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**MACROECONOMIC PERFORMANCE IN THE BRETTON WOODS  
ERA, AND AFTER**

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# Macroeconomic Performance in the Bretton Woods Era, And After

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## **Abstract**

During the Bretton Woods era, OECD countries grew at historically unprecedented rates. This Golden Age has many possible explanations, ranging from the return to liberal policies in international trade to a backlog of profitable growth opportunities after the neglect of the 1930s and war-time damage. Eichengreen (1996) has argued that the proximate cause of the rapid growth was high investment, and that this high investment was made possible by certain institutions that were particularly well suited to reconstruction and growth. On the domestic side, these institutions led to high investment rates and moderate wage claims. This paper interprets the interaction between unions and firms as a coordination game. The risk-dominant equilibrium is selected via a global game argument. Only small changes to the payoffs are necessary to explain a change in the selected equilibrium, and therefore, the growth slowdown.

## **Keywords**

Coordination Games, Global Games, Risk-Dominance, Bretton Woods, Macroeconomic Performance and Institutions.

## **JEL Classification**

N14, C70, E22

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## 1. Introduction

It is somewhat of a cliché to say that the quarter century that ended around 1973 was a Golden Age of economic growth, but clichés are often true. As Feinstein, Temin and Toniolo (1997) pointed out, the rate of growth of GDP per capita in fifteen European countries averaged 1.4 per cent between 1890 and 1913, 0.9 per cent between 1913 and 1950, 4.0 per cent between 1950 and 1973, and 1.7 per cent between 1973 and 1994. The rate of growth during the Golden Age therefore stands out as over double the rate achieved in any other period. As Temin (2002) argued, growth between 1913 to 1950 also stands out as being particularly slow.

There is a number of possible explanations for the slowdown in the 1970s. It is convenient to divide them into three broad groups: mis-measurement, the demand-side, and the supply side. The mis-measurement explanation argues that one effect of the oil shock was to make the standard measure of real GDP an unreliable indicator due to the single-deflation bias (see Bruno and Sachs, 1982, Muellbauer, 1991, Stoneman and Francis, 1994, and Cameron, 2002). In addition, mis-measurement of growth may have been made worse by the increasing importance of industries where growth is hard to measure (see Griliches, 1994). The demand-side explanation is that mistakes in demand management led directly to the stagflation of the 1970s (see Friedman, 1977, and Feldstein, 1982), as policymakers pursued expansionary policies in the belief that there was a permanent trade-off between unemployment and inflation.

The supply-side explanation itself has two elements. The first consists of a number of supply-side factors that had been very favourable to growth in the 1960s that gradually became less favourable in the 1970s, such as slower labour supply growth (due to there being less scope to raise education levels and transfer workers from agriculture into industry, see Temple, 2001) and the exhaustion of catch-up gains due to technology catch-up with the USA, war-time damage, and interwar neglect (Maddison, 1987, and Temin, 2002). The second consists of particular developments in the early 1970s that were allegedly inimical to growth. Among these developments were the breakdown of the Bretton Woods system in 1971-3; the oil shock in 1973; the rising power of the trade unions from 1968-9 (see Soskice, 1978); and lax competition policies.

Naturally, it is unlikely that any one of these three explanations was solely responsible for the slowdown, whereas it is easy to imagine some combination being influential. For example, a rise in the oil price might lead to a rise in the equilibrium rate of unemployment (see Carlin and Soskice, 1990, and Carruth, Hooker, and Oswald, 1998). If a government did not realize that this had occurred, it might use demand-management to keep actual unemployment down at the cost of higher and higher inflation. But eventually, of course, actual unemployment would have to rise (see Layard, Nickell and Jackman, 1990).

Eichengreen (1996) proposed a particularly interesting explanation. Drawing upon the theoretical work of Grout (1984) and van der Ploeg (1987), he argued that one of the key factors in explaining rapid growth during the Golden Age was a set of institutions that were supportive of high investment and wage restraint. He also argued that the collapse of the ‘Wage Restraint; High Investment’ equilibrium was an important factor in the subsequent growth slowdown (see also Eichengreen and Iversen, 1999, and Eichengreen and Vazques, 2000).

Imagine a consensus between unions and firms: that neither side will try to raise wages or prices unexpectedly, and that firms will reinvest profits rather than pay large dividends. That is, labour and capital shares in income are stable by consensus and that there is a high investment rate. Eichengreen suggested that domestic labour market bargaining institutions in Europe (and to a lesser extent in the rest of the OECD) fulfilled this rôle in the 1960s but that the equilibrium broke down in the late 1960s leading to a switch to a ‘Wage Push; Low Investment’ equilibrium. He suggested that there are a variety of possible culprits for this including the capture of corporatist institutions by trade unions (see Olson, 1982); the breakdown of the Bretton Woods system; the oil shocks; increased capital mobility; and the end of the postwar catch-up process. Overall, it is clear that he favours the latter culprit.

This paper develops a global game interpretation of the slowdown. In particular, it focuses on the interaction between changes in the economic environment (both gradual and abrupt) and the nature of the game being played between firms and unions. By considering a simple coordination game in which there are two pure strategy Nash equilibria, this paper does not necessarily assume any degree of cooperation between unions and firms. Instead, each acts in its own short-term self-interest.<sup>1</sup> Therefore, the paper explains the collapse of ‘Wage Restraint; High Investment’ as an equilibrium switch, rather than a defection from a cooperative arrangement. As a result, only small changes to the nature of the game are needed to generate an equilibrium switch, and that a switch will occur once a change in the nature of the game is anticipated by either of the players.

This paper has five sections. After this brief introduction, section 2 discusses the available data on growth and macroeconomic performance in the OECD during and after the Golden Age, as well as the evidence on institutional arrangements. Section 3 outlines a simple game-theoretic model of the bargaining between firms and unions. Section 4 discusses why the ‘Wage Restraint; High Investment’ equilibrium might have become unstable as the Golden Age ended. Section 5 draws conclusions.

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<sup>1</sup> Cooperation in the sense used by Eichengreen (1996) requires that at least one player is not following their own short-term self-interest. Note that Soskice’s (1990) use of the term *coordination* differs from that of this paper; his usage more closely resembles *cooperation* as found in Eichengreen.

## 2. Data and Discussion

It is beyond the scope of this paper to offer a thorough history of the Bretton Woods era; instead, a brief précis must suffice.

The OECD grew at an unprecedented rate in the twenty five years between 1948 and 1973. This period broadly coincides with that of the Bretton Woods agreement, which was signed in 1944 but only became fully operational when full convertibility of member currencies was achieved in 1958. The Bretton Woods system worked through a fixed dollar-gold exchange rate, with countries intervening to defend their par values against the dollar and with the dollar valued against gold. Occasional realignments of currencies were allowed in cases of ‘fundamental disequilibrium’.

The immediate postwar period was marked by a dramatic recovery that saw most Western European countries recover their pre-War income levels by the early 1950s (Crafts and Toniolo, 1996). The 1950s were a period of rapid growth and high investment. Of course, this period was not without its ups and downs, but in general, the Netherlands, Germany, Belgium, Norway and Austria all had considerable success in achieving rapid growth without excessive wage pressure (indeed, in the Netherlands and Germany, real wage growth was quite slow, see Eichengreen, 1996). On the other hand, the UK, Italy, Ireland and France had less success in suppressing wage pressure, although growth rates were impressive by pre-War standards.

**Table 1**  
**Productivity Growth in the Business Sector (per cent per annum)**

	TFP Growth			Labour Productivity Growth		
	1960-73	1973-79	1979-97	1960-73	1973-79	1979-97
<b>OECD</b>	2.9	0.6	0.9	4.6	1.7	1.7
<b>EU</b>	3.4	1.2	1.1	5.4	2.5	1.8
<b>USA</b>	1.9	0.1	0.7	2.6	0.3	2.2
<b>Japan</b>	4.9	0.7	0.9	8.4	2.8	2.3
<b>Germany</b>	2.6	1.8	1.2	4.5	3.1	2.2
<b>France</b>	3.7	1.6	1.3	5.3	2.9	2.2
<b>Italy</b>	4.4	2.0	1.1	6.4	2.8	2.0
<b>UK</b>	2.6	0.5	1.1	4.1	1.6	2.0

*Source: OECD.*

Table 1 summarizes the evidence on labour productivity and Total Factor Productivity (TFP) growth since 1960. The extent of the labour productivity slowdown from 1973 to 1979 is immediately apparent, with only a small upturn after 1979 in the OECD as a whole. There was certainly no return to Golden Age performance levels, except perhaps in the United States in the late 1990s, for reasons admirably discussed in Temple (2002). This tends to militate against the idea that mis-measurement and the demand-side can explain the slowdown, since their effects should have unwound with the fall in the real price of oil in the mid-1980s and the return to sensible demand management policies in the 1980s and 1990s.

Table 2 shows some more detailed measures of macroeconomic performance in the OECD since 1960. On most counts, OECD performance was worse after 1973 than before; one exception is inflation during the 1990s. Of course, a policymaker in the 1960s would not be surprised by such subdued inflation given that unemployment in the OECD was two and a half times higher in the 1990s than in the 1960s. Curiously, only the USA and Japan had higher investment rates in the 1990s than in the 1960s, but this was sufficient to raise the OECD average above its 1960s level. In contrast, the investment rate in the EU was considerably lower in the 1990s than in the 1960s.

**Table 2**  
**Macroeconomic Performance in the OECD**

	OECD	EU	USA	JAPAN	GERMANY	FRANCE	ITALY	UK
<b>Output Growth (per cent per annum)</b>								
<b>1960-73</b>	4.9	4.7	4.0	9.7	4.3	5.4	5.3	3.1
<b>1973-79</b>	3.2	2.6	2.9	3.5	2.4	2.7	3.5	1.5
<b>1979-89</b>	2.9	2.2	2.8	3.8	2.0	2.1	2.4	2.4
<b>1989-99</b>	2.6	2.0	3.0	1.7	2.2	1.7	1.3	1.9
<b>Unemployment (per cent)</b>								
<b>1960-73</b>	2.9	2.6	4.8	1.2	1.0	2.6	5.7	3.3
<b>1973-79</b>	5.0	4.6	6.7	1.9	3.0	4.4	6.0	4.9
<b>1979-89</b>	7.3	9.4	7.3	2.5	5.8	8.8	8.2	9.8
<b>1989-99</b>	7.4	9.9	5.8	3.1	7.5	11.2	10.9	8.3
<b>Inflation (per cent per annum)</b>								
<b>1960-73</b>	3.9	4.1	3.1	6.1	3.4	4.9	4.9	4.8
<b>1973-79</b>	8.8	9.6	7.8	9.5	4.6	11.1	16.7	15.6
<b>1979-89</b>	5.4	6.6	5.3	2.5	2.8	7.5	11.4	7.0
<b>1989-99</b>	2.7	3.4	2.4	1.0	2.4	2.1	4.6	3.8
<b>Investment Share (per cent)</b>								
<b>1960-73</b>	21.9	26.5	15.3	29.5	31.1	26.9	28.7	18.8
<b>1973-79</b>	22.7	25.0	16.6	32.0	27.2	26.8	24.5	18.5
<b>1979-89</b>	21.5	22.2	17.0	29.9	24.8	23.2	21.7	17.1
<b>1989-99</b>	22.3	22.5	17.5	32.4	24.2	22.9	20.7	18.4

*Source: OECD.*

It has also been argued that macroeconomic volatility was high in the 1970s. For example, Chadha and Dimsdale (1999) show that inflation volatility rose in the USA, France and the UK from 1969 (at the same time as inflation itself began rising across the OECD) with only Germany experiencing a fall in inflation volatility even as inflation itself rose. In a broader study of nineteen monthly macroeconomic time-series across the G7, van Dijk, Osborn, and Sensier, M. (2002) found that volatility was high throughout the 1970s (including the expansion period before 1974-75) and early 1980s, with volatility in G7 production only falling between 1984 and 1990. However, there are good grounds to doubt whether there is a robust empirical connection between high volatility and low economic growth. For example, Mills (2000) found a positive correlation between volatility and growth in the postwar period for 22 countries between 1870 and 1994, in contrast to Altman (1995) who found no significant correlation at all.

From table 2, it is also apparent that there is not much correlation between the different measures of macroeconomic performance. For example, Fischer (1981) found little evidence of a link from high inflation to volatile inflation to slow growth,

while Bruno and Sachs (1985) found little evidence of a link between rising unemployment and slower growth (both Japan and Switzerland underwent rapid growth slowdowns while maintaining full employment, although their figures may be distorted by labour underutilization). Bruno and Sachs also found that corporatist economies suffered smaller rises in their misery indices after 1973.<sup>2</sup>

**Table 3**  
**Labour Share of Value-Added in Manufacturing (per cent)**

	1961	1969	1973	1975	1979	1981
<b>Belgium</b>	<b>58.3</b>	<b>60.6</b>	<b>67.9</b>	<b>77.0</b>	<b>75.7</b>	<b>76.9</b>
<b>Canada</b>	<b>67.3</b>	<b>68.5</b>	<b>65.8</b>	<b>69.2</b>	<b>65.8</b>	<b>NA</b>
<b>Denmark</b>	<b>68.6</b>	<b>72.2</b>	<b>74.8</b>	<b>74.5</b>	<b>76.5</b>	<b>74.5</b>
<b>France</b>	<b>65.9</b>	<b>65.8</b>	<b>68.7</b>	<b>74.1</b>	<b>74.6</b>	<b>75.9</b>
<b>Germany</b>	<b>52.6</b>	<b>52.6</b>	<b>58.8</b>	<b>60.5</b>	<b>59.2</b>	<b>63.3</b>
<b>Japan</b>	<b>39.6</b>	<b>40.3</b>	<b>44.5</b>	<b>53.8</b>	<b>49.8</b>	<b>NA</b>
<b>UK</b>	<b>69.9</b>	<b>71.0</b>	<b>71.4</b>	<b>80.2</b>	<b>79.7</b>	<b>82.8</b>
<b>USA</b>	<b>70.5</b>	<b>71.0</b>	<b>71.6</b>	<b>71.6</b>	<b>73.8</b>	<b>75.6</b>

*Source: Bruno and Sachs (1985) table 8.8.*

Another striking aspect of the macroeconomic performance of the OECD in the early 1970s is the rise of real wages relative to output (that is, the share of value-added paid to workers rather than to capital). Table 3, shows that the labour share in manufacturing was broadly stable in many countries over the 1960s, but rose steeply from 1969, except in the USA and Canada. Unfortunately, it was not possible to obtain data on exactly the same basis for the 1990s, but in general, the labour share fell through the 1980s and 1990s with the exceptions of West Germany and Japan.<sup>3</sup>

The data for manufacturing are rather more variable than for the whole economy. Table 4 shows the changes in US and UK labour shares in the whole economy since 1960. The US clearly experienced much less of a rise in the labour share between 1969 and 1975 than the UK.

To take this analysis one step further, it is interesting to examine Table 5 which compares the growth rates of aggregate real GDP and the aggregate real wage bill in the USA and the UK from 1960. These data confirm the picture of a broadly stable labour share in the 1960s (that is, the real wage bill rising only slightly faster than real GDP). Interestingly, these data then show that in the UK, the increasing power of the trade unions was able to stave off a fall in the growth of the real wage bill until after 1975. Despite the slower overall GDP growth rate in 1969 to 1975, unions were able to raise the wage share so rapidly that the real wage bill grew faster in 1969-75 than in

<sup>2</sup> Bruno and Sachs (1995) define the misery index as the *rise* in inflation plus the *slowdown* in real GNP growth after 1973.

<sup>3</sup> Glyn (1997) provides a comprehensive account of the development of the profit share (that is, GDP minus the labour share) in the OECD over the period 1960 to 1994, which is broadly consistent with the account in this paper.

the 1960s. The table shows that this was especially true in 1973-75. However, all the gains of the unions were reversed in the period 1975 to 1979 and the UK wage share declined reasonably steadily until 1996.<sup>4</sup>

**Table 4**

**Labour Share in Whole Economy Value Added (per cent)**

	USA	UK
1960	69.3	66.2
1961	69.0	67.6
1969	72.0	66.6
1970	73.7	67.9
1973	72.0	65.9
1975	72.9	71.2
1979	72.3	66.6
1981	73.1	67.7
1989	71.7	63.6
1997	70.3	61.4
1999	71.2	63.2

*Source: Economic Report of the President, 2002; Economic Trends Annual Supplement, 2002.*

**Table 5**

**Growth Rates of real GDP and real wages (per cent per annum)**

	USA		UK	
	GDP	Wage Bill	GDP	Wage Bill
1960-69	4.6	5.0	2.9	3.0
1969-75	1.9	2.1	2.2	3.3
1969-73	3.6	3.6	3.6	3.4
1973-75	-1.5	-0.9	-0.6	3.3
1975-79	5.0	4.8	1.8	0.1
1979-89	2.8	2.8	2.5	2.1
1989-99	3.0	2.9	2.2	2.1

*Source: Economic Report of the President, 2002; Economic Trends Annual Supplement, 2002.*

It is clear from these tables that there was a substantial difference between real wage growth and productivity growth in the 1960s and 1970s, which accounts for the dramatic rises in the labour share outside North America. This real wage explosion comes before the oil shocks and the collapse of Bretton Woods. Bruno and Sachs (1985, pp. 167) argued that there were three major factors in the European real wage explosion of 1969 to 1975. First, it reflects a catch-up of wages that were constrained by incomes policies in the mid-1960s and as a reaction to high levels of profits between 1966 and 1969. Second, sustained high employment in the 1960s, as well as

<sup>4</sup> Both real GDP and the real wage bill are calculated here using the GDP deflator. In practice, it is likely that consumer prices and the GDP deflator will rise at different rates over the short to medium run.



increasing industrial unrest in the late 1960s, led to important rises in union power and coverage. Third, once real wages had begun to rise, governments were reluctant to introduce deflationary policies in the early 1970s.<sup>5</sup> Note that the rise in labour share after 1969 and rise in the prices of raw materials and oil from 1972 imply a considerable profit squeeze.<sup>6</sup> This profit squeeze took a long time to unwind; even the rapid growth in the USA in the late 1990s did not restore profit rates to their mid-1960s peak, as noted by Allsopp and Glyn, 1999.

**Table 6**  
**Unionization and Strike Rates**

	Degree of Unionization				Strike Rates	
	1960	1970	1975	1979	1960-67	1968-75
<b>Canada</b>	<b>0.25</b>	<b>0.27</b>	<b>0.31</b>	<b>0.33<sup>a</sup></b>	<b>0.35</b>	<b>0.82</b>
<b>Denmark</b>	<b>0.47</b>	<b>0.51</b>	<b>0.5</b>	<b>0.69</b>	<b>NA</b>	<b>NA</b>
<b>Germany</b>	<b>0.30</b>	<b>0.30</b>	<b>0.35</b>	<b>0.37</b>	<b>0.01</b>	<b>0.03</b>
<b>Japan</b>	<b>0.17</b>	<b>0.23</b>	<b>0.24</b>	<b>0.23</b>	<b>0.09</b>	<b>0.10</b>
<b>Sweden</b>	<b>0.53</b>	<b>0.66</b>	<b>0.75</b>	<b>0.80</b>	<b>NA</b>	<b>NA</b>
<b>UK</b>	<b>0.42</b>	<b>0.46</b>	<b>0.50</b>	<b>0.54</b>	<b>0.12</b>	<b>0.45</b>
<b>USA</b>	<b>0.26</b>	<b>0.25</b>	<b>0.23</b>	<b>0.21<sup>a</sup></b>	<b>0.33</b>	<b>0.53</b>

*Source: Bruno and Sachs (1985) pp. 169 table 8.13.*

*Notes: Degree of unionization is union membership per total employed workers. The strike rate is workdays lost due to strikes per total employed. a: 1978.*

Soskice (1978) argued that the rise in labour militancy in Europe in the late 1960s and early 1970s was often the result of dissatisfaction of union members at apparent inaction on the part of union leaders. Certainly, in the case of the United Kingdom, this led to the rise of shop-floor and more militant union representatives in place of more traditional and moderate union leaders. This was followed by a significant and failed attempt by the Labour government to democratize and defuse strike action with its 1969 white paper *In Place of Strife* (see Pimlott, 1992, and Pearce, 2002). In the case of Italy, a traditionally weak and disorganized union movement was bypassed by strike committees organized in response to shopfloor disputes in the run-up to the ‘Hot Autumn’ of 1968.

As Table 6 shows, all this led to a major increase in European union militancy, whether measured by the number of days lost to strikes or union coverage. Soskice

<sup>5</sup> There was a sharp tightening of fiscal and monetary policies across the OECD in 1968 and 1969, leading to a mild recession between 1969 and 1971. This recession was rather more marked in the USA and Japan than in Europe. It did little to suppress inflation, being followed quickly by a ‘mini-boom’ in 1972-3. This synchronized upswing was largely due to the large increase in international liquidity that followed the weakness of the dollar and the Smithsonian Agreement in December 1971, and the fact that an unusually large number of elections were scheduled in 1972-3, see Armstrong, Glyn and Harrison (1984, pp. 301).

<sup>6</sup> Armstrong, Glyn and Harrison (1984) noted that between 1968 and 1973, the share of profits in business output in the OECD fell by about 15 per cent, with a sharp decline having begun in the USA in 1966 and in Japan in 1970.

pointed out that between 1968 and 1973, union power grew dramatically and new union rights were enacted in France, Germany, Italy and the United Kingdom. For example, plant-based bargaining was recognized in France in 1968 and unions' powers at the plant level were extended in Italy in 1970, marking a significant break with earlier more centralized bargaining processes. Armed with these new rights, trade unions were in a position to abrogate their part in the 'Wage Restraint; High Investment' consensus.

So, what was the effect of this abrogation? Bruno and Sachs (1985) argued that on the supply-side there were two main effects: first, on the equilibrium rate of unemployment since firms were no longer willing to hire the full-employment labour force at prevailing factor prices (see also Carlin and Soskice, 1990, and Carruth, Hooker, and Oswald, 1998). Second, higher factor prices reduced the profitability of capital and thereby played a major rôle in the slowdown of capital accumulation and productivity growth.

In fact, there are three possible effects of higher labour and energy prices on investment and the capital stock. It is certainly true that the profitability of the installed capital stock fell, which should have reduced investment especially where credit constraints meant that firms financed investment internally (see Hall, 2001, for discussion of financial accelerator effects more generally). In addition, some of the capital stock was designed for low real input prices and was therefore rendered useless and scrapped (see Muellbauer, 1991). However, the profitability of the marginal investment might also have risen as part of factor substitution away from expensive labour and energy. *A priori*, it is difficult to say which effect would be dominant.

However, it is probably the case that the collapse of the 'Wage Restraint; High Investment' equilibrium rendered the latter channel less effective. This is because once energy prices and real labour costs rose, although investment became more profitable at the margin, unions could not guarantee not to grab the ensuing rents.

In a recent analysis of the determinants of labour costs in the OECD between 1960 and 1994, Nunziata (2001) found that labour market institutions can help to explain a large part of the rise in OECD labour costs after controlling for productivity. He suggests that this effect either works directly, by inducing wage pressure despite excess supply of labour, or indirectly, by affecting the matching process of the unemployed to vacancies. In particular, stronger unions increase wages, although their adverse effect can be offset when bargaining is highly coordinated (in the Soskice, 1990, sense). In a series of dynamic simulations, he decomposed the rise in labour costs between the 1960s and the 1980s by country. Although the role of labour market institutions varied across countries, major changes in labour costs were caused by increases in the benefit replacement rate, the tax wedge, and employment protection (the rules and procedures governing the treatment of dismissals of employed workers). In particular, European countries (except Switzerland) suffered

markedly from stricter employment regulations over the 1970s, which triggered dramatic real wage rises.

A number of other authors has found effects of labour market institutions, especially unionization on economic performance. For example, Addison, Heywood and Wei (2001) found a robust positive correlation in Britain between measures of unionization and plant closures. Denny and Nickell (1992) found that the investment rate was about 28 per cent lower in British firms that recognized unions and had an average union density compared with those that did not recognize unions. This was the gross effect, holding wages, prices, and productivity constant. Taking the effect of unions on those as well, the overall effect was a reduction in investment of 16 per cent in competitive firms and 3 per cent in noncompetitive firms. While much of this literature focuses on the UK, there is also evidence for the USA that union recognition can have a negative effect on investment (Fallick and Hassett, 1999) and for Germany that works councils and collective agreements are positively correlated with plant closures (Addison, Bellman and Kölling, 2002). Addison and Chilton (1998) summarized the literature as pointing unequivocally to lower investment in the presence of unions, but noted that it was not yet clear whether this was an artefact of selection or a genuine effect of unions.

### **3. A Global Game Interpretation**

In this section, a simple model of wage negotiation is presented in the form of a coordination game. The primary goal is to formalise the ideas of Eichengreen (1996) with a view to examining the impact of various factors upon the wage bargain. Critical among these are the discount factors of the firm and the union, a parameter reflecting the overall productivity level of the firm, and the level of wage claim made by the union. This last variable is intended to reflect union power. The wage (investment) level chosen by the union (firm) corresponds to an equilibrium selection problem in the coordination game. Using a global game interpretation of the model, interest lies in the risk-dominant equilibrium. The condition for risk-dominance is derived and interpreted in terms of the key factors mentioned above. This enables a critical evaluation of the arguments made in Eichengreen (1996) and provides a formal framework within which to discuss the events that resulted in the collapse of the high growth rates observed during the Bretton Woods era (see Section 4).

There is a large literature on the wage bargaining process. A key contribution is that of van der Ploeg (1987), who constructs a formal model of wage bargaining between a single union and a firm. The two agents play a dynamic game in which the union moves first and announces its intention to demand a particular wage rate. Following this, the firm (or the management), having observed the intended wage claim, decides how much to pay in dividends and how much to invest in capital. Payoffs accrue at the end of the game, and are given by the discounted stream of profits (for the firm) and a utilitarian welfare function depending both on the wage level and on the number

of employees (for the union). Initially, it is assumed that the wage contract announced by the union is binding.

Via backward induction the optimal investment strategy for the firm can be calculated for any given wage claim observed, and hence the optimal wage claim for the union given this response can be found. However, this claim is time inconsistent, in the sense that if the contract were not binding the union would wish to make a higher claim after the firm has invested in capital. Once capital is invested (and assuming pay claims can be made more quickly than disinvestment can take place), the union has an incentive to renege on its earlier announcement and extract more of the surplus from the already heavily capitalised firm. Knowing this would happen, the firm chooses a lower level of investment at the outset and the union initially makes a higher wage claim. The conclusion is that under binding contracts, the wage claim would be low; investment, employment and profits high. In the absence of binding contracts, the wage claim is high; investment, employment and profits low.

In fact, it is shown that binding contracts offer a Pareto improvement (although not Pareto efficiency). Essentially, the firm and union are engaged in a Prisoners' Dilemma. Considering an infinitely repeated version of this game, a multiplicity of equilibria arise, including an equilibrium in which the payoffs in the presence of binding contracts are achieved in each period. Of course, there is no a priori reason for the selection of such an equilibrium of the repeated game.

Eichengreen (1996) views the postwar period through the lens of the model developed in van der Ploeg (1987). The paper makes the claim that the institutional framework that arose after World War II was a way of encouraging the agents to play the high investment; low wage claim equilibrium. Implicitly it seems that Eichengreen is thinking in terms of the coordination problem that might result from a repeated interaction of the sort examined in van der Ploeg (1987), although this is never made explicit.

Rather than formally model this unnecessarily complex situation, the current paper constructs the simplest possible framework within which to analyse the key variables influencing the wage/investment decision. From this perspective, the critical feature of the interaction between the union and the firm is the coordination aspect, rather than the repeated nature of the game.

For this reason, consider a simultaneous move game in which a union and a firm choose a wage claim and an investment level respectively. Suppose that the firm is currently employing  $L_0$  people and paying a wage  $w_0$ . The union can choose to make an aggressive pay demand ( $w_H > w_0$ ) or leave wages as they are (the strategies are Wage Push, Wage Restraint respectively). The firm can choose High Investment, bear a fixed cost  $I > 0$ , and ensure the firm continues operation for another period, or Low Investment, in which case the firm shuts down after the initial period. It takes time to react to the wage claim (something that will be further discussed in Section 4), and hence it is only in the second period that the firm is able to change its employment

level. If the union has made an aggressive demand, the firm would wish to employ  $L(w_H)$  workers, the optimal employment level for the new wage level.

The firm has a production function  $f(L)$ , and sells output at a unit price. Hence  $w_0 = f'(L_0)$  and  $w_H = f'(L(w_H))$ . Profits are thus given by  $\pi(w, L) = f(L) - wL$ . The union has a discount factor of  $\delta_U$  and the firm  $\delta_F$ . The union cares about the discounted sum of total wages ( $wL$ ), and the firm cares about the discounted sum of profits, minus any investment costs. It would be straightforward to generalise the union's payoffs in the manner of van der Ploeg (1987), but would add little to the analysis. Constructing a simple game matrix to reflect this situation yields:

	High Investment	Low Investment
Wage Push	$\pi(w_H, L_0) + \delta_F \pi(w_H, L(w_H)) - I$ $w_H L_0 + \delta_U w_H L(w_H)$	$\pi(w_H, L_0)$ $w_H L_0$
Wage Restraint	$(1 + \delta_F) \pi(w_0, L_0) - I$ $(1 + \delta_U) w_0 L_0$	$\pi(w_0, L_0)$ $w_0 L_0$

In order to effectively capture the environment suggested by the discussion in Eichengreen (1996) the game needs to involve a coordination problem. The idea is to model a situation where it is profitable for the firm to invest if the union selects a low wage claim, but not if the union makes an aggressive pay claim. This requires the following condition on  $I$ :

$$\delta_F \pi(w_0, L_0) > I > \delta_F \pi(w_H, L(w_H))$$

In addition, were the union to know for sure that the firm would invest (and not pay profits out in dividends), a lower pay claim would be optimal. Hence:

$$(1 + \delta_U) w_0 L_0 > w_H L_0 + \delta_U w_H L(w_H)$$

These two conditions ensure that the game above is a coordination game with two pure strategy Nash equilibria, {Wage Restraint; High Investment} and {Wage Push; Low Investment}. Notice that one equilibrium is 'bad' and one is 'good'. As might be expected, the former is 'good' – {Wage Restraint; High Investment}, and the latter is 'bad' – {Wage Push; Low Investment}. To check this note that from the first equation:

$$(1 + \delta_F) \pi(w_0, L_0) - I > \pi(w_0, L_0) > \pi(w_H, L_0)$$

In addition, from the second equation:

$$(1 + \delta_U)w_0L_0 > w_HL_0 + \delta_Uw_HL(w_H) > w_HL_0$$

Hence {Wage Restraint; High Investment} Pareto dominates {Wage Push; Low Investment}. However, a global game argument would result in the selection of the *risk-dominant* equilibrium (see Carlsson and van Damme, 1993), which may or may not correspond with the Pareto dominant one.<sup>7</sup> Alternative approaches have also suggested risk-dominance as an appropriate selection criterion – see, for example, the evolutionary selection literature, epitomised by Kandori, Mailath and Rob (1993) and Young (1993).

In order for a global game argument to apply, it is necessary that at least some of the payoffs to the agents are less than common knowledge. This could be achieved by simply adding noise to the elements in the matrix, or, with more realism, augmenting the production function with some random element. Agents would then receive private and public signals of the true values. Rather than model this directly, it is well known that such an argument will result in the selection of the risk-dominant equilibrium as the signals become increasingly precise.<sup>8</sup> In an asymmetric game such as this, the risk-dominant equilibrium is the one with the higher deviation payoff product. Hence the ‘Wage Restraint; High Investment’ equilibrium is selected if and only if:

$$\begin{aligned} & [\delta_F\pi(w_0, L_0) - I][(1 + \delta_U)w_0L_0 - w_HL_0 - \delta_Uw_HL(w_H)] \\ & > [I - \delta_F\pi(w_H, L(w_H))](w_H - w_0)L_0 \end{aligned}$$

At this point it is instructive to introduce a concrete example. Consider the simple production function  $f(L) = AL^\alpha$ .<sup>9</sup> The above inequality reduces to the following important selection condition:

$$\frac{\delta_F}{\delta_U} \{(1 + \delta_U)w_0 - w_H\}L_0 > \frac{\alpha}{1 - \alpha} I \quad (1)$$

where  $L_0 = (\alpha A / w_0)^{1/(1-\alpha)}$ . Hence tipping out of the ‘Wage Restraint; High Investment’ equilibrium is likely to occur if  $\delta_U$ ,  $\delta_F$  or  $A$  decrease, or  $w_H$  increases

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<sup>7</sup> In fact, this game is an asymmetric stag-hunt, with the {Wage Restraint; High Investment} equilibrium Pareto dominating the {Wage Push; Low Investment} equilibrium. Consider a very simple symmetric version with the payoffs to the ‘good’ equilibrium being 5,5 (union, firm), the payoffs to the ‘bad’ equilibrium being 3,3, and the payoffs to {Wage Push; High Investment} and {Wage Restraint; Low Investment} being  $x,0$  and  $0,x$  respectively (where  $0 < x < 5$ ). To calculate the risk-dominant equilibrium, take the products of the ‘deviation’ payoffs for each equilibrium:  $(5-x)(5-x)$  and  $(3-0)(3-0)$ . The equilibrium associated with the larger of these, for any given value of  $x$ , is risk-dominant. Here, if  $x > 2$ , the ‘bad’ equilibrium is risk-dominant, and if  $x < 2$ , the ‘good’ equilibrium is risk-dominant.

<sup>8</sup> There are many examples of this sort of argument in the literature, see The Assessment for a more complete discussion of this issue along with a fuller examination of the origin and nature of risk-dominance.

<sup>9</sup> This could be augmented to account for uncertainty over payoffs, to  $f(L) = A\theta L^\alpha$ , where  $\theta$  is unknown, but agents receive public and private signals of its true value.

(recall this last parameter is intended to capture union power). The lower the discount factors of the union or firm, the lower investment and the higher wages will be. Adverse technology shocks will reduce investment and raise wages, as would increased union bargaining power.

The analysis of the next section discusses the events of the postwar era in the light of these comparative statics. Importantly, none of these parameters need change much to enable a switch from the ‘Wage Restraint; High Investment’ equilibrium to the ‘Wage Push; Low Investment’ outcome. The expression given in equation (1) above is a ‘knife-edge’ condition, and payoffs need not alter much to reverse the inequality and result in the selection of the ‘Wage Push; Low Investment’ equilibrium. The institutions that helped unions and firms coordinate on the ‘Wage Restraint; High Investment’ equilibrium in the postwar period would not need too big a shock to destabilise and collapse.

Whilst the above model highlights the fragility inherent in the postwar system, Eichengreen’s (1996) discussion stresses the need to find a significant factor (or factors) to explain the collapse of growth rates at the end of the Bretton Woods era. The view that the institutions facilitated coordination rather than enforced cooperation (in a Prisoners’ Dilemma sense) results in this shift of emphasis. Under the interpretation offered here, the agents voluntarily restrain wage claims and dividend payments because it is equilibrium behaviour to do so. This is important, as otherwise there needs to be an argument to explain why neither firm nor union withdrew from these (often voluntary) agreements. Either they were not, after all, playing a Prisoners’ Dilemma, or the institutions themselves were able to coerce the players into participation.

The model presented here offers support for many of Eichengreen’s (1996) arguments, but does not require the magnitude of change necessary for the collapse of the institutions themselves. The problem is determining which of the factors discussed could have been significant enough to cause the collapse of a ‘cooperative outcome’. With a coordination game framework and a risk-dominance selection criterion, a slight change in payoffs can have an enormous impact upon observed equilibrium behaviour. Nor does this argument require the payoffs received by the agents *in equilibrium* to alter at all. For example, the payoff that the union would get were they to exercise wage restraint in the face of low investment by the firm becomes of critical importance (and appears in the selection equation), even though this payoff is never received by the union. The payoffs of the entire game matrix (and not just the payoffs that accrue in equilibrium) determine which equilibrium is risk-dominant.

With these observations in mind, the next section conducts an analysis of the factors that brought the high rates of economic growth in the Bretton Woods era to an end.

#### 4. What led to the collapse of ‘Wage Restraint; High Investment’?

Imagine that a consensus, aided by ‘coordination facilitators’ of the kind described in the previous section, has allowed the ‘Wage Restraint; High Investment’ equilibrium to be maintained for some time. As shown by the selection equation (1), the incentive to switch from the ‘good’ to the ‘bad’ equilibrium will be high, if:

- i. Inflation is expected to be volatile and potential economic growth is slower;
- ii. There is a movement towards a floating exchange-rate;
- iii. Wage-setting becomes decentralized or disorganized; corporatist institutions are ‘captured’ by one side, either unions or firms; or union legislation changes;
- iv. There is a rise in international capital mobility;
- v. Increased employment protection makes it harder for firms to change their employment levels;
- vi. There is a relaxation of credit constraints on consumers;
- vii. There is increased competition in world markets;
- viii. An oil shock leads to a fall in productivity.

The intuition behind some of these is fairly straightforward, and for some is rather more complicated.

If expected inflation is volatile and economic growth is expected to be slower, a union will have less incentive to choose wage restraint (see also White and Voth, 2000) and a firm will have less incentive to choose a high investment level. In terms of the model, this is equivalent to both sides having low discount factors ( $\delta_U$  and  $\delta_F$  respectively).

A fixed exchange-rate system places constraints upon union behaviour because high wage claims turn into lost competitiveness and lost employment quickly (of course, this effect will be stronger in a more open economy). Therefore  $w_H$  (which reflects union bargaining power) will tend to be lower under a fixed exchange rate. Of course, this effect will be less prevalent in less centralized or corporatist bargaining systems where individual unions might not appreciate their effect on firm competitiveness.

When wage-setting is centralized (or coordinated in the sense of Soskice, 1990) and when corporatist negotiations take place, it is more likely that firms and unions will take a long-term view of their interests and hence will be less worried about future malfeasance: this is equivalent to high values of  $\delta_U$  and  $\delta_F$  respectively.

In terms of the model, high international capital mobility is equivalent to firms being able to adjust their employment levels quickly. This increases their profitability in the first period of the game if unions choose an aggressive wage stance, but doesn’t affect their profitability if unions exercise restraint. If firms can adjust employment quickly, the union finds it less attractive to be aggressive in the first place (this is similar to Baldwin’s, 1983, argument that a shorter replacement cycle of capital helps to reduce



union malfeasance). In effect, this directly lowers the first term of the union's payoff in the top left hand corner of the game matrix  $w_H L_0 + \delta_U w_H L(w_H)$ .<sup>10</sup> However, when unions begin to worry that firms may move abroad they are likely to become more impatient and hence have a lower value of  $\delta_U$ , which impacts upon the selection equation and hence makes the 'Wage Push; Low Investment' equilibrium more likely (this is similar to Addison and Chilton's, 1998, argument that a shorter replacement cycle of capital raises the possibility of malfeasance on the part of the firm, and hence reduces the ability of the union to punish a firm for opportunistic behaviour).

Therefore, capital mobility has a direct and an indirect effect on union behaviour (as noted by Eichengreen, 1996, and Addison and Chilton, 1998) and these effects are in opposite directions. In a world of *slowly* increasing capital mobility, one might expect the latter effect to outweigh the former since the incentive to be aggressive *now* is falling only slowly, but the union's impatience takes into account the full expected impact of future capital liberalisation.

A similar argument, but in reverse, applies to the stricter employment protection that emerged in the late 1960s. Whilst increasing capital mobility makes it easier for firms to change their employment levels, employment protection makes it harder. The direct effect of making it harder for firms to adjust their employment levels is to make unions more aggressive. However, the indirect effect is to make the union worry less about malfeasance by the firm and so the union may become less impatient. In a world of *rapidly* increasing employment protection, one might expect the former effect to be large since the incentive to be aggressive rises sharply.<sup>11</sup>

One can also make an ambiguously-signed argument about the effect of financial liberalization. On the one hand, financial liberalization enables workers to smooth their consumption more easily and should therefore make unions less aggressive (since current earnings matter less when smoothing is easier,  $\delta_U$  should be higher). On the other hand, it is well known (but outside the scope of the model presented here) that saving rates tend to be lower in countries that have undergone financial liberalization (see Muellbauer, 1994). This tends to suggest that firms will have less easy access to external investment finance and face a higher cost of capital.<sup>12</sup> A higher cost of capital can be thought of as either a reduction in  $\delta_F$  or a rise in  $I$ .

Increased competition in international markets may also affect the equilibrium. The trade liberalization of the 1950s and 1960s led to a rise in world trade relative to

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<sup>10</sup> This is because  $L_0$  in the first term would be replaced by a lower value for employment as the firm can react more quickly to a high wage claim.

<sup>11</sup> It should be noted that there is some controversy about the empirical magnitude of the effect of employment regulations (cf. Addison and Teixeira, 2001, and Nickell and Layard, 1999, for example).

<sup>12</sup> Chadha and Dimsdale (1999) argue that the gradual relaxation of restrictions on private sector borrowing and lending have contributed to the rise in the real interest rate in the OECD. Allsopp and Glyn (1999) show that the average real short-term interest rate in the USA, UK, Germany and France was considerably higher over 1980-97 than over 1951-68.

world output. In particular, the entry of Japan into world markets may have reduced the expected future profitability of firms in the tradeable sector. The effect of this will have been to make firms less sanguine about their investment decisions and to have reduced their discount factor,  $\delta_F$ .

Lastly, there is the effect of the oil shock on productivity. As shown by the selection equation in Section 3, anything that reduces productivity ( $A$ ) will increase the likelihood that the economy will ‘tip’ out of the ‘good’ equilibrium into the ‘bad’ equilibrium. Furthermore, Bruno and Sachs (1985, pp. 196) point out that in response to productivity shocks it may be difficult for managers to convince unions that real wages need to fall, building upon the model of Grossman and Hart (1981). This asymmetric information might have the effect of increasing union demand’s relative to real output ( $w_H$ ), which again makes the selection of the ‘bad’ equilibrium more likely.

## 5. Conclusion

This paper has developed a global game interpretation of the macroeconomic performance of the OECD during the Bretton Woods era, and after. In particular, it has focused on the interactions between changes in the economic environment (both slow-moving and rapid) and the nature of the global game being played between firms and unions.

A number of contributions has been made. First, at a theoretical level, the paper has formalised the critical part of the argument made in Eichengreen (1996). Focussing on the coordination aspect of the interaction between firms and unions results in an equilibrium selection problem. The ‘Wage Restraint; High Investment’ equilibrium Pareto dominates the ‘Wage Push; Low Investment’ equilibrium, but need not be *risk-dominant*. Section 3 provides a selection equation that emphasises the rôles of the union’s and firm’s discount factors, the bargaining power of the union, and the productivity level. The discussion in Section 4 integrates the formality of the selection equation with the economic interpretation provided by Eichengreen and finds much common ground.

Second, and in contrast, the paper suggests a reinterpretation of the arguments made in Eichengreen (1996). This paper shifts the emphasis away from viewing the institutions as ‘cooperation enforcers’ toward viewing them as ‘coordination facilitators’. The former interpretation implies coercion within a Prisoners’ Dilemma; otherwise there is a need to explain why neither firm nor union withdrew from these (often voluntary) arrangements. The latter interpretation entails a selection mechanism within a coordination game where both parties pursue their self-interests. It is only when their interests changed that the equilibrium switched. This explanation is rather better suited to explain the slowdown as a reaction to changes in the economic environment, as opposed to the collapse of the bargaining institutions themselves.

Third, in order to explain the slowdown, this argument does not require the payoffs actually received by the agents in equilibrium to alter at all. The payoffs of the entire game matrix (and not just the payoffs that accrue in equilibrium) determine which equilibrium is risk-dominant. External factors can destabilise the ‘good’ equilibrium and lead to a sudden flip to the other. Nor does it take much of a change. One of problems that Eichengreen faces is how to determine which factor could have been significant enough to cause a collapse of the ‘cooperative outcome’. With a risk-dominance argument a slight change in any payoff can have enormous impact upon observed equilibrium behaviour.

Turning now to the implications of the model outlined above, we can propose the simple hypothesis that dramatic changes in investment behaviour should only have occurred in countries where the corporatist system was unsuccessful in the 1970s (from Table 2, it appears that Germany, France, Italy and the UK are in this category). Even if the equilibrium had not switched, investment rates may have fallen as catch-up opportunities diminished, but this process would have been more gradual. It might well be that there were some countries that remained successfully in the ‘good’ equilibrium (from Table 2, it appears that Japan may be such a case). Of course, non-corporatist countries were already in the ‘bad’ equilibrium, so they would not have experienced big falls in investment (such as the USA).

The upsurge of union militancy in Europe in 1968-9 provided a presentiment of the next twenty or so years of labour relations. To take the example of the United Kingdom, the large increase in union aggressiveness between 1969 to 1975 led to a remarkable rise in the labour share of output, from 66.6 per cent to 71.2 per cent (see Table 4). This rise was so rapid that even though real GDP growth fell from 2.9 per cent per annum between 1960 and 1969 to 2.2 per cent between 1969 and 1975, real wage growth rose from 3.0 per cent to 3.3 per cent (Table 5). That is, union bargaining power rose sufficiently fast that it temporarily offset the long-term decline in growth. Of course, this was not without an effect on the investment decisions of firms: the investment rate fell from 20.2 per cent of GDP in 1969 to 17.0 per cent of GDP in 1975.

The downturn in the fortunes of unions happened fairly quickly (as the economy tipped into the ‘bad’ equilibrium) with the labour share falling to 66.6 per cent of GDP in 1979 before rising to 67.7 per cent in 1981, and then declining fairly steadily to 63.2 per cent in 1999. The investment share did not return to its previous level however, and continued to be very subdued until it staged a cyclical recovery in the late 1980s.

This fits well with how an equilibrium switch works in the model presented in Section 3. Initially, the economy is in the ‘good’ equilibrium (that is, the bottom right-hand cell of the game matrix), with a moderate labour share and high investment. As the equilibrium switches, employment remains the same but wages rise implying a rising labour share, while investment collapses. Subsequently, investment remains low and employment falls, leading to a fall in the labour share.

Of course, none of the analysis in this paper should detract from the view that the main source of the prodigious growth of Europe after the war was due to the exceptionally favourable initial conditions. As Temin (2002) and Smolny (2000) pointed out, this was a period of catch-up towards the high productivity level of the United States, based upon both capital deepening and technology transfer. The Golden Age would have ended anyway when this disequilibrium was eliminated, but the slowdown would have been more gradual had the 'Wage Restraint; High Investment' consensus not collapsed.

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