), were also associated with a rising real exchange rate. Between 1931 Q4 and 1938 Q4, the nominal exchange rate increased by 29% against the dollar, or 16% in "Andrews"-weighted EER terms; over the same period there was a rise of 29% against the dollar in "real" terms, and of 13% in the "Andrews"-weighted RER.

The following conclusions are tentatively suggested:

(i) The "real exchange rate" measures reflect the profile of the nominal exchange rate fairly closely in the 1930s;

(ii) In the 1920s, the "real exchange rate" moved in line with the nominal exchange rate appreciations only for short periods;

(iii) Otherwise, a strong downward trend in the real exchange rate prevailed throughout the 1920s despite the substantial nominal appreciation: a feature of this trend was the speed with which rises in the real exchange rates were offset.

The downward trend in the real exchange rate in the 1920s prompts further analysis. Several statistical problems with the wholesale price indices used may have influenced the results:

(i) Many of the wholesale price series had to be constructed using chain-linking procedures, which might make comparisons over a long period dangerous.

(ii) The method of averaging used to obtain the aggregate index from commodity group indices varied between countries. Geometric averaging in preference to arithmetic was used only in compiling the UK Board of Trade and Belgian wholesale price indices in 1924,[1]

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1. For details of averaging systems used, see League of Nations Memorandum on Currency 1913-23, pp.204-290, especially p.208.

though several other countries adopted geometric averaging later. If prices are falling generally, and if the prices of different goods fall at different rates from the base level, a geometrically weighted index will fall more rapidly than an arithmetically weighted index. This could conceivably help explain the apparent improvement in UK "wholesale price competitiveness".

(iii) The weights of different commodity groups in the aggregate indices vary considerably between countries. In the 1920s, few of the wholesale price indices published were systematically weighted according to the importance of goods in production or consumption: systematic schemes were applied only by Austria, Germany, Italy, Sweden and the US in 1924. Most countries simply averaged the individual price quotations obtained, although, on an ad hoc basis, the most important commodities frequently had more than one quotation taken and therefore extra weight. For the Board of Trade index for the UK, for example, the 1907 Census of Production was used to determine the number of price quotations for each commodity.

The weighting problem is of considerable importance, since in the 1920s there were particuarly sharp declines in the world price of certain commodities, notably textiles, which were important components of UK total production and therefore had a high ad hoc weight in the UK wholesale price index.[1] Weighting differences

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1. Board of Trade (1931b) shows that cotton, with 16/150 weight in the UK index, fell in price by 68% 1920-29, and over 32% 1924-29, compared with overall falls in wholesale prices of over 55% 1920-29 and about 18% 1924-29. By contrast, in Germany, textiles had only 12/400 weight. Between December 1924 and December 1929, textiles fell in price by 38.7% in Germany, compared with a fall of less than 6% in wholesale prices in general. (Cf. Board of Trade (1931b) pp.274-5 and 258-9).

constitute a general problem with aggregate price indices, relative export prices as well as domestic prices, and offer a strong argument for studying sectoral as well as aggregate export performance.

(iv) There are several other differences between the national wholesale price indices; different indices may be monthly averages or represent values on particular days during the month; indirect taxes may or may not be excluded; and there are inevitably differences in reliability between indices constructed, as was the US Bureau of Labour Statistics index, from 404 price quotations for approximately 200 goods, and (say) the Japanese index, with 56 price quotations averaged without a systematic weighting scheme with the original base for price quotations being October 1900.[1]

Conclusion

We have thus failed to establish from the wholesale price measure that the UK exchange rate was obviously overvalued in the long term as a result of the 1925 return to gold, though we have suggested that some gain in "competitiveness" resulted from devaluation in 1931, and the result is qualified by statistical problems. This suggests the importance of employing superior measures of competitiveness. Some potentially better measures are discussed in chapter 3 and tested in chapter 4 and subsequently. For this narrative, we consider changes in some of the different competitiveness measures employed in later chapters.

1. Details from League of Nations Memorandum on Currency 1913-23, p.247.

6. Alternative Measures of Competitiveness: A Brief Description

The following discussion refers to Table 2.4, in which the reference base is no longer January 1924 but the 1924 annual average. The last four columns are calculated from data available only on an annual basis.

(i) Relative Exports UVIs: Column 4

This measure is constructed as follows:

$$RUVI = \frac{UVI_{UK}}{UVI_{W9}}$$

where UVI_{UK} is the unit value index of aggregate UK exports and UVI_{W9} the unit value index for the aggregate exports of nine principal competitors of the UK.[1]

UVI_{XUK} and UVI_{XW9}, when included separately in the equation specification, proved the most successful competitiveness measures in modelling aggregate UK exports in this study. The method of construction[2] entails that UVI_{XW9} is weighted according to each country's share (by dollar value) in exports each year, rather than with a fixed weighting base as for the two EER series and the two relative unit labour cost (RULC) series in Table 2.4.

(ii) Relative Unit Labour Costs (Normalised): Column 5

The price of labour is much less likely than the price of tradeable goods to be equalised across countries by international

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1. Those listed on p.408.

2. See pp.408-411 and Table SA.5.

arbitrage (at least in the short term). Relative unit labour costs in common currency may therefore be superior to relative wholesale prices as a measure of competitiveness, capturing both supply and demand influences on trade. The measure is constructed as

$$RULC = \frac{ULC_{UK}}{ULC_{W9}}$$ where W9 is defined as for RUVI.[1] The unit labour cost series used have been normalised (adjusted to remove cyclical influences on productivity), reflecting superior performance of the normalised measure in explaining export performance.

(iii) Relative Unit Value Index, Exports of Coal: Column 6

We discussed earlier the possibility that compositional differences affected the calculation of UK "competitiveness" in the 1920s. We therefore examined competitiveness in a single sector. Coal was a relatively homogeneous good, of great importance to the UK and several other economies, for which a substantial body of data exists.

One key distinction between the unit value indices (UVIs) for the UK and its competitors used for coal[2] and those used in the aggregate export price figures derived from Maddison (1962) is that Maddison constructed UVIs from raw price data, and then calculated volume as value/UVI. In the coal sector, value and volume data were readily available: UVI was calculated as value/volume. As

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1. See chapter 3 for further discussion of RULC and normalised unit labour costs, and pp.423-439 for details of construction. $RULC_{23}$ is used in Table 2.4 (cf. Table SA.13).

2. For further details see pp.457-461.

in constructing RUVI, the world coal UVI series is weighted according to each country's share (by dollar value) in exports each year, rather than with a fixed weighting base. The country coverage of this coal RUVI index is more limited than the aggregate export RUVI, since only six of the nine foreign countries included in the UK aggregate RUVI produced and exported significant quantities of coal: France, Germany, Netherlands, Belgium, US and Japan.

(iv) Relative Unit Labour Costs: Coal: Column 7

We constructed ULC indices for the UK and its leading competitors in the coal sector[1] using statistics on wages in the coal industry published in the International Labour Review and output per man hour data published by the OEEC/OECD in issues of "Industrial Statistics". Some important points should be noted:

(a) "Normalised" figures are not quoted in Table 2.4; although crudely normalised unit labour costs were slightly more successful than actual unit labour costs in explaining coal exports (chapter 7), the choice of cyclical "peak" for all the countries in the sample was particularly difficult;

(b) Unlike the coal RUVI series, the coal relative ULC series has fixed (1929) weights attached to the foreign country ULC indices in forming "world" ULC.

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1. See pp.462-472.

(v) "Andrews" series: Columns 2 and 3

The "Andrews" nominal EER and RER series are derived from the series given in Tables 2.1 and 2.3 with reference base adjusted to 1924 = 100.

7. Alternative Measures of Competitiveness: Major Developments

Distinctions between the results obtained from the alternative measures and those from the nominal and "real" EER series are noted in two key respects: trends taken by the series (although very long term comparisons of these series may be statistically suspect) and year to year changes.

To deal with aggregate RUVIs first, it is evident that the trend during the 1920s was upwards, in direct contrast to the "real" EER series. After the break brought about by devaluation in 1931, this upward trend resumed. The RUVI for coal does not show an upward trend in the 1920s - when it was dominated by the struggles in the UK coal industry, in turn probably implying that the lack of UK competitiveness in coal in the early 1920s was untenable - but does show an upward trend in the 1930s.

The trends in relative ULCs, both aggregate and in the coal industry, seem not to have borne much relationship to the trends in RUVIs (although the statistical problems connected with all the series make this comparison tenuous). Both RULC series exhibit downward trends in the 1920s (thus showing some similarity to the real EER series), and little trend change after the 1931 devaluation. These divergent trends clearly give rise to important questions. Did profits per unit really increase in the UK relative to other industrial countries over the period?[1] If so, was this achieved at the cost of sales volume? Or are the divergences statistical artefacts? It should be noted that while the RULC measures included labour employed on production for domestic as well as foreign consumption, RUVIs only measure the prices of goods exported.

The year-by-year changes in the alternative measures of competitiveness are of particular importance in illustrating the short- and medium-term effects of the major exchange rate episodes. Three of the four measures of competitiveness in cols. 4 to 7 show a larger loss of competitiveness than the real EER measure over 1924-6. The exception, the RUVI index for exports of coal, is unreliable in 1926 given that UK exports in that year were devastated by the coal strike: but the price of coal in the UK did fall rapidly in this period, and, as will be seen, RULCs in coal followed suit.

The 1931 devaluation showed up particularly clearly in the real EER measures in Table 2.3. This is confirmed in columns 4 to 7 in Table 2.4. Three of the four alternative measures of competitiveness suggest that an improvement in competitiveness of around 10% occurred; the relative export UVI for coal shows a larger change (though casual inspection suggests that the level of competitiveness by this measure in 1931 may have been freakishly poor)

There is, however, considerable divergence between the various measures in the periods following the great exchange rate movements. It is not clear from Table 2.4 whether the short-term changes in

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1. The consequences of RUVI competitiveness changes in the period are discussed in Chapter 8. Hart (1965) Table 1.1 p.21 shows a substantial increase in total gross profits in the 1930s, and an even larger increase in gross profits in extractive industries (dominated by coal) after 1927.

competitiveness were or were not durable. For example, the aggregate export RUVI suggests that competitiveness remained at a level worse than that of 1924 throughout the 1920s, worsening again at the end of the decade; but the aggregate RULC measure suggests that a 12% improvement in competitiveness occurred between 1926 and 1929. Alternatively, in the 1930s, it appears from the RUVIs that the advantage in competitiveness gained late in 1931 had been dissipated by 1936, but from aggregate RULCs it would appear that the gain in competitiveness persisted throughout the decade.

8. Alternative Measures of Competitiveness: Conclusions

This brief examination of the paths of some of the alternative competitiveness measures used in chapters 4 to 7 has probably raised more questions than were answered. Beyond establishing that major exchange rate changes were associated with changes in competitiveness in the expected direction in the short-term, there appears to have been little consistency in the movements of these measures. Various explanations may be advanced:

(i) The statistical problems already discussed, e.g. the very poor aggregate RULC data deriving from the poor quality of each component series, and the lack of comparability between countries of aggregate price data.

(ii) It is not clear in these series what might constitute an equilibrium level, and whether, and how rapidly, there is a tendency to return to equilibrium after a major disturbance. 1924 was as close to an equilibrium year as could be found for aggregate trade performance early in the sample period - after the war, after the hyperinflation on the continent, and before the final ascent to \$4.86. In the coal industry, however, it was clear that a crisis was pending once Germany recommenced exports in autumn 1924. By mid-1925, the industry was reliant on Government subsidies.[1] Clearly there were likely to be strong pressures on both prices and labour costs.

This study devotes less attention to econometric analysis of the relationship between the exchange rate and various relative prices than to the relationship between relative prices and export performance. However, we have noted some interesting divergences between measures in this first set of relationships. The ensuing survey of the theory and literature underlying measures of competitiveness suggests various reasons for divergences between measures. Moreover, we clarify in chapter 5 two key issues here: first, that a rise in domestic prices measured in foreign currency will adversely affect export competitiveness; and second, that exchange rate changes may be particularly important in the short-term.

1. See e.g. Buxton (1982).

ANNEX 2.1

Object: To show that a given % change in a geometric-weighted EER index for sterling between any two dates has the same interpretation whether or not the base period is one of those dates. This property does not hold in general when arithmetic weighting is used. (cf. p. 25)[1]

The result is shown for the case of 3 countries (h, 1 and 2). We show that for geometric averaging,

$$(2.A1.1) \qquad \frac{EE_{h2}}{EE_{ho}} \text{ at base 0 } = \frac{EE_{h2}}{EE_{no}} \text{ at base 1.}$$

(the notation of the chapter is amended so that EE_{ho}, e_{ho}, replace $\bar{\bar{EE}}_h$, $\bar{e}_n$).

We also show that this result does not in general hold when arithmetic averaging is used.

Consider first the case of geometric averaging. Using the formula of equation (2.2) on p.25, the Left Hand Side of (2.A1.1) becomes:

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1. Note that throughout this Annex the weights w_{h1}, w_{h2} (the weights of country 1 and country 2 in h's index) are constant.

$$(2.A1.2)\quad \frac{\left(\frac{e_{h2}}{e_{12}}\Big/\frac{e_{ho}}{e_{10}}\right)^{w_{h1}} * \left(\frac{e_{h2}}{e_{22}}\Big/\frac{e_{ho}}{e_{20}}\right)^{w_{h2}}}{\left(\frac{e_{ho}}{e_{10}}\Big/\frac{e_{ho}}{e_{10}}\right)^{w_{h1}} * \left(\frac{e_{ho}}{e_{20}}\Big/\frac{e_{ho}}{e_{20}}\right)^{w_{h2}}}$$

The denominator is $1^{w_{h1}} * 1^{w_{h2}} = 1$

$(w_{h1} + w_{h2} = 1)$.

The numerator is, after rearrangement

$$(2.A1.3)\quad \frac{e_{h2}^{w_{h1}} * e_{10}^{w_{h1}} * e_{h2}^{w_{h2}} * e_{20}^{w_{h2}}}{e_{12}^{w_{h1}} * e_{ho}^{w_{h1}} * e_{22}^{w_{h2}} * e_{ho}^{w_{h2}}}$$

and using $w_{h1} + w_{h2} = 1$, the left hand side of (2.A1.1) can now be written

$$(2.A1.4)\quad \frac{\;\dfrac{e_{h2} * e_{10}^{w_{h1}} * e_{20}^{w_{h2}}}{e_{ho} * e_{12}^{w_{h1}} * e_{22}^{w_{h2}}}\;}{1} = \frac{e_{h2} * e_{10}^{w_{h1}} * e_{20}^{w_{h2}}}{e_{ho} * e^{w_{h1}} * e_{22}^{w_{h2}}}$$

Now consider the right hand side of (2.A1.1) when geometric averaging is used; $\frac{EE_{h2}}{EE_{ho}}$ with base period 1.

$$(2.A1.5)\quad \frac{\left(\frac{e_{h2}}{e_{12}}\Big/\frac{e_{h1}}{e_{11}}\right)^{w_{h1}} * \left(\frac{e_{h2}}{e_{22}}\Big/\frac{e_{h1}}{e_{21}}\right)^{w_{h2}}}{\left(\frac{e_{ho}}{e_{10}}\Big/\frac{e_{h1}}{e_{11}}\right)^{w_{h1}} * \left(\frac{e_{ho}}{e_{20}}\Big/\frac{e_{h1}}{e_{w1}}\right)^{w_{h2}}}$$

The numerator (2.A1.5) becomes, after rearrangement,

$$(2.A1.6) \quad \frac{e_{h2}^{w_{h1}} * e_{11}^{w_{h1}} * e_{h2}^{w_{h2}} * e_{21}^{w_{h2}}}{e_{h1}^{w_{h1}} * e_{12}^{w_{h1}} * e_{22}^{w_{h2}} * e_{h1}^{w_{h2}}} = \frac{e_{h2} * e_{11}^{w_{h1}} * e_{21}^{w_{h2}}}{e_{h1} * e_{12}^{w_{h1}} * e_{22}^{w_{h2}}}$$

The denominator becomes

$$(2.A1.7) \quad \frac{e_{ho}^{w_{h1}} * e_{11}^{w_{h1}} * e_{ho}^{w_{h2}} * e_{21}^{w_{h2}}}{e_{10}^{w_{h1}} * e_{h1}^{w_{h1}} * e_{20}^{w_{h2}} * e_{h1}^{w_{h2}}} = \frac{e_{ho} * e_{11}^{w_{h1}} * e_{21}^{w_{h2}}}{e_{h1} * e_{10}^{w_{h1}} * e_{20}^{w_{h2}}}$$

$$\frac{\text{TOP}}{\text{BOTTOM}} = \frac{e_{h2} * e_{10}^{w_{h1}} * e_{20}^{w_{h2}}}{e_{ho} * e_{12}^{w_{h1}} * e_{22}^{w_{h2}}} = \quad (2.A1.4)$$

$\therefore$ since (2.A1.7) = (2.A1.4) Left Hand and Right Hand Sides of (2.A1.1) are equal. Q.E.D.

Now consider the case of arithmetic averaging. Using the formula on page 25, the Left Hand Side of (2.A1.1) is

$$(2.A1.8) \quad \frac{w_{h1}\left[\frac{e_{h2}}{e_{12}} \Big/ \frac{e_{ho}}{e_{10}}\right] + w_{h2}\left[\frac{e_{h2}}{e_{22}} \Big/ \frac{e_{ho}}{e_{20}}\right]}{w_{h1}\left[\frac{e_{ho}}{e_{10}} \Big/ \frac{e_{ho}}{e_{10}}\right] + w_{h2}\left[\frac{e_{ho}}{e_{20}} \Big/ \frac{e_{ho}}{e_{20}}\right]}$$

Bottom line = $w_{h1} + w_{h2} = 1$.

Top line:

(2.A1.9) $$w_{h1}\left(\frac{e_{h2} * e_{10}}{e_{12} * e_{ho}}\right) + w_{h2}\left(\frac{e_{h2} * e_{20}}{e_{22} * e_{ho}}\right)$$

or $$\frac{w_{h1}\, e_{h2}\, e_{10} + w_{h2}\, e_{h2}\, e_{20}}{e_{12}\, e_{ho}^{2}\, e_{22}}$$

The right hand side of (2.A1.1), with base period 1, is now

(2.A1.10) $$\frac{w_{h1}\left(\frac{e_{h2}}{e_{12}}\Big/\frac{e_{h1}}{e_{11}}\right) + w_{h2}\left(\frac{e_{h2}}{e_{22}}\Big/\frac{e_{h1}}{e_{21}}\right)}{w_{h1}\left(\frac{e_{ho}}{e_{10}}\Big/\frac{e_{h1}}{e_{11}}\right) + w_{h2}\left(\frac{e_{ho}}{e_{20}}\Big/\frac{e_{h1}}{e_{21}}\right)}$$

Rearranging, we have

(2.A1.11) $$\frac{w_{h1}\left(\frac{e_{h2} * e_{11}}{e_{12} * e_{h1}}\right) + w_{h2}\left(\frac{e_{h2} * e_{21}}{e_{h1} * e_{22}}\right)}{w_{h1}\left(\frac{e_{ho} * e_{11}}{e_{10} * e_{h1}}\right) + w_{h2}\left(\frac{e_{ho} * e_{21}}{e_{20} * e_{h1}}\right)}$$

or

(2.A1.12) $$\frac{\dfrac{w_{h1}\, e_{h2}\, e_{11} + w_{h2}\, e_{h2}\, e_{21}}{e_{12}\, e_{h1}^{2}\, e_{22}}}{\dfrac{w_{h1}\, e_{ho}\, e_{11} + w_{h2}\, e_{ho}\, e_{21}}{e_{10}\, e_{hi}^{2}\, e_{20}}}$$

which equals

(2.A1.13) $$\frac{e_{h2} * e_{10} * e_{20}}{e_{12} * e_{22} * e_{ho}}\left(\frac{w_{h1}\, e_{11} + w_{h2}\, e_{21}}{w_{h1}\, e_{11} + w_{h2}\, e_{21}}\right) = \frac{e_{h2}\, e_{10}\, e_{20}}{e_{12}\, e_{22}\, e_{ho}}$$

This is NOT in general equal to (2.A1.9), so our result holds: the choice of reference base is of importance when arithmetic averaging is used, but not for geometric averaging.

TABLE 2.1: UK EFFECTIVE EXCHANGE RATE 1920-38

		Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	£/$
1920	Q1	72.5	75.4	72.5	72.0	72.3	84.5
	2	79.9	82.4	80.8	80.0	79.0	91.8
	3	77.9	78.8	75.8	74.7	74.7	86.1
	4	81.4	82.4	77.9	76.9	80.1	81.4
1921	Q1	87.8	88.6	82.5	81.8	84.7	90.2
	2	85.9	85.3	78.6	78.2	79.9	91.5
	3	83.4	83.0	76.5	75.9	78.2	86.1
	4	88.5	89.6	82.9	82.1	85.2	93.8
1922	Q1	90.6	90.3	84.5	83.6	83.8	101.3
	2	91.3	90.8	85.1	84.3	83.8	104.2
	3	93.6	92.7	89.1	88.1	86.3	104.5
	4	96.1	95.0	92.8	91.9	89.6	105.7
1923	Q1	101.3	100.8	99.4	98.5	96.8	109.9
	2	100.6	99.8	98.2	97.4	95.5	108.8
	3	102.5	101.8	101.1	100.4	98.9	107.1
	4	99.8	99.4	98.8	98.2	97.1	103.8
1924	Q1	101.6	101.6	101.8	101.9	101.8	100.6
	2	98.8	99.1	97.9	98.3	98.6	102.0
	3	100.2	100.7	99.8	99.8	100.1	104.3
	4	102.3	103.8	102.9	103.1	103.4	107.9

TABLE 2.1 (cont.)

		Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	£/$
1925	Q1	105.4	107.5	106.9	106.9	107.3	112.2
	2	107.3	109.5	109.4	109.0	109.4	113.6
	3	109.1	111.5	111.8	111.4	111.6	114.0
	4	110.3	112.8	113.7	113.2	113.3	113.8
1926	Q1	111.7	114.0	115.8	114.8	114.9	114.1
	2	116.2	117.9	121.1	119.9	119.4	114.2
	3	120.0	121.7	126.1	124.7	123.7	114.1
	4	115.9	116.6	119.9	118.8	117.9	113.9
1927	Q1	114.2	114.7	117.5	116.5	115.7	113.9
	2	113.8	113.8	116.4	115.8	115.0	114.0
	3	113.7	113.8	116.2	115.7	114.9	114.1
	4	113.8	114.0	116.4	115.9	115.1	114.5
1928	Q1	113.9	114.1	116.6	116.0	115.2	114.5
	2	114.0	114.2	116.7	116.0	115.3	114.6
	3	113.8	114.1	116.4	115.9	115.1	114.0
	4	113.6	113.9	116.3	115.7	114.9	113.9
1929	Q1	113.8	114.2	116.4	116.1	115.2	113.9
	2	114.0	114.3	116.3	116.1	115.3	113.9
	3	113.8	113.9	116.2	115.7	114.9	113.9
	4	114.0	114.0	116.5	115.8	115.0	114.5

TABLE 2.1: (continued)

		Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	£/$
1930	Q1	113.8	113.8	116.5	115.6	114.8	114.2
	2	113.7	113.6	116.3	115.5	114.7	114.1
	3	113.8	113.6	116.4	115.5	114.7	114.2
	4	113.6	113.5	116.3	115.4	114.6	114.0
1931	Q1	113.8	113.7	116.4	115.5	114.7	114.0
	2	113.9	113.8	116.6	115.7	114.9	114.2
	3	111.9	111.7	114.2	113.6	112.8	111.6
	4	91.5	88.9	88.7	89.3	88.5	85.9
1932	Q1	89.0	86.9	85.0	86.9	86.2	82.3
	2	93.2	91.6	89.6	91.7	90.9	86.7
	3	89.8	88.4	85.2	88.3	87.6	82.2
	4	86.1	84.8	80.8	84.6	83.8	77.9
1933	Q1	88.3	87.1	82.8	86.8	86.0	79.9
	2	92.6	91.3	87.3	90.6	89.6	91.3
	3	95.5	93.9	90.1	92.2	91.0	108.1
	4	97.3	95.5	92.1	93.6	92.2	116.8
1934	Q1	96.6	94.8	91.0	92.4	91.2	118.9
	2	96.3	94.7	90.7	92.1	91.1	119.8
	3	94.9	93.1	89.2	90.5	89.6	118.2
	4	93.8	91.9	87.6	89.0	88.2	116.4

TABLE 2.1 (continued)

	Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	£/$
1935 Q1	92.4	90.4	86.0	87.5	86.7	113.9
2	95.1	92.5	88.4	90.1	88.8	114.8
3	96.2	93.6	89.6	91.2	89.9	116.3
4	95.9	93.3	89.2	90.9	89.6	115.5
1936 Q1	96.3	93.8	89.8	91.4	90.1	116.9
2	96.7	94.3	90.3	91.8	90.6	116.9
3	97.6	95.2	91.3	92.8	91.5	118.1
4	102.3	101.2	97.8	98.7	97.8	115.0
1937 Q1	102.8	101.5	98.0	98.9	98.2	114.9
2	103.7	102.5	99.1	100.0	99.3	115.8
3	106.2	105.4	102.6	103.4	102.5	116.6
4	107.2	106.6	104.0	104.8	103.9	117.0
1938 Q1	107.9	107.4	104.9	105.7	104.8	117.4
2	109.0	108.5	106.1	107.0	106.0	116.7
3	108.1	107.6	105.2	106.2	105.2	114.4
4	105.7	105.1	102.5	103.7	102.7	110.8

January 1924 = 100

TABLE 2.2: EER INDEX WEIGHTING SCHEMES

	Bilateral	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews" 1922	"Andrews" 1929
Austria	0.58	2.12	0.0	0.0	0.0	2.38
Belgium-Luxemburg	7.18	4.83	6.46	6.93	5.94	5.47
Czechoslovakia	0.96	3.30	0.0	0.0	6.32	4.51
France	9.69	11.44	14.35	14.02	27.29	13.59
Germany	11.84	17.31	23.46	26.46	0.0	24.61
Italy	3.64	5.41	5.72	4.78	6.17	5.08
Netherlands	7.26	5.15	5.84	3.23	3.93	3.07
Sweden	4.12	2.43	3.55	2.23	2.64	2.06
Switzerland	2.18	2.54	2.95	3.54	6.05	3.34
Canada	9.03	7.62	0.0	4.51	3.23	3.35
India	14.58	5.86	0.0	2.96	4.38	3.07
Japan	2.48	5.50	0.0	5.03	7.80	4.99
USA	26.46	26.49	37.67	26.31	26.25	24.49

TABLE 2.3: UK "REAL" EXCHANGE RATE 1920-38

	Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	UK v.US
1920 Q1	97.3	101.0	97.6	99.2	100.1	102.2
2	109.6	113.9	108.3	111.5	114.3	110.9
3	108.0	110.9	103.3	107.0	110.1	106.0
4	113.2	115.1	108.4	110.9	116.0	108.1
1921 Q1	116.1	117.7	111.6	113.2	117.3	115.7
2	110.1	110.9	106.3	107.1	109.4	116.1
3	102.8	103.2	100.1	99.8	101.6	105.9
4	100.5	101.3	99.5	98.5	100.1	105.5
1922 Q1	98.2	98.1	97.2	96.5	95.6	106.8
2	96.5	96.4	94.9	94.9	93.6	103.7
3	95.9	95.2	94.1	94.7	93.5	97.0
4	96.6	96.2	95.0	95.9	95.2	97.1
1923 Q1	99.3	99.4	98.1	98.8	98.1	101.0
2	100.3	100.0	98.7	98.9	98.2	102.1
3	101.0	100.8	100.2	100.3	100.1	100.8
4	99.1	99.0	98.9	98.4	98.1	100.3
1924 Q1	101.2	101.4	101.5	101.8	101.6	100.9
2	100.6	101.2	100.3	100.8	100.9	104.0
3	101.7	102.8	102.4	102.7	102.7	105.8
4	103.4	104.8	104.2	104.7	104.6	108.9

TABLE 2.3 (continued)

	Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	UK v. US
1925 Q1	105.0	106.2	105.2	106.1	106.1	107.6
2	103.3	104.3	103.4	104.1	104.2	105.6
3	101.2	101.9	100.4	101.5	101.7	101.5
4	99.8	100.9	100.1	100.8	101.1	101.0
1926 Q1	98.9	100.1	99.9	100.3	100.8	99.5
2	101.3	101.9	101.6	102.2	102.4	99.7
3	105.5	105.8	105.8	106.1	106.0	104.0
4	103.7	103.5	102.8	103.4	103.3	105.3
1927 Q1	98.5	98.4	97.9	98.3	98.1	101.2
2	97.7	97.3	97.0	97.4	97.0	101.9
3	97.3	97.4	96.7	97.4	97.2	100.3
4	97.0	97.1	96.0	96.9	96.9	98.5
1928 Q1	97.2	97.2	96.1	97.0	96.9	99.2
2	97.7	97.6	96.3	97.3	97.2	99.3
3	95.6	95.3	93.8	94.9	94.8	95.0
4	95.0	94.8	93.5	94.3	94.3	96.0
1929 Q1	95.7	95.6	94.0	95.1	95.1	96.6
2	96.2	95.9	94.1	95.4	95.4	95.8
3	95.1	95.0	93.5	94.5	94.7	94.2
4	96.3	96.1	94.6	95.3	95.7	95.9

TABLE 2.3 (continued)

	Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	UK v. US
1930 Q1	96.0	95.5	94.0	94.7	95.1	94.0
2	95.5	94.6	93.0	93.8	94.1	92.9
3	95.2	94.3	92.1	92.9	93.2	94.7
4	96.0	94.5	92.0	93.1	93.3	93.5
1931 Q1	96.0	94.2	91.3	92.7	92.7	93.3
2	96.8	94.8	92.2	93.3	93.1	95.9
3	95.1	92.8	90.2	91.3	91.1	92.1
4	83.3	79.7	76.4	78.0	77.5	76.5
1932 Q1	83.3	79.9	76.1	78.3	77.7	76.5
2	86.8	83.4	79.1	81.8	81.0	79.5
3	83.9	80.8	75.8	79.2	78.4	74.7
4	81.8	78.7	73.5	77.1	76.3	72.8
1933 Q1	85.5	82.2	77.0	80.5	79.5	77.6
2	89.7	86.3	81.3	84.2	83.1	86.2
3	91.5	87.9	82.6	85.0	83.9	94.8
4	93.0	89.1	83.5	85.8	84.6	100.9
1934 Q1	92.2	88.5	82.6	85.0	84.0	101.0
2	91.2	87.7	81.8	84.2	83.4	99.6
3	89.6	85.8	79.7	82.2	81.4	95.8
4	88.3	84.3	78.0	80.5	79.8	93.3

TABLE 2.3 (continued)

	Bilateral Weights	LON Network	"Maddison"	Maizels-Dimsdale	"Andrews"	UK v. US
1935 Q1	86.1	82.3	75.9	78.7	78.0	88.3
2	87.8	83.5	77.2	80.2	79.3	88.4
3	89.1	84.7	78.4	81.3	80.4	90.1
4	89.3	85.0	78.6	81.5	80.7	91.6
1936 Q1	90.0	85.5	79.0	81.8	81.0	93.5
2	91.2	86.5	80.0	82.7	81.9	95.3
3	92.6	87.8	81.3	83.9	83.2	96.8
4	96.2	92.6	86.1	88.3	88.1	96.4
1937 Q1	96.7	93.1	86.9	88.9	89.0	97.3
2	100.2	96.8	90.8	92.8	92.8	102.0
3	102.3	99.4	93.4	95.5	95.6	103.9
4	103.0	99.8	94.2	95.9	95.9	106.9
1938 Q1	103.0	99.2	94.2	95.2	95.2	108.7
2	101.7	97.4	92.5	93.5	93.3	106.2
3	99.2	94.8	89.8	91.0	90.6	101.6
4	96.5	91.8	86.7	88.0	87.5	98.8

January 1924 = 100

TABLE 2.4: MEASURES OF UK COMPETITIVENESS: 1924-38

	£/$ Index	Nominal EER "Andrews"	Real EER "Andrews"	Relative Export UVI	Relative ULC (aggregate)	Relative UVI Exports (Coal)	Relative ULC (coal)
1924	100.	100.	100.	100.	100.	100.	100.
1925	109.3	109.3	100.8	103.5	103.4	104.0	102.3
1926	110.0	117.8	100.7	105.4	108.5	98.3	103.6
1927	110.0	114.1	95.0	104.1	103.1	88.8	97.5
1928	110.2	114.0	93.5	103.2	98.1	85.1	88.2
1929	110.0	114.0	92.9	102.5	95.4	86.0	86.4
1930	110.0	113.6	91.7	107.2	97.7	88.0	87.7
1931	102.6	106.7	86.5	109.1	98.3	102.8	88.2
1932	79.4	86.3	76.5	97.2	88.3	86.2	78.6
1933	95.5	88.8	80.8	105.1	90.3	95.0	75.7
1934	114.1	89.2	80.2	106.3	86.0	98.9	71.0
1935	111.0	87.9	77.7	106.9	81.9	101.4	69.3
1936	112.5	91.6	81.6	110.2	81.5	109.5	74.0
1937	112.0	100.	91.1	112.0	83.0	105.5	77.2
1938	110.7	103.7	89.5	117.3	88.2	-	-

For details of column titles, see pp. 69-72.

Chapter Three

COMPETITIVENESS IN THEORY AND PRACTICE

I. Introduction

Charles Enoch's definition of competitiveness[1] encompasses a wide variety of economic factors, but neither specifies the extent to which a change in competitiveness changes sales performance nor describes how a change in competitiveness may be brought about. Here we expand Enoch's definition; discuss the problems of measuring various concepts of competitiveness; review the empirical evidence of the effects of competitiveness on trade performance; and consider how government policy may bring about changes in competitiveness.

1. Definition

Enoch's definition leaves the meaning of competitiveness as an empirical question; anything which can be shown by econometric analysis to change a country's market share is "competitiveness". This goes beyond an intuitive understanding of the term, which examines what influences a buyer's choice between similar goods. The relative price of the goods may be an important factor, and is the focus of much empirical work including this study. This does, however, assume that the "Law of One Price", which asserts that the relative price of identical goods will be equalised by arbitrage, is

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1. See p.1.

not applicable.[1] A number of other factors will also be considered by a buyer; for example quality, speed of delivery, and after-sales service. Good marketing techniques may persuade a buyer on any of these features. Profitability is also important; firms must earn a return for a particular level of sales to be sustainable.

2. Measurement

In practice, we cannot examine each individual buyer's and producer's decision and compare goods traded with those rejected or not supplied. We therefore rely on aggregate measures, on the one hand of relative prices, on the other of the various non-price components of competitiveness.

The measurement section begins by considering the implications of different market forms. We suggest that there may be difficulties in relating relative price to trade volume developments. We then define and consider in more detail advantages and disadvantages of the following possible measures of price or cost competitiveness. The focus is upon factors affecting export performance, reflecting the content of our more detailed empirical work, but some discussion of domestic competitiveness vis a vis imported goods is included for completeness. The taxonomy is derived largely from Enoch (1978).

(i) Relative Export Prices

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1. Posner and Steer (1978) p.143 cite Isard (1977) as concluding that "... in reality the law of one price is flagrantly and systematically violated by the empirical data".

(ii) Import Price Competitiveness

(iii) Relative Wholesale Prices

(iv) Relative Export Profitability

(v) Kravis and Lipsey's Ideal Price Competitiveness

(vi) Relative Unit Labour Costs in Manufacturing

(vii) Relative Normalised Unit Labour Costs in Manufacturing

(viii) Unit Costs

(ix) Absolute Export Profitability.

We then consider possible measures of a variety of non-price factors which may influence competitiveness:

(i) Unique products

(ii) Product quality and other forms of differentiation

(iii) Speed of delivery

(iv) Institutional arrangements

The choice between measures of competitiveness will ultimately be made on various grounds, theoretical, empirical and practical. In explaining trade behaviour aggregated across sectors in which a variety of market forms prevail, theory may support no single measure, and we return to Enoch's argument that the measure which best explains trade volume performance is the best measure of competitiveness. These empirical results are, however, heavily constrained, in the recent literature and a fortiori for the inter-war period, by data availability and quality.

3. Effects of competitiveness

It should be clear from the foregoing that measuring the effects of various competitiveness measures is of interest not only in establishing the power of policy operating on certain instruments, but in determining precisely what competitiveness is.

Central in the literature to be surveyed are attempts to estimate the volume response of UK exports of manufactures to changes in relative prices or costs, in models incorporating a world activity variable and a variety of other supply and demand factors. Supply and demand for exports may be considered separately, although various assumptions may permit single equation estimation. The literature also considers consistently specified export price equations. Similar factors may also determine imports of manufactures.

Several divergent strands will also be pursued; for example, the long-run effects of changes or trends in competitiveness on the supply of tradeables may be studied via flows of direct investment, as McAleese (1981) has done. We also suggest how the effects of features of non-price competitiveness which are not easily measured or associated with price competitiveness variables may be analysed, although this is very difficult to carry out in our own empirical work.

4. The Determination of Competitiveness

This section discusses the means by which government policy may directly affect competitiveness; it also briefly considers constraints on exchange rate changes as a policy instrument, and other means by which competitiveness and trade performance may indirectly be affected by policy actions. Further review of previous empirical work on the determination of UK export prices is deferred to chapter 5.

II. Measuring 'Price' Competitiveness

1. The Implications of Market Form

The conventional analysis of export behaviour usually assumes an "imperfect substitutes" model,[1] in which one country's exports are not perfect substitutes for domestic production in the importing country or for the exports of other countries. Exporters thus face a downward-sloping demand curve for their goods. A rise in UK export prices relative to those of other exporters (measured in common currency, so that exchange rate appreciation has this effect when, e.g., export prices are marked up over costs fixed in domestic currency) reduces demand for UK exports. An export supply function may be specified as $X_{si} = (\overset{(+)}{P_{xi}}, \overset{(-)}{P_i})$, i.e. a rise in export prices, or a fall in domestic prices, increases willingness to supply exports.

This model may be contrasted with the alternative "perfect substitutes" model. Assume that tradeable goods produced by all countries are homogeneous, and markets are competitive such that the "Law of One Price" (LOOP) holds. Each producer faces an infinitely elastic demand curve. Devaluation has no effect on export demand in this case, but may still increase exports via supply, by increasing the "world" price of the homogeneous tradeable good relative to the price of domestic non-tradeables.

Further complications arise in the case of oligopolistic markets. If the standard "sticky-price" model holds, in which other firms follow price cuts but not price rises by an individual firm, Cripps (1978) observed that LOOP holds as in the competitive

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1. See Goldstein and Khan (1985), p.1044.

paradigm.[1] But in this case, a small devaluation will change neither the foreign currency price nor the quantity sold, but will entirely pass into profits.

None of these paradigms is likely to hold in entirety for aggregate exports. Indeed, one advantage of disaggregation is that "perfect substitutes" and "imperfect substitutes" models may be applied separately as appropriate.[2] But they yield several important insights. First, a change in the relative prices of UK and competitor countries' exports need not occur following a devaluation of sterling, and yet a volume change may occur (through the supply side).[3] Second, if the "perfect substitutes" or oligopoly models are believed to hold, relative prices may not be observed. Variations between measured UK and foreign prices of tradeables may reflect various types of measurement error, but may have no economic impact.[4] Third, in the more general imperfect substitutes model, quantities and prices are in theory determined simultaneously. Empirical attempts to derive supply-price elasticities from simultaneous models have not generally produced definitive results.[5]

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1. Cripps (1978) p.168.

2. Goldstein and Khan (1985), p.1044.

3. Hay and Morris (1981) found that initially after an exchange rate change exporters' profits changed more significantly than export prices.

4. See p.99 below.

5. See Goldstein and Khan (1985) p.1072, and cf. p.135 et seq. below.

More frequently, supply-price elasticities have been assumed infinite. While this may be implausible "unless there exists a large pool of unemployed resources in the export industry itself or elsewhere in the economy,"[1] a similar procedure is also adopted in chapter 4 and subsequently. We justify the assumption for the UK between the wars,[2] and test for simultaneity in various ways. Moreover, the use of relative labour costs may circumvent the problem of ambiguous sign expectations on competitiveness coefficients.[3]

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1. Goldstein and Khan (1985) p.1048. Our procedure is also consistent with the recursive model of Winters (1981) discussed below (p.135).

2. See p.174 and Table 4.2.

3. See p.106.

2. Measures of Price and Cost Competitiveness

(a) General Form

We now define and evaluate nine suggested measures of price/cost competitiveness. Most of these take the general index form:

$$(3.1) \quad I_t = \frac{P_{ht}/P_{ho}}{\sum_{i=1}^{n} (P_{it}/P_{io}) w_i / \sum_{i=1}^{n} w_i} \qquad i = 1 \ldots n$$

where suffixes t and 0 denote present and base periods respectively;

P_h is the home country price or cost index

P_i is the price or cost index of the i_{th} foreign country

w_i is the weight assigned to the i_{th} country

The weighting formula may be arithmetic (as shown above) or geometric.[1] The factors relevant in the choice of weighting scheme are in general those relevant to the weighting of effective exchange rates discussed in chapter 2.[2]

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1. Preferably geometric; cf. Annex 2.1.

2. Effective exchange rate and competitiveness index weighting schemes should not necessarily be identical. Ideally a competitiveness index allows, and an exchange rate index does not, for the feedback of an exchange rate onto prices and costs. If an exchange rate decline of 10% against country A produces (say) a rise of 5% in prices in country B and of only 2% in C, country C gains 8% and B only 5% in competitiveness from the same exchange rate change, and country C "ought", in a sense, to have a higher weight than B in A's effective exchange rate index. This does not preclude the possibility that a 10% change in the competitiveness of B against A may have the same effect on A's current account and trade performance as a 10% change in C's competitiveness against A, in which case B and C should have equivalent weights in A's competitiveness index. In practice, these effects can only readily be allowed for in a model of the sophistication of IMF MERM. We do not allow for them in this study.

It is assumed that P_h and P_i are expressed in a common currency, typically dollars. With home and foreign prices in local currency fixed, a decline in the exchange rate of currency h against the dollar (exchange rates of the i countries against the dollar fixed) reduces P_h proportionately relative to P_i. This improves competitiveness, the index being conventionally defined such that a rise in I denotes loss of competitiveness.

(b) General Problems

There are a number of problems common to measures using (relative) wholesale or traded goods prices which are best considered initially. These criticisms principally derive from Enoch (1978) and Kravis and Lipsey (1971), and primarily apply to trade in manufactures, though their force is not diminished if other goods are also included.

First, the discussion of market form suggested that prices of goods produced by different countries may be constrained to be equal if sold in the same market. Apparent differences in index movements between countries may be interpreted as symptomising faults in measurement of wholesale price or export unit value indices which in turn vitiate their use as measures:

(i) Variable coverage and completeness of the indices between countries. The problem will probably be less acute for wholesale prices than for export prices, since the "bundle" of manufactures produced by one country will probably resemble that produced by another more closely than the two respective bundles of exports of manufactures, assuming that a degree of specialisation occurs in trade.

This problem is potentially of considerable empirical importance in the inter-war period. The UK's price competitiveness apparently improved during the 1920s according to the relative wholesale price measure.[1] But textiles, a sector in which prices declined disproportionately during the 1920s worldwide, had larger weight in the UK wholesale price index than in many others.[2]

(ii) Quality improvements may show up as a loss of relative price competitiveness, since they entail higher value added in production and hence bring about higher prices.

(iii) Where goods in international trade are sold by one subsidiary of a multinational corporation to another, the transactions may not take place at true "economic" prices. This is a particular problem of export UVIs, but is less likely to be of empirical significance inter-war.

(iv) Neither export price indices nor wholesale price indices can take account of unsuccessful tenders - goods offered for sale but not bought because their prices were uncompetitive. Any good that is the subject of a transaction (which is all that wholesale price and export price indices can measure) is in a sense competitive. Hence, Kravis

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1. See Table 2.3.

2. See p.67 above.

and Lipsey (1971) (p.76) consider offer prices of some goods which were the subject of unsuccessful tenders. This required the use of survey techniques, which were not available here.

(c) Specific Measures

(i) Relative Export Prices

Typically constructed using equation (3.1) with P_h, P_i unit value indices of the exports of countries h, i. Gould, Mills and Stewart (1981) favour the measure:

> "The only two indices which deal exclusively with goods entering into international trade are those covering relative export prices for manufacturers and the terms of trade for manufacturers. It should come as no surprise that, used with care, these two indices are better able than any others to explain what has actually happened to our trade." (p.132)

The measure suffers from all the general problems discussed. Relative prices of goods not entering trade are not considered. Further, the measure does not consider competitition between exports of the home country and domestic production in foreign countries. Nor are profit margins of exporters considered. In a competitive market, profits can be squeezed when prices rise, leaving relative prices unchanged, but reducing export volumes via the supply side. Conversely, a fall in relative export prices can occur in ways which would not be expected to increase export volumes; e.g. (1) A fall in the world price of a good which has greater weight in home country exports than in the average of exports of competitor countries; (2) A decline in the relative quality of home country exports which the level of disaggregation in the export UVIs could not pick up.

(ii) Import Price Competitiveness

This is typically expressed (for the UK) as:

(3.2) $$\frac{\text{UK wholesale price index (manufactures)}}{\text{UVI of UK imports (manufactures)}}$$

A rise in this index, implying a loss of competitiveness, would be expected to increase imports, so that the competitiveness term should have a positive coefficient in the import equation.[1] But the difficulty that the 'domestic' and 'foreign' bundles of goods may differ in composition is likely to be particularly acute with this measure, since many imported goods are goods for which there is no domestic substitute. If the measure refers to total imports, and not merely manufactures, this difficulty would be intolerable. It would be misleading, in the inter-war period, to regard UK competitiveness as being directly affected by a change in the price relativity between manufactures and coal (dominating UK output) and food and raw materials (predominating in imports). The measure is further subject to the general problem that goods not imported are not measured.

(iii) Relative Wholesale Prices

This takes the general form of equation (3.1) with P_h and P_i representing home and foreign wholesale prices. The chief advantage of the measure is that wholesale prices may be the closest available measure of the price of "tradeables" - goods which potentially could be exported or compete with imports. But difference of composition

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1. Possibly because this is unusual, the numerator and denominator are reversed in Horton (1984).

between countries is again likely to be a serious problem. Moreover, in the inter-war period, when wholesale price indices were dominated by raw materials, the competitive market paradigm may be highly applicable, so that relative price movements may be hard to interpret.

(iv) Relative Export Profitability

This measure constitutes an attempt to take supply side factors into account. It compares the profitability of producing goods for export as against producing for the home market, being typically defined as:

$$(3.3) \qquad \frac{\text{UVI for UK Exports (of manufactures)}}{\text{UK Wholesale Prices (manufactures)}}$$

An increase in the index implies improved competitiveness. The measure may be criticised on various grounds:

(i) Enoch (1978) argues that the export UVI reflects past production prices, whereas the WPI is a current price measure. If the relationship between past and current production prices changes between the base and current periods, the measure is distorted. Enoch suggests the use of export price and GNP deflators to resolve this, but this would pose considerable data problems;

(ii) It is assumed that production for the home and export markets are alternatives; this may be inappropriate in the short term;

(iii) Changes in this measure of competitiveness may only be of great importance when the economy is at full capacity (so that attracting resources from other uses rather than idleness is important.)

(iv) There may be considerable compositional differences between numerator and denominator;

(v) It is not clear that the ratio does reflect a difference in profitability; for example, in a mark-up pricing world, a rise in this measure of "competitiveness" could simply reflect an increase in the cost of exporting;

(vi) Richardson (1977) suggests that the analogous ratio should be examined for foreign competitors, so as to arrive at "relative relative export profitability". But this is only obviously valid where criticism (iii) is generally inappropriate, i.e. in a world of general full capacity.

(v) Kravis and Lipsey's Ideal Price Competitiveness

This measure aims to overcome the problems of compositional differences and the exclusion of goods which failed to enter transactions. Each country index is to be constructed with a common commodity weighting system, and using the actual prices at which trade occurred or price offers, rather than UVIs. E.g. the "international" price index for the US would be:-[1]

$$(3.4) \quad P_{US} = \frac{\sum_{i=1}^{k} \left(\frac{P_{i1}}{P_{io}}\right)_{US} w_{i,1963}}{\sum_{i=1}^{k} W_{i,1963}}$$

where i = 1 ... k	indicates specific goods
$w_{i,1963}$	denotes the weight of i in world trade in 1963 (base year).
P_{ioUS}	is the price of good i when exported by the US in 1963
P_{i1US}	is the price of good i when exported by the US in the current period.

P_{US} and the analogous indices for other countries can be constructed for groups of commodities, so that bilateral or multilateral comparisons can be made sector-by-sector or in aggregate. Survey data were used in Kravis and Lipsey (1971) to obtain figures on unsuccessful tenders.

The measure is still subject to considerable practical and theoretical problems:

(i) The data are hard to acquire and somewhat subjective; survey data are necessary to measure unsuccessful tenders;

(ii) Interpretation of rises or falls in the index is still complicated by considerations of market paradigm; a rise in the

1. cf. Kravis and Lipsey (1971) p. 8 and discussion of methods, pp.39-120.

index could produce a rise in exports if supply side factors were predominant.

(vi) Relative unit labour costs (manufacturing)

This measure takes the form of equation (3.1) with P_h, P_i unit labour costs in the home and foreign countries. In turn unit labour costs are now defined as labour compensation divided by actual output. For the inter-war period compensation is simplified to "earnings".

An improvement in competitiveness by this measure (reduction in relative unit labour costs) should improve trade volume performance whether supply or demand factors are more important. If mark-up pricing prevails, the fall in relative unit labour costs will reduce relative prices and improve trade volume performance through the demand side. If the market structure is such that relative prices are constrained, lower relative unit labour costs imply increased profits, and provide an incentive to increase supply.

The use of relative unit labour costs has been criticised on the grounds that since labour hoarding may occur during recession, productivity tends to vary pro-cyclically, but that such expected variations may not affect pricing or production decisions of firms. Hence:

(vii) Relative Normalised Unit Labour Costs (RNULC) (Manufacturing)

This is defined as relative unit labour costs, except that potential output replaces actual output in the calculation of "normalised" unit labour costs at home and abroad. Potential (i.e.

full capacity) output is calculated using data on investment and an estimate of the effect of technological progress.[1]

RNULC is in turn criticised on a number of grounds:

(i) The calculation of potential output, especially of productivity improvements arising from technical progress, is extremely complex. In this study, we adopt the crude procedure of assuming potential output to grow at the average growth rate of actual output between cyclical peaks.

(ii) It may be that a high level of domestic demand impairs export performance, ceteris paribus, by drawing resources out of the export sector. RNULC will tend to suggest that a country is less competitive than shown by the RULC measure when it is close to full capacity, and may therefore give a better fit in an export equation excluding a domestic demand term, but in such circumstances its interpretation may be unclear.

(iii) RNULC and RULC as used in modern work both confront the problem that costs in the manufacturing sector perfectly proxy costs in other tradeable sectors, if trade outside manufacturing is to be modelled.

(iv) It could be objected that RNULC and RULC both take no account of actual pricing decisions, and may understate demand-side influences of competitiveness.

(v) The rationalisation for normalisation is unclear in a prolonged

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1. For details, see Artus (1977).

recession, such as that in the inter-war period, since labour hoarding will eventually be unsustainable. It is possible that if the least efficient plants and workers eventually become idle, unit labour costs may be artificially lowered.

Nevertheless, the capacity of RNULC to capture both demand and supply side influences of competitiveness emphasises the value of subjecting it to further testing, in particular where there is reason to suppose that exports may be supply constrained.

(viii) Unit costs

Pricing and supply decisions of firms may be influenced by costs other than labour costs. OECD (1978) favours considering unit labour and raw material input costs. This allows the possible rise in costs faced by domestic firms following devaluation or the imposition of import tariffs to be taken into account. However, the OECD (1978) study revealed considerable difficulties in obtaining comparable international data for such a measure. Moreover, the study showed about 75% of unit costs accounted for by labour (with proportions varying across countries between 70% and 85%). Finally, measured in foreign currency terms, and excluding commodities (e.g. energy) distorted by inter-country differences in taxes or tariffs, the prices of raw materials traded in competitive international markets tend to vary relatively little.

(ix) Absolute Export Profitability

Richardson (1977) suggests that a measure of the absolute profitability of exporting should be considered, for example:

(3.5) $\frac{\text{UVI UK Exports}}{\text{UK NULC (or ULC)}}$ [1]

If 'absolute' profitability contributes to export performance by providing resources for e.g. greater sales effort, or improved product design, a measure of "relative" absolute export profitability should be constructed, calculating indices for competitor countries analogous to (3.5).

Richardson preferred in practice to use wholesale prices rather than the export UVI in the numerator; this might be particularly appropriate for the "relative absolute" measure, since this best captures the competitive position of foreign suppliers in their domestic markets in which UK exports must compete.

The importance of relative costs

Richardson (1977) wrote, in common currency ($):

$$(3.6) \quad \ln XGMA = a_0 + a_1 (L) \ln \left[\frac{(UX)}{(PW)}\right] + a_2 (L) \ln \left[\frac{(UX)}{(PWHO)} \Big/ \frac{(PW)}{(WPWHO)}\right] + a_3 (L) \ln \left[\frac{(PWHO)}{(ULC)} \Big/ \frac{(WPWHO)}{(WULC)}\right] + a_4 (L) \ln WT + a_5 (L) \ln C_{UK} + a_6 (L) \ln C_c + a_7 t + U_t$$

1. Total unit costs would be preferable but are assumed impracticable

where: XGMA = UK exports of manufactures

WT = world trade in manufactures

$\left(\frac{UX}{PWHO}\right) / \left(\frac{PW}{WPWHO}\right)$ = UK "relative relative export profitability

$\left(\frac{PWHO}{ULC}\right) / \left(\frac{WPWHO}{WULC}\right)$ = UK "relative" absolute profitability

PWHO, WPWHO = UK and competitors' wholesale prices of manufacture

ULC, WULC = UK and competitors' unit labour costs in manufacturing

C_{UK}, Cc = UK and competitors' domestic demand pressure

UX, PW = UK and competitors' export UVIs in manufacturing

t is a time trend, and U_t a stochastic error term.

(L) denotes a lag structure

Sign expectations are $a_1, a_5 > 0$

$a_2, a_3, a_4, a_6 > 0$

Collecting terms:

(3.7) $$\ln XGMA = a_o + (a_1 (L) + a_2 (L)) \ln \left(\frac{UX}{PW}\right)$$

$$+ (a_3(L) - a_2(L)) \ln \left(\frac{PWHO}{WPWHO}\right)$$

$$- a_3 (L) \ln \left(\frac{ULC}{WULC}\right)$$

+ (terms in time, demand pressure, and world trade)

If the absolute values of a_1, a_2 and a_3 are equal, and the corresponding lag structures identical, (3.6) reduces to an equation with only relative costs as the competitiveness measure. In any case, an improvement in relative cost competitiveness unambiguously improves export performance (with $a_3 > 0$) while changes in the measures using relative export or wholesale prices are ambiguous in their effects.

3. Measuring 'Non-Price' Competitiveness

Opinions as to the relative importance of non-price and price competitiveness vary from Gould, Mills and Stewart (1981):

> "In any case, there is no such thing as non-price competition in a market economy" (p.100)

to NEDO (1977) and Brech and Stout (1981), who ascribe much of the UK's long-run decline in share of world manufactured exports to a loss of non-price competitiveness. Curiously, both feel that the importance of exchange rate changes may therefore be understated; Gould, Mills and Stewart argue

> "... it follows that any imbalance in trading performance as evidenced by a persistent deficit or a declining share of world trade, is due to a misalignment of exchange rates." (p.88)

while Brech and Stout contend that

> "apparent price elasticities of demand for UK exports probably underestimated true price elasticities because of the relative product degradation which had been accompanying a series of devaluation episodes." (p.269)

We consider here various possible elements of non-price competitiveness, and how the various concepts may be measured.

(i) "Unique products

This is a function of the degree of disaggregation employed; a unique product at a very high level of disaggregation is merely a differentiated product when broader product categories are considered. Nevertheless, Kravis and Lipsey[1] produce survey evidence suggesting that product uniqueness is a factor in purchasers' decisions.

Where such products are important, one would expect:

(i) absolute profitability to be high; and

(ii) demand to be less than perfectly elastic with respect to price (although if markets are monopolised by a firm or profit-maximising cartel, the price-elasticity of demand should exceed 1).

Estimated relative price elasticities are therefore likely to be consistent with "demand-side" rather than "supply-side" predominance in determining trade performance.

(iii) Product quality and other forms of differentiation

For Brech and Stout (1981), this is a very important factor in non-price competitiveness. A crude macro-economic measure which may

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1. Kravis and Lipsey (1971) chapter 7.

be suggested is the relative UVI of exports, UK against other countries, in detailed product categories. But it is difficult to determine whether an increase in such a measure reflects improved product quality or a loss of price competitiveness - or simply the various problems with UVIs. More disaggregated analysis may be helpful. It might for instance be revealed at a very fine level of disaggregation that genuinely identical goods were subject to LOOP internationally, but that at a more aggregate level one country had had an increasing relative export UVI index. This would suggest that that country exported a high proportion of higher quality goods, and had a structural competitive advantage, as distinct from an advantage in competition within each sectoral market.

Alternatively (though with formidable data difficulties) value added per unit of production can be examined. This assumes that high quality is reflected in the amount of workmanship (and/or capital) applied to a given quantity of raw materials in a product. Of course, it is difficult to separate high value added per unit from high unit labour costs. One possible point of distinction is the time element; an increase in relative unit labour costs which reflected an improvement in quality competitiveness might persist (and possibly result in a further increase in RULC,[1] if a decline in "price competitiveness" occurs to leave the current account in balance). An increase in relative unit labour costs which was

1. In common currency. This effect is highly likely to occur via the exchange rate, and might be termed "trading up".

associated with a loss of price competitiveness might be expected not to persist if prices are the only equilibrating forces present in different markets. This assumes that 'quality' is less mobile internationally than factors of production - a highly contentious assumption.

At a more disaggregated level, Kravis and Lipsey (1971) suggest looking at product characteristics - regarding a particular product not as one unit but as a bundle of "virtues"[1] to be bought by the consumer. Conceivably, regression analysis (of the prices paid for products on their varying "virtues") may give an estimated price for each "virtue".

Data on research and development expenditure in particular industries in particular countries may be examined. Although this once again regards increasing cost as an indication of improving competitiveness, R and D is a form of expenditure fairly directly aimed at quality.

Product differentiation may occur through means other than the product itself. Kravis and Lipsey's evidence suggested that after-sales service was important.[2] Effective marketing may be critical; Batchelor (1977) argued that a reduction in unit labour costs may facilitate an increase in marketing expenditure through expanded profit margins.

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1. My terminology.

2. See Kravis and Lipsey (1971), p.153.

None of these influences on competitiveness can easily be tested on inter-war data. They do, however, suggest that disaggregated work may have some independent value. They also tend to confirm the difficulties of interpretation of conventional competitiveness measures, and may constitute partial explanations of frequently disappointing or widely varied estimates of competitiveness elasticities.

(iii) Speed of delivery

Greene (1975) has surveyed much earlier work on this topic. The theoretical insight is that where the time between placing an order and shipment is longer than anticipated by the buyer, there is a loss to the purchaser of the present value of the use of the good in the period between expected and actual arrival time, only partially offset (assuming a positive discount rate and no increase in the value of the good's services over time) by the value of the good's services after the period when it was expected to have been exhausted. A machine likely to arrive earlier than a competitor machine therefore has a competitive advantage.

Greene studied export orders for particular industries in both current and constant prices. The typical regression equation for the constant price (i.e. volume) model was:

$$(3.8) \quad \ln KXO_{ijt} = b_o + b_1 \ln KD_{oit} + b_2 (W_{ij} - W_{ik})_t + b_3 \ln (P_{ij}/P_{ik})_t + e_t$$

where KXO_{ijt} = Export orders placed with industry in country j at time t (in 1965 \$)

KD_{oit} = sum of all orders placed with industry i at time t

P_{ij}/P_{ik} = price index for industry i in country j/country k

W_{ij}, W_{ik} = waiting time in months between order and shipment for industry i in countries j and k.

Sign expectations are $b_2 < 0$, $b_1 > 0$, $b_3 < 0$.

Some reasonable results were obtained; waiting time was significant in about half of the equations for which the equation itself and b_1 were significant; 70% of the waiting-time coefficients were right-signed. Some experimentation was done, using foreign income as the scalar variable, and taking into account the relative price of good i in the world, without altering results substantially.

The statistical prodedures may be criticised in various respects:

(i) Cochrane-Orcutt or a lagged dependent variable were automatically applied where the original DW statistic was unsatisfactory, which may be naive;

(ii) Without the separate inclusion of a "domestic demand pressure" term, the extent to which "waiting time" may proxy for this is not clear, though increased waiting time may be a key means by which demand pressure in practice influences exports;

(iii) The "pair-wise" relative price indices may not measure competitiveness well.

The possible influence of waiting time may perhaps most practically be allowed for by considering for the home country and competitors:

(i) The level of aggregate demand (is anyone kept waiting?);

(ii) The relative profitability of selling at home or exporting (who is kept waiting?).

(iv) Institutional arrangements

A wide variety of institutional arrangements may influence trade performance. Several of these may be slow to change over time (at least in relative terms between different countries), and may have little econometric effect. Nevertheless we consider some potential influences briefly:

(a) Tariffs. Tariffs imposed by the home country, to improve the competitiveness of its import-competing sectors, would need to be allowed for in an import volume equation. They may, however, impair export competitiveness by raising the price of imported inputs[1], and possibly of domestic labour (in response to more general inflation).

Tariffs imposed by foreign countries can of course seriously affect UK exports. This effect should be picked up by a "world trade" variable in a UK export equation, if UK and other countries' exports are proportionately affected. This will not be the case if: (1) The UK (or other countries[2]) are specifically

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1. See Corden (1971) (chapter 3) for further discussion, and Capie (1978), who allows for this in calculating "effective protection" for UK industries inter-war.

2. As for instance in the case of Imperial Preference following the Ottawa Conference in 1932.

discriminated against; (2) Tariffs discriminate against goods exported particularly heavily by the UK (or others); (3) Tariffs are imposed by countries with which the UK (or others) trade disproportionately intensively.

Tariffs may also pose difficulties in constructing the appropriate competitiveness index; for example, the UK export UVI will not reflect the prices facing purchasers in tariff-imposing importing countries. This consideration may again suggest the usefulness of a relative cost measure.

(b) Other trade distortions. Various other trade policies may have an impact on trade performance; e.g. export subsidies; quota restrictions; or (nowadays) "safety" regulations. Differences in the availability of export credit may be important. This is nowadays provided by government; in the inter-war period, a well-developed private financial sector might yield a competitive advantage.

(c) Other distortions. The case of export credit arrangements could be taken as one example of the many ways in which infrastructure may contribute to trade performance; transport and communications, and degrees of official efficiency in document processing are others. Political and other bilateral relations between particular countries may influence trade, even if not supported by protective measures; this was of some importance in the 1930s when the multilateral world trade and payments systems largely broke down.[1]

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1. See, for example, Foreman-Peck (1983) pp.213 et seq.

In general, these distortions will simply constitute sources of error in empirical work. They do, however, suggest the importance of considering institutional factors and trading relationships prior to econometric estimation.

Conclusion

Our discussion has highlighted a number of difficulties of interpretation arising with conventional competitive measures. Whether or not improving price or cost competitiveness is likely to be associated with improving or deteriorating non-price competitiveness remains a critical debate. Batchelor (1977) suggested that cost reductions may facilitate improved marketing, or research and development. Overseas investment, which may well be stimulated by strong competitiveness (see p. 144), may help to improve the dynamism and responsiveness of the economy. On the other hand, Brech and Stout (1981) fear that depreciation which produces relative price/cost reductions may preserve in business firms producing low-quality goods.

The debate indicates the extent to which "competitiveness" may be an empirical as well as a theoretical construct. Empirical investigation should proceed at both aggregate and disaggregated levels; there may be an important distinction to be drawn between a shift in types of industry (from 'low' to 'high' quality industries) and an improvement in the quality of output within an industry. Both types of work, particularly the disaggregated, will be subject to theoretical (as well as data-deficiency) sources of error, and in both, there may be relevant institutional considerations.

III. The Effects of Competitiveness

1. Introduction

Empirical work in this field aims to answer (or assist in answering) two questions:

(i) What is the best measure of "competitiveness"?

(ii) What effects do changes in this measure of competitiveness have on trade performance?

The preceding discussion suggests that a variety of measures may illuminate a country's competitive position, and that empirical work may help to clarify the relative usefulness of the various measures. The empirical work frequently takes the form of regressing the volume of a country's exports (in aggregate or in key sectors) and/or imports on a "scalar" variable - world income, industrial production, or trade (domestic income or expenditure in the case of imports) - and the selected measure of competitiveness. This introductory section discusses various issues raised by this procedure.

(a) Why exports of manufactures?

A number of factors contribute to a tendency in the literature to estimate equations for exports, specifically of manufactures.

(i) Exports in primary product sectors may be prone to major supply fluctuations, e.g. harvest failures.

(ii) The manufacturing sector is most likely to have foreign demand affected by price competitiveness: product differentiation is more important than for food and raw materials.[1]

(iii) Manufactures have for many years constituted a large proportion of total UK exports (69% in 1929[2]; 82% in 1975[3]). An adequate explanation of manufactured exports is a major contribution to explaining total UK exports.

(iv) Since economies of scale are (allegedly) most readily achieved in manufacturing, and productivity growth is fastest in this sector, rapidly growing countries are most likely to enjoy an expanding share of world markets in this sector.[4]

More generally, export performance may be regarded by many as the truest test of competitiveness since each country has a smaller share in world markets than in its own. "Home" industries have many advantages besides tariffs - e.g. domestic tastes; social pressures; marketing network; low transport costs; and covert or overt government support (though if these factors remain relatively

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1. Though trade in primary products may still be influenced by competitiveness through the supply side.

2. League of Nations Memorandum on Balance of Payments etc. (1930). BISC classification, category IV.

3. NIER (1980) Table 16 p.75. SITC 5-8 as percentage of total.

4. For example, Krugman (1986) notes that Japan's productivity growth advantage relative to the US has been most pronounced in the tradeable sectors, notably manufacturing, and especially in some of the fastest growing "hi-tech" sectors.

constant over time they should not unduly influence estimated elasticities). Firms which export may be considered to be on an equal footing with exporting firms in other countries, although not vis a vis foreign domestic suppliers.

(b) Interpretation of the scalar coeffients

A problem of interpretation arises if the elasticity coefficient on the 'scalar' term significantly differs from 1;[1] e.g. if the scalar is world trade, the UK market share varies for reasons other than competitiveness (and any other terms included in the equation). A tendency to lose market share as world trade expands might reflect a competitive weakness. Two interpretations are offered here. First, if integration and specialisation were increasing abroad without UK participation, it would be possible for the UK to preserve a constant share of world trade in value-added while losing share in world trade volume. Alternatively, world industrial production [2] can be used as the scalar. In this case, a rise in the scalar variable entails both an implicit increase in demand for UK exports and an explicit rise in the volume of competing supply. A coefficient of less than 1 seems plausible in such a case. Moreover, this coefficient will also be affected by variation in the global relationship between trade and output.

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1. Assuming the usual log-linear specification, e.g.
(3.9) $\ln X = \alpha_1 \ln WTX + \alpha_2 \ln COMP + \ldots$ other terms
where X = exports, WTX = world exports, COMP = competitiveness.

2. Or UK trade-weighted industrial production (TWIP), as used in the exports of manufactures equation estimated by Hotson and Gardiner (1983).

An analogous problem of interpretation may arise with the income (or total expenditure) elasticity of imports in an aggregate equation. Barker argues that as real income and demand rise, the share of imports would be expected to increase as purchasers tend to buy a greater variety of similar products.[1]

(c) Time Trends

Many researchers include a time trend in their export equation. Various rationales may be offered, e.g. a trend change in trade ties with particular countries (e.g. EEC or Commonwealth countries in the UK case) arising from political developments. Nevertheless, a time trend with a negative coefficient in an export volume equation might be interpeted as proxying a long-term loss of non-price competitiveness.

(d) Degree of disaggregation

Winters (1981) reveals the wide variation of parameter estimates for different sectors obtainable in a disaggregated study (see Tables 3.4 and 3.5), and we have already suggested that disaggregation may be helpful in illuminating various problems connected with market form and non-price competitiveness. There are, however, advantages to estimating relatively aggregated equations, e.g.:

(1) The aggregate results following from operation of macro-economic policy instruments (the exchange rate, or fiscal and

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1. Barker (1976) p.165

monetary demand management) may be of most interest to government.

(2) There are considerable difficulties in constructing the most appropriate competitiveness measures in disaggregated sectors (see chapter 6).

(e) Dynamics

Changes in competitiveness may affect export and import volumes with lags. The specification of the distributed lags of the competitiveness terms is highly controversial.[1] Two prior observations:

(1) Small changes in the specified lag structure can apparently change the long-run coefficient on competitiveness substantially. Compare the coefficient of -0.55 on the sum of lagged relative NULC terms in the Bank of England (1979) export equation with that of -0.82 on a similarly defined variable in the HMT (1980) equation. The different order Almon lag patterns appear to be an important source of the divergence.

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1. Brooks (1981) tested two fairly successful equations for exports of manufactures, the Bank of England (1979) and HMT (1979) equations, and found evidence of misspecification (auto correlation) which might have been a consequence of inappropriate length of lags and constraints on them.

(2) The length of lag to be included is also controversial. The HMT (1979) and (1980) equations include terms lagged from 0 to 17 quarters, whereas Thomas (1976), working on the UK in the inter-war period, considers only 1 year lagged competitiveness terms.

Both theory and observation should play a large role in deciding such issues. Perception and reaction lags on the demand side may be relatively short, assuming that substitute products made by foreign firms are available. If, however, supply side factors, such as the location and investment decisions of multinationals, are held to be important, extremely long lags could be justified on a competitiveness term which reflected these factors (e.g. relative costs or profitability).

The shape of the lag coefficient restrictions may also be influenced by theory. It may be unsatisfactory to have opposite signed coefficients on various lagged terms in competitiveness. Polymodal patterns may be justified by the variety of lagged effects covered, or as a consequence of aggregation across commodities (e.g. if a country exports only cars, where from order to delivery may be only a short lag, and perceptions may also be rapid, and ships, where production is a long process, a bimodal distribution would be expected). It is therefore wise not to restrict the possible choice of lag patterns too much in advance. However, our own estimates on annual data for the inter-war period suggest that complex lag structures may not be required.

2. Simple estimates of price elasticities in international trade

Existing empirical work has been undertaken at varied levels of complexity. We distinguish here between single equation and multiple equation models, but even single equation work may implicitly include both supply and demand-side factors. Simple approaches have frequently characterised international comparisons, which are useful corroborative evidence for any conclusions drawn for the UK.

Results from some recent work are summarised in Tables 3.1 and 3.2. Some general features should be noted:

(i) Nearly all the coefficient signs are in accordance with a priori expectations consistent with the interpretation that a rise in the relative price of exports, or a fall in the relative price of imports, represents a loss of competitiveness which ceteris paribus leads to a fall in export volumes or a rise in import volumes.

(ii) Table 3.1, reporting results for the UK, gives little ground (the OECD result excepted) for "elasticity pessimism" (i.e. the view that relative price changes have little effect). Where estimates for exports and imports are both available, the absolute values of the relative price elasticities sum to well over 1. However, the results in Table 3.2, comparing results for different countries, are variable. Prima facie, a devaluation would worse the trade balances of Belgium and the UK on the OECD LINK figures, and of the Netherlands on Houthakker and Magee's figures.[1]

(iii) The divergence between the price elasticities facing countries in Table 3.2 is striking, even though the table refers to total trade, so that different commodity composition of exports may account for some of these differences.

(iv) Table 3.2 shows striking divergences between the LINK estimates and those of Houthakker and Magee. To take two spectacular cases, LINK have the Swedish export elasticity with respect to price at -1.92 compared with a figure of -0.71 for the UK; Houthakker and Magee have the elasticities for the UK at -1.24 and for Sweden at -0.47.

(v) Balassa (1979) makes several criticisms of the work of Houthakker and Magee. The omission of a capacity variable, and the failure to consider changes in quality, are, he suggests, very serious. Balassa examined the commodity composition of UK exports, and found that the UK would have had very rapid export growth between 1955 and 1970 had it maintained its share of the world market in each sector. The apparently low income elasticity of demand for UK products (0.86, but 1.00 after correction for serial correlation) estimated by Houthakker and Magee therefore represents a loss of competitiveness rather than genuine low income

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1. Goldstein and Khan (1985), p.1076, read the consensus of empirical results, at least for long-run elasticities, as "firmly in the camp of the elasticity optimists."

elasticity of demand for these products, according to Balassa. The presence of severe serial correlation in many of the equations estimated by Houthakker and Magee could be further evidence of misspecification.

Overall, there is a considerable range of estimates of competitiveness elasticities in both export and import equations, not only for different countries but even for the UK on slightly different data and in different specifications. All these estimates are subject to doubts arising from the earlier discussion of the measures of competitiveness used. There is therefore considerable scope for further research on both recent and historic data.

Chapter 4 discusses in more detail the specifications and competitiveness measures used in the work of Thomas (1976), Hatton (1982) and Matthews (1985) on UK exports inter-war, but the results obtained form an interesting comparison with the post-war results. Thomas does not use the log-linear form, so that price elasticities are not constant along the export demand schedule, but computation at the mid-point of the demand schedule gave a reported elasticity of - 0.53. Thomas reports Chang (1951) as also estimating an export price elasticity of - 0.53. He also quotes Chang's estimated import price elasticity of between - 0.28 and - 0.59 in corroboration of his own midpoint estimate of - 0.42.[1] Hatton obtained an export price elasticity of - 2.19, and Matthews an elasticity on a linear combination of the real exchange rate

1. Cf.Chang (1951) chapters II and III with Thomas (1976) chapter V.

and the expected real exchange rate of -1.68. The - 1.5 assumption of Moggridge[1] accords well with these later estimates. This controversy over competitiveness elasticities is of considerable importance in view of the inter-war macro-economic policy context.[2] The more exhaustive approach in this study tends to confirm the Hatton/Matthews results as against Thomas, with implications discussed further in chapter 8.

3. Simple estimates of cost elasticities in international trade

Prior to considering some more complex specifications, we review here Fetherston, Moore and Rhodes (1977) (hereafter FMR) and Enoch (1978). Results are given in Tables 3.3 and 3.Tl.

Enoch considered 9 different measures of competitiveness as alternatives in equation 3.Tl.1. The equation which used relative NULC had the lowest standard error and was therefore preferred. $\bar{R}^2$ and DW statistics were also favourable; the t-value on the COMP. variable was the highest apart from that on XPROF; and the equation performed relatively well in tests of parameter stability. On the other hand, the coefficient obtained on WTX was low (which might be symptomatic of weak competitiveness not indicated by RNULC). Subsequent re-estimation using 1975 as the price base increased the WTX coefficient and reduced that on RNULC.[3]

A similar exercise on UK imports of finished manufactures produced two important points of comparison:-

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1. See pp.91 et seq. in Moggridge (1969).
2. See pp.6-17 above.
3. See Bank of England (1979) p.23.

TABLE 3.T1: Comparing measures of competitiveness in explaining exports

Comp.variable	Competitiveness Elasticity	$\bar{R}^2$	SE	DW	
REP	- 0.9964 (2.03)	.981	.0286	1.72	EST.1967 Q1-1977 Q2 Lags of 0 to 16 quarters on COMP.
RCPI	- 0.8384 (2.83)	.978	.0271	1.74	
XPROF	1.0338 (53.29)	.977	.0273	1.71	
RULC	- 0.7742 (3.31)	.979	.0261	1.79	
RNULC	- 0.8381 (3.86)	.981	.0252	1.88	
RSULC	- 0.6572 (2.82)	.978	.0267	1.79	
RSTUC	- 0.8144 (2.95)	.979	.0265	1.81	
RPX	4.2534 (3.07)	.978	.0272	2.21	
APX	- 2.9766* (2.48)	-	-	-	

Source:Enoch (1978)

t - values in parentheses

* "wrong" sign.

The table gives regression results from:

$$(3.T1.1) \quad \ln XGMA = \alpha_o + \alpha_1 \ln WTX + \alpha_2 \ln DWIP + \alpha_3 D674 + \alpha_4 \ln COMP + \alpha_5 TREND + \varepsilon_1$$

XGMA = volume of exports of manufactures excluding erratics

WTX = Volume, world exports of manufactures

D674 = Dummy, 1967 Q4 dock strike

DWIP = Deviation of OECD industrial production from trend

COMP = Competitiveness variable

REP = Relative export prices

RCPI = Relative consumer prices

XPROF = $\frac{\text{UVI exports of manufactures}}{\text{Wholesale prices}}$

RULC = Relative unit labour costs

RNULC = Relative normalised unit labour costs

RSULC = Relative seasonally adjusted unit labour costs

RSTUC = Relative seasonally adjusted total unit costs

RPX = $\frac{\text{Export price deflator}}{\text{GDP deflator}}$

APX = $\frac{\text{Export price deflator}}{\text{GDP deflator * relative productivity in manufacturing}}$

(i) Changes in competitiveness had much more rapid effects on imports than on exports. Conceivably, UK exporters may be slower to respond to a gain in UK competitiveness than foreign exporters to the UK if the UK loses competitiveness. Alternatively, the result may follow from misspecification, e.g. of the Almon polynomial lag structure in the export equations.

(ii) Different measures of competitiveness were used in the best fitting equations on exports and imports. However, in the import equation published in Bank of England (1979),[1] RNULC had a 50% share in the preferred composite competitiveness measure. Overall, therefore, Enoch's work suggested that RNULC was the best single measure of competitiveness.

Since Enoch included no domestic demand pressure term in the XGMA equation, the normalisation procedure (which lowers UK RNULC, implying better competitiveness than implied by RULC, when there is a high degree of spare capacity in the economy) may improve the equation fit by proxying a domestic demand effect.

We therefore consider the performance of the (unnormalised) RULC measure more closely. Table 3.1 allocates this variable second place in minimising the SE of the export equation. FMR compared RULC elasticities in different countries, with the results shown in Table 3.3. The coefficients on lagged competitiveness decline

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1. Bank of England (1979) pp.32-3, which employs the notation NULC for the term called RNULC in this study.

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1. Bank of England (1979) pp.32-3, which employs the notation NULC for the term called RNULC in this study.

geometrically, by contrast with the Almon patterns in Enoch (1978) and HMT (1979) and (1980).

"Short" lags in FMR's work have λ such that there is a 60% per annum decline in the weight of the lagged terms in current competitiveness; "Longer" lags have a 30% pa. decline in these weights. Outstanding features of the results were as follows:

(i) The low responsiveness of German market share to competitiveness changes. This might suggest a trend to improving non-price competitiveness as the DM rose in value in the 1970s.

(ii) The other long-run coefficients shown are surprisingly similar, and those on the "short" lag patterns are well in line with Enoch's estimate in Table 3.T1 for UK RULC.

(iii) There is further evidence that the full effects of a change in competitiveness may take some time to come through on export performance, although the long-run competitiveness coefficients are still in several cases not well determined.

(iv) Several points arise from the coefficients on time (α_1) and world trade (α_2). France, the UK, and Italy all had negative α_2, while Germany had $\alpha_2 = 0$ and the US and Japan $\alpha_2 > 0$, suggesting that the last two countries gained in share during world cyclical upswings and would thus have an incentive to act as "locomotives" of world demand. The UK and US had $\alpha_1 < 0$ (i.e. a trend loss of market share); West Germany, Italy and Japan had $\alpha_1 > 0$, while France showed little trend change in share.

FMR observed that between 1970 and 1976 the UK would have needed to improve its RULC by 16.8% to maintain market share, and that despite a massive decline in sterling, only a 2.9% improvement was achieved. They concluded that long-term trends dominate performance over anything but the very short term, and that exchange rate changes were insufficient response.

Note in comparing the RULC elasticities in Tables 3.Tl and 3.3 with the price-elasticity estimates in Tables 3.1 and 3.2 that relative price elasticities should normally be greater in absolute terms than cost elasticities. Suppose that the UK devalues by 10% against the dollar. This will reduce UK costs by 10% in dollar terms at impact. The dollar price of UK exports will fall by between 0 and 10%, depending on the influence of domestic costs on export prices.[1] The given change in export volumes resulting from the devaluation will have followed a smaller relative export price change than relative cost change; hence the export price elasticity will appear greater. The RNULC and RULC elasticities in Enoch's work were therefore consistent with the Marshall-Lerner condition being comfortably met.

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1. Cf. chapter 5.

There may be a danger of misspecification attached to these single equation models of exports and imports.[1] Several more complex models attempt to consider supply and demand factors explicitly, and/or the determination of trade prices along with volumes. Some of these are now examined, principally for further insights into the problems faced by simpler models.

4. Complex estimates of price and cost elasticities in international trade

We begin by considering the model of Winters (1981) for visible exports. His key assumption was that prices were fixed prior to and independent of current actual export volume.[2] Export prices were then a function of:

(i) unit production costs

(ii) the sterling price of competing foreign goods

(iii) UK and foreign demand pressure

(iv) time trend

and export quantities were a function, on the demand side, of the aggregate demand for them and of UK relative prices, and on the supply side of the pressure of demand and the profitability of exporting. It was important to test whether different factors could be shown to influence quantity and price of exports, to provide evidence against simultaneous determination.

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1. See Goldstein and Khan (1985) and Brooks (1981).

2. Compare the recursive model of Hotson and Gardiner (1983).

Prices and quantities were then modelled separately for 16 commodity groups.[1] For quantities, 10 separate areas of destination were considered.

Winters allowed for a wide variety of dynamics on the annual data used. The coefficient of adjustment, γ , between actual and desired prices, was less than 1, indicating less than full adjustment within a year, for 7 of 16 commodity groups.

Amongst the most important results and features of Winters' model were the following:

(i) Most of the preferred price equations showed symptoms of misspecification. Only two equations had (a) $\gamma = 1$ (b) $\rho = 0$ (indicating no autocorrelation) and (c) $DW > 1.5$. The standard arguments for the partial adjustment dynamics may be counterintuitive here: if it is costly to change prices (reprinting of literature, etc.), it is costlier to change them frequently rather than adjust in full.[2] On the other hand, the engineering and metal manufactures export price equations seem to perform well.

(ii) The generally high coefficients on domestic costs in the price equations constitute some empirical support for mark-up pricing

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1. The disaggregated results are shown in Table 3.5 and later compared with our own results in chapter 6.

2. Winters showed that partial adjustment will also appear to occur if firms' decision periods are less than 1 year - but then his coefficient estimates are biased. See Winters (1981) chapter 2 Annex (d).

against "LOOP" competitive paradigms. Thus, an exchange rate change can apparently change relative price competitiveness.

(iii) Domestic and foreign demand pressure were significant in relatively few price equations.

(iv) Table 3.4, on the volume equations, suggests an overall long-run "substitution" price elasticity of demand of - 1.53 for UK exports. The relative profitability of exporting as against producing for the home market also has a significant role. Thus, an exogenous reduction of export prices (e.g. by government restrictions) by 1% while home market prices are untouched would eventually increase exports by only 1.17% (the "substitution" effect in foreign purchases minus the 0.36 "comparative profitability" effect).

(v) Table 3.5 gives the long-run effects of changes in the explanatory variables on export volumes when feedback via the export price equations is taken into account. The high estimate of the "domestic demand pressure" effect on total exports is important. The elasticities in columns 1 and 2 combined suggested that if activity in the UK and in the world simultaneously increases by 1%, UK exports will increase by only 0.34%. However, the domestic demand pressure elasticities are suspect.[1] Some of the individual sectoral estimates seem implausibly high. Measuring domestic demand pressure relevant

1. Cf. the difficulties reported on pp.193-195.

to each industry is difficult. The effects of increaes and decreases in domestic activity may not be symmetrical (can lost overseas markets be regained if denied sales during a domestic boom?) and may not be linear (if production is below full capacity, is an increase in domestic demand as likely to reduce exports as when capacity is fully utilised?)

Winters' model suggests various advantages in working with approaches at a higher level of aggregation:

(i) "aggregate" rather than "sectoral" domestic demand pressure is more readily interpreted.

(ii) Winters' model has no pure, clear, competitiveness term, since relative prices and profitability both play a part, and underlying relative cost relationships which influence both are not explicit.

(iii) The forecasting performance of Winters' model was poor.

We therefore consider the model of manufactured export volumes and prices for the UK estimated by Hutton and Minford (1975).[1] The method proceeds as follows:

(i) Specify an export demand equation;

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1. Various similar models have been produced, e.g. O'Connell (1977) and Goldstein and Khan (1978). But there are key differences; these latter authors prefer quantity and price adjustment to excess demand and supply, rather than adjustment via stocks and queues.

(ii) Specify a supply function (for a competitive industry) or a marginal cost function (for monopoly firms);

(iii) Equilibrium can then be specified as a reduced form in the price of exports;

(iv) The possible existence of stocks or queues is then recognized, so Hutton and Minford separate periods of excess demand and excess supply, using capacity utilisation indices;

(v) Supply and demand equations are then separately estimated.

Various outcomes were possible depending on whether both stocks and queues occurred, or only one of these, and whether home or foreign demand was frustrated. Empirical inspection suggested that the most interesting case occurred when either stocks were used or home demand was frustrated, but overseas buyers were given some priority:

$$(3.10) \quad Q_t = \min \{XD_t, (WXS_t + (1-W)XD_t)\}$$

i.e. where Q_t = quantity exported, XD_t = demand for exports, XS_t = supply of exports, $0 \leqslant W \leqslant 1$ = some weight; if XD_t is smaller than XS_t,[1] stocks are accumulated; if XD_t is greater than XS_t, a volume of exports greater than XS_t is exported, presumably by drawing from the home market.

A few features should be noted. First, following from Hutton and Minford's analysis of various sources of lags in export demand

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1. In which case $XD_t < XD_t + WXS_t - WXD_t$.

(the lag between order and delivery; lags in acquiring [costly] information; lags in the formation or reformation of expectations; and possible adjustment costs), a second-order Almon pattern was regarded as too "simple", a fourth order Almon polynomial was imposed on lagged relative price terms, generating "twin peak" period effects. Data on stocks in the UK were poor, so the disequilibrium behaviour posited by the model was difficult to verify.

Hutton and Minford finally obtained[1]

$$(3.11)\quad \ln XD_t = \underset{}{2.906} + \underset{(0.133)}{0.478}\ln M_t + \underset{(0.142)}{0.433}\ln M_{t-1} - \underset{(0.101)}{0.322}\ln M_{t-3} + \underset{(0.282)}{0.627}\ln WBC_{t-1} + \underset{(0.385)}{1.051}(\ln WBC_{t-3} - \ln WBC_{t-4}) + \underset{(0.007)}{0.0172}\, D2 + \sum_{i=1}^{21} w_i \ln P_{t-i}$$

$$\Sigma w_i = -1.524\ (0.183)$$

$$R^2 = 0.998 \qquad SE = 0.01625$$

and

$$(3.12)\quad \ln Q_t = 7.268 + \underset{(0.136)}{0.483}\ln XD_t + \underset{(0.004)}{0.0143}t - \underset{(0.267)}{0.838}\ln DE_{t-2}$$

$$R^2 = 0.997 \qquad SE = 0.0205$$

---

1. Rounded figures; from Hutton and Minford (1975) p.30. The estimation period begins in 1958 Q2 (with price data back to 1954 Q1) and ended in 1971 Q2. Standard errors in parentheses.

and (conditional upon the demand schedule)

(3.13) $\ln XS_t = 14.07 + 0.0278t - 1.621\ DE_{t-2}$

In addition to the notation of (3.10),

DE_t represents domestic demand for exportables

M_t is world trade

WBC is the world business cycle; (roughly) world industrial production relative to trend

P is relative export prices

t is a time trend

D2 is a seasonal dummy

Their equation for export prices is discussed in chapter 5.

Thus, underlying elasticities were,

in export demand

(i) 0.6 with respect to world trade

(ii) -1.5 with respect to relative prices

(iii) 0.6 with respect to the world business cycle

in export supply

(i) 0.0278 with respect to the growth rate

(ii) -1.6 with respect to domestic demand for exportables.

Examination of the export quantity equation shows that first, the coefficient on DE is remarkably similar to that obtained by Winters for aggregate exports, and second, that the elasticity of volume with respect to relative price is reduced (to - 0.74) by virtue of appearing only in the XD_t equation.

Some further comments:

(i) Hutton and Minford suggest that the large positive coefficient on WBC may be attributable to the UK's strong position in trade with primary producers (whose terms of trade improve when world activity is strong);

(ii) The low elasticity on M_t suggests that the UK experiences trend loss of market share;

(iii) No significant profitability effects could be found in the supply equation.

Overall, Hutton and Minford's results depend on there being sufficient observations of both supply and demand constrained periods to obtain meaningful estimates; but the correspondence of several of the key features to other, less complex models (in particular the trade and price elasticities) is reassuring.

O'Connell (1977) compared the results of single equation and simultaneous equation approaches over a single dataset: Ireland's manufactured exports from 1964 Q1 to 1974 Q4.

Two different simultaneous equation approaches were adopted. In both cases, equations for export volume and price were estimated. In the first case continuous equilibrium was assumed. In the second case, equilibrium was not required; it was assumed that the quantity of exports adjusted to clear excess demand over time, while the price of exports adjusted to clear excess supply over time.[1]

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1. An alternative exercise using stocks and queues to bear the burden of adjustment was less successful.

The disequilibrium model produced the best fit,[1] but all the models produced implausible long-run elasticities of export volumes with respect to world income of over 5. Price elasticities in the disequilibrium model were:

(i)	on demand (impact)	- 0.59
(ii)	on demand (long run)	- 1.44
(iii)	on supply	+ 2.33

The importance of prices on the supply side forms a sharp contrast to the results obtained by Hutton and Minford for the UK.

5. Caveats on the econometric evidence

Many of the results in sections 2 to 4 above are subject to technical problems which necessitate cautious interpretation.

(i) Collinearity among the "independent" variables is a serious problem. World trade is positively correlated with time (in the post-war period), and successive price terms are strongly correlated with each other, especially when quarterly data are used. The first problem makes income elasticities difficult to distinguish from time trends; e.g. it may appear that UK goods are regarded as "inferior" (with income elasticity less than 1), while in practice a negative trend with other causes may operate. The second problem contributes to the sensitivity of price elasticities to the specification of the lag patterns.[2]

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1. Measured by $\bar{R}^2$; O'Connell does not report standard errors of equations.

2. See Brooks (1981) pp.67 and 73.

(ii) Brech and Stout (1981) (p.269) suggest that the price elasticity estimates may be biased downwards if non-price competitiveness worsens following a devaluation.[1]

(iii) Wilson and Takacs (1979) suggest that in the short term the effects of an exchange rate change might differ from those of a relative price or cost change. They hypothesised that exchange rate changes would have more rapid effects, because in general exchange rate changes would be large (the study chiefly related to the "adjustable peg" period up to 1971) and perceived as durable, while relative price changes would usually be small and might be seen as transitory.

The difficulty of identifying separate factors on the supply side suggests that, if possible, evidence besides that of trade flows should be examined. We consider briefly international investment decisions.

6. Investment Decisions

We have considered the effects of changes in the price of labour upon flows of goods. But, via the influence on productivity, labour costs may also affect international investment flows. An examination of these flows in response to changes in "competitiveness" may in turn help to suggest the influence of supply

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1. See p.119 above.

factors on trade.[1] McAleese (1981) and Committee on Costs and Competitiveness (1981) applied these ideas to the Irish economy, relating the large increase in US investment in Ireland in the late 1970s to Ireland's strong cost competitiveness after 1976 and the decline in this investment from 1980 to the lagged effects of weakening competitiveness.[2]

Several points relating to this work are noteworthy:

(i) Flows of investment capital may be accompanied by flows of entrepreneurial skills, which may enhance productivity. Companies may therefore choose to locate where initial <u>hourly</u> labour costs, rather than <u>unit</u> labour costs, are lowest. Absolute differences in hourly labour costs between, say, developed and developing countries may be so large as not to be susceptible to practicable changes in exchange rate policy, so that small changes in RULC indices may be ineffective in changing investment patterns.

(ii) If, nevertheless, favourable movements in price or cost competitiveness can encourage the establishment of new companies, such movements may contribute to dynamic economic growth in the longer term (cf. McAleese (1981)).

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1. Panic and Joyce (1980) suggest that foreign participation in an industrial sector was strongly correlated with UK exports in the sector in the 1970s. There may also be incentives for companies wishing to sell goods in a particular market to establish their production there (see p. 118 above), thus tending to reduce imports.

2. For details, see McAleese (1981) Tables 5 and 6.

(iii) Testing the influence of competitiveness on UK investment in the inter-war period would present great practical problems.

(a) In contrast to the Irish case, the UK historically experienced a net outflow of investment. A rather different set of factors may underlie a fall in an outflow as against a rise in inward investment.

(b) Protection in the 1930s may have distorted the response of investment flows to price/cost factors.

(c) There is a more general problem in relating investment flows to trade performance. In the short term, direct investment into a country may well be associated with an increase in imports; the increased exports following from increased productive capacity may take some time to be realized.

(d) There are severe data difficulties.

6. Recapitulation

We have examined various empirical studies of UK and foreign trade performance. While in most cases the expected direction of effect between measured competitiveness and trade volumes was observed, a wide range of estimates of the magnitude of the effect has been obtained. It was suggested that single-equation work considering only relative prices was particularly problematical, since it was unclear whether supply or demand parameters were being estimated, but it frequently proved difficult to obtain satisfactory estimates in more complex systems. Successful single equation estimates using relative cost terms and suggesting that a 1% improvement in RNULC competitiveness would produce a long-run gain of ½% to 1% in manufactured export volume have been made by the Bank of England and the Treasury. Even here Brooks (1981) suggested the possibility of misspecification. Overall, however, the evidence suggests that relative unit labour costs are a useful alternative measure of competitiveness to relative prices, but that the effects of changes in competitiveness are not yet definitively estimated.

Empirical work also suggested the existence of powerful trends in UK trade performance. Trends in non-price competitiveness may have been responsible, but other factors - e.g. trade liberalisation, greater economic integration and specialization, or rapid growth of industrial capacity abroad - might also have been important. The uncertainties regarding the relative influences of supply- and demand-side factors, the most relevant measure of competitiveness, the econometric specification, and (in the inter-war period) the data, are such that a variety of corroborative empirical evidence of the main economic mechanisms would be invaluable.

IV. The Determination of Competitiveness

1. Introduction

This section primarily considers the power of government policy to influence competitiveness via exchange rate policy, although other mechanisms by which policy may interact with competitiveness are noted. The relationship between a given exchange rate and export prices is further explored in chapter 5.

2. Exchange Rate Policy and Competitiveness

Let us assume that our accepted measure of competitiveness is

$$\frac{ULC_{UK}\ (£)}{\sum_{i=1}^{n} ULC_i\ (\$)} \cdot R$$

where R is the exchange rate (measured according to the British convention i.e R is the foreign currency price of domestic currency; a rise in R represents appreciation). A rise in the index represents a deterioration in competitiveness. If R can be changed independently of ULC_{UK} and $\sum_{i=1}^{n} ULC_i$ (hereafter WULC), or if ULC_{UK} can be changed independently, competitiveness is changed proportionately. We consider (i) the means by which government policy may affect the real exchange rate; (ii) indirect effects of devaluation or revaluation which may constrain government; (iii) further constraints imposed by the advantage of stable exchange rates, and (iv) other ways in which policy may impinge upon competitiveness.

(i) We discount the case where purchasing power parity holds throughout - so that government can only change the (nominal) exchange rate by changing relative prices proportionately, and has no lever on competitiveness (except possibly via the supply side by changing the relative price of tradeables). There are various policy instruments over the exchange rate:

 (a) Prohibitive exchange controls. These will normally have a considerable effect on the real exchange rate, though they may also deter foreign inward investment in the tradeable sector. They were probably less difficult to enforce inter-war than now;

(b) Government foreign exchange market operations, particularly towards the limits of a range of rates which government finds acceptable. This requires reserves of a reasonable size relative to the volume of internationally mobile funds;

(c) A statement that (b) will be carried out, or will cease to be carried out, may be sufficient to influence foreign exchange market expectations with similar effect;

(d) Interest rate policy. In the UK in the inter-war period it was expected that Bank Rate would be the key instrument in achieving a rise in sterling to the old Gold Standard parity (see p.50 above). This required that Bank Rate was effective in influencing other domestic interest rates.

(e) Other policies may influence foreign demand for the domestic currency, or domestic demand for foreign exchange, indirectly. Ceteris paribus any government policy which tends to worsen the current account, e.g. fiscal expansion, will tend to lower the exchange rate by this means, although there may be an offsetting influence through the effect on interest rates.[1] Conversely, the introduction of import controls, which normally

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1. These mechanisms are relevant to the discussion of assigning policy instruments to internal and external objectives: see Fleming (1962) and Mundell (1962).

improves the trade balance in the short term, may produce exchange rate appreciation.

(ii) The direct effect of exchange rate changes on competitiveness and hence on the current account may be mitigated in various ways. Most important is the tendency of an exchange rate change to trigger offsetting changes in domestic prices and costs. For example, a devaluation tends to raise the domestic price of imported goods. Further inflation may result: (a) domestic producers in competition with overseas producers can maintain market share while increasing domestic prices; (b) firms facing higher prices for imported inputs may increase prices via a mark-up rule; (c) workers facing higher living costs may press for higher wages, which can be conceded by firms experiencing higher profits after devaluation.

Exchange rate changes also affect the real value of a country's net asset position. Assume that international loans are denominated in the currency of the lending country. A revaluation increases the foreign currency value of the home country's net loans abroad and interest received on them. The domestic currency value of net borrowing from abroad, and interest payments on it, are reduced. The current account balance on interest, profits, and dividends, is strengthened in consequence.

(iii) Government exchange rate policy may be further influenced by the prospective advantages from a stable exchange rate policy:

(a) The stimulus to production of tradeables given by depreciation and improved competitiveness ultimately falls as the economy approaches full capacity and resources have to be bid away from competing activities. Further, the inflation cost to devaluation may increase under these circumstances.

(b) Nominal wages may adjust rapidly to a devaluation, so rendering any cost competitiveness advantage to be gained short-lived. An appreciation may produce a longer-lasting rise in unit labour costs (when denominated in foreign currency), due to downward nominal wage stickiness, and therefore an enduring competitive disadvantage.

(c) For the UK, particularly inter-war, the contribution made by a stable exchange rate to a stable international exchange rate regime, may be a key consideration. There are collective advantages to be derived from stable exchange rates, for example the stimulus given to trade by greater certainty regarding the value of payments in foreign currency.[1] Alternatively, in a regime of general floating, any exchange rate change by a major economy may be followed by other economies, greatly reducing its effect on competitiveness.

(iv) Many other policies may impinge upon a country's competitiveness without affecting the exchange rate: (a) Incomes

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1. Although most recent research has not found this stimulus to be significant; see IMF (1984).

policy will tend to lower wage costs in domestic currency below what they would otherwise have been; (b) Non-price competitiveness may be improved, e.g. by subsidies to research and development, or (tangentially) by improving education or the infrastructure; (c) Policies which are an incentive to increase capacity in manufacturing may contribute to gains in market share, via increasing capacity relative to domestic demand pressure; (d) Import restrictions or export subsidies may be adopted.

Several of the arguments advanced above can be investigated empirically, in particular the speed of adjustment of nominal wages and prices to an exchange rate change. Odling-Smee and Hartley (1978), using the HMT model, found that for the UK a quarter of the competitive advantage (measured by RNULC) to be gained from devaluation still remained after six years. The paper did not, however, investigate whether this medium term competitive advantage benefits the most or least dynamic sectors. Other issues raised, for example the international exchange rate regime, and the degree of capacity utilisation, require description for each period rather than econometric investigation.

Summary

Our preliminary conclusion from this section is that changes in the exchange rate are a means by which changes in a country's relative price or cost competitiveness may be brought about. Several questions remain open, e.g.

(i) Do changes in non-price competitiveness offset the effects of a price/cost competitiveness change brought about by an exchange rate change?

(ii) How durable are the effects of an exchange rate change?

(iii) How strong are exogenous influences (e.g. foreign export prices) on UK export prices?

The latter two questions, in particular, are discussed further in chapter 5.

V. Conclusions

This survey was intended to provide a framework for the analysis of the effects of the measured changes in the UK inter-war exchange rate on export performance. Despite conflicting and inconclusive evidence, some conclusions may be suggested both for our study and more generally:

(i) There are many problems in obtaining satisfactory measures of price and non-price competitiveness. However, several authors would agree that a measure of UK relative unit labour costs would be useful. In addition, various relative price indices may be relevant, but attempts should be made to ensure that commodity coverage and weighting of price indices are similar in different countries.

(ii) Competitiveness changes may be reflected in movements in profitability rather than relative prices; this may influence exports through the supply side.

(iii) There are great difficulties in measuring non-price competitiveness and changes therein. The importance of trend changes in UK (and other countries') market shares in recent times suggests that this could be serious. Circumstantial evidence on the quality of exports - e.g. value added per unit, R and D expenditure, or the commodity composition of exports - would be useful for the post-war period. We examine here only the last of these - plus time trends, which may reflect trends in non-price competitiveness.

(iv) Changes in the volume and direction of international investment flows could be a further source of evidence for the underlying strength of the supply side of the UK (or foreign countries') economies. Again, evidence in this field for the inter-war period is limited.

(v) Microeconomic studies may corroborate - or refute - conclusions suggested by macro-economic analysis.

(vi) A study of UK export market share in aggregate and at disaggregated level is to be of prime importance in tracking the course of UK competitiveness between the wars. We may expect to find significant negative elasticities of UK export volumes and market share with respect to UK relative prices and costs.

(vii) We deduce from chapter 2 that the UK government had some discretionary power over the inter-war exchange rate for sterling, and proceed to examine the implications of this in determining UK export prices (see Chapter 5).

Table 3.1: Recent Import and Export Price Elasticity Estimates for the UK

Source and Estimation Period	Trade Category	Import price elasticity	Export price elasticity
LBS, 1963-1973	All goods	0	- 1.15
CEPG (no period given)	All goods	0	- 1.9
HMT 1959-1969	Basic materials	- 1.0	
	Semi-manufactures	- 0.9	
	Semi-manufactured capital goods	- 0.5	
	Finished manufactures: capital goods	- 0.9	
	Consumer goods	- 0.8	
	Fuel	- 0.2	
HMT 1958-1974	XGMA (exports of manufactures excluding erratic items)		- 2.3 (if not supply constrained)
	Non-manufactures		- 1.0
NIESR 1955-1972	Semi-manufactures	-1.3 to -1.7	
	Finished manufactures	-1.1 to -1.5	
Worswick ("statement of the NIESR view for two years")			
1956-73	Total goods		- 0.75
1962-73	Total goods	- 1.0	
	Finished manufactures	- 4.2	

Table 3.1 (continued)

Source and Estimation Period		Trade Category	Import price elasticity	Export price elasticity
OECD	1955-1969	Total goods	0	- 0.33
CEPG	1954-1973	All goods		- 1.22
		Chemicals		- 0.91
		Transport equipment		- 0.78
	1955-1966	Total goods	-0.67 to -0.74	
Artus	1960-1972	Semi-manufactures	-3.4	- 2.5
		(Lags up to 2 years)		
		Finished Manufactures		
		(Lags up to 1 year)	-1.0	- 1.4
		Foreign travel	-2.2	- 1.66

Source: NEDO (1977)

Table 3.2: Price elasticity estimates, total trade, by country

	IMPORTS			EXPORTS		
	LINK	Houthakker and Magee	Taplin	LINK	Houthakker and Magee	Stern et al.
Belgium	- 0.20	- 1.02	- 0.65	0	0	- 1.02
Canada	- 1.98	- 1.46	- 1.59	- 0.59	- 0.59	- 0.79
France	N/A	0	- 0.39	N/A	- 2.27	- 1.31
Italy	- 0.95	- 0.13	- 1.03	- 0.72	- 1.12	- 0.93
Japan	- 0.17	- 0.72	- 0.81	- 2.38	- 0.80	- 1.25
Netherlands	- 0.41	0	N/A	N/A	N/A	- 0.95
Sweden	0	- 0.79	- 0.76	- 1.92	-0.47	- 1.96
UK	0	- 0.21*	- 0.22	- 0.71	- 1.24	- 0.48
US	- 0.52	- 1.03*	- 1.05	- 1.44	- 1.51	- 1.41
West Germany	- 1.21	- 0.24	- 0.61	- 1.68	- 1.25	- 1.11

* denotes figure corrected for first-order autocorrelation. Prior to the correction, coefficients were UK + 0.22
US - 0.54

Zeroes denote zero or wrong-signed coefficients

Sources: NEDO 1977 and Goldstein and Khan (1985) pp.1078-9

Table 3.3: Estimated RULC elasticities, 6 industrial countries (with imposed trade elasticities)

	Short Lag	Longer Lags	
	1956-1976	1956-1976	1960-1976
UK	- 0.71 (4.5)	- 1.1 (6.5)	- 1.37 (5.0)
USA	- 0.80 (8.3)	- 0.98 (9.0)	- 1.0 (6.8)
France	- 0.64 (3.2)	- 1.1 (3.1)	- 0.44 (1.0)
Italy	- 0.58 (1.5)	- 1.3 (1.6)	- 1.1 (1.3)
West Germany	+ 0.23 (0.8)	- 0.2 (0.4)	- 0.3 (1.4)
Japan	- 0.73 (7.4)	- 0.83 (7.1)	- 1.0 (5.5)

t-values in parentheses

Source: Fetherston, Moore and Rhodes (1977)

These are elasticities of <u>shares</u> of manufacturing exports with respect to relative unit labour costs, from regressing

$$(3.3.1) \quad \ln\left(\frac{X_i}{W}\right) = \alpha_{oi} + \alpha_{1i}t + \alpha_{2i}\ln\frac{W}{W*} + \alpha_{3i}(RCL_i - \ln RC_{i,\,1970})$$

where X_i = country i's exports of manufactures

W = "World" exports of manufactures, $W = \Sigma X_i$. (i.e. the world comprises the 6 countries above).

$W*$ = Trend value of W (fitting a log-linear trend 1956-76)

$RCL_{i,t} = \ln RC_{it} + (1-\lambda)\, RCL_{i,t-1}$

where $\ln RC_i = \ln ULC_i - \sum_{i \neq j} \beta_{ji} \ln ULC_j$

β_{ji}, the weights in the RULC index, are multilateral trade shares; the weight of country j in i's RULC index is its share of $\sum_{i \neq j} X_j$.

Table 3.4: Winters (1981) Export Volume Equation: Aggregate Price Responses

			Lag in Years				
		Long Run	0	1	2	3	4
(1)	Relative comparative profitability	0.36	0.06	0.18	0.10	0.01	0.00
(2)	Competitor prices (demand)	1.18	0.19	0.39	0.25	0.20	0.15
(3)	Importers prices (demand)	0.35	0.18	0.13	0.03	0.01	0.01
(4)	Own prices (demand)	- 1.53	- 0.44	- 0.60	- 0.34	- 0.13	- 0.03
(5)	Competitor prices (all)	0.82	0.13	0.21	0.15	0.18	0.15
(6)	Importers prices (all)	0.71	0.24	0.31	0.13	0.03	0.01
(7)	Own prices (all)	- 1.17	- 0.38	- 0.42	- 0.24	- 0.12	- 0.03

(Columns may not sum to long-run totals due to rounding errors)

Note (1) Importers' prices are p_i^w, wholesale prices in the importing country.

(2) Row 1 and Row 4 are constrained to sum to Row 7 throughout; in the long run, row 2 and row 3 sum to - row 4 (as do row 5 and row 6).

Source: Winters (1981) chapter 6

Table 3.5: Winters (1981) Export Full Model: Some Disaggregated Long-Run Responses

Commodity group	1% rise in World output	UK home sales	World prices
Food	2.02	- 2.56	0.88
Drink	0.96	- 0.42	0.81
Textile Fibres	0.38	- 0.37	0.83
Petroleum Products	- 0.60	0.03	1.55
Rest of Non-Manufactures	0.56	0.00	0.79
Chemicals	0.72	- 0.35	0.57
Textiles	0.66	- 1.86	2.16
Iron and Steel	1.63	- 0.31	0.09
Non-ferrous Metals	1.38	- 0.46	0.59
Metal Manufactures	0.49	- 0.36	2.99
Mechanical Engineering	1.40	- 0.39	0.96
Electrical Engineering	1.16	- 0.35	1.85
Transport Equipment	1.61	- 0.33	1.69
Instruments	1.76	- 1.85	1.04
Clothing	1.65	- 3.68	2.40
Rest of Manufacturing	0.88	- 2.75	2.09
TOTAL EXPORTS	1.09	- 0.75	1.24

Figures are the % increase in quantity of exports of the commodity group generated by a 1% rise in the variable indicated.

Chapter 4

MODELLING AGGREGATE UK EXPORTS BETWEEN THE WARS

I. Introduction

This chapter reports estimation of various equations specified for aggregate UK exports between the wars. The principal objectives are to test some of the different measures of competitiveness discussed in chapter 3, and so to estimate the implications of the exchange rate changes documented in chapter 2; and to identify other key influences on export performance and their quantitative importance.

Our methodology is as follows. First, characteristic modern specifications are examined for their applicability, and we consider econometric problems relevant to this study. We then review the world economic background and essential characteristics of UK exports in the period. This prior descriptive consideration is essential in selecting appropriate specifications, and is of particular importance given the difficulties confronting historical econometric work. Next, we briefly consider other simple equations for UK exports estimated for the inter-war period. In section V, we develop notation and our main specification. Section VI discusses results in two different equation forms (log-linear and logistic), and tests alternative activity and competitiveness variables. We derive some conclusions in section VII. Some key quantitative implications of the results are discussed in chapter 8, and construction of the data series is described in the Statistical Appendix. Annexes to this chapter report further tests of our preferred equation, and provide further background to the logistic specification.

We should not expect, using annual data (often of doubtful quality) over a period of less than twenty years, to obtain definitive results. Moggridge[1] notes that there are several statistical difficulties in estimating trade elasticities, citing Orcutt (1950) and Machlap (1950), which tend to lead to underestimates of responsiveness to prices. Nevertheless, the use of annual (rather than quarterly) data limits the importance of lagged responses to changes in explanatory variables, which are shown to be hard to identify. Overall, our approach is to compensate for difficulties attached to individual estimates by careful prior consideration, testing of a wide range of alternatives, and looking for corroborative evidence.

II <u>Characteristic Modern Specifications</u>

Chapter 3 reviewed, inter alia, various modern attempts to capture supply and demand factors, and to investigate joint price/quantity determination. Nevertheless, many models[2] remain based on a typical equation for world demand for UK exports:

$$(4.1) \quad X_d = f(\overset{(+)}{AD_w}, \overset{(-)}{P_x}, \overset{(+)}{P_1} \cdots P_i)$$

1. Moggridge (1969) p.76.

2. See Hotson and Gardiner (1983)

X = demand for UK exports by volume

AD_w = aggregate world demand

P_x = price of UK exports

$P_1 \ldots P_i$ = prices of relevant products of other countries

All prices are defined in common currency.

We noted that a rise in the price of UK exports should produce a fall in demand for UK exports. Ex ante, an exogenous rise in the price of UK exports might be expected to produce a rise in UK - willing supply.[1] We assume that supply is already available to meet potential demand.[2] A rise in any of $P_1 \ldots P_i$ should increase demand for UK exports, assuming that substitution effects are not dominated by income effects.

Further steps must be taken to reach an estimable equation. First, a measure of world demand must be chosen. Different terms may be appropriate depending on the independent variable to be explained.[3] But there are considerable practical advantages to using aggregate world exports. First we gain an indication of UK export market share performance. Second, in a period when, worldwide, the ratio of exports to income or output changed sharply (e.g. as a

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1. See p.95

2. The assumption is justified below (p.174). The importance of supply factors is also tested in various ways.

3. See e.g. Goldstein and Khan (1985) pp.1056-1061.

consequence of protection) we may avoid having to estimate the importance of that change. Third, exports by foreign countries may be a powerful determinant of their capacity to import. Finally, data on aggregate exports are more easily available than national income data for many countries in this period.

There are also various disadvantages. First, we assume separability in demand between home production and imported goods by ignoring domestic output in the foreign country. Winters (1984) showed this not to be a good assumption for the post-war period. It may be more valid between the wars, to the extent that distinctions in the pattern of output between different countries were more pronounced, but increasing competition from domestic producers was a problem for the UK.[1]

Second, it may be undesirable to treat world trade as exogenous. The UK was sufficiently important as a trading nation to have had, potentially, powerful effects on world trade. Moreover, the possibility of foreign retaliation to UK protection or exchange rate policy means that UK trade may have influenced the relationship between world trade and world output.

Third, if the size of the world market is given, an increase in exports by other industrial countries would entail a loss of UK export share and thence of exports. In the inter-war period, given

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1. See e.g. Latham (1981), chapter 3.

the strong initial position of the UK in many markets, if other countries were to expand their exports it was likely to be at the expense of the UK. This should enjoin caution in interpreting coefficient estimates.

Finally, the geographic distribution is important; the UK share of particular markets may help explain its share of total world exports if those particular markets expand or contract at a rate different from the rest of the world. Some modern models, e.g. Bank of England (1979), use world exports of manufactures[1] constructed to reflect import growth in individual markets weighted according to the importance of those markets to the UK. We report tests with an analogous variable (WTMV) later (p.192).[2]

Chapter 3 indicated various problems in specifying price terms to be used in equation (4.1).

(i) Simultaneity

In principle, output and price are jointly determined. Short-term forecasting models may avoid this problem by working in a disequilibrium framework, with prices set by reference to home and foreign prices and supply assumed perfectly elastic over the relevant range, without interaction between "price" and "volume"

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1. In the equation for exports of manufactures. Here we are modelling total exports of goods.

2. A further variable appropriate to exports of an intermediate product is tested in chapter 7.

processes, but this is not wholly satisfactory. Modelling over a longer period renders the problem more serious. Moreover, if it is assumed that the export price is given equal to the output price because production for export is small relative to production for home consumption, the assumption of separability is violated. Winters (1981) assumes a "recursive" model, in which export pricing decisions are made prior to volume decisions. We implicitly make the same assumption here, but test the role of export volumes in explaining export prices in chapter 5.

(ii) Separability/Comparability

P_1 ... P_i in equation (4.1) will in practice be highly aggregated indices for foreign exports. Suppose that one single price index is to be obtained for each foreign country, and that those indices are weighted together to form one composite 'world' price index. For the estimated coefficient on this index to be interpreted as a "competitiveness" elasticity, it is desirable for the foreign price indices to comprise goods similar to those in the UK price index, and competing with UK exports. The "separability" problem re-emerges; if export prices of foreign countries are used, we overlook potential competition between UK exports and domestic production in foreign countries.

This procedure also fails to take account of the differing commodity composition of countries' exports. As discussed in chapter 3, this may suggest the use of relative costs. Alternatively, only export prices of countries with similar commodity exports to the UK might be considered.[1] Both possibilities are tested here.

Supply

Chapter 3 reviewed various means by which supply factors in export determination might be captured. Full-model approaches achieved mixed success. In our single equation approach, the chief difficulty of interpretation created by non-infinite supply elasticities stems from a rise in UK export prices, which should induce a rise in willing-supply of exports but a fall in foreign demand. Some allowance is made by estimating separate coefficients on UK and foreign export prices. Alternatively, relative cost terms, allowing for both supply and demand factors, are tested; superior performance of these measures over the whole period or in sub-periods could indicate that supply constraints may have operated.

Dummies

Even if in general exports are demand-determined, temporary interruptions of supply may be significant. The seven month coal strike in 1926 was a substantial hiatus in our period, reducing exports of coal and possibly of other industries reliant on coal inputs, e.g. iron and steel. We therefore test a dummy variable for 1926. Two arguments against this procedure may be advanced:

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1. On the predominance of manufactures in UK exports in this period, see Tables SA.14 and SA.15.

(i) It may be superior to estimate the effects of the strike by other means, adjust the dependent variable for 1926 accordingly prior to regression, and avoid the loss of a degree of freedom;

(ii) The strike could be viewed as a consequence of a loss of competitiveness. Chapter 2 (Table 2.1) suggests that the sterling effective exchange rate was at an inter-war peak in 1926, and by several measures UK competitiveness was weak (see Table 2.4). The relationship between competitiveness and export performance may not be continuous (or symmetrical for competitiveness gains or losses) because of the risk of industrial disruption when competitiveness is lost.

On the other hand, it would be difficult to estimate the full effects of the 1926 strike, due to its implications beyond the coal industry. And we regard (ii) only as a qualification to the estimates of the dummy variable.

Functional Form

Most recent work uses a log-linear specification, e.g. Bank of England (1979), HMT (1980). This has various advantages:

(i) Whatever the values of the explanatory variables, the equation cannot predict an impossible negative value for exports.

(ii) Percentage changes, rather than absolute changes, of the competitiveness indices (and indeed in exchange rates) are most meaningful. Given percentage changes in competitiveness will be predicted to have constant percentage effects on total exports in a log-linear specification.

There are also problems:

(i) If it is believed that UK exports depended on different factors in different markets (e.g. Imperial markets as against the rest of the world), an additive relationship between the two is not easily captured. (But see equations 4.14 and 4.15 below).

(ii) It has been suggested[1] that UK export share of world markets should be modelled explicitly, using the logistic specification,[2] which has the advantage of imposing an upper limit on possible predicted values of the dependent variable. We test this specification in Section V(2), p.202.

III. Background: The World Economy and UK Exports 1921-39

(A) The World Economy

More detailed accounts may be found in various places;[3] this narrative is additionally based on League of Nations Memoranda on Balance of Payments, and on Maddison (1962).

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1. I am indebted to Professor Hendry for this suggestion.

2. See Griliches (1957) for an early application of this method in econometric literature.

3. See e.g. Lewis (1949); Drummond (1981).

(1) Up to 1924, much of Europe was still disrupted by the consequences of the First World War. German and Austrian hyperinflation made price and exchange rate data from these countries hard to interpret. The Ruhr occupation and the embargo on German coal exports until mid-1924 removed a major competitor of the UK in a vital commodity. Trade data on export volumes and values given in Maddison (1962) and used here are not complete for 1920-3. Hence, we begin our estimation in 1924.

(2) From 1924 to 1929, rapid growth in output and trade occurred worldwide (see Table 4.1). However, international overcapacity was still a problem in various industries (e.g., coalmining and shipbuilding) which had been overstimulated by the demands of the war; towards the end of the decade, there was agricultural overproduction,[1] evidenced by rapidly declining prices outside the industrial countries after 1925, especially after 1928.

(3) From 1929 to 1932, there was a severe depression, characterised by (a) a general collapse in activity; (b) increased trade protection, so that trade fell more than output; (c) a very sharp fall in the terms of trade of primary producing countries as their export prices collapsed.

(4) From about 1933 there was a fairly general recovery, with a setback in 1938. Several features are noteworthy:

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1. See e.g. Latham (1981) pp.176 and 183; Kindleberger (1973) chapter 4.

(a) Despite a recovery in output, world trade volume remained below its 1929 level;

(b) To some extent, a bilateral pattern of trade replaced the multilateral pattern of the 1920s.[1] Tariff barriers provided scope for barter negotiations,[2] and countries with particular economic or trading strength could secure favourable agreements, e.g. Germany with several smaller South East European countries, and arguably the UK with the Empire via Imperial Preference.[3]

(c) The 1930s exchange rate regime was very different from both the floating of the early 1920s and the stability of 1926-31 (cf. Table SA1). Most leading industrial countries were forced to devalue against gold during the 1930s; those which failed to do so often experienced a delay in economic recovery. Germany, the principal exception, maintained its official exchange rate by a complex set of exchange controls and shadow exchange rates;[4] several other exchange rates, including sterling, were managed through a dirty float.

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1. See League of Nations, Network of World Trade (1942), p.91.

2. See e.g. PEP Report (1936) p.163; French restrictions of imports of Welsh coal were lifted in return for UK agreement to import French pitwood. Jones (1938) pp.248 et seq. gives further detail on trade agreements affecting UK coal exports.

3. See e.g. Drummond (1974), chapter 6. His evaluation (pp.279-289) emphasises the relatively small scale of concessions at Ottawa, and the importance of exchange rate changes.

4. See Nurkse (1944), chapter 7.

The points raised in (c) above suggest that equations fitting the 1920s trade regime might break down in the 1930s, and in particular that multilateral-weighted measures of foreign export prices may be less appropriate.[1]

(B) Characteristics of UK exports

Table SA.14 shows the domination of manufactures (category IV) in UK exports between the wars. Table SA.15 shows exports in certain key commodity groups. The continuing predominance of "older" industries should be noted. It is also interesting to note that structural shifts in the commodity composition of UK exports were as marked before 1929 as afterwards.[2]

Table SA.6 gives a breakdown of the geographical distribution of UK exports between two groups of countries, W9, nine leading industrial countries,[3] and WR, the remainder.[4] The UK exported an unusually large proportion of its total exports to the primary producers throughout the period. Table SA7 shows the high proportion of primary producers' imports from industrial countries which came from the UK.

Two difficulties of interpretation arise. First, we note in Table SA.6 a shift in the distribution of UK exports towards the

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1. But see Annex 4.1, Test (4.11).
2. Contrast with, e.g., Aldcroft (1969).
3. The countries are listed on p.408.
4. Hereafter we refer to these countries as "primary producers", which is a heavy simplification.

primary producers (even before the introduction of Imperial Preference). This shift could undermine the stability of the coefficient on $\$X_C$ in the equations described below.

Second, exports by other manufacturing countries, the majority of which went to other industrial countries (including the UK), may not be a complete direct measure of demand for UK exports. Hence we allow for the geographic pattern of UK demand (by constructing a variable WTMV, weighting imports in different markets according to their importance in UK exports, and in the bulk of this chapter by separating out the purchasing capacity of primary producers), as well as proxying demand for the UK's principal export sector (manufactures) by demand for exports of other industrial countries.

Finally, Table (4.1) also reveals the performance of aggregate UK exports in the period. A gentle increase in export volume to 1929 was followed by a drastic collapse to 1931. This was followed by a rapid recovery after 1933 which was nevertheless insufficient to reattain the 1929 level. Export unit values (in dollar terms) were on a down trend after the return to the Gold Standard in 1925, which accelerated during the slump and in association with devaluation in 1931, and was reversed by the devaluation of the dollar. It should be noted that volumes, values and unit values all showed substantial year to year variations and had a wide range over the period as a whole. This helps compensate in econometric estimation for lack of degrees of freedom in attempting to obtain well-defined estimates.

(C) The Domestic Economy

Following many other researchers (cf. chapter 3), we propose to estimate what are basically demand equations, possibly incorporating some supply side factors in ad hoc specifications which might be termed "process equations". (Table 4.2), showing UK unemployment in aggregate and in key sectors, forms an heuristic justification of this for the inter-war period. The aggregate figure suggests a considerable degree of slack in the economy throughout the period, and the older exporting industries suffered most severely. Table (4.2) also suggests sectors, e.g electrical engineering and motor vehicles, where supply may have been a constraint. We also test the probable implications of aggregate demand pressure (p.193 below).

IV. Earlier Estimated UK Export Equations for the Inter-War Period

A few attempts to construct macro-economic models for the UK in the inter-war period incorporate, in general rather crudely, equations for UK exports.[1] Broadberry cites Dimsdale (1982):

$$(4.2) \quad X_t = \underset{(204.83)}{1715.65} + \underset{(1.14)}{3.14WT_t} - \underset{(151.17)}{1287.80}\ (PX/PF)_t$$

$$R^2 = 0.89 \quad \hat{\sigma} = 0.045 \quad d = 1.52 \quad \text{EST. 1924-38}$$

(Standard errors in parentheses)

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1. For a recent review of these, see Broadberry (1986), particularly pp.72-4.

(X represents UK exports, WT world trade, and PX/PF relative prices; PF is apparently[1] the price of imports).

Thomas (1981), drawing on Thomas (1976), reports an equation:[2]

$$(4.3)\quad FE = \underset{(0.065)}{11.547} + \underset{(2.020)}{347.413}\,WRLD + \underset{(4.157)}{382.325}\,(PFI/P)_{-1}$$

$$\bar{R}^2 = 0.6694 \quad DW = 1.3065 \qquad EST.1925-38$$

FE represents exports (1938 £mn), WRLD world imports (index 1938= 1.0), PFI represents the import price deflator and P the UK implicit GNP deflator (both 1938 = 1.0).

Thomas does not report a standard error. The R^2 and $\bar{R}^2$ statistics for these equations compare unfavourably with those of other equations reported in this chapter; the linear (rather than log-linear) specifications in principle allow the Dimsdale and Thomas equations to predict impossible values; and in both cases we regard the competitiveness terms as unrealistic, since UK imports were very different in composition either from UK GNP or UK exports.

Hatton[3] reports a more plausible equation using world export prices in the competitiveness variable:

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1. Cf. Broadberry (1986) p.72.

2. In equation (4.3), and hereafter except where otherwise stated, t-values are in parentheses.

3. Hatton (1982) p.34.

$$\text{(4.4)} \quad \ln X_t = \underset{(0.584)}{1.803} + \underset{(0.131)}{0.609} \ln WT_t - \underset{(0.213)}{2.187} \ln \left(\frac{PX}{PW}\right)_t$$

$\bar{R}^2 = 0.923$ DW = 1.5526 RSS = 0.023 EST. 1924-38
(Standard errors in parentheses)

X_t represents UK export volume (base year 1927); WT_t represents volume of world exports (base year 1929); PX and PW are price indices for UK exports and world trade (in gold).

The SE is not reported; my own run on Hatton's data (from League of Nations (1939)) produced a figure of 0.045. I have also estimated this specification using Maddison's (1962) data on UK and world export volumes and prices, with the following result:

$$\text{(4.5)} \quad \ln X_t = \underset{(0.247)}{0.328} + \underset{(5.80)}{0.764} \ln WT_t - \underset{(10.17)}{1.63} \ln \left(\frac{PX}{PW}\right)_t$$

$\bar{R}^2 = 0.915$, SE = 0.048 DW = 1.19 EST. 1924-38

Matthews (1985)[1] estimated the following equation by instrumental variables:

$$\text{(4.6)} \quad \log X = \underset{(18.16)}{6.327} - \underset{(4.24)}{1.677} \left(0.6x + 0.4 \sum_{i=1}^{5} x^e_{t+i}/5\right) + \underset{(6.68)}{0.762}\, WT$$

$\bar{R}^2 = 0.6878$ SE = 0.0822 EST. 1921-38

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1. See his Table 2.

where X = exports, WT = index of "world trade", x is the real exchange rate and x^e is the expected real exchange rate. Matthews in fact selected US industrial production as the measure of world trade, so the equation is vulnerable to the criticism that a change in the relationship between world trade and output (e.g. following from protection) would shift the parameters. Other measures of world trade were, however, tested: World Industrial Production; world exports; and world imports. The elasticities obtained were consistent both with those of Hatton and with those found later in this chapter; the goodness-of-fit is very poor, but this may in part be explained by the estimation period, since the years 1921-3 were still heavily affected by post-war disruption. The original contribution of this equation lies in the use of leads of the real exchange rate, justified by the argument that "In so far as delivery lags are a feature of the supply of capital goods, the foreign purchase of such goods would be dictated by some expected future exchange rate"[1] - at the time at which the capital goods would be yielding output of consumer goods. The "real exchange rate" is defined as the nominal sterling-dollar rate deflated by relative output prices[2] (UK relative to US). The whole equation is therefore cast simply in bilateral US/UK terms, which we have argued passim may not be appropriate.[3] We therefore regard the Hatton (1982)

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1. See Matthews (1985) p.11.

2. This term is not further defined in Matthews (1985) (cf.p.15).

3. Interestingly, Matthews (p.12) found that Dimsdale's (1982) effective exchange rate outperformed the sterling-dollar rate in work on the import equation, although eventually he used no competitiveness term at all.

equation as the best of those currently available, and against which we now examine various potential improvements.

V. Notation and Specification

Let X_{UK} denote UK export volume

X_{W9} denote volume of exports of nine other industrial countries[1] (including exports from each of those nine countries to each other)

X_C denote the volume of exports of other (mainly primary producing) countries (again including exports from those countries to each other)

$\$X_{UK}$, $\$X_{W9}$ and $\$X_C$ denote the dollar values of exports of those groups

UX_{XUK}, UV_{XW9} and UV_{XC} denote the unit values of exports of these groups (1913 = 100),[2] in dollars

Now suppose that UK exports, predominantly of manufactures, only compete with other manufactured exports by the W9 countries, whether in W9 markets or in other countries. Suppose also that while X_{W9} remains a first approximation of the worldwide demand for exports of manufactures, the capacity of primary producing countries to import is constrained by the value of their exports, $\$X_C$ (which will ideally be deflated reflecting the price of their imports). Because of the geographical pattern of UK exports, we expect UK exports to respond far more strongly than those of W9 countries to an increase in $\$X_C$. Note that $\$X_C$ may increase

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1. Those listed on p.408.

2. See Table 4.1 and p.414. These "unit values" are in practice "average value indices", such that $100 * \frac{\$X_{UK}}{UV_{XUK}} = X_{UK}$.

not only as a result of an increase in volumes of exports of primary producers, but as a result of an increase in the price of primary products.

We could therefore estimate:

$$(4.7) \quad X_{UK} = f\left(\overset{+}{X_{W9}},\ \overset{+}{\frac{\$X_C}{(Deflator)}},\ \overset{-}{\frac{UV_{XUK}}{UV_{XW9}}},\ \overset{\pm}{TIME},\ \overset{-}{DUM26}\right)$$

where a time trend is included to allow for various possible factors (e.g. a tendency for the UK to lose share to faster developing countries), and DUM26 allow for the coal strike. Sign superscripts show expected signs of coefficients.

We have in general preferred to estimate coefficients on UV_{XUK} and UV_{XW9} separately. Two major reasons may be advanced for expected coefficients on these terms not to be equal and opposite; first, the supply side argument that higher UV_{XUK} may promote UK supply of exports and hence detract from the absolute size of the negative coefficient on UV_{XUK}; and second, the argument that some combination of UV_{XUK} and UV_{XW9} may form the most appropriate deflator for $\$X_C$. This will tend to detract from the positive coefficient on UV_{XW9} and to increase the size of the negative coefficient on UV_{XUK} if no deflator for $\$X_C$ is separately included. Nevertheless, we begin section V by estimating a simpler specification in which COMP represents $\frac{UV_{XUK}}{UV_{XW9}}$.

We have some very broad expectations regarding magnitudes of the estimated coefficients. On the competitiveness terms, elasticities of less than 0.5 (in absolute terms) would be surprising in comparison with the results reported in Tables 3.2 and 3.5, while elasticities of 1.5 to 2 would be well in line with Hatton's (1982) result. The activity terms would be expected to be collinear to some extent, but it would be a surprise if the sum of the elasticities on X_{W9} and $\$X_C$ (however deflated) exceeded 1. Low values, on X_{W9} in particular, might suggest that new foreign exporters were tending to crowd out UK exports, rather than simply reflecting world demand for all exports. The time trend might be expected to be negative, though in a case where the coefficient on the activity term was very low, Horton (1984) obtained a surprising positive time trend in the reported equation on US exports.[1] The expected size of the dummy terms is discussed in chapter 8.

It may be helpful to summarise the innovations introduced over equations (4.4) and (4.5). We have first the elimination of the UV of exports of primary producers from the competitiveness term; second, the separation of X_{W9} and $\$X_C$ to make simple allowance for the specific market structure of UK exports; and third, in general, separate estimation of coefficients on UV_{XUK} and UX_{XW9}. We now proceed to report results from these innovations in two alternative equation forms, together with further sophistication of the activity

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1. The rationalisation is that world trade increases over time; an unexpectedly low coefficient on world trade is therefore compensated by a positive time trend. Even between the wars, world trade had a tendency to rise, interrupted by the 1929-32 slump. See Horton (1984) pp.24 and B-1.

and competitiveness terms.

VI. Results

(1) Log-linear specification

(i) Simplest forms

Regression results throughout this study were derived using OLS except where otherwise stated.[1] We begin with the simplest form of (4.7), leaving $\$X_C$ undeflated at present:[2]

$$(4.8)\quad \ln X_{UK} = \underset{(3.29)}{1.935} + \underset{(1.18)}{0.109}\ \ln X_{W9} + \underset{(9.88)}{0.531}\ \ln \$X_C$$

$$- \underset{(5.32)}{1.592}\ \ln COMP + \underset{(0.92)}{0.00326}\ TIME - \underset{(2.49)}{0.0806}\ DUM26$$

$$\bar{R}^2 = 0.970 \quad SE = 0.0282 \quad DW = 2.43 \quad EST. 1924\text{-}38$$

The insignificant TIME trend is reported for comparison with some later estimates; when eliminated, we obtained

$$(4.9)\quad \ln X_{UK} = \underset{(4.09)}{2.162} + \underset{(1.12)}{0.103}\ \ln X_{W9} + \underset{(10.7)}{0.509}\ \ln \$X_C - \underset{(8.30)}{1.362}\ \ln COMP$$

$$- \underset{(3.02)}{0.0911}\ DUM26$$

$$\bar{R}^2 = 0.971 \quad SE = 0.0280 \quad DW = 2.43 \quad EST. 1924\text{-}38$$

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1. Regressions used TSP, versions 3.5C and 4.0I, on VAX. Construction of the data series is discussed in the Statistical Appendix; see in particular Tables SA.3 to SA.7 and explanatory text.

2. i.e. the relative price coefficients may conceivably be distorted in this section if a deflator was appropriate.

(4.8) was also estimated over 1925-38 for comparison with (4.16).[1]

(4.10) $$\ln X_{UK} = \underset{(3.16)}{1.537} + \underset{(2.12)}{0.160} \ln X_{W9} + \underset{(12.4)}{0.524}$$

$$- \underset{(7.04)}{1.667} \ln COMP + \underset{(2.08)}{0.00630}\ TIME - \underset{(2.30)}{0.0610}\ DUM26$$

$$\bar{R}^2 = 0.982 \quad SE = 0.0222 \quad DW = 2.96 \quad EST.\ 1925\text{-}38$$

When, as we suggested earlier, an equation was estimated with UK and world prices separated, we obtained the following:

(4.11) $$\ln X_{UK} = \underset{(1.19)}{0.938} + \underset{(2.13)}{0.248} \ln X_{W9} + \underset{(2.06)}{0.297} \ln \$X_C$$

$$- \underset{(5.98)}{1.847} \ln UV_{XUK} + \underset{(4.80)}{2.251} \ln UV_{XW9} + \underset{(2.00)}{0.0123}\ TIME$$

$$- \underset{(2.20)}{0.0668}\ DUM26$$

$$\bar{R}^2 = 0.976 \quad SE = 0.0256 \quad DW = 2.90 \quad EST.1924\text{-}38$$

(4.12) $$\ln X_{UK} = \underset{(1.90)}{1.583} + \underset{(1.23)}{0.153} \ln X_{W9} + \underset{(2.60)}{0.538} \ln \$X_C$$

$$- \underset{(5.28)}{1.654} \ln UV_{XUK} + \underset{(2.73)}{1.629} \ln UV_{XW9}$$

$$+ \underset{(0.826)}{0.00586}\ TIME - \underset{(2.15)}{0.0611}\ DUM26$$

$$\bar{R}^2 = 0.979 \quad SE = 0.0237 \quad DW = 2.95 \quad EST.1925\text{-}38$$

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1. In the absence of full world data before 1924, specifications with lagged variables were run over shortened periods.

Despite the poorer fit, the equations covering the full period 1924-38 were preferred for various reasons. First, a key objective was to analyse the effects of the appreciation of 1924-6. Second, the residual for 1924 is not generally exceptional (cf. Tables 8.1, 8.2 and 8.3); there is only weak evidence to suggest 1924 was a "special case". Finally, we show in Annex 4.2 that a year in which the price variables took extreme values, such as 1924, is of interest in distinguishing the performance of log-linear and logistic specifications.

Equations (4.8) and (4.11) confirm the substantial improvement in fit from estimating the separate term in $\$X_C$ and respecifying the competitiveness term(s) to exclude UV_{XC}. Moreover, despite the very different levels of trade in the 1920s and 1930s, there is no real evidence from residuals that the specification fitted better in one decade than other.[1]

Most of the estimated coefficients are plausible in size - it is particularly notable and important that the competitiveness elasticities seem consistently between roughly 1.5 and 2 - but two less satisfactory features are the high DW statistics in 4.10, 4.11 and 4.12, and the extent to which the activity coefficients change in 4.12 as against 4.11 simply due to the subtraction of one year from the data set.

We note also that the absolute sizes of the coefficients on UK

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1. See the residuals in Table 8.1. Annex 4.1 Test 11 did not reject our assumption that (4.8) could be estimated over both decades. There were insufficient degrees of freedom to Chow-test equation (4.11).

and industrial country export prices in 4.11 are more consistent with the hypothesis that supply side effects might entail a larger effect on UV_{XW9} than UV_{XUK}, rather than with the view that the (negative) UV_{XUK} effect would be larger because of the depressant effect on primary producers' imports of a rise in UV_{XW9}.

(ii) Other Tests of the Simplest Static Models

We continue our analysis from equation (4.11), the best fitting equation over the full estimation period. First, the value of primary producers' exports was split into its UVI and volume components. While the coefficient on the UVI for exports of primary producers was significant at the 10% level, the coefficient on the volume (X_C) was not. The improvement in standard error over (4.11) was negligible; an F-test suggested that the restriction of forcing the UVI and volume coefficients to be equal was acceptable.[1]

Equation (4.11) was also tested with the value of UK exports as the dependent variable. This compels separate estimation of coefficients on UV_{XUK} and UV_{XW9}, since a rise in UV_{XUK} increases the value of $\$X_{UK}$ directly, as well as inducing a reduction in export volume.

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1. The F-statistic comparing equation (4.11) with this equation was 1.03. By comparison, the F-Statistic obtained when (4.11) was restricted to (4.8) was 2.96. To reject the restriction at the 5% level, F-statistics over 5 would be required in each case. See Annex 4.1, Tests 1 and 3.

$$(4.13)\quad \ln \$X_{UK} = \underset{(4.62)}{-3.659} + \underset{(2.10)}{0.246} \ln X_{W9} + \underset{(2.07)}{0.301} \ln \$X_C$$

$$- \underset{(2.70)}{0.842} \ln UV_{XUK} + \underset{(4.74)}{2.239} \ln UV_{XW9}$$

$$+ \underset{(1.97)}{0.0122}\ TIME - \underset{(2.18)}{0.0667}\ DUM26$$

$\bar{R}^2 = 0.994$ SE = 0.0258   DW = 2.90   EST. 1924-38

The standard error of this equation is slightly inferior to that of (4.11); parameter estimates are similar (except on UV_{XUK}).

We tested separate equations for UK exports to industrial countries and to primary producers. In the latter equation, X_{W9} as well as $\$X_C$ was included, as a generalised measure of primary producers' demand for manufactures. The 1926 dummy proved insignificant (as we discuss in chapter 7, most UK coal exports went to other industrial countries, and $\$X_C$ proved insignificant in the coal export equation). A dummy taking value 1 for 1932-8 and 0 elsewhere was included to test for any increase in exports brought about by Imperial Preference. Although positively signed, this never approached significance.

The following equations resulted:

UK exports to industrial countries:

$$(4.14)\quad \ln X_{UK/W9} = -\underset{(0.70)}{0.736} + \underset{(3.41)}{0.448} \ln X_{W9} - \underset{(3.06)}{1.768} \ln UV_{XUK}$$

$$+ \underset{(3.68)}{2.471} \ln UV_{XW9} - \underset{(0.74)}{0.00625}\ TIME - \underset{(3.35)}{0.196}\ DUM26$$

$\bar{R}^2 = 0.950$ SE = 0.0509   DW = 2.67   EST. 1924-38

UK exports to primary producers

$$(4.15) \quad \ln X_{UK/C} = \underset{(0.61)}{0.493} + \underset{(2.43)}{0.365} \ln \$X_C + \underset{(1.83)}{0.220} \ln X_{W9}$$

$$- \underset{(6.33)}{1.978} \ln UV_{XUK} + \underset{(4.93)}{2.324} \ln UV_{XW9} + \underset{(3.43)}{0.0209}\ TIME$$

$\bar{R}^2 = 0.966 \quad SE = 0.0277 \quad DW = 2.76 \quad$ EST. 1924-38

Neither equation improves on (4.11) in reducing standard error, and the competitiveness effects are of similar orders of magnitude in both these equations to those in (4.11). There is thus no evidence to reject the single equation approach in favour of further geographic disaggregation.

(iii) Introducing Dynamics

Many quarterly equations of UK export volumes[1] incorporate lagged values of the competitiveness variables, at least. With an annual model, previous period values of independent and dependent variables should influence current variables less; nevertheless, we test some dynamics here.

Equation (4.16) reports a test of a "Hendry" specification[2] version of (4.10). Incorporation of the lagged dependent variable and lags of all the main independent variables is equivalent to estimation in logged levels and first differences (the form specified in chapter 5).

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1. See e.g. Bank of England (1979) and HM Treasury (1980).
2. The locus classicus is Davidson, Hendry, Srba and Yeo (1978).

$$(4.16)\quad \ln X_{UK} = \underset{(3.99)}{1.933} - \underset{(3.78)}{0.465} \ln X_{UK-1} - \underset{(1.16)}{0.105} \ln X_{W9}$$

$$+ \underset{(2.04)}{0.290} \ln X_{W9-1} + \underset{(10.1)}{0.631} \ln \$X_c + \underset{(2.91)}{0.230} \ln \$X_{c-1}$$

$$- \underset{(12.8)}{1.649} \ln COMP - \underset{(5.64)}{1.343} \ln COMP_{-1}$$

$$+ \underset{(7.05)}{0.0142} \; TIME - \underset{(2.40)}{0.0475} \; DUM26$$

$$\bar{R}^2 = 0.997 \quad SE = 0.00972 \quad DW = 1.76 \quad EST. \; 1925\text{-}38$$

An F-test on the 4 implied zero restrictions in estimating (4.10) rather than (4.16) rejected the restrictions.[1] However, when a "Hendry" equation incorporating separate price terms (cf. equation (4.12)) was tested, the restrictions implied by (4.12) were not rejected.[2]

In order to save degrees of freedom, some results were also obtained using 1-period lags on UK and industrial country export UVIs only;

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1. See Annex 4.1 Test 6 (the criterion is the upper 5% point of the F-distribution).

2. See Annex 4.1 Test 7.

$$(4.17) \quad \ln X_{UK} = \underset{(1.64)}{1.230} + \underset{(1.33)}{0.156} \ln X_{W9} + \underset{(2.99)}{0.540} \ln \$X_C$$

$$- \underset{(6.30)}{1.827} \ln UV_{XUK} - \underset{(2.06)}{0.623} \ln UV_{XUK_{-1}} + \underset{(3.34)}{1.740} \ln UV_{XW9}$$

$$+ \underset{(1.98)}{0.781} \ln UV_{XW9_{-1}} + \underset{(1.87)}{0.0142} \; TIME - \underset{(2.13)}{0.0543} \; DUM26$$

$\bar{R}^2 = 0.984 \quad SE = 0.0206 \quad DW = 2.13 \quad$ EST. 1925-38

Both the lagged competitiveness terms are close to significance at the 5% level, and the SE of (4.12) is reduced slightly, but the F-test of the restrictions to obtain (4.12) from (4.17) did not reject the restrictions.[1]

Several points arise from these dynamic results:

(i) In both (4.16) and (4.17), the total competitiveness elasticity is rather larger than in the corresponding static equations.

(ii) Run over 1925-38 (rather than 1924-38), we confirm that a single COMP variable can be used in place of separate terms in UV_{XUK} and UV_{XW9}. This is not the case when $\$X_C$ is deflated (see p.189 below).

(iii) If equation (4.11) is preferred to (4.8) over the full estimation period, none of the F-tests conducted have rejected the simplifications implied vis a vis a more complex dynamic framework. This is advantageous given the shortage of degrees of freedom and the fact that the non-dynamic specifications

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1. See Annex 4.1 Test 4.

allow the inclusion of 1924 in the estimation period.

(iv) The relative robustness of the simple equation results tends to support our interpretation of UK exports as mainly demand determined; we would expect if supply side factors were crucial that longer lags might be critical.

(v) Notwithstanding the strong performance of (4.17) over 1925-38, we continue to treat (4.11) as the preferred equation over 1924-38, and note more generally that we have some justification for excluding dynamics from chapter 6, where degrees of freedom are even more limited.

(iv) Alternative Specifications of the Activity Terms

(a) Deflators of primary producers' export values

Two alternative deflators of the $\$X_c$ terms were tested:

(1) The UVI for exports of ten major industrial countries (W9 plus the UK). This is represented by $UV_{X.WI}$.

(2) An index formed by weighting the UV of exports of each of these countries according to the share of each in imports of primary producers.[1] This deflator is represented by $UV_{X.WI/MC}$.

Re-estimating the specifications of (4.8) and (4.11) with the first deflator produced the following results:

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1. For further details, see Statistical Appendix Section 4.3 and Table SA.T1.

$$\ln X_{UK} = \underset{(0.24)}{-0.303} \; \underset{(0.25)}{-\,0.0676} \ln X_{W9} + \underset{(3.69)}{0.954} \ln \left(\frac{\$X_C}{UV_{X.WI}}\right) \quad (4.18)$$

$$- \underset{(0.91)}{0.551} \ln COMP - \underset{(3.00)}{0.0222}\, TIME - \underset{(1.56)}{0.111}\, DUM26$$

$$\bar{R}^2 = 0.860 \quad SE = 0.061 \quad DW = 1.49 \quad EST.\ 1924\text{-}38$$

$$\ln X_{UK} = \underset{(0.77)}{-\,0.419} + \underset{(2.00)}{0.243} \ln X_{W9} + \underset{(2.00)}{0.297} \ln \left(\frac{\$X_C}{UV_{X.WI}}\right) \quad (4.19)$$

$$- \underset{(5.69)}{1.815} \ln UV_{XUK} + \underset{(6.40)}{2.53} \ln UV_{XW9}$$

$$+ \underset{(2.04)}{0.0126}\, TIME - \underset{(2.18)}{0.0672}\, DUM26$$

$$\bar{R}^2 = 0.975 \quad SE = 0.0259 \quad DW = 2.90 \quad EST.\ 1924\text{-}38$$

The second deflator produced a similarly poor result in the specification analogous to (4.8); in that analogous to (4.11), we obtained:

$$\ln X_{UK} = \underset{(0.76)}{-\,0.430} + \underset{(2.05)}{0.259} \ln X_{W9} + \underset{(1.78)}{0.271} \ln \frac{\$X_C}{UV_{X.WI/MC}} \quad (4.20)$$

$$- \underset{(5.28)}{1.796} \ln UV_{XUK} + \underset{(6.04)}{2.527} \ln UV_{XW9}$$

$$+ \underset{(2.25)}{0.0139}\, TIME - \underset{(1.99)}{0.0628}\, DUM26$$

$$\bar{R}^2 = 0.973 \quad SE = 0.0268 \quad DW = 2.85 \quad EST.\ 1924\text{-}38$$

The fit in both (4.19) and (4.20) was a little worse than in (4.11). It is encouraging that the estimated coefficient on UV_{XW9} was noticeably larger than in (4.11) once the depressing effect of UV_{XW9} on primary producers' capacity to import was stripped out of the competitiveness term.

One further sophistication actually yielded a marginal improvement in standard error on (4.11); this was to use the value of exports by the primary producing countries only to the ten leading industrial countries, ($\$X_{C/WI}$),[1] in place of $\$X_C$ in (4.20). But the time trend lost significance at the 5% level in this specification. The resulting equation was:

$$(4.21) \quad \ln X_{UK} = \underset{(0.94)}{0.502} + \underset{(2.15)}{0.246} \ln X_{W9} + \underset{(2.13)}{0.316} \ln \left(\frac{\$X_{C/WI}}{UV_{X.WI/MC}} \right)$$

$$- \underset{(5.37)}{1.742} \ln UV_{XUK} + \underset{(6.12)}{2.451} \ln UV_{XW9}$$

$$+ \underset{(1.88)}{0.0117}\ TIME - \underset{(2.08)}{0.0612}\ DUM26$$

$$\bar{R}^2 = 0.976 \quad SE = 0.0253 \quad DW = 2.87 \quad EST.\ 1924\text{-}38$$

(b) Imports of Primary Producers

A more direct test of the primary producers' capacity to import is to use import volumes of the primary producers (M_C) in place of $\$X_C$. As before, estimations with the COMP variable were substantially

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1. i.e. subtracting exports within the primary producing group (in Table SA.6) from $\$X_C$.

inferior to those with UK and industrial country export prices estimated separately. We therefore obtained (4.22):

$$(4.22) \quad \ln X_{UK} = \underset{(0.84)}{-0.550} + \underset{(0.47)}{0.130} \ln X_{W9} + \underset{(1.19)}{0.405} \ln M_c$$

$$- \underset{(5.61)}{1.94} \ln UV_{XUK} + \underset{(6.23)}{2.69} \ln UV_{XW9}$$

$$+ \underset{(1.30)}{0.0120} \; TIME - \underset{(1.64)}{0.0553} \; DUM26$$

$$\bar{R}^2 = 0.968 \quad SE = 0.0292 \quad DW = 2.64 \quad EST. \; 1924\text{-}38$$

This is a substantially inferior result to (4.11) and (4.21), with higher standard error and several variables becoming insignificant, though the fit is still well superior to Hatton's equation (4.4).

(c) UK trade weighted world import volume

A series WTMV was constructed by weighting indices of imports of each industrial country, plus those of primary producers as a group, according to the share of UK exports which that country received in 1929.[1] The equation analogous to (4.11) resulted thus:

$$(4.23) \quad \ln X_{UK} = \underset{(3.94)}{1.514} + \underset{(6.34)}{0.578} \; WTMV - \underset{(6.15)}{1.911} \ln UV_{XUK} + \underset{(7.35)}{2.683} \ln UV_{XW9}$$

$$+ \underset{(2.30)}{0.0110} \; TIME - \underset{(1.63)}{0.0516} \; DUM26$$

$$\bar{R}^2 = 0.971 \quad SE = 0.0277 \quad DW = 2.46 \quad EST. \; 1924\text{-}38$$

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1. See pp.415-6. This variable is the most appropriate available approximation to the variable WTX used in Bank of England (1979). Cf.p. 165 above.

Once again, an equation with COMP rather than separate price terms proved inferior. The problem is not one of dynamics; an equation analogous to (4.16) still gave poor fit.

(4.23) fits a little worse than (4.11), though with 1 more degree of freedom the difference is not great. The WTMV term makes no allowance for the commodity composition of UK exports to the extent that this is not reflected in the geographic pattern. It is therefore unsuitable for use in chapter 6. Nevertheless, we note the consistency of the price elasticities with earlier results, and that the coefficient on WTMV is similar in size to the sum of those on X_{W9} and $\$X_c$ in (4.11).

(d) Testing Measures of Domestic Demand Pressure

Higher domestic demand might detract from export performance, ceteris paribus;[1] the presumption is that potential exports are drawn off for domestic customers. We did not expect domestic demand pressure to be a serious problem for the UK in the inter-war period.[2] Nevertheless, two measures of overall demand pressure in the UK have been tested:[3]

(i) UK GDP relative to "trend" (CYC_{UK})

(ii) UK capacity utilisation (CU_{UK})

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1. e.g. through increasing waiting time; cf. pp.115-117.

2. See p.174 above.

3. Details are provided on pp.421-2. I am indebted to Nicholas Dimsdale of The Queen's College, Oxford for the second series.

When these were included in the specification of (4.11), the following results were obtained:

$$(4.24)\quad \ln X_{UK} = \underset{(1.13)}{1.503} + \underset{(1.91)}{0.236} \ln X_{W9} + \underset{(1.85)}{0.283} \ln \$X_c - \underset{(5.41)}{1.804} \ln UV_{XUK}$$

$$+ \underset{(4.02)}{2.139} \ln UV_{XW9} + \underset{(0.54)}{0.332} \ln CYC_{UK} + \underset{(1.45)}{0.0105}\ TIME$$

$$- \underset{(1.26)}{0.0524}\ DUM26$$

$$\bar{R}^2 = 0.973 \quad SE = 0.0268 \quad DW = 2.97 \quad EST.1924\text{-}38$$

$$(4.25)\quad \ln X_{UK} = \underset{(0.03)}{0.0316} + \underset{(2.54)}{0.295} \ln X_{W9} + \underset{(1.39)}{0.211} \ln \$X_c - \underset{(5.39)}{1.697} \ln UV_{XUK}$$

$$+ \underset{(4.11)}{1.996} \ln UV_{XW9} + \underset{(1.35)}{0.398} \ln CU_{UK}$$

$$+ \underset{(0.72)}{0.00558}\ TIME - \underset{(1.24)}{0.0424}\ DUM26$$

$$\bar{R}^2 = 0.978 \quad SE = 0.0244 \quad DW = 3.05 \quad EST.\ 1924\text{-}38$$

In neither of these is the demand pressure term significant. This may reflect countervailing influences; domestic demand tending to inhibit exports, but on the other hand higher exports tending to be associated with stronger domestic output. The positive coefficients on both CYC_{UK} and CU_{UK} suggest that the latter influence may have been stronger between the wars. This again suggests that a demand determined model of export performance is reasonable; supply constraints were not significant. These cyclical terms were also tested in specifications including unit labour costs (analogous to (4.26) below). Interestingly, negative coefficients were obtained on

CYC_{UK}, though not approaching significance at the 5% level.

(e) Assessment

The tests reported suggest a benefit from estimating separate coefficients on UK and industrial country export UVIs separately, and tend to confirm the significance of such competitiveness terms. Separate allowance for the geographic pattern of UK trade also brings about improved performance. There is no clear improvement in fit from alternative measures of primary producing countries' capacity to import employing various deflators, and even when these were used it was still apparently necessary to estimate separate coefficients on UK and industrial country export UVIs. We therefore continue to use $\$X_C$ undeflated, and to regard (4.11) as our baseline specification, though deflated $\$X_C$ is also tested further.

Overall, the results suggest little to gain from further consideration of the activity terms; we now proceed to consider an alternative "competitiveness" variable; relative unit labour costs.

(v) Unit labour costs

It was argued in chapter 3 that UK unit labour costs relative to those of foreign countries would be a useful measure of competitiveness, e.g. in capturing supply side influences, in particular profitability (which may influence non-price/cost competitiveness as well), or capturing the loss of competitiveness of potentially saleable goods not sold because the price was too high. Since an increase in UK unit labour costs, unlike an increase in UK export prices, would be expected to have an adverse effect on profitability, divergent coefficients on UK and industrial country unit labour costs could not be rationalised, as for export prices, by appeal to supply side factors. We therefore estimate primarily equations with RULC as the competitiveness term, and make comparisons with equation (4.8).

(a) Indices constructed[1]

The Statistical Appendix reveals the particular data difficulties in constructing cost competitiveness indices. We therefore estimated similarly specified equations with 21 alternative relative unit labour cost terms, 7 with each of three weighting schemes. Of the seven, one used both wage and output data from Phelps Brown and Browne (1968);[2] the others tested two alternative sets of wage data (Tables SA.8 and SA.9) combined with three alternative sets of output per head data (Tables SA.10 to SA.12). Of the latter, sets 1 and 3 may be regarded as "trended", so that the resulting competitiveness terms may be regarded as analogous to relative "normalised" unit labour costs (cf. p.106 above).

(b) Results in Simple Specifications

In general, "Maddison" weights gave superior results in regression (with standard error of the equations the main criterion). We write $RULC_{UK.11}$ to denote UK relative unit labour costs

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1. Full details of data used on wages and output per head, and of weighting schemes used, are given on pp.423-436 and Tables SA.8 to SA.13.

2. Hereafter PB.

calculated using wage data set 1 (Table SA.8) and output per head data set 1 (Table SA.10). Best fit was obtained using wage set 2 and output per head set 3,[1] thus:

$$(4.26) \quad \ln X_{UK} = \underset{(1.47)}{1.276} + \underset{(2.52)}{0.370} \ln X_{W9} + \underset{(4.57)}{0.322} \ln \$X_{C}$$

$$- \underset{(3.62)}{1.181} \ln RULC_{UK,23} - \underset{(5.36)}{0.0318} \, TIME - \underset{(0.66)}{0.0319} \, DUM26$$

$$\bar{R}^2 = 0.950 \quad SE = 0.0367 \quad DW = 2.21 \quad EST. \ 1924\text{-}38$$

The insignificant 1926 dummy was then eliminated:

$$(4.27) \quad \ln X_{UK} = \underset{(1.36)}{1.066} + \underset{(3.15)}{0.410} \ln X_{W9} + \underset{(4.77)}{0.306} \ln \$X_{C}$$

$$- \underset{(6.35)}{0.0334} \, TIME - \underset{(4.88)}{1.298} \ln RULC_{UK.23}$$

$$\bar{R}^2 = 0.953 \quad SE = 0.0357 \quad DW = 2.20 \quad EST. \ 1924\text{-}38$$

Prior to analysing these coefficients, we note the considerable gain in adding additional country information to our dataset from that provided by PB, notwithstanding the higher quality of the data in the latter source. The equation obtained with PB data (using Maizels weights[2] for foreign countries) was as follows:

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1. This output per head data, one of the trended sets, may help to reduce year to year fluctuations caused by vagaries of the data used.

2. Maizels weights were superior to Maddison weights in this instance.

$$\ln X_{UK} = \underset{(2.32)}{2.431} + \underset{(0.72)}{0.121} \ln X_{W9} + \underset{(4.90)}{0.437} \ln \$X_C \tag{4.28}$$

$$- \underset{(1.65)}{0.792} \ln RULC_{UK.PB} - \underset{(2.73)}{0.0290}\, TIME - \underset{(2.43)}{0.136}\, DUM26$$

$$\bar{R}^2 = 0.906 \quad SE = 0.0504 \quad DW = 2.16 \quad EST.\ 1924\text{-}38$$

We note that the standard error of (4.27) is rather higher than that of (4.8) (although the DW statistic is lower), but still superior to, e.g., (4.4) estimated by Hatton. The sum of coefficients on the activity terms is somewhat larger (in excess of 0.7) than in (4.8). This may explain the switch to a negative time trend.[1] The term in X_{W9} achieves significance at the 5% level. The coefficient on RULC, though lower than in (4.8) (but very little lower than in (4.9)) is still easily significant. Moreover, a lower elasticity on RULC than on COMP might be expected.[2]

Several equations analogous to those reported in sections (i) and (iv) were tested. First, with terms in the export UVIs of the UK and W9 countries omitted, it was imperative to test a deflator of $\$X_C$; we tested $UV_{X.WI}$, with the following preferred result after the insignificant 1926 dummy was omitted.

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1. Cf. p.180fn.

2. See above, p.134.

$$(4.29)\quad \ln X_{UK} = \underset{(1.69)}{1.987} + \underset{(1.54)}{0.314} \ln X_{W9} + \underset{(3.31)}{0.635} \ln \left(\frac{\$X_C}{UV_{x.WI}}\right)$$

$$- \underset{(7.18)}{0.0440}\ TIME - \underset{(3.96)}{1.323} \ln RULC_{UK.23}$$

$$\bar{R}^2 = 0.926 \quad SE = 0.0446 \quad DW = 1.53 \quad EST.\ 1924\text{-}38$$

For completeness, two equations with UK and foreign country unit labour costs ($ULC_{UK.23}$ and $ULC_{W9.23}$) separated were estimated:

$$(4.30)\quad \ln X_{UK} = \underset{(3.22)}{3.039} + \underset{(1.01)}{0.144} \ln X_{W9} + \underset{(4.89)}{0.635} \ln \$X_C$$

$$- \underset{(5.16)}{1.337} \ln ULC_{UK.23} + \underset{(2.55)}{0.760} \ln ULC_{W9.23}$$

$$- \underset{(5.35)}{0.0267}\ TIME - \underset{(1.36)}{0.0520}\ DUM26$$

$$\bar{R}^2 = 0.970 \quad SE = 0.0284 \quad DW = 2.30 \quad EST.1924\text{-}38$$

$$(4.31)\quad \ln X_{UK} = \underset{(1.13)}{1.666} + \underset{(1.29)}{0.310} \ln X_{W9} + \underset{(2.01)}{0.525} \ln \left(\frac{\$X_C}{UV_{x.WI}}\right)$$

$$- \underset{(2.55)}{1.098} \ln ULC_{UK.23} + \underset{(3.02)}{1.283} \ln ULC_{W9.23}$$

$$- \underset{(5.94)}{0.0411}\ TIME - \underset{(0.51)}{0.0313}\ DUM26$$

$$\bar{R}^2 = 0.921 \quad SE = 0.0462 \quad DW = 1.87 \quad EST.\ 1924\text{-}38$$

(4.30) produces some improvement in fit, but it is perhaps intuitively surprising that the coefficient on $ULC_{UK.23}$ is larger (in absolute terms) than that on $ULC_{W9.23}$. Part of this may be due to the failure to deflate $\$X_C$ (so that rises in <u>either</u> $ULC_{UK.23}$ <u>or</u> $ULC_{W9.23}$ diminish primary producers' capacity to import); however, although the difference between the two coefficients is diminished when $\$X_C$ is deflated, the fit is considerably less good.

An equation in which WTMV replaced the terms in X_{W9} and $\$X_C$ was also estimated; after omission of the insignificant dummy, the following equation resulted:

$$(4.32) \quad \ln X_{UK} = \underset{(4.43)}{2.674} + \underset{(8.31)}{1.078} \ln WTMV - \underset{(3.84)}{1.398} \ln RULC_{UK.23} - \underset{(6.91)}{0.0519}\, TIME$$

$$\bar{R}^2 = 0.898 \quad SE = 0.0524 \quad DW = 0.97 \quad EST.1924\text{-}38$$

The DW statistic and poorness of fit suggest misspecification here. The high coefficient on the activity term and the size of the coefficient on the time trend (implying a steady state decline of 5% of UK exports per annum) are also surprising.

(c) <u>Assessment</u>

It appears that, on balance, the goodness-of-fit obtainable from equations incorporating relative unit labour costs is less good than is obtainable using export UVIs. However, the difference in fit between, e.g., (4.11) and (4.27) or (4.30) is sufficiently small to justify continuing to test unit labour costs in sectoral equations. Nor do we regard these results as sufficient to reject applications of relative (normalised) unit labour costs in aggregate equations for other periods; it is eminently possible that the poorer quality of the data may have been a factor in generating inferior equation performance.[1] Finally, we regard the degree of robustness of other characteristics of the equations with relative price terms (approximate sums of coefficients on activity terms, strong significance of $\$X_C$ term, order of magnitude of competitiveness coefficients) as important supporting evidence for the innovations introduced in those equations.

(d) Instrumental Variable Estimation

$RULC_{UK.23}$ ("Maddison"-weighted) was tested as an instrument for COMP in IV estimation of (4.8).[2] It can be argued that in a full macroeconomic model, costs may well appear in a prices equation, and are an appropriate instrument for prices in a volume equation in which prices appear:

$$(4.33)\quad \ln X_{UK} = \underset{(2.90)}{1.805} + \underset{(1.21)}{0.115} \ln X_{W9} + \underset{(9.51)}{0.544} \ln \$X_C$$

$$- \underset{(4.60)}{1.776} \ln COMP + \underset{(1.18)}{0.00508}\, TIME - \underset{(2.23)}{0.0753}\, DUM26$$

SE = 0.0288 DW = 2.35 EST. 1924-38. IV

COMP instrumented by $RULC_{UK.23}$

In practice, a marginal improvement in standard error was obtained using $RULC_{UK.21}$ as the relevant instrument:

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1. For example, data on non-wage compensation (e.g. employers' social insurance contributions) were not available on an internationally comparable basis, and so were not considered, but may have been of some importance in the UK.

2. I am indebted to Robert Bacon for this suggestion.

$$\text{(4.34)} \quad \ln X_{UK} = \underset{(3.22)}{1.946} + \underset{(1.17)}{0.109} \ln X_{W9} + \underset{(9.54)}{0.530} \ln \$X_C$$

$$- \underset{(4.34)}{1.575} \ln COMP + \underset{(0.76)}{0.00310}\, TIME - \underset{(2.46)}{0.0811}\, DUM26$$

SE = 0.0283 DW = 2.44 EST. 1924-38. IV.

COMP instrumented by $RULC_{UK.21}$.

This latter equation differs very little from (4.8), either in goodness-of-fit (even with respect to the DW statistic, implying that simultaneity of the type tested here was not a serious problem in (4.8)) or in coefficient estimates. This provides further evidence of the robustness of the simple specification tested in our section V(1)(i).

(2) Estimating UK Share of World Exports: The Logistic Specification

(i) Developing the Specification

Consider the function:

$$\text{(4.35)} \quad y_t = \frac{K}{1 + e^{-(\alpha + \beta' x_t + \varepsilon_t)}}$$

where y_t is the dependent variable and x_t the matrix of explanatory variables. y_t is bounded by 0 and K (K is known as the "ceiling" of the function) and approaches both bounds asymptotically with a point of inflexion at some intermediate value of x.

Rearranging (4.35):

(4.36) $$e^{-(\alpha + \beta' x_t + \varepsilon_t)} = \frac{K - y_t}{y_t}$$

(4.37) $$\ln\left(\frac{K-y_t}{y_t}\right) = - (\alpha + \beta' x_t + \varepsilon_t) ,$$ or

(4.38) $$\ln\left(\frac{y_t}{K-y_t}\right) = \alpha + \beta' x_t + \varepsilon_t$$

So the original, "logistic", specification can be transformed into an equation suitable for estimation by linear methods e.g. OLS. Where y_t is defined as a share, for example in this chapter as the UK share of world exports, K will typically be set equal to 1. The functional form has attractive properties; the equation is constrained to predict feasible values for UK exports (whereas a log-linear equation could theoretically predict a value for UK exports in excess of "world" exports); and a given change in an independent variable (e.g. competitiveness) will make little difference when the UK is in a dominant position or when its share is anyway negligible, but will have greater effect over an intermediate range.[1]

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1. The locus classicus in the econometric literature is Griliches (1957).

We would not wish to impose the condition that the UK share of world trade was invariant with respect to the scale of world trade. Accordingly, $\frac{1}{X_W - X_{UK}}$ is included among the explanatory variables.

Note that in (4.38), the right hand side variables are measured in absolute terms, not in logs. The estimated coefficients thus depend on the units of measurement, and elasticities cannot easily be read off from reported equations.[1]

In estimating the following equations, two alternative definitions of UK export share were adopted:

λ_1 = UK share of <u>total</u> world export volume.[2]

λ_2 = UK share of export of ten industrial countries (W9 plus UK)

When the second definition is used, we substitute X_{WI} for X_W in the term $\frac{1}{X_W - X_{UK}}$

K, the ceiling of λ_1, is set at 1 (in earlier work, alternative ceilings down to 0.3 were tested, but none improved the fit).

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1. We derive partial derivatives and elasticities in Annex 4.2 and Annex 8.1.

2. Less satisfactorily, "world" and "industrial country" exports include exports to the UK here.

(ii) Results

$$(4.39)\quad \ln\left(\frac{\lambda_1}{1-\lambda_1}\right) = \underset{(21.4)}{-\,3.737} + \underset{(3.01)}{6129}\ \frac{1}{X_W - X_{UK}}$$

$$- \underset{(6.03)}{0.0154}\ UV_{XUK} + \underset{(7.55)}{0.0275}\ UV_{XW9}$$

$$+ \underset{(3.31)}{0.0164}\ TIME - \underset{(0.96)}{0.0322}\ DUM26$$

$$\bar{R}^2 = 0.965 \qquad SE = 0.0281 \qquad DW = 2.52 \qquad EST.\ 1924\text{-}38$$

Where λ_2 (which excludes exports of primary producers) was used, we tested the influence of $\$X_C$. The equations most closely analogous to (4.11) and (4.19) were as follows:

$$(4.40)\quad \ln\left(\frac{\lambda_2}{1-\lambda_2}\right) = \underset{(23.0)}{-\,3.238} + \underset{(6.24)}{6292}\left(\frac{1}{X_{WI} - X_{UK}}\right)$$

$$+ \underset{(2.07)}{(10^{-4} * 0.207)}\ \$X_C - \underset{(4.84)}{0.0122}\ UV_{XUK}$$

$$+ \underset{(4.93)}{0.0206}\ UV_{XW9} + \underset{(2.86)}{0.0162}\ TIME - \underset{(1.60)}{0.0494}\ DUM26$$

$$\bar{R}^2 = 0.944 \qquad SE = 0.0249 \qquad DW = 2.99 \qquad EST.\ 1924\text{-}38$$

$$(4.41)\quad \ln\left(\frac{\lambda_2}{1-\lambda_2}\right) = \underset{(17.9)}{-\,3.498} + \underset{(6.12)}{6707}\left(\frac{1}{X_{WI} - X_{UK}}\right)$$

$$+ \underset{(2.25)}{(10^{-4} * 0.322)}\left(\frac{\$X_C}{UV_{X.WI}}\right) - \underset{(4.71)}{0.0118}\ UV_{XUK}$$

$$\bar{R}^2 = 0.947 \qquad SE\ 0.0241 \qquad DW = 3.04 \qquad EST.\ 1924\text{-}38$$

Both these equations produced slightly lower SE than (4.11), though the $\bar{\bar{R}}^2$ and DW values are a little worse. Coefficient signs are as would be expected; the implications of the precise size of the coefficients are discussed further in chapter 8. When the equations were estimated over 1925-38, for comparison with equations employing lagged terms, $\$X_C$ proved slightly superior to $\left(\frac{\$X_C}{UV_{X.WI}}\right)$

Annex 4.1 reports results in which the restrictions implied in (4.40) vis a vis an equation with one lag of both price variables (Test 8) and vis a vis the full Hendry specification (Test 5) were tested. In neither case were the restrictions rejected, i.e. the 1925-38 version of equation (4.40) was acceptable. Tests 9 and 10 in Annex 4.1 report similar tests on the 1925-38 version of (4.41); (4.41) was rejected vis a vis the full Hendry specification. We report this latter equation (which has only two degrees of freedom).

$$(4.42) \quad \ln\left(\frac{\lambda_2}{1-\lambda_2}\right) = \underset{(37.2)}{-\,6.143} - \underset{(9.00)}{0.546} \ln\left(\frac{\lambda_2}{1-\lambda_2}\right)_{-1}$$

$$+ \underset{(24.2)}{10949}\left(\frac{1}{X_{WI}-X_{UK}}\right) + \underset{(7.09)}{3044}\left(\frac{1}{X_{WI}-X_{UK}}\right)_{-1}$$

$$+ \underset{(17.7)}{(10^{-4} * 0.8024)}\left(\frac{\$X_C}{UV_{X.WI}}\right) + \underset{(6.15)}{(10^{-4} * 0.350)}\left(\frac{\$X_C}{UV_{X.WI}}\right)_{-1}$$

$$- \underset{(13.3)}{0.00700}\ UV_{XUK} - \underset{(11.6)}{0.0104}\ UV_{XUK_{-1}}$$

$$+ \underset{(16.9)}{0.0132}\ UV_{XW9} + \underset{(12.0)}{0.0172}\ UV_{XW9-1}$$

$$+ \ 0.0104 \ TIME \ - \ 0.0615 \ DUM26$$
$$(4.56) \qquad (6.32)$$

$$\bar{R}^2 = 0.999 \quad SE = 0.00335 \quad DW = 3.19 \quad EST.1925\text{-}38$$

Based on the low SE, and upon the results of these tests, (4.40) in its full 1924-38 version has been adopted as the preferred equation from the logistic specification; its implications are analysed along with those of equation (4.11) in chapter 8.

(iii) Further Tests

We compared the residuals on equations (4.11) and (4.40) given in Tables 8.1 and 8.2, and referred also to Table 8.4, giving the implied elasticities (for a log-linear specification) of the coefficients estimated on the explanatory variables in (4.40). Noting that the logistic specification implies smaller elasticities when the explanatory variables take smaller absolute values, we checked residual performance in the early 1930s, when, as Table 8.4 shows, the low values of both UK and foreign prices implied competitiveness elasticities substantially smaller than the -1.85 (on UK prices) and 2.25 (on W9 export prices) of equation (4.11), and contrast with the 1920s, when the logistic implies larger elasticities.[1]

The differences in tracking performance of the two specifications are not great. Both considerably overpredict UK

1. Though we suggest in Annex 4.2 that the competitiveness elasticities quoted in Table (8.4) are probably biased upwards in terms of absolute size.

exports in 1934 (where the problem could be that the devaluation of the dollar raised both UK and W9 dollar export prices, and the equation overestimates the benefit to UK exports of the rise in foreign prices). The logistic performed a little better in the early 1930s, while the log-linear is slightly superior in the late 1920s. This may constitute evidence that if anything competitiveness elasticities are slightly over-estimated

VII. Conclusions

The scanty previous estimates of UK export equations in the inter-war period have been considerably improved upon here by taking appropriate account of the geographic and commodity composition of UK exports. Two key innovations, restricting consideration of UK competitiveness to comparisons with other major industrial countries only, and introducing a term to represent primary producers' import capacity, were successful. We concluded that for this period, relative export prices were preferable as a measure of competitiveness to relative unit labour costs; this may reflect data inadequacies, but supports our initial assumption that exports were mainly demand- rather than supply-determined.

The year-to-year and longer-term changes in UK export volumes in two preferred equations have been analysed further in chapter 8, suggesting inter alia that loss of competitiveness in association with the return to the Gold Standard was a key factor in performance in the 1920s, and that the performance of primary producers' exports was critical in accounting for fluctuations in UK exports in the Great Depression and the subsequent recovery. It is suggested that devaluation in 1931 was of little direct benefit to UK activity and employment via improved export performance.

The equations may be useful in analysis outside the estimation period. For example, Broadberry (1986) has suggested[1] that the UK lost more competitiveness in 1921 than in 1924/5, and this is supported by the calculations illustrated in Table 2.3, which relate to wholesale prices. We cannot make a precise calculation using export UVIs. However, Maddison (1962) gives the following export UVIs for the UK and some key competitors in 1921, with 1913 = 100.

UK	213
US	158
France	134
Germany	81
Italy	99
Netherlands	153
Sweden	216
Switzerland	184

Given the pattern of trade volumes in 1921, the US and France would have overwhelming weight in a competitiveness calculation; overall, the export index for the W9 countries might have averaged some 150. This implies very much weaker UK competitiveness than in 1925/6 (cf. Table 8.5). The relatively high competitiveness elasticities implied by (4.9), (4.11) and (4.40) suggest that a level of competitiveness some 10% weaker than that of 1925/6 could have entailed a further 15% loss of export volume, although other circumstances (for example a three month coal strike in the UK in

1. See his pp.124, 165. Broadberry attributes the rise in the real exchange rate in 1921 to the adoption of the strategy for the return to gold.

1921, and post-war disruption elsewhere) may have made these estimates unreliable.

The process by which UK export prices were determined is clearly of importance given the significant relative price competitiveness effects estimated here, and are considered next. However, our results already suggest the potential gains from incorporating detailed information on trade patterns; accordingly, in chapter 6, we take into account further detail on the commodity composition of UK exports.

ANNEX 4.1

F-TESTS OF KEY EQUATIONS

Test 1: In the specification of Equation (4.11), to test whether the restriction implied in equation (4.8) is justified (i.e. equal and opposite coefficients on UV_{XUK} and UV_{XW9}).

Unrestricted sum of squared residuals	$RSSQ_u$	=	0.00524156
Restricted sum of squared residuals	$RSSQ_R$	=	0.00718223

The equations are both run over 1924-38, i.e. 15 observations. In the unrestricted equation, there were 7 explanatory variables:

TIME, DUM26, UV_{XUK}, UV_{XW9}, X_{W9}, $\$X_C$, and the constant.

The test statistic

$$F = \frac{(RSSQ_R - RSSQ_u)/r}{RSSQ_u/(n-k)}$$

where n = number of observations

r = number of restrictions

k = number of explanatory variables

therefore has 1 degree of freedom (df) in the numerator and 8 in the denominator.

$RSSQ_R - RSSQ_u = 0.00194067$

The denominator $RSSQ_u/(n-k) = 0.000655195$

The F-ratio is $\therefore$ 2.96

The upper 5% point of the F-distribution for dfs (1,8) is 5.32[1]

∴ the restriction is not rejected.

Test 2: Testing the analogous restriction (the single "COMP" term rather than separate UK and world price terms) in the logistic specification

$RSSQ_R$ = 0.0140436

$RSSQ_u$ = 0.00494863 (Equation (4.40) in the text)

(Run over 1924-38 with n-k=8, r=1).

F-ratio = 14.7

If the upper 5% point is taken as the test statistic, the restriction _is_ rejected.

Test 3: Testing the restriction implied by estimating equation (4.11) rather than an equation with separate terms in volume and unit value of exports of primary producers.

$RSSQ_R$ = 0.00524156

$RSSQ_u$ = 0.00456664

1. Test statistics from Maddala (1977).

$n - k = 7$ for this test,

$$\therefore \quad \frac{RSSQ_R - RSSQ_u / 1}{RSSQ_u/7} = 1.03$$

The upper 5% point for a (1,7) F test is 5.59

$\therefore$ the restriction is not rejected.

Test 4: Testing the restrictions implied by estimating equation (4.12) rather than Equation (4.17), i.e. not including one lagged value of each price term.

$RSSQ_R = 0.0039351$

$RSSQ_u = 0.00212462$

$r = 2$ for this test (since both lagged price variables are set to zero in (4.12))

The equations are estimated over 1925-38, and the unrestricted equation has nine variables:

constant, X_{W9}, $\$X_C$, TIME, DUM26 UV_{XUK}, $UV_{XUK_{-1}}$, UV_{XW9}, $UV_{XW9_{-1}}$

$n - k \therefore = 5$

Numerator $RSSQ_R - RSSQ_u/2 = 0.00181048/2 = 0.00090524$

Denominator $0.00212462/5 = 0.000424924$

F-ratio $= 2.13$

The upper 5% point of a (2,5) F distribution is 5.79

∴ The restrictions are not rejected.

Test 5: Testing the same pair of restrictions in the logistic specification, again with $\$X_c$ undeflated as an independent variable

$RSSQ_R$ = 0.00401909 (equation (4.40) run over 1925-38)

$RSSQ_u$ = 0.00217851

The computed ratio with 2 dfs in the numerator and 5 in the denominator is 2.11

cf. the upper 5% point of the (2,5) F distribution at 5.79

Again, the restrictions are not rejected.

Test 6 Testing the restrictions implied by estimating equation (4.10) rather than equation (4.16), the "Hendry" specification with COMP

$RSSQ_R$ = 0.00393805

$RSSQ_u$ = 0.000377788

In this test, r = 4 (since the lagged dependent variable and lagged terms in X_{W9}, $\$X_c$ and COMP have all been assumed = 0).

There are ten variables in the unrestricted equation:

constant	COMP
X_{UK-1}	$COMP_{-1}$
X_{W9}	TIME
X_{W9-1}	DUM26
$\$X_c$	
$\$X_{c-1}$	

Both equations are estimated 1925-38 $\therefore$ n - k = 4.

$$F \text{ ratio} = \frac{0.003560262/4}{0.000377788/4} = 9.42$$

The upper 5% point of a (4,4) F distribution is 6.39.

$\therefore$ the restrictions are rejected.

Test 7: Testing the restrictions implied by estimating equation (4.12) rather than the corresponding Hendry equation

$RSSQ_R$ = 0.00393531

$RSSQ_u$ = 0.000143937

This time, five restrictions are applied (lagged terms on X_{UK}, X_{W9}, $\$X_i$ and two price terms) in obtaining (4.12). There are twelve independent variables, $\therefore$ n - k = 2.

$$\therefore F = \frac{0.003791373/5}{0.000143937/2} = 10.54$$

The upper 5% point of a (5,2) F distribution is 19.3

∴ the restrictions are not rejected.

Test 8: Testing the analogous set of restrictions to those tested in Test 7 in the logistic specification. $\$X_c$ is again undeflated

$RSSQ_R$ = 0.00401909 (equation (4.40) run over 1925-38)

$RSSQ_u$ = 0.000189957

$$F = \frac{0.003829133/5}{0.000189957/2} = 8.06$$

The upper 5% point of a (5,2) F distribution is 19.3

∴ The restrictions are not rejected.

Test 9 Testing the two restrictions implied in estimating equation (4.41) (run over 1925-38) rather than incorporating lags of each price term - logistic specification, $\$X_c$ deflated by $UV_{X.WI}$

$RSSQ_R$ = 0.00405578

$RSSQ_u$ = 0.00259741

$$\frac{.00145837/2}{.00259741/5} = 1.40$$

The upper 5% point of a (2,5) F-distribution is at 5.79

$\therefore$ the restrictions are not rejected.

Test 10: Testing the 5 restrictions implied by estimating equation (4.41) over 1925-38 rather than equation (4.42), the full Hendry specification in the logistic, with $\$X_C$ deflated by $UV_{X.WI}$

$RSSQ_R = 0.00405578$

$RSSQ_u = 0.0000224858$

$$\therefore \text{ F-ratio is } \frac{0.004033294/5}{0.0000224858/2} = 71.7$$

The upper 5% point of a (5,2) F-distribution is at 19.3.

$\therefore$ <u>The restrictions are rejected</u>

Test 11: "Chow"-testing[1] Equation (4.8) for unstable parameters between the 1920s and 1930s.

We test for a break in 1930, subdividing the estimation period into two subsets,

1924-1930

1931-1938

---

1. See Chow (1960), and for earlier applications of the test, Maddala (1977) p.198.

$RSSQ_u$ is obtained by summing the RSSQ figures obtained from estimating separately over the two periods:

$$RSSQ_{24-30} = 0.0000145427$$

$$RSSQ_{31-38} = 0.00110913$$

$$\therefore RSSQ_u = 0.0011236727$$

$$RSSQ_R = 0.00718223$$

There are six explanatory variables in the first sub-period but only 5 in the second, since DUM26 is irrelevant here.

Five restrictions are therefore implied.

There are therefore a total of 11 explanatory variables in the full unrestricted equation, leaving four denominator dfs.

$$F(5,4) = \frac{(0.00718223 - 0.0011236727)/5}{0.0011236727/4}$$

$$= 4.31$$

The upper 5% point of the F(5,4) distribution is at 6.26.

$\therefore$ The restrictions are not rejected.

Annex 4.2: The relationship between coefficient estimates in logistic specifications and elasticities of dependent variables with respect to explanatory variables.

We begin by establishing the partial differential of export share with respect to a single explanatory variable.

Recall equation (4.35), set K = 1, and write λ for y, as in the estimated equation.

(4.A2.1) $$\lambda_t = \frac{1}{1 + e^{-(\alpha + \beta' x_t + \varepsilon_t)}}$$

Writing the right hand side denominator as $h(x_t)$

(4.A2.2) $$\lambda_t = \frac{1}{h(x_t)}$$

Now from the quotient rule of differentiation, where $h_1{}'(x_t)$ denotes the partial derivative of $h(x_t)$ with respect to (wrt) x_{1t}, a given explanatory variable,

(4.A2.3) $$\frac{\partial \lambda_t}{\partial x_{1t}} = \frac{-h_1'(x_t)}{(h(x_t))^2}$$

(4.A2.4) Since $h_1 (x_t) = 1 + e^{-(\alpha + \beta_1 x_t + \ldots + \beta_n x_{nt} + \varepsilon_t)}$

it follows that

(4.A2.5) $h_1{}'(x_t) = 0 - \beta_1[e^{-(\alpha + \beta_1 x_{1t} + \ldots + \beta_n x_{n_t} + \varepsilon_t)}]$

or, obviously,

(4.A2.6) $$- h_1' (x_t) = \beta_1 [e^{-(\alpha + \beta_1 x_{1t} + \ldots + \varepsilon_t)}]$$

So, since $\frac{1}{(h(x_t))^2} = \lambda_t^2$

(4.A2.7) $$\frac{\partial \lambda_t}{\partial x_{1t}} = \beta_1 \lambda_t^2 [e^{-(\alpha + \beta_1 x_{1t} + \ldots + \varepsilon_t)}]$$

From equation (4.36), the expression in square brackets can be written $\frac{1 - \lambda_t}{\lambda_t}$

It follows that

(4.A2.8) $$\frac{\partial \lambda}{\partial x_{1t}} = \beta_1 . \lambda_t (1 - \lambda t)$$

Now, to find the elasticity of UK export share λ_t with respect to any given x_{1t} the coefficient estimates in the logistic specification on x_{it} being β_i, define

(4.A2.9) $$\mu_{it} = \frac{x_{it}}{\lambda_t} \cdot \frac{\partial \lambda}{\partial x_{it}}$$

From (4.A2.8), the right hand side may be written

$$\frac{x_{it}}{\lambda_t} (\beta_i \lambda_t (1-\lambda_t))$$

(4.A2.10) $$\mu_{it} = \beta_i x_{it} (1-\lambda_t)$$

Now to relate μ_{it} to the elasticities of UK export (volume) with respect to the same x_{it}. Let

(4.A2.11) $$\gamma_{it} = \frac{x_{it}}{X_{UK_t}} \cdot \frac{\partial X_{UKt}}{\partial x_{it}}$$

[γ_{it} is therefore comparable to coefficient estimates from a log-linear equation.]

Recall that $\lambda_t = \frac{1}{h(x_t)}$

so that in our study

(4.A2.12) $$\frac{X_{UK_t}}{X_{UK_t} + X_{W9_t}} = \frac{1}{h(x_t)}$$

(we adopt $\lambda_t = \lambda_2$, in the notation of chapter 4).

so,

(4.A2.13) $$X_{UK_t} = \frac{X_{UK_t} + X_{W9_t}}{h(x_t)} \Rightarrow X_{UK_t}[h(x_t) - 1] = X_{W9_t}$$

(4.A2.14) $$X_{UK_t} = \frac{X_{W9_t}}{h(x_t) - 1}$$

Using the quotient rule, we differentiate wrt x_{1t}.

(4.A2.15) $$\frac{\partial X_{UK_t}}{\partial x_{1t}} = \frac{\frac{\partial X_{W9_t}}{\partial x_{1t}} (h(x_t) - 1) - X_{W9_t} \cdot h_1' \ (x_t)}{[h(x_t) - 1]^2}$$

$$(4.A2.16) \quad h_1'(x_t) = -\beta_1 e^{-(\alpha + \beta_1 x_{1t} \cdots + \varepsilon_t)}$$

[from (4.A2.6)]

$$(4.A2.17) \quad h_1'(x_t) = -\beta_1 (h(x_t)^{-1})$$

$\therefore$

$$(4.A2.18) \quad \frac{\partial X_{UK_t}}{\partial x_{1t}} = \frac{(h(x_t) - 1)\left[\frac{\partial X_{W9_t}}{\partial x_{1t}} + \beta_1 X_{W9_t}\right]}{[h(x_t) - 1]^2}$$

If $\lambda_t = \frac{1}{h(x_t)}$, $h(x_t) = \frac{1}{\lambda_t}$

$$(4.A2.19) \quad h(x_t) - 1 = \frac{1}{\lambda_t} - 1 = \frac{1-\lambda_t}{\lambda_t}$$

$$(4.A2.20) \quad \therefore \frac{1}{h(x_t) - 1} = \frac{\lambda_t}{1-\lambda_t}$$

(4.A2.18) and (4.A2.20) produce

$$(4.A2.21) \quad \frac{\partial X_{UK_t}}{\partial x_{1t}} = \frac{\lambda_t}{1-\lambda_t} \left[\frac{\partial X_{W9_t}}{\partial x_{1t}} + \beta_1 X_{W9_t}\right]$$

multiplying through by $\frac{x_1}{X_{UK}}$

$$(4.A2.22) \quad \gamma_{1t} = \frac{x_{1t}}{X_{UK_t}} \cdot \frac{\lambda_t}{1-\lambda_t} \cdot \left[\frac{\partial X_{W9_t}}{\partial x_{1t}} + \beta_1 X_{W9_t}\right]$$

Recalling that $\lambda_t = \frac{X_{UK_t}}{X_{UK_t} + X_{W9_t}}$

$\$X_c$ may be biased downwards.

There is one explanatory variable in equation (4.40) for which our assumption clearly cannot be made; the variable

$$\frac{1}{X_{WI}-X_{UK}} = \frac{1}{X_{W9}}$$

In this case

$$(4.A2.26) \quad \gamma_{1t} = \frac{\frac{1}{X_{W9_t}} \cdot \partial X_{UK_t}}{X_{UK_t} \cdot \partial\left(\frac{1}{X_{W9_t}}\right)}$$

has been calculated in (4.A2.24)

We require

$$(4.A2.27) \quad \gamma_{jt} = \frac{X_{W9} \cdot \partial X_{UK}}{X_{UK} \cdot \partial X_{W9}}$$

Now

$$(4.A2.28) \quad \frac{\partial X_{UK_t}}{\partial X_{W9_t}} = \frac{\partial X_{UK_t}}{\partial\left(\frac{1}{X_{W9_t}}\right)} \cdot \frac{\partial\left(\frac{1}{X_{W9}}\right)_t}{\partial X_{W9_t}}$$

$$= -\frac{1}{X_{W9}^{2}} \cdot \frac{\partial X_{UK_t}}{\partial\left(\frac{1}{X_{W9_t}}\right)}$$

$$(4.A2.29) \quad \gamma_{jt} = -\frac{X_{W9}}{\left(X_{W9_t}^{2}\right)} \cdot \frac{\partial X_{UK_t}}{\partial\left(\frac{1}{X_{W9_t}}\right)}$$

$$= -\gamma_{1t}$$

Returning to (4.A2.24) and substituting for x_1,

$$\text{(4.A2.30)} \quad \gamma_{1t} = \frac{1}{X^2_{W9_t}} \cdot \left[\frac{\partial X_{W9_t}}{\partial \left(\frac{1}{X_{W9_t}} \right)} + \beta_1 X_{W9_t} \right]$$

$$= \frac{1}{X_{W9_t}^{\;2}} \left[- X^2_{W9_t} + \beta_1 X_{W9_t} \right]$$

$$= \frac{\beta_1}{X_{W9_t}} - 1$$

But $\gamma_{jt} = - \gamma_{1t}$

$\therefore$

$$\text{(4.A2.31)} \quad \gamma_{jt} = 1 - \frac{\beta_1}{X_{W9_t}}$$

Table 4.1: World Exports 1924-38

	VALUE			VOLUME			UV		
	UK	9 Industrial Countries	Rest of World	UK	9 Industrial Countries	Rest of World	UK	9 Industrial Countries	Rest of World
1924	3539	12434	11622	2047	8816	8900	173	141.0	130.6
1925	3735	12945	14581	2041	8983	10284	183	144.1	141.8
1926	3173	12855	13625	1834	9607	10530	173	133.8	129.4
1927	3447	13512	14286	2090	10455	11229	165	129.2	127.2
1928	3522	14134	14796	2174	11041	11608	162	128.0	127.5
1929	3550	14659	14537	2233	11592	12212	159	126.5	119.0
1930	2778	11846	11564	1840	10312	12137	151	114.9	95.3
1931	1764	8648	8168	1400	9189	11787	126	94.1	69.3
1932	1278	5531	5748	1405	7245	10413	91	76.3	55.2
1933	1563	6235	6959	1421	7306	10852	110	85.3	64.1
1934	1995	7739	8895	1513	7645	11157	132	101.2	79.7
1935	2102	7765	9321	1617	7830	11972	130	99.2	77.9
1936	2191	8210	10274	1622	8217	12537	135	99.9	81.9
1937	2579	10381	12520	1778	9837	13613	145	105.5	92.0
1938	2302	9564	10624	1566	9359	12665	147	102.2	83.9

NOTES

(1) Sources are as for Tables SA.3 and SA.5.

(2) All figures f.o.b.. Values in millions of current dollars; UVIs are prices in 1913 dollars (1913 = 100). Volumes defined as $\frac{\text{Value}}{\text{UVI}} * 100$

Table 4.2: Unemployment in Selected UK Industries 1924-36

	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
Coal mining	4.8	25.0	10.2[1]	19.1	25.7	19.0	23.9	36.2	40.7	37.6	36.5	32.0	30.6
Chemicals	9.0	8.6	13.0	6.4	6.2	6.1	11.8	18.8	16.4	14.2	10.4	10.6	8.3
Cotton Industry	15.4	8.5	25.1	7.0	12.9	13.7	41.5	40.6	32.3	25.1	23.1	22.2	16.6
Woollen and Worsted Industry	5.9	19.6	25.0	9.5	12.0	14.1	24.5	33.0	27.0	14.2	21.3	14.9	11.1
Pig Iron Manufacture	13.8	19.5	70.9[1]	12.8	15.4	10.6	18.9	38.2	42.4	40.9	23.8	21.8	14.2
Electric Engineering	5.5	5.6	11.4	4.7	4.9	4.4	7.4	14.3	16.0	15.2	7.9	6.7	4.0
General Engineering	14.2	12.3	18.5	9.5	9.5	8.8	15.7	28.4	29.0	25.0	15.1	12.7	8.0
Motor Vehicles, cycles and aircraft	7.1	6.0	10.4	5.7	7.9	6.1	13.1	21.2	22.2	16.2	9.6	10.1	6.0
All industries and services	9.3	11.9	14.6	8.8	10.7	9.6	15.4	21.2	22.2	19.4	16.4	15.4	12.8

Notes: Figures are % of Insured Persons Aged 16 and 64 recorded as unemployed, classified by industries, at end-June each year.

Source: Abstracts of Labour Statistics (1928), (1931), (1934), (1937).

[1] These figures are distorted by the miners' strike of 1926.

Chapter Five

UK EXPORT PRICES 1924-38

I. Introduction

The key equations reported in chapter 4 give prominence to the role of the UK export prices relative to those of overseas producers. This in turn implies that the process by which UK export prices were determined was of great importance in determining UK exports and market share. In many theoretical market forms, export prices and volumes are determined simultaneously.[1] An heuristic defence of the separate analysis carried out here is as follows:

(i) Alternative models of export price and volume determination hypothesise that export prices may be determined in advanced of volumes, e.g. by mark-up over costs, in a recursive framework;[2]

(ii) We test the role of demand factors in these price equations;[3]

(iii) Costs, as possible key determinants of prices, were tested as instruments for prices in the export volume equations;[4]

(iv) We have observed that excess supply probably prevailed in the UK economy in aggregate for much of the period.[5]

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1. See chap 3, pp.95-7.
2. See e.g. Winters (1981), Hotson and Gardiner (1983).
3. See Annex 5.1 equations (5.A1) to (5.A5), in addition to the testing of the cyclical position in the main text.
4. See equations (4.33) and (4.34).
5. cf. Table 4.2.

In section II we consider some of the earlier literature on UK export price determination. In section III we discuss the specification of equations to estimate the UK export price used in chapter 4; various measures of domestic cost and price influences and other factors are taken into account. Section IV reports the results, and relates them to the issues raised earlier. Section V presents conclusions.

II. Determination of Export Prices: Existing Studies

The major issue to which previous studies have addressed themselves is the relative importance of domestic and foreign influences in determining export prices. For example, does pure cost-plus pricing apply? Or do competitive forces in international markets completely constrain UK exporters?

The econometric approach to the problem is largely common to all the studies reviewed here. The equation in Bank of England (1979) was specified as follows:[1]

$$(5.1) \quad \Delta \ln UXGM = \alpha_o + \alpha_1 \ln UXGM_{-1} + \alpha_2 \Delta \ln PIMO + \alpha_3 \ln PIMO_{-1} + \alpha_4 \Delta \ln (PCOM.ERUK) + \alpha_5 \ln (PCOM.ERUK)_{-1}$$

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1. See Bank of England (1979) pp.50-1. On the "Hendry"-type specification, cf. chapter 4, p.186. See also Bond and Brown (1980).

where UXGM = UVI for UK exports of manufactures (in sterling)

PIMO = wholesale price index of UK manufacturing output

PCOM = price index of competitors' exports (in dollars)

ERUK = index of sterling against the dollar.

Prior coefficient expectations are as follows:

$-1 < \alpha_1 < 0$. This is usual for a "Hendry" equation, implying that UXGM converges on equilibrium following a shock in one period. $\alpha_1 < -2$ or > 0 implies that UXGM would diverge away from equilibrium following a shock. $-2 < \alpha_1 < -1$ implies damped oscillations rather than monotic convergence. The speed with which UXGM converges on equilibrium is greater as α_1 approaches -1.

$0 < \alpha_2, \alpha_3, \alpha_4, \alpha_5 < 1$. α_2 and α_4 give the impact effects of domestic and foreign price changes respectively. α_3 and α_5 give the long-term effects. Informally, we expect $\alpha_3 + \alpha_5 = -1$, which gives the property that, in the long term, proportional changes in domestic and foreign prices result in proportional changes in UK export prices. Failure of this homogeneity condition to hold might indicate model misspecification.

Bank of England (1979) estimated over 1964 Q1 - 1978 Q2 obtained:

$\alpha_1 = -0.347$

$\alpha_2 = 0.420$

$\alpha_3 = 0.185$

$\alpha_4 = 0.236$

$$\alpha_5 = 0.184$$

implying that in the short-term, domestic prices are almost twice as important as foreign prices, while in the long-term, domestic and foreign influences have roughly equal weight ($\alpha_3 \approx \alpha_5$).

Ormerod (1980) carried out similar research for various estimation periods beginning in 1964 Q3, testing more general lag structures than in equation (5.1). He obtained no significant effect for capacity utilisation. Long-run homogeneity was imposed in the preferred equations.[1] Instrumental variable estimates were obtained, as well as the reported OLS results, to check for simultaneity; virtually none was found. There was some parameter instability: as the estimation period was extended to include the period of high and rising inflation in the mid-1970s, there was some tendency for domestic costs (measured by the wholesale price index for manufactures excluding food, drink and tobacco) to increase in importance relative to world prices, and also for current quarter data to increase in importance. For the period 1964 Q3 to 1976 Q2, Ormerod obtained long-run world price and domestic cost weights of 0.545 and 0.455 respectively.

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1. This was rationalised in Deppler and Ripley (1978)(p.153) who show that a reduced form price equation for a profit maximiser subject to: (a) diminishing returns to scale because capital is fixed in the short run; (b) perfect competition in markets for variable factors of production; (c) less than perfect competition in the market for the firm's output; will be of the form UV = f (PW, PD, U) where UV is the unit value of exports, PW and PD are world prices and domestic costs, and U measures capacity utilisation, with coefficients on PW and PD summing to 1.

Ormerod reported several earlier studies of the effect on pricing behaviour of the UK devaluation in 1967, e.g. Hague, Oakeshott and Strain (1974), Rosendale (1973) and Holmes (1978). Each found a proportion of manufacturers taking advantage of devaluation to improve profit margins, while others adopted competitive pricing strategies. Ormerod concluded that his results were consistent with this microeconomic evidence.

Winters' disaggregated study of UK exports and export prices, 1955-73, contains less rich dynamics (which are less likely to be crucial with annual data).[1] Of 16 commodity groups, the UK set prices (i.e. there was a domestic weight of 1) in 9, while the others exhibited varying degrees of responsiveness to foreign prices. Hutton and Minford (1975)[2] tend to confirm these estimates of higher domestic weight; they report[3]:

(5.2) $$\Delta \ln PX_t = \underset{(0.047)}{0.145}\, \Delta \ln (PW/R)_t + \underset{(0.049)}{0.129}\, \Delta \ln (PW/R)_{t-1}$$

$$+ \underset{(0.159)}{0.321}\, \Delta \ln PD_t + \underset{(0.153)}{0.368}\, \Delta \ln PD_{t-1}$$

$$+ \underset{(0.00098)}{0.0017} \qquad SE = 0.00492 \qquad R^2 = 0.680 \qquad DW = 1.79$$

where PX is the sterling price of exports of manufactures

PW the dollar price of foreign exports of manufactures

R the sterling-dollar exchange rate

PD the domestic wholesale price index

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1. Winters (1981) chapter 4. See also chap.3 above, pp.135-138.
2. See chap.3 above, pp.138-142 and Hutton and Minford (1975), p.33.
3. Standard errors in parentheses.

This would imply a domestic weight in excess of 70%. Homogeneity almost holds: the four coefficients sum to 0.963.

Attempts to find significant effects for other variables have generally been less successful. Winters (1981) found prices of UK exports in a minority of commodity groups affected by either domestic or foreign cyclical positions. However, Basevi and Orsi (1978) found an important temporary influence on Italian export prices arising from what they term the "customs conversion effect". In periods of rapid exchange rate change, the domestic currency value of an amount of foreign currency fixed in a contract of sale may change between the time the contract is signed and the time the goods cross an international border and are recorded in customs statistics. Following this argument, we test separate exchange rate effects below.

A further issue arising from equation (5.1) is whether or not long run homogeneity (i.e. $\alpha_3 + \alpha_5 = - \alpha_1$) should be imposed. This is done explicitly in the HM Treasury model of the world economy[1] in the equation for export UVIs for the US, Canada, Japan, W.Germany, France and Italy, in which the key variables are specified as:

(domestic prices) $\ln \left\{\frac{PXG}{P} \times \frac{RX}{RX_0}\right\}_{-1}$

(world prices) $\ln \left\{\frac{PXG}{WXP}\right\}_{-1}$

1. Horton (1984) Table 10, p.28, shows domestic and foreign price weights summing to 1 for 5 of the 6 countries; figures for Japan appear to be misprinted. pp.B4-B7 give functional forms for the six major countries.

PXG is the unit value of exports (in dollars)

RX is the current dollar exchange rate of the "home" currency

RX_o is the base period (1980) exchange rate

WXP is a weighted average of export prices of the following countries (excluding the country analysed): US, Canada, Japan, West Germany, France, Italy, Netherlands, Belgium, UK, Sweden, Switzerland.

Thus the influences of P and WXP on PXG are introduced as a weighted average.

The homogeneity property is of greatest importance in forecasting equations, which should allow for the possibility of future large changes in the explanatory variables (e.g. due to generalised inflation). For analysis of a completed past period, the case is less clear. A degree of measured heterogeneity may arise from problems with the price measures, or to relationships which have been inadequately modelled.[1] The implications of imposing homogeneity on equations tested here are reported in Annex 5.1.

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1. Hotson and Gardiner (1983) p.12 do not impose homogeneity in their equations for UK manufactured export prices having found that where this was imposed the equation had various undesirable properties. They suggest measurement error as a possible source of heterogeneity, and also note the problems for simulation work.

III. Specification of the UK Aggregate Export Price Equation

1. Variables to be Tested: Price and Cost Terms

Returning to equation (5.1), we consider analogous terms for the study of UK exports in the 1920s. For UXGM, we substitute $\$UV_{XUK}$, and for PCOM, $\$UV_{XW9}$.

These variables (from chapter 4) refer to prices of aggregate exports rather than manufactures, but given the predominance of manufactures in exports of the UK and the W9 countries, the analogy should be close. Note that these variables are in dollar terms, not sterling. The unit value of exports of other ("primary producing") countries may influence UK export prices via the price of UK imported inputs; this influence should be measured via the UK price terms. The $\$UV_{XW9}$ terms should capture the world price of exports competing with UK exports.

The choice of domestic price or cost variable, analogous to PIMO in equation (5.1), involves several key issues. For example, we may test either price or cost terms. If a price index of domestic tradeable goods (e.g. wholesale prices, as in equation (5.1), or the price of manufacturing output) is tested, these prices may already be influenced by foreign competition: the equation estimated might therefore understate the true foreign price influence on UK domestic prices. We therefore test here both normalised and actual unit labour costs, the former allowing for the possibility that prices may move less cyclically than costs if firms trim margins to maintain market share.[1]

On the other hand, unit labour costs may not accurately reflect the unit costs facing firms. Suppose that exported goods contain a higher proportion of imported inputs than the average for domestic output. Then an exchange rate depreciation may induce a rise in labour costs reflecting the proportion of imports in GDP as labour recoups the "first round" rise in inflation, but may result in a sharp rise in domestic currency export prices to compensate for higher input costs. This point is important at disaggregated level. Consider the UK cotton textile industry. In 1924, around 70% of all its output was exported (nearly £200mn f.o.b., or about £180 mn at factory prices[2]). Less than 23% of gross output constituted net value added. A large proportion of the materials used were imported; UK imports of raw or simply prepared cotton, the major input into cotton spinning, totalled £110 mn in 1924.[3] This contrasts with the coal industry, in which over 83% of gross output in the industry constituted net output in 1924.[4]

Both price and unit labour cost measures of the domestic influence upon export prices have therefore been tested here.

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1. Cf. Godley and Nordhaus (1972).

2. Board of Trade (1930), (Report on 1924 Census of Production), Part I: The Textile Trades, p.62.

3. From BISC Bulletins (category 94).

4. Business Statistics Office (1978), pp.74-5.

Seven measures of UK unit labour costs were available;[1] the simple "Phelps Brown and Browne" measure and six derived by permutating two sets of wage data with three sets of output per head data.

Three price series have been tested:

(i) WHP_{UK}: UK wholesale prices, derived from the Board of Trade series for UK wholesale prices.[2] This index includes a large proportion of inputs into manufacturing and considerable effort was devoted to construction and analysis of wholesale prices.[3] However, the index largely comprised raw materials, the prices of which were mainly determined internationally. Domestic influences may therefore not be separately measured.

(ii) $PGDP_{UK}$: the UK GDP deflator at factor cost.[4] This is a broad measure, capturing a range of domestic influences. But the index includes the price of services and other non-marketed output; it is inevitably subject to difficulties of construction[5] and may not well reflect the prices of input materials and labour facing manufacturers.

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1. See Statistical Appendix, section (4.5) and Tables SA.8 to SA.13. The Maddison-weighted series have been used, having given best-fitting results in chapter 4.

2. See Statistical Appendix, section 2.2, and Table SA.T4.

3. See Statistical Appendix, section 2.2.

4. For sources of $PGDP_{UK}$ and $POUT_{UK}$, see p.440.

5. See Feinstein (1972), pp.206-211.

(iii) $POUT_{UK}$: price of total final output at market prices. This may be distorted by indirect taxes (though this may not be a disadvantage if exported goods, or inputs into exports, are subject to the same taxes).

2. Other Variables to be Tested

(i) Exchange Rate

An index (1924 = 100) for sterling against the dollar is used to convert domestic price and cost variables to dollars. It is also included as a separate explanatory variable, to allow for possible slow adjustment of UK export prices to a change in dollar home and foreign prices brought about by an exchange rate change. We expect a positive coefficient - a rise in sterling being associated with higher UK dollar export prices in the short-term.

(ii) Cyclical position

Ormerod (1980) tested a capacity utilisation term, hypothesising that when the domestic economy was booming, firms were less willing to trim margins to raise sales. We include a term in domestic output relative to trend, CYC_{UK},[1] on which we therefore expect a positive coefficient.

(iii) Time trend

This was tested in the full specification. We do not expect a significant coefficient. In a changes equation, any trend tendency for prices to increase or decrease over time should be reflected in

1. See pp.421-2.

the constant term. The time trend picks up the second differential a tendency for prices to accelerate or decelerate upwards or downwards over time.

3. The Full Specification

The following set of ten equations was estimated over 1925-38 (incorporating data for 1924 in the lag terms).

(5.3) $$\Delta \ln \$UV_{XUK} = \beta_0 \ln \$UV_{XUK-1}{}^{(1)} + \beta_1 \Delta \ln \$UV_{XW9} + \beta_2 \ln \$\, UK_{XW9-1} + \beta_3 \Delta \ln \$P_{UK} + \beta_4 \ln \$P_{UK-1} + \beta_5 \Delta \ln EXUK + \beta_6 \ln EXUK_{-1} + \beta_7 \Delta \ln CYC_{UK} + \beta_8 \ln CYC_{UK-1} + \beta_9 CONST. + \beta_{10}.TIME$$

where $\$P_{UK}$ denotes the chosen UK domestic price or cost index (in dollars), and EXUK is the sterling/dollar index.

Sign expectations:

(i) $-1 < \beta_o < 0$. With annual data, we expect β_o close to -1,

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1. $\$UV_{XUK}$ and $\$UV_{XW9}$ correspond to UV_{XUK} and UV_{XW9} in other chapters.

implying that a deviation from equilibrium is largely eliminated in a few periods.

(ii) β_2, $\beta_4 > 0$ with $\beta_2 + \beta_4 \approx - \beta_o$. This is analogous to $\alpha_3 + \alpha_5 \approx - \alpha_1$ in equation (5.1).

(iii) $\beta_1, \beta_3, \beta_5, \beta_7 > 0$. β_1, β_3 are analogous to α_2 and α_4 in (5.1)

(iv) $\beta_6 = 0$ — We would not expect the exchange rate to have a long term influence on UK dollar export prices apart from that which it has via $\$UV_{XW9}$ and $\$P_{UK}$. Where a significant effect is estimated, the β_2 and β_4 estimates may be distorted. We might expect $\beta_2 + \beta_4 + \beta_6 = - \beta_o$, which would imply that a large change in the dollar (affecting EX_{UK}, $\$P_{UK}$ and $\$UV_{XW9}$) eventually induced proportional change in UK dollar export prices.

(v) $\beta_8 = 0$ — The state of the cycle should only have a short term effect!

(vi) $\beta_9 \lessgtr 0$ — Since prices tended to fall between the wars, $\beta_9 < 0$ might be expected.

(vii) $\beta_{10} = 0$

IV. Results

Table 5.1 gives the standard errors obtained by estimation of the set of ten equations in different measures of UK prices and costs over the full specification and those resulting from the omission of various explanatory variables.

We begin with observations on the full specification:

(i) When all explanatory variables are included, there are only three degrees of freedom, emphasizing the desirability of eliminating variables of little significance.

(ii) The equations using measures of UK prices are generally superior to those using costs.

(iii) Of the seven equations using costs, those using trend output (sets (1) and (3))[1] to form "normalised" unit labour costs are generally superior to those using actual output data (set (2)). The Phelps Brown and Browne series, using actual output data, performs relatively well - possibly reflecting its superior construction.

We proceed to consider the three best-fitting equations; first, the best-fitting specification using labour costs.

Wage set 1 and output set 1 proved superior:

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1. i.e. those using Tables SA.10 and SA.12 rather than Table SA.11.

$$(5.4) \quad \ln \$UV_{XUK} = \underset{(5.86)}{-1.51} \ln \$UV_{XUK-1} + \underset{(14.2)}{0.752} \Delta\ln \$UV_{XW9}$$

$$+ \underset{(5.34)}{1.34} \ln \$UV_{XW9-1} + \underset{(2.82)}{1.19} \Delta\ln \$ULC_{UK.11}$$

$$+ \underset{(4.36)}{2.46} \ln \$ULC_{UK.11-1} - \underset{(4.30)}{0.686} \Delta\ln CYC_{UK}$$

$$- \underset{(3.45)}{1.22} \Delta\ln CYC_{UK-1} - \underset{(1.50)}{0.647} \Delta\ln EXUK \underset{(4.66)}{-1.85} \ln EXUK_{-1}$$

$$+\underset{(4.97)}{0.0392} \; TIME - \underset{(3.39)}{1.65} \; CNST$$

EST. 1925-38 $\bar{R}^2 = 0.999$ SE = 0.00444 DW = 2.51

Second, using wholesale prices,

$$(5.5) \quad \Delta\ln \$UV_{XUK} = - \underset{(4.91)}{0.893} \ln \$UV_{XUK_{-1}} + \underset{(0.68)}{0.112} \Delta\ln \$UV_{XW9}$$

$$+ \underset{(1.68)}{0.375} \ln \$UV_{XW9_{-1}} + \underset{(4.57)}{0.335} \Delta\ln \$WHP_{UK}$$

$$+ \underset{(2.65)}{0.505} \ln \$WHP_{UK_{-1}} + \underset{(0.39)}{0.0434} \Delta\ln CYC_{UK}$$

$$- \underset{(0.12)}{0.0219} \ln CYC_{UK-1} + \underset{(9.06)}{0.579} \Delta\ln EXUK + \underset{(0.35)}{0.0408} \ln EXUK_{-1}$$

$$+ \underset{(1.26)}{0.00611} \; TIME + \underset{(0.60)}{0.213} \; CNST$$

EST. 1925-38 $\bar{R}^2 = 0.999$ SE = 0.00436 DW = 3.26

Finally, the best-fitting equation, employing the price of final output.

$$(5.6) \quad \Delta \ln \$UV_{XUK} = - \underset{(7.90)}{0.871} \$UK_{XUK-1} + \underset{(1.70)}{0.161} \Delta \ln \$UV_{XW9} + \underset{(4.13)}{0.524} \ln \$UV_{XW9}$$

$$+ \underset{(6.97)}{1.40} \Delta \ln \$POUT_{UK} + \underset{(5.38)}{1.02} \ln \$POUT_{UK-1}$$

$$- \underset{(0.89)}{0.0711} \Delta \ln CYC_{UK} - \underset{(2.40)}{0.336} \ln CYC_{UK-1}$$

$$- \underset{(3.51)}{0.481} \Delta \ln EXUK - \underset{(6.41)}{0.559} \ln EXUK_{-1}$$

$$+ \underset{(4.05)}{0.00901} \; TIME - \underset{(1.38)}{0.259} \; CNST$$

EST. 1925–38 $\bar{R}^2 = 0.999$ SE = 0.00315 DW = 2.39

Equation (5.4) is a poor result. The coefficient on $\$UK_{XUK_{-1}}$ β_0[1] < -1, implying that a shock to the system would lead to oscillations around long-run equilibrium. The EX_{UK} and CYC_{UK} terms all enter with unexpected negative coefficients. $\beta_2 + \beta_4 = 3.80$, more than twice the absolute value of β_0; allowing for the distorting effect of the long-run coefficient on EX_{UK}, $\beta_2 + \beta_4 + \beta_6 = 1.95$. Given generalised inflation of 10% at home and abroad with no change in the exchange rate, export prices would rise by $\frac{3.80}{1.51} * 10 =$ 25.2%. This is highly unsatisfactory.

Equation (5.6), the best fitting of all the equations estimated, exhibited similar problems. Again, the CYC_{UK} and EX_{UK} coefficients were all negative; $\beta_2 + \beta_4 = 1.54$ as compared with $\beta_0 = - 0.87$ (though again this problem may be exaggerated by the long-run exchange rate coefficient).

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1. The notation of equation (5.3) is used throughout this analysis.

Equation (5.5) most closely corresponds to prior expectations. The coefficient on β_o implies that nearly nine-tenths of a "shock" is eliminated within a year. Both EX_{UK} coefficients are positive, with the long-run coefficient, as expected, insignificant. $\beta_2 + \beta_4 = 0.88$, while $\beta_o = -0.893$, so long-run homogeneity roughly holds. The time trend and the constant terms (which imply accelerating dollar price inflation over time) are insignificant.

Comparing β_2 and β_4 to establish the long-run domestic $\left(\frac{\beta_4}{\beta_2 + \beta_4}\right)$ and foreign $\left(\frac{\beta_2}{\beta_2 + \beta_4}\right)$ weights in export price determination, we find a domestic weight of 57% (foreign weight 43%). Equations (5.4) and (5.6) imply long-run domestic weights of 65% and 66% respectively.[1] Comparing β_1 and β_3, we find a <u>short-term</u> domestic weight of 75%. It is plausible that firms may more rapidly perceive changes in domestic price conditions than changes in foreign prices, so that domestic price changes have larger impact effect.

We now test equation (5.5) down by eliminating various parameters in accordance with prior theoretical expectations. We removed successively the insignificant terms in ln CYC_{UK-1} and ln $EX_{UK_{-1}}$.[2]

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1. It is a priori surprising that the lowest domestic weight arises from the equation using wholesale prices, which we suggested earlier were in turn most likely to be influenced by foreign prices. Thus the "true" domestic weight implied by this equation may be lower than 57%.

2. Standard errors of equations using other price/cost measures eliminating the same terms are shown in Table 5.1.

Eliminating ln CYC_{UK-1}

(5.7) $$\Delta \ln \$UV_{XUK} = -\underset{(5.67)}{0.891} \ln \$UV_{XUK_{-1}} + \underset{(0.79)}{0.103} \ln \$UV_{XW9}$$

$$+ \underset{(2.48)}{0.356} \ln \$UV_{XW9} + \underset{(5.49)}{0.337} \Delta \ln \$WHP_{UK}$$

$$+ \underset{(3.14)}{0.509} \ln \$WHP_{UK_{-1}} + \underset{(1.08)}{0.0551} \Delta \ln CYC_{UK}$$

$$+ \underset{(12.3)}{0.584} \Delta \ln EXUK + \underset{(0.50)}{0.467} \ln EXUK_{-1}$$

$$+ \underset{(1.67)}{0.00576} \, TIME + \underset{(1.17)}{0.245} \, CNST$$

EST. 1925–38 $\bar{R}^2 = 0.999$ SE = 0.00378 DW = 3.20

Eliminating ln CYC_{UK-1} and ln EX_{UK-1}

(5.8) $$\Delta \ln \$UV_{XUK} = -\underset{(11.6)}{0.822} \ln \$UV_{XUK-1} + \underset{(2.09)}{0.155} \Delta \ln \$UV_{XW9}$$

$$+ \underset{(5.16)}{0.414} \ln \$UV_{XW9} + \underset{(7.63)}{0.316} \Delta \ln \$WHP_{UK}$$

$$+ \underset{(7.42)}{0.434} \ln \$WHP_{UK-1} + \underset{(1.07)}{0.0491} \Delta \ln CYC_{UK}$$

$$+ \underset{(19.6)}{0.565} \ln EXUK + \underset{(7.94)}{0.00741} \, TIME + \underset{(1.28)}{0.169} \, CNST$$

EST. 1925–38 $\bar{R}^2 = 0.999$ SE = 0 00349 DW = 3.35

The insignificant $\Delta \ln CYC_{UK}$ term was also eliminated. The insignificance of the proxies for demand helps to justify our general approach treating prices as parametric to the volume equations.[1]

Eliminating both CYC_{UK} terms and $\ln EX_{UK-1}$

$$(5.9)\quad \Delta\ln \$UV_{XUK} = \underset{(11.4)}{-\ 0.810} \ln \$UV_{XUK-1} + \underset{(3.58)}{0.205} \Delta\ln \$UV_{XW9}$$

$$+ \underset{(5.12)}{0.416} \ln \$UV_{XW9-1} + \underset{(7.81)}{0.298} \Delta\ln \$WHP_{UK}$$

$$+ \underset{(7.26)}{0.423} \ln \$WHP_{UK-1} + \underset{(21.0)}{0.552} \Delta\ln EXUK$$

$$+ \underset{(7.94)}{0.00748}\ TIME + \underset{(1.08)}{0.142}\ CNST$$

EST.1925-38 $\bar{R}^2 = 0.999$ SE = 0.00353 DW = 3.13

The only insignificant[2] term is the constant. The time trend, implicitly the "second moment" of inflation, is significant. The fit remains good, and in the columns of Table (5.1) referring to the three restricted specifications corresponding to equations (5.7), (5.8) and (5.9), the equation using $\$WHP_{UK}$ has lowest standard error in each case. Table 5.1 also indicates that elimination of further variables (ΔEX_{UK} and TIME) substantially worsens fit.

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1. The possible independent influence of UK export volumes on prices is tested in Annex 5.1.

2. With 6 degrees of freedom, significance at the 95% level requires $t > 2.447$ (Maddala (1977) p.507).

We now consider further properties of equation (5.9):[1]

(i) The speed of adjustment, given by β_o = -0.810, is lower than in equation (5.5) (-0.893).

(ii) The equation continues to exhibit approximate homogeneity; $\beta_2 + \beta_4 = 0.84$ cf. $\beta_o = -0.81$.

(iii) The long-run foreign price weight is now 50% (cf. 43% in equation (5.5)), and the short-term foreign price weight is now 41% (cf. 25% in equation 5.5)). The long run home and foreign weights correspond precisely with those in Bank of England (1979) for a very different period.[2]

(iv) The cofficient on $\Delta \ln EX_{UK}$ is very similar to that in Equation (5.5).

V. Conclusions

The implications for export prices of the 11% rise in sterling against the dollar entailed by the return to the Gold Standard are discussed in detail in chapter 8. We expect a short term rise in UK dollar export prices of 9.35%, falling to a rise of 5.65% in the long term.[3] It is notable that a fall of 11% in dollar export

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1. Further tests of equation (5.9):- IV estimation; the imposition of long-run homogeneity; and residual inspection - are reported in Annex 5.1.

2. See above, p.231.

3. See pp.344-5.

prices of the foreign industrial countries unaccompanied by a change in the sterling-dollar exchange rate has a slightly different effect. Equation (5.9) suggests that in the first year, UK dollar (and sterling) export prices will fall by 2.26%; in the long-term, we expect a fall of $\left(\frac{0.416}{0.81}\right)$ x 11%, i.e. 5.65%. The short-term fall in sterling export prices is slightly greater in this latter case, the difference being made by the short-run stickiness with respect to exchange rate changes, which applies only in the appreciation case.

Both our quantitative and more general conclusions are subject to various qualifications. The analysis presented here is partial; in the absence of a full macroeconomic model, feedback mechanisms from the exchange rate to export prices via the domestic economy, or via the effect on foreign competitors' prices, have been ignored. The DW statistics suggest that the final equation could still be improved. Our investigation of dynamics was necessarily limited by the shortage of degrees of freedom. Nevertheless, equation (5.9) fitted the data well and conformed closely to our prior expectations. Its marked superiority in goodness-of-fit and coefficient estimates over other plausible specifications suggests considerable explanatory power.

The preferred equation suggests a few more general conclusions:

(i) In the long-term, export prices of foreign competitors and domestic wholesale prices appear to have had equal weight in influencing UK export prices between the wars.

(ii) In the short-term, domestic influences seem to have had more weight.

(iii) An exchange rate appreciation would result in an initial loss of competitiveness of some 85% of the total appreciation, which would partly be eroded subsequently. Depreciation is assumed to have symmetrical effects.

(iv) No evidence for an effect on export prices from domestic activity or export volumes could be found. This lends some support to our "recursive" approach, with export prices being determined prior to volumes.

(v) Domestic wholesale prices proved superior as an explanatory variable to measures of unit labour costs.

ANNEX 5.1; Further Tests of Preferred Equation (5.9)

1. Instrumental Variables Estimation

The possibility that export prices were determined simultaneously with activity was tested by re-estimating equation (5.9) using instrumental variables. In equation (5.A1) $\Delta \ln X_{W9}$ was employed as instrument for $\Delta \ln \$UV_{XW9}$ and $\Delta \ln CYC_{UK}$ as instrument for $\Delta \ln \$ WHP_{UK}$.

(5.A1)
$$\ln \$UV_{XUK} = \underset{(0.23)}{0.0412}\ CNST - \underset{(10.0)}{0.799}\ \ln \$UV_{XUK_{-1}}$$

$$+ \underset{(2.76)}{0.274}\ \Delta \ln \$UV_{XW9} + \underset{(4.41)}{0.468}\ \ln \$UV_{XW9_{-1}}$$

$$+ \underset{(4.09)}{0.259}\ \Delta \ln WHP_{UK} + \underset{(4.59)}{0.378}\ \ln \$WHP_{UK_{-1}}$$

$$+ \underset{(17.1)}{0.542}\ \Delta \ln EXUK + \underset{(6.42)}{0.00812}\ TIME$$

EST. 1925-38 $\bar{R}^2 = 0.999$ SE = 0.00393 DW = 2.78

The fit here is little worse, and DW a little better, than in equation (5.9). The relative long-term importance of foreign export prices increases a little; rough homogeneity is preserved.

In equation (5.A2), $\Delta \ln \$ULC_{UK11}$ was used as instrument for $\Delta \ln \$WHP_{UK}$:

(5.A2)
$$\Delta \ln \$UV_{XUK} = - \underset{(0.17)}{0.158}\ CNST - \underset{(3.61)}{0.759}\ \ln \$\ UV_{XUK-1}$$

$$+ \underset{(0.63)}{0.423}\ \Delta \ln \$UV_{XW9} + \underset{(1.22)}{0.556}\ \ln \$UV_{XW9-1}$$

$$+ 0.137 \; \Delta\ln \$WHP_{UK} + 0.281 \; \ln \$WHP_{UK-1}$$
$$(0.28) \qquad\qquad (0.62)$$

$$+ 0.562 \; \Delta\ln EXUK + 0.00952 \; TIME$$
$$(9.36) \qquad\qquad (1.62)$$

EST. 1925-38 $\bar{R}^2 = 0.997$ SE = 0.00702 DW = 2.14

Fit here is worse than (5.9), though the DW is substantially closer to 2. The long run homogeneity property is slightly eroded (long run coefficients on UK and W9 price terms sum to 0.837 against -0.759 on $\$UV_{XUK-1}$), and the weight attached to the world price term in the long-run is substantially greater.

Nevertheless (5.A1) and (5.A2) taken together seem not to undermine the OLS results in chapter 5 fundamentally.

2. Independent Effect of UK Export Volume

We tested separate inclusion of terms in UK export volumes; equations (5.A3), (5.A4) and (5.A5) respectively report results obtained when both $\Delta\ln X_{UK}$ and $\ln X_{UK-1}$ were included; when only $\Delta\ln X_{UK}$ was included; and when only $\ln X_{UK-1}$ was included.

(5.A3) $$\Delta\ln \$UV_{XUK} = 0.180 \; CNST - 0.839 \; \ln \$UV_{XUK_{-1}} + 0.193 \; \Delta\ln \$UV_{XW9}$$
$$(1.08) \qquad\qquad (8.80) \qquad\qquad (2.03)$$

$$+ 0.458 \; \ln \$UV_{XW9} + 0.290 \; \Delta\ln \$WHP_{UK} + 0.426 \; \ln \$WHP_{UK-1}$$
$$(3.78) \qquad\qquad (6.57) \qquad\qquad (6.48)$$

$$+ 0.569 \; \Delta\ln EXUK + 0.00741 \; \Delta\ln X_{UK}$$
$$(9.40) \qquad\qquad (0.24)$$

$$- 0.0139 \; \ln X_{UK-1} + 0.00793 \; TIME$$
$$(0.54) \qquad\qquad (6.69)$$

EST. 1925-38 $\bar{R}^2 = 0.999$ SE = 0.00397 DW = 3.29

(5.A4) $$\Delta\ln \$UV_{XUK} = \underset{(1.01)}{0.138}\ CNST - \underset{(11.0)}{0.811} \ln \$UV_{XUK-1} + \underset{(2.17)}{0.169}\ \Delta\ln \$UV_{XW9}$$

$$+ \underset{(4.90)}{0.415} \ln \$UV_{XW9} + \underset{(7.37)}{0.295}\ \Delta\ln \$WHP_{UK} + \underset{(6.99)}{0.427} \ln \$WHP_{UK-1}$$

$$+ \underset{(11.4)}{0.583}\ \Delta\ln EXUK + \underset{(0.72)}{0.0172}\ \Delta\ln X_{UK} + \underset{(7.46)}{0.00771}\ TIME$$

EST. 1925-38 $\bar{R}^2 = 0.999$ SE = 0.00368 DW = 3.17

(5.A5) $$\Delta\ln \$UV_{XUK} = \underset{(1.34)}{0.191}\ CNST - \underset{(10.3)}{0.846} \ln \$UV_{XUK-1} + \underset{(3.59)}{0.209}\ \Delta\ln \$UV_{XW9}$$

$$+ \underset{(4.67)}{0.470} \ln \$UV_{XW9} + \underset{(7.29)}{0.289}\ \Delta\ln \$WHP_{UK} + \underset{(7.19)}{0.425} \ln \$WHP_{UK-1}$$

$$+ \underset{(20.5)}{0.557}\ \Delta\ln EXUK - \underset{(0.92)}{0.0173} \ln X_{UK-1} + \underset{(7.42)}{0.00792}\ TIME$$

EST. 1925-38 $\bar{R}^2 = 0.999$ SE = 0.00358 DW = 3.27

These results suggested that UK export volumes did not have separate explanatory power in the export price equation, apparently confirming the absence of a serious simultaneity problem.

3. Imposition of Homogeneity

Equation (5.9) closely approximated the property of homogeneity, i.e. that a 1% rise in both competitors' export prices and UK wholesale prices generates a long-run rise in UK export prices of 1%. This is desirable if all prices are changing substantially, and, with all the variables specified in dollars, particularly if the dollar changes greatly in value against other currencies and/or commodities. We tested the imposition of long-run homogeneity on equation (5.9), and on equation (5.6), the best fitting equation using output prices.

(i) <u>Output prices</u>

$$
\begin{aligned}
(5.A6)\quad \Delta\ln \$UV_{XUK} = {} & \underset{(0.58)}{0.307} + \underset{(0.78)}{0.234}\ \Delta\ln \$\ln UV_{XW9} + \underset{(1.53)}{0.901}\ \Delta\ln \$POUT_{UK} \\
& + \underset{(0.55)}{0.206}\ \ln \left(\frac{\$UV_{XW9}}{\$UV_{XUK}}\right)_{-1} + \underset{(0.24)}{0.0887}\ \ln \left(\frac{\$POUT_{UK}}{\$UV_{XUK}}\right)_{-1} \\
& + \underset{(0.96)}{0.205}\ \Delta\ln CYC_{UK} + \underset{(1.42)}{0.369}\ \ln CYC_{UK-1} \\
& - \underset{(0.12)}{0.0462}\ \Delta\ln EXUK - \underset{(0.55)}{0.0530}\ \ln EXUK_{-1} \\
& + \underset{(0.65)}{0.00435}\ TIME
\end{aligned}
$$

EST. 1925 - 38 $\bar{R}^2 = 0.994$ SE = 0.0101 DW = 2.19

An F-test was used to test whether the imposition of homogeneity was justified. The statistic calculated, with degrees of freedom (1,3), was 38.2, which is well in excess of the upper 5% point of 10.1.[1] Homogeneity is therefore rejected.

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1. See Maddala (1977) p.510.

(ii) Wholesale prices

$$(5.A7)\quad \Delta\ln \$UV_{XUK} = \underset{(12.7)}{0.318} + \underset{(3.32)}{0.155}\ \Delta\ln \$UV_{XW9} + \underset{(9.45)}{0.325}\ \Delta\ln \$WHP_{UK}$$

$$+ \underset{(5.91)}{0.332}\ \ln\left(\frac{\$UV_{XW9}}{\$UV_{XUK}}\right)_{-1} + \underset{(16.7)}{0.493}\ \ln\left(\frac{\$WHP_{UK}}{\$UV_{XUK}}\right)_{-1}$$

$$+ \underset{(20.2)}{0.558}\ \Delta\ln\ EXUK + \underset{(15.4)}{0.00630}\ TIME$$

EST. 1925-38 $\bar{R}^2 = 0.999$ SE = 0.00374 DW = 2.75

Again the imposition of homogeneity was subjected to an F-test. The statistic calculated, with degrees of freedom (1,6), was 1.87, well below the upper 5% point of 5.99. The imposition of homogeneity would not therefore be rejected. We would choose to impose it were the equation to be used for forecasting. Since the equation is only used for analysis of a past period, we simply note the acceptability of homogeneity as a further favourable property of equation (5.9).

4. Residuals on equation (5.9)

The residuals on equation 5.9 were as follows:

1925	0.0021
1926	- 0.0021
1927	0.0016
1928	0.0014
1929	- 0.0056
1930	0.0020
1931	- 0.0002
1932	- 0.0002
1933	0.0000
1934	- 0.0007
1935	0.0035
1936	- 0.0032
1937	0.0017
1938	- 0.0004

The tracking performance of this equation is excellent (several turning points are correctly picked). There is no evidence of heteroskedasticity. There is some evidence of negative autocorrelation of the residuals (suggested by the DW statistic), but it is not clear that this implies misspecification.

Table 5.1: UK Export Prices 1924-38: Standard Errors of Equations

Specification --> / Measure of Domestic Costs/ Prices ↓	Includes: both CYC_{UK}, both EXUK terms, and TIME (1)	Includes: $\Delta \ln CYC_{UK}$, both EXUK terms and TIME (2)	Includes: $\Delta \ln CYC_{UK}$ $\Delta \ln$ EXUK, TIME (3)	Includes: $\Delta \ln$ EXUK, TIME (4)	Includes: only the basic terms: see note (2) (5)
1. Unit Labour Costs: Phelps Brown and Browne measure	.00661	.00676	.00745	.00755	.02475
2. Unit Labour Costs: Wage Set (1); Output Set (1)	.00444	.00856	.01009	.01063	.02384
3. Unit Labour Costs: Wage Set (1); Output Set (2)	.01092	.00952	.01069	.00989	.02426
4. Unit Labour Costs: Wage Set (1); Output Set (3)	.00649	.00614	.01047	.01108	.02370
5. Unit Labour Costs: Wage Set (2); Output Set (1)	.00751	.00673	.01151	.01140	.02081
6. Unit Labour Costs: Wage Set (2): Output Set (2)	.01060	.00928	.01175	.01094	.02475
7. Unit Labour Costs: Wage Set (2); Output Set (3)	.00598	.00521	.01184	.01174	.02087
8. Wholesale Prices	.00436	.00378	.00349	.00353	.03039
9. GDP deflator	.00965	.00923	.01058	.00997	.01543
10.Price of total final output	.00315	.00466	.01315	.00889	.01353

NOTES:

(1) Column (1) includes Equations (5.4), (5.5) and (5.6) in the text; columns (2), (3) and (4) contain text equations (5.7), (5.8) and (5.9) respectively.

(2) <u>All</u> equations include: log of (dollar) UK export prices as the dependent variable; a constant; $\ln \$UV_{XUK-1}$, $\Delta \ln \$UV_{XW9}$, $\ln \$UV_{XW9-1}$; and $\Delta \ln \$P_{UK}$, and $\ln \$P_{UK-1}$ where the particular price or cost index used to represent P_{UK} is given in the ten rows of the Table.

Chapter 6

UK EXPORTS IN PRINCIPAL SECTORS

I. Introduction

We concluded in chapter 4 that simple equation specifications could produce a reasonable degree of explanatory power in modelling UK aggregate exports between the wars when the geographic pattern of UK exports was taken into account, and when the predominance of manufactured goods in UK exports was reflected in the competitiveness term. However, with relatively few observations, and data of doubtful quality, particularly those used in the construction of unit labour costs, these conclusions were tentative.

We have already suggested[1] that changes in competitiveness and their causes and effects can best be studied with reference to a variety of evidence. For example, we have already considered movements in a wide selection of competitiveness of "real exchange rate" measures in chapter 2, and tested the effects of a variety of competitiveness measures on aggregate exports in chapter 4. In this chapter and the next, we aim to test the applicability of some of the simple specifications in chapter 4 to disaggregated export data. Equations in the value of UK exports in eight key sectors have been estimated over 1925-35,[2] using a specification closely akin to

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1. See e.g. pp.153-4.

2. The data problems constraining this choice are explained on p.444.

equation (4.11).[1] We then allow for patterns of competition from other industrial countries specific to each individual sector. While the data necessary to construct unit value and volume indices for the UK and each foreign country in each commodity group were not in general available, the coal sector was an important exception, and is given more detailed consideration in chapter 7.

We begin with a note on the econometric problems created by estimation in value, rather than volume terms. We proceed, by analogy with the methodology in chapter 4, to a short preview of the sectors to be tested. Section IV describes the specifications tested, including incorporation of sector-specific activity and competitiveness terms, and considers the results in comparison with the results of chapter 4. Section V analyses the results in more detail, sector by sector. We draw in this section on the analysis in chapter 8 of the implications of the UK loss of competitiveness in 1924-6 and the slump in the value of exports of primary producing countries in 1929-32 for UK exports in these key sectors and for employment in them. We draw some more general conclusions in section VI. Annexes 6.1, 6.2 and 6.3 analyse certain features of the results in more detail, while Annex 6.4 expands on section II in illustrating the problems of interpreting an equation estimated for the value share of UK exports in a sector.

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1. For completeness, we have also tested equations in the value of exports in the eight sectors combined.

II. Some Econometric Problems

1. Log-linear equations specified in value terms

Suppose we believe the true model for the volume of UK exports in a particular sector z is

$$(6.1)\quad X_{UKZ_t} = \alpha_o . X_{W9Z_t}^{\alpha_1} \left[\frac{\$X_{c_t}}{f(P_{UK_1} P_{W9})_t}\right]^{\alpha_2} . P_{UKZ_t}^{\alpha_3} . P_{W9Z_t}^{\alpha_4} . e^{\varepsilon_t}$$

where ε_t is well-behaved,

X_{UKZ_t} denotes the volume of exports by the UK in the sector

X_{W9Z_t} denotes volume of exports by competitor countries in the sector

$\$X_{c_t}$ denotes the dollar value of total exports of primary producers

$f(P_{UK}, P_{W9})_t$ is the "appropriate" deflator for $\$X_c$ to reflect the capacity to import of primary producers. If such a deflator exists,[1] it will be some combination of UK and W9 aggregate export prices

P_{UKZ_t}, P_{W9Z_t} are the prices of good Z exported by the UK and competitor countries

$\alpha_1 \ldots \alpha_4$ are parameters with expected values $\alpha_1, \alpha_2, \alpha_4 > 0$ and $\alpha_3 < 0$.

No serious difficulty in interpetation arises if the dependent variable is $P_{UKZ_t} . X_{UKZ_t}$. In effect, we estimate a right-hand-side coefficient of $\alpha_3 + 1$ on P_{UKZ_t}. There is, however, a slightly more serious problem if data on exports by competitor countries in each

1. Recall that no deflator gave significantly superior results in estimation to $\$X_c$ undeflated in chapter 4.

sector are only available in value terms; we estimate in effect:[1]

$$(6.2)\quad P_{UKZ_t} \cdot X_{UKZ_t} = \alpha_o \left(P_{W9Z_t} \cdot X_{W9Z_t}\right)^{\alpha_1} \cdot \left[\frac{\$X_{C_t}}{f(P_{UK}, P_{W9})_t}\right]^{\alpha_2}$$

$$P_{UKZ_t}^{(\alpha_3+1)} \cdot P_{W9z_t}^{(\alpha_4-\alpha_1)} \cdot e^{\varepsilon_t}$$

So the estimated coefficient on world prices may be biased downwards[2] from the true competitiveness coefficient (even leaving aside the complication of the terms of trade deflator on $\$X_c$). This should influence our interpretation of (i) the significance of coefficients on P_{W9Z_t} and (ii) the calculation of the response of exports to changes in competitiveness. The problems may be further complicated when unit labour costs are used as the competitiveness terms, since a rise in ULCs overseas will be related (but not perfectly) with P_{W9Z_t} and UV_{XW9_t}

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1. Our assumption is that P_{UKZ_t}, X_{UKZ_t}, P_{W9Z_t} and X_{W9Z_t} are not separately observable. P_{UKZ_t} and P_{W9Z_t} are proxied by UV_{XUK_t} and UV_{XW9_t} on the right-hand-side in estimation. We prefer the creation of tractable problems of interpretation and measurement error in the right-hand-side variables and coefficients to the problems additionally created by measurement error in the dependent variable which would result if volume proxies were obtained by dividing each $\$X_{UKZ_t}$ and $\$X_{W9Z_t}$ by UV_{XUK_t} and UV_{XW9_t} (the aggregate export UVIs). We could not assume (as Maddala (1977) p.292 does in obtaining tractable results) that the mean of the measurement errors on the dependent variable would be zero in each sector; UV_{XUK_t} may be a biased estimate of each P_{UKZ_t}.

2. Assuming $\alpha_1 > 0$. The results indicate that this may not be taken for granted.

2. Other Issues

Several other econometric problems arise in the interpretation of equations estimated in this chapter. We have already noted some of the problems created by the $f(P_{UK}, P_{W9})$ term in the deflator for $\$X_C$. Consider the case in which unit labour costs are used as the competitiveness terms. Aggregate export UVIs for the UK and the world may be some function of unit labour costs.[1] It was therefore important to test some specifications in which ULCs were used with $\$X_C$ already deflated, to avoid distorting the estimated ULC "competitiveness" coefficients. (In practice, this did not improve the fit). Similarly, where sector-specific country weights were used in constructing the world price term, the competitiveness terms might not pick up the effect of industrial country export price changes on primary producers' import demand to best effect; again it was important to test a plausible deflator.

These considerations lead us to regard the estimated coefficients on the competitiveness terms with reservations. Consequently, the estimates of effects of price changes (in particular) given in chapter 8 must be regarded as approximate. In practice, since the UK export UVI (in dollars) was the same in 1926 as in 1924, the elasticity on this term made little different to the calculations[2], but it is useful to note that our estimates based on

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1. Based on the failure in chapter 4 to find strong dynamic effects, we incorporate no lags in this chapter; with only eleven observations it would be difficult to obtain well determined estimates. But this may entail further misspecification if the relationships between UK and world prices and their respective ULCs are dynamic. Note also that in chapter 5 unit labour costs did not provide strong explanations of UK export prices.
2. See Table 8.8.

the changes in world prices are likely to understate losses of exports (and hence employment) in the period.

There would be further difficulties of interpretation in estimation of an analogous logistic specification. Let ϕ_{zt} denote UK share of value of exports of industrial countries.

$$(6.3) \quad \phi_{Z_t} = \frac{X_{UKZ_t} \cdot P_{UKZ_t}}{X_{WIZ_t} \cdot P_{WIZ_t}} \quad \text{where}$$

$$X_{WIZ_t} \cdot P_{WIZ_t} = X_{UKZ_t} \cdot P_{UKZ_t} + X_{W9Z_t} \cdot P_{W9Z_t}$$

note that

$$(6.4) \quad \phi_{Z_t} = \lambda_{Z_t} \frac{P_{UKZ_t}}{P_{WIZ_t}},$$ where λ_{zt} is the UK volume

share in sector Z, an analogue to λ_2 in chapter 4. We have two problems. First, a rise in P_{UKZ_t} may reduce UK volume share through competitiveness effects, but will increase the UK export value and value share directly. Second, a rise in P_{W9Z_t} may increase UK export volume share through competitiveness, but will increase P_{WIZ_t} and hence directly reduce UK value share. Coefficient estimates in a value share logistic specification are thus poor estimators of the competitiveness coefficients that would be obtained from a volume equation. We show in Annex 6.4 that the resulting biases are extremely complex and not easily estimable from observed coefficients. Consequently, we do not report logistic estimates in this chapter.

III. Preview of Sectors Tested

(1) General Observations

The primary criterion in selecting the sectors to be tested was their importance in aggregate UK exports during the period. However, there was also interest in examining sectors with differing experiences - both declining and expanding industries, for example. Shipbuilding, an important declining industry, was excluded as being (both between the wars and subsequently) too erratic to model with such limited data.[1]

Table 6T.1: Exports in selected sectors
(% by value of total UK merchandise exports)[2]

Sector	%
Coal	7.4
Cotton Manufactures	17.9
Wool Manufactures	6.7
Apparel	3.6
Chemicals	3.2
Iron and Steel Manufactures	9.2
Machinery	10.1
Vehicles	3.9
Total, these 8 sectors	62.0

1. See p.82 in Parkinson (1982) for fluctuations in tonnage launched.

2. For sources and definitions, see pp.441-5 and Tables SA.T5 and SA15.

Table 6.T1 is a "snapshot" of the importance of the selected sectors. We also draw in this section on Table SA.19, which gives the UK share, by value, of total exports in each sector by the main industrial countries (UK plus W9 countries). The absolute figures are slightly arbitrary, since the sample of countries included varies slightly between categories, and the definitions of the commodity groups may differ slightly for those countries (US, Japan) for which data were not available in the BISC Bulletins.[1]

Table SA.20 gives the shares of the UK's nine leading industrial competitors in each of the sectors under review in 1929.[2] Note that the sectors in the final row of the table, which reflect the importance of each country as a competitor to the UK across the eight sectors combined, do not differ greatly from the "Maizels" weights reported in Table 2.2, which were derived from total exports of manufactures.[3] Table SA.20 forms the basis for the the sector-weighted foreign export prices indices used later.[4] But it is also useful as more general background.

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1. Bulletins of the Bureau International de Statistique Commerciale. We suggest (p.444) that in practice the omitted data are not likely to have been significant items.

2. See pp.441-5 for sources and details of construction.

3. The main differences include a rather higher weight for Japan in Table SA.20 than in "Maizels", mainly attributable to its importance in cotton textiles, a key export product for the UK. The US has only a slightly smaller weight in Table SA.20 despite the omitted sectors. These results are encouraging confirmation of the sector weightings and the contention that the omitted data are probably not of great importance.

4. See pp.279-281 below.

Table 6.T2: UK Exports and Output in Key Sectors, 1924-35 (1)(2)

	Exports £mn.				Gross Output £mn		
	1924	1930	1935		1924	1930	1935
Coal	79.6	50.1	36.0		251.6	167.0	146.6
Chemicals	23.0	19.7	20.1		142.4	135.1	151.5
Wool	61.2	34.1	25.7	All Textiles	760.1	433.6	442.9
Cotton	192.2	83.9	56.7				
Apparel	30.9	19.2	12.4		213.6	195.2	186.8
Iron and Steel	71.7	51.0	38.2		227.2	167.7	194.6
Machinery	55.4	60.2	48.9		156.2	150.2	168.5
Vehicles	18.9	21.3	20.5		180.9	201.4	187.0

(1) Export figures from BISC, as described on pp. 441-5, and converted to sterling using exchange rates in Table SA.1. Output figures from Business Statistics Office (1978); see pp. 482-3.

(2) The export and output categories do not correspond completely, even outside the textile sector.

Table 6.T2 may indicate the extent to which our survey of UK export performance in these sectors may contribute to overall histories of the related industries.[1]

Some general trends should be observed:

(1) The UK had a dominant position in world exports of textiles and coal throughout the period, but in the other sectors, although the UK share was substantial, she was either one of several competing countries, or (vehicles being the principle example) competing in a market dominated by other producers. Taking the eight sectors together, the UK suffered a substantial loss of share during the period, but three sectors, wool, apparel, and vehicles, bucked the trend.

(2) In every sector, and in the aggregate, the UK value share stood rather higher by 1935 than at the low point for the period. For every sector except coal (where special circumstances applied in 1926), 1931 was the low point. There is therefore some casual evidence that devaluation late in 1931 may have achieved some positive results, possibly with some lagged effects not allowed for in our equations.

(3) Table 6.T2 illustrates some of the substantial changes in structure both of UK output and exports over the period. We note in particular the rapid decline of coal and textiles

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1. We have drawn in particular on Buxton and Aldcroft (1982) and Allen (1959), with additional information from, inter alia British Association: Economic Science and Statistics Section (1938).

(especially cotton), which were heavily reliant on trade. Machinery and vehicles were stronger sectors both in output and trade, but note that while vehicles were a sector in which UK producers were mainly reliant on domestic sales, machinery exports were over 25% of output even in 1935. It cannot straightforwardly be concluded that the strongest UK industries in the 1930s were those least exposed to foreign competition.

2. Coal

We preview the coal sector in more detail in chapter 7. This was a sector in which the decline in UK share of industrial country exports was most pronounced. It might be expected that the coal trade of overseas countries would also show a tendency to decline, given the rise of other sources of energy.[1] But Table SA.17 suggests that coal exports by our sample of foreign countries declined by less than most sectors. The key foreign competitor was Germany, with Belgium, Netherlands, and France also important. We suggest in chapter 7 that the importance of the US as a competitor to the UK may have been exaggerated, since UK exports went principally to Europe, notably to France, Italy and the Scandinavian countries, where other Europeans were key competitors.[2]

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1. For example, League of Nations: "World Production and Prices" 1937/8 (1938) p.62 suggests that while world production of coal fell by 2% between 1929 and 1937, petroleum production increased 35% and hydroelectric power production 47% (1937 figures were estimates). Over 1929-35, the respective changes were -14%, +10% and +30%.

2. See PEP (1936), pp.165-167.

Chemicals

Reader (1982) expresses the view that the UK chemical industry, strengthened by the formation of ICI in 1927, survived the inter-war period very well. Table 4.2 shows that unemployment in the UK chemical industry was well below the average for all industries and services throughout the period, so that this might be a key sector to examine for the relevance of supply factors to UK export performance.[1] But the UK industry remained a small player on a world scene dominated by Germany (by the IG grouping, in particular). Exports were small as a proportion of UK output in the sector. The relative strength of the UK performance required protection of domestic producers even in the 1920s under the Dyestuffs Act. Later in the 1930s, ICI diversified production into other Empire countries, which probably inhibited the growth of UK exports within its protected markets even though Table SA.22 (for unit labour costs) and comparison of Table SA.5[2] with Table SA.21 (for relative export prices) suggested that UK competitiveness improved substantially in the 1930s, as a consequence of devaluation in 1931 which, crucially, Germany did not follow.

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1. Tested in our specifications by the inclusion of unit labour costs as the competitiveness measure. But a supply constraint may not be relevant in a single sector where the economy is not close to full capacity, since resources may in theory be attracted from other sectors.

2. The "UK" column in Table SA.5 is compared with the "Chemicals" column in Table SA.21. On the diversification of ICI production, see Reader (1982) p.176. Reader also notes (p.173) the worldwide cartelisation of the industry, which may also have limited the scope of the UK to take advantage of its competitive position.

4. Textiles: Wool and Cotton

Cotton and wool were two components of a UK textiles industry which was heavily reliant on exports[1] (especially before the First World War and in the 1920s). Both sectors were heavily concentrated geographically, cotton in Lancashire, wool in Yorkshire. In both industries, the UK held a predominant position in world trade, with over half the exports of our group of ten industrial countries in the cotton sector, and just under half the wool exports of the group.

Between the wars, both cotton and wool industries suffered heavy falls in exports, and the cotton industry in particular experienced a steep decline in employment, output and share of world markets. Since the decline in exports was overwhelmingly the source of the contraction in UK output, our analysis is of key importance in these sectors.

The decline in UK exports had many sources. Crucial in the cotton industry was the collapse of exports to the Far East. British India, China, and Japan accounted for more than 50% of UK cotton exports in 1913.[2] The development of local production, in India

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1. Note that in Table 6.2 wool and cotton by no means accounted for total exports in the textile sector; e.g. our "apparel" category includes hosiery exports, which are included in textile output.

2. See Allen (1959) p.216.

particularly, damaged UK prospects. Higher Indian tariffs were a factor,[1] but domestic producers in the Far East anyway had the advantage of lower wage costs than the UK. Although we allow for the importance of Japan in this sector, the competitiveness of non-industrial countries is not considered; nor can we derive from our competitiveness indices conclusive evidence as to whether the initial level of UK competitiveness was untenable.[2]

Porter (1982)[3] points to continuing obsolescence and lack of efficiency and adaptability in the textiles sector, although, under the pressure of the slump in demand, a considerable degree of rationalisation of capacity was accomplished by the Lancashire Cotton Corporation in the 1930s, aided by the Bank of England.[4]

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1. Allen (1959), p.222, suggests that the tariffs of India, the US and Brazil were unhelpful, but the disadvantage of higher UK labour costs was crucial. Latham (1981), p.101, and Hughes and Saunders (1938) (see section II) ascribe more importance to protection, the latter noting the stronger performance of the UK in the Sterling Area, where Imperial Preference may have been helpful.

2. Some evidence of the adjustment pressures faced even before the Great Depression may be found in the level of industrial disputes in the industry. In terms of aggregate working days lost, textiles accounted for half the UK total in 1928, and over three-quarters of the UK total in 1929 and 1930. In 1929, wage reductions predominated total UK disputes in terms of numbers of work people involved. (Abstract of Labour Statistics 1936/7, pp.128-9 and pp.132-3).

3. See in particular pp.33-38.

4. Business Statistics Office (1978) pp.45 and 79 shows that while the value of UK textiles output per head fell considerably, while UK industrial output per head was constant, between 1924 and 1930, the recovery from 1930 to 1935 was a little stronger than in industry as a whole. But UK textile prices were particularly weak in the 1920s; cf. p.67 above.

But although slack demand and obsolescence were problems for the wool industry as well as cotton, the UK substantially increased its share of industrial countries' wool exports. The principal foreign competitors were France, Germany and Italy.[1] Exchange rate policies in these countries implied that the UK was in a far stronger competitive position than in cotton.[2]

(5) Apparel

The UK clothing industry was far less dependent on foreign demand than the wool and cotton sectors. Despite a considerable fall in the value of UK exports, therefore, output was far less damaged. Even the decline in UK exports plotted in Tables 6.T2 and SA.16 entailed an increase in the share which the UK had of exports of industrial countries in the sector. This was far less dominating than the position in cotton and wool, but, as Table SA.20 shows, France and Germany were again key competitors, so that once again the UK derived a durable competitive advantage from devaluation in 1931.

(6) Iron and Steel

The UK had ceded world leadership in iron and steel production well before the First World War to Germany (which appears in Table SA.20 as the principal foreign competitor) and to the US, which exported a relatively low proportion of its output.[3] Throughout

1. See Table SA.20 and Allen (1959) p.270.

2. Cf. Tables SA.21 and SA.22.

3. See Warren (1982) pp.104-106 and 113 et seq. on the advantages of the US over the UK industry.

the 1920s, the UK industry was depressed; the slump in shipbuilding affected domestic demand for steel,[1] while exports were hampered by relatively low UK productivity,[2] high relative costs, and a shift in world demand away from the types of steel produced by the UK.[3] In addition, the UK industry was seriously affected by the coal strike in 1926 (cf. the unemployment figures in pig-iron manufacturing shown in Table 4.2).

The recovery in UK output in the iron and steel industry which gathered pace in the mid-1930s[4] was, as is well shown in Table 6.T2, largely home-based; exports continued to decline as a share of UK output, and relatively little gain was made in share of industrial countries' exports,[5] despite apparently improving cost and price competitiveness.[6] This may have owed much to protection at home and abroad. The UK imposed an ad valorem duty of 33 1/3% in April 1932,[7] while foreign markets were also heavily

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1. This was partially offset later by growth in vehicle production; see Warren (1982) pp.107-108.
2. Warren (1982) p.115.
3. Allen (1959) p.107.
4. Although the re-armament boom in the UK and overseas lies largely beyond our estimation period.
5. See Table SA.19.
6. See Tables SA.21 and SA.22.
7. See Warren (1982) p.112.

cartelised.[1] This may be expected to mitigate against the performance of simple equations such as those below.

7. Machinery

The principal characteristic of this sector, noted particularly by Gourvish (1982),[2] was its heterogeneity. There was a variety of products, spanning both declining sectors (e.g. marine engineering) and expanding sectors (e.g. electrical engineering).[3] Output in the sector was volatile,[4] which was perhaps not surprising given relatively high reliance on exports (cf. Table 6.T2) and investment demand. The pattern of export competition was very varied. For example, Allen[5] notes considerable specialisation within engineering; the US tended to specialise in items requiring mass production, while the UK produced goods requiring more skill. Such a pattern might be expected to bring about relatively low price elasticities of demand for exports, particularly if UK goods were highly differentiated. Gourvish[6] notes the

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1. Allen (1959) p.112 notes that the British agreement with the European Steel Cartel served to limit imports beyond the effect of the tariff. But he also notes (p.113) the adverse effect of protection on UK exports of higher value added products (including the motor industry).

2. See e.g. Gourvish (1982) p.143.

3. Catterall (1982) p.241 notes that the growth rate in electrical engineering between 1926 and 1938 was second only to that of the vehicles industry, among major industrial sectors. Domestic demand was particularly important in this sector, supported by the development of the National Grid (cf. Catterall (1982) pp.243-246).

4. See Gourvish (1982) pp.129-131.

5. Allen (1959), p.137.

6. Gourvish (1982) pp.140-143.

dominance of Germany and the US in the machine tools sector, and Table SA.20 confirms that these two countries were overall key competitors to the UK in the sector. On the other hand, Gourvish also notes[1] the importance of Japanese competition in the growing market for textile machinery in India (as Indian domestic textile production expanded); this might suggest that the improvement in UK price and cost competitiveness shown in Tables SA.21[2] and SA.22 was overstated, given the low weight accorded to Japan in the machinery sector (Table SA.20). Nevertheless, productivity grew more strongly in mechanical engineering than in "factory trades" as a whole, and Gourvish cites Hart (1965) as showing that the profits of "engineering" grew faster than profits in manufacturing in general:[3] this might suggest improving competitiveness[4], entailing improved export performance from the supply side and via non-price competitiveness.

(8) Vehicles

There are some interesting differences of interpretation of the UK performance in the vehicles sector between the wars. This was an industry in which the UK experienced rapid output growth (though subject to sharp fluctuations).[5] The home market was protected

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1. Gourvish (1982) pp.133-135.
2. Table SA.21 should be compared with the UK unit value series shown in Table SA.5.
3. Gourvish (1982) pp.144-5; Hart (1965) p.70.
4. See pp.95-97, p.103 and p.108 above.
5. See Miller and Church (1982), pp.179-181.

almost continuously throughout the period,[1] and demand was further fostered by the improvement in the UK terms of trade in the 1930s; the rise in real incomes was a helpful factor for an industry with a high income elasticity of demand.[2]

Miller and Church note the rapid growth in productivity in the UK industry in this period,[3] and they note the substantial rise in UK exports after 1931, while despite rapid growth in the home market in the same period, imports took little of the increase.[4] Various reasons are cited for the competitive success of the UK: international agreements may have helped protect the domestic market further;[5] Imperial Preference strengthened the UK position in several key markets and strongly influenced the pattern of UK export growth; and it was suggested that at the depth of the world depression, when the UK performance in the car industry was relatively strong, the UK's position as a supplier of an inferior substitute for US cars was significant.[6] On the other hand, Allen suggests that the UK motor

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1. See Allen (1959), p.180. From 1915 on, except between August 1924 and July 1925, tariffs of 33 1/3% applied. Preference given to Empire countries considerably encouraged the Canadian industry. In addition, UK taxes on horsepower encouraged domestic production of smaller cars, and worked to protect the home market while handicapping exports in markets with a preference for larger models.

2. See Allen (1959) p.182.

3. Miller and Church (1982) pp.180-1; this suggests ceteris paribus that our aggregate measure of UK unit labour costs may be too high for this industry.

4. Miller and Church (1982) p.186.

5. Miller and Church (1982), p.196.

6. Miller and Church (1982) pp.198-9, citing Sieve (1950), p.290.

industry did not capture a share of the world market appropriate to the size of its engineering industry, while the rise of the world car industry entailed the displacement of older engineering products in which the UK was particularly strong.[1] Allen also notes that the competitiveness of the US in the 1930s may have been adversely affected by the severe fall in domestic demand for the industry there. This would have reduced the size of production runs, and led to higher unit costs under mass production methods.[2]

Both the pattern of international competition and of UK markets in the inter-war motor industry are of interest. Table SA.20 confirms the dominating position of the US in the industry, while Table SA.19 confirms the strong performance of UK exports in this sector relative to other key UK export products, starting from a lower world market share than in the staple industries. The accuracy of our competitiveness variables may be affected by the omission of Canada,[3] and possibly, as suggested above, by a loss of competitiveness in the US industry which may not have been fully reflected in economy-wide measures of US prices and costs. UK exports were heavily concentrated outside the identified group of industrial countries: Australia, India, Ireland, Malaya, New Zealand and South Africa accounted for an overwhelming majority of UK

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1. Allen (1959) pp.179-181.
2. See Allen (1959) pp.182-3.
3. Cf. Miller and Church (1982) pp.193-5.

markets.[1] This might lead us to expect a particularly strong coefficient on the primary producers' export value, or capacity to import, term.

Table 4.2 above suggested that the motor vehicle industry experienced relatively low unemployment throughout the industry, and the rapid pace of growth in the sector also suggests that supply factors were an important determinant of export behaviour. To the extent that unit labour costs reflect supply factors, their performance in explaining export behaviour is noteworthy in this sector.

(9) Total of the eight sectors

We should perhaps restate our expectations regarding the equations in the aggregate total of the eight sectors. Broadly, we would expect coefficient estimates similar to those of the analogous equations in chapter 4, particularly (reflecting the shorter estimation period) equation (4.12), allowing for the coefficient differences to be expected between value and volume equations.[2] It would also be expected that the difference made by adjustment for specific patterns of competition and industrial countries' exports in each sector would be less than for particular sectors. Both of these expectations are to be examined in the following sections.

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1. These six markets accounted for 85% of UK exports of private cars and chassis in 1929, 59% in 1932, and 80% in 1937. See Miller and Church (1982) pp.195-6 and Table 6.

2. See above, pp.260-1.

IV. Results: Specifications Tested

(1) Introduction

Seven alternative specifications of equations in the eight key sectors and the combined total of exports in these sectors were tested, with results presented in Tables 6.1 to 6.7. The specifications were as follows.[1]

(i) Table 6.1 reports results with explanatory variables in each equation exactly as used in equations (4.11) and (4.12):

X_{W9} : volume of nine industrial countries' total exports

$\$X_C$: dollar value of "primary producers'" exports

UV_{XUK}: unit value of UK aggregate exports

UV_{XW9}: unit value of industrial countries' aggregate exports,

plus a time trend, and, in the coal and iron and steel sectors and the aggregate equation, a dummy for 1926.

(ii) Table 6.2 reports the results when UV_{XW9} in the Table 6.1 equations was replaced by UV_{XW9S}, nine industrial countries' aggregate export UVIs weighted separately in each sector using the weights in Table SA.20.[2]

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1. In all these specifications, the dependent variable is $\$X_{UKS}$, the dollar value of UK exports in the specific sector. All seven specifications are log-linear.

2. See pp.454-5.

(iii) The equations in Table 6.3 report results when substituting $\$X_{W9S}$ (the value of industrial countries' exports in each individual sector) for X_{W9} in the Table 6.2 equations. Thus in this table we allow in both activity and price competitiveness terms for the specific sectoral pattern of trade.

(iv) In the equations reported in Table 6.4, $\$X_C$ is replaced by $\left(\frac{\$X_C}{UV_{x.WI/MC}}\right)$, abbreviated as W_C.CAP, "capacity to import" or "real value of exports" of primary producing countries,[1] with other dependent variables as for Table 6.3.

We then proceeded to analyse the effects of including unit labour costs rather than export unit values as the competitiveness measures. Recalling from p.277 above that we regarded it as preferable, when unit labour costs are used, to deflate the SX_C term:

(v) Table 6.5 has as explanatory variables:

X_{W9} : aggregate export volume of nine industrial countries;

W_CCAP : "primary producing" countries' "capacity to import";

$NULC_{UK.23}$: UK normalised unit labour costs, using wage data set 2 and output per head data set 3;[2]

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1. For details of construction, see p.420. We preferred to use $UV_{x,WI/MC}$ despite the slightly superior results given by $UV_{X.WI}$ in chapter 4 since when the sectoral pattern of world competition in trade was allowed for, to allow also for the geographical pattern of primary producers' imports seemed a more consistent approach. Table SA.T1 suggests that anyway one key difference between the two series arose after 1935.

2. See pp.423-439 for details of construction.

$NULC_{W9.23.s}$: normalised unit labour costs (wage set 2, output per head set 3) of nine foreign countries, using foreign country weights given in Table SA.20;

plus the time trend, and the dummy for 1926 in the coal and iron and steel sectors and the equation for the eight sectors combined. This may be regarded as analogous to Table 6.2.

(vi) Table 6.6 reports estimations in which $\$X_{W9s}$ replaced X_{W9} in the specifications of Table 6.5.

(vii) For completeness, Table 6.7 reports results when $\$X_C$ was used undeflated in place of W_CCAP in the specifications of Table 6.6.

(2) Overview of results

Overall, the results reported are unimpressive. The equations in exports of the eight sectors combined generally fit the data much better than most of the individual sector equations. The high frequency of DW statistics well in excess of two suggests a degree of misspecification. And the range of estimated coefficients on each main explanatory variable is so wide across the different sectors as to give little independent evidence regarding the plausibility of the coefficient estimates reported in chapter 4. These difficulties are unsurprising. The aggregate UVI and NULC data for the UK and the nine foreign industrial countries may well not be good proxies for export prices and unit labour costs in each sector. Moreover, a wide range of coefficient estimates across sectors is in itself a plausible result from disaggregated analysis.[1]

The results suggest a few general conclusions. First, with regard to the main methodological contention in this chapter, there is substantial confirmation of the value of taking sector-specific patterns of activity and competition into account. The results in Tables 6.3 and 6.4 are generally much superior to those in 6.1. There were three exceptions, the cotton and coal sector equations and the equation for exports of the eight sectors combined. This last result does not constitute particular cause for concern; we might expect exports in the eight sectors combined to be explained relatively well by aggregate variables. Moreover, our investigations of exports of coal in chapter 7 suggest that the coal equation in Table 6.1 can be improved upon with further sector-specific analysis.

Second, there is general support for the result obtained in chapter 4 that export prices were superior to unit labour costs as measures of competitiveness in the inter-war period if empirical explanatory power was the key criterion. The results in Tables 6.5 to 6.7 are in general inferior to those in Tables 6.3 and 6.4, with the cotton sector constituting an exception.

Third, $\$X_c$ undeflated generally yields better overall explanations of UK exports than when deflated to represent more accurately the "capacity to import" of primary producing countries, although (as in chapter 4) it might be contended that the pure competitiveness effects of domestic and foreign price changes are more accurately measured when $\$X_c$ is deflated.

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1. See the discussion of the model of Winters (1981) on pp.135-138 above and the coefficient estimates given in Table 3.5.

Finally, the key innovative results obtained in chapter 4 seem reasonably robust. The terms in $\$X_c$ are consistently right-signed and generally significant in the best-fitting equations in each sector; the exception, the coal sector, is plausibly explained.[1] Moreover, the importance of the $\$X_c$ term holds up in almost all other estimated equations also. The coefficient estimates on the competitiveness terms are extremely varied, but with the exception of the apparel sector are usually "right-signed", where this is counted as positive for UV_{XW9} or UV_{XW9s} terms and less than +1 (rather than strictly negative) for UV_{XUK} or UV_{XUKs} terms.[2] Table 6.A2.2 shows the coefficients adjusted for the biases suggested by equation (6.2) above. These results for estimated coefficients on $\$X_c$ and the competitiveness terms, together with the relatively strong results in Table 4.3, which may be regarded as the most natural "sector-specific" adaptation of equation (4.11), constitute some corroborative evidence for the preferred equation arrived at in chapter 4.

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1. See pp.323-5.

2. Reference to equation (6.2) suggests that, if competitiveness has no effect at all, and ignoring any effect on primary producers' capacity to import, a 1% rise in UK export prices would produce a 1% increase in the value of UK exports.

V Results: Individual Sectors

(1) Coal

The results obtained in this sector were in general very poor; the lowest standard error obtained (Table 6.1) was some 7.5%. The coefficients on $\$X_C$ or W_C CAP are consistently negative. Failure to obtain significant positive coefficients is not unduly remarkable given the low proportion of British coal exports going to "primary producing" countries.[1] The coefficient estimates on other explanatory variables are in general rather erratic - except that the 1926 dummy was highly significant in every equation.

The poor fit, the importance of the sector in total UK exports, and the abundance of international data specific to the coal-mining sector, justify the separate consideration of UK coal exports in chapter 7.

(2) Chemicals

This was consistently the best-fitting equation; in Tables 6.3 and 6.4 we report SEs of 0.0163. Given the overall variation in the series[2] (the lowest observation (1932) is barely half the highest, and changes of up to 25% between single observations occurred), this is a very good result. The parameter estimates obtained in the best-fitting equation (Table 6.3) are eminently plausible (cf. Table 6.A2.2), with adjusted competitiveness elasticities of 1.2 to 1.3,

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1. See Table 7.T1 below.

2. See Table SA.16

and both $\$X_{W9}$ and $\$X_C$ entering with positive coefficients, though both are relatively low. The positive (but not significant at the 5% level) time trend is also intuitively plausible in a sector in which the UK share of industrial country exports held up better than average.

There were some less satisfactory features. First, the coefficient estimates are very sensitive to the precise specification. For example, comparing Table 6.1 with Table 6.3, the crucial $\$X_C$ coefficient falls from 1.05 to 0.357. Second, the DW statistics in Tables 6.3 and 6.4 are high. It is interesting that although the chemical sector was one in which unemployment was low and hence the supply side might be expected to be relevant, the specifications including NULCs performed much less well than those using UVIs.

Finally, we compare our coefficient estimates with those of Winters (1981) for the chemical sector in the post-war period[2]; we have rather higher competitiveness elasticities (cf. Winters 0.57 on world prices), but are lower on the world activity term; compare the sum of the coefficients on the $\$X_{W9S}$ and $\$X_C$ or W_C CAP terms in Tables 6.3 and 6.4, around 0.5, with Winters' 0.72 on world output.

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1. See Table SA.19.

2. See above, Table 3.5.

3. Cotton Textiles

This proved a very difficult sector in which to obtain well-defined estimates. Part of the problem may be associated with the downward trend in world prices in the industry;[1] it may be that UK and foreign aggregate export prices are particularly poor proxies for prices in this sector.

The first remarkable feature of our results is the extraordinary sensitivity of the goodness-of-fit of the equations to small changes in specification. In sharp contrast to all other sectors, the introduction of sector-specific information on the value of industrial countries' exports in the sector and the geographical pattern of competition sharply worsens the fit (cf. a standard error of 2.8% in Table 6.1 with over 10% in Tables 6.3 and 6.4).[2]

Although we have already discussed the importance of markets in developing countries for the UK cotton indsutry, it is still surprising to find heavily negative coefficients on X_{W9} and $\$X_{W9S}$ in Tables 6.1 to 6.3, with, in the first two cases, coefficients on $\$X_C$ well in excess of +1. It is difficult to believe that the income elasticity of demand for UK cotton exports in the primary producing countries was as high as these coefficient estimates might imply. Multicollinearity between $\$X_C$ and $\$X_{W9S}$ may be a distorting factor here. It is also posible that the coefficient estimates on the X_{W9}

1. Cf. p.67.

2. This is particularly surprising given the high weight of Japan in the sector-specific competitiveness term, not reflected in the aggregate W9 UV and ULC terms.

terms were affected by the strong downward trend in the UK share of world trade in this sector which was partly a consequence of the dominant initial UK position. To the extent that the UK and other industrial countries were competing for a limited world market in cotton textiles (as the domestic capacity of India, in particular, increased), it might even be expected that a rise in exports by other industrial countries necessarily entailed a fall in UK exports, rather than (as is our normal interpretation) suggesting an increase in world demand which the UK could also exploit.

The coefficient estimates on the export price terms in Tables 6.3 and 6.4 are also remarkably large. Although this result does not consistently hold when unit labour costs are used as the competitiveness measure, the price elasticities in the best fitting equation, shown in Tables 6.1 and 6.A2.2, still suggest that UK cotton exports were highly responsive to changes in competitiveness.

There is independent evidence to suggest that high competitiveness elasticities may have been a feature of the cotton industry both inter-war and more recently. Winters (1981)[1] found a world price elasticity for textiles of 2.16 (though the elasticity was only 0.83 for textile fibres) for post-war data. Chang (1951) estimated the inter-war elasticities of substitution between British and Japanese cotton piece goods in the Indian and Chinese markets at -1.94 and -2.31 respectively.[2] Ginsburg and Stern (1965) report

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1. See Table 3.5.

2. See Chang (1951) p.74.

elasticities of substitution between UK and US exports in over 60 commodities inter-war, and report elasticities of -3.30 on cotton hosiery, -3.72 on cotton cloth and -4.29 on "cotton knit underwear".[1] Although it may be misleading to compare bilateral elasticities of substitution with coefficients on competitiveness terms including prices in nine foreign countries, this range of estimates at least suggests that the high price elasticities in our equations are not unreasonable. Thus, the vulnerability of this sector to the loss of competitiveness in the mid-1920s suggested in chapter 8 would be a result common to a variety of empirical work.

4. Wool and Worsted

This sector suggests considerable benefits from taking the sector-specific geographical pattern of competition into account. Tables 6.3 and 6.4 both show standard errors below 2% when UV_{XW9s} and $\$X_{W9s}$ are used as the industrial country price and export value terms. This is encouraging given the very different pattern of competition in this sector from the aggregate. We noted earlier[2] that the predominance of France and Germany as competitors in this sector entailed a relatively strong UK competitive position in the 1930s.

Once again, the activity terms suggest a very considerable effect on UK exports from a rise in primary producers' aggregate exports, while exports by other industrial countries in the sector

1. See Ginsburg and Stern (1965) pp.273-4.

2. See p.272 above.

had little net effect. Again the rationalisation for the latter result may be that the UK was a major producer operating in a limited and declining market in which a rise in sales by others entailed a loss of UK share. It is of interest that, in common with most other sectors,[1] the inclusion of W_CCAP rather than $\$X_C$ tends to increase the coefficient on this term, in this case from 1.21 to 1.56.

The estimated coefficients on the price terms (some -1.3 on UV_{XUK} and 1.5 on UV_{XW9s} when adjusted for bias as in Table 6.A2.2) are again strong, though not out of line with the aggregate elasticities obtained in chapter 4. These would confirm the importance of the gain in competitiveness made by the UK in the 1930s in this sector, as well as the loss of competitiveness in the mid-1920s.

(5) Apparel

This sector provided an interesting problem. We obtained standard errors of around 3% or below for each of the equations using export prices as the measures of competitiveness (cf. Tables 6.1 to 6.4). However, in all of these cases, the competitiveness variables obtained were totally insignificant and/or "wrong-signed" (e.g. a negative coefficient on UK_{XW9s} was obtained in Table 6.3). The equations were only slightly repaired by the inclusion of unit labour cost rather than export price terms. Only in Table 6.6 was

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1. Comparison of Table 6.3 with 6.4 suggests cotton as the major exception, though we are comparing two very poor equations in the cotton sector. The equations for the eight sectors combined also have slightly higher coefficients on $\$X_C$.

a positive coefficient obtained on $NULC_{W9.23.s}$, but in that equation, the coefficient on $NULC_{UK.23}$ was in excess of +1. The best fitting equation was that in Table 6.7, with a standard error of only 2.5%, and an adjusted coefficient[1] on UK NULC of -0.65, but a "wrong-signed" coefficient on W9 NULC. These results suggest that only a small part of the problem could be attributed to testable supply side factors.

Closer inspection, indeed, suggests that the overall goodness-of-fit may be attributed almost entirely to the $\$X_C$ or WcCAP terms and to a strong negative time trend. Once again, coefficients on X_{W9} or $\$X_{W9s}$ were close to zero and could take either positive or negative signs.

We regarded these results as highly unsatisfactory. It was unlikely that progress could be made by eliminating insignificant variables, since this would eliminate behaviour in most of the terms of interest. We did not, therefore, analyse the apparel sector when examining implications of key changes in the explanatory variables in chapter 8.

(6) Iron and Steel and Manufactures

Goodness-of-fit of the equations in this sector was generally disappointing. The lowest standard error, obtained in Table 6.3, exceeded 5%. Nor was there strong evidence that this equation provided much explanation of export behaviour additional to the

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1. See Annex 6.2 and Table 6.A2.2. The adjustment procedure is very doubtful in specifications using NULCs rather than export prices.

explanation of poorer equations, which typically produced SEs in the 6% to 7% range.

The coefficients on the activity terms suggested a familiar problem of multicollinearity: X_{W9} or $\$X_{W9s}$ do not approach significance in any of Tables 6.1 to 6.7, while coefficients on $\$X_C$ or $W_C CAP$ were generally in excess of 1 (1.4 in our preferred equation).

The coefficients on the price terms were of a plausible order of magnitude, although the difference in absolute size between the coefficients on UV_{XUK} and UV_{XW9s} (1.943 and 1.032 respectively in our preferred equation when adjusted for bias) is surprising. The strength of these effects is in sharp contrast to the result obtained by Winters quoted in Table 3.5. He obtained, on post-war data, an elasticity of only 0.09 on world prices in this sector.

The 1926 dummy was not significant at the 95% level in any of the equations tested for iron and steel, so the effects of removing it were tested in Annex 6.1. After removal, the standard error of the adjusted specification of Table 6.2 was lower than that of the adjusted Table 6.3. Neither equation fitted as well (even in terms of $\bar{R}^2$) as when the dummy was included. Our qualitative conclusions regarding the activity and competitiveness terms were not affected. It is notable that the coefficient estimates for $\$X_C$ and the competitiveness terms are very similar in Tables 6.2 and 6.3 (and for the analogous equations in Annex 6.1). Thus the analysis carried out in chapter 8, which was conducted on the Table 6.3 equation including the dummy, would not seriously be affected by the exclusion of the dummy or the different equation choice thereby resulting.

(7) Machinery

The relatively low level of unemployment in the electrical engineering section of this industry,[1] and the great degree of heterogeneity and specialisation in the sector which we discussed above,[2] suggested that supply side effects might be important. Indeed, the worsening of fit resulting from the introduction of normalised unit labour costs (which might be expected to capture both supply and demand influences) as the competitiveness measure was relatively small here; we obtained a standard error of 0.0316 in the best fitting equation, that in Table 6.3, while the analogous equation in Table 6.7 yielded a standard error of 0.0377. The DW statistic was, however, much higher in the latter equation, and we regarded the specification of Table 6.3 as the preferred equation for further analysis.

The coefficient estimates on the activity terms are in interesting contrast to most other sectors. The coefficient on $\$X_C$ is not significant in Table 6.3, although in absolute size it is little smaller than the highly significant coefficient on $\$X_{W9S}$. Thus, although we retain $\$X_C$ in the equation for the analysis conducted in chapter 8 on the effects of the fall in primary producers' exports in the Great Depression on UK exports, these calculations should be

1. See Table 4.2

2. See p.274.

regarded as suspect in this sector. It might be expected that machinery exports would be particularly likely to go to other industrial countries, and that trade in these products within the industrial group would be the key indicator of the prospective size of the market for UK goods. However, Gourvish notes[1] the importance of Imperial markets in this sector also; and it should be recalled that agricultural machinery is included within the sector.[2]

When adjusted for bias in Table 6.A2.2, the competitiveness elasticities (-1.343 on UK export prices and 1.865 on UV_{XW9S}) appear plausible; both terms would exceed the 95% level of significance given the original standard errors on the coefficients. The plausibility of the coefficients is enhanced by comparison with the elasticities on world prices reported by Winters (1981)[3]: 0.96 for UK exports in mechanical engineering; 1.85 in electrical engineering.

The positive time trend (worth almost 2% per annum in the best-fitting equation) is an interesting feature. We suggested earlier[4] that this may in part be associated with relatively low activity coefficients; the combined coefficients on $\$X_{W9S}$ and

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1. See Gourvish (1982) p.140 (on marine engineering), p.141 (on machine tools), p.137 (on prime movers and boilers).

2. See Table SA.T5. In 1929, agricultural machinery (BISC category 166) accounted for about 2.7% of UK exports in the machinery sector (categories 160 to 167).

3. See Table 3.5.

4. See p.180 and cf. equation (4.11).

$\$X_C$ in Table 6.3 sum to 0.628. Both the sum of coefficients on the activity terms and the time trend are larger than obtained on the preferred aggregate equation (4.11), which would be consistent with the account of Gourvish[1] of a growing industry which was nevertheless subject to sharp external fluctuations.

(6) Vehicles

Only in Table 6.3 was an equation obtained for UK vehicle exports with standard error below 4%, and here the DW statistic was, at 3.01, disturbingly high. Once again, given the rate of growth in UK output in this sector during the inter-war period,[2] it might have been expected that supply factors would be important, but the relatively poor performance of equations including unit labour costs offered no evidence that the relevant factors could be included by this means. On the other hand, the strong time trend (worth over 7% per annum in Table 6.3) may reflect this supply growth; it certainly cannot be rationalised in terms of a low sum of coefficients on the activity terms.

These activity terms showed the now familiar pattern with a very high coefficient (1.73 in Table 6.3) on $\$X_C$ and a negative coefficient on $\$X_{W9S}$. We noted earlier[3] that UK exports in the vehicle sector were heavily concentrated to "primary producing" countries. One would expect motor vehicles to have been a highly

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1. See Gourvish (1982) pp.130 and 148-9.

2. See Miller and Church (1982), p.187.

3. See p.277.

income-elastic product at this time, even if UK vehicles were in some places regarded as an inferior product to US vehicles. Once again, the negative $\$X_{W9S}$ coefficient may indicate a competitive relationship between the UK and its overseas competitors outweighing the extent to which changes in sales by other industrial countries indicated the total size of the market available to the UK. This is, however, surprising in a sector in which the UK was not initially a dominant competitor.

The competitiveness terms, when adjusted for biases (see Table 6.A2.2), suggested that motor vehicle exports were less responsive than in most of the sectors (certainly less than in the eight sectors combined). Even so, we have an elasticity with respect to UK prices of around 1. The world price elasticity, at about 0.2, is considerably lower than that reported by Winters (1981) for post-war data; the figure quoted for "transport equipment" is 1.69.[1] It is possible that elasticities for the motor vehicle industry may be less comparable between the inter-war and post-war periods than for other industries where patterns of production and competition were already established between the wars. However, it may be argued that the competitiveness terms used might be very inappropriate in the vehicle industry; it was suggested that the US lost competitiveness in the sector in the 1930s as its domestic production weakened in the depression; by the same logic, the very rapid growth in UK production in this period may have entailed stronger UK competitiveness than measured here.

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1. See Table 3.5 above.

(9) Eight Sectors Combined

The equations in UK exports in the eight sectors combined tended to fit rather better than most of the sector equations. The best-fitting equation, in Table 6.1, yielded a standard error below 2%. As in most of the sector equations, the coefficient on X_{W9} was negative. The coefficient on \$Xc, at 0.854, was considerably higher than in the aggregate equation (4.11), but was unremarkable given the estimates for individual sectors. The export price terms, when adjusted for bias (see Table 6.A2.2), are consistent with a competitiveness elasticity of over 1.5, and are highly significant. There is a relatively small difference in absolute size between the adjusted home and foreign price terms, and the elasticities are comparable to the competitiveness elasticities in equations (4.10) and (4.12) which also excluded 1924 from the estimation period. The coefficient on the 1926 dummy is a little larger than in (4.10) and (4.11) which is again a result that would be expected given that coal and iron and steel, the main sectors affected, are included in the combined sectors as well as the aggregate, while non-manufactured exports, which would in general be expected to be less affected by the coal strike, would be included only in the aggregate equations estimated in chapter 4. The time trend, though negative, was insignificant in the equation estimated in Table 6.1. It is of interest that the trend becomes significant in Tables 6.3 and 6.4, which have very similar coefficients on the main explanatory variables (but slightly lower competitiveness effects).

VI. Conclusions

We have alredy referred[1] to the limited support afforded for the main innovations in chapter 4 by the results presented here. One concern emerging from the sector results may be that some of the coefficients on the $\$X_c$ term are implausibly strong, and that inevitable problems of collinearity with the $\$X_{W9S}$ terms may have distorted both coefficients.

Despite the data problems, and the number of estimated equations which fitted poorly, there are a few results which may be applied further. The best-fitting equations in chemicals, cotton, wool and worsted, machinery and vehicles each had standard errors under 4% with plausibly signed $\$X_c$ and competitiveness coefficients. These equations plus that for iron and steel, which had plausible coefficients on $\$X_c$ and competitiveness but fitted less well, have been analysed further in two key episodes in the period in chapter 8.

The variety of coefficients obtained on similar terms in the individual sector equations certainly suggests that external shocks (exchange rate changes or changes in foreign demand) may influence the structure of the economy by affecting different sectors differently. We note here the particular sensitivity of the textile industries, iron and steel and machinery to changes in competitiveness. Chemicals and vehicles seem to have been less exposed in this sense, though the latter sector was particularly

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1. See p.283 above.

vulnerable with respect to the trading performance of the primary producing countries.

The difficulties posed by the specification in value terms and the use of aggregate export prices on proxies for sector export prices confirm the usefulness of further investigation of volume behaviour where data are available. We therefore return to the coal sector, where the general conclusions of this chapter have been least tenable.

Annex 6.1 Results of omitting 1926 Dummy from Iron and Steel Equations

Specification (i)

(6.A1.1)
$$\ln \$X_{UKs} = -\underset{(2.62)}{6.60} - \underset{(0.38)}{0.162} \ln X_{W9} + \underset{(1.87)}{1.52} \ln \$X_C$$
$$- \underset{(1.03)}{0.948} \ln UV_{XUK} + \underset{(0.42)}{0.845} \ln UV_{XW9} + \underset{(0.80)}{0.0159} \text{ TIME}$$

$\bar{R}^2 = 0.980$ SE = 0.0601 DW = 3.00 EST. 1925-35

Specification (ii)

(6.A1.2)
$$\ln \$X_{UKs} = -\underset{(2.90)}{8.40} + \underset{(0.13)}{0.0558} \ln X_{W9} + \underset{(3.11)}{1.46} \ln \$X_C$$
$$- \underset{(1.76)}{1.106} \ln UV_{XUK} + \underset{(1.04)}{1.104} \ln UV_{XW9s} - \underset{(0.19)}{0.00258} \text{ TIME}$$

$\bar{R}^2 = 0.983$ SE = 0.0555 DW = 3.23 EST. 1925-35

Specification (iii)

(6.A1.3)
$$\ln \$X_{UKs} = -\underset{(7.44)}{8.01} + \underset{(0.03)}{0.00845} \ln \$X_{W9s} + \underset{(3.86)}{1.50} \ln \$X_C$$
$$- \underset{(1.67)}{1.08} \ln UV_{XUK} + \underset{(1.33)}{1.00} \ln UV_{XW9s} - \underset{(0.12)}{0.00184} \text{ TIME}$$

$\bar{R}^2 = 0.983$ SE = 0.0556 DW = 3.20 EST. 1925-35

Specification (iv)

(6.A1.4)
$$\ln \$X_{UKs} = -\underset{(6.63)}{8.87} - \underset{(0.40)}{0.127} \ln \$X_{W9s} + \underset{(3.57)}{1.93} \ln W_C CAP$$
$$- \underset{(0.34)}{0.258} UV_{XUK} + \underset{(2.24)}{1.65} \ln UV_{XW9s} - \underset{(1.12)}{0.0168} \text{ TIME}$$

$\bar{R}^2 = 0.980$ SE = 0.0605 DW = 3.19 EST. 1925-35

Specification (v)

(6.A1.5) $\ln \$X_{UKs} = -\underset{(2.11)}{5.50} - \underset{(0.73)}{0.393} \ln X_{W9} + \underset{(3.51)}{2.34} \ln W_c CAP$

$+ \underset{(0.31)}{0.195} \ln NULC_{UK.23} + \underset{(1.19)}{0.719} \ln NULC_{W9.23.s} - \underset{(1.78)}{0.0401}\, TIME$

$\bar{R}^2 = 0.979$ SE = 0.0627 DW = 3.06 EST. 1925-35

Specification (vi)

(6.A1.6) $\ln \$X_{UKs} = -\underset{(3.79)}{7.58} - \underset{(0.18)}{0.0670} \ln \$X_{W9s} + \underset{(3.14)}{1.99} \ln W_c CAP$

$- \underset{(0.01)}{0.00887} \ln NULC_{UK.23} + \underset{(2.37)}{1.03} \ln NULC_{W9.23.s} - \underset{(2.21)}{0.0487}\, TIME$

$\bar{R}^2 = 0.976$ SE = 0.0658 DW = 3.02 EST. 1925-35

Specification (vii)

(6.A1.7) $\ln \$X_{UKs} = -\underset{(4.19)}{6.73} - \underset{(0.00005)}{0.0000156} \ln \$X_{W9s} + \underset{(3.52)}{1.47} \ln \$X_c$

$- \underset{(1.22)}{0.748} \ln NULC_{UK.23} + \underset{(0.83)}{0.416} \ln NULC_{W9.23.s} - \underset{(0.19)}{0.00557}\, TIME$

$\bar{R}^2 = 0.980$ SE = 0.0609 DW = 2.98 EST. 1925-35

Annex 6.2: Further Analysis of Best Fitting Equations: Residuals and Adjusted Competitiveness Elasticities

Introduction

We report here residual paths for the best-fitting equations in each sector obtained in Tables 6.1 to 6.7. We then proceed to adjust the coefficient estimates for UV_{XUK} and UV_{XW9s} (or UV_{XW9} as relevant) reported in Tables 6.1 to 6.7 for the biases suggested by the analysis on pp.261-2 in order to obtain estimated price coefficients more strictly comparable with those reported in chapter 4.

Residual check

Table 6.A2.1 shows residuals for sector equations in the following specifications which produced the lowest standard errors. The coal sector was omitted, since superior equations were obtained in chapter 7.[1]

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1. For a residual check on the preferred equation for UK coal exports, see Table 8.9. This confirmed the poor tracking performance. There was large overprediction in 1928, 1931 and 1936, when UK coal exports weakened, and large underpredictions when exports were stronger - notably in 1929-30 and 1937. Otherwise, no obvious conclusions could be derived.

Chemicals	Specification (iii)
Wool and Worsted	Specification (iv)
Cotton	Specification (i)
Apparel	Specification (vii)
Iron and Steel	Specification (iii)
Machinery	Specification (iii)
Vehicles	Specification (iii)
Eight Sectors Combined	Specification (i)

The residuals were inspected for evidence of consistent tendency to overpredict or underpredict across sectors in any particular year, and for evidence of omitted variables within particular equations. The results are not particularly suggestive of potential specification improvements. There is a general tendency for the equations to overpredict UK exports in 1931, and to underpredict in 1926 except in sectors where industrial disruption suggested the use of the dummy. Underprediction in 1931 may be attributable in part to the lack of dynamics in these equations, since devaluation in September 1931 may have taken some time to have its effect. There is also a slight tendency to underprediction in 1932. Most of the equations seem to fit better in the 1930s than in the 1920s, despite the disruptions to trade in the 1930s which might have been expected to undermine the relevance of the competitiveness measures.

Adjusted Competitiveness Coefficients

Equations (6.1) and (6.2)[1] suggest that in an equation with $\$X_{UK}$[2] as the dependent variable, the coefficient estimated on UV_{XUK} is (α_3 + 1) where α_3 is the coefficient which would be estimated on UV_{XUK} in a pure volume equation. In addition, where $\$X_{W9s}$ is included as an explanatory variable, the coefficient estimated on UV_{XW9s} is (α_4 - 1) where α_4 is the "true" volume equation coefficient on UV_{XW9s} and α_1 is the coefficient on $\$X_{W9s}$. In Table 6.A2.2, we show adjusted price elasticities in each sector derived by subtracting 1 from the estimated coefficient on UV_{XUK} and, where $\$X_{W9s}$ is included (as in specifications (iii), (iv), and (vii), but not in (i)), adding α_1 to the coefficient on UV_{XW9s}.[3]

We have carried out this procedure on the coefficients from the best-fitting apparel equation, despite the fact that the competitiveness terms used were NULCs rather than export prices. This is likely to involve significant error, since it is by no means clear that cost changes will produce proportional export price changes (we suggested in chapter 5 that this was not the cases for aggregate export prices). If a smaller adjustment to α_3 was appropriate, the estimate shown here would overstate the extent to which the coefficient on $NULC_{UK.23}$ was "right-" (i.e. negatively) signed.

1. See pp.260-2.

2. It is for this purpose irrelevant whether we discuss aggregate UK exports or a single sector.

3. We ignore here the complexity that α_3 and α_4 may pick up income effects on primary producing countries when $\$X_C$ undeflated is an explanatory variable. Our adjustment is sufficient to make elasticities in Table 6.A2.2 comparable with those in equation (4.11).

Table 6.A2.1: Residuals on Best-Fitting Equations

	Chemicals (iii)	Wool and Worsted (iv)	Cotton (i)	Apparel (vii)	Iron and Steel (iii)	Machinery (iii)	Vehicles (iii)	Combined Sectors (i)
1925	-0.0141	-0.0079	0.0080	-0.0060	-0.0198	-0.0033	-0.0180	0.0063
1926	0.0227	0.0142	-0.0022	0.0203	0.0	0.0173	0.0111	0.0
1927	-0.0012	-0.0175	-0.0187	-0.0250	0.0556	-0.0035	0.0417	-0.0062
1928	0.0026	0.0147	-0.0103	-0.0126	-0.0411	0.0011	-0.0646	-0.0330
1929	-0.0001	0.0027	0.0332	0.0211	-0.0163	-0.0227	0.0241	0.0242
1930	-0.0119	-0.0033	-0.0080	0.0133	0.0540	0.0183	0.0191	0.0263
1931	-0.0034	-0.0089	-0.0065	-0.0146	-0.0416	-0.0038	-0.0115	-0.0231
1932	-0.0075	-0.0071	-0.0167	0.0026	-0.0009	0.0074	0.0101	0.0098
1933	0.0168	0.0202	0.0416	0.0013	0.0226	-0.0107	-0.0160	-0.0025
1934	-0.0091	0.0053	-0.0045	0.0215	-0.0074	-0.0426	0.0059	0.0087
1935	0.0053	-0.0123	-0.0159	-0.0217	-0.0050	0.0426	-0.0019	-0.0105

Table 6.A2.2: Adjusted Export Price Coefficients

	Chemicals	Wool and Worsted	Cotton	Apparel	Iron and Steel	Machinery	Vehicles	Combined Sectors
	(iii)	(iv)	(i)	(vii)	(iii)	(iii)	(iii)	(i)
Adjusted Coefficient, UK Export Prices	-1.326 (8.26)	-1.306 (6.19)	-2.97 (6.88)	-0.651 (2.61)	-1.943 (3.20)	-1.343 (4.07)	-0.963 (2.88)	-1.773 (5.89)
Adjusted Coefficient W9 Export prices	1.216 (4.83)	1.521 (6.64)	1.59 (1.67)	-0.413 (1.69)	1.032 (1.47)	1.865 (2.97)	0.211 (0.44)	1.41 (2.14)

Figures in parentheses are t-values constructed by dividing adjusted coefficients by original coefficient standard errors.

For details of construction, see Annex 6.2.

Annex 6.3: Instrumental Variables Estimation

To check the robustness of the coefficient estimates and goodness of fit of the equations in chapter 6, all of which were estimated using OLS, the equations reported in Table 6.3, which included many of the best-fitting results, were estimated using IV, with UK and industries countries' normalised unit labour costs as instruments for the respective export price terms.[1] The results are shown in Table 6.A3.1. We may draw a few straightforward conclusions:

(i) IV worsens the fit for almost every equation.

(ii) DW statistics improve for five equations. The differences are not generally very great; to the extent that DW statistics consistently over 2 indicate misspecification of some variety, it would appear that this cannot be corrected by taking account of possible simultaneity of UK and world export prices with other variables in the equations in this simple manner;

(iii) There is little evidence that coefficient estimates in the original equation are artificially plausible. Significance of "right-signed" coefficients is fairly generally reduced, and the absolute size of coefficient estimates frequently diminished, but few previously right-signed coefficients become perverse (the coefficient on $\$X_C$ in the cotton equation is an interesting exception since we argued earlier that

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1. Cf. pp.201-2.

this was the sector in which, given the importance of trade with the Far East, it would be expected that "non-industrial" countries' capacity to import would be more likely to have an important effect). The competitiveness coefficients are not greatly affected except, again, in the cotton equation (which is in any case poorly determined).

Table 6.A3.1: Re-estimation of equations in Table 6.3 using IV

	CONST.	$\$X_{W9s}$	$\$X_c$	UV_{XUK}	UV_{XW9s}	TIME	DUM26	$\bar{R}^2$	SE	DW
Coal	0.0613	0.243	-0.0647	1.158	-0.264	-0.00368	-0.982	0.920	0.088	2.20
	(0.04)	(0.67)	(0.08)	(1.29)	(0.17)	(0.16)	(4.71)			
Chemicals	-3.22	0.0778	0.432	-0.254	0.937	0.0168	-	0.994	0.017	2.26
	(10.4)	(0.47)	(2.13)	(1.37)	(3.20)	(1.50)				
Cotton Manufactures	-1.35	-1.665	-1.870	-8.150	15.4	0.219	-	0.897	0.176	2.56
	(0.20)	(0.67)	(0.56)	(1.44)	(1.41)	(0.97)				
Wool and Worsted Manufactures	-6.96	0.0441	1.238	-1.018	1.173	-0.0196	-	0.998	0.020	2.19
	(22.6)	(0.65)	(9.95)	(3.78)	(3.48)	(4.84)				
Apparel	-5.34	-0.216	1.242	0.687	-0.772	-0.0515	-	0.997	0.027	2.58
	(13.4)	(1.75)	(6.88)	(1.29)	(1.17)	(7.05)				
Iron and Steel Manufactures	-7.84	-0.110	1.556	-0.564	0.484	0.00369	-0.0828	0.983	0.055	2.82
	(7.24)	(0.38)	(3.80)	(0.70)	(0.53)	(0.20)	(1.23)			
Machinery	-5.03	0.439	-0.0526	-0.692	2.38	0.0156	-	0.988	0.037	2.77
	(8.74)	(3.05)	(0.10)	(1.26)	(1.81)	(1.97)				
Vehicles	-12.19	-0.442	1.610	0.0488	0.797	0.0727	-	0.985	0.040	2.98
	(4.69)	(1.97)	(2.35)	(0.13)	(0.96)	(6.86)				
Total of above	-2.85	-0.122	0.955	-0.564	1.100	-0.0103	-0.0902	0.996	0.024	2.27
	(7.39)	(0.70)	(2.65)	(1.40)	(1.48)	(2.72)	(3.06)			

ANNEX 6.4: Problems in a Logistic Value-Share Specification

Using the notation of chapter 6, suppose we estimate an equation

$$(6.A4.1) \quad \ln \left(\frac{\emptyset_{Z_t}}{1-\emptyset_{Z_t}}\right) = \alpha_o + \alpha_1 \left(\frac{1}{\$X_{W9Z_t}}\right) + \alpha_2 \left(\frac{\$X_{C_t}}{(\text{deflator})_t}\right)$$

$$+ \alpha_3 P_{UKZ_t} + \alpha_4 \; P_{W9Z_t} + \varepsilon_t$$

(with UV_{UKX_t} proxying P_{UKZ_t} and an appropriate combination of foreign countries' aggregate export UVIs proxying P_{W9Z_t}).

The "true model", specified in λ_{Z_t}, the volume rather than the value share of the UK, would yield analogous parameters $\beta_o \ldots \beta_4$ such that, e.g.

$$(6.A4.2) \quad \frac{\partial \lambda Z_t}{\partial P_{UKZ_t}} = \beta_3 \cdot \lambda_{Z_t} (1 - \lambda_{Z_t}) \text{ by analogy with (4.A2.8)}$$

(This assumes that the right hand side variables are independent; relaxing the assumption only strengthens our conclusion that logistic estimation is inappropriate here).

Consider $\frac{\partial \phi_{Z_t}}{\partial P_{UKZ_t}}$, to consider the relationship between α_3 and β_3

We have from (6.4)

$$[(6.4)] \quad \emptyset_{Z_t} = \lambda_{Z_t} \frac{P_{UKZ_t}}{P_{WIZ_t}}$$

and by analogy with (4.A2.8)

$$(6.A4.3) \quad \frac{\partial \phi_{Z_t}}{\partial P_{UKZ_t}} = \alpha_3 \phi_{Z_t} (1 - \phi_{Z_t})$$

Given that the price terms are current-period weighted, we can write

$$(6.A4.4) \quad P_{WIZ_t} = \lambda_{Z_t} P_{UKZ_t} + (1 - \lambda_{Z_t}) P_{W9Z_t}$$

$$(4.A4.5) \quad \therefore \phi_{Z_t} = \frac{\lambda_{Z_t} P_{UKZ_t}}{\lambda Z_t P_{UKZ_t} + (1 - \lambda_{Z_t}) P_{W9Z_t}}$$

Now we may differentiate ϕ_{Z_t} with respect to P_{UKZ_t} to obtain a relationship between α_3 (from 6.A4.3)) and β_3 (via terms in λ_{Z_t} by substituting in (6.A4.2)). But the functional relationship betwen λ_{Z_t} and P_{UKZ_t} complicates calculations. We obtained:

$$(6.A4.6) \quad \frac{\partial \phi_{Z_t}}{\partial P_{UKZ_t}} = \frac{P_{UKZ_t} \cdot \beta_3 \lambda_{Z_t} (1 - \lambda_{Z_t})}{\lambda Z_t P_{UKZ_t} + (1 - \lambda_{Z_t}) P_{W9Z_t}}$$

$$+ \frac{\lambda_{Z_t}}{\lambda_{Z_t} P_{UKZ_t} + (1 - \lambda_{Z_t}) P_{W9Z_t}}$$

$$- \frac{P_{UKZ_t} \lambda_{Z_t} [\lambda_{Z_t} + P_{UKZ_t} [\beta_3 \lambda_{Z_t} (1 - \lambda_{Z_t})] - P_{W9Z_t} [\beta_3 \lambda_{Z_t} (1 - \lambda_{Z_t})]]}{\{\lambda_{Z_t} P_{UKZ_t} + (1 - \lambda Z_t) P_{W9Z_t}\}^2}$$

The relationship between α_3 and β_3 (and similarly α_4 and β_4) may evidently not be inferred simply; accordingly, we have not continued with logistic estimation in value terms.

NOTES TO RESULT TABLES

The sector equations shown in Tables 6.1 to 6.7 were all specified in log-linear form. In each case, the dependent variable is the value in dollars of UK exports in the sector. Sector definitions are shown in Table SA.T5, and the main data used are shown in Tables SA.15 to SA.25. The notation used in the tables is described on pp. 279-81. The time trend shown takes the value 1 in 1925. The estimation period throughout is 1925-35.

Table 6.1: Results, Specification (i)[1]

	Const.	X_{W9}	$\$X_c$	UV_{XUK}	UV_{XW9}	TIME	DUM26	$\bar{R}^2$	SE	DW
Coal	- 5.80 (1.84)	0.950 (1.79)	-1.47 (1.45)	-0.0773 (0.07)	3.45 (1.37)	0.0313 (1.25)	-0.877 (9.66)	0.942	0.0746	3.02
Chemicals	- 1.11 (1.34)	-0.369 (2.62)	1.05 (3.92)	0.0928 (0.31)	-0.280 (0.42)	0.0253 (3.87)	-	0.991	0.0198	2.29
Cotton Manufactures	1.05 (0.88)	-0.881 (4.37)	1.69 (4.42)	-1.97 (4.56)	1.59 (1.67)	-0.0629 (6.72)	-	0.997	0.0283	2.44
Wool and Worsted Manufactures	-4.09 (2.91)	-0.486 (2.03)	1.84 (4.07)	-0.482 (0.94)	-0.215 (0.19)	-0.0172 (1.55)	-	0.995	0.0335	2.05
Apparel	-5.44 (4.29)	-0.0284 (0.13)	0.832 (2.04)	-0.191 (0.41)	0.654 (0.64)	-0.0351 (3.51)	-	0.996	0.0303	2.63
Iron and Steel Manufactures	-6.20 (2.58)	-0.198 (0.49)	1.47 (1.91)	-0.776 (0.89)	0.752 (0.39)	0.0115 (0.60)	-0.0875 (1.27)	0.982	0.0568	2.59
Machinery	-10.1 (5.02)	0.808 (2.36)	-0.110 (0.17)	-0.578 (0.79)	2.502 (1.54)	0.0547 (3.45)	-	0.979	0.0480	2.51
Vehicles	- 5.90 (2.74)	-0.269 (0.74)	1.00 (1.44)	0.0166 (0.02)	0.675 (0.39)	0.0525 (3.10)	-	0.975	0.0514	2.79
Total of above	- 1.87 (2.24)	-0.165 (1.18)	0.854 (3.24)	-0.773 (2.56)	1.41 (2.14)	-0.00320 (0.49)	-0.0840 (3.53)	0.998	0.0195	2.84

(1) See page 279

Table 6.2: Results, Specification (ii)[1]

	CONST	X_{W9}	$\$X_c$	UV_{XUK}	UV_{XW9s}	TIME	DUM26	$\bar{R}^2$	SE	DW
Coal	-5.03 (1.03)	0.793 (1.00)	-0.890 (0.74)	0.847 (0.86)	1.522 (0.62)	-0.00887 (0.42)	-0.897 (8.31)	0.922	0.0864	2.69
Chemicals	-2.78 (2.60)	-0.0936 (0.54)	0.634 (2.64)	-0.228 (1.17)	0.693 (1.42)	0.0226 (5.06)	--	0.993	0.0170	2.43
Cotton Manufactures	2.69 (2.93)	-1.14 (6.79)	2.17 (4.13)	-1.46 (2.31)	0.279 (0.21)	-0.0705 (2.33)	--	0.996	0.0352	1.83
Wool and Worsted Manufactures	-7.9 (5.93)	0.107 (0.50)	1.20 (5.25)	-1.04 (4.57)	1.27 (2.84)	-0.0229 (5.52)	--	0.998	0.0208	2.43
Apparel	-5.34 (2.72)	0.0110 (0.03)	0.959 (2.41)	-0.0690 (0.14)	0.298 (0.31)	-0.0407 (8.58)	--	0.996	0.0312	2.80
Iron and Steel Manufactures	-7.86 (2.88)	0.00328 (0.01)	1.41 (3.22)	-0.932 (1.55)	1.00 (1.01)	-0.00503 (0.39)	-0.0837 (1.33)	0.985	0.0517	2.86
Machinery	-11.57 (5.44)	1.06 (2.93)	-0.415 (0.68)	-0.239 (0.55)	2.57 (2.15)	0.0327 (5.10)	--	0.984	0.0421	2.32
Vehicles	-5.52 (3.11)	-0.328 (1.04)	1.129 (2.00)	0.243 (0.58)	0.226 (0.25)	0.0494 (3.63)	--	0.975	0.0518	2.80
Total of above	-2.12 (1.73)	-0.110 (0.51)	0.853 (2.37)	-0.613 (1.95)	1.20 (1.53)	-0.0116 (2.62)	-0.0994 (3.35)	0.997	0.0227	2.56

(1) See p. 279.

Table 6.3: Results, Specification (iii)[1]

	CONST.	$\$X_{W9s}$	$\$X_c$	UV_{XUK}	UV_{XW9s}	TIME	DUM 26	$\bar{R}^2$	SE	DW
Coal	0.319 (0.22)	0.366 (1.10)	-0.447 (0.60)	1.16 (1.37)	0.292 (0.21)	-0.0104 (0.50)	-1.06	0.925	0.0846	2.16
Chemicals	-3.19 (10.7)	0.136 (0.89)	0.357 (1.89)	-0.326 (2.03)	1.08 (4.30)	0.0123 (1.21)	-	0.994	0.0163	2.75
Cotton Manufactures	-1.97 (0.53)	-7.64 (0.52)	0.256 (0.16)	-2.92 (1.51)	5.32 (1.48)	0.0246 (0.29)	-	0.960	0.110	1.62
Wool and Worsted Manufactures	-6.96 (23.1)	0.0642 (1.09)	1.21 (10.5)	-1.11 (5.22)	1.29 (14.86)	-0.0193 (4.91)	-	0.998	0.0192	2.61
Apparel	-5.34 (13.18)	-0.166 (1.49)	1.17 (6.90)	0.472 (1.04)	-0.466 (0.81)	-0.0490 (7.21)	-	0.997	0.0259	2.58
Iron and steel Manufactures	-7.82 (7.72)	0.0116 (0.05)	1.40 (3.79)	-0.943 (1.55)	1.02 (1.45)	-0.00548 (0.36)	-0.0837 (1.34)	0.985	0.0517	2.87
Machinery	-5.07 (10.5)	0.356 (4.37)	0.272 (0.98)	-0.343 (1.04)	1.509 (2.40)	0.0192 (3.44)	-	0.991	0.0316	2.48
Vehicles	-12.53 (5.32)	-0.470 (2.33)	1.73 (3.32)	0.0366 (0.11)	0.681 (1.41)	0.0723 (7.51)	-	0.985	0.0396	3.01
Total above	-2.78 (7.59)	-0.0660 (0.46)	0.805 (2.74)	-0.618 (1.92)	1.34 (2.31)	-0.0102 (2.81)	-0.0953 (3.39)	0.997	0.0228	2.56

1. See page 280.

Table 6.4: Results, Specification (iv)[1]

	CONST	$\$X_{W9}$	W_c.CAP	UV_{XUK}	UV_{XW9s}	TIME	DUM26	$\bar{R}^2$	SE	DW
Coal	0.602	0.436	-0.652	0.918	0.134	-0.00754	-1.10	0.930	0.0819	2.15
	(0.40)	(1.27)	(0.81)	(1.05)	(0.13)	(0.47)	(5.54)			
Chemicals	-3.34	0.0698	0.465	-0.139	1.26	0.0117	-	0.994	0.0163	2.89
	(9.50)	(0.37)	(1.90)	(0.69)	(6.49)	(1.19)				
Cotton Manufactures	0.647	0.302	-1.08	-3.60	5.55	0.0680	-	0.965	0.103	2.12
	(0.23)	(0.21)	(0.84)	(1.96)	(1.88)	(1.17)				
World and Worsted Manufactures	-7.31	-0.0292	1.56	-0.306	1.55	0.0362	-	0.999	0.0174	2.64
	(25.2)	(0.49)	(11.5)	(1.45)	(6.79)	(8.37)				
Apparel	-5.46	-0.198	1.34	0.970	0.119	-0.0589	-	0.995	0.0320	2.73
	(11.2)	(1.37)	(5.44)	(1.58)	(0.18)	(6.10)				
Iron and Steel Manufactures	-8.61	-0.0988	1.79	-0.217	1.65	-0.0193	-0.0655	0.984	0.0544	3.04
	(6.98)	(0.34)	(3.54)	(0.31)	(2.49)	(1.41)	(0.97)			
Machinery	-5.10	0.354	0.275	-0.244	1.69	0.0175	-	0.991	0.0317	2.49
	(10.2)	(4.21)	(0.96)	(0.64)	(3.43)	(3.55)				
Vehicles	-13.6	-0.57	1.92	0.877	1.72	0.0765	-	0.982	0.0434	3.07
	(4.48)	(2.17)	(2.88)	(2.27)	(3.56)	(6.71)				
Total of above	-2.80	-0.0497	0.776	-0.435	1.97	-0.0131	-0.0944	0.996	0.0261	2.59
	(6.47)	(0.29)	(2.20)	(1.00)	(4.20)	(3.10)	(2.92)			

1. See page 280.

Table 6.5: Results, Specification (v)[1]

	CONST	X_{W9}	W_c.CAP	$NULC_{UK.23}$	$NULC_{W9.23.s}$	TIME	DUM26	$\bar{R}^2$	SE	DW
Coal	-4.21 (1.06)	0.766 (0.69)	-0.812 (0.45)	0.360 (0.19)	1.021 (0.49)	-0.0366 (0.59)	-0.865 (6.78)	0.893	0.101	2.62
Chemicals	-0.745 (0.65)	-0.498 (1.64)	1.313 (2.77)	0.516 (1.13)	0.341 (0.65)	0.00117 (0.06)	-	0.986	0.0250	2.81
Cotton Manufactures	6.07 (2.67)	-1.88 (3.66)	3.48 (6.77)	0.286 (0.34)	0.189 (0.17)	-0.103 (9.52)	-	0.987	0.0635	2.12
Wool and Worsted Manufactures	-3.43 (2.42)	-0.753 (2.89)	2.52 (7.84)	0.574 (2.15)	0.392 (1.41)	-0.0577 (4.03)	-	0.995	0.0319	2.58
Apparel	-3.23 (1.86)	-0.535 (1.59)	1.89 (3.86)	1.12 (2.00)	-0.140 (0.24)	-0.0532 (2.16)	-	0.988	0.0510	2.67
Iron and Steel Manufactures	-5.16 (1.57)	-0.462 (0.68)	2.39 (3.09)	0.310 (0.35)	0.622 (0.77)	-0.0376 (1.36)	-0.0221 (0.21)	0.973	0.0697	3.02
Machinery	-8.36 (4.98)	0.941 (2.16)	-0.564 (0.65)	-1.29 (1.36)	3.01 (2.63)	-0.0410 (1.78)	-	0.975	0.0532	3.06
Vehicles	-3.61 (1.76)	-0.877 (2.44)	2.07 (3.22)	1.18 (1.66)	0.301 (0.33)	0.0229 (2.13)	-	0.953	0.0706	2.71
Total of above	-0.319 (0.19)	-0.457 (1.35)	1.52 (2.71)	-0.551 (0.63)	1.73 (1.71)	-0.0703 (3.25)	-0.00267 (0.04)	0.987	0.0456	2.48

(1) See page 280.

Table 6.6: Results, Specification (vi)[1]

	CONST	$\$X_{W9s}$	Wc.CAP	$NULC_{UK.23}$	$NULC_{W9.23.s}$	TIME	DUM 26	$\bar{R}^2$	SE	DW
Coal	0.840 (0.25)	0.513 (0.94)	-0.716 (0.56)	0.360 (0.24)	0.717 (0.52)	-0.0392 (0.75)	-1.11 (4.13)	0.902	0.0968	1.95
Chemicals	-3.38 (4.18)	-0.423 (1.32)	1.09 (2.58)	0.138 (0.43)	1.06 (4.46)	-0.00347 (0.18)	-	0.984	0.0268	2.40
Cotton Manufactures	4.41 (2.19)	2.20 (3.39)	-0.704 (0.81)	0.406 (0.47)	-2.44 (3.26)	0.0135 (0.46)	-	0.985	0.0670	2.41
Wool and Worsted Manufactures	-8.21 (13.0)	-0.246 (2.57)	2.11 (9.46)	0.535 (1.90)	0.685 (3.03)	-0.0859 (7.63)	-	0.994	0.0342	2.23
Apparel	-6.38 (7.80)	-0.246 (1.89)	1.55 (5.58)	1.03 (2.10)	0.230 (0.52)	-0.080 (4.07)	-	0.990	0.0478	2.50
Iron and Steel Manufactures	-7.57 (3.39)	-0.0634 (0.15)	2.00 (2.81)	-0.0424 (0.05)	1.05 (2.04)	-0.491 (1.97)	0.00993 (0.10)	0.971	0.0734	3.05
Machinery	-3.23 (3.08)	0.334 (3.31)	0.0784 (0.19)	-0.944 (1.53)	2.30 (3.46)	-0.0396 (2.42)	-	0.985	0.0414	3.13
Vehicles	-7.47 (0.81)	0.0302 (0.04)	0.870 (0.50)	1.24 (1.17)	0.472 (0.23)	0.0298 (1.91)	-	0.898	0.104	2.C8
Total of above	-2.88 (2.74)	-0.235 (0.85)	1.26 (2.22)	-0.908 (1.03)	2.41 (2.87)	-0.0824 (4.12)	0.0237 (0.34)	0.984	0.0506	2.64

(1) See page 281.

Table 6.7: Results, Specification (vii)[1]

	CONST.	$\$X_{W9s}$	$\$X_c$	$NULC_{UK.23}$	$NULC_{W9.23.s}$	TIME	DUM 26	$\bar{R}^2$	SE	DW
Coal	-1.77 (0.49)	0.0787 (0.14)	0.349 (0.29)	1.27 (0.86)	-0.517 (0.23)	0.0115 (0.12)	-0.916 (3.73)	0.897	0.0995	2.11
Chemicals	-2.81 (4.97)	-0.126 (0.66)	0.647 (2.91)	-0.213 (0.87)	0.645 (2.20)	0.00774 (0.38)	-	0.986	0.0249	1.79
Cotton Manufactures	1.58 (0.61)	1.09 (1.13)	0.595 (0.67)	0.818 (1.37)	-2.55 (3.50)	-0.0258 (0.79)	-	0.984	0.0683	2.47
Wool and Worsted Manufactures	-6.56 (11.4)	-0.0458 (0.53)	1.35 (8.76)	-0.569 (1.83)	0.465 (1.84)	-0.0413 (3.20)	-	0.994	0.0367	1.35
Apparel	-5.59 (14.7)	-0.117 (2.01)	1.15 (11.5)	0.349 (1.40)	-0.296 (1.21)	-0.0344 (3.12)	-	0.997	0.0245	2.48
Iron and Steel Manufactures	-7.13 (4.14)	-0.0992 (0.28)	1.53 (3.51)	-0.449 (0.62)	0.222 (0.39)	0.00154 (0.05)	-0.0700 (0.85)	0.979	0.0627	2.70
Machinery	-3.89 (4.02)	0.288 (3.59)	0.357 (1.04)	-0.690 (1.33)	1.59 (1.84)	-0.0188 (0.78)	-	0.987	0.0377	3.09
Vehicles	-15.3 (5.51)	-0.727 (2.79)	2.31 (4.95)	-0.216 (0.41)	0.757 (0.99)	0.0673 (6.59)	-	0.982	0.0441	3.10
Total of above	-2.66 (4.98)	-0.239 (1.70)	1.20 (4.59)	-0.605 (1.14)	0.812 (1.14)	-0.0314 (1.65)	-0.0501 (1.10)	0.994	0.0302	2.59

1. See page 281.

Chapter 7

UK EXPORTS OF COAL 1924-37

I. Introduction

Before 1913, and in the early 1920s, the UK was the world's premier coal exporter. Coal accounted for 10% of all UK exports in 1924.[1] The decline in coal exports between 1924 and 1937 was of great importance both to the UK's trading position and to domestic activity. Employment in the coal industry declined from 1.199 mn in 1924 to 0.766 mn in 1935.[2] The decline had considerable regional implications: for example, Wales, which depended heavily on coal and steel, was in 1923 the UK region with the lowest percentage of unemployed workers, but by 1927 was the region with the highest unemployment rate.[3]

We therefore attempted to improve on the explanations of UK trade performance in coal in chapter 6, using the substantial additional data available.[4] We constructed alternative measures for:

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1. See Table SA.15.
2. See Business Statistics Office (1978) p.75.
3. Cf. Table 1.Tl p.16.
4. These data are of considerable independent interest. See Tables SA.23 to SA.35 and pp.457-72.

(i) The dependent variable: a volume series for UK exports was constructed;

(ii) (a) relative export unit values, using UVIs for UK and foreign countries' exports of coal rather than aggregate export UVIs.

(b) relative (normalised) unit labour costs, in which the wage and productivity data relate to coal-mining.

(iii) Market demand for UK coal, based on

(a) volume of industrial countries' exports of coal, improving directly on chapter 6.

(b) world industrial production.

We begin with some prior consideration of the sectoral history, together with preliminary inspection of the data, and then turn to the regression results. These were not especially encouraging in terms of goodness of fit. Nevertheless, some improvement on chapter 6 was effected, and coefficient estimates more in line with expectations were obtained.

II Background to Empirical Results

1. The UK Coal Industry between the Wars

In the period immediately after the First World War, the UK coal industry benefited from various disruptions to overseas production. The coalfields in North West France which had been occupied were slow to reach full production; the US endured a 16-week strike in the industry in 1922; in 1923 the Ruhr coalfield was occupied by France; Germany was not permitted to recommence exports of coal (except in settlement of reparations) until August 1924.[1]

After the settlement of the 1921 strike, the UK coal industry enjoyed a period of relatively high export volume and prices. But the recovery of the continental fields from 1924 exposed the UK to serious competition. Coal production was subsidised betweeen August 1925 and May 1926. Immediately afterwards, attempts to cut wages in coal-mining produced a strike lasting until December 1926. Adjustment to post-war conditions was therefore largely delayed until 1927.

The collapse of world trade after 1929 affected the UK coal industry severely, and various special measures taken are difficult to incorporate in empirical work. Under the reorganisation plans of the 1929-31 Labour government, UK coal exports were subsidised by a levy on domestic coal production in 1930-1.[2] From 1932 onwards, a sequence of bilateral trade agreements was negotiated protecting the position of UK exports in several key markets, notably in Scandinavia. However, these agreements may have forced Poland, also an important exporter to Scandinavia, to switch to other important UK markets in the Mediterranean.[3,4]

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1. See Allen (1959) pp.53-59; Buxton (1982) p.49; PEP (1936) chapter V; Jones (1935) pp.153-160.

2. Jones (1935) p.163.

3. Jones (1938) pp.248-250; Allen (1959) p.56.

4. See Table 7.T1. By contrast, Poland's exports to Denmark, Norway and Sweden combined fell by nearly 40% between 1929 and 1934, but exports to France rose by over 40% in the same period, and exports to Italy almost doubled between 1932 and 1934.

Two unfavourable trends operated in this period. First, competition to coal was increasing. Between 1925 and 1937, world production of coal increased by 10.5%, of petroleum by 87%, and of hydroelectric power by 113.6%.[1] Second, foreign competition grew in importance. The UK share of coal export values and volumes of the main industrial countries declined considerably in the 1920s as output elsewhere increased,[2] though holding up better in the 1930s. While UK output per head remained high, several older fields were becoming less easy to work relative to newer fields in Europe. Productivity and mechanisation were increasing rapidly in Europe, in such fields as underground transport.[3]

2. The Market for UK Coal

Table 7.T1 shows the great importance of European countries, mainly those classified as "industrial" in this study, as markets for UK coal, despite the shifts between 1929 and 1934 associated partly with trade agreements. Before the First World War, coal exports had allowed ships due to bring imports into the UK to travel outwards laden,[4] but between the wars there was a mismatch between coal exports and the pattern of other UK trade. For example, in 1929, 20% of UK imports by value came from North America,[5] but less than 2% of

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1. League of Nations; Review of World Production and Prices (WPP) (1937/38) Appendix I Table 2, p.109.

2. See Tables SA.23 and SA.24.

3. See Buxton (1982) pp.60-62.

4. Buxton (1982) pp.48-49; Allen (1959) p.49.

5. See League of Nations Memoranda on Balance of Payments etc. e.g. 1930 issue. Merchandise only, excluding re-exports.

Table 7.T1

Destinations of UK Coal Exports

Destination		1929	1934
Europe and Mediterranean		51378 (85.3)	33718 (85.0)
of which:	Sweden	2336 (3.9)	2610 (6.6)
	Norway	1444 (2.4)	1371 (3.5)
	Denmark (inc.Faroes)	2194 (3.6)	3089 (7.8)
	France	13045 (21.6)	7669 (19.3)
	Germany	5521 (9.2)	2541 (6.4)
	Italy	7095 (11.8)	4699 (11.8)
	Belgium	4140 (6.9)	972 (2.5)
AFRICA AND ASIA		1706 (2.8)	592 (1.5)
SOUTH AMERICA		5271 (8.7)	2937 (7.4)
N. AND CENTRAL AMERICA		1172 (1.9)	2280 (5.7)
of which:	Canada	745 (1.2)	1747 (4.4)
TOTAL		60267	39660

Notes: Total includes exports to other destinations. Exports in foreign bunkers excluded. Thousands of UK tons. Figures in parentheses are percentage of total.
Source: PEP (1936) pp.157-8.

UK coal exports went there.

The concentration of demand for UK coal in industrial countries suggests proxying overseas demand for UK coal with a measure of foreign industrial production. Coal was (and is) an important industrial input, particularly in the steel industry. The Bank of England (1979) model of the UK economy used UK trade-weighted world industrial production (TWIP) in the equation for volume of UK exports of basic materials (XGBM).[1]

Table SA.35 gives figures for world industrial production (WIP) and TWIP calculated from various sources. There are wide differences between the different series.[2] Nevertheless, once again there was rapid growth up to 1929, followed by a sharp decline, and recovery after 1932 which was by some measures sufficient to outstrip the 1929 level by 1937. Measures of WIP incorporating countries outside our industrial countries group grew especially strongly.

Trade volume data therefore suggest that the UK had a declining share of a slow-growing market in the 1920s and a stable share of a declining market later. The world industrial production measures suggest that the UK may have failed to exploit a growing market after 1932.

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1. Bank of England (1979) p.24.
2. See pp.473-81.

3. Competitiveness

First, consider the series for the unit values for coal exports of industrial countries shown in Tables SA.25 and 7.T2.[1] The UK was apparently able to undercut most of its leading competitors throughout the period, but notwithstanding short-term fluctuations, there seems to have been a long-term trend running against it. Between 1922 and 1925, the UK position declined as the pound attained its Gold Standard parity. Some improvement followed between 1925 and 1928.[2] The departure from the Gold Standard in 1931 effected only a relatively small improvement in the UK competitive position, which weakened significantly thereafter. This occurred despite the adherence of Germany, a key competitor, to the Gold Standard.

Table SA.25 also reveals the downward trend in coal export prices, both in the UK and overseas, after 1923. While improving productivity may have contributed to falling prices, and Table 7.T2 shows some recovery in dollar terms from 1933, there was nevertheless fairly continuous pressure on costs in the period.

Table SA.29 shows UK relative unit labour costs in the period, while Table SA.30 presents relative "normalised" unit labour costs.[3] Both suggest that UK cost competitiveness in coal was much stronger in the 1930s than in the 1920s. A degree of adjustment

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1. The unit values in Table SA.25 are in gold francs. For regression work, these were calculated in index form in current dollars, and the resulting series are shown in Table 7.T2.

2. Cf. Table 2.4; this improvement also applied to the whole economy.

3. For details of construction, see pp.462-472.

Table 7.T2

UK and Industrial Country Coal Export UVIs

	UK	Industrial Countries
1924	100	100
1925	92.0	88.7
1926	89.6	90.5
1927	84.4	94.0
1928	73.8	86.1
1929	75.6	87.1
1930	77.7	87.6
1931	70.8	77.4
1932	55.1	64.0
1933	66.1	69.8
1934	80.0	81.0
1935	78.5	77.4
1936	83.3	76.0
1937	92.3	86.2

Source: Calculated as dollar value of coal exports divided by volume at 1924 prices[1]. Industrial countries series includes Czechoslovakia[2]. Index, 1924 = 100.

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1. The volume series are formed by calculating indices, 1924 = 100, from gross tonnage figures and multiplying by the 1924 dollar values of exports.

2. See p.334 below.

followed the return to gold in 1925; UK competitiveness weakened in the world slump,[1] but this was rectified by the departure from gold in 1931. Even after 1932, the UK gained cost competitiveness, while the relative price advantage was eroded.

Tables SA.26, SA.27 and SA.28 suggest, when the UK is compared with Germany and the US, that this gain in competitiveness was principally attributable to a superior UK productivity performance in the 1930s. German productivity deteriorated strikingly after 1934, while US productivity, having fallen sharply between 1932 and 1934, was slow to recover.

Table SA.26[2] shows the course of local currency wages in the main coal producing countries. In the UK, after the defeat of the miners' strike in 1926, there was a substantial fall in wages; then, from 1929 to 1935, wages were roughly constant, picking up in the late 1930s. But any nominal wage response to the devaluation of 1931 was slow to appear.[3] In dollar terms (Table SA.27), wages fell more in 1932 in the UK than in competitor countries, and this relative advantage was not eroded as the dollar depreciated in 1932-4.

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1. Note that this result must represent a "genuine" weakening of the UK position; it cannot be attributed to differences in the commodity composition of UK as against competitors' output.

2. See pp.462-5 for details of construction.

3. Comparing Table SA26 with Table SA.8, UK wages in coal mining fell more in the 1920s, but recovered faster in the 1930s, than wages in aggregate. Overall, the relationship between wages in mining and wages in other industries was very similar in 1938 to that in 1924.

By contrast, in Germany, wages increased in the 1920s broadly in line with productivity, but wage rates[1] remained constant in the 1930s despite static productivity and a rise in the mark against the dollar. In the US, wages declined sharply to 1932, and then recovered as the dollar depreciated.

In France and Belgium-Luxembourg, rising nominal wages in 1926 were not sufficient to offset the fall in the currency against the dollar; conversely, a rise in dollar wages in France and Belgium was associated with dollar devaluation in 1933-4, but this was corrected by devaluation in Belgium in 1935 and in France in 1936. Overall, however, dollar wages rose strongly in France during the period, but only increased modestly in Belgium given the strong productivity performance. In the Netherlands, Czechoslovakia and Japan, local currency wages were relatively depressed throughout. Japan devalued in 1931, implying very low dollar wages in the 1930s. Dollar wages rose strongly in the 1930s in the Netherlands and Czechoslovakia, which maintained "strong" currencies until 1936.

We conclude that the UK had a strong cost competitiveness position for most of the period relative to its position in 1924-6 (although the problems in those years suggest that 1924-6 was not an equilibrium period). In the late 1920s, this was attributable mainly to nominal wage restraint; in the 1930s, to devaluation in 1931 and later to a relatively strong productivity performance.

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1. For Germany wage rates, not earnings, had to be used; data are therefore not strictly comparable.

By contrast, in Germany, wages increased in the 1920s broadly in line with productivity, but wage rates[1] remained constant in the 1930s despite static productivity and a rise in the mark against the dollar. In the US, wages declined sharply to 1932, and then recovered as the dollar depreciated.

In France and Belgium-Luxembourg, rising nominal wages in 1926 were not sufficient to offset the fall in the currency against the dollar; conversely, a rise in dollar wages in France and Belgium was associated with dollar devaluation in 1933-4, but this was corrected by devaluation in Belgium in 1935 and in France in 1936. Overall, however, dollar wages rose strongly in France during the period, but only increased modestly in Belgium given the strong productivity performance. In the Netherlands, Czechoslovakia and Japan, local currency wages were relatively depressed throughout. Japan devalued in 1931, implying very low dollar wages in the 1930s. Dollar wages rose strongly in the 1930s in the Netherlands and Czechoslovakia, which maintained "strong" currencies until 1936.

We conclude that the UK had a strong cost competitiveness position for most of the period relative to its position in 1924-6 (although the problems in those years suggest that 1924-6 was not an equilibrium period). In the late 1920s, this was attributable mainly to nominal wage restraint; in the 1930s, to devaluation in 1931 and later to a relatively strong productivity performance.

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1. For Germany wage rates, not earnings, had to be used; data are therefore not strictly comparable.

We noted that in the 1930s, UK coal prices rose relative to those abroad while costs did not. This would lead us to expect, ceteris paribus, an improvement in UK profitability (at least relative to overseas). Buxton (1982)[1] showed that profit per ton in all six UK fields surveyed was higher in 1937 than in 1932; for Great Britain as a whole, profits per ton were higher in 1937 than in any year quoted from 1924 onwards.

The observed difference between relative price and relative cost competitiveness is of use in testing two alternative measures of competitiveness. We suggested earlier[2] that costs might be of particular relevance when exports were supply- rather than demand-constrained. There is evidence that, in general, supply constraints were not binding. There was a general downward trend in the size of the UK industry. Amalgamation was official policy after 1926.[3] Evidence on world coal stocks, shown in Table 7.T3, suggests that 1929 and 1937 were the two years in which worldwide supply constraints were most likely to be relevant.[4] Stocks of the major economies shown in Table 7.T3 formed 2.9% of total world production[5]

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1. Buxton (1982), pp.64-67.

2. See p.269.

3. Buxton (1982) pp.73-4 and 77 notes that the advantages of amalgamation were limited: small mines were frequently just as efficient as larger operations. There were no compulsory amalgamations before 1939, and only 90 voluntary amalgamations between 1926 and 1938 (reduced to 65 by further subsequent amalgamations).

4. And, perhaps, years before 1925, while German exports were limited.

5. League of Nations WPP 1937/8, p.62.

Table 7.T3

Coal Stocks 1925-37

	USA[1]	4 European countries	5 European countries
1925	40,279	13,173	
1926	38,750	9,078	
1927	57,032	5,278	
1928	40,340	6,047	
1929	34,038	3,919	5,148
1930	33,698		20,026
1931	32,336		25,174
1932	26,890		23,887
1933	29,953		22,857
1934	31,315		21,364
1935	33,698		16,885
1936	39,484		9,936
1937	42,548		6,178

000 metric tonnes

Sources: 1925-9 (US and 4 European countries) League of Nations WPP 1925-33, Appendix I, Table 6.

1929 (5 European countries), 1930-7, League of Nations WPP 1931/8, Appendix II, Table 2, converted from index numbers.

1. US figures are consumers' stocks only.

in 1929, 5.3% of world production in 1931, and (declining steadily) 3.7% in 1937.

III Regression Results

Recall the best-fitting equation for coal from chapter 6, in Table 6.1:[1]

$$(7.1) \quad \ln \$X_{88UK} = \underset{(1.84)}{-5.80} + \underset{(1.79)}{0.950} \ln X_{W9} - \underset{(1.45)}{1.47} \ln \$X_C$$

$$- \underset{(0.07)}{0.0773} \ln UV_{XUK} + \underset{(1.37)}{3.45} \ln UV_{XW9}$$

$$+ \underset{(1.25)}{0.0313}\ TIME - \underset{(9.66)}{0.877}\ DUM26$$

EST 1925-35 $\bar{R}^2 = 0.942$ SE = 0.0746 DW = 3.02

We first substituted X_{88UK} (volume) for $\$X_{88UK}$ as dependent variable, and added observations for 1936 and 1937 facilitated by

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1. Additional notation in this chapter:

$\$X_{88UK}$: dollar value, UK exports of coal (BISC category 88)

X_{88UK}: volume of UK exports of coal

$\$X_{88W9}$:)dollar value and volume of industrial countries') exports of coal.

X_{88W9}:) In this chapter, this group includes Czechoslovakia where stated

UV_{88UK}, UV_{88W9}: unit values of UK and industrial country exports of coal (cf. Table SA.25).

(N)ULC_{88UK}, (N)ULC_{88W9}: (normalised) unit labour costs in coal production in the UK and industrial countries, all in dollars

(T)WIP: (UK trade-weighted) world industrial production. Suffixes denote data source (see Table SA.35).

additional data in the sector:

$$(7.2)\quad \ln X_{88UK} = \underset{(2.22)}{-\,4.63} + \underset{(4.30)}{1.34} \ln X_{W9} - \underset{(2.61)}{1.36} \ln \$X_C$$

$$- \underset{(2.10)}{1.54} \ln UV_{XUK} + \underset{(2.76)}{3.85} \ln UV_{XW9} + \underset{(1.35)}{0.0236}\ TIME$$

$$- \underset{(13.7)}{0.901}\ DUM26$$

EST 1925-37 $\bar{R}^2 = 0.959$ SE = 0.0548 DW = 2.75

When the term in $\$X_C$ (which had no clear rationalisation, since UK exports to primary producers were low) was omitted, we obtained:

$$(7.3)\quad \ln X_{88UK} = \underset{(0.09)}{-\,0.150} + \underset{(3.01)}{0.635} \ln X_{W9} - \underset{(0.86)}{0.788} \ln UV_{XUK}$$

$$+ \underset{(0.79)}{0.836} \ln UV_{XW9} - \underset{(1.22)}{0.0151}\ TIME - \underset{(10.3)}{0.914}\ DUM26$$

EST. 1925-37 $\bar{R}^2 = 0.924$ SE = 0.0742 DW = 1.77

The fit was poor (very similar to (7.1)), with insignificant competitiveness terms, although there is less evidence of misspecification (DW close to 2, relative price terms almost equal in size).

We then introduced X_{88W9} for X_{W9}, and UV_{88UK} and UV_{88W9} for UV_{XUK} and UV_{XW9}, so that the specification was fully sector-specific. Equations were estimated both including and excluding Czechoslovakia in the W9 countries.[1] Standard errors when Czechoslovakia was included (as in equation (7.4)) were generally slightly lower:

$$(7.4)\quad \ln X_{88UK} = \underset{(2.66)}{-\,4.88} + \underset{(0.49)}{0.147}\ \ln X_{88W9} - \underset{(1.40)}{0.659}\ \ln UV_{88UK}$$

$$+ \underset{(1.36)}{1.284}\ \ln UV_{88W9} - \underset{(1.36)}{0.0169}\ TIME - \underset{(6.31)}{0.973}\ DUM26$$

EST. 1925-37 $\bar{R}^2 = 0.921$ SE = 0.0760 DW = 1.87

Thus, fit was worse than without sector specific terms; moreover, the coefficient on X_{88W9} was insignificant. Results deteriorated further when unit labour costs were used in place of the price terms.[2]

To some extent foreign export increases may have been gained at Britain's expense. We therefore tested the inclusion of measures of industrial production as alternative measures of world demand for coal.[3]

Several measures of industrial production were constructed, using data provided by Maddison, Mitchell, the OEEC/OECD, and League of Nations, trade-weighted according to each foreign country's

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1. Czechoslovakia is not reported in Maddison's aggregate trade data; nor was it, in aggregate, sufficiently large for this to be serious. It was, however, included in the Effective Exchange Rate measures discussed in chapter 2, and was a sufficiently large coal exporter to warrant investigation.

2. There was also no substantial change in fit in an analogous logistic specification.

3. See p.325.

coal imports from the UK. An index of WIP provided by the League of Nations (not trade weighted) was also tested.[1]

$TWIP_{MA}$, the index formed from Maddison's data, proved superior in terms of goodness-of-fit, whether prices or unit labour costs were used, whether or not unit labour costs were normalised, and whether or not Czechoslovakia was included within the W9 group. Using price terms and including Czechoslovakia, equation (7.5) was obtained.[2]

$$(7.5) \quad \ln X_{88UK} = \underset{(0.72)}{-2.37} + \underset{(2.48)}{1.74} \ln TWIP_{MA} - \underset{(1.52)}{0.440} \ln UV_{88UK}$$

$$+ \underset{(1.25)}{0.679} \ln UV_{88W9} - \underset{(3.10)}{0.0423}\ TIME$$

$$- \underset{(13.1)}{0.901}\ DUM26$$

EST. 1925-37 $\quad \bar{R}^2 = 0.956 \quad SE = 0.0564 \quad DW = 2.03$

When unit labour costs were tested, normalised ULCs proved superior. We again report the equation with Czechoslovakia included in W9:

$$(7.6) \quad \ln X_{88UK} = \underset{(2.56)}{-5.48} + \underset{(5.30)}{2.52} \ln TWIP_{MA} - \underset{(1.20)}{0.412} \ln NULC_{88UK}$$

$$+ \underset{(0.80)}{0.301} \ln NULC_{88W9} - \underset{(5.41)}{0.0697}\ TIME - \underset{(12.5)}{0.890}\ DUM26$$

$\bar{R}^2 = 0.955 \quad SE = 0.0571 \quad DW = 2.41 \quad$ EST. 1925-37

1. See pp.473-81 and Tables SA.31-35.
2. Further tests on equation (7.5) (IV estimation and residual inspection) are reported in Annex 7.1.

The lower coefficients on the NULC than on the price terms may be explicable if firms absorb some of the effect of a change in costs on profit margins.[1] Both (7.5) and (7.6) have high coefficients on TWIP. This might be rationalised if UK coal exports were a marginal source of energy for foreign users and thus sensitive to small changes in their activity.

These poor static results prompted some testing of dynamic specifications. When lags of competitiveness were included, but relative price or cost terms $\left(\frac{UV_{88UK}}{UV_{88W9}}\right)$ or $\left(\frac{NULC_{88UK}}{NULC_{88W9}}\right)$ used to save the lost degrees of freedom, standard errors increased slightly.

Industrial countries might increase imports of raw materials prior to increasing industrial output. We therefore tested an equation including one lead of $TWIP_{MA}$. ULCs (not normalised) proved superior to price terms, and the fit was improved by estimating relative unit labour costs as one term; with Czechoslovakia included, we obtained:

$$(7.7) \quad \ln X_{88UK} = \underset{(1.02)}{-1.798} + \underset{(6.90)}{3.103} \ln TWIP_{MA} - \underset{(3.05)}{1.471} \ln TWIP_{MA+1}$$

$$- \underset{(1.87)}{0.570} \ln \frac{ULC_{88UK}}{ULC_{88W9}} - \underset{(8.77)}{0.0617}\ TIME - \underset{(13.8)}{0.855}\ DUM26$$

$$\bar{R}^2 = 0.975 \qquad SE = 0.0424 \qquad DW = 2.82 \qquad EST.\ 1925\text{-}37$$

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1. Cf. p.134.

The improvement in significance of relative costs was encouraging, but the initial hypothesis that $TWIP_{MA+1}$ would have a positive coefficient was rejected. We therefore regarded equation (7.5) as the preferred equation using industrial production terms.

IV. Conclusions and Implications

Overall, these regression results were disappointing. But the differences in fit statistics between the best equations and some other plausible specifications suggested that some degree of explanation was achieved.

Foreign industrial production, particularly in those countries which were important markets for UK coal, was a key determinant of UK coal exports. There was, however, only weak evidence that competitiveness (price or cost) was a significant variable; although estimated coefficients on price or cost terms were generally right-signed, t-statistics were low, and the elasticities in our preferred equation (7.5) were lower than for aggregate exports in chapter 4 or in most sectors in chapter 6. There was also little evidence that significant improvement could be achieved with more sophisticated dynamic specifications.

The quantitative implications of equation (7.5), particularly with respect to the loss of UK competitiveness associated with appreciation in the 1920s, are discussed in chapter 8 and illustrated in detail in Table 8.9. The analysis suggests that although the return to the Gold Standard was an unhelpful factor, UK coal exports were predominantly to be explained by world industrial production and by the strong negative trend. In particular, during the 1930s, when UK exports in aggregate recovered after 1932, coal exports remained depressed. No benefit was gained from the recovery in primary producers' trade performance; price competitiveness deteriorated, and the time trend continued to run. The result suggests that the structural factors working against the UK were stronger than could be remedied by policy: a depression in coal exports (and, given their importance, in the industry as a whole) was almost inevitable in the inter-war period. Policy needed to be aimed at ameliorating the effects of this decline and encouraging growth in more promising sectors.

These results may be of more interest to historians than econometricians. Despite the higher quality and quantity of data available in this sector, well-defined estimates of competitiveness effects were not to be obtained. The strong effects of the time trends, though plausible, are symptomatic of the weakness of more concrete explanations achieved. But we have confirmed that the UK remained a leading (and low price) producer and exporter of coal throughout the period, and that productivity grew much less rapidly in the UK coal industry than in competitor countries in the 1920s. We also found that in the 1930s, the UK experienced relatively strong productivity growth, and that this may have facilitated stronger profitability - without, however, improving output or export performance.

Annex 7.1: Some Further Tests

Equation (7.5) was examined further, first by instrumental variables estimation with unit labour costs used to instrument export unit values, and secondly by a residual check.

(1) Instrumental Variables Estimation

The following equation resulted:

$$(7.A1)\quad \ln X_{88UK} = \underset{(0.22)}{-\,2.06} + \underset{(0.82)}{1.67}\ \ln TWIP_{MA} - \underset{(0.55)}{0.515}\ \ln UV_{88UK}$$

$$+ \underset{(0.39)}{0.788}\ \ln UV_{88W9} - \underset{(0.88)}{0.0403}\ TIME - \underset{(12.1)}{0.895}\ DUM26$$

EST. 1925-37 $\bar{R}^2 = 0.956$ SE = 0.0567 DW = 2.00

The goodness of fit is very slightly worse than in equation (7.5); the Durbin-Watson statistic suggests that there is no problem with residual autocorrelation (equation (7.5) in any case suggested this); and the parameter estimates are very little changed (although their significance is in general substantially reduced). This result gives no grounds to reject equation (7.5).

2. Residuals on equation (7.5)

Table 7.A1 Residuals on equation (7.5).

1925	0.0275	1932	0.0009
1926	0.0	1933	0.0274
1927	-0.0334	1934	0.0277
1928	-0.0905	1935	0.0206
1929	0.0593	1936	-0.0571
1930	0.0502	1937	-0.0012
1931	-0.0313		

There is some evidence of heteroskedasticity here, as the period of high residuals 1927-30 coincides with the strongest performance of UK coal exports in the period. We had hypothesised that the equation might tend to overpredict in periods when supply constraints could apply, and that unit labour costs could consequently be a better competitiveness measure in such periods; but the equation underpredicts in 1925, strongly underpredicts in 1929 (the peak inter-war year for UK coal exports), and only slightly overpredicts in 1937, when export volume recovered somewhat from the low levels of the previous five years. There is some evidence that the effect of the 1926 coal strike was prolonged beyond that year, but the weak performance of UK export volumes in 1928 cannot wholly be attributed to this factor. Indeed although other features of the residual profile were very different for other equations reported in this chapter, the weakness of UK coal export performance in 1928 was a consistent result, arising also in equation (7.6) and equation (7.3).

Chapter Eight

FURTHER QUANTITATIVE IMPLICATIONS OF RESULTS

I. Introduction

The empirical results in chapters 4 to 7 enable us to make quantitative estimates of the effects of changes in the main explanatory variables - world activity, and the UK exchange rate/competitiveness. This chapter concentrates in particular on the implications of the return to the Gold Standard in 1925, and on the slump and recovery in 1929-32 and 1933 onwards, for export prices/competitiveness, for export volumes in aggregate and in key sectors, and, following from the latter, for the UK economy more generally.

The quantitative conclusions drawn should be treated with considerable caution. The doubtful econometric properties of several equations and the quality of data used are discussed elsewhere. Three more general problems are noteworthy:

(i) We have not incorporated policy feedback in other countries resulting from UK actions. A lower dollar parity for sterling in the 1920s might have induced lower dollar exchange rates for other countries too. And certainly the sterling devaluation in 1931 contributed to devaluations of other currencies, both at the time and later.

(ii) We are cautious in linking the exchange rate changes measured in chapter 2 with the changes in export prices and volumes discussed later. The discussion in chapter 2 focusses upon the sterling effective exchange rate while export prices are necessarily denominated in dollar terms in chapter 5.

(iii) We report some rough calculations for the direct effects of exchange rate and activity changes on unemployment via exports, but, as we discussed on pp.6-17, this is inevitably a partial account. The exchange rate may also affect the economy, and employment in particular, via imports, via multiplier effects which cannot be calculated without a full macro-economic model, via real wages, and via other changes in government policy. Changes in foreign activity may influence government policy if, for example, the overall balance of payments improves or deteriorates.

Some more general econometric points should be commented upon. First, the aggregate export equation fitted relatively well, and the specification was adequately robust to "Chow" tests. This suggested that some macroeconomic relationships prevailed throughout the period despite major disturbances both generally and of a microeconomic kind. Second, simultaneity between trade volumes and prices could have posed serious problems for the quantifications presented here, but the tests in chapter 5 suggested that, for the UK at least, a recursive model with prices determined first was a reasonable approximation. Third, the lack of strong dynamic behaviour in the export volume behaviour (see chapter 4, pp.186-9) also facilitated the calculations here, and justifies the lack of dynamics in the export sector equations (where degrees of freedom were minimal). But the exclusion of dynamics should still be regarded as a strong simplifying assumption in both cases.

II. Exchange Rate Changes and Export Prices

In this section, we relate the main exchange rate changes and changes in world prices to the coefficients in the UK export price equation.[1]

(1) Between 1924 Q2 and 1925 Q2, sterling rose against the dollar by 11.4% and in (nominal) effective terms[2] by 11.0%. (The total increase in the effective exchange rate to 1926 Q2 was 21.1%, though much of this was reversed by the following year).

(2) Between 1931 Q2 and 1932 Q4, sterling fell by 31.8% against the dollar (27.1% in effective terms). But from 1932 Q4 to 1934 Q2, sterling recovered against the dollar to 4.9% above its 1931 Q2 level, though in effective terms only to 20.7% below the level of 1931 Q2.

This episode is considerably more difficult to analyse. The export price equation contains terms in the sterling exchange rate against the dollar (short term only), and in the dollar price of foreign industrial countries' exports. But the implications of changes in the value of the dollar against other currencies, as occurred between 1933 and 1934, for the dollar prices of foreign country exports, are not explicitly modelled in this study. The specification of the export price equation assumes that, e.g., a 10% rise in the sterling/dollar exchange rate, or in UK wholesale prices, will have equal and opposite

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1. Our analysis is based on equation (5.9), the preferred equation from chapter 5 (without imposing homogeneity).

2. "Effective terms" refers throughout this chapter to the "Andrews" index; see Table 2.1.

effects to a 10% fall.[1] We therefore derive the effect of the pure sterling exchange rate changes by analogy with episode (1), with simplifying assumptions.

(3) Between 1929 and 1932 the dollar price of exports by nine foreign industrial countries fell by 39.7%. (See Table SA5). This, of course, was in part associated with devaluations against the dollar of 1931 onwards (see Table SA1), as well as possible competitive pressure arising from the devaluation of sterling. However, we analyse the implications of the price change on the assumption that it was an independent event, to illustrate the properties of the export price equation.

(1) Effects of an 11% rise in sterling against the dollar

We assume that the change occurs at one point rather than distributed through a one-year period (our main interest is anyway in longer-term effects). We assume that this brings about an instantaneous rise of 11% in $\$WHP_{UK}$ (UK wholesale prices in dollar terms) as well as in EXUK, the sterling-dollar exchange rate. The impact effect, given by the coefficients on $\Delta \ln EXUK$ and $\Delta \ln \$WHP_{UK}$, is a rise in UK dollar export prices of 9.35% (a fall in sterling

1. This may be challenged. Exporting firms may be able to expand their profit margins in the face of a devaluation, but not to contract them (due to the risk of bankruptcy) if the country in which they produce revalues relative to the country in which they sell. But log-linear specifications throughout this study may be subjected to similar criticisms.

export prices of 1.65%).[1] In the long term, UK dollar export prices end $\frac{0.416}{0.81} \times 11$ = 5.65% higher than initially, implying that sterling export prices continue to fall, by a further 3.7%, between the instant effect and the infinite future. The βo coefficient of .81 in equation (5.9) implies that we would expect over 99% of the total effect to have occurred by the end of three years after the change. Naturally, if sterling wholesale prices fall, e.g. as import costs and subsequently wages fall, a further fall in dollar and sterling export prices could be expected.

(2) Effects of exchange rate changes 1931-34

As we have suggested, these are more complex. We do not present detailed calculations, but suggest the assumptions which are required to subdivide the problem in ways which render the analysis analogous to (1) and (3).

First, the movement of the pound against the dollar. The eventual rise of 5% may be assumed to have long-run effects similar to (but about half the size of) those in (1); in the short-term, of course, the sharp fall and then rise of sterling will have had opposite effects to each other (and both rather larger than (1) in absolute size).

Second, the fall in both the pound and the dollar against other currencies (resulting in the substantial fall in sterling's effective rate 1931-4, though other currencies were subject to downward

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1. Strictly speaking, these calculations are only accurate for infinitesimal changes.

pressures after 1934). This does not affect EXUK, and we assume that $\$WHP_{UK}$ is not affected (although the rise in the dollar price of imports from countries other than the US which results from dollar depreciation may eventually produce some rise in UK sterling and dollar wholesale prices). The key issue is the response of $\$UV_{XW9}$, dollar export prices of foreign industrial countries. One assumption would be that the 20% fall in "effective" sterling with little change against the dollar implied a 20% rise in foreign dollar export prices (rough constancy in US export prices with more than 20% increases in dollar export prices of those countries which appreciated by more than 20% against the dollar). This would have an effect about half the size of the change in (3) below, although with opposite sign. The foreign countries experiencing appreciation may be constrained by competitive forces to reduce their local currency export prices; the rise in total foreign dollar export prices might consequently be less than 20%. On the other hand, there might be scope for higher US export prices, which would work in the opposite direction.

(3) Effects of a 40% Fall in Dollar Export Prices of Major Industrial Countries

$\$UV_{XW9}$ is reduced by 40% with EXUK unchanged and, we assume, UK dollar wholesale prices unchanged (though there is likely to be downward pressure from lower import prices). Equation (5.9) suggests that in the first year following the change, UK dollar (and sterling) export prices will fall by (0.205 x 40) = 8.2%. UK relative price competitiveness will have changed from 100 to $\frac{91.8}{60}$, implying a weakening of 53%. In the long term, the 40% fall in foreign export prices of $\left(\frac{0.416}{0.81}\right)$ x 40%, i.e. 20.5%, implies a final weakening of competiveness to $\left(\frac{79.5}{60}\right)$, or a loss of 32.5%.

Once again, the adjustment of UK competitiveness is greater in the long term (i.e. the extent of the weakening is less) than the short term; again, we might expect further adjustment through changes in either domestic prices and costs or the exchange rate.

III. Influences on Aggregate Export Volumes

Our analysis is based principally on our preferred equations (4.11) and (4.40). First, we give some approximate calculations for the consequences of the episodes discussed in II above. However, we have already noted that the implications of, e.g., exchange rate changes for foreign trade prices may in practice be complex. We therefore proceed to analyse the implications for aggregate export volumes of the changes in UK and foreign export prices and world trade that did in fact occur.

A. Volume Consequences of Implications for Export Prices

(1) The rise of 11% in sterling would be expected to produce a short term rise of 9.35% in UK export prices, with foreign export prices fixed. According to equation (4.11) this could reduce UK exports by (1.847 * 9.35) = 17.27%. In the long term, we expected UK export prices to end 5.65% higher, which would reduce the level of UK export volumes relative to the case in which sterling was unchanged by some 10.4%.

(3) The fall of 40% in the dollar price of foreign exports is so large as to render our method of calculation untenable, but we may

illustrate the type of effect by considering a 10% fall in foreign prices. In the short term, this would reduce UK dollar export prices by (1/4 * 8.2) = 2.05%, and in the long term by (1/4 * 20.5) = 5.125%. According to equation (4.11), a 10% fall in foreign prices should reduce UK export volumes by 22.51%. The fall in UK export prices should bring about a short-term improvement of (2.05 * 1.847) = 3.8% in UK export volume, rising eventually to (5.125 * 1.847) = some 9.5% in the long term, still implying an overall loss of 13% on the level of UK export volumes. If these orders of magnitude are close to accurate, the pressures on the exchange rate or domestic prices and costs from lost competitiveness may have been substantial; conversely the relief brought by the 1931 devaluation, albeit temporary, was probably considerable (although we have not taken calculations of episode (2) above further).

B Analysis of effects on export volumes of changes in explanatory variables

Introduction

Tables 8.1, 8.2 and 8.3 were constructed using the coefficient estimates of equation (4.11), the overall preferred equation, for (8.1), and equation (4.40), the preferred "logistic" equation, for (8.2) and (8.3). Further details of construction are given in Annex 8.1, and in the discussion of the relationship between logistic and log-linear parameters in Annex 4.2. Some additional preliminary notes are essential:

(i) The effects given are calculated by averaging the partial differentials at the earlier year and the later year for each change in independent variable. The "error" column in the Tables largely reflects this source of inaccuracy, although there are also rounding errors.

(ii) It will be noted that changes in the residuals account substantially for "explanations" of changes in volume or UK export share in several years. This suggests the rewards to further research improving these equations, illustrates the importance of the gains made already vis a vis, e.g., equation (4.4), and indicates the need for caution in analysing the identified effects of changes in the independent variables.

(iii) Table 8.4 assists the interpretation of Tables 8.2 and 8.3 by giving implied elasticities of UK export volume in the logistic equation (4.40) with respect to the major explanatory variables in each year. Note from equation 4.A2.25 that these elasticities depend on the actual values of the associated variables, and from the associated discussion that the competitiveness elasticities may be overstated and the elasticity on $\$X_C$ probably understated. In the early 1930s, all the explanatory variables were at historically low levels, and the elasticities in this period therefore lie well below the estimates of equation (4.11).

(iv) Tables 8.5 and 8.6 give the effects of changes in UK export price competitiveness on export volumes implied by the effects of the price changes illustrated in Tables 8.1, 8.2 and 8.3. There are three further reasons for cautious interpretation of these estimates:

(a) Some of the effects of changes in UK and other industrial country export prices may have their impact via primary producers' purchasing power, rather than via strict "competitiveness".

(b) As suggested in our discussion of UK export prices, changes in UK and foreign export prices may be interrelated in complex ways (possibly via their effects on export volume performance). But elasticities on the price terms were not very much larger than on the single COMP terms in (4.8) or (4.9), implying that multicollinearity was not a major problem even if it was the sole source of the difference.

(c) Given the estimated greater volume response of UK exports to changes in industrial country export prices than to UK export prices, it may not be inferred that any given change in "relative price competitiveness" would produce the same effect on export volumes. As is shown in the tables, the effects will vary depending on the composition of the competitiveness change. This should counsel against simplistic interpretation of the changes given in Table 2.4.

Analysis

Consider Table 8.2. Between 1924 and 1938, the UK suffered a 4½ percentage point decline in share of export volumes of the ten leading industrial countries. This occurred in various phases. Share was lost slowly during the 1920s as UK export volume increased slightly; there was then a sharp loss of share between 1929 and 1931 (and since world trade also declined at this time, the loss of UK export volume was even sharper). This loss was more than recovered up to 1935, after which UK export share again declined as world trade rose.

Various key issues are to be examined. First, are the main exchange rate/competitiveness episodes of the period reflected in export performance? Second, to what extent can the changes in UK export volumes and in share of industrial country exports be explained in terms of changes in demand for UK products of the "primary producers?" Finally, what contributions did "competitiveness" and the pattern of international demand for UK products make to the UK's relatively poor economic performance in the 1920s and/or to the relatively early and strong recovery of the UK from the Great Depression.

Tables 8.5 and 8.6 suggest that between 1924 and 1938, the UK's loss of competitiveness more than accounted for the total loss of export share and volume. A substantial loss of export share and volume occurred in 1924-26 which could be attributed to the loss of competitiveness associated with the return to the Gold Standard. The devaluation of 1931 appears to have been shortlived in its benefits.[1] A sharp loss of competitiveness vis a vis the other industrial countries between 1929 and 1931, generated by the massive fall in

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1. But only according to relative export UVI competitiveness: other competitiveness measures showed more durable gains. See Table 2.4.

foreign industrial country export prices at this time, also shows up clearly, and would help to account for the collapse of UK exports at the same time.

This may be slightly misleading. For example, Table SA.14 showed that several countries in the W9 group had a larger proportion of agricultural products and raw materials in their aggregate exports than did the UK. But we can verify that the UK was tending to lose relative price competitiveness in this period in the coal sector by reference to Table SA.25.

We now consider the contribution of the $\$X_C$ term. Intepretation here is complex: the variable is not deflated by any price term; nor is it easily discussed in isolation from exports of other industrial countries. Nevertheless, Table 8.2 suggests that the early weakening of the value of primary producers' trade in 1928/9 entailed some loss of share for the UK in 1929 while the other industrial countries were still booming. In 1932 and 1933 the particularly strong recovery in the value of trade of these countries more than offset the loss of UK share which might have resulted both from a turnround in exports by the industrial countries and erosion of the competitiveness gain from devaluation. Table 8.1 confirms that the UK benefited from the strength of $\$X_C$ relative to the volume of exports by W9 countries right up to 1937. Table SA.7 suggests that the regression analysis may understate the importance of recovery in the primary producing countries to UK export performance, since the UK more than maintained its share of this expanding market between 1931 and 1934, perhaps partly reflecting the introduction of

Imperial Preference.[1]

The tables offer only limited guidance on the more general problems of the UK's relative economic weakness in the 1920s and strength in the 1930s. The low coefficient on X_{W9} in equation (4.11), which has its counterpart in the negative coefficient on $\frac{1}{X_{W9}}$ in equation (4.40), suggests that the UK would perform relatively badly when other industrial country exports were buoyant, and relatively well when these exports were depressed, which may help account for UK relative weakness in the 1920s, along with lost competitiveness in 1924-6 and at the end of the decade. Since UK exports did not in any year in the 1930s attain the level even of 1926, their role in the recovery in the 1930s should not be overplayed. Nevertheless, between 1931 and 1937 the UK share of industrial country exports rose by 2 percentage points, despite a recovery in industrial country exports in this period. The (surprising) positive time trends, both in (4.11) and (4.40), account for some of this recovery (about half the increase in share in Table 8.2), but it does also seem that the recovery in the value of primary producers' exports was more important than the various fluctuations in competitiveness.

Alternative Implications of Dynamic Specification

The robustness of the conclusions can be checked by brief comparison of the coefficient estimates used from equation (4.11) with the long run elasticities of UK export volumes with respect to

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1. Table SA.7 is calculated in value terms, while Tables 8.1, 8.2 and 8.3 assess UK volume performance.

X_{W9}, $\$X_C$ and competitiveness obtainable from equation (4.16). Where long-run coefficients differ substantially from those from the less well-fitting static equations, this should be taken into account.

Recall that the coefficient on ln X_{UK-1} (the lagged dependent variable, UK export volume lagged one period) in equation (4.16) was -0.465. The sum of coefficients on

X_{W9} and X_{W9-1} = + 0.185

$\$X_C$ and $\$X_{C-1}$ = +0.861

COMP and $COMP_{-1}$ = -2.992

Long-run coefficients are obtained by dividing these figures by 1.465, yielding

on X_{W9} , +0.126

on $\$X_C$, +0.588

on COMP , -2.042

The competitiveness elasticity obtained was rather higher than that in (4.8) or (4.10); the coefficients on X_{W9} and $\$X_C$ were also higher.

When a similar analysis was carried out on a "Hendry-type" equation analogous to (4.11)[1] the long-run elasticities obtained were as follows:

on X_{W9} , +0.244

on $\$X_C$, +0.540

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1. This was not reported in chapter 4 due to shortage of degrees of freedom and, as shown in Test 7 in Annex 4.1, the restrictions implied in equation (4.12), [(4.11) run over 1925-38], were not rejected.

on UV_{XUK} , -1.908

on UV_{XW9} , +1.910

The competitiveness elasticities are greater than in (4.12), though of very similar magnitude to (4.11), but the distinction in absolute size between the opposite signed coefficients on UK and W9 export unit values is weak here. The key difference with (4.11) (but not with (4.12), which suggests that the difference may have been a product of the estimation period rather than the specification) is the higher coefficient on $\$X_C$, which tends to strengthen our conclusion that recovery in primary producing countries' exports was a key feature of the UK's gain in share of industrial country exports in the 1930s.

Implications for Employment of the Return to Gold

Moggridge (1969)[1] attempts to estimate the effects of the return to the Gold Standard on employment. First, price elasticities of demand of 0.5 for UK imports and 1.5 for UK exports (Moggridge suggests that this latter is conservative, and equation (4.11) tends to support this) were assumed. The 11% appreciation 1924-5 was assumed to bring about a 7% rise in the foreign currency price of UK exports and an 8% fall in the sterling price of UK imports. The changes in the sterling values of exports and imports could then be calculated as producing a deterioration in the trade account of £64 mn, or, allowing for some worsening on invisibles also, about £80 mn in the current account (compared with a surplus of £73 mn in

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1. See his Appendix, pp.91 et seq.

1924). Moggridge implicitly assumed a binding constraint on the current account, and analysed alternative means by which the £80 mn. loss could be restored. Assuming a marginal propensity to import of 0.3 (derived from Chang (1951)), and net national income per capita of £185.6 (from Phelps Brown and Browne (1968)), a rise in unemployment of 1.4 mn would bring about a sufficient reduction in imports.

As noted, our results suggest that the price elasticity of demand for UK exports assumed in this calculation may be a little low. On the other hand, we showed in section 8.II that we would expect in the long run a rise of only 5.7%, rather than 7%, in UK foreign currency export prices (though in the short-term the competitiveness problem is more acute). We have also suggested that 11% may slightly understate the total appreciation entailed by the return to the Gold Standard, since Moggridge's calculation ignores changes in the exchange rates of countries other than the US and UK subsequent to 1925.

However, we consider an alternative basis of calculation here. Moggridge's assumption of a constant and binding current account constraint is open to criticism, since the capital account position was not predetermined. Moggridge noted the possibility of more stringent controls on overseas lending, though this would have been a major reversal in policy. The rise in the exchange rate might have tended ceteris paribus to increase UK overseas investment, since foreign currency assets would have appeared cheaper in sterling terms. On the other hand, the chief instrument of demand policy, higher Bank Rate, increased the returns to UK assets relative to those overseas. Moreover, to the extent that domestic income was depressed by the decline in exports and demand management policies, this might also tend to diminish the capacity to invest abroad, although slack demand and lower profitability would tend to discourage investment in the UK. A further criticism of Moggridge's estimate is that division of the reduction in aggregate income required by per capita income is a very rough procedure.[1] The workers to be laid off might be those with relatively low marginal product. This would if anything suggest a greater loss of employment for given lost income than dividing by average product. Moreover, the nature of the calculation, macroeconomic rather than focussing on exports, means that employment specifically in the exporting industries is ignored.

In this section, we suggest alternative calculations based purely on the loss of demand stemming from lower exports; we consider the sectoral consequences in section IV.

We calculated earlier that the 11% appreciation in 1924-5 would be expected in the long term to reduce export volume by 10.4%. At 1924 prices, and the 1924 level of exports, this represented a reduction of £83.3 mn.[2] Average net product per head at 1924 prices

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1. Nevertheless we adopt a similar procedure here, for want of alternatives.

2. Calculated from UK export value in Table SA.6 and the exchange rate in Table SA.1.

was £215 in 1924[1]; this implies a direct loss of some 390,000 jobs. This could underestimate the job loss, if product per head of lost workers was lower than average. There will also have been contractionary effects on demand through the multiplier,[2] and through additional imports at the expense of domestic production.

Alternatively, consider the impact, in Table 8.1, of the changes in competitiveness that actually occurred in association with the return to the Gold Standard. Taking 1924 to 1926, which allows for the period of further sterling appreciation as some European currencies depreciated after April 1925, Table 8.1 suggests that the combined effect of changes in UK and W9 export prices was to reduce UK export volume by $235.1 mn (1913 dollars and prices). Converting to 1924 sterling prices (using the 1924 export UVI and the average exchange rate for the year) yields a loss of volume of £92.1 mn. At 1924 net product per head, the implied job loss is about 430,000, very similar to the estimate obtained indirectly from the export price equation. Adjustment of UK competitiveness to the appreciation may not have been complete in 1926, and the longer-term effect of appreciation on UK export prices and jobs was smaller than the short term effect.[3]

1. Business Statistics Office (1978) p.79; total for all industries, SIC Orders II to XXI. For the aggregate calculations, we use net output per head, overestimating the UK job loss if some jobs in input industries were located overseas. For the sectoral calculations, gross output per head is used, understating the job loss in each sector to the extent that it provided inputs into other sectors affected.

2. Thomas (1981) p.346 gives a short-term multiplier of 1 and a long-run multiplier of 1.5.

3. Mitchell (1978), p.66 gives unemployment at 1.13mn in 1924,1.23 mn in 1925, 1.39mn in 1926 and 1.09mn in 1927. Our estimate of the direct effects more than explains the total rise in unemployment 1924-26, while Moggridge's seems excessive.

Moggridge's (1969) estimate of the unemployment loss was some three times ours. The key difference lies in his assumption of a binding constraint on the current account; while we indicate only the direct effect of a fall in export volume, he implies that domestic activity had to be depressed to reduce imports pari passu.

Implications for Employment of Slump in Exports of Primary Producers

The focus on unemployment in analyses of the slump post-1929 lends particular interest to estimates of the effects of the fall in the value of exports by the primary producing countries in this period. From 1929 to 1932, the value of these exports fell by $8789 mn., reducing the volume of UK exports, according to Table 8.1, by $448.9 mn. (1913 prices).[1] We convert to 1930 sterling prices for comparison with the 1930 Census of Production, yielding a fall in volume of UK exports of £146.8 mn. Net per capita output in 1930[2] was £215, suggesting a loss of employment of over 680,000 jobs. This may understate the total loss of employment resulting, since the domestic multiplier was not allowed for; on the other hand, the stimulus to domestic activity from lower import prices would have

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1. We compared this loss with an estimate of the actual decline in the volume of UK exports to primary producers between 1929 and 1932. Deflating the 1929 and 1932 dollar values of UK exports to these countries (see Table SA.6) by the dollar UVI for UK exports in 1929 and 1932 respectively (see Table SA.5) suggested a total fall in exports to primary producers of $572.4 mn. Since Table 8.1 indicates that the UK lost exports as a result of competitiveness changes in this period, and some of the lost exports would have been to primary producers, the equation and the evidence correspond well.

2. Census of Production figure for SIC Orders II to XXI (all industries). Business Statistics Office (1978), p.79.

been particularly powerful in this case.[1] Moreover, in contrast to the case of weaker competitiveness, there is not the further omission of the effects of higher import penetration. The calculation again suggests the importance of the primary producers in the UK experience; indeed, the slump in exports of these countries may already have detracted from UK export performance before 1929.

IV. Influences on Exports in Key Sectors

We focus here upon two key episodes; the period from 1924-26, in which the UK lost a significant degree of relative price competitiveness; and the slump from 1929-32, in which we have already identified the crucial role of the collapse of the value of exports of primary producing countries.

The results presented may serve to illustrate the properties of the equations in chapter 6 as much as to illuminate economic history. We defer consideration of the coal sector to section 8.V. We also exclude the "Apparel" sector, since the "perverse" coefficients generally obtained on the world price and cost terms in the equations estimated invalidate this kind of analysis; and we do not further analyse the "aggregate" of the sectors. Thus, Tables 8.7

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1. Between 1929 and 1932, UK unemployment rose by 1.53 mn [Mitchell (1978) p.69]. Crafts, McKinnon and Thomas (1984), cited in Hatton (1985a) p.27, suggest that the fall in total UK exports 1929-32 more than accounted for the total rise in unemployment, though this was partly offset by rising domestic demand.

and 8.8 analyse UK experience in the remaining six key sectors.

The effects on the value of UK exports in $ mns given in row 1 of Tables 8.7 and 8.8 were calculated by the methodology used in calculating Tables 8.1, 8.2 and 8.3.[1] The equations providing the elasticities used to construct 8.7 and 8.8 were given in Annex 6.2. Although the results are broadly comparable across sectors, the world price term used in calculating the effect of the change in competitiveness on exports of cotton is not "sector-weighted" but is simply the unit value for nine industrial countries' exports as used in chapter 4. In Table 8.8, the measure of the fall in exports of primary producing countries is the dollar value of their exports, except for the UK wool and worsted sector, where this term is deflated by UK and nine industrial countries' export UVIs.[2]

The effects on UK export values are converted to the estimated volume effects given in row 4 assuming that the unit values of UK exports in each sector moved in line with the UVI of aggregate UK exports. The figures for output per head in each sector, used to derive estimated effects on employment in the sectors given in row 5, are taken from UK Censuses of Production and are discussed further in the Statistical Appendix. UK Censuses of production also provide data on total employment in each sector used in constructing row 6.

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1. See Annex 8.1. The competitiveness effects shown in Table 8.7 reflect a combination of the individually calculated effects of domestic and foreign price changes.

2. See pp.302 and 316.

Influences on Values of Exports in Key Sectors

Some general conclusions arise from comparison of Tables 8.7 and 8.8.

(i) The far greater importance of the collapse in exports of primary producing countries in 1929-32 than the loss of relative price competitiveness in the mid-1920s stands out.[1]

(ii) The calculations in 8.8 suggest that some elasticities estimated on exports of primary producing countries are implausibly high, notably for the vehicles sector.

(iii) The three sectors which managed to increase the dollar value of their exports between 1924 and 1926 apparently experienced relatively small negative effects from the loss of competitiveness; two of these sectors, chemicals and machinery, were also apparently relatively lightly affected by the contraction in exports of primary producers in the 1930s.

Influences on Employment in Key Sectors

The estimated effects on employment shown in Tables 8.7 and 8.8 further emphasise the catastrophic significance of the slump among the primary producers in and after 1929. The estimated loss of employment in the six industries resulting from this slump amounted to about 0.5 million. Mitchell (1978) gives the total rise in unemployment in the UK from 1929 to 1932 as 1.53 mn. By contrast, the

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1. The quoted effects of changes in industrial country export prices may be slightly distorted; see pp.303, 305.

loss of competitiveness entailed by the return to gold appears to have cost some 60,000 jobs in the same six industries, while unemployment in the UK as a whole rose by just over 1/4 million between 1924-26 (and the coal strike probably artificially boosted the total in the latter year). It should, however, be recalled that other factors operated to maintain employment in these sectors between 1929 and 1932. First, productivity growth in the whole economy was weak over this period (Table SA.11). Productivity may actually have declined in the most affected sectors, implying that employment declined less rapidly than output. Second, the slump in the value of exports by primary producers was associated with a massive movement in terms of trade in favour of the UK; this acted to support UK domestic demand.

The sectoral pattern of estimated employment losses is illuminating. The slump in the primary producing countries apparently had their most severe effects on the cotton and iron and steel industries as a proportion of total sectoral employment, and the same industries also suffered notably from the return to gold. Machinery and vehicles exports were also vulnerable to the loss of competitiveness in 1924-6, but growing domestic and foreign demand were more than sufficient to offset this. Chemicals were least affected in employment terms in both episodes, and in 1929-32 the vehicles sector was potentially insulated from a severe loss of overseas sales by the limited extent of its exports.[1]

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1. See Table 6.T2.

V. Influences on Exports of Coal

Table 8.9 shows the effects of changes in the explanatory variables on the volume of UK exports of coal, calculated according to the methodology described in Annex 8.1 using equation (7.5), the "preferred" equation.

The quantitative implications are sharply distinct from those of the aggregate and other sectoral equations. First, the analysis of the implications of the return to the Gold Standard is complicated by the fact that UK relative export price competitiveness in coal actually improved over the total period 1924-6. The UK price index may be subject to large error in 1926 due to the coal strike; the reduced worldwide availability of coal may have put upward pressure on the world price and made UK competitiveness appear artificially good. 1924 lies outside our estimation period (hence the omission of a residual for 1924 in Table 8.9), so that the effects of changes in explanatory variables from 1924 to 1925 should be interpreted cautiously. Second, UK coal exports appear not to have been specifically affected by the slump in primary producers' exports from 1929.

There is some evidence to confirm that the position of the UK in 1924 was untenable once Germany recommenced full production and trade, most notably the pressure on UK competitiveness to improve in the sector, and the strength of the time trend. The latter apparently reduced UK exports over the period 1924-37 by almost 40% of the 1924 volume. This more than offset the effect of the rise in TWIP, which should ceteris paribus have implied an increase of close to 30% in coal export volume.

Notwithstanding our earlier reservations, there is also evidence that exchange rate policy was unhelpful in 1924/5. The net effect of changes in UK and foreign export prices between 1924 and 1925 was a fall in UK export volume of $14.3 mn (1924 prices), or about 4% of the 1924 total. A calculation similar to that employed for other sectors implies a potential loss of some 15,500 jobs. To the extent that UK coal exports were kept artificially competitive in 1925 by government subsidy,[1] the effects of the exchange rate change alone could have been even more serious.

Nevertheless, the decline in exports of coal seems to have been only one of several factors contributing to the fall in employment in the industry in the 1920s. From 1924-30, the total decline in the volume of UK exports could have implied a loss of over 40,000 jobs at 1924 productivity levels. But the total contraction in employment in the industry amounted to some 265,000 jobs.[2] By contrast, between the 1930 and 1935 Censuses of Production the industry contracted by a further 170,000 jobs, of which nearly 80,000 could be accounted for by the further fall in UK export volume in this period calculated at 1930 productivity levels. It would, however, be wrong to ascribe this latter slump in UK coal exports solely to the decline in world activity, though world industrial production (UK trade-weighted) did fall in the period. In addition to the time trend, a loss of UK competitiveness associated with a substantial fall in foreign prices appears to have been important. Devaluation in 1931 was apparently

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1. Allen (1959) p.53.

2. Business Statistics Office (1978) p.75.

insufficient to maintain the competitive position of the UK over 1930-2. Curiously, (due to the low weight of the US in this sector), the dollar devaluation in 1933-4 seems not to have damaged UK exports significantly.

One important check on these quantitative implications is the estimated effect of the 1926 dummy. The loss of volume, at some $184mn (1924 prices), represented about 63% of UK exports in 1925 and 1927. This is greater proportionately than the loss of total output implied by Mitchell's (1978)[1] figures (showing output in 1926 some 49% below the average of output in 1925 and 1927), but this might be expected if home consumption had first call on the production that was available. The figure seems consistent with the seven months duration of the strike.[2]

The estimation period in the coal sector allows a short comparison with aggregate UK exports over the recovery up to 1937. The most striking contrast between Tables 8.1 and 8.9 is that while aggregate exports increased by over 26% between 1932 and 1937, the increase in coal exports over the same period was less than 4%. The deterioration in UK competitiveness over the period affected aggregate exports far more than coal. The increase in the volume of industrial countries' exports, at 36%, was rather more than that of TWIP, at 17%, though its estimated influence on aggregate exports was less than that of TWIP on coal exports. The greater strength of aggregate exports as compared with coal exports is overwhelmingly

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1. See his p.192.

2. Allen (1959), p.53.

attributable to two factors. First, the value of exports of primary producing countries' exports more than doubled between 1932 and 1937. This made no apparent direct difference to UK coal exports but accounted for almost the whole increase in aggregate exports. Second, the positive time trend in the aggregate equation is estimated of itself to have increased UK exports by nearly 7% between 1932 and 1937, while the trend in the coal equation accounts for a fall of over 20% over the same period.

VI. Conclusions

General conclusions from this analysis are given in Chapter 9, and, where relevant, Chapters 4 to 7. But we note three points of interest here. First, we note the difficulty of tieing up the estimated effects of exchange rate changes on export prices with the actual price changes which were analysed subsequently. In part this reflects the importance of other developments in progress at the time. In particular, the effects of the appreciation of sterling from 1920 up to 1924 on export volumes are not analysed, but this appreciation may have been contributing to downward pressure on UK export prices from 1924 onwards (notably in the coal sector). We may, in other words, be commencing our analysis out of equilibrium. Second, although the aggregate equation suggests that the employment consequences of the loss of competitiveness after 1924 were less serious than those of the collapse in primary producers' exports after 1929, the estimated loss of employment from the loss of exports stemming from the competitiveness loss more than explained the total rise in UK unemployment between 1924 and 1926. By contrast, the estimated loss of employment from the loss of exports stemming from the collapse in primary producers' exports between 1929 and 1932 goes less than half way towards explaining the total rise in unemployment in the UK over the whole period. Third, an interesting corollary is that competitiveness changes in the sectors identified account for only a small proportion of the estimated aggregate loss of employment stemming from lost competitiveness in 1924-6, while the loss of employment in these key sectors stemming from the collapse of primary producers' exports explains nearly three quarters the aggregate loss of employment from this source. The sectoral experience actually seems more consistent with the behaviour of unemployment in the whole economy than does the behaviour of aggregate exports, despite greater econometric problems with the sectoral equations.

ANNEX 8.1: Construction of Analysis of Changes in Exports Tables

Tables 8.1, 8.2, 8.3 and 8.9 are constructed by assessing the effects of year to year changes in the explanatory variables on the dependent variable. The following results were necessary for the calculations:

(A) Elasticities and Partial Differentials in the Log-Linear Form (for Tables 8.1 and 8.9)

(i) Elasticity of the dependent variable wrt an explanatory variable

The log-linear form may be written:

$$(8.A1) \qquad Y_t = A.X_{1t}^{\beta_1} e^{\varepsilon_t}$$

where ε_t is the usual residual term and β_1 the estimated coefficient on explanatory variable X_{1t}.

Differentiating wrt X_{1t}

$$(8.A2) \qquad \frac{\partial Y_t}{\partial X_{1t}} = A.e^{\varepsilon_t} . \beta_1 X_{1t}^{\beta_1 - 1}$$

Since tne elasticity γ_1 is defined as $\frac{X_{1t}}{Y_t}\frac{\partial Y_t}{\partial X_{1t}}$,

both sides are multiplied by $\frac{X_{1t}}{Y_t}$;

(8.A3) $$\gamma_1 = \frac{A.e^{\varepsilon_t} . \beta_1 X_{1t}^{\beta_1}}{Y_t} = \beta_1$$

(ii) Partial differential of the dependent variable wrt an explanatory variable

It follows from (8.A3) that the right hand side of (8.A2) may be simplified by multiplying both sides of (8.A3) by $\frac{Y_t}{X_{1t}}$;

(8.A4) $$\frac{\partial Y_t}{\partial X_{1t}} = \frac{\beta_1 Y_t}{X_{1t}}$$

Thus the effect of an actual change in X_{1t}, ∂X_{1t}, on the dependent variable is given by

(8.A5) $$\partial Y_t = \frac{\beta_1 Y_t \partial X_{1t}}{X_{1t}}$$

There is a practical problem of selecting the appropriate values for Y_t and X_{1t} where ∂Y_t and ∂X_{1t} are not infinitesimal. We have taken tne arithmetic average of the two consecutive years between which each change ∂X_{1t} is measured, but this is inevitably a source of error in the tables, particularly where movements in Y_{1t} and Y_t are very large.

(iii) Partial differential of the dependent variable wrt the residual

Differentiating (8.A1) wrt ε_t, we obtain

(8.A6) $$\frac{\partial Y_t}{\partial \varepsilon_t} = A.X_{1t}^{\beta_1} e^{\varepsilon_t} = Y_t$$

(assuming that the residual is well-behaved, i.e. not correlated with the explanatory variable). Thus

(8.A7) $$\partial Y_t = Y_t . \partial \varepsilon_t$$

This procedure is similar to that used to calculate the effects of the time trend and dummy terms where present. Adapting (8.A1);

(8.A8) $$Y_t = A.X_{1t}^{\beta_1} . e^{\beta_2 \, TIME_t} . e^{\beta_3 \, DUM_t}$$

$\therefore$

(8.A9) $$\frac{\partial Y_t}{\partial TIME_t} = A.X_{1t}^{\beta_1} . \beta_2 e^{\beta_2 \, TIME_t} . e^{\beta_3 \, DUM_t}$$

$$= \beta_2 Y_t$$

$\therefore$

(8.A10) $$\partial Y_t = \beta_2 Y_t \, \partial TIME_t$$

and

(8.A11) $$\frac{\partial Y_t}{\partial DUM_t} = \beta_3 Y_t, \text{ or } \partial Y_t = \beta_3 Y_t \, \partial DUM_t$$

(B) Partial Differentials in the Logistic Specification

(i) Partial differentials of UK export share with respect to explanatory variables

Recall equation (4.A2.8) on p. 220

(8.A12) $$\frac{\partial \lambda_t}{\partial X_{1t}} = \beta_1 \cdot \lambda_t (1 - \lambda_t)$$

or

$$\partial \lambda_t = \beta_1 \cdot \lambda_t (1 - \lambda_t) \, \partial X_{1t}$$

In calculating Table 8.2 from this, we averaged the two consecutive observations on λ_t and X_{1t} between which the changes occurred, analogously to construction of 8.1 and 8.9 . In the logistic specification, (8.A12) is equally applicable to the time and dummy terms.

(ii) Partial differential of UK export share wrt the residual

Recall equation (4.A2.1) on p. 219.

(8.A13) $$\lambda_t = \frac{1}{1 + e^{-(\alpha+\beta X_{1t} + \varepsilon_t)}}$$

and with the X_{1t} held constant, we can write analogously to (4.A2.2)

(8.A14) $$\lambda_t = \frac{1}{h(\varepsilon_t)}$$, and hence

(8.A15) $$\frac{\partial \lambda_t}{\partial \varepsilon_t} = \frac{- h_1'(\varepsilon_t)}{(h(\varepsilon_t))^2}$$

Recalling that $h_1(\varepsilon_t) = 1 + e^{-(\alpha + \beta_1 X_{1t} + \varepsilon_t)}$

(8.A16) $$h_1'(\varepsilon_t) = 0 - e^{-(\alpha+\beta_1 X_{1t} + \varepsilon_t)}$$

$$\therefore \quad - h_1'(\varepsilon_t) = e^{-(\alpha+\beta_1 X_{1t} + \varepsilon_t)}$$

Since $\dfrac{1}{(h(\varepsilon_t))^2} = \lambda^2$

(8.A17) $$\frac{\partial \lambda_t}{\partial \varepsilon_t} = \lambda_t^2 \cdot e^{-(\alpha+\beta_1 X_{1t} + \varepsilon_t)}$$

and recalling from (4.36) that

$$e^{-(\alpha+\beta_1 X_t + \varepsilon_t)} = \frac{1 - \lambda_t}{\lambda_t}$$

(8.A18) $$\frac{\partial \lambda_t}{\partial \varepsilon_t} = \lambda_t (1 - \lambda_t)$$

so $\partial \lambda_t = \lambda_t(1 - \lambda_t)\partial \varepsilon_t$

(iii) Partial differentials, UK export volume wrt explanatory variables in share equation

Equation (4.A2.25) yielded the result

(8.A19) $\gamma_1 = \beta_1 X_{1t}$ (under certain restrictive conditions; see Annex 4.2)

where γ_1 is the elasticity of volume of exports wrt X_1 and β_1 is the estimated coefficient in the logistic specification.

(8.A20) $\gamma_1 = \frac{\partial Y_t}{\partial X_{1t}} \cdot \frac{X_{1t}}{Y_t}$ by definition, where Y_t is the export volume

Substitute in (8.A19) for γ_1.

(8.A21) $$\frac{\partial Y_t}{\partial X_{1t}} \cdot \frac{X_{1t}}{Y_t} = \beta_1 X_{1t}$$

$$\therefore \frac{\partial Y_t}{\partial X_{1t}} = \beta_1 Y_t \quad \therefore \partial Y_t = \beta_1 Y_t \partial X_{1t}$$ (1)

comparing (8.A12) with (8.A18), we also derive

(8.A22) $$\frac{\partial Y_t}{\partial \varepsilon_t} = Y_t \quad \therefore \quad \partial Y_t = Y_t \partial \varepsilon_t$$

This is identical to (8.A7) (though the ε_t may differ, of course); hence the <u>interpretation</u> of the residuals is analogous to that of the residuals in the volume equation.

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1. We have adjusted this result in the case where x_1 is the term $\frac{1}{X_{WI} - X_{UK}}$, on the lines of equation (4.A2.31).[1] But it is likely that the competitiveness terms used in deriving Table 8.3 from 8.2 are too large; cf. Annex 4.2.

Table 8.1 Analysis of Changes in UK Export Volume (Volume Equation)

Year	UK_{VOL} Δ	X_{W9} Δ	EFFECT	$\$X_c$ Δ	EFFECT	UV_{XUK} Δ	EFFECT	UV_{XW9} Δ	EFFECT	TIME Δ	EFFECT	DUM 26 Δ	EFFECT	RESIDUAL Δ	EFFECT	ERROR
1924	2047	8816		11622		173		141.04						0.0178		
	- 6	+167	+ 9.5	+2959	+137.3	+10	-212.1	+ 3.07	+ 99.1	1	+25.1	0	0	-0.032	-65.4	+0.5
1925	2041	8983		14581		183		144.11						-0.0143		
	-207	+624	+32.3	- 956	- 39.1	-10	+201.1	-10.30	-323.2	1	+23.8	+1	-129.5	+0.0142	+27.5	+0.1
1926	1834	9607		13625		173		133.81						0		
	+256	+848	+41.1	+ 661	+ 27.6	- 8	+171.6	- 4.57	-153.4	1	+24.1	-1	+131.1	+0.0072	+14.1	-0.2
1927	2090	10455		14286		165		129.24						0.0072		
	+ 84	+586	+28.8	+ 510	+ 22.2	- 3	+ 72.3	- 1.23	- 45.9	1	+26.2	0	0	-0.0093	-19.8	+0.2
1928	2174	11041		14796		162		128.01						-0.0021		
	+ 59	+551	+26.6	- 259	- 11.6	- 3	+ 76.1	- 1.56	- 60.8	1	+27.1	0	0	+0.0007	+ 1.5	+0.1
1929	2233	11592		14537		159		126.46						-0.0014		
	-393	-1280	-59.0	-2973	-138.0	- 8	+194.2	-11.58	-439.8	1	+25.0	0	0	+0.0120	+24.4	+0.2
1930	1840	10312		11564		151		114.88						0.0106		
	-440	-1123	-46.3	-3396	-165.8	-25	+540.2	-20.76	-724.3	1	+19.9	0	0	-0.0392	-63.5	-0.2
1931	1400	9819		8168		126		94.11						-0.0286		
	+ 5	-1944	-82.3	-2420	-145.1	-35	+835.7	-17.77	-658.2	1	+17.2	0	0	+0.0246	+34.5	+3.2
1932	1405	7245		5748		91		76.34						-0.0040		
	+ 16	+ 61	+ 2.9	+1211	+ 80.1	+19	-493.5	+ 9.00	+354.1	1	+17.4	0	0	+0.0396	+56.0	-1.0
1933	1421	7306		6959		110		85.34						0.0356		
	+ 92	+339	+16.5	+1936	+106.6	+22	-492.7	+15.89	+562.4	1	+18.0	0	0	-0.0813	-119.3	+0.5
1934	1513	7645		8895		132		101.23						-0.0457		
	+104	+185	+ 9.3	+ 426	+ 21.8	- 2	+ 44.1	- 2.06	- 72.4	1	+19.2	0	0	+0.0524	+82.0	--
1935	1617	7830		9321		130		99.17						0.0067		
	+ 5	+387	+19.4	+ 953	+ 46.9	+ 5	-112.9	+ 0.74	+ 27.1	1	+19.9	0	0	+0.0028	+ 4.5	+0.1
1936	1622	8217		10274		135		99.91						0.0095		
	+156	+1620	+75.7	+2246	+ 99.6	+10	-224.3	+ 5.62	+209.3	1	+20.9	0	0	-0.0150	-25.5	+0.3
1937	1778	9837		12520		145		105.53						-0.0055		
	-212	-478	-20.7	-1896	- 81.5	+ 2	- 42.3	- 3.34	-121.0	1	+20.5	0	0	+0.0196	+32.8	+0.2
1938	1566	9359		10624		147		102.19						0.0141		

TABLE 8.2 Analysis of Changes in UK Export Share (Share Equation)

Year	UK % Share Δ	$\frac{1}{X_{W9}}$ Δ	EFFECT	$\$X_c$ Δ	EFFECT	UV_{XUK} Δ	EFFECT	UV_{XW9} Δ	EFFECT	TIME Δ	EFFECT	DUM26 Δ	EFFECT	RESIDUAL Δ	EFFECT	ERROR
1924	18.84													0.0124		
	-0.330	(10^{-5}) x -0.211	-0.202	+2959	+0.931	+10	-1.855	+3.07	+0.961	1	+0.246	0	0	-0.0270	-0.410	-0.001
1925	18.51													-0.0146		
	-2.484	10^{-5} x -0.723	-0.650	- 956	-0.283	-10	+1.745	-10.30	-3.034	1	+0.231	+1	-0.706	+0.0146	+0.209	+0.004
1926	16.03													0		
	+0.630	10^{-5} x -0.844	-0.726	+ 661	+0.187	- 8	+1.336	- 4.57	-1.288	1	+0.221	-1	+0.676	+0.0164	+0.224	--
1927	16.66													0.0164		
	-0.209	10^{-5} x -0.508	-0.442	+ 510	+0.146	- 3	+0.506	- 1.23	-0.350	1	+0.224	0	0	-0.0213	-0.294	+0.001
1928	16.45													-0.0049		
	-0.299	10^{-5} x -0.431	-0.370	- 259	-0.073	- 3	+0.500	- 1.56	-0.439	1	+0.221	0	0	-0.0102	-0.139	+0.001
1929	16.15													-0.0151		
	-1.010	10^{-4} x 0.107	+0.889	-2973	-0.813	- 8	+1.289	-11.58	-3.151	1	+0.214	0	0	+0.0425	+0.561	+0.001
1930	15.14													0.0274		
	-1.920	10^{-4} x 0.119	+0.911	-3396	-0.856	-25	+3.716	-20.76	-5.209	1	+0.197	0	0	-0.0556	-0.677	+0.002
1931	13.22													-0.0282		
	+3.022	10^{-4} x 0.292	+2.308	-2420	-0.630	-35	+5.369	-17.77	-4.602	1	+0.203	0	0	+0.0304	+0.382	-0.008
1932	16.24													0.0022		
	+0.040	10^{-5} x -0.115	-0.099	+1211	+0.342	+19	-3.160	+ 9.00	+2.527	1	+0.221	0	0	+0.0154	+0.210	-0.001
1933	16.28													0.0176		
	+0.238	10^{-5} x -0.607	-0.524	+1936	+0.550	+22	-3.684	+15.89	+4.492	1	+0.222	0	0	-0.0597	-0.819	+0.001
1934	16.52													-0.0421		
	+0.595	10^{-5} x -0.309	-0.272	+ 426	+0.123	- 2	+0.342	- 2.06	-0.594	1	+0.227	0	0	+0.0551	+0.771	-0.002
1935	17.12													0.013		
	-0.631	10^{-5} x -0.602	-0.529	+ 953	+0.276	+ 5	-0.854	+ 0.74	+0.213	1	+0.226	0	0	+0.0024	+0.034	+0.003
1936	16.49													0.0154		
	-1.178	10^{-4} x -0.200	-1.68	+2246	+0.622	+10	-1.633	+ 5.62	+1.549	1	+0.217	0	0	-0.0184	-0.246	-0.005
1937	15.31													-0.0030		
	-0.974	10^{-5} x 0.519	+0.412	-1896	-0.496	+ 2	-0.308	- 3.34	-0.869	1	+0.204	0	0	+0.0065	+0.082	+0.001
1938	14.33													0.0036		

Note: UK share of exports of ten industrial countries.

TABLE 8.3 : Analysis of Changes in UK Export Volume (Share Equation)

Year	UK_{VOL}	X_{W9}	EFFECT	$\$X_c$	EFFECT	UV_{XUK}	EFFECT	UV_{XW9}	EFFECT	TIME	EFFECT	DUM 26	EFFECT	RESIDUAL	EFFECT	ERROR
	Δ	Δ		Δ		Δ		Δ		Δ		Δ		Δ		
1924																
	- 6	+ 167	+11.2	+2959	+125.2	+10	-249.6	+ 3.07	+129.4	1	+33.1	0	0	-0.0270	-55.2	-0.1
1927																
	-207	+ 624	+42.0	- 956	- 38.4	-10	+236.6	-10.30	-411.5	1	+31.4	+1	-95.7	+0.0146	+28.3	+0.3
1926																
	+256	+ 848	+61.8	+ 661	+ 26.9	- 8	+191.7	- 4.57	-184.9	1	+31.8	-1	+97.0	+0.0164	+32.2	-0.5
1927																
	+ 84	+ 586	+48.2	+ 510	+ 22.5	- 3	+ 78.1	- 1.23	- 54.1	1	+34.5	0	0	-0.0213	-45.4	+0.2
1928																
	+ 59	+ 551	+47.6	- 259	- 11.8	- 3	+ 80.7	- 1.56	- 70.9	1	+35.7	0	0	-0.0102	-22.5	+0.2
1929																
	-393	-1280	-101.2	-2973	-125.4	- 8	+199.0	-11.58	-486.2	1	+33.0	0	0	+0.0425	+86.6	+1.2
1930																
	-440	-1123	-66.2	-3396	-113.9	-25	+494.6	-20.76	-693.4	1	+26.2	0	0	-0.0556	-90.1	+2.8
1931																
	+ 5	-1944	-77.7	-2420	- 70.3	-35	+599.5	-17.77	-513.9	1	+22.7	0	0	+0.0304	+42.6	+2.1
1932																
	+ 16	+ 61	+ 1.6	+1211	+ 35.4	+19	-327.9	+ 9.00	+262.2	1	+22.9	0	0	+0.0154	+21.8	--
1933																
	+ 92	+ 339	+10.5	+1936	+ 58.8	+22	-394.1	+15.89	+480.6	1	+23.8	0	0	-0.0597	-87.6	--
1934																
	+104	+ 185	+ 7.0	+ 426	+ 13.8	- 2	+ 38.2	- 2.06	- 66.5	1	+25.3	0	0	+0.0551	+86.2	--
1935																
	+ 5	+ 387	+16.9	+ 953	+ 32.0	+ 5	- 98.9	+ 0.74	+ 24.7	1	+26.2	0	0	+0.0024	+ 3.9	+0.2
1936																
	+156	+1620	+92.4	+2246	+79.1	+10	-207.6	+ 5.62	+197.0	1	+27.5	0	0	-0.0184	-31.3	-1.1
1937																
	-212	- 478	-28.7	-1896	-65.6	+ 2	- 40.8	- 3.34	-115.1	1	+27.1	0	0	+0.0065	+10.9	+0.2
1938																

TABLE 8.4: Elasticities implied by Preferred Export Share Equation

YEAR	X_{W9}	$\$X_c$	UV_{XUK}	UV_{XW9}
1924	0.286	0.241	-2.113	2.908
1925	0.300	0.302	-2.235	2.971
1926	0.345	0.282	-2.113	2.759
1927	0.398	0.296	-2.015	2.665
1928	0.430	0.306	-1.978	2.639
1929	0.457	0.301	-1.942	2.607
1930	0.390	0.239	-1.844	2.369
1931	0.325	0.169	-1.539	1.940
1932	0.132	0.119	-1.111	1.574
1933	0.139	0.144	-1.343	1.760
1934	0.177	0.184	-1.612	2.087
1935	0.196	0.193	-1.588	2.045
1936	0.234	0.213	-1.649	2.060
1937	0.360	0.259	-1.771	2.176
1938	0.328	0.220	-1.795	2.107

Note: These are the elasticities of UK export volume with respect to each of the explanatory variables shown implied by the coefficient estimates of Equation (4.40).

TABLE 8.5: Effects of Competitiveness Changes on UK Export Volume

Year	UV_{XUK}	UV_{XW9}	COMP Δ	NET EFFECT TABLE 8.1	NET EFFECT TABLE 8.3
1924	173	141.04	122.7		
			+ 4.3	-113.0	-120.2
1925	183	144.11	127.0		
			+ 2.3	-122.1	-174.9
1926	173	133.81	129.3		
			- 1.6	+ 18.2	+ 6.8
1927	165	129.24	127.7		
			- 1.1	+ 26.4	+ 24.0
1928	162	128.01	126.6		
			- 0.9	+ 15.3	+ 9.8
1929	159	126.46	125.7		
			+ 5.7	-245.6	-287.2
1930	151	114.88	131.4		
			+ 2.5	-184.1	-198.8
1931	126	94.11	133.9		
			-14.7	+177.5	+ 85.6
1932	91	76.34	119.2		
			+ 9.7	-139.4	- 65.7
1933	110	85.34	128.9		
			+ 1.5	+ 69.7	+ 86.5
1934	132	101.23	130.4		
			+ 0.7	- 28.3	- 28.3
1935	130	99.17	131.1		
			+ 4.0	- 85.8	- 74.2
1936	135	99.91	135.1		
			+ 2.3	- 15.0	- 10.6
1937	145	105.53	137.4		
			+ 6.4	-163.3	-155.9
1938	147	102.19	143.8		
TOTAL			+21.1	-789.5	-903.1

TABLE 8.6: Effects of Competitiveness Changes on UK Export Share

Year	UV_{XUK}	UV_{XW9}	COMP	NET EFFECT TABLE 8.2
1924	173	141.04	122.7	
			+ 4.3	-0.894
1925	183	144.11	127.0	
			+ 2.3	-1.289
1926	173	133.81	129.3	
			- 1.6	+0.048
1927	165	129.24	127.7	
			- 1.1	+0.156
1928	162	128.01	126.6	
			- 0.9	+0.061
1929	159	126.46	125.7	
			+ 5.7	-1.862
1930	151	114.88	131.4	
			+ 2.5	-1.493
1931	126	94.11	133.9	
			-14.7	+0.767
1932	91	76.34	119.2	
			+ 9.7	-0.633
1933	110	85.34	128.9	
			+ 1.5	+0.808
1934	132	101.23	130.4	
			+ 0.7	-0.252
1935	130	99.17	131.1	
			+ 4.0	-0.641
1936	135	99.91	135.1	
			+ 2.3	-0.084
1937	145	105.53	137.4	
			+ 6.4	-1.177
1938	147	102.19	143.8	
TOTAL			+21.1	-6.485

TABLE 8.7: Estimated effects on UK Exports and Employment, in Key Sectors, of Loss of Competitiveness 1924-26

	Chemicals	Wool and Worsted	Cotton	Iron and Steel	Machinery	Vehicles
1. Effect on value of UK exports, $mns, 1924-26	- 3.3	-34.2	-73.7	-13.5	-15.7	- 6.2
2. (1) as % of value of UK exports in 1924	- 3.3	-12.6	- 8.7	- 4.3	- 6.4	- 7.4
3. (1) as % of total change in UK exports, 1924-26	-71.7	77.3	58.3	28.4	-37.7	-24.4
4. Estimated effect on volume of UK exports (1924 prices) £mn	- 0.7	- 7.7	-16.7	- 3.1	- 3.6	- 1.4
5. Estimated effect on employment 000 jobs	- 0.9	-12.8	-27.6	- 4.4	- 9.9	- 3.6
6. (5) as percentage of total employment in sector in 1924	0.5	1.0*	2.2*	1.4	2.3	0.8

*: % of total employment in textiles

TABLE 8.8: Estimated Effects on UK Exports and Employment, in Key Sectors, of Fall in Exports of Primary Producing Countries 1929-32

	Chemicals	Wool and Worsted	Cotton	Iron & Steel	Machinery	Vehicles
1. Effect on value of UK exports, $mns, 1929-32	-27.3	-92.0	-524.4	-242.9	-56.7	-126.9
2. (1) as % of value of UK exports in 1929	-24.1	-39.0	- 82.9	- 74.6	-16.7	-103.6
3. (1) as % of total change in UK exports 1929-32	51.0	56.5	124.3	108.0	26.5	164.0
4. Estimated effect on volume of UK exports (1930 prices) £mn	- 5.4	- 18.8	-105.5	- 49.0	-11.4	- 25.5
5. Estimated effect on employment, 000 jobs.	- 6.5	- 46.3	-258.9	- 88.0	-32.1	- 63.5
6. (5) as percentage of total employment in sector in 1930	4.0	4.3*	24.3*	29.2	7.6	12.6

*: % of total employment in textiles.

TABLE 8.9: Analysis of Changes in UK Coal Exports

Year	UK_{VOL}	$TWIP_{MA}$	EFFECT	$UVI_{88.UK}$	EFFECT	$UVI_{88.W9}$	EFFECT	TIME	EFFECT	DUM 26	EFFECT	RESIDUAL	EFFECT	ERROR
	Δ	Δ		Δ		Δ		Δ		Δ		Δ		
1924	351.7	100.0		1.000		1.000								
	-61.4	+ 4.6	+25.1	-0.080	+11.8	-0.113	-26.1	1	-13.6	0	0	-	-	-
1925	290.3	104.6		0.920		0.887						+0.0275		
	-173.0	+ 2.4	+ 8.1	-0.024	+ 2.4	+0.018	+ 2.8	1	- 8.6	+1	-183.6	-0.0275	- 5.60	+11.5
1926	117.3	107.0		0.896		0.905						0		
	+174.1	+ 2.0	+ 6.6	-0.052	+ 5.4	+0.035	+ 5.3	1	- 8.6	-1	+184.1	-0.0334	- 6.8	-11.9
1927	291.4	109.0		0.844		0.940						-0.0334		
	- 3.3	+ 5.7	+25.7	-0.106	+17.1	-0.079	-17.3	1	-12.3	0	0	-0.0571	-16.5	--
1928	288.1	114.7		0.738		0.861						-0.0905		
	+57.5	+ 5.2	+24.5	+0.018	- 3.4	+0.010	+ 2.5	1	-13.4	0	0	+0.1498	+47.5	- 0.2
1929	345.6	119.9		0.756		0.871						+0.0593		
	-32.5	- 2.6	-12.6	+0.021	- 4.0	+0.005	+ 1.3	1	-13.9	0	0	-0.0091	- 3.0	- 0.3
1930	313.1	117.3		0.777		0.876						+0.0502		
	-66.7	- 4.8	-20.4	-0.069	+11.4	-0.102	-23.5	1	-11.8	0	0	-0.0815	-22.8	+ 0.4
1931	246.4	112.5		0.708		0.774						-0.0313		
	-21.6	- 4.0	-14.9	-0.157	+25.8	-0.134	-30.3	1	-10.0	0	0	+0.0322	+ 7.6	+ 0.2
1932	224.8	108.5		0.551		0.640						+0.0009		
	+ 1.4	+ 2.7	+ 9.7	+0.110	-18.0	+0.058	+13.3	1	- 9.5	0	0	+0.0265	+ 6.0	- 0.1
1933	226.2	111.2		0.661		0.698						+0.0274		
	+ 2.3	+ 2.3	+ 8.1	+0.139	-19.0	+0.112	+22.9	1	- 9.6	0	0	+0.0003	+ 0.1	- 0.2
1934	228.5	113.5		0.800		0.810						+0.0277		
	- 3.8	+ 3.6	+12.3	-0.015	+ 1.9	-0.036	- 7.0	1	- 9.6	0	0	-0.0071	- 1.6	+ 0.2
1935	224.7	117.1		0.785		0.774						+0.0206		
	-24.3	+ 3.0	+ 9.4	+0.048	- 5.5	-0.014	- 2.6	1	- 9.0	0	0	-0.0777	-16.5	-0.1
1936	200.4	120.1		0.823		0.760						-0.0571		
	+32.9	+ 7.0	+21.4	+0.090	- 9.8	+0.102	+18.5	1	- 9.2	0	0	+0.0559	+12.1	- 0.1
1937	233.3	127.1		0.923		0.862						-0.0012		

Notes: (1) Volume of UK exports in 1924 dollars

Chapter Nine

CONCLUSIONS

The results obtained were primarily designed to answer questions of historical or macroeconomic policy interest, which we shall summarise in turn, but we consider first the contribution to theoretical discussions.

1. Theoretical and Methodological Issues

We noted in chapter 1 that this study is tangential to the testing of "purchasing power parity" theories of exchange rate determination, since we have taken the exchange rate as in part a policy-determined instrument. But several results suggest that strong forces existed between the wars tending to equalise prices even where exchange rates were pre-determined; we noted the surprising improvement in UK relative wholesale price competitiveness in Chapter 2, and also the pressure on the price of UK exports of coal (chapters 7 and 8). Nevertheless, this falls some way short of acceptance of a full "Scandinavian" model of price determination; the results in chapter 5 suggest that there was a domestic influence on trade prices which was of particular significance in the short term.

This result, which suggests that competitiveness (in the sense of UK export prices relative to those of other countries, affecting foreign demand) is open to domestic influence, if not wholly determined by exchange rate policy, is contingent upon our econometric results. Our contention that the theoretical/methodological issues involved in the construction of real and nominal exchange rate indices are of considerable importance is more robust. Chapter 2 showed that there are considerable differences in the profiles of indices constructed differently - as would be expected for a period of considerable exchange rate and price volatility. Although an index based on multilateral manufactured export weights, using geometric averaging, may not be "ideal" (and several criticisms were made even of our standard of comparison, the IMF MERM), it was, we argued, the most appropriate in the present context.

Our results also tend to confirm the importance of the choice of competitiveness variables, although we concluded, with Enoch (1978), that an eclectic and empirical approach might be most appropriate, given the theoretical and data problems with all measures. We would not necessarily expect our result that relative export prices were generally superior to relative costs in this period to apply at other times when relative difficulties of data collection were different.

A final methodological conclusion would be the repeated demonstration of the advantages of taking account of specific factors affecting both aggregate and sectoral export behaviour. While several of our econometric results were disappointing, substantial improvements resulted when, in the aggregate case, the specific pattern of UK markets (as distinct from general world trade) was allowed for. In the sectoral case, allowing for the specific geographic pattern of competition to the UK was also generally rewarded.

2. Policy Issues

Several issues of interest to economic historians remain important in other contexts to policy makers. The principal results in this class concern the exchange rate. Our results confirm that a policy for the sterling exchange rate against the dollar had complex consequences for sterling's overall international value. Other European currencies might have stabilized at even lower levels (or not at all) had not sterling returned to gold at the old dollar parity. It is also likely that a failure to devalue in 1931 might have entailed less subsequent pressure on the dollar and then on the "gold bloc" in Europe. Nevertheless, the medium-term loss of competitiveness against countries other than the US entailed by appreciation after 1920 and particularly after 1924, and the largely temporary gain of 1931, were of considerable importance. We showed later that these movements in exchange rates, and also movements in relative prices, had different implications for UK competitiveness in different sectors, due to the widespread differences in the geographic pattern of competition across sectors, and also in the coal sector due to very different price movements.

While we have stressed many problems connected with our econometric results, the conclusion that competitiveness had significant effects on export volume performance, and hence directly on employment in the main exporting sectors, seems fairly robust.[1]

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1. In the sense of recurring consistently under alternative specifications, with the preferred equation "surviving" the tests reported in Annex 4.1.

Moreover, our preferred estimate of the aggregate price elasticities suggests that exports were more responsive to price competitiveness inter-war than seems to be indicated in most of the work on the post-war period surveyed in chapter 3. The Marshall-Lerner condition was easily met on the export side alone, so even without a satisfactory import equation, we can reasonably conclude that the return to the Gold Standard weakened the current account ceteris paribus. On the other hand, although the departure from the Gold Standard was of itself a helpful development, its direct influence on exports was temporary, since the advantage in competitiveness was soon eroded; its consequent direct influence on employment was also dampened by the relatively smaller importance of exports in 1931 than in the mid-1920s.

This does not imply that the devaluation of 1931 was unimportant in other respects in the recovery from the depression of 1929-32; we have already described mechanisms by which exchange rate changes may have influenced the domestic economy in chapter 1. Moreover, to the extent that the economic policy of the UK influenced global conditions in this period, the downward pressure on activity and prices implied by the return to gold may have been unhelpful to primary producers. The series of devaluations set in motion by sterling in 1931, most importantly the larger devaluation of the dollar in 1933-4, probably helped to support commodity prices. As the primary producers were a vital market for the UK in this period, these "second-round" effects of exchange rate policy could be important (though extremely hard to measure).

3. Historical Issues

Perhaps our key conclusion of historical interest is that most of the slump in UK exports, and a good deal of the overall decline in the economy between 1929 and 1932, may have resulted from the collapse of exports by primary producing countries over this period; indeed, the early stages of this collapse may have contributed to the mildly disappointing performance of the UK relative to other industrial countries in 1928-1929. The recovery in UK exports during the 1930s, though too limited to make a major impact on economic activity at home, could in large part be attributed to the recovery of the primary producers.

Our sectoral analysis cast some doubts as to the size of the estimated aggregate effects of the primary producers' position, and, as noted in Chapter 4, it is inevitably difficult to disentangle trade prospects for the primary producing countries from those for the industrial countries (we return to this shortly); nevertheless, the general result was fairly robust.

From this conclusion, others follow. The effects of the violent fluctuations in foreign activity or UK exports seem to have been even more significant than movements in competitiveness. This might suggest that greater attention to these activity terms is more generally worthwhile in research work. It might also be held to support those in the UK who argued in the inter-war period that it would be worth accepting a measure of competitive disadvantage/domestic deflation in order to promote world trade more generally (although whether the chosen means supported those overseas markets of particular importance to the UK might be disputed).

We raised in the chapter 1 two explanations of the pattern of industrial recovery in the UK in the 1930s, which may be characterised as "cold bath" and "feather bed" theories: the first being that the shock of the slump prompted greater efficiency and productivity, while eliminating inefficient industries; the second being the notion that the combination of protection, devaluation, and "cheap money" provided a favourable environment for expansion. Chapter 8 suggested insights into the external contribution to the restructuring process. The "shocks" of the Return to Gold and the decline in the UK markets in 1929-31 naturally impacted relatively severely on industries which exported a high proportion of their output, notably the textile industry. But it appears that the exports of these sectors were in some cases particularly sensitive to the shocks. The most notable examples are the cotton industry and the iron and steel sector. Shifts in demand away from these sectors in the early 1930s when the large improvement in the UK terms of trade allowed a potential increase in domestic absorption was probably an important factor in restructuring in the 1930s not strictly consistent with either "cold bath" or "feather bed" views.

4. Research Issues

Several of the results obtained, and the data provided in the Statistical Appendix, open up avenues of related research. We note four here.

First, this study may be viewed in part as a contribution to full models of the inter-war UK economy more sophisticated than those of Thomas (1976) and Matthews (1985). Only within a full model can some of the simultaneous relationships present in the external sector be fully allowed for. Although we have suggested that the major results here seem not to be invalidated by simultaneity, some feed-backs could usefully be investigated, notably those from external prices on UK wholesale prices, and from export performance onto capacity utilisation.

Second, a full model would require an account of UK import behaviour. There appears to have been even less previous progress in this area than on the export side, since Thomas (1976)[1] has an equation which is not log-linear and fits indifferently, while Matthews (1985) takes no account of protection.[2] Unlike the export case, there is no separate import equation in Hatton (1982). It is difficult to quantify the effects of protection both after 1932 and immediately before it. But until this is accomplished, the multiplier estimated by Thomas quoted in chapter 8 must be regarded as highly tentative.

Third, there may be scope for absorbing the results in chapters 6 and 7 into more detailed analysis of key industrial sectors. Further progress would require estimates of unit values for other major sectors on the lines of those estimated for coal in chapter 7.

Finally, there would be much interest in further analysis of international interactions. Two major questions may be suggested.

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1. See Thomas (1981), p.342.

2. See Matthews (1985), table following p.11.

First, the determination of the terms of trade between manufactures and the exports of primary producers bears further examination; the decline in commodity prices has been identified by several authors[1] as a key cause of the world slump in the 1930s, and, from our results, this decline was of particular importance to the UK. Second, the relationship between trade volumes involving the industrial countries and trade flows of the "primary producing bloc" would be of interest both with reference to the UK result and more generally with regard to the process of development. Analysis of international economic co-ordination would be particularly informed by the role of exchange rate policy and activity in the industrial countries in influencing the international terms of trade.

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1. e.g. Latham (1981) pp.176-178.

STATISTICAL APPENDIX

Introduction

This Appendix provides further details on the sources and construction of the main series reported and used in the study, and presents individual series of particular interest. Further details, for example on individual country exchange rates, wholesale prices, unit labour costs and trade, are available from the author.

Sections are numbered as appendices to the chapters to which they mainly refer.

2.1 Exchange Rate Data

For 1924-30, these were taken from League of Nations Statistical Yearbooks. Earlier figures were from League of Nations Memoranda on Currency and Central Banks. Figures for 1931 onwards are from the Federal Reserve Bulletin, since these are given to a greater degree of accuracy than League of Nations alternatives. Figures are generally New York buying rates on cable transfers. Monthly figures are averages for calendar months; quarterly and annual figures are averages of relevant monthly figures. Prior to 1922, however, monthly averages quoted in the League of Nations Memoranda on Currency were calculated from weekly averages for Belgium, France, Italy, Netherlands, Switzerland, UK and Czechoslovakia, and by averaging biweekly quotations for Sweden, Canada, India and Japan.

Two countries changed their currencies during the period. Austria introduced the schilling at a rate of 10,000 paper kronen in December 1924, and Belgium introduced the belga in October 1926 at a value of 5 paper Belgian francs. We obtained continuous series by multiplication as appropriate.

The Indian rupee was revalued in February 1920 to a par of 24d (two shillings) against a previous par of 16d; League of Nations Memoranda do not quote a rupee exchange rate for January 1920. We constructed an estimate by taking quotations for sterling against the rupee and US dollars against sterling of 2nd, 9th, 16th, 23rd and 30th January, from the Statist, February 14th 1920, pp.300-301. We thus obtained estimates of US cents per rupee for each of the five dates, and averaged these five arithmetically.

The Anschluss entailed the disappearance of separate data for Austria after March 1938. We have assumed that the same exchange rate (cents per schilling) and Austrian wholesale price index continued throughout 1938. Austria had small weights in all the exchange rate indices constructed, so the error introduced is unlikely to be large. The assumption is justifiable; Austria, like Germany, had been pursuing a fixed exchange rate policy; Austrian prices were roughly constant in the first three months of 1938 and German prices were stable for the remainder of the year.

TABLE SA.1: Annual Exchange Rates 1920-39 (US cents per currency unit)

	Austria	Belgium-Lux	Czechoslovakia	France	Germany	Italy	Netherlands	Sweden	Switzerland	UK	Canada	India	Japan
1920	-	(36.78)[3]	1.60	7.01	-	4.95	34.41	20.49	16.91	366.0	88.68	(38.63)[4]	50.42
1921	-	(37.25)[3]	1.26	7.46	-	4.30	33.64	22.56	17.35	384.9	89.56	27.02	48.69
1922	-	(38.39)[3]	2.41	8.19	-	4.75	38.48	26.19	19.14	442.6	98.57	29.40	48.08
1923	-	(26.07)[3]	2.96	6.07	-	4.60	39.10	26.56	18.06	457.4	98.05	31.52	48.58
1924	(14)[1]	(23.19)[3]	2.95	5.23	23.08	4.36	38.22	26.53	18.23	441.8	98.75	32.24	41.20
1925	14.06	(23.80)[3]	2.97	4.77	23.80	3.98	40.16	26.86	19.33	482.9	99.98	36.73	41.03
1926	14.07	(16.38)[3]	2.96	3.25	23.80	3.89	40.10	26.77	19.31	485.8	100.00	36.56	47.11
1927	14.08	13.92	2.96	3.92	23.76	5.15	40.11	26.82	19.26	486.1	99.98	36.66	47.41
1928	14.07	13.93	2.96	3.92	23.86	5.26	40.22	26.80	19.26	486.6	99.91	36.47	46.41
1929	14.06	13.91	2.96	3.92	23.81	5.23	40.16	26.78	19.28	485.7	99.25	36.20	46.08
1930	14.09	13.95	2.96	3.92	23.85	5.24	40.22	26.85	19.38	486.2	99.84	36.07	49.39
1931	14.02	13.93	2.96	3.92	23.63	5.21	40.23	25.24	19.40	453.3	96.31	33.67	48.87
1932	13.96	13.91	2.96	3.93	23.75	5.13	40.29	18.47	19.41	350.4	88.08	26.33	28.13
1933	15.42	17.81	3.80	5.01	30.37	6.67	51.46	21.95	24.71	421.8	91.77	31.67	25.54
1934	18.79	23.28	4.24	6.58	39.38	8.56	67.38	25.98	32.36	504.1	101.01	37.87	29.71
1935	18.83	18.46	4.16	6.60	40.26	8.25	67.68	25.27	32.49	490.3	99.49	36.97	28.70
1936	18.79	16.92	4.00	6.12	40.30	7.28	64.40	25.62	30.13	497.1	99.92	37.52	29.02
1937	18.77	16.88	3.49	4.04	40.21	5.26	55.05	25.49	22.94	494.4	100.00	37.33	28.79
1938	18.92[2]	16.90	3.47	2.88	40.17	5.26	55.01	25.20	22.87	489.0	99.42	36.59	28.45

Notes:
1. US cents per paper kronen multiplied by 10,000. The schilling, introduced 20 December 1924, equalled 10,000 kronen.
2. Exchange rates for Apr.-Dec. 1938 assumed equal to March 1938.
3. US cents per belgian franc multiplied by five. The belga, equal to five paper francs, was introduced 26 October 1926.
4. See p.393.

2.2 Wholesale Prices

I. Introduction

Rebasing and revisions to data caused problems in constructing these series, in particular forming continuous country series for 1920-38. It was usually necessary to "splice" overlapping series covering less than the full period. In general we preferred to retained the longest possible run of data calculated on the most recent basis, since statistical methods tended to improve over the period. There was also a case for attempting to maximise the sum of data through the final reference base period (Jan.1924 = 100), especially where the country series were formed by arithmetic averaging, since changes relative to the reference base might be more meaningful within such a run.

Sub-series have been spliced[1] by comparing a selected period (t_1) for which observations are available in both "old" and "new" series. Let the "old base" observation be α_{11}, the "new base" observation be α_{21}. The spliced "old base" observations for $t_2 \ldots t_n$, = $\alpha_{12} \ldots \alpha_{1n}$, are given by multiplying "new base" observations $\alpha_{22} \ldots \alpha_{2n}$ by $\frac{\alpha_{11}}{\alpha_{21}}$, i.e.

$$\text{(SA.1)} \qquad \alpha_{1i} = \frac{\alpha_{11}}{\alpha_{21}} \cdot \alpha_{2i} \qquad\qquad i = 1 \ldots n$$

Data for all countries presented with reference base 1929 = 100 were given in League of Nations Statistical Yearbook (SYB) 1935/6 and onwards for 1933 and in League of Nations Monthly Bulletin of Statistics (MBS) April 1933 for 1931 and 1932. Weighting

1. See Allen (1975) pp.27-33.

bases vary; even in this period several countries used 1913 or 1914 as a weighting base. Earlier years were usually presented in the sources used with 1913/14 as reference base, and we have in general converted the post-1931 figures to the 1913/14 reference base before rescaling to Jan.1924 = 100.

II. Country Details

Austria.

Data from SYB; for 1924-31 at 1913/14 base; 1931 onwards on 1929 reference base spliced to earlier series by multiplying by 1929 annual average on 1913/14 base.

Belgium.

Satisfactory figures were not available for the first nine months of 1920, so Belgium has been omitted from wholesale price competitiveness calculations in that year. A series with October 1920 as reference base from MBS was used from January 1921. This was spliced with August 1921 as reference base to a continuous series available in MBS/SYB (as for Austria), including 130 commodities and chain-linked month by month.

Czechoslovakia.

No data for 1920. A series calculated by Professor Mildschuh was available for 1921 in MBS and the League of Nations Memorandum on Currency and Central Banks (MCCB), and was spliced, with December 1921 as the common observation, to the "official" series provided in MBS and SYB from December 1921 to December 1938.

France

An official series available in MCCB and MBS for 1920 and 1921 was spliced, with December 1921 as the common observation, to a continuous series available in MBS to 1924 (and 1931-2) and SYB otherwise. The weighting base for this series was an average of 1901-10, though the reference base was 1913 for observations to 1930 and 1929 thereafter.

Germany

A continuous official series was available in MBS and SYB for 1924-38.

Italy.

This was the most complex case. For early 1920, a series calculated by Professor Bachi was given in MCCB. This was spliced, using June 1920 as the common observation, to a series quoted in SYB and MBS running from June 1920 to May 1927. This second series, also a "Bachi" series, had various unsatisfactory features; it was constructed using arithmetic averaging and a 1901-5 average weighting base.

From May 1927 (the common observation) to 1938 a continuous series was available in SYB and MBS, with a 1928 weighting base, geometrically averaged. This series could have been used with retrospective observations calculated back through 1926. We preferred (just!) to use the Bachi series to preserve the longer data run through the final reference base (1924) and given doubts concerning the retrospective observations on the later series.

India

Figures for Calcutta were accepted throughout. The series available in MBS for 1923 to April 1928 was revised in MBS.[1] Observations for 1920-22 in MBS and MCCB were spliced to this revised series with January 1923 as the common observation. From April 1928 to end-1930 a "gold series" was available in SYB, spliced to the earlier series with April 1928 as the common observation. There was no common observation to splice to the 1931-8 series in MBS/SYB, but since this series had 1929 = 100, the 1929 average in the "gold series" was used as the common observation.

Japan

A continuous series calculated by the Bank of Japan was available from 1920 in MCCB, MBS and SYB (with post-1931 at a 1929 reference base). The weighting base for this series was October 1900, so its accuracy is highly suspect.

Netherlands

For January 1920 to November 1922 (common observation), a series was available in MBS and MCCB. The new series used was available for November 1922 to 1938[2] in MBS and SYB. Irregular observations on this series for earlier months in 1922 suggest that

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1. MBS November 1926, p.411.

2. Earliest figures from MBS January 1924, p.20.

errors of up to 3% may have been introduced by using the older series spliced at November 1922.

Sweden

A continuous official series (with the usual adjustment to 1913 from 1929 reference base for post-1931 observations) was available in SYB, MBS and MCCB from 1920.

Switzerland

No data available for 1920. For January 1921 to November 1927 (common observation) we used the "Lorenz" series available in MBS and MCCB. Thereafter we used the "official" series available in MBS and SYB (with the usual post-1931 adjustment).

UK

Official (Board of Trade) figures were used in preference to alternative series published by the Statist and the Economist. For 1920-30 a continuous series is available from MBS, MCCB and SYB. Revised figures for 1922 were given in MBS from February 1923 onwards and were used.

For 1931 onwards, a series with weighting and reference base 1930 was available in SYB. This was spliced to the earlier series using the average for 1930. Details of the new series are given in the Board of Trade Journal (24 January 1935, pp.i to xvi).

US

For January 1920 - December 1927, the Bureau of Labor Statistics series provided in MBS and MCCB was used. For December 1927 (common observation) to December 1930 a series with weighting and (original) reference base 1926 was used from SYB. 1931-8 figures from MBS and SYB were spliced to this second series with the 1929 average providing the common observation.

Canada

Figures for January 1920 - January 1922 (common observation), with an average of 1890-99(!) as the weighting base, were taken from MCCB and MBS. For January 1922 - November 1928 (common observation), a series on a 1913 base was available in MBS. Subsequent figures from MBS and SYB with a weighting base of 1926 were spliced to this series. The 1929 annual average was used as the common observation to shift from 1929 to 1913 as reference base for 1931-8 figures.

TABLE SA.2: Wholesale prices (1913 = 100)

	Austria	Belgium-Lux	Czechoslovakia	France	Germany	Italy	Netherlands	Sweden	Switzerland	UK	US	Canada	India	Japan
1920	-	-	-	509.4	-	624.2	280.8	358.8	-	307.8	226.5	222.5	199.4	259.6
1921	-	387.2	1454.0	344.9	-	577.5	181.2	222.1	191.2	198.2	147.2	164.0	176.8	200.5
1922	-	367.0	1299.0	326.7	-	562.3	159.6	172.7	167.5	158.8	149.3	152.1	175.7	196.0
1923	-	497.2	974.8	419.0	-	574.6	150.8	163.4	180.6	159.0	154.3	154.2	171.7	199.2
1924	135.7	573.1	999.9	488.5	137.6	585.0	155.8	162.2	174.6	166.1	150.0	155.1	172.8	206.5
1925	135.5	557.9	1001.1	549.8	141.6	689.9	154.7	161.2	161.6	159.2	158.5	160.1	159.3	201.6
1926	123.1	743.8	954.7	702.6	134.4	708.4	144.5	149.3	147.4	148.1	151.1	156.3	148.3	178.9
1927	132.8	846.9	979.0	617.2	137.6	589.9	147.8	146.2	147.7	141.4	146.7	151.3	147.8	169.8
1928	130.2	843.4	976.5	620.6	140.0	550.9	149.3	148.2	147.9	140.3	150.3	150.5	144.8	170.9
1929	130.1	850.9	916.2	610.4	137.2	531.6	141.8	140.1	144.4	136.7	148.7	149.5	140.7	166.2
1930	117.3	744.3	801.2	532.1	124.6	457.2	117.2	122.2	129.4	119.7	133.0	136.1	116.0	136.8
1931	109.2	625.6	733.5	486.9	110.9	392.0	96.8	110.9	112.2	105.1	113.9	112.9	95.8	115.8
1932	112.3	531.9	678.3	416.0	96.5	362.6	78.6	109.0	98.2	102.4	101.3	104.5	90.9	121.8
1933	108.2	500.8	658.1	387.8	93.3	333.1	73.8	107.4	93.1	102.6	102.9	105.0	87.2	135.7
1934	110.1	473.2	677.4	366.1	98.4	325.2	77.7	113.5	91.8	105.4	117.0	111.9	88.8	134.3
1935	109.8	536.7	705.1	329.5	101.8	359.1	77.8	115.9	91.8	106.5	124.9	112.7	90.5	140.2
1936	109.2	588.3	705.9	399.6	104.1	400.5	80.7	120.3	97.8	113.1	126.1	116.6	91.3	149.3
1937	113.2	684.0	751.6	565.8	105.9	469.9	96.0	137.2	113.8	130.2	134.6	132.2	101.9	180.1
1938	(111.0)[1]	630.0	741.6	635.5	105.7	503.5	90.9	130.0	109.5	121.5	122.6	122.9	95.0	190.0

Note: Austrian prices were assumed constant at their March 1938 level for the rest of 1938.

2.3 Construction of the "Real Exchange Rate" Series

Satisfactory wholesale price data were not available for 1920 for Belgium, Czechoslovakia, and Switzerland. The overall real exchange rate index (see formula p.63) was calculated for 1920 onwards with these countries excluded, and for 1921 onwards with these countries included; the 1920 "series" was then spliced to the 1921 series using 1921 Q1 as the common observation.

2.4 "Andrews" Weighting of the Effective Exchange Rate Indices: Notes on the Trade Statistics Used

Sources

The chief data source used for trade data disaggregated by commodity was the Bulletin of the Bureau International de Statistique Commerciale (BISC). This provides data on imports and exports, in local currency and gold francs, for most of the countries considered for 1922-1935 (see below). The data are broken down into 186 commodity groups and five principal categories. Category IV, wholly or mainly manufactured goods, is taken to define "manufactures" for the purpose of assigning multilateral manufactured export weights.

Data were available from BISC Bulletins for the following countries relevant to this study. Recall that 1922 and 1929 were the two years used as weighting bases in constructing the "Andrews" indices.

1922	1929
Belgium-Luxembourg	Belgium-Luxembourg
France	France
Sweden	Sweden
Switzerland	Switzerland
Czechoslovakia	Czechoslovakia
Austria	Austria
Germany	Germany
	Netherlands
	UK

League of Nations Memoranda on Trade (LMOT) gave local currency values for trade of the following additional countries by the BISC categories

1922	1929
USA	USA
Netherlands	Japan
	Italy

UK figures were not necessary to the construction of the foreign country weights. This left the following countries for which category IV trade had to be estimated.

1922	1929
India	India
Canada	Canada
Italy	
Japan	

Methodology for obtaining 1922 estimates for Italy and Japan

Data for exports of these countries were available in LMOT, for both 1922 and 1929, broken down into detailed commodity groups. These were sorted into BISC Categories I to V using the detailed Lexicon of Goods given in BISC Bulletins.[1] The problem remaining was to allocate "other" items between Category IV and the other categories.

In order both to control and to estimate the error introduced, three alternative methods of allocation were used. The same overall methodology was adopted for Italy and Japan. The three alternative

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1. See e.g. the 1922 Bulletin, p.XLVI.

total figures for Category IV were arithmetically averaged. These local currency estimates were then converted to gold francs by first converting to dollars at the annual average exchange rate and then converting at 19.2954 US cents per gold franc, the appropriate rate until 1933.

Method 1

Assume that Category IV exports formed the same proportion of aggregate exports in 1922 as in 1929 (when precise data were available.

Method 2

Consider the value of exports which could be allocated by category in 1922. Calculate the proportion of this total in Category IV. Assume that Category IV exports accounted for the same proportion of unallocated exports.

Method 3

For both Italy and Japan, details given in LMOT were more extensive for 1929 than for 1922. Items included specifically in 1929 but not in 1922 were subtracted from 1929 figures for the relevant categories. It was then possible to calculate (given the 1929 breakdown of trade by categories) what proportion of the "other" exports (on a 1922 basis) belonged to Category IV in 1929. This proportion was applied to the "other" figure for 1922 and the result added to the explicit Category IV figure. A slight adjustment to this procedure was necessitated by an item in Japanese exports listed separately in the 1922 LMOT breakdown but not in the 1929 breakdown.

This was added to the 1922 "other" items when applying the 1929 "1922-based" proportions in Category IV to the 1922 "other items" total.

These three methods produced 1922 estimates within a range of 2% of the arithmetic average of the three for Italy, but of 10% of the average for Japan.

Methodology for obtaining 1922 and 1929 estimates for India and Canada

The following additional sources were used to obtain more extensive commodity details of exports than available in LMOT.

India: "Statistical Abstract for British India, with statistics relating to certain Indian states, from 1920-1 to 1929-30". Cmd. 4109. Table 210.

Canada. "Statistical Abstract for the British Empire for each of the years 1913 and 1924-9". Cmd. 3919.

Individual commodity exports listed were classified using the BISC Lexicon. A proportion of the unclassified items (which for neither country, and for none of the years concerned, exceeded 15% of total domestic exports and were in general substantially less) was then allocated to Category IV according to the proportion of Category IV exports within the total of classified items.

Figures for both India and Canada were reported in financial years. To obtain calendar year estimates, 1922 figures were computed as 0.25 of the 1921/2 totals plus 0.75 of the 1922/3 totals. An analogous procedure was used for 1929. Examination of monthly aggregate figures in LMOT suggested this was a good approximation.

4.1 Aggregate Trade Volume and Price Data

Sources and Methods

The empirical work on trade behaviour in this study treats nine foreign countries as key industrial competitors of the UK. From the thirteen included in chapter 2, we eliminated Austria, Czechoslovakia and India due to absence of individual data in the principal source, Maddison (1962). Canada could not be included in the disaggregated study of exports (Chapters 6 and 7) due to absence of appropriate BISC or LMOT data, and was excluded here for consistency. This left nine countries: Belgium-Luxembourg; France; Germany; Italy; Netherlands; Sweden; Switzerland; Japan; and USA, in addition to the UK.

Within this group, Maddison did not provide data for 1924 for Belgium-Luxembourg, or for Japan throughout. The importance of these countries' exports as competition to the UK (Belgium in most sectors, Japan in textiles, cf. Table SA.20) necessitated their inclusion.

Throughout this study (and in the calculation of Maddison's data), trade values (on which data are readily available) have been assumed equal to unit value * volume, so that it is only necessary to construct either a price or a volume series to derive the other. Current British usage defines both volume and unit value indices as base-weighted series, with value = average value index * volume.[1] Over time, goods tending to rise in price relatively less rapidly

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1. Bond and Brown (1980) p.296 fn. note that this usage is not universal.

would be expected to have an increasing share in demand, so that the average value index may grow less rapidly than a true unit value index. Thus:

(i) a volume index constructed by dividing value by UVI may tend to understate "true" volume;

(ii) a UVI constructed by dividing value by volume may tend to understate "true" UVI.

Data for Japan were constructed as follows. First, annual value data[1] (local currency) were derived from successive issues of LMOT (taking the last figure provided for each year as authoritative). We then constructed a 1913-based yen price series. Data for 1923 to 1936 (with 1927 = 100) were available in the League of Nations Review of World Trade (LRWT) (1938). Subsequent issues of LRWT report for 1936-8 a series derived from the Oriental Economist with 1928 = 100. This was spliced to LRWT with 1936 as common observation. Data for 1921-5 with 1913 = 100 were available in the League of Nations Memorandum on Balance of Payments etc. 1912-26, and were spliced to LRWT with 1923 as common observation. The resulting 1913-based price series was multiplied by an index of the yen exchange rate against the dollar (an index of 100

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1. There are problems of detail with definitions of "trade" in work on inter-war data, though these should not affect year-to-year changes excessively. "Trade" for Japan is here understood to be special trade excluding bullion. See e.g. League of Nations Memoranda on Balance of Payments (forerunners to LMOT), 1912-26, volume II, pp.5-29 for general details on trade definitions.

being represented by the pre-war par of US c49.846 = 1 yen). This yielded a dollar price series which was used to divide dollar values of Japanese exports to produce a volume series in 1913 dollars. An analogous methodology was used to construct Japanese import UVI and volume series.

Export price data for Belgium-Luxembourg were not available in League of Nations sources. The volume figures in Maddison (1962) were extended back to 1924 using data from LMOT on the weight in metric tons of Belgian exports for 1924 and 1925, assuming that the increase of 3.5% in the weight of Belgian exports reflected a proportionate increase in true export volume. Value data were available in Maddison (1962) from 1921. Unit value data could thus be extended back to 1924 by dividing the value figure by the volume figure for 1924.

The regressions in chapter 4 onwards were run on volume series constructed by multiplying volume indices (generally provided by Maddison (1962)) by the 1913 (base year) figure. Table SA.3 provides the individual country export volumes and Table SA.4 the import volume series constructed.[1] Alternative export volume series calculated from revised volume indices given in Maddison (1982) gave rather higher figures for Japanese exports towards the end of the period, and a lower figure for German exports in 1924.

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1. Note the discrepancy between exports and imports. Maddison (1962) gives exports f.o.b. (free on board) but imports c.i.f. (cost, insurance and freight).

Table SA.5 gives the export unit value indices associated with the volume series in Table SA.3. These are direct from Maddison (1962) except for Japan, and for Belgium in 1924. These were not used directly in constructing the unit value index for industrial country exports used in chapter 4. Rather, we divided the value of exports of these nine countries in total by their total export volume.

The UK volume series was compared with that in Feinstein (1972) Table 5. The two series moved closely together in the 1920s. The Feinstein series fell proportionately less than Maddison's between 1929 and 1932. Precise correspondence would not be expected, given that Feinstein's series included exports of services.

Table SA.3: Export Volumes

f.o.b. 1913 $mn

	Belgium Lux.	France	Germany	Italy	Netherlands	Sweden	Switzer-land	US	Japan	UK	Others	World
1924	504	1580	1900	570	445	207	232	2942	436	2047	8900	19763
1925	522	1647	1573	657	477	218	239	3120	530	2041	10284	21308
1926	548	1780	1864	605	501	221	230	3315	543	1834	10530	21971
1927	692	1939	1917	634	560	272	261	3584	596	2090	11229	23774
1928	773	1965	2181	644	591	269	293	3701	624	2174	11608	24823
1929	769	1952	2434	712	601	316	268	3837	703	2233	12212	26037
1930	665	1753	2311	694	571	291	240	3139	648	1840	12137	24289
1931	677	1487	2116	700	532	236	205	2568	668	1400	11787	22376
1932	527	1142	1438	574	437	212	134	2004	777	1405	10413	19063
1933	545	1169	1354	590	417	256	140	1975	860	1421	10852	19579
1934	563	1208	1224	545	427	302	167	2159	1050	1513	11157	20315
1935	627	1089	1304	543	421	306	166	2235	1179	1617	11932	21419
1936	702	1036	1436	485	437	344	169	2373	1235	1622	12537	22376
1937	798	1116	1664	764	540	405	202	3051	1297	1778	13613	25228
1938	734	1208	1503	747	492	339	211	3044	1081	1566	12665	23590

Sources: Maddison (1962), LMOT.

TABLE SA.4: Import Volumes (c.i.f. 1913 $mn)

	Belgium-Lux	France	Germany	Italy	Netherlands	Sweden	Switzerland	UK	US	Japan	Others	World
1924	650	1869	1613	705	661	303	313	3566	2832	574	8763	21849
1925	641	1723	2144	809	676	283	318	3659	3046	530	9729	23558
1926	613	1804	1903	833	731	305	319	3820	3286	589	10088	24291
1927	709	1771	2727	814	774	340	327	3916	3318	610	10978	26284
1928	773	1885	2647	953	818	369	350	3820	3356	600	11873	27444
1929	907	2161	2542	950	864	385	360	4034	3834	630	12120	28787
1930	888	2324	2270	895	838	398	385	3983	3266	554	11053	26854
1931	892	2291	1929	759	846	372	393	4092	2874	622	9668	24738
1932	726	1918	1793	684	718	304	363	3560	2316	589	8105	21076
1933	725	1999	1760	672	780	306	363	3595	2556	621	8269	21646
1934	726	1723	1890	731	744	363	326	3685	2510	674	9088	22460
1935	758	1674	1678	714	650	408	323	3720	3106	706	9943	23680
1936	818	1836	1621	446	664	460	308	3993	3418	769	10405	24738
1937	1084	1950	1911	674	748	542	340	4246	3908	825	11664	27892
1938	957	1739	2250	572	736	529	311	4073	2754	607	11553	26081

Sources: Maddison (1962), LMOT.

TABLE SA.5: Export Unit Value Index (1913 = 100. Current dollars)

	Belgium-Lux	France	Germany	Italy	Netherlands	Sweden	Switzerland	US	Japan	UK	9 Foreign countries
1924	128	140	128	110	143	163	157	153	166.4	173	141.0
1925	132	133	133	111	152	167	165	154	172.0	183	144.1
1926	119	109	133	120	140	172	153	142	171.1	173	133.8
1927	107	111	134	127	136	159	148	133	152.2	165	129.2
1928	111	103	134	119	135	157	152	136	142.0	162	128.0
1929	115	101	132	110	133	154	151	134	137.6	159	126.5
1930	109	96	124	92	121	143	143	120	109.1	151	114.9
1931	95	80	108	76	99	119	128	93	81.7	126	94.1
1932	78	68	95	61	78	82	116	79	49.3	91	76.3
1933	92	80	110	68	90	93	134	83	54.3	110	85.3
1934	112	97	136	82	112	112	164	97	60.4	132	101.2
1935	92	94	132	80	109	108	161	100	59.7	130	99.2
1936	94	91	134	79	109	113	158	102	61.8	135	99.9
1937	107	87	143	72	117	126	146	108	69.4	145	105.5
1938	99	73	150	74	116	137	143	100	70.2	147	102.2

Sources: Maddison (1962), LMOT.

4.2 Geographical Distribution of World Trade

LMOT, various issues from 1912-26 to 1938, provide detailed data on the percentages of each main country's exports and imports to and from each other country. These percentages were multiplied by the trade values and volumes calculated from Maddison to provide an 11 * 11 matrix of world trade (9 industrial foreign countries, UK, and "rest of the world") for each year 1924 to 1938. A minor problem was caused by incomplete coverage of the sources of imports into Italy in 1923-4. Figures for Belgium-Luxembourg, Japan, Netherlands and Sweden had to be constructed using figures for those countries' exports to Italy and adjusting by a c.i.f./f.o.b. factor[1] derived from the ratio between UK exports to Italy and Italian imports from the UK.

Our applications of this trade matrix are relatively limited. Table SA.6 has been constructed to show the interdependence of the UK and "primary producing" countries. Table SA.7 shows weights of the industrial countries used in constructing a "unit value index of imports from industrial countries" series in turn used in forming the primary producers' capacity to import term tested in, e.g., equations 4.20 and 4.21.

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1. Similar adjustments had to be made for "rest of world" exports and imports derived from trade of the individual industrial countries, in this case from the aggregate figures.

The constructed matrix was also used to form the series WTMV, an index of world import volumes with individual countries'import volumes weighted according to their importance as UK markets. Weights were derived from UK exports in 1929, and were as follows:

Belgium-Luxembourg	2.66	Sweden	1.45
France	4.34	Switzerland	0.88
Germany	5.07	Japan	1.84
Italy	2.19	USA	6.25
Netherlands	2.99	Rest of World	72.33

The resulting series for WTMV was as follows:

1924	100.0	1932	94.6
1925	109.6	1933	96.9
1926	113.2	1934	103.7
1927	123.4	1935	111.3
1928	132.1	1936	115.4
1929	136.7	1937	130.9
1930	125.8	1938	125.8
1931	112.1		

TABLE SA.6: Value of Exports, Major Groupings (current dollars)

	Exports by UK		Exports by W9			Exports by WR		
	To W9	to WR	To other W9	To UK	To WR	To W9	To UK	To other WR
1924	1125	2414	5026	2138	5270	5843	2807	2973
1925	1091	2644	5127	2302	5516	6768	3078	4735
1926	809	2364	4992	2154	5709	6590	2748	4286
1927	944	2503	5355	2095	6062	6905	2816	4565
1928	965	2557	5562	2011	6561	7131	2845	4820
1929	980	2570	5723	2051	6885	7189	2901	4448
1930	758	2020	4670	1765	5410	5439	2464	3661
1931	501	1263	3463	1389	3797	3944	1919	2305
1932	328	950	2347	711	2473	2739	1403	1606
1933	416	1147	2724	793	2718	3290	1705	1964
1934	487	1508	3183	1004	3552	3846	2214	2835
1935	511	1591	2971	1044	3750	4481	2216	2625
1936	524	1667	2959	1093	4158	4922	2555	2797
1937	632	1947	3712	1301	5368	6354	3045	3121
1938	490	1812	3283	1211	5070	4894	2666	3065

TABLE SA.7: Weights in imports of the primary producing group from ten industrial countries

	Belgium	France	Germany	Italy	Japan	Netherlands	Sweden	Switzerland	US	UK
1924	2.07	9.68	16.78	3.52	4.68	1.82	1.36	1.52	27.16	31.41
1925	2.25	9.29	12.87	3.99	5.59	2.19	1.39	1.51	28.52	32.41
1926	2.04	9.01	13.81	4.04	5.98	2.41	1.51	1.56	30.35	29.28
1927	2.71	8.87	14.15	4.21	5.40	2.48	1.60	1.57	29.78	29.22
1928	2.71	8.73	15.49	3.95	4.90	2.75	1.69	1.61	30.12	28.04
1929	2.86	8.25	15.59	3.88	5.24	2.67	1.74	1.45	31.14	27.18
1930	2.85	9.20	16.75	3.77	5.49	2.71	1.92	1.59	28.55	27.18
1931	3.27	10.00	19.52	4.72	5.91	2.72	1.94	1.67	25.29	24.96
1932	3.43	11.29	17.81	4.83	6.75	2.57	1.94	1.48	22.15	27.75
1933	3.90	12.17	15.83	4.74	7.79	2.50	2.05	1.51	19.81	29.68
1934	3.87	11.58	13.65	4.00	9.03	2.48	2.30	1.67	21.62	29.80
1935	3.37	9.86	15.38	4.03	9.11	2.49	2.09	1.57	22.30	29.79
1936	3.41	8.55	17.66	3.68	8.89	2.53	2.18	1.47	23.01	28.62
1937	3.79	6.42	17.93	4.45	8.58	2.93	2.30	1.41	25.57	26.62
1938	3.47	6.23	18.69	4.50	8.31	2.97	2.32	1.60	25.59	26.33

Note: Derived from trade values in current dollars.

NOTES TO TABLES SA.6 and SA.7

1. W9 denotes nine industrial countries as in Table T4.1.
   WR denotes rest of the world, excluding UK and W9.

2. The calculations remain approximate. Percentages are only given in LMOT to 1 decimal place, and are strictly applicable not to Maddison's adjusted data but to aggregates unadjusted (e.g. for bullion trade) by the League of Nations. Rounding errors may be present.

4.3 Deflators of Primary Producers' Export Value Terms

Two alternative deflators of $Xc were tested, e.g. on pp.189-191. First, the unit value index for ten industrial countries (W9 plus the UK) was formed as $100 * \frac{\text{value of exports}}{\text{volume of exports}}$ with value data from Table SA.6 and volume data from Table SA.3. Second, these ten countries were weighted according to their shares in primary producers' imports (Table SA.7). The resulting series were as follows:

Table SA.T1 (1913 = 100)

	$UV_{X.WI}$	$UV_{X.WI/MC}$
1924	147.0	152.4
1925	151.3	157.8
1926	140.1	147.8
1927	135.2	141.3
1928	133.6	139.6
1929	131.7	137.1
1930	120.3	125.8
1931	98.3	102.7
1932	78.7	81.6
1933	89.4	93.5
1934	106.3	111.2
1935	104.0	109.9
1936	105.7	112.7
1937	111.6	119.0
1938	108.6	118.4

4.4 Measures of UK Demand Pressure

Two measures of demand pressure were tested in regressions reported on pp.193-195. These were

(i) CYC_{UK}: UK GDP relative to "trend", where trend GDP is constructed by assuming constant growth rates from 1924 to 1929 and from 1929 to 1937, extrapolating the latter to 1938. Data are GDP at 1938 factor cost from Feinstein (1972), Table 5. p.T16, standardised to 1924 = 100.

(ii) CU_{UK}: UK capacity utilisation. This series was kindly provided by Nicholas Dimsdale. He describes it as a "Wharton Index of Capacity utilisation for some twelve industries".

The series are as follows:

Table SA.T2

	CYC_{UK}	CU_{UK}
1924	100.0	90.62
1925	103.3	91.31
1926	96.3	84.63
1927	101.4	94.14
1928	101.3	90.74
1929	101.7	92.93
1930	99.6	85.68
1931	92.4	79.19
1932	91.3	76.94
1933	90.4	79.85
1934	95.0	85.64

1935	96.7	90.14
1936	97.7	95.65
1937	100.0	98.93
1938	101.2	94.40

1929 was chosen as the cyclical peak in mid-period. 1924 was the pre-1929 year with unemployment closest to the 1929 rate (see Table 4.2)[1]. 1937 was generally the peak year post-1929 for activity in the UK and worldwide, although this is not reflected in the CYC_{UK} measure.

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1. Feinstein (1972) Table 58 gives figures for aggregate unemployment which confirm this. Unemployment among total employees was 8% in 1929; 7.9% in 1924 (and for comparison 8.6% in 1925 and 7.4% in 1927); and 8.5% in 1937, the only year after 1929 in which unemployment stood below 10%.

4.5 Unit Labour Costs

(1) Introduction

This section reviews the data on wages and output per head which were used to construct aggregate unit labour cost and normalised unit labour cost series for the UK and the nine main foreign industrial countries, and hence relative unit labour cost and relative normalised unit labour cost terms for the UK. Analogous series were constructed for coal and are discussed in section 7.2 below.

The data problems encountered entailed the construction of several alternative ULC and RULC series. These series are necessarily illustrative rather than authoritative, and the poor regression results obtained using unit labour cost measures in chapters 4-6 may reflect the data problems. It should be noted that all the weighting schemes used in constructing RULC and RNULC refer to single year trade patterns, and may consequently be inferior to the moving weights implied in the construction of the UVI for industrial countries. Seven RULC/RNULC series are constructed for the UK; one derived directly from Phelps Brown and Browne (1968)[1] (PB); six constructed by combining two alternative sets of wage data with three alternative measures of output per head.

2. Wages

The two sets of wage series used are given in Tables SA.8 and SA.9. PB gives detailed calculations of annual earnings per head,

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1. PB, Appendix 3.

based on national accounts, census of production and census data as available, for UK, US, France, Germany and Sweden. These series are used in set 1 (SA.8) together with calculated series for Belgium, Italy, Netherlands, Switzerland and Japan. Set 2 comprised the same series for the latter five countries together with series calculated by similar sources and methodology for the former five.

Country details of the calculated series are as follows:

Belgium: Wages of males in industry and transport from Mitchell (1978).[1] This series corresponds closely to the series for hourly earnings in mines, industries and transport in ILO Yearbooks of Labour Statistics (YLS).

France: ILO YLS (1939) figures for Paris and towns other than Paris, males, chiefly skilled, hourly wage rates. These two series were extended back to 1924 separately, using figures given in "Statistics Showing Movements in the General Level of Wages" in International Labour Review (1929). They were then averaged (with weights Paris 4/31, other towns 27/31, derived from PB[2]).

Germany Mitchell (1978), weekly wage rates.

Italy Index of weekly wages, Mitchell (1978).

Japan Mitchell (1982), daily male wages in manufacturing, was used from 1926. ILO "Wage Changes in Various Countries 1914-25"

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1. Mitchell (1978) p.73.
2. PB Appendix 1.

gives male daily earnings in the coal industry as 1.77 yen in 1924. YLS (1939) gives 1.876 yen as the corresponding figure for 1927; the 1934 SYB, Table 1, gives a 5% rise in daily earnings in mines (male and female) between 1926 and 1927,[1] implying a 1926 figure of 1.787. Interpolation suggests 1.778 for 1925. These figures - very unsatisfactorily - were used to extend the Mitchell series back to 1924.

Netherlands. Figures up to 1930 were for Tinbergen (1934), index of hourly earnings. This is unsatisfactory - industries included are not weighted systematically - but the series corresponds closely to ILO YLS (1933) where common observations are available. The series was extended forward using the index of hourly earnings in YLS (1939). All these series refer to males, skilled and unskilled.

Sweden: Mitchell (1975), daily wages in industry and commerce.

Switzerland: Mitchell (1975), index of weekly earnings, males only. This series, based on ILO sources, is derived from earnings of accident victims. Coverage is hence limited and may be unrepresentative.

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1. The Mitchell (1982) series for manufacturing shows no increase between 1926 and 1927; no increase is incorporated in Set 1, i.e YLS series are used only for 1924-6.

UK: Mitchell (1975). Weekly wages in June in all industries and services. It is not stated whether the series is for wage rates or wage earnings; the series corresponds closely to Feinstein's (1972) series in turn derived from Chapman and Knight (1953) relating to weekly earnings.

US ILO YLS (1939) series on weekly earnings, originally given by the National Industrial Conference Board (NICB), from 1927.

For 1926 and earlier, the NICB series published in International Labour Review (1929) was used. This series referred to the fourth quarter of each year. Successive Q4 figures were averaged to form "calendar year" data for 1924-7. The resulting index was spliced to the 1927-38 series with 1927 as common observation.

3. Output per Head Series

PB data for UK, US, Germany and Sweden were used only in the "Phelps Brown" unit labour cost series (see Table SA.13, first column). The three sets of output per head data constructed as described here are given in Tables SA.10 to SA. 2.

Set 1 Trend output per head indices (1924 = 100) were constructed using growth rates in GDP per man-hour given by Maddison (1979).

Compound % p.a. Growth Rates

GDP per man-hour 1913-50

Belgium	1.5	Netherlands	1.5
France	1.7	Sweden	2.9
Germany	1.2	Switzerland	1.9

Italy	1.8	UK	1.5
Japan	1.4	US	2.5

This set may be unsatisfactory, since the wars affected these countries very differently.

Set 2 For all ten countries, figures for volume of total output were taken from Maddison (1977). This was to be divided by an index of the employed labour force. For nine of these countries (Japan being the exception), Maddison (1977) also gives annual data on the labour force by interpolating between census data. For "benchmark" years - 1913, 1929 and 1938 - Maddison (1979) gives hours worked per head. It would in principle be possible to give trends in output per man-hour using these figures. However, 1929 was a year of high activity in the industrial countries while 1938 was generally a year of weaker activity. An adjustment based on such a trend (and its backward extension to 1924) might therefore be seriously misleading. Moreover, hourly wage data were not uniformly available. Data on the economically active labour force in Japan in 1920, 1930 and 1940 were taken from Mitchell (1982), and interpolation was used to provide a continuous series.

The crude labour force indices were adjusted by unemployment (% rates) to form indices of the employed labour force. Maddison (1980) provided figures for Belgium, Germany, Netherlands, Sweden, UK and US. Procedures for the other countries are described below. Extensive interpolation was involved. This, however, gave more plausible results than direct interpolation of output per head data from the years for which unemployment figures were available. (The latter procedure would in some cases have implied employment higher than total active labour force).

France Maddison (1980) gives unemployment figures for 1921, 1926, 1929, 1931, 1936 and 1938. Between 1921 and 1926, the resulting unemployment-adjusted labour force figures have been interpolated.

For 1927 onwards, ILO YLS 1938 gives figures for applications for work, with a discontinuity in 1931/2. Unemployment percentages for 1927, 1928 and 1930 have been calculated by multiplying Maddison's 1929 unemployment percentage by the ratio of applications in 1927, 1928 and 1930 to applications in 1929. Unemployment percentages for 1932-1935 and 1937 have been calculated similarly with Maddison's 1936 unemployment figure as the base.

Italy Maddison (1980) gives unemployment percentages for 1913, 1929-34, and 1937-8. The 1932 ILO YLS gives June and December figures for total unemployed for 1925-1930; 1935 YLS gives annual average figures for 1927-32. To obtain annual averages for 1925 and 1926 from June and December figures, these two months had "weights" calculated which were such that, applied to the June and December figures for the sum of the four years 1927-1930, the aggregate for those four years would be obtained.

Unemployment percentages for 1925-9 were then calculated using these annual aggregates and Maddison's 1929 percentage figure. It was crudely assumed that the 1925 unemployment level also prevailed in

1924. 1935 and 1936 figures were obtained by interpolating the employment-adjusted labour force from 1924-37.

Switzerland: Inspection suggested little relationship between the Maddison unemployment percentages available and used for 1929 onwards and the data in YLS 1932. Figures for total volume of output in Maddison (1977) for 1924-9 suggested a growth rate sufficiently smooth for an assumption that unemployment was constant in this period not to be unreasonable, particularly given Switzerland's minor importance in the final UK RULC series.

Japan: Percentage figures for unemployment 1930-38 were from Mitchell (1982). For 1926-33, YLS (1933) gave an index of employment in industry in Japan. This index showed a fall of 9.3% between 1930 and 1931, corresponding to a rise of 0.8 percentage points in unemployment (5.3 to 6.1). The factor $\frac{0.8}{9.3}$ was then used to convert percentage changes in employment in industry 1930 back to 1926 to percentage point changes in unemployment. It was assumed that unemployment was constant 1924-6.

These assumptions, especially for Japan and Switzerland, are clearly crude. We defend the construction by noting:

(i) The resulting output per head series are plausible;

(ii) The labour force unemployment adjustment made relatively little different in the 1920s (when data problems for Switzerland and Japan are most acute) for countries on which better data are available;

(iii) The weights of Switzerland and Japan in RULC are small.

(iv) Alternative sources on output were also unsatisfactory. Mitchell (1978) and (1982) gives industrial output for several countries (but not the US). League of Nations Memoranda on Production and Prices give series for industrial production after 1925, and output per man and per man hour after 1929 for key countries. OEEC (later OECD) Industrial Statistics (various issues) also gives series on industrial production. But the various series correlate poorly with each other. Any splicing procedure would inevitably be as arbitrary as those used in our preferred construction.

(v) Regression analysis suggested that the information gained by including countries additional to those for which PB provides data had some explanatory power.

The output and employment figures used refer to aggregate output and labour force rather than to manufacturing only. This may in practice be an advantage in work on aggregate trade, but may be less appropriate to the sectoral analysis in chapter 6. Output per head in the whole economy tends to grow less rapidly (and exhibit less violent fluctuations) than in manufacturing. Faster growing countries tend to have particularly rapid growth in manufacturing relative to the rest of the economy.[1] We may therefore tend to underestimate the competitiveness (overestimate the unit labour costs) of key manufacturing sectors of rapidly growing countries towards the end of the period.

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1. See for example Krugman (1986).

Set 3 Set 2 data for each country for 1924, 1929 and 1937 were taken as benchmarks (cf. the procedure for CYC_{UK}) and "potential" or "trend" output per head was constructed by interpolating a constant growth rate between benchmarks.

TABLE SA.8: Wage Indices Set 1

Year	UK	Belgium	France	Germany	Italy	Netherlands	Sweden	Switzerland	USA	Japan
1924	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1925	100.7	88.7	107.9	135.2	111.8	97.0	102.3	100.0	102.3	100.5
1926	97.9	85.8	126.3	140.3	120.4	98.0	104.4	101.0	103.9	103.0
1927	100.0	87.7	130.3	149.1	119.4	99.0	106.2	101.0	103.4	103.0
1928	98.6	91.5	136.8	160.7	109.7	99.0	104.3	101.0	104.5	105.0
1929	98.9	94.3	157.9	171.1	107.5	103.0	107.4	103.1	105.4	107.0
1930	98.5	100.0	163.2	172.9	106.5	105.1	110.5	104.1	98.6	103.0
1931	96.7	93.4	160.5	159.5	98.9	103.0	106.4	105.2	89.4	98.9
1932	94.7	85.8	144.7	137.4	93.5	95.8	100.6	101.0	73.9	102.0
1933	93.9	83.0	144.7	131.8	90.3	91.6	98.9	99.0	72.8	103.0
1934	95.0	79.2	144.7	133.6	87.1	88.6	102.7	96.9	79.8	101.0
1935	96.5	76.4	140.8	136.9	83.9	85.5	105.0	94.8	87.3	98.9
1936	98.7	83.0	159.2	140.7	83.9	83.4	107.8	92.8	94.1	97.9
1937	101.3	91.5	188.2	144.8	87.1	84.4	112.4	91.8	102.5	100.0
1938	104.8	97.2	202.6	152.5	91.4	88.6	115.9	95.9	97.1	101.0

1924 = 100. Local currency

TABLE SA.9: Wage Indices - Set 2

Year	UK	Belgium	France	Germany	Italy	Netherlands	Sweden	Switzerland	USA	Japan
1924	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1925	101.1	88.7	106.6	135.2	111.8	97.0	102.2	100.0	100.6	100.5
1926	100.0	85.8	123.8	140.7	120.4	98.0	103.3	101.0	101.8	103.0
1927	100.0	87.7	127.0	157.4	119.4	99.0	103.3	101.0	101.1	103.0
1928	98.0	91.5	132.1	179.6	109.7	99.0	104.4	101.0	102.1	105.0
1929	98.0	94.3	147.1	185.2	107.5	103.0	109.9	103.1	104.8	107.0
1930	97.1	100.0	157.4	170.4	106.5	105.1	112.1	104.1	94.9	103.0
1931	96.1	93.4	157.3	150.0	98.9	103.0	111.0	105.2	83.1	98.9
1932	94.1	85.8	153.5	124.1	93.5	95.8	108.8	101.0	62.6	102.0
1933	93.1	83.0	150.1	125.9	90.3	91.6	105.5	99.0	65.0	103.0
1934	93.1	79.2	150.1	135.2	87.1	88.6	104.4	96.9	73.9	101.0
1935	94.1	76.4	146.7	138.9	83.9	85.5	107.7	94.8	81.8	98.9
1936	97.1	83.0	170.2	144.4	83.9	83.4	108.8	92.8	89.9	97.9
1937	100.0	91.5	218.6	150.0	87.1	84.4	113.2	91.8	99.5	100.0
1938	102.9	97.2	240.0	157.4	91.4	88.6	119.8	95.9	89.9	101.0

1924 = 100 Local currency

TABLE SA.10 : Output per Head - Set 1

Year	UK	Belgium	France	Germany	Italy	Netherlands	Sweden	Switzerland	USA	Japan
1924	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1925	101.5	101.5	101.7	101.2	101.8	101.5	102.9	101.9	102.5	101.4
1926	103.0	103.0	103.4	102.4	103.6	103.0	105.9	103.8	105.1	102.8
1927	104.6	104.6	105.2	103.6	105.5	104.6	109.0	105.8	107.7	104.3
1928	106.1	106.1	107.0	104.9	107.4	106.1	112.1	107.8	110.4	105.7
1929	107.7	107.7	108.8	106.1	109.3	107.7	115.4	109.9	115.1	107.2
1930	109.3	109.3	110.6	107.4	111.3	109.3	118.7	112.0	116.0	108.7
1931	111.0	111.0	112.5	108.7	113.3	111.0	122.2	114.1	118.9	110.2
1932	112.6	112.6	114.4	110.0	115.3	112.6	125.7	116.3	121.8	111.8
1933	114.3	114.3	116.4	111.3	117.4	114.3	129.3	118.5	124.9	113.3
1934	116.1	116.1	118.4	112.7	119.5	116.1	133.1	120.7	128.0	114.9
1935	117.8	117.8	120.4	114.0	121.7	117.8	137.0	123.0	131.2	116.5
1936	119.6	119.6	122.4	115.4	123.9	119.6	140.9	125.3	134.5	118.2
1937	121.4	121.4	124.5	116.8	126.1	121.4	145.0	127.7	137.9	119.8
1938	123.2	123.2	126.6	118.2	128.4	123.2	149.2	130.1	141.3	121.5

1924 = 100

TABLE SA.11: Output Per Head - Set 2

Year	UK	Belgium	France	Germany	Italy	Netherlands	Sweden	Switzerland	USA	Japan
1924	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1925	105.0	100.2	100.0	106.4	106.8	102.9	108.9	106.9	99.3	102.7
1926	101.4	101.9	101.2	115.2	107.6	103.5	115.5	111.7	102.1	102.9
1927	106.5	104.6	104.9	121.0	106.0	107.7	120.2	117.2	103.6	104.0
1928	108.0	107.8	106.6	126.0	113.6	108.5	119.3	122.8	103.6	111.4
1929	109.4	105.6	115.0	128.1	116.6	112.5	128.1	126.1	107.5	114.2
1930	113.5	104.7	111.5	131.3	111.2	112.6	136.1	125.0	101.8	106.3
1931	111.6	108.0	107.0	127.4	112.1	109.2	128.1	119.8	100.1	109.8
1932	112.0	109.1	104.7	122.6	116.3	108.2	127.0	117.3	93.0	110.7
1933	112.7	110.1	110.3	126.6	115.8	105.2	130.2	123.6	88.1	113.0
1934	116.4	111.0	112.0	127.0	114.8	104.5	136.6	123.2	88.7	123.4
1935	118.8	117.4	110.7	132.4	124.7	107.3	143.9	123.8	93.7	124.8
1936	121.1	115.1	113.6	139.9	123.9	109.0	150.8	124.6	100.2	127.3
1937	122.4	115.6	120.3	149.8	131.0	111.7	152.4	129.0	102.9	155.4
1938	125.1	115.4	121.6	160.7	131.5	110.6	157.3	133.5	101.2	158.1

1924 = 100

TABLE SA.12: Output per Head - Set 3

Year	UK	Belgium	France	Germany	Italy	Netherlands	Sweden	Switzerland	USA	Japan
1924	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1925	101.8	101.1	102.8	105.1	103.1	102.4	105.1	104.7	101.4	102.7
1926	103.7	102.2	105.8	110.4	106.3	104.8	110.4	109.7	102.9	105.5
1927	105.6	103.3	108.8	116.0	109.7	107.3	116.0	114.9	104.4	108.3
1928	107.5	104.4	111.9	121.9	113.1	109.9	121.9	120.4	105.9	111.2
1929	109.4	105.6	115.0	128.1	116.6	112.5	128.1	126.1	107.5	114.2
1930	111.0	106.8	115.7	130.6	118.3	112.4	130.9	126.4	106.9	118.7
1931	112.5	108.0	116.3	133.2	120.0	112.3	133.8	126.8	106.3	123.3
1932	114.1	109.2	117.0	135.9	121.8	112.2	136.8	127.2	105.7	128.2
1933	115.7	110.5	117.6	138.5	123.6	112.1	139.8	127.5	105.2	133.2
1934	117.3	111.7	118.3	141.3	125.4	112.0	142.8	127.9	104.6	138.4
1935	119.0	113.0	118.9	144.1	127.2	111.9	146.0	128.2	104.0	143.9
1936	120.7	114.3	119.6	146.9	129.1	111.8	149.2	128.6	103.5	149.5
1937	122.4	115.6	120.3	149.8	131.0	111.7	152.4	129.0	102.9	155.4
1938	124.1	116.9	120.9	152.8	132.9	111.6	155.8	129.3	102.4	161.5

1924 = 100

4. Weighting and Construction of UK RULC

UK RULC (relative unit labour costs) is defined as

(SA.2) $RULC_{UK} = \frac{UK.ULC}{WULC}$ (in dollars). WULC comprises foreign (industrial) country ULC series weighted together geometrically. We may also define UK RNULC (relative normalised unit labour costs) as $\frac{UK.NULC}{WNULC}$, where UK and foreign NULC series are constructed using output per head sets 1 and 3; the PB ULC figures and output per head set 2 may be considered as ULC measures.

The three alternative weighting schemes tested in chapter 4 used data from Maizels (1963), Maddison (1962) and League of Nations Network of World Trade (1942). The first two sources refer to 1929 trade data, the last to 1928; the Maizels data refer to exports of manufactures. Weights attached to the foreign countries were as follows:

Table SA.T3: Alternative Weighting Schemes for WULC

	Maddison	Maizels	LON
Belgium	6.46	7.48	5.96
France	14.35	15.13	14.11
Germany	23.46	28.56	21.35
Italy	5.72	5.16	6.67
Netherlands	5.84	3.49	6.35
Sweden	3.55	2.41	3.00
Switzerland	2.95	3.82	3.13
Japan	-	5.43	6.78
US	37.67	28.41	32.65

As in chapter 2, the Maddison weights excluded the Japanese data taken from League of Nations Memoranda described in section 4.1. The goodness-of-fit performance appears if anything to have gained from strict adherence to "Maddison" data (possibly because of the doubtful quality of the Japanese data).

The unit labour cost series shown in Table SA.13 are denoted as $RULC_{11}$ ... $RULC_{23}$, the first subscript denoting the wage set used, the second denoting the output per head set. All six series are quoted using the "Maddison" weighting scheme, which was most successful in testing. $RULC_{PB}$, devised directly from PB wage and output per head data, weights together only US, Germany and Sweden using Maizels weights (appropriately rescaled) which produced superior regression results in this case.

TABLE SA.13: UK Relative Unit Labour Costs 1924-38 ("Maddison" weights)

Year	$RULC_{PB}$	$RULC_{11}$	$RULC_{21}$	$RULC_{12}$	$RULC_{22}$	$RULC_{13}$	$RULC_{23}$
1924	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1925	97.1	101.7	102.8	98.7	99.8	102.3	103.4
1926	95.4	104.0	107.3	107.8	111.3	105.2	108.5
1927	96.4	101.3	101.3	102.4	102.5	103.1	103.1
1928	92.8	97.6	95.8	98.8	97.0	99.9	98.1
1929	91.4	94.1	92.5	96.9	95.3	96.9	95.4
1930	89.2	95.3	96.1	92.4	93.1	96.9	97.7
1931	88.4	94.2	97.8	90.5	93.9	94.7	98.3
1932	76.7	83.1	89.0	76.1	81.5	82.5	88.3
1933	86.0	88.7	92.1	80.1	83.2	87.0	90.3
1934	80.2	88.7	88.7	77.9	77.9	86.0	86.0
1935	77.1	86.6	85.6	77.1	76.3	82.8	81.9
1936	77.4	87.5	86.2	79.6	78.4	82.7	81.5
1937	74.6	91.8	89.0	85.8	83.1	85.7	83.0
1938	75.4	97.7	95.6	90.1	88.1	90.1	88.2

1924 = 100.0

5.1 Measures of UK Domestic Prices

Ten measures of domestic price/cost pressure were tested in chapter 5. Construction of the seven measures of UK unit labour costs is discussed in section 4.4, and the UK wholesale price index in section 2.2. The other measures were the GDP deflator at factor cost and the price of total final output at market prices. Both were taken from Feinstein (1972) (p.T133), rescaled such that 1924 = 100, and converted to dollars (cf. equation (5.3)). The series input (in sterling) are given below:

Table SA.T4 UK Domestic Prices 1924 = 100.

	UK Wholesale Prices	UK GDP Deflator	UK Price of Final Output
1924	100	100	100
1925	95.8	100.3	99.9
1926	89.2	98.9	97.8
1927	85.1	96.5	95.2
1928	84.5	95.4	94.7
1929	82.2	95.1	93.7
1930	72.1	94.7	90.8
1931	63.3	92.5	86.0
1932	61.6	89.2	83.5
1933	61.8	87.9	82.0
1934	63.5	87.3	81.9
1935	64.1	88.1	82.6
1936	68.1	88.6	83.9
1937	78.4	91.9	88.2
1938	73.1	94.4	88.9

6.1 Disaggregated Trade Data

Sources

The principal data source was the BISC Bulletin, published from 1922-35 in Brussels. This classified commodities into five main categories (following the Brussels classification of 1913):[1]

I Live animals

II Articles of food and drink

III Materials, raw or partly manufactured

IV Manufactured articles

V Gold and silver: specie and unmanufactured

Table SA.14 shows the distribution of exports of the UK and nine foreign industrial countries included in the empirical work in chapters 4 and 6. The predominance of manufactured items for most of these countries is confirmed.

The main categories were subdivided into a total of 186 individual sub-categories. This study focuses on the following categories of particular importance to the UK:

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1. A new system of classification was drawn up in September 1935 to replace the Brussels classification. See League of Nations International Trade Statistics 1938, p.3 (preface).

Table SA.T5: Definition of Key Commodity Groups

Commodity Group	BISC Sub-Categories	Detailed Description
Coal	BISC category 88	Mineral coals, carbonated or agglomerated
Chemicals etc.	BISC category 103	Colours, dyes and varnishes
	104	Chemical products (including industrial alcohol)
	105	Compound drugs
Wool and Worsted Goods	BISC category 113	Threads and yarns of wool
	119	Tissues/fabrics of wool
Cotton Goods	BISC category 115	Threads and yarns of cotton
	121	Tissues/fabrics of cotton
Apparel	BISC category 125	Hosiery
	126	Fashion hats
	127	Other hats
	128	Lingerie
	129	Ladies clothing
	130	Men's clothing
	131	Other Manufactured apparel
Iron and Steel and Manufactures	BISC category 148	Iron and steel simply beaten, stretched or laminated
	149	Other iron and steel products
Mechanical and Electrical Machinery and Apparatus	BISC category 160	Electric machines and apparatus
	161	Motored machines (other than electrical machinery or locomotives etc.)

		162	Machine tools
		163	Textile industry machinery
		164	Machinery for sewing, embroidery and knitting
		165	Machines for sugar industry, distilleries, vinegar factories, breweries, etc.
		166	Agricultural machinery
		167	Other machines and mechanisms and detachable parts
Vehicles	BISC categories	169	Cars and wagons for railways and tramways
		170	Motor cars
		171	Motor cycles and similar products
		172	Bicycles
		173	Other vehicles (including airships)

Table SA.15 shows the importance of exports in these groups within overall UK exports between the wars. Tables SA.16 and SA.18 give the dollar values of UK exports over the period used for regression in Chapter 6, and the shares of these eight sectors within the aggregate of the eight for the UK.

The regression period was restricted to 1925-35 largely for data availability reasons; BISC Bulletins figures were not published for years after 1935, while prior to 1925 the LMOT commodity breakdown of trade by those countries not included within the BISC figures (US, Italy and Japan) was not sufficient to facilitate their inclusion. From 1925 onwards, individual exports for these countries as given in LMOT were allocated to the commodity groups described in Table SA.T5 having regard to the detailed description of each BISC sub-category. This was inevitably arbitrary. However, the reasonable correspondence between figures for UK exports in detailed commodity groups in the two sources where checked suggested that the errors might not be excessive. Returns will generally have been made to the League of Nations using the BISC classification (allowing LMOT to produce the figures given in Table SA.14). The most likely source of error is omission of exports by the three non-BISC Bulletin countries in sub-categories in which they were of little importance (so that exports did not merit separate inclusion in LMOT's limited space). This should not unduly distort the regression results in chapter 6 unless substantial growth took place in the omitted sub-categories, but it necessitates caution in interpreting Tables SA.14, SA.19 and SA.20 given here, and implies slightly misleading weights in the price and cost competitiveness indices constructed using shares given in Table SA.20, which also shows which of the foreign countries were not included in particular sectors.

The conversion of the gold franc figures in the BISC Bulletins to dollars was made more difficult by the departure of the dollar from the Gold Standard in 1933. The following factors were used to convert gold franc to current dollar trade figures:

	(dollars per gold franc)
1932	0.193
1933	0.2478
1934	0.3268
1935	0.3268

These figures were derived from LMOT for 1935, which gave rates to convert trade figures to old gold dollars. For 1934 and 1935, we used the new dollar "par" of 0.5906 old dollars. For 1933, LMOT provided separate factors appropriate to converting US imports and US export to gold. Neither factor was appropriate for trade of all the countries in our sample; we averaged the two US figures to produce a factor of 1 current dollar = .7788 old dollars.

TABLE SA.14: Distribution of Exports by BISC Categories

Percentages

	1924					1929					1932				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
UK	0.3	6.0	16.7	69.9	7.1	0.3	5.7	14.4	69.0	10.6	0.1	5.4	12.3	54.4	27.8
Belgium-Lux	0.9	9.5	33.4	55.8	0.4	0.4	8.0	32.1	59.2	0.3	0.6	9.5	35.3	52.5	2.1
France	0.3	10.2	19.7	69.3	0.5	0.7	11.9	20.9	66.1	0.4	0.2	13.2	16.1	59.4	11.1
Germany	0.2	6.7	13.8	78.8	0.5	0.2	5.0	18.5	69.2	7.1	0.2	3.3	16.7	72.5	7.3
Italy	0.4	27.7	12.9	58.9	0.1	0.1	24.7	12.5	62.7	-	0.3	32.4	17.2	49.9	0.2
Netherlands	2.1	48.5	16.6	24.9	7.9	0.8	41.6	19.0	35.8	2.8	0.7	26.8	14.6	28.3	29.6
Sweden	0.6	5.6	51.3	38.5	4.0	0.3	9.2	49.7	40.6	0.2	0.1	7.7	42.1	49.2	0.9
Switzerland	0.3	8.9	7.9	76.1	6.8	0.4	9.9	9.0	77.6	3.1	0.3	9.2	8.7	66.8	15.0
Japan	-	6.3	44.4	49.3	-	-	8.3	42.3	49.3	0.1	0.1	8.9	27.1	56.9	7.0
US	0.1	19.8	45.1	31.3	3.7	0.1	13.6	38.9	44.0	3.4	-	9.6	33.5	23.0	33.9

Source LMOT

TABLE SA.15: Value of UK Exports in Selected Commodity Groups

£000	1924		1929		1935	
	Value	%	Value	%	Value	%
Chemicals	23,004	2.9	23,296	3.2	19,964	4.7
Wool and Worsted Goods	61,260	7.7	48.622	6.7	25,555	6.0
Cotton Goods	192,484	24.0	130,302	17.9	56,416	13.3
Apparel	30,930	3.9	25,897	3.6	12,288	2.9
Iron and Steel and Manufactures	71,791	9.0	67,055	9.2	38,007	8.9
Machinery	55,437	6.9	69,649	9.5	48,652	11.4
of which Electrical	(16,007)	(2.0)	(19,466)	(2.7)	(13,609)	(3.2)
Vehicles	18,894	2.4	25,220	3.5	20,374	4.8
of which Cars	(3,693)	(0.5)	(8,582)	(1.2)	(9,662)	(2.3)
Total of above	453,800	56.7	390,041	53.5	221,256	52.0
All Manufactures	602,770	75.3	563,235	77.2	317,526	74.6
Coal	79,708	10.0	53,785	7.4	35,790	8.4
Total Exports (exc.Bullion and Coinage)	800,968	100	729,349	100	425,835	100

Source: BISC Bulletins

TABLE SA.16: UK Exports in Chosen Sectors: Dollar Values

Year	Coal	Chemicals	Cotton	Wool	Apparel	Iron and Steel	Machinery	Vehicles	Aggregate of 8 sectors
1925	268.1	107.4	932.2	258.7	145.9	319.9	292.8	113.2	2438.2
1926	105.1	106.1	722.9	226.1	139.6	269.1	286.3	108.6	1963.8
1927	245.8	109.3	697.4	248.2	131.0	336.6	292.4	119.2	2179.9
1928	212.4	114.2	682.0	253.3	129.3	323.5	324.5	112.9	2152.1
1929	261.2	113.2	632.9	236.2	125.8	325.7	338.3	122.5	2155.8
1930	243.4	95.6	407.9	165.8	93.4	247.8	292.6	103.7	1650.2
1931	174.5	74.9	245.2	104.8	60.3	138.7	186.1	63.2	1047.7
1932	123.9	59.6	211.1	73.3	40.7	100.7	124.8	45.1	779.2
1933	149.5	74.1	236.8	94.0	48.6	130.4	144.8	63.4	941.6
1934	182.9	95.2	283.2	128.5	61.5	184.2	210.3	92.3	1238.1
1935	176.3	98.4	277.9	125.9	60.6	187.3	239.7	100.4	1266.5

$ millions

TABLE SA.17: Exports of Foreign Industrial Countries in Selected Sectors

	Coal	Chemicals	Cotton	Wool	Apparel	Iron and Steel	Machinery	Vehicles	Aggregates of 8 sectors
1925	289.2	384.7	838.4	280.9	379.5	760.8	835.1	572.7	4341.1
1926	520.6	380.9	758.3	266.8	318.1	814.6	884.0	532.0	4475.3
1927	431.1	457.3	790.6	314.5	346.4	862.2	999.6	599.1	4800.9
1928	383.8	518.2	759.3	324.5	371.4	949.9	1172.2	719.8	5199.2
1929	422.2	510.7	770.2	304.7	356.4	1016.6	1414.8	780.0	5575.6
1930	382.0	438.5	577.4	252.5	323.9	856.7	1300.0	475.7	4606.8
1931	275.0	391.3	410.1	187.4	243.9	613.6	930.7	292.0	3344.1
1932	198.9	284.9	284.3	89.6	125.7	370.3	533.0	153.6	2040.2
1933	211.7	363.9	327.7	102.2	137.7	451.4	540.2	187.8	2322.6
1934	274.1	435.7	418.1	116.2	156.0	629.5	722.6	328.4	3080.6
1935	275.3	474.5	390.4	95.2	142.5	595.8	761.1	379.4	3114.0

Current dollars. Countries included are those among the nine foreign industrial countries for which data were available; See Table SA.20

TABLE.SA.18: Relative Importance of Selected UK Export Sectors to UK

Year	Coal	Chemicals	Cotton	Wool	Apparel	Iron and Steel	Machinery	Vehicles	Aggregate of these 8
1925	11.0	4.4	38.2	10.6	6.0	13.1	12.0	4.6	100.0
1926	5.4	5.4	36.8	11.5	7.1	13.7	14.6	5.5	100.0
1927	11.3	5.0	32.0	11.4	6.0	15.4	13.4	5.5	100.0
1928	9.9	5.3	31.7	11.8	6.0	15.0	15.1	5.2	100.0
1929	12.1	5.3	29.4	11.0	5.8	15.1	15.7	5.7	100.0
1930	14.7	5.8	24.7	10.0	5.7	15.0	17.7	6.3	100.0
1931	16.7	7.1	23.4	10.0	5.8	13.2	17.8	6.0	100.0
1932	15.9	7.6	27.1	9.4	5.2	12.9	16.0	5.8	100.0
1933	15.9	7.9	25.1	10.0	5.2	13.8	15.4	6.7	100.0
1934	14.8	7.7	22.9	10.4	5.0	14.9	17.0	7.5	100.0
1935	13.9	7.8	21.9	9.9	4.8	14.8	18.9	7.9	100.0

Derived from Table SA.16

% of totals of UK exports in the eight sectors in each year.

TABLE SA.19: UK share of value of industrial countries' exports, selected sectors

	Coal	Cotton Manufactures	Wool Manufactures	Apparel	Chemicals	Iron and Steel	Machinery	Vehicles	Total these 8
1925	48.0	52.7	47.9	27.8	21.8	29.6	26.0	16.5	36.0
1926	16.8	48.8	45.9	30.5	21.8	24.8	24.5	17.0	30.5
1927	36.3	46.9	44.1	27.4	19.3	28.1	22.6	16.6	31.2
1928	35.6	47.3	43.8	25.8	18.1	25.4	21.7	13.6	29.3
1929	38.2	45.1	43.7	26.1	18.1	24.3	19.3	13.6	27.9
1930	38.9	41.4	39.6	22.4	17.9	22.4	18.4	17.9	26.4
1931	38.8	37.4	35.9	19.8	16.1	18.4	16.7	17.8	23.9
1932	38.4	42.6	45.0	24.4	17.3	21.4	19.0	22.7	27.6
1933	41.4	42.0	47.9	26.1	16.9	22.4	21.1	25.2	28.8
1934	40.0	40.4	52.5	28.3	17.9	22.6	22.5	21.9	28.7
1935	39.0	41.6	57.0	29.8	17.2	23.9	24.0	20.9	28.9

Sources: BISC Bulletins and LMOT

6.2 Sector Weighting of Foreign UVIs and ULCs

The results quoted in chapter 6, Tables 6.1 to 6.7, use sector-weighted foreign unit value or unit labour cost indices rather than the multilateral weighted series used in chapter 2 and 4. The weights used are given in Table SA.20, and are derived from the individual foreign country commodity export data given in BISC Bulletins and LMOT and used in constructing Table SA.17. It was assumed that countries for which data were not available in particular sectors could be given zero weight.[1] Country weights in the "total of the above" row were obtained by multiplying the percentage weight in each sector cell in Table SA.20 by the weight of that sector in UK exports in 1929 (given in Table SA.18). This final set of weights indicates the overall importance of the main foreign industrial countries as competitors to the UK when the disaggregated pattern of competition is taken into account.

These weights were then applied to the aggregate export unit values given in Table SA.5 and the aggregate normalised unit labour cost series (wage set 2, output per head set 3) discussed in section 4.4.[2] The resulting series are given in Tables SA.21 and SA.22.

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1. This is not unreasonable, since the degree of detail given in LMOT is sufficient to make it likely that a major export of an important industrial country would be included, but is clearly a disadvantage, particularly where the US is omitted.

2. The assumption that within a particular country export prices and unit labour costs moved identically in all sectors is undoubtedly a huge simplification, which is probably less inappropriate for unit labour costs than the export UVI.

The differences made by sector weighting are discussed in chapter 6. The divergent experience of cotton is particularly noticeable; this derives from the high weight of Japan in the cotton sector. The Japanese yen depreciated heavily in the 1930s (cf. Table SA.1). The general rise in dollar prices and costs at the end of the period derived largely from the devaluation of the dollar in 1933-4. The apparently sharp rise in foreign dollar normalised unit labour costs in most sectors in 1925 (cf. 1924 = 100) stemmed from a particularly violent rise in wages in Germany in that year (see Table SA.9).

TABLE SA.20: Shares of 9 Leading Foreign Industrial Countries in Selected Export Sectors 1929

	Belgium - Lux	France	Germany	Italy	Japan	Netherlands	Sweden	Switzerland	USA
Coal	6.8	7.7	50.9	N	2.5	8.7	N	N	23.2
Chemicals	4.1	13.3	49.1	2.8	2.8	5.0	0.8	5.7	16.2
Cotton and Manufactures	7.3	15.4	6.7	13.3	28.0	6.5	0.3	3.9	18.6
Wool and Manufactures	8.6	41.9	32.5	10.9	*	2.7	1.2	2.3	*
Apparel	5.6	33.8	41.1	*	14.2	1.6	0.2	3.5	*
Iron and Steel and Manufactures	19.3	17.6	50.3	*	*	1.8	3.7	0.9	6.3
Machinery	2.2	6.1	33.6	1.0	0.5	5.0	4.0	3.7	44.0
Vehicles	3.7	10.4	5.9	2.4	*	0.5	0.5	0.6	76.2
Total of the above	7.38	15.45	29.77	4.50	7.78	4.32	1.59	2.56	26.64

N denotes a negligible quantity (less than 0.05)

* signifies that adequate data were not available from BISC Bulletins or LMOT

Figures are the % share of earnings of the nine countries in exports (by value) of the nine in total in 1929 in each sector. The "Total" figures are a weighted average of the eight sectors, weights chosen according to the weights of the sector in UK exports in 1929. See Table SA.18 and p.452.

TABLE SA.21: Unit Value Indices for Nine Foreign Countries in Selected Sectors

Year	Coal	Chemicals	Cotton	Wool	Apparel	Iron & Steel	Machinery	Vehicles	Aggregate
1925	138.7	138.0	145.9	132.4	139.3	135.1	145.9	150.0	141.9
1926	132.1	131.2	138.4	121.4	128.9	127.1	138.1	137.7	133.4
1927	129.1	129.3	132.2	121.9	126.9	124.4	133.5	130.9	129.4
1928	129.1	128.4	128.1	117.7	122.9	123.8	134.2	132.1	128.0
1929	127.5	126.4	125.0	115.5	121.0	123.0	132.3	130.1	126.0
1930	117.8	117.0	109.3	107.6	111.4	115.5	121.3	117.7	114.8
1931	98.7	98.7	87.9	91.3	93.6	98.9	99.6	93.2	94.7
1932	83.9	84.1	66.9	77.5	76.7	84.2	84.5	79.0	78.3
1933	95.0	95.8	75.0	90.1	88.7	97.5	93.7	85.1	88.2
1934	115.3	116.5	88.3	110.0	107.2	119.2	112.7	100.5	105.9
1935	112.3	113.5	86.5	105.3	103.5	112.4	111.9	101.4	103.4

Construction: See section 6.2.
1913 = 100. All in common currency (dollars)

TABLE SA.22: UK NULC and Combined NULC of Nine Foreign Countries, Sector Weights

	UK NULC	Coal	Chemicals	Wool	Cotton	Apparel	Iron and Steel	Machinery	Vehicles	Aggregate
1925	108.4	112.8	112.3	106.4	99.3	109.2	111.2	109.4	101.0	106.4
1926	106.1	107.1	106.2	91.8	96.0	98.9	97.3	105.9	96.5	99.7
1927	104.2	110.1	111.3	102.3	100.0	106.6	100.3	107.7	97.1	103.4
1928	104.4	115.1	115.5	104.8	98.6	110.5	105.4	110.2	97.2	105.5
1929	98.4	115.0	115.5	107.0	98.8	112.2	106.1	110.4	98.7	106.1
1930	96.3	108.0	109.5	106.6	97.4	110.3	102.4	103.1	92.1	101.8
1931	87.6	95.9	98.4	99.2	90.0	101.4	92.1	91.8	82.3	92.1
1932	65.4	78.7	82.1	89.5	69.9	84.5	78.5	73.8	65.1	75.1
1933	76.8	94.0	98.6	109.2	74.2	100.9	97.0	84.9	70.4	86.2
1934	90.6	120.4	127.0	142.4	88.8	130.2	126.2	105.1	83.0	107.4
1935	87.8	122.1	128.2	137.4	85.1	126.8	121.5	109.9	88.9	107.3

Note: "Coal" series denotes NULC of nine foreign industrial countries weighted according to relative importance in the coal industry (weights given in Table SA.19); other sector headings have analogous interpretation. All series constructed with wage set 2 and output per head set 3. 1924 = 100. All in dollars.

7.1 UK and "World" Volumes and UVIs for Exports of Coal

The series constructed are given in Tables SA.23, SA.24 and SA.25. BISC data were used for Belgium-Luxembourg, Czechoslovakia, France and Germany (1922-35), and Netherlands (1923-35), and UK (values) (1924-35). Exports by Italy, Switzerland and Sweden were negligible. Data for the US and Japan throughout, for all countries 1936-7, and for Netherlands (1922) and UK (values 1922-23; volumes throughout) were from LMOT.

League of Nations series did not correspond exactly to BISC data where common observations were available. First, LMOT give UK and Japanese export volumes in long tons (= 1.016 metric tonnes); these were converted to metric tonne figures. Where LMOT figures were used to extend BISC series backwards to 1922 or forwards to 1937, they were adjusted according to the proportionate difference at the first or last common observation as appropriate. Differences were generally small in the 1930s. Those in the early 1920s were of less significance, with regression analysis in general proceeding from 1925.

The use of tonnages as measures of volume is crude, but probably more satisfactory in coal than most sectors since the product is relatively homogeneous. Nevertheless coal, coke and briquettes are all included in BISC category 88, and figures for Czechoslovakia include lignite.

Unit values (Table SA.25) were obtained by dividing value by volume of coal exports. Volume and unit value indices were then constructed on a 1924 base, and unit values were converted to dollars. Dollar unit value indices for the UK and the group of industrial countries including Czechoslovakia are given in Chapter 7, Table 7.T2.

TABLE SA.23: Coal Export Volumes 1922-37

Year	UK	USA	Japan	Belgium	Czech.	France	Germany	Netherlands	Total exc.UK	UK share %
1922	69026	13666	1718	4399	4993	2722	6496	2003	35997	65.7
1923	85848	24081	1599	3644	4617	3042	1809	2975	41767	67.3
1924	66578	19154	1738	3402	5162	2931	4339	3356	40082	62.4
1925	54954	18725	2738	4015	4667	5207	19248	4931	59531	47.7
1926	22212	35654	2631	5359	6325	5048	38739	8397	102153	17.9
1927	55169	19356	2208	4531	5753	4998	38476	6514	81836	40.3
1928	54536	17690	2184	5901	5622	5598	35554	7381	79930	40.6
1929	65431	18902	2043	5297	5990	5974	40685	7766	86657	43.0
1930	59276	16719	2131	5501	4787	4687	35493	8098	77416	43.4
1931	46644	12618	1540	7327	4146	4204	32775	8589	71199	39.6
1932	42561	9178	1388	5103	3301	3682	26175	6735	55562	43.4
1933	42822	9136	1561	5035	3353	3472	26084	5836	54477	44.0
1934	43263	11036	1087	5238	3703	3531	30172	5829	60596	41.7
1935	42540	10298	1019	5731	3416	1664	35565	5525	63218	40.2
1936	37946	11188	1113	6608	3510	1292	38174	6065	67950	35.8
1937	44173	13661	1027	5720	5129	1033	50519	7048	84137	34.4

Thousand metric tonnes.

Sources: BISC Bulletins and LMOT

TABLE SA.24: Coal Exports Value 1922-37

Year	UK	USA	Japan	Belgium	Czech	France	Germany	Netherlands	Total exc.UK	UK share
1922	1817.7	472.8	58.6	164.4	182.1	109.0	128.4	71.5	1186.8	60.5
1923	2656.7	798.6	54.2	131.1	171.8	100.2	75.1	116.5	1447.5	64.7
1924	1822.1	575.3	47.8	123.4	162.6	91.7	128.9	108.4	1238.1	59.5
1925	1383.8	519.0	70.6	126.3	135.0	129.5	522.0	126.0	1628.4	45.9
1926	544.7	1020.2	75.8	156.4	167.3	131.4	1077.9	224.9	2853.9	16.0
1927	1273.8	540.2	62.7	130.3	149.2	164.3	1162.1	165.1	2373.9	34.9
1928	1100.9	477.3	58.9	144.4	139.8	158.9	974.1	170.7	2124.1	34.1
1929	1353.5	507.8	55.5	149.6	147.2	168.7	1112.8	190.4	2332.0	36.7
1930	1261.1	435.2	55.7	158.5	117.8	134.9	984.9	207.2	2094.2	37.6
1931	904.2	310.9	38.0	176.4	100.2	114.0	774.8	188.4	1702.9	34.7
1932	641.8	217.6	18.0	120.2	69.9	84.8	460.3	126.6	1097.4	36.9
1933	603.5	152.9	14.5	106.3	61.9	76.0	402.3	99.8	913.7	39.8
1934	559.6	157.6	9.2	102.0	58.2	75.1	404.0	89.6	895.7	38.5
1935	539.6	147.6	8.8	100.7	51.3	39.7	462.0	82.7	892.8	37.7
1936	510.7	160.6	9.0	112.4	51.1	27.7	493.9	88.2	942.9	35.1
1937	658.9	197.6	8.9	131.4	65.7	21.0	780.8	117.9	1323.3	33.2

In millions of gold francs

Sources: BISC Bulletins and LMOT

TABLE SA.25: Coal Export UVIs 1922-37

Year	UK	USA	Japan	Belgium	Czech.	France	Germany	Netherlands	Total exc.UK	Total / Total ex.UK
1922	26.3	34.6	24.1	37.4	36.5	40.0	19.8	35.7	33.0	0.797
1923	30.9	33.2	33.9	36.0	37.2	32.9	41.5	39.2	34.7	0.890
1924	27.4	30.0	27.5	36.3	31.5	31.3	29.7	32.3	30.9	0.887
1925	25.2	27.7	25.8	31.5	28.9	24.9	27.1	25.6	27.4	0.920
1926	24.5	28.6	28.8	29.2	26.5	26.0	27.8	26.8	27.9	0.878
1927	23.1	27.9	28.4	28.8	25.9	32.9	30.2	25.3	29.0	0.797
1928	20.2	27.0	27.0	24.5	24.9	28.4	27.4	23.1	26.6	0.759
1929	20.7	26.9	27.2	28.2	24.6	28.2	27.4	24.5	26.9	0.770
1930	21.3	26.0	26.1	28.8	24.6	28.8	27.7	25.6	27.1	0.786
1931	19.4	24.6	24.7	24.1	24.2	27.1	23.6	21.9	23.9	0.812
1932	15.1	23.7	13.0	23.6	21.2	23.0	17.6	18.8	19.8	0.763
1933	14.1	16.7	9.3	21.1	18.5	21.9	15.4	17.1	16.8	0.839
1934	12.9	14.3	8.5	19.5	15.7	21.3	13.4	15.4	14.8	0.872
1935	12.7	14.3	8.6	17.6	15.0	23.9	13.0	15.0	14.1	0.901
1936	13.5	14.4	8.1	17.0	14.6	21.4	12.9	14.5	13.9	0.971
1937	14.9	14.5	8.7	23.0	12.8	20.3	15.5	16.7	15.7	0.949

Gold francs per ton

7.2 Relative Normalised Unit Labour Costs in Coalmining

(1) Wages

ILO YLS (1939) gave data back to 1927. For earlier years, ILO figures were obtainable in a series of articles in the International Labour Review (ILR) entitled "Recent Wage Changes in Various Countries" . Detailed sources for the figures in Table SA.26 were as follows:

UK

Figures given in ILO YLS for 1927 onwards refer to Q4 of each year. Annual averages were formed by averaging e.g. 1927 Q4 and 1928 Q4 to create a 1928 average. Earlier figures in ILR "Recent Wage Changes in Various Countries: Great Britain" (May 1928), were obtained by averaging across areas and did not correspond exactly to the figures averaged across all wage earners in YLS; they were spliced to the YLS series with 1927 Q4 the common observation.

Belgium-Luxembourg

There was no common observation between the YLS series (1927-38) and the figures in ILR "Recent Wage Changes..." (June 1928) covering 1922-26. The series had to be assumed continuous. The assumption was justified by the close correspondence between the changes in unit labour costs given for 1924-9 in PEP (1936) (p.154) and those resulting here.

Czechoslovakia

ILO YLS only gives figures for 1927-37. For 1924-7 ILR "Recent

Wage Changes ...." (Jan. 1929) gives figures for underground and surface workers separately. We assumed that the relative weights of these two groups were constant at the levels which produced the 1927 YLS figure. For 1920-4, figures were available from ILR "Wage Changes 1914-25", and spliced to subsequent observations with 1924 as common observation.

France

YLS gives figures for 1927-38. ILR "Recent Wage Changes ..." (June 1928) gives figures for Q3 in each of 1922-1927. These were taken as annual averages; only a small adjustment to these observations was required to splice the two series.

Germany

There were particular difficulties with this series. First, figures for 1928-38 in YLS refer to hourly wage rates. Data for all other countries here refer to earnings. Second, 1924-28 figures in ILR "Recent Wage Changes ....." (Oct. and Nov. 1928) refer to weekly wage rates, which were converted to hourly assuming a 48-hour working week, and separate underground and surface workers. 1927 figures for underground, surface, and total wages in the Ruhr field given in the International Labour Review[1] were used to derive weights for underground and surface worker wages, assuming that these remained constant through the period. The 1928 figures in ILR refer to June, and those in YLS to July; these figures were assumed equal

1. ILR (Oct.1929) p.548. Ibid., p.562, shows the predominance of the Ruhr field, accounting for over 80% of saleable German output of coal.

when splicing the series. The splice yielded weights for skilled and unskilled workers to be applied to the separate series given in YLS for 1928-38. Finally, to form annual averages in the 1928-38 series, successive December observations were averaged; in the earlier series, successive January observations were averaged.

Netherlands

ILO YLS gives separate series for daily earnings of underground and surface workers 1927-38, with information on numbers of workers covered in 1938. From the latter figures we derived weights which were applied to all separate figures for underground and surface workers in YLS and ILR. The 1927-38 totals were multiplied by six to convert to weekly earnings, as provided for 1920-7 in ILR "Recent Wage Changes..." (Sept. 1928). The earlier series was spliced to the later with 1927 as splicing observation.

USA

Series were available for hourly earnings, 1932-7, in ILO YLS, for mining of anthracite and bitumenous coal separately; the bitumenous coal series was used here. Observations were multiplied by 96 for comparability with the half month/fortnightly figures for 1922, 1924 and 1926 in ILR "Recent Wage Changes..." (Feb. 1929), and for 1927, 1929 and 1931 in ILO YLS entitled "NICB series", the latter being in index form. For continuity with the later series, it was assumed that wages in US coalmining fell by the same percentage as wages in US industry between 1931 and 1932 (ILO YLS series). Observations for 1923, 1925, 1928 and 1930 were formed by interpolation.

Japan

The "Cabinet" series, for daily earnings (males only) was available for 1927-38 in ILO YLS. An index citing 1927 as 105 with 1926 = 100 was given in the YLS for 1933, including males and females. Figures for male and female daily wages separately were available for 1924 in ILO "Wage Changes in Various Countries 1914-25". It was assumed that male figures in this source are consistent with YLS for 1927. 1926 was then constructed as $\frac{100}{105}$ x 1927, and 1925 was derived by interpolation.

Dollar wages, shown in Table SA.27, were derived from the local currency wages in Table SA.26 and the exchange rates in Table SA.1.

(2) Output per shift

Statistics were available:

(i) For UK, Germany, France, Belgium and Netherlands, 1924-34, in PEP Report (1936), p.153.

(ii) In OEEC "Industrial Statistics 1900-55" for 1924-38 for the above five countries (Germany 1931 and 1936-8 only), plus US (we used figures for bitumenous coal only).

The OEEC data (Table SA.28) posed three problems. First, there was no UK figure for 1926 (due to the seven-month coal strike). We averaged the results obtained by two possible solutions: (i) multiplying the 1925 OEEC figure by the factor by which the 1926 PEP figure exceeded that for 1925; (ii) Multiplying the 1927 OEEC figure by the factor obtained by dividing 1926 by 1927 in the PEP series. Second, for Germany, PEP data were used for 1924-34, splicing to OEEC data for 1936-8 using 1931 as common observation. The 1935 figure was interpolated. Third, in the absence of data for Czechoslovakia and Japan, it was assumed that output per head in those countries increased at the same rate as in the UK after 1924.

(3) Construction of RULC and RNULC in Coalmining

Table SA.29 has been constructed, by analogy with equation SA.2, as

$$\text{(SA.3)} \qquad RULC_{UK} = \frac{\$ULC_{UK}}{\$ULC\ world} \quad \text{in coalmining.}$$

with each country ULC given as $\frac{\text{wages per head}}{\text{output per head}}$

and converted to dollars.

The world ULC index is a geometric weighted average of the ULCs of the seven foreign countries shown in Table SA.27.[1] Weights were derived from the value of each country's coal exports in 1929:

Belgium	6.42%	Netherlands	8.16%
Czechoslovakia	6.31%	USA	21.77%
France	7.24%	Japan	2.38%
Germany	47.72%		

Two alternatives to Table SA.29 were constructed. First, the relative ULC measure was constructed omitting Czechoslovakia and Japan (in the absence of output per shift data). This was generally slightly inferior in regression analysis, so the "seven country" world was preferred. Second, the output per head data were

1.For justification of Czechoslovakia's inclusion, see p.334.

normalised by taking trends between 1924 and 1929, and 1929 and 1937, observations in Table SA.28. Results are shown in Table SA.30.

TABLE SA.26: Wages in Coalmining 1922-38

Year	UK	USA	France	Germany	Netherlands	Belgium-Luxembourg	Czechoslovakia	Japan
1922	--	114.5	75.3	--	108.2	67.6	142.5	--
1923	94.5	107.3	87.3	--	103.0	85.2	107.8	--
1924	100	100	100	100	100	100	100	100
1925	100.6	99.0	103.9	118.1	93.6	89.4	104.3	100.5
1926	100	98.0	124.5	126.9	94.4	102.0	111.2	101.0
1927	98.0	97.0	137.2	133.6	95.2	137.5	111.9	106.0
1928	90.2	89.0	135.5	147.5	96.1	139.7	116.8	107.0
1929	88.2	81.0	150.3	150.9	99.4	163.9	118.4	107.3
1930	88.6	76.0	162.2	151.0	101.7	174.4	120.0	100.1
1931	88.4	71.0	156.4	141.8	98.2	148.0	122.9	87.9
1932	87.8	62.0	144.0	119.4	92.5	127.7	122.3	83.1
1933	87.5	76.7	142.6	119.4	90.5	123.1	121.3	89.1
1934	87.6	92.6	142.9	119.4	90.4	122.3	117.9	97.9
1935	88.6	102.6	142.3	119.4	89.2	119.9	117.9	100.5
1936	92.7	103.5	158.2	119.4	88.6	129.2	117.3	106.0
1937	97.9	112.8	219.9	119.4	92.3	155.0	118.5	118.6
1938	103.3	114.7	253.8	119.4	96.5	166.4	--	139.4

Notes: (1) Indices, 1924 = 100
(2) Local currency

Sources: ILO YLS and ILR

TABLE SA.27: Dollar Wages in Coalmining 1922-38

Year	UK	USA	France	Germany	Netherlands	Belgium-Luxembourg	Czechoslovakia	Japan
1922	-	114.5	118.0	--	109.0	111.9	116.4	--
1923	97.8	107.3	101.4	--	105.4	95.8	107.8	117.9
1924	100.	100	100	100	100	100	100	100
1925	110.0	99.0	94.7	121.8	98.4	91.7	104.7	100.1
1926	110.0	98.0	77.3	130.8	99.0	72.0	111.5	115.5
1927	107.8	97.0	102.9	137.5	99.9	82.5	112.2	122.0
1928	99.3	89.0	101.6	152.5	101.1	84.0	117.2	120.6
1929	96.9	81.0	112.6	155.6	104.5	98.3	118.6	120.1
1930	97.5	76.0	121.7	156.0	107.0	105.0	120.4	120.0
1931	90.7	71.0	117.3	145.2	103.4	88.9	123.3	104.2
1932	69.6	62.0	108.1	122.9	97.5	76.6	122.7	56.8
1933	83.6	76.7	136.6	157.1	121.8	94.5	156.2	55.2
1934	100.0	92.6	179.6	203.7	159.4	122.8	169.4	70.6
1935	98.3	102.6	179.6	208.2	158.0	95.4	166.2	70.0
1936	104.3	103.5	185.3	208.5	149.3	94.2	159.1	74.6
1937	109.6	112.8	169.8	208.0	132.9	112.8	140.1	82.9
1938	114.4	114.7	139.8	207.8	138.9	121.1	--	96.2

Indices, 1924 = 100

TABLE SA.28: Output per Manshift Underground 1924-38

Year	Belgium	France	Netherlands	Germany	USA (Bitumenous)	UK
1924	100	100	100	100	100	100
1925	104.0	101.3	113.5	110.1	98.4	103.2
1926	106.9	106.1	134.7	129.6	98.1	106.3
1927	109.5	104.7	138.0	132.0	98.8	118.6
1928	118.6	115.0	159.6	138.5	101.7	122.6
1929	124.6	125.0	166.9	147.9	104.8	124.2
1930	123.2	124.5	164.9	157.4	108.3	124.2
1931	127.1	131.1	171.7	173.4	111.6	125.0
1932	133.4	146.5	194.2	189.9	112.2	127.4
1933	144.7	156.4	214.1	195.3	103.9	131.5
1934	161.0	163.2	235.4	195.3	95.4	133.9
1935	169.3	168.1	256.9	190.6	97.7	136.3
1936	174.8	165.5	260.5	185.9	99.4	137.9
1937	169.7	156.3	248.8	175.3	99.8	136.4
1938	162.4	155.4	231.1	168.5	104.0	134.2

Indices, 1924 = 100

Sources: OEEC Industrial Statistics; PEP Report (1936)

TABLE SA.29: UK Relative Unit Labour Costs in Coalmining 1924-37

	UK ULC (dollars)	World ULC (dollars)	UK RULC
1924	100	100	100
1925	106.5	102.5	103.9
1926	103.5	93.8	110.3
1927	90.9	96.7	94.0
1928	81.1	94.7	85.6
1929	78.0	90.8	85.9
1930	78.5	87.7	89.5
1931	72.6	77.1	94.2
1932	54.7	62.4	87.7
1933	63.5	76.4	83.1
1934	74.6	97.2	76.7
1935	72.2	97.8	73.8
1936	75.6	98.1	77.1
1937	80.3	102.7	78.2

Indices, 1924 = 100

TABLE SA.30: UK Relative Normalised Unit Labour Costs in Coalmining 1924-37

	UK NULC	World NULC	UK Relative NULC
1924	100	100	100
1925	105.3	102.7	102.5
1926	100.8	97.9	103.0
1927	94.6	97.4	97.1
1928	83.6	95.2	87.8
1929	78.0	90.8	85.9
1930	77.6	89.1	87.1
1931	71.4	81.9	87.2
1932	54.1	69.6	77.7
1933	64.2	85.1	75.4
1934	75.9	106.4	71.3
1935	73.8	105.9	69.7
1936	77.4	103.8	74.6
1937	80.3	102.7	78.2

Indices 1924 = 100

7.3 World Industrial Production and UK Trade-Weighted Industrial Production

(1) Sources

In view of the rudimentary quality of most industrial output statistics, four alternative data sources were used.

(i) League of Nations: Review of World Production and Prices (WPP)

We consider first the "world output" series (WPP 1937/8, Appendix III, Table 1). USSR is included, but mining output is excluded, from the measure (one would expect higher mining output elsewhere in the world to reduce UK coal exports cet. par.) The resulting series is given in Table SA.35 column 1.

Individual country series were given for 1929-37 at a 1929 base in WPP 1937/8 (p.44) (see Table SA.31). These were extended back to 1925, with 1929 as the common observation for splicing, using figures for "Industrial Productive Activity" in WPP 1925-33, p.129.

Three problems appeared. First, there were two series for Canada. We used that excluding production of electric power and the output of the building industry. Second, no figures were available for Italy prior to 1928. Italy was excluded from the pre-1929 series (and the weights in TWIP, see Table SA.T5, were slightly amended to allow for this). Finally a choice of series was available for the UK (which is included for interest in Tables SA.31, 33 and 34). The otherwise preferable Board of Trade index lacked observations for 1925 and 1926; the London and Cambridge Economic Service series was therefore used.

1938 observations were available in SYB 1938/9; splicing was necessary (with 1937 the common observation) for some individual countries.

(ii) OEEC

Successive issues of OEEC (later OECD) Industrial Statistics covered 1900–55, 1900–57, 1900–59, and 1900–62. The series used are those for production in manufacturing industry (i.e. excluding extraction). The series are 1938 based, but are shown for comparison with 1924 = 100 in Tables SA.32 and SA.35.

Separate figures were given for Belgium and Luxembourg. These were combined with weights 3.34 : 0.19, these being relative weights of Belgium and Luxembourg in the aggregate production of OEEC countries in 1938 (as given by OEEC Industrial Statistics).

Data for the Netherlands were only available from 1926. The 1925 figure was constructed assuming that 1925-6 growth was as in WPP. The 1924 figure was constructed assuming that industrial growth in the Netherlands between 1924 and 1925 equalled that of the aggregate for OEEC countries reported in Industrial Statistics. The small weight of the Netherlands in TWIP makes the error introduced of small importance.

(iii) Maddison

The Statistics in Table SA.33 refer to total, rather than industrial, production, and are from Maddison (1977). Figures for Germany include the Saar throughout (other sources are not explicit on this point). The use of total production may tend to reduce the amplitude of cyclical fluctuations a little (since e.g. government services, being less exposed to demand pressures, tend to be less volatile).

(iv) Mitchell

The data in Table SA.34 derive from Mitchell (1978) pp.180 et seq. Figures were not available for Netherlands for 1924. A backward one year splice was made using Maddison. The French series was substantially rebased and recalculated in 1928. Figures on old and new bases were provided for 1928 and pre-1928 observations were adjusted accordingly. The 1924 figure for Germany came from OEEC.

(2) Weighting Industrial Production Indices to form TWIP

Eight countries were included in the TWIP indices shown in Table SA.35, the main constraint being data availability on industrial production. Weights were derived from the volume of UK coal exports to each country in 1929. For comparison, the weights that would have been derived had 1934 been selected as the base year are also shown in Table SA.T6.

Table SA.T6: Weights in TWIP.

	1929	1934
Belgium-Luxembourg	11.39	4.41
Canada	2.05	7.92
France	35.90	34.91
Germany	15.19	11.52
Italy	19.52	21.31
Netherlands	8.59	7.33
Sweden	6.43	11.83
USA	0.92	0.75

Source: PEP (1936) Table 5.

These countries accounted for over 60% of UK coal exports in 1929 (over 56% in 1934). The possible inappropriateness of 1929 weights later in the estimation period may have contributed to lack of goodness-of-fit in the regression results in chapter 7.

(3) Concluding Note

The particularly divergent paths of the TWIP measures, and indeed of the individual country industrial production series, confirms the poor quality of these statistics. This emphasises the need for cautious interpretation of the regression results.

TABLE SA.31: Industrial Production: League of Nations Figures

Year	Belgium	Canada	France	Germany	Italy	Netherlands	Sweden	US	UK
1924	--	--	--	--	--	--	--	--	--
1925	73.9	70.3	77.2	79.8	--	74.8	74.4	87.2	88.4
1926	85.6	78.8	90.4	79.8	--	77.4	81.2	90.8	67.9
1927	92.8	83.1	79.0	100	--	86.1	83.8	89.0	97.3
1928	98.2	92.4	91.2	99.2	91.7	97.4	88.9	92.7	92.9
1929	100	100	100	100	100	100	100	100	100
1930	89	85	100	88	92	91	102	81	92
1931	81	71	89	72	78	79	96	68	84
1932	69	58	69	58	67	62	89	54	83
1933	72	60	77	65	74	69	91	64	88
1934	73	73	71	83	80	70	110	66	99
1935	82	81	67	95	94	66	123	76	106
1936	87	90	70	106	87	72	135	88	116
1937	97	100	72	116	100	91	149	92	124
1938	79	90	67	125	99	92	146	72	--

Sources: League of Nations; Reviews of World Production and Prices (1925-33, 1937-8, and 1938-9).
Indices 1929 = 100

TABLE SA.32: Industrial Production: OEEC Figures

Year	Belgium	Canada	France	Germany	Italy	Netherlands	Sweden	US
1924	100	100	100	100	100	100 [1]	100	100
1925	100.6	109.1	101.0	117.7	109.5	106.0 [1]	102.1	110.9
1926	107.0	125.8	111.2	111.8	114.9	109.7	110.6	117.4
1927	118.1	133.3	105.1	143.1	108.1	117.6	114.9	116.3
1928	127.7	147.0	117.4	151.0	121.6	127.0	121.3	122.8
1929	131.8	157.6	125.5	149.0	123.0	133.2	136.2	138.0
1930	122.6	140.9	123.5	125.5	113.5	142.6	140.4	114.1
1931	108.8	119.7	107.1	105.9	101.4	130.1	134.0	93.5
1932	95.5	100	91.8	86.3	91.9	114.4	125.5	72.8
1933	100.2	100	104.1	100	98.6	111.3	130.0	84.8
1934	102.8	118.2	98.0	123.5	101.4	116.0	153.2	93.5
1935	114.3	130.3	95.9	143.1	117.6	119.1	172.3	108.7
1936	123.8	148.9	104.1	162.8	118.9	125.4	187.2	128.3
1937	135.9	165.2	111.2	182.4	136.5	139.5	210.6	141.3
1938	120.8	151.5	102.0	196.1	135.1	156.7	212.8	108.7

Indices 1924 = 100
Converted from 1938 = 100

(1) Constructed figures; cf. p. 474.

TABLE SA.33: Total Production: Maddison Figures

Year	Belgium	Canada	France	Germany	Italy	Netherlands	Sweden	US	(UK)
1924	100	100	100	100	100	100	100	100	100
1925	101.5	104.3	101.1	111.2	107.0	104.8	109.3	102.3	104.9
1926	105.0	113.5	102.3	114.4	107.9	107.3	116.3	109.0	101.0
1927	108.9	124.2	101.1	125.8	105.2	113.1	121.5	110.1	109.1
1928	114.6	135.6	106.9	131.3	113.1	116.3	121.8	111.3	110.5
1929	113.6	136.2	116.3	130.8	116.6	122.2	131.2	118.1	113.7
1930	112.5	130.3	112.8	128.9	110.5	123.4	138.7	106.9	112.9
1931	110.5	113.8	108.1	119.1	109.6	119.3	129.0	98.7	107.1
1932	105.5	101.9	103.5	110.2	112.3	115.2	125.9	85.0	107.9
1933	107.8	95.2	108.1	117.1	112.3	112.2	128.8	83.3	111.1
1934	106.9	106.8	108.1	127.8	112.3	113.2	136.9	89.9	118.4
1935	113.5	115.1	104.6	137.4	122.8	116.1	144.8	98.0	123.0
1936	114.3	120.2	105.8	149.5	122.8	118.3	154.0	111.4	128.6
1937	115.8	132.2	111.6	165.7	130.7	124.7	156.4	116.6	133.0
1938	113.2	133.3	111.6	182.6	132.4	125.9	161.5	111.7	134.7

Indices 1924 = 100

TABLE SA.34: Industrial Production: Mitchell Figures

Year	Belgium	Canada	France	Germany	Italy	Netherlands	Sweden	US	(UK)
1924	100	100	100	100	100	100	100	100	100
1925	94.3	109.1	99.1	117.6	113.7	105.9	102.0	110.9	103.9
1926	110.3	125.8	115.7	105.5	113.7	108.8	112.0	117.4	98.2
1927	121.8	133.3	100.9	134.9	109.6	120.4	116.0	116.3	113.2
1928	132.2	147.0	116.7	134.9	120.5	137.8	126.0	122.8	110.2
1929	132.2	157.6	129.3	136.7	123.3	140.7	132.0	138.0	115.6
1930	111.5	140.9	129.3	119.4	116.4	143.6	136.0	114.1	110.7
1931	101.1	119.7	110.4	96.9	105.5	134.9	128.0	93.5	103.6
1932	83.9	100.0	95.6	83.0	105.5	118.9	118.0	72.8	103.2
1933	87.4	100.0	104.1	93.4	112.3	127.6	120.0	84.8	109.9
1934	87.4	118.2	96.7	115.9	109.6	130.5	146.0	93.5	120.9
1935	95.4	130.3	92.5	136.7	117.8	127.6	162.0	108.7	130.2
1936	103.4	143.9	99.9	155.7	117.8	129.1	178.0	128.3	142.0
1937	114.9	165.2	105.1	173.0	137.0	145.1	200.0	141.3	150.4
1938	93.1	151.5	96.7	190.3	137.0	146.5	202.0	108.7	146.3

Indices 1924 = 100

TABLE SA.35: World Industrial Production and UK Trade-Weighted Industrial Production by various measures

Year	WIP_{LN}	$TWIP_{LN}$	$TWIP_{OE}$	$TWIP_{MA}$	$TWIP_{MI}$
1924	--	--	100	100	100
1925	81..9	76.6	105.7	104.6	104.9
1926	83.7	85.1	111.7	107.0	112.4
1927	89.4	85.9	114.6	109.0	112.9
1928	94.3	94.1	125.7	114.7	124.7
1929	100	100	131.1	119.9	131.2
1930	88.0	94.6	124.4	117.3	124.6
1931	78.7	83.1	109.4	112.5	109.0
1932	68.7	66.9	95.0	108.5	96.9
1933	77.5	73.4	103.7	111.2	104.3
1934	85.1	75.9	107.6	113.5	106.4
1935	96.5	77.7	115.3	117.1	110.9
1936	110.7	83.3	124.1	120.1	118.6
1937	119.0	90.4	137.0	127.1	130.7
1938	120.0	85.7	133.1	--	--

Notes: (1) LN = League of Nations figures (Table SA.31); OE = OEEC figures (Table SA.32); MA = Maddison figures (Table SA.33); MI = Mitchell figures (Table SA.34).

(2) LN indices 1929 = 100; MA, MI, OE indices 1924 = 100.

(3) WIP denotes world industrial production, and TWIP UK trade-weighted industrial production.

8.1 Gross Output per Head Data: Aggregate and Sectors

Data from the 1924 and 1930 Censuses of Production were presented in Business Statistics Office (1978). The output and employment data for the six sectors covered in Tables 8.7 and 8.8, plus coal, were taken from the following orders and categories of the Standard Industrial Classification.

Coalmining:	Order II	Mining and Quarrying Heading 101 Coal Mining
Chemicals:	Order V	Chemicals and Allied Industries
Wool and Worsted)) Cotton)	Order XIII	Textiles
Iron and Steel	Order VI Headings:	Metal Manufacture 311 Iron and Steel (general) 312 Steel tubes 313 Iron castings etc.
Machinery	Order VII	Mechanical Engineering
Vehicles	Order XI	Vehicles

There were a few problems. Detailed breakdown of the textiles sector was not available in full for years before 1935, so the aggregate figure for the whole order was used for both cotton and wool (the two sectors together dominated the UK textile industry, accounting for some 60% of total employment in the industry in 1948). It would have been desirable to include Order IX (Electrical engineering) Heading 361 (Electric Machinery) in estimating output per head on "Machinery", but details on Heading 361 separately were only available from 1948.

The output per head figures derived (in current prices) were as follows:

Table SA.T7: Gross Output per head in key sectors £

	1924	1930
Coalmining	209.9	178.8
Chemicals	863.0	830.9
Wool and Worsted	(603.8)	(407.3)
Cotton	(603.8)	(407.3)
Iron and Steel	697.1	556.4
Machinery	359.2	353.9
Vehicles	385.4	401.4

The net output per head figures for all industries (Orders II to XXI) used in chapter 8 were £215 for both 1924 and 1930. The corresponding gross output per head figures were £516 in 1924 and £476 in 1930.

Similarly defined series for gross output were used in constructing Table T6.2. Apparel was also included in Table T6.2, and correspondence with BISC categories 125-131 was best achieved by taking Order XV (clothing and footwear), subtracting heading 450 (footwear), and adding heading 417 (hosiery and other knitted goods) from Order XIII (textiles).

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