ON THE DETERMINATION AND MACROECONOMIC CONSEQUENCES OF PUBLIC FINANCIAL POLICY

Abstract

This study develops a theoretical framework for the analysis of regular patterns in public financial behaviour, and applies that framework in an empirical assessment of budgetary policies in the United States and in the Netherlands.

Its purpose and scope are threefold. First, it sheds theoretical light on economic considerations guiding public financial behaviour in a dynamic model of optimal taxation. The resulting idea, that it may be sensible to smooth taxation over time, is subsequently extended to a more general model of the public finances, which involves spending, taxation, debt and money creation in an effort to control the government budget.

Second, using modern econometric methods the practical relevance of this model is illustrated with estimations for the United States and the Netherlands.

Third, the model is sufficiently flexible to allow for a number of more institutional insights. In this respect the emphasis is placed on the Dutch economy and public finances.

The thesis thus engages economic theory, econometric technique and institutional and macroeconomic background in a combined effort to understand and evaluate regular patterns in public financial behaviour. Its findings have implications for each of these three areas of economic interest.

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ON THE DETERMINATION AND MACROECONOMIC CONSEQUENCES OF PUBLIC FINANCIAL POLICY

by

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PREFACE

Recent years have seen important steps forward both in the theory of economic policy and in the theory and application of econometric methodology. This thesis forms an effort to tie together two strands in those developments. It aims at doing three things. First, it offers a contribution to the theory of optimal public financial policy. Second, it utilises modern econometric methodology in order to assess the empirical relevance of the theoretical contribution. Third, it places the results against the background of difficulties which tend to arise in practical public financial policymaking.

The combination of these three aspects is not an easy task, or, to quote Buiter (1985, see below), 'all this is hard work'. It requires not only knowledge of economic theory, econometric method and problems which occur in practical policymaking, but also the ability to combine the three. For such a project, I could not have had the privilege of a more stimulating supervisor than J. Muellbauer. He has read everything I have written over the past few years, and I am extremely grateful for all his comment, criticism, advice and encouragement.

As will be clear from several chapters of this thesis, I owe much to the teachings of D. Hendry. His writings, lectures and discussions can only convince one of the challenge and feasibility to confront economic theory with real-world data.

The field of economic research of the present study, which was first introduced to me by D. Webb at the University of Bristol, has

benefitted from the pioneering work of R. Barro. I am grateful for his interest and for his comments on Chapter 2.

The Warden, Fellows and Students of Nuffield College provided a valuable academic environment. The Gwilym Gibbon Prize Research Fellowship, to which I was elected by Nuffield College, and a Scholarship of the British Council and Foreign and Commonwealth Office supported this research and are gratefully acknowledged.

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I enjoyed many discussions on several chapters with D. Neven, P. van Els and K. Hoover. Chapter 2 benefitted from suggestions made by W. Buiter, W.M. Gorman, J. Mirrlees, and seminar participants at Birkbeck College London, the Gorman Workshop of Nuffield College, the Money Workshop of the University of Rochester and the World Congress of the Econometric Society in Boston. Chapter 3 received appreciated attention from seminar participants from the University of Tilburg, and Chapter 4 improved thanks to comments made by T. Callan, C. Granger and G. Smith. For valuable reactions to the analysis of Chapter 5 I am grateful to J. Black, J.S. Cramer, J. Frijns, H. van Gemert, Th. van de Klundert, J.P. Neary, F. Nivard, M. Scott and participants of the Conference on Natural Resources and the Macroeconomy at the Centre for Economic Policy Research in London. Errors in any of these chapters are mine.

The challenge offered by my parents is in a class of its own. For their patient support and impatient encouragement I have great respect and gratitude.

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CHAPTER 1. AN INTRODUCTION: THE RELEVANCE OF MODELLING PUBLIC FINANCIAL BEHAVIOUR

1.1. Introduction

The theoretical and empirical study of regular patterns in public financial behaviour is a cornerstone in the evaluation of the relative merits of alternative fiscal and monetary policies. The relevance of that study emanates from two sides of public financial policy.

First, recent developments both in the theory and in the practice of macroeconomic policy emphasise the considerable degree to which the effectiveness of policy can depend on the private sector's perception of regular patterns in policymaking. If the government's reactions to economic developments are to some degree predictable, then the private sector may take its anticipations of future policy into account and adapt its own behaviour accordingly. This idea is often associated with the "Rational Expectations" strand of economic theory. The same phenomenon is known as "Goodhart's Law" in the context of monetary policy. It does not require any extreme assumptions concerning the information and opportunity sets of the private sector; it suffices to acknowledge that the government cannot "fool all of the people all of the time".

The profound econometric implications of this insight have recently received ample attention in the literature on causality and exogeneity. I shall give a further introductory account of this first side of public financial policy in Section 1.2, which leads to the conclusion that sustainable inference on the efficacy of past and future policies can only be made in due regard of existing policy endogeneity and the private sector's perception of it.

The second side of public financial policy which warrants studying its regular patterns concerns its timing and dynamic controllability. Just as private behaviour is often a combined reaction to undesired disequilibria incurred in the past and to new insights gained in the present, economic policy may incorporate short-term considerations in a medium-term effort to move the budget towards its long-run desired state. Short-run considerations could for example involve political and macroeconomic stabilisation motives. Disequilibria incurred in the past can limit the scope for policymaking in the present and the future, for example through the stock-flow aspects of money, debt and deficits. This second side of budgetary policy which makes the study of regular patterns worthwhile is obviously related to the first one. While the first refers to the implications of policy endogeneity in general, the second focusses on the distinction between two types of components in public financial behaviour: "activist" policy components reacting to new information on the one hand, and "retroactive" components reacting to disequilibria incurred in the past on the other. Section 1.3 explains why it is worth modelling this distinction, and especially what will be the interest of measuring these two components separately and assessing their relative contributions to observed budgetary patterns.

There is probably no field in economics which has received so much attention as the area of public financial policy. It covers the theoretical oeuvre on fiscal and monetary policy, not to speak of the many empirical projects on these subjects. This renders it impossible to give a general overview of the literature to which the present study is hoped to make a contribution. In an effort to place the study in a wider perspective, I shall confine myself in this introductory chapter to a sketch of the relevant strands of economic research which I mentioned above. This global perspective will be further specified in the course of the ensuing presentation.

1.2. The General Case for Studying Regular Patterns in Economic Policy

A decade after the publication of the Lucas (1976) Critique, it has now become widely accepted that both theoretical and empirical economic research should pay due care to possible endogeneity of government behaviour.

On the theoretical side, attention has been focussed on the distinction between anticipated and unanticipated strands in public policy. If there are regular patterns in public policy which the private sector has the ability to predict, then private agents may take these anticipations into account in the formulation and execution of their own behavioural plans. If the private sector's ability to predict public behaviour is very well developed, and if the private sector's opportunity set allows a full reflection of these excellent anticipations in subsequent behaviour, then the implications for the theoretical effectiveness of economic policy are profound. Many variants have by now been well documented [see e.g. Lucas and

Sargent (1981)]. Moreover, even if the private sector's information and opportunity sets are not as complete as they are sometimes assumed to be, private behaviour can still be based on notions of regularities in public behaviour inasfar as the private sector's opportunity set (e.g. the existence of contingent markets) allows it to do so. When information and opportunity sets are less than complete, it may become more complicated to determine the effectiveness of alternative policies, but the important question remains: what information on government behaviour influences the behaviour of private agents, and in which way does it do so?

The matter becomes more intricate if we reverse the argument, and accept that the public sector may also determine its own behaviour on the basis of its assessment of regularities in private sector behaviour. In that case the setting becomes that of a game. The intricacies of such a setting have recently become the focus of attention in the literature on reputations and time-consistency in public policy [e.g., Barro (1985)].

The basic econometric problem to which the Lucas Critique draws our attention surfaces when a change of policy regime occurs. If private agents perceive this change and adapt their behaviour, then the coefficients of a reduced-form type of econometric model may be unstable. The model thus becomes unreliable for the prediction of private behaviour across regimes, and therefore also for the simulation of hitherto untried alternatives for future policy. Roughly speaking, there seem to be two ways around this problem. The first is probably the more ambitious, and was suggested by Lucas (1976). If instead of reduced-form coefficients we were able to estimate the constant parameters of the agents' underlying preferences, then a change of policy regime would pose no econometric problems under the assumption that it left preferences unaffected. It would seem that, apart from exceptional cases, the empirical identification of these underlying preference parameters will still require the estimation of the processes governing public sector behaviour as well. In macroeconomics, where the available samples are usually short and the game-theoretic setting may not be constant, this presents an interesting and ambitious programme for continuing research.

The second way around the Lucas Critique offers the following shortcut. Instead of estimating the underlying preferences explicitly, we can concentrate on the empirical identification of different policy regimes. If historically there have been prolonged and sufficiently homogeneous periods during which interpretable and identifiable aspects of public policy remained constant, then there is much to be learned from studying the operational characteristics of those policies which have already been applied in the past. For example, this approach may enable us to distinguish between anticipated and unanticipated, and between permanent and transitory components of observed policy patterns, and to subsequently analyse their respective influences on the economy. This is the approach taken in the research of Barro (1977,1978) on the economic effects of anticipated and unanticipated monetary policy, and more recently by the same author (1979,1980,1984a) on the determination and macroeconomic consequences of the public debt. It will also form one of the points of focus in the present study.

Formally, this second approach does <u>not</u> allow us to simulate the effects of economic policies which have not yet been applied in the past. Still, the scala of policies which have internationally been tried is broad. A thorough understanding of the merits of the policies which we can analyse econometrically, and also of the identifiable aspects of individual policies such as those discussed in the following section, will therefore definitely add to our knowledge of how to model and run the macroeconomy. Finally, these two ways to deal with the Lucas Critique are not mutually exclusive. One may hope that research along both routes will lead to converging insights in the appropriateness of alternative policies.

Even though the second approach may appear to be less ambitious, the identification of policy regimes, their constituent components, and their macroeconomic effects is not a trivial matter. Before we can even contemplate addressing the effectiveness of a macroeconomic policy, we shall first have to be able to formulate a concise and empirically robust specification of the policy itself. A misspecified model of public financial behaviour, which is subsequently employed to evaluate for instance the effects of its anticipated and unanticipated components, is likely to result in incorrect inference. Indeed, this is one of the criticisms which Pesaran (1982) levels against the work of Barro (1977,1978). Just as in the empirical analysis of economic phenomena such as money demand or the consumption function, it is therefore important to subject our models of public financial behaviour to the usual rigourous econometric testing procedures in order to reduce the risk of undetected misspecification. This leads us to the econometrics of the present study.

The econometric issues connected with the Lucas Critique are well documented [Richard (1980,1982), Hendry and Richard (1983), Engle et al. (1983)]. Let me just highlight a few points which are of particular relevance in the present context.

Engle et al. (1983) derive the exact conditions under which it is possible to estimate, predict and simulate private sector behaviour conditional on that of the public sector, i.e. without modelling them both simultaneously. Their general argument can just as well be applied to the empirical analysis of public sector behaviour conditional on that of the private economy. Since in this study we are primarily interested in characterising and estimating public financial behaviour in such a conditional setup, we shall pay careful attention to the econometric requirements for valid conditional inference. Our econometric approach will be introduced briefly in the following section, and developed further in the course of the argument.

Richard (1980,1982) emphasises the special econometric issues surrounding a change of policy regime. Our treatment of these issues wil be modest in scope and pragmatic. The first step in analysing changes of regime would seem to consist of deriving ways of characterising, identifying and estimating a policy regime itself. This is a task we set ourselves in this project. The next step will be to model and estimate how the private sector perceives, learns and incorporates policy regimes and their changes [Friedman (1979), Richard (1980,1982), Kremers (1984a)].

1.3. Two Relevant Components of Public Financial Policy and Their Implications for Model Specification

The 1960s were the years of Keynesian stabilisation policy in most Western economies. These policies have to some extent been brought into discredit by the economic difficulties of the 1970s. One of the factors behind their breakdown, at least in the Netherlands but probably more generally, was the fact that practical aspects to do with their timing and controllability were not yet fully understood. In the 1960s, public financial policy in the Netherlands was made along the prescriptions of Structural Budget Policy. This set of policy rules, which will be described more fully in Chapter 5, was designed to exert an automatically stabilising influence on the economy by running relatively large budget deficits in times of recession and large surplusses during an upswing. The short-run, and in the Keynesian setup countercyclical, behaviour of the budget is however only one aspect of public financial policy. This policy is made against the background of a notion of the desired path of the budget in the medium to long run. For example, the government may wish to see its expenditure fluctuate along a trend of, say, 30% of national income. It may also wish to keep the stock of public debt and the interest payments on that debt within particular limits. In practice, budgetary policy will be the resultant of the two aspects combined.

The medium- to long-term aspect of the budget forms a connection between short-run policies today and short-run policies tomorrow. Of course, the stock-flow dynamics of money, debt and deficits are the prime example: relatively large deficits today will result in large debts and interest payments tomorrow. If the latter are undesired, then future short-run considerations may have to be overridden in order to get the debt back to an acceptable level. Moreover, the debt-deficit dynamics do not form the only intertemporal connection between government budgets. Due to the real-world inertia in changing other budget instruments such as public spending and taxation [Post (1973), Premchand (1983)], it may also take a while to redress, say, excessive growth of public expenditure [e.g., because of "Incremental Budgeting", see Wildavsky (1964,1975)]. In this view of the budgetary process, the art of running a successful macroeconomic stabilisation policy lies in combining both aspects of the process in such a way that the result is actually countercyclical.

The breakdown of Structural Budget Policy in the Netherlands can partly be ascibed to the government's neglect of the second aspect. In the course of the 1960s, expenditure programmes were initiated which by the mid-1970s appeared to be unsustainable and also uncontrollable even in the medium term. These programmes led to increasingly undesirable levels of taxation and deficits, and ultimately to the complete abandonment of Structural Budget Policy itself. Only now, by the mid-1980s, is control over the public finances being regained, at great economic cost because the restoration of equilibrium to the public finances has (perhaps inevitably as we shall see below) been particularly poorly attuned to cyclical and even structural developments of the economy.

The experiences of these past decades may help us to avoid such mistakes in the future. How can we design budgetary policies such that major conflicts between short-run desires and long-run imperatives do not arise? A first step would seem to consist of finding ways to measure these aspects, so that we can identify when, which and why difficulties have occurred. In this study we shall show that the recent econometrics literature on Co-Integration and Error Correction offers a suitable framework for such measurement. These recent developments are designed to disentangle short- and long-run strands in economic behaviour, which makes them fit for present purposes.

This illustrative sketch of the Dutch experience also suggests that our analysis of budgetary behaviour should pay attention to all budgetary instruments simultaneously. If we are to capture the interplay between short- and long-run components in this behaviour, then the interaction between budget instruments will have to be taken into account. The practical experience that budget-wide "tension" (due for example to excessive public debt) may disturb otherwise desirable budgetary patterns, deserves our full consideration.

In Chapter 3, I shall formulate a theoretical framework which will allow us to combine the aspects referred to above and to study them empirically. Using a Co-Integration approach, Chapter 4 identifies one type of long-run "tension" in the public finances of the United States, namely that originating from the government's desire to stabilise real interest payments on Federal debt as a percentage of national income. After an historical account of recent developments in the economy and public finances of the Netherlands in Chapter 5, the chapter that follows presents an estimation of the theoretical framework of Chapter 3 with Dutch quarterly data over 1960-1982.

As remarked in Section 1.2, we would ideally like to estimate a model for the public and private sectors simultaneously in order to avoid invalid conditioning. However, the empirical analysis of Chapter 6 will show that we can model public financial behaviour largely conditional on lagged information. In conjunction with the fact that our error processes will be innovations, this means that for purposes of estimation we are allowed to model public sector behaviour separately. Current-dated explanatory variables will be treated with care, and in this context the use of quarterly data will prove advantageous.

At various points we shall compare our results with those of Barro (1979,1980,1984a), who formulated and estimated an influential model of public debt creation. The basic idea of his model is that, given the path of public spending, governments smooth tax rates over time in order to minimise the excess burden of distortive taxation. This implies that public debt creation absorbs the deviations of public spending and national income from trend. While in agreement with the basic notion that it may be sensible to smooth tax rates over time, our approach differs from that of Barro in two major respects.

In the first place, we diverge in our theoretical justification for the optimality of tax smoothing. Barro's argument, which will be further introduced in the following chapters, is based on the "Ricardian Neutrality Proposition" of the public debt [Barro (1974)]. In Chapter 2 we show that the combination of Barro's first-order neutrality proposition with a second-order excess burden of taxation is not a natural one [Flemming (1983) calls this specification of the excess burden 'essentially arbitrary']. We develop an alternative which acknowledges the non-neutral effects of public financing, even if most of the assumptions for the "Ricardian Neutrality Proposition" are accepted, and comment on wider implications for the theory of public financial behaviour.

Our second divergence from the Barro approach concerns the empirical implementation of the tax smoothing idea. In the Barro approach, only the planned tax/income ratio is constant [see Barro (1979) for the derivation of the planned ratio, which equals the present value of future expenditure divided by that of future income]. Changes in this ratio reflect new information about public spending and other variables only. In Barro's empirical work, this is translated into a path for the deficit which absorbs deviations of spending and national income from trend [equation (4.1) below]. In our model of Chapter 3, however, we also attach costs to changing taxation itself and thus express the idea that not only planned but also actual tax rates may be smoothed. We shall find in Chapter 6 that the tax/income ratio in the Netherlands has been smoothed in such a fashion. Furthermore, and this is an important extension, we involve public spending in the smoothing process as well. The Barro analysis is conditional on current spending. In our Dutch model of Chapter 6, we shall demonstrate that this is unnecessary and that it can be incorrect empirically. Finally, unlike Barro who confines his attention to the debt equation only, we develop and estimate a model for the budget as a whole in order to grant a systematic and measurable role to "tension" in the budget.

1.4. Summary

In his "Guide To Public Sector Debt And Deficits", Buiter (1985, p. 60) concludes that the formulation of a measure for the stance of fiscal policy requires the following:

> '(1) A model of the economy [...].
> (2) A specification of the length of the run over which one wishes to measure the impact of fiscal policy.
> (3) A full specification of the benchmark and the alternative policies. This includes the following:
> (a) How fiscal policy is parameterised (the tax and spending functions).
> (b) How monetary and financial policy are parameterised [...].
> (4) A full specification of how information about the changes in fiscal and financial policy actions or rules is disseminated to and processed by the private sector. This includes at least a characterisation of the unanticipated-anticipated, current-future, and permanent-transitory aspects of the policy change.'

He goes on to observe that:

> 'All this is hard work. It is also essential for informed policy debate. It is possible that there are reasonable shortcuts, but we won't know this until we have first obtained the results from following the correct procedures which can then be compared with the answers suggested by seat-of-the-pants methods.'

This study of regular patterns in public financial behaviour and their measurement is intended to add to our understanding of points (3) and (4) in quote number one, and forms an illustration of the first point in quote number two.

CHAPTER 2. THE OPTIMALITY OF DYNAMIC TAX SMOOTHING

2.1. Introduction

What motivates government in the determination of its budgetary policy? In an effort to shed some theoretical light on this question, the present chapter focusses on the desirability of dynamic tax smoothing. It aims at doing three things.

First, it asks under what conditions dynamic smoothing of tax rates is an optimal policy. The chapter contains a two-period model of the economy in which the effects of public financial policy are fully neutral except for the distortive impact of income taxation. This enables us to utilise and extend results from the literature on optimally uniform commodity taxation.

Second, the chapter derives a money-metric measure for the welfare cost of <u>sub</u>-optimal patterns of taxation. Having established under what conditions tax smoothing is optimal, we study under what circumstances deviations from the optimal policy carry serious consequences. The relevance of the distinction between <u>conditions</u> for optimally uniform taxation and the <u>size</u> of losses due to sub-optimal taxation is illustrated by the next aim.

Third, we apply the preceding analysis in a brief assessment of the theoretical foundation of the Barro (1979,1980,1984a) model of public financial behaviour. The chapter supports Barro's claim, that under reasonable assumptions the intertemporal smoothing of taxation is a sensible economic policy. Contrary to the Barro argument, however, the rationale for tax smoothing crucially depends on non-neutrality of the public finances. Our model allows us to focus on policy effects which are usually seen as second-order ones associated with public finance theory, and to explore their relationship with the usual first-order effects in standard macro models.

The setup is as follows. In Section 2.2, I present a two-period model of the excess burden of income taxation and derive the necessary and sufficient condition for optimally uniform intertemporal taxation. Section 2.3 explores the relationship between alternative sets of sufficient conditions for this optimality. The dependence of the cost of sub-optimal taxation on the underlying structure of preferences is the subject of Section 2.4, which also mentions implications for recent developments in the theory of public financial behaviour. Section 2.5 briefly concludes.

2.2. A Necessary and Sufficient Condition for Tax Smoothing

The choice between debt or tax financing involves essential dynamic aspects. A simple dynamic framework for analysing this choice is the two-period model to be presented shortly. This model contains a representative consumer, a representative producer, and the government.[1] There are two traded "goods" (consumption and labour), and there is one traded financial asset (government bonds).

Two simplifications ask for comment. I shall not model a money market, since its presence would not add much of conceptual interest to the argument, but would complicate the analysis unnecessarily. The second simplification concerns the status of pre-tax prices and wages. I assume both to be exogenous to the model, which is a fairly conventional simplifying assumption in the optimal taxation literature. The endogeneity of prices and wages would add to the variety of insights to be gained from this model, but would at the same time obscure the main argument. This also holds for capital formation, from which I abstract. Consequently, the interest rate is not determined within the model. One could either think of a small open economy model, or leave it to be determined elsewhere in the economy. Although of course the model is artificial, it serves well to make the relevant points.

The agents in the economy know that life lasts for two periods only, and hold correct expectations for the second period with certainty during the first. In summary, there cannot be any non-neutrality of the public finances caused by uncertainty, by contemporary distribution effects between different types of consumers and/or producers and by intertemporal distribution effects due to imperfect intergenerational chains. Throughout the analysis all such potential causes for non-neutrality remain excluded. All the assumptions needed for the Ricardian Neutrality Proposition of the public debt [Barro (1974)] hold, except of course the assumption of lump-sum taxes as we shall see below.

The consumer maximises utility U subject to the period 1 and period 2 budget restrictions. In direct utility terms this problem can be written as:[2]

$$\max U = U(L^1,L^2,c^1,c^2) \tag{2.1}$$

subject to:

$$w^{*1}(1-\tau^1)L^1 + p^{*1}c^1 + B = w^{*1}(1-\tau^1)I^1 \tag{2.2}$$

$$w^{*2}(1-\tau^2)L^2 + p^{*2}c^2 = w^{*2}(1-\tau^2)I^2 + (1+r)B \tag{2.3}$$

where L represents leisure, c consumption, w^* the pre-tax wage rate, p^* the price of the consumption good, τ the proportional income tax rate ($0 \leq \tau^i \leq 1$, $i=1,2$), I the consumer's total time endowment, B government bonds, and r the interest rate.

Notice that only labour income is taxed, and that the tax scheme is restricted to proportional taxation. The choice of tax system is dictated by the problem at hand and I do not consider any other system in this chapter.

I confine the analysis to income taxation for two reasons. First, income tax is the largest relatively homogeneous tax category in most modern Western economies. This supports the choice to have a single income tax rate in each period. The consumption scalars in this model can be interpreted as vectors, without affecting the analysis at all. I shall do so when commenting on the restrictiveness of consumption/labour separability below. Second, by modelling income taxation the importance of the labour supply schedule for this type of dynamic analysis can be highlighted.[3]

Notice that government expenditure, which will be introduced shortly, does not appear in the consumer's utility function. In all that follows, I take government expenditure to be exogenous. Formally, it could be endogenised in the utility function (2.1) in a separable way. In the next chapter, which formulates a transition from theory to empirical applications, public spending will be treated as endogenous. The exogeneity which I assume here serves the expositional clarity of this theoretical chapter.

As can be seen from (2.2), the consumer spends his period 1 time endowment (valued at the post-tax wage rate) on consumption, leisure, and on the purchase of government bonds. In period 2, principal plus interest on these bonds is paid, and total disposable income is spent on consumption and leisure. Given that there are no restrictions on public borrowing/lending B, and redefining the price-wage vector as:

$$p^1=p^{*1},\quad w^1=w^{*1},\quad p^2=p^{*2}/(1+r),\quad w^2=w^{*2}/(1+r)$$

we can without any further assumptions collapse the two budget constraints into a single overall restriction by substituting out for B:

$$w^1(1-\tau^1)L^1 + w^2(1-\tau^2)L^2 + p^1c^1 + p^2c^2 = W \qquad (2.4)$$

where intertemporal wealth W is defined as:

$$W \equiv w^1(1-\tau^1)I^1 + w^2(1-\tau^2)I^2 \qquad (2.5)$$

By analogy, the government is represented by two budget restrictions which can be combined into the overall budget:

$$T = p^1g^1 + p^2g^2 \qquad (2.6)$$

where the intertemporal tax take T is defined as:

$$T \equiv \tau^1w^1(I^1-L^1) + \tau^2w^2(I^2-L^2) \qquad (2.7)$$

Notice that (I-L) equals the supply of labour. In period 1, public spending g is financed by income taxation and debt creation, whereas in period 2 both public spending and debt servicing costs are financed by income taxation only. I assume that it is feasible to raise the tax revenue required to finance the given present discounted value of public spending, as formalised in (2.6).

The central question concerns the determination of tax rates τ^1 and τ^2. Under what circumstances is it optimal for government to smooth tax rates ($\tau^1=\tau^2$), and what would then be the cost of <u>not</u> smoothing them ($\tau^1\neq\tau^2$)? Given the exogeneity of public spending and given budget constraint (2.6), the government has one degree of freedom at its disposal. A variety of possible objectives for its use can be thought of [<u>e.g.</u> Atkinson (1982)]. In this economy with one representative consumer, the government goal of maximising citizens' utility U forms the natural choice. While setting its tax parameters, the government manipulates the consumer's budget constraint (2.4) in such a way as to enable the consumer to reach a high level of utility.

It is convenient to represent the consumer's preferences by the dual of the direct utility maximisation problem presented above. We can write the consumer's expenditure function E with all the usual properties [Deaton and Muellbauer (1980)] as:

$$E[w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2,U]$$

E is a monotone increasing function of utility U. As explained more fully by Diamond and McFadden (1974), it can provide a neat money-metric measure for utility loss due to distortionary influences of taxation. It will also enable us to derive an expression for the <u>size</u> of this loss which makes the importance of the labour supply schedule apparent in a convenient way. In the following, E_i will be the partial derivative of the expenditure function with respect to its i-th argument (i=1,...,4), which equals the compensated or Hicksian demand for good i. Notation for second derivatives will be chosen analogously. Arguments of partial derivatives are deleted.

I define the social deadweight loss ℓ as 'the excess of the income we must give a consumer to restore him to his pretax indifference curve over the tax revenue collected from him' [Diamond and McFadden (1974), Section 3]:[4]

$$\ell \equiv [E - \{w^1(1-\tau^1)I^1 + w^2(1-\tau^2)I^2\}] - T \qquad (2.8)$$

In the absence of taxation the deadweight loss is zero. Taxation will involve distortions, and thus cause a loss.

The government's problem is to minimise loss (2.8), while keeping the total tax take T constant as dictated by its budget constraint (2.6).[5] The marginal loss of increasing τ^1, while adjusting τ^2 to stay within the limits of the budget, amounts to:

$$(d\ell/d\tau^1)_T = (\delta\ell/\delta\tau^1) + (d\tau^2/d\tau^1)_T(\delta\ell/\delta\tau^2)$$

where subscript T stands for holding the total tax take T constant. Using: $(d\tau^2/d\tau^1)_T=-(\delta T/\delta\tau^1)/(\delta T/\delta\tau^2)$ and equations (2.6), (2.7) and (2.8) we can write this in wage elasticity terms as:

$$(d\ell/d\tau^1)_T = w^1w^2(I^1-E_1)(I^2-E_2)[\frac{\tau^1}{1-\tau^1}(e^{11}-e^{21}) - \frac{\tau^2}{1-\tau^2}(e^{22}-e^{12})]/(\delta T/\delta\tau^2) \qquad (2.9)$$

where $e^{ij}=\delta\log(I^i-E_i)/\delta\log\{w^j(1-\tau^j)\}$, $i,j=1,2$. Notice that e^{ij} are wage elasticities of <u>labour supply</u>, not of leisure demand.

When optimising, the government sets $(d\ell/d\tau^1)_T$ equal to zero. Inspection of (2.9) shows that the necessary and sufficient condition for the optimality of tax smoothing ($\tau^1=\tau^2$) is:[6]

$$e^{11} + e^{12} = e^{21} + e^{22} \qquad (2.10)$$

This condition is <u>necessary</u> only at the optimum itself. Tax smoothing is optimal if, in percentage terms, an equal change in both elements of the net wage vector has identical aggregate consequences for labour supply in both periods. Using the homogeneity of E_i, we can write:

$$e^{i1} + e^{i2} + e^{i3} + e^{i4} = 0 \qquad ,i=1,2,$$

where e^{i3} and e^{i4} are elasticities of labour supply with respect to prices of consumption goods. If there is some price index for the two consumption goods (naturally homegeneous of degree one in p^1 and p^2), then this can be rewritten as:

$$e^{i1} + e^{i2} + e^{i0} = 0 \qquad ,i=1,2,$$

where e^{i0} is the elasticity of labour supply in period i with respect to the (intertemporal) consumption price index. Condition (2.10) can thus be reinterpreted as the requirement that $e^{13}+e^{14}=e^{23}+e^{24}$ or that $e^{10}=e^{20}$. Tax smoothing is optimal if labour supply interacts with consumption (taken as an intertemporal totality) in an identical way in both periods. This is a generalisation of Corlett and Hague (1953), who consider taxation of two goods in a three-good world. The next section considers conditions on preferences which imply (2.10) and are therefore sufficient for tax smoothing.

2.3. Two Types of Sufficient Conditions for Tax Smoothing

The first set of sufficient conditions requires implicit separability of labour supply from consumption, which is shown to be substantially less restrictive than the setting Barro proposes as the microeconomic background for his theory of public financial policy [Barro (1979, fn. 7)]. The latter involves an application of the work of Sandmo (1974) and Sadka (1977) on uniform commodity taxation to this dynamic taxation model. The former builds on work by Deaton (1979,1981a) on the same subject. The second set of assumptions, based on a dynamic symmetry argument, may prove even less restrictive than the implicit separability requirement.

2.3.a Separability

This sub-section presents "separability-type" conditions on preferences under which uniform taxation is optimal. In order to guarantee optimally uniform taxation, these conditions should at least imply (2.10), which has been shown to be necessary.

Consider the following non-restrictive way of writing E:

$$E = w^1(1-\tau^1)I^1 + w^2(1-\tau^2)I^2$$
$$+ F[f\{w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2,U\},p^1,p^2,U] \qquad (2.11)$$

where F and f are functions such that E is a proper expenditure function. Without loss of generality, F and f can be taken to be homogeneous of degree one in (f,p^1,p^2) and $\{w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2\}$, respectively. The fact that (2.11) is perfectly general can be understood by removing (p^1,p^2,U) as a separate argument of F without loss of generality, and by realising that both I^1 and I^2 may be parameters of f. The following analysis will clarify why the notation of (2.11) is advantageous.

The version of tax smoothing condition (2.10) that goes with (2.11) is:

$$f_2.[w^1(1-\tau^1)f_{11}+w^2(1-\tau^2)f_{12}] = f_1.[w^1(1-\tau^1)f_{21}+w^2(1-\tau^2)f_{22}] \qquad (2.12)$$

where dots denote multiplication.

We want to avoid $f_1 \equiv f_2 \equiv 0$ because it would entail zero consumption in both periods, and $f_1 \equiv f_2 \not\equiv 0$ because it will appear in a more general form in Sub-Section 2.3.b. This means that both terms in square brackets in (2.12) should be zero for (2.12) to hold for <u>any</u> wage-price vector. This will be true if and only if f_1 and f_2 are homogeneous of degree zero in the net-wage vector <u>only</u>, which is equivalent to requiring a restricted form of (2.11):

$$E = w^1(1-\tau^1)I^1 + w^2(1-\tau^2)I^2$$

$$+ F[f^*\{w^1(1-\tau^1), w^2(1-\tau^2), U\}, p^1, p^2, U] \qquad (2.13)$$

This is the straightforward analogue for optimally uniform dynamic income taxation of the result for commodity taxation obtained by Deaton (1979,1981a). In (2.13) labour supply can be said to be "implicitly separable" from consumption [<u>cf.</u> Deaton and Muellbauer (1980, pp. 133-7)]. This precludes close substitution or complementarity between labour supply (leisure) and consumption within the period. Taking the consumption variables as vectors, it is clear that the exclusion of a close contemporaneous relationship between leisure and, say, skiing equipment may be serious. On the other hand, if the model is interpreted as describing the long-run development of an economy rather than short-run fluctuations, and consumption stands for a broad group, then this may be less serious.

It is straightforward to show that the background which Barro (1979) suggests for his model of tax smoothing is unnecessarily restrictive. He proposes a combination of weak separability of leisure from consumption with equal wealth elasticities of labour supply in each period. This set of assumptions obviously does not imply $f_1 \equiv f_2$ in (2.11). It has just been shown that in the category of "separability-type" conditions, implicit separability (2.13) is <u>necessary</u>

for (2.10) if we exclude $f_1 \equiv f_2$. Therefore, in order for the Sandmo-Sadka-Barro set of conditions to be sufficient for (2.10), it must be sufficient for (2.13) as well. It is well known that the intersection of weak and implicit separability is the case of "homothetic separability" [Gorman (1976), Blackorby et al. (1978, Theorem 4.4), and Deaton (1981a)]:

$$E = w^1(1-\tau^1)I^1 + w^2(1-\tau^2)I^2$$
$$+ F[f^{**}\{w^1(1-\tau^1),w^2(1-\tau^2)\},p^1,p^2,U] \qquad (2.14)$$

This is clearly more restrictive than (2.13). It is easily checked that (2.14) entails equal wealth elasticities of labour supply, by establishing that $\delta[(I^1-E_1)/(I^2-E_2)]/\delta U=0$.

2.3.b Symmetry

In essence, the symmetry argument maintains that tax smoothing is optimal if economic conditions are similar in the two periods and preferences are symmetric (and sufficiently smooth and convex). No further conditions on the shape of preferences are required. In contrast with the separability arguments above, this condition is required to hold only at the optimum.

Suppose the consumer's expenditure function is symmetric in labour, i.e.:[7]

$$E[w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2,U] \equiv E[w^2(1-\tau^2),w^1(1-\tau^1),p^1,p^2,U] \qquad (2.15)$$

From this it follows that the two equalities:

$$E_1[w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2,U] = E_2[w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2,U]$$

$$E_{11}[w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2,U] = E_{22}[w^1(1-\tau^1),w^2(1-\tau^2),p^1,p^2,U] \qquad (2.16)$$

hold at least where the after-tax wage rates are equal:

$$w^1(1-\tau^1) = w^2(1-\tau^2) \qquad (2.17)$$

If the consumer's preferences are sufficiently smooth and convex, (2.17) is indeed a <u>necessary</u> condition for (2.16). Substitution of (2.16) into the condition for optimality of tax smoothing (2.10) shows that, provided the initial time endowments and the discounted pre-tax wages are equal ($I^1=I^2$ and $w^1=w^2$), tax smoothing is optimal since it guarantees that (2.17) holds. It appears that symmetry entails tax smoothing by implying that $e^{11}=e^{22}$ and $e^{12}=e^{21}$ hold at the optimum, which in turn implies (2.10).

Notice that this set of conditions is less restrictive than $f_1 \equiv f_2 \not\equiv 0$ of Sub-Section 2.3.a, which would cause (2.10) to hold for <u>any</u> net-wage vector. The present set does <u>not</u> entail any restrictions on preferences, except that they are symmetric between the present and the future. Although for an individual consumer that may not be very realistic, for society as a whole (with many overlapping generations) it may be a lot less unrealistic. The entire set of conditions of this sub-section could go through in a setting with economic growth, to which the model can be extended without conceptual difficulty.

<u>2.4. The Cost of Sub-Optimal Taxation</u>

We can now use the expression for the excess burden of taxation to assess the compatibility of optimally smooth taxation and the macroeconomic neutrality of public debt. For that purpose, substitute (2.7) and (2.10) in (2.9) to obtain:

$$(d\ell/d\tau^1)_T = w^1(I^1-E_1)(e^{11}-e^{21})\left(\frac{\tau^1}{1-\tau^1} - \frac{\tau^2}{1-\tau^2}\right)\Big/ \left(1-\frac{\tau^1}{1-\tau^1}e^{21} - \frac{\tau^2}{1-\tau^2}e^{22}\right) \qquad (2.18)$$

Under "separability-type" conditions for smoothing, (2.18) holds for any net-wage vector. The corresponding expression under symmetry, where (2.18) holds only at the optimum, is more complicated but the qualitative results below are the same - reason to confine ourselves to (2.18). This expression provides the desired link between optimality considerations usually associated with public finance theory, and policy effects which are found in standard macroeconomic models.

The loss due to an uneven pattern of taxation can be calculated by comparing the loss ℓ at e.g. $\tau^1=k\tau^2<\tau^2$ with the loss at $\tau^1=\tau^2$. Equivalently, we can integrate the marginal loss given in (2.18) over τ^1, running from $k\tau^2$ to τ^2. Consequently, inspection of (2.18) will yield insight into the factors determining the order of magnitude of such losses. Intuitively, one would expect that the more elastic the labour supply schedules (the greater e^{11} and e^{22}) and the smaller in absolute terms the intertemporal elasticities of substitution (e^{12} and e^{21}), the greater will be the utility loss due to uneven taxation. With some qualifications, this appears to be correct.

Suppose we want to know the importance of e^{11} (or e^{22}) for such loss. In (2.18) we can vary e^{11} freely, keeping e^{12} and e^{21} constant, as long as (2.10) remains satisfied. This is warranted if we vary e^{11} and e^{22} in exactly the same way, which also justifies the approximation that E_1 in (2.18) remains unaffected. Keeping everything else constant, and after substitution for e^{22} from (2.10), we can indeed derive from (2.18) that a greater own-wage elasticity of labour supply increases the loss due to uneven taxation.[8]

Whereas for the own-wage effect this result is unambiguous, such is not the case for the cross-wage effects. Greater intertemporal substitution only leads to smaller utility losses due to uneven taxation if the own-wage elasticities are sufficiently large and the tax rates are sufficiently high.[9] The argument for the symmetry case should be conducted in terms of (2.9), and leads to the same qualitative results.

The usual notion of macroeconomic public debt neutrality entails that a shift in the debt/tax mix to finance given public spending does not have any consequences for variables such as production and employment. In this model, debt neutrality would be a fair approximation of reality if all labour supply elasticities were close to zero. However, it is clear from (2.18) that in that case tax smoothing loses its rationale. The loss of <u>not</u> smoothing will of course tend to zero if the distortive impact of taxation becomes negligible. The theoretical model of Barro (1979,1980,1984a) is an approximation to this limiting case. Barro models government behaviour as being guided by the goal of a minimal present discounted value of expected future costs incurred in the tax generating process. These costs (representing the excess burden of taxation) are taken to be homogeneous of degree one in the tax take and national income, so that a constant planned future tax/income ratio results as the optimal policy. To derive this result, Barro accepts the Ricardian Neutrality Proposition of public debt as a valid first-order assumption, so that variables such as national income remain unaffected by the debt/tax choice.

While tax smoothing may definitely be a sensible policy, it appears that its explicit foundation in the non-neutrality of the public finances may have significant empirical implications. In this theory of public financial behaviour, which is based on the deadweight burden of taxation, there exists no a priori justification for assuming that variables such as national income, prices and interest rates remain unaffected by the government's policy choices. This forms a potential source of simultaneity, even if one is prepared to make most of the strong assumptions for the Ricardian Neutrality Proposition. The econometric problems of simultaneity are well-known, as are means to deal with them [e.g. Engle et al. (1983), Hendry and Richard (1983), and Maddala (1981)]. Barro (1979,1980,1984a) and Canarella and Garston (1983) do not take these potentially serious simultaneity effects into account [see also Bomhoff (1982) and Kremers (1983)]. It is unclear how sustainable empirical progress in this field can be made without acknowledging the potential non-neutralities of the public finances. The following chapters will pay careful attention to this issue.

Furthermore, the proposition of Kydland and Prescott (1980, p. 186) [cf. Barro (1979, fn. 7)], that the cost of sub-optimal distortive taxation is larger the stronger intertemporal substitution, must be qualified. It has been shown above that implicit separability between labour supply and consumption is a sufficient condition for the optimality of tax smoothing. Implicit separability entails that the decision on how to distribute the total (long-run, life-time) labour supply over the present and the future depends on the relative after-tax wages and total utility only [Deaton and Muellbauer (1980, p. 136)]. Such a scenario would intuitively seem to combine quite naturally with strong intertemporal labour supply substitution. This does, however, not have any bearing on the costs of sub-optimal taxation. It appears that those costs are only positively related to strong intertemporal substitution if labour supply is relatively insensitive to changes in the contemporaneous tax rate (fn. 9).

2.5. Conclusion

This chapter presents general conditions under which dynamic tax smoothing may be a sensible public financial policy. The character of the underlying model seems at least to justify the application of its results to long-run developments in the economy, around which short-run movements can fluctuate. The short-run validity of the Ricardian Neutrality Proposition, whose assumptions underly the model, has been widely criticised [e.g. Buiter and Tobin (1979), Feldstein (1982) and Blanchard (1985)]. If one would nevertheless wish to apply this type of approach to the short run [as Barro (1979,1980,1984a) and Kydland and Prescott (1980) do], then this chapter clarifies the role of intertemporal substitution and justifies the optimality of tax smoothing with an explicit assessment of the distortive impact of this aspect of public financial policy. Nevertheless, in the remainder of this study we shall assign the theory of this chapter a role at the long-run background of the more general model of public financial behaviour which will be presented next in Chapter 3.

<u>Footnotes Chapter 2.</u>

1 The concepts of a representative consumer and a representative producer are merely convenient artefacts, which enable us to analyse aggregate behaviour as a function of aggregate prices, outlays and so on. An analysis of the conditions under which such aggregation of individual consumers and producers is feasible is beyond the scope of this study. For an introduction, see Deaton and Muellbauer (1980, Chapter 6).

2 Throughout the rest of the chapter, the convention will be that subscripts denote partial derivatives, and superscripts denote periods. Furthermore, I assume preferences to be smoothly convex, so that all the usual properties of the expenditure function apply.

3 In an optimal taxation model, which is aiming at the greatest possible generality, one usually assigns the consumers initial endowments of <u>all</u> the goods in the economy. In such a model, the choice of one untaxed good as the numeraire does not introduce any asymmetries [Deaton (1981b)]. Since the present optimal taxation problem originates from a particular macroeconomic problem, I have traded generality for expositional clarity by modelling two untaxed goods with no endowments, and two taxed goods with endowments.

4 Assuming that U is feasible. The choice of benchmark utility is not important in this context.

5 This leads to the same solution as the maximisation of U subject to both E=W and (2.6) in compensated demand form.

6 Provided we rule out $e^{11}=e^{21}$ and $e^{22}=e^{12}$. It is reasonable to take $e^{11},e^{22}>0$ and $e^{12},e^{21}<0$. $\delta T/\delta\tau^i$ and I^i-E_i are assumed to be strictly positive and finite, i=1,2, which rules out anomalies which this chapter is not interested in. Sufficiently close to the optimum, where $e^{11}+e^{12}\approx e^{22}+e^{21}$, second-order conditions can be checked in (2.9). If $\tau^2>\tau^1$, it shows that an increase in τ^1 will decrease loss ℓ, just as required.

7 The symmetry defined in (2.15) is equivalent near the optimum to symmetry in the consumer's direct utility function:

$$U(L^1,L^2,c^1,c^2) \equiv U(L^2,L^1,c^1,c^2)$$

This can easily be seen by realising that where $w^1(1-\tau^1)=w^2(1-\tau^2)$, the optimisation problem which underlies the expenditure function is entirely symmetric in labour if the direct utility function is symmetric as above.

8 Provided $\delta T/\delta\tau^2>0$, the derivative of $(d\ell/d\tau^1)_T$ with respect to e^{11} is negative for $\tau^1<\tau^2$ and positive for $\tau^1>\tau^2$. The loss due to uneven taxation relative to the loss at $\tau^1=\tau^2$ therefore increases with e^{11}.

9 Provided $\delta T/\delta\tau^2>0$, the derivative of $(d\ell/d\tau^1)_T$ with respect to $(-e^{21})$ is negative for $\tau^1<\tau^2$ and positive for $\tau^1>\tau^2$ if and only if:

$$\frac{\tau^1}{1-\tau^1}e^{11} + \frac{\tau^2}{1-\tau^2}e^{22} > 1$$

or, equivalently:

$$[\delta(I^1-E_1)/\delta\tau^1][\tau^1/(I^1-E_1)] + [\delta(I^2-E_2)/\delta\tau^2][\tau^2/(I^2-E_2)] < -1$$

The sum of the "own-tax" elasticities of labour supply in period 1 and in period 2 should be sufficiently large in absolute terms.

CHAPTER 3. PLANS, BUFFERS, AND UNCERTAINTY IN PUBLIC FINANCIAL POLICY

3.1. Introduction

In order to offer scope for capturing observed policy patterns, an empirical model of the public finances may pay attention at least to the following three aspects of budgetary policy. First, policy is made against the background of some long-run notions about the size and role of government in society and within the limits of its borrowing collateral. Second, in the short run policy can react to new information and to cyclical developments in the economy. Third, the empirical model should pay attention to the way in which the government embeds these short-run reactions in a medium-term effort to move the budget towards its long-run targets.

One example of a long-run target would be a set of constant ratios of spending, taxation and, say, the national debt over national income. The approach suggested below allows such long-run targets to be dependent on other variables (such as the interest rate) in a flexible way. However, it does not impose these targets on the data; they merely emerge as the hypothetical long-run trends underlying the estimated short-run dynamics.

The models of Barro (1979) and of Chapter 2 offer one type of theoretical rationale for these long-run targets. It may be noted, however, that other academic disciplines have provided other considerations on the level of government spending and on the determinants of taxation. An example from the political science literature is Cameron (1978), who explains the size of government by the state of development of the economy; the traditional tax structure; the political system and partisan setting; the institutional structure of government; and the openness of the economy. Following Downs (1957) the economics profession came to appreciate and study the relationship between politics and economics, which also led to studies of the size and operation of government [for examples and references, see Alt (1979), Meltzer and Richard (1981) and Borooah and Van der Ploeg (1983)].

This chapter builds on that literature. For reasons of presentation, I assume that the government has constant ratios of spending, taxation and the stock of public debt over national income as its long-run targets. It will become clear in the course of the argument that both this theoretical approach and its empirical implementation are more flexible than they may seem at first sight. It is straightforward to make the targets dependent on other relevant variables, or to incorporate slow, trendwise movements of them.

The second aspect of a potentially useful model concerns the short run. How does the budget react to short-run developments in the economy? This is the realm of macroeconomic stabilisation policy. Given the underlying long-run pattern, it is desirable that the model allows explicit measurement of short-run impact reactions of the budget to business cycles in the economy.

However, practical policymaking experience offers an abundance of evidence of potential conflict between long-run and short-run aspects of government budgets. The policymaker has to weigh the benefits of short-run stabilisation (or other) policies against the background of a long-run desired state of the budget. For example, if the stock of public debt is already very large the government may be more reluctant to engage in an expansionary policy than when the debt is close to target. An analysis of the public finances which ignores the day-to-day relevance of this interplay between short-run desires and long-run imperatives is in danger of being unrealistic. As a third aspect of our model, it will offer the opportunity to actually measure the extent to which short-run stabilisation policy is hampered by long-run control considerations.

In summary, the model to be presented shortly follows Barro (1979) in assuming a given long-run target for public spending. However, Barro assumes spending to be exogenous also on the short run. The present model engages not only taxation and debt creation but also spending in an effort to control the budget, in a way that satisfies short-run objectives and simultaneously observes long-run constraints. Furthermore, we do not impose those long-run targets on the data; they merely appear as the underlying long-run patterns.

Unlike Barro, I also include long-run targets for taxation and the public debt (or interest payments). These long-run targets are mutually consistent, by being required to satisfy the long-run budget constraint. Unlike Barro (1979, p. 942), we thus explicitly represent the government's interest to remain within the limits of its long-run collateral. The model of Barro does not have any target for the public debt. Our incorporation of long-run requirements for all the budgetary instruments introduces "tension" into the budget. For example, if interest payments are far above target, then there will be pressure on both spending and taxation to temporarily reduce deficits and thus also the future stock of debt and future interest payments. The empirical importance of this aspect of the model will be illustrated with U.S. data in Chapter 4. A different approach to the same phenomenon is offered by Hamilton and Flavin (1985), who present a variety of direct tests of the proposition that there are long-run limits on public borrowing. Their findings with postwar U.S. data lead to the conclusion that 'the government must promise creditors that it will balance the budget in expected present-value terms'.

The setup of this chapter is as follows. In Section 3.2 I introduce the distinction between long-run targets, short-run plans, and short-run realisations. Section 3.3 formalizes the planning side of the model. The resulting planned policy rule is supplemented with a stochastic structure in Section 3.4, which is followed by a discussion of budget buffers in Section 3.5.

Two features of the model must be noted at the outset. First, in this chapter I do not model government money creation explicitly. It can be introduced in a straightforward manner by writing the public debt variable as consisting of two components: funded debt and floating debt or money. Monetary financing will be included in the empirical work on the Netherlands in Chapter 6.

Second, something must be said on the logical structure of the planning process. This process is taken to consist of two stages. In the first stage, the government forms itself an opinion on long-run targets, and also on the extent to which it would wish the budget to behave in a countercyclical fashion. In the second stage, which is conditional on the first one, it implements the policy by formulating budget plans for the next few years. The two ingredients of the first stage can be found as parameters in the second, which contains parameters for long-run targets and parameters for "the degree of countercyclical fluctuation" of the deficit. In Section 3.6, which concludes this chapter, I shall suggest how future work might integrate these two stages. For present purposes it will prove clarifying to treat them separately. In my view the model of budget planning which I present in this chapter is helpful, but the subsequent analysis of budgetary uncertainty is not restricted to this particular approach.

3.2. Three Levels of the Budget Constraint

In this chapter I consider four main components of the budget: taxation (T_t), public debt creation [(B_t-B_{t-1}), where B_t is the stock of debt at the end of period t], interest payments on the public debt [$I_t=r_{t-1}B_{t-1}$, where r_t is the interest rate], and public expenditure net of interest payments (G_t).

The period t can be thought of as a fiscal year. For simplicity I assume all public debt to be one-period bonds, but one may also think of 1 as the average maturity and r_{t-1} as the effective interest rate. Inflation is absent so that everything is in real terms. These abstractions will of course be relaxed in the empirical applications below.

The budget constraint can be written as:

$$G_t + r_{t-1}B_{t-1} = T_t + (B_t-B_{t-1}) + Q_t \qquad (3.1)$$

where Q_t is an item beyond the government's short- to medium-term control. I model this term because in the Dutch application below the revenues from natural gas exploitation play a major role in the budget. These revenues are not part of the budget control process in the normal way, and especially uncertainty around their future values is a relevant phenomenon in the planning process. The presence of Q_t will suggest ways of treating such off-control items.

Although ultimately we are interested in evaluating <u>observed</u> budgetary patterns, it is important to distinguish three levels at which the budget equation must be satisfied.

In the first place, the government's long-run objectives should be consistent with the long-run budget constraint. As announced in the previous section, this chapter formulates the long-run objectives as ratios of budget variables over national income:

$$T_t/Y_t=\tilde{\theta},\ G_t/Y_t=\tilde{\gamma} \text{ and } B_t/Y_t=\tilde{\beta} \qquad (3.2)$$

It remains an open question whether to incorporate a target for the debt or for interest payments. We proceed with (3.2) because it will enable us to concentrate on one-period-ahead planning. Nevertheless, a reformulation in terms of a target for I_t/Y_t is straightforward, and indeed in the following chapter I shall argue that since the 1930s U.S. governments have been targeting this real interest/income ratio. It may also be preferable to analyse the constancy of the ratio of two flow variables (I_t/Y_t), rather than the constancy of the ratio of a stock and a flow (B_t/Y_t). Nevertheless, for reasons of notation I proceed with a target for B_t/Y_t in this chapter.

Finally, the off-control variable Q_t should behave in a way which is consistent with the long-run budget. I assume that in the long run Q_t converges on a constant fraction of national income:

$$Q_t/Y_t = \tilde{\upsilon} \qquad (3.3)$$

Notice that this fraction might well be zero, so that the setup can cater for temporary phenomena such as the natural gas boom in the Netherlands.

For compatibility with budget constraint (3.1), which must hold in the long run, the targets (3.2) and the fraction (3.3) must satisfy:

$$\tilde{\gamma} + \tilde{\beta}(r-\pi)/(1+\pi) = \tilde{\theta} + \tilde{\upsilon} \qquad (3.4)$$

where π is the long-run rate of growth of Y, and in view of (3.2, 3) also of the variables in the budget.

The fact that long-run targets must satisfy the budget constraint has an interesting implication for the approach of Barro (1979,1980,1984a). In his model, government plans a constant ratio of taxation over national income. Given the fact that there are limits to the fraction of national income which can be assigned to public spending G (both a lower and an upper limit – we model a spending/income target but Barro assumes spending to be exogenous), the budget constraint implies that there will also be limits to the ratio of government interest payments over national income. In Chapter 4, we shall show the empirical significance of this implication by establishing that there has been a target for the ratio of real interest payments over national income in the U.S., 1930–1983. This phenomenon introduces "tension" into the budget. However, Barro does not uncover any feedback on a debt-related variable because his tests are too restricted as we shall further substantiate in the following chapter.

At the second level of the budget, the government at t-1 formulates a short-run plan for period t. Again, the planned variables must satisfy the budget on an ex ante basis if the planning method is to be consistent.

In the third place, the ex post realisations of budget plans by definition have to satisfy (3.1).

Using the distinction between these three levels of budgeting, at each of which the variables satisfy the budget equation, it becomes feasible to study the interplay of long-run notions, short-run plans converging on those long-run notions, and short-run stochastic shocks to the budget. Since in reality these three levels together result in actually observed policy patterns, an empirical analysis of such patterns may fruitfully take this distinction into account. The next section derives the government's plans which are meant to converge on its long-run targets, while the section after that considers the stochastic side of the budget.

3.3. Budget Plans

Before proceeding to a formal description of budget planning, let me first add a few more ingredients to the sketch which was initiated above. The two-stage character of planning has already been mentioned. Within that framework, the actual planning and control process proposed here resembles that introduced by i.a. Richard (1980), Hendry and von Ungern-Sternberg (1981) and Hendry and Richard

(1983). They provide an econometric framework within which the various aspects of the budget alluded to above can be combined, and in which these aspects can be linked directly to interpretable empirical representations.

The first ingredient of our model is the government goal function. As explained, the planning process should not require very precise expectations on the state of the economy and of the public finances in the distant future. Against the background of an underlying notion of long-run developments, government plans actual budgets for a few years ahead only. For mathematical convenience I derive the optimal policy for a one-year-ahead budget, but the character of the control rule would not be altered if we extended the planning horizon to several years [see *e.g.* Hendry and von Ungern-Sternberg (1981), Anderson and Hendry (1984), and Nickell (1985)].

At the end of fiscal year t-1, the government has a plan (g_t^p, τ_t^p, b_t^p) for the budget of year t which minimises loss function (3.5) below. Notation is chosen such that lowercase letters denote the natural log of their uppercase equivalents. For example, g_t^p is the log of planned public spending, τ_t^p is that of taxation, and b_t^p of the public debt. I formulate the model in logarithms straightaway because the empirical specification will also be in logs. The latter is motivated by the fact that a log-linear specification allows us to estimate elasticities, which may at least potentially be stable. It also offers considerable flexibility in imposing, manipulating and testing linear parameter restrictions, and it results in a residual which is a percentage of the level of the dependent variable. However, as we shall see below the empirical specification of the Dutch model will be slightly more hybrid than a pure log-linear one.

The loss function is:

$$L_t^e = \lambda_1[b_t^p - y_t^e - \beta]^2 + \lambda_2[g_t^p - y_t^e - \gamma]^2 + \lambda_3[\tau_t^p - y_t^e - \theta]^2$$

$$+ \lambda_4[\Delta b_t^p - (B_{t-2}/B_{t-1})\Delta b_{t-1}]^2 + \lambda_5[\Delta g_t^p]^2 + \lambda_6[\Delta \tau_t^p]^2$$

$$- 2\lambda_7[\Delta b_t^p - (B_{t-2}/B_{t-1})\Delta b_{t-1}][\Delta y_t^e]$$

$$- 2\lambda_8[\Delta g_t^p][\Delta y_t^e] - 2\lambda_9[\Delta \tau_t^p][\Delta y_t^e] \qquad (3.5)$$

where $\lambda_i \geq 0$ $(i=1,\ldots,9)$, $\beta=\ln(\tilde{\beta})$, $\gamma=\ln(\tilde{\gamma})$, $\theta=\ln(\tilde{\theta})$, $y_t=\ln(Y_t)$, $\Delta y_t^e = y_t^e - y_{t-1}$ with "e" denoting an expectation, and $\Delta b_t^p = b_t^p - b_{t-1}$.

The first three terms of goal function (3.5) refer to the cost of being away from the long-run targets. This is the long-run "driving-force" behind the model.

The next three terms attach costs to changing instrument values and represent a "smoothing" argument. Notice that I do not attach costs to changing the <u>stock</u> of debt, but to changing the government's recourse to the capital market. This is a flow, just as spending and taxation. We can write that term as:

$$\Delta b_t^p - (B_{t-2}/B_{t-1})\Delta b_{t-1} \simeq [(B_t^p - B_{t-1}) - (B_{t-1} - B_{t-2})]/B_{t-1}$$

I use a <u>common</u> scaling factor B_{t-1} because this seems to be the closest way of attaching costs to changing the <u>deficit</u> (which may itself be zero, and is therefore not suitable as a scaling factor). A similar alternative would be to take simply $(\Delta b_t^p - \Delta b_{t-1})$, but a slightly different version is used here for presentational consistency with the budget constraints (3.6) and (3.7) below, and with the empirical analysis in Chapter 6. While this setup seems the most natural one, we could easily change it and make it costly to change the stock of debt or interest payments without affecting the character of the resulting policy.

The last three terms mitigate the cost of changing instrument values if they move in the same direction as the target. Hendry and von Ungern-Sternberg (1981) justify this type of term 'to allow more adjustment at a given cost when [the target] has changed than when it is constant. By comparison, partial adjustment models enforce quadratic adjustment costs irrespective of how much the target is known to have changed'. In the present context these terms are given quite a specific interpretation. As remarked, the second three terms represent a "smoothing" argument, stemming from an economic analysis of the distortionary impact of the budget (see e.g. Chapter 2). Given the fact that the government is targeting, say, the long-run tax/income ratio, it yet remains to be determined whether this target is to be pursued through smoothing the ratio of taxation over income or through smoothing the tax take itself. The former would on the short run yield more fluctuations in taxation, whereas the latter would produce a more volatile tax/income ratio. The third set of terms in the loss function determines the degree to which government smoothes the tax take or its ratio over national income, and for spending and the debt equivalently. For example, if $\lambda_9=\lambda_6$ we can rewrite the relevant part of the cost function as $\lambda_6[(\tau_t^p-y_t^*)-(\tau_{t-1}-y_{t-1})]^2$, so that a pure case of tax ratio smoothing applies. If $0<\lambda_9<\lambda_6$, the tax take will be smoothed relative to fluctuations in income. If $\lambda_9>\lambda_6$, the tax take will converge along a path with larger fluctuations than national income. Finally, if $\lambda_9=0$ partial adjustment results for the tax rate. A similar typology exists for spending and the deficit.

We can thus interpret the third set of terms in the cost function in the context of automatic stabilisation policy. As will be shown below, the parameters λ_7, λ_8 and λ_9 are the sole determinants of the degree to which the budget on impact behaves in a countercyclical fashion, and as such they have been determined in the first stage of the planning process. From a countercyclical perspective, it may seem odd that I assume $\lambda_7,\lambda_8,\lambda_9 \geq 0$. Recall, however, that the government tries to keep the long-run development of the budget in line with that of national income, and that simultaneously it endeavours to do that in a countercyclical pattern. The latter is determined by the relative magnitudes of λ_7, λ_8, and λ_9 together, and can be captured by $\lambda_7,\lambda_8,\lambda_9 \geq 0$ as we shall see below.

Of course one of the λ_i $(i=1,\ldots,9)$ in the cost function could be eliminated through suitable normalisation. The same is true for the parameters from the long-run budget constraint (3.4). It is furthermore not conventional to attach costs to changing the government's indebtedness explicitly as in (3.5) [cf. Barro (1979) and Chapter 2]. However, I model all the terms and parameters of (3.5) so as to be able to trace their respective roles in the optimal policy rule derived below.

Notice, finally, that since the planning process evolves in stages, this second stage is conditional on an expectation for Y_t. It will be interesting to endogenise Y_t explicitly, and I shall comment on such an integration of planning stages in Section 6.

The loss function (3.5) is to be minimised with respect to instruments b_t^p, g_t^p and τ_t^p, subject to the budget constraint. Hence we have to make a choice. Since the decision variables are in logs, we need a log-linear approximation of the budget which itself is in levels. First differences of budget constraint (3.1) can be approximated fairly accurately by:

$$[\Delta b_t{}^p - (B_{t-2}/B_{t-1})\Delta b_{t-1}] = (G_{t-1}/B_{t-1})\Delta g_t{}^p - (T_{t-1}/B_{t-1})\Delta\tau_t{}^p$$

$$- (Q_{t-1}/B_{t-1})\Delta q_t{}^* + (I_{t-1}/B_{t-1})\Delta i_t \qquad (3.6)$$

If the plans and their realisations evolve not too differently from the long-run target path, then (3.6) can in turn be approximated by:

$$[\Delta b_t{}^p - (B_{t-2}/B_{t-1})\Delta b_{t-1}] = (\tilde{\gamma}/\tilde{\beta})\Delta g_t{}^p - (\tilde{\theta}/\tilde{\beta})\Delta\tau_t{}^p$$

$$- (\tilde{\omega}/\tilde{\beta})\Delta q_t{}^* + r/(1+\pi)\Delta i_t \qquad (3.7)$$

where parameters must satisfy (3.4). Of course I could also replace (B_{t-2}/B_{t-1}) by its long-run constant value $1/(1+\pi)$, but I consider the entire term $[\Delta b_t{}^p-(B_{t-2}/B_{t-1})\Delta b_{t-1}]$ as the "debt acceleration" variable and stick to the present notation.

Strictly speaking it would be correct to perform the optimisation exercise subject to budget constraint (3.6), but for notational reasons I assume that budget constraint (3.7) is a fair approximation. However, the close resemblance of the two will allow us to consider at a later stage what the consequences would be if (3.7) were a poor approximation. In fact, we shall see that this approximation may form a source of heteroskedasticity (Appendix 3A).

After substituting $b_t{}^p$ out of $L_t{}^*$ by using budget constraint (3.7), we can set the derivatives of $L_t{}^*$ with respect to $g_t{}^p$ and $\tau_t{}^p$ equal to zero in order to obtain the following optimal policy rule:

$$\begin{bmatrix} \Delta g_t^p \\ \Delta \tau_t^p \\ \Delta b_t^p-(B_{t-2}/B_{t-1})\Delta b_{t-1} \end{bmatrix} = \begin{bmatrix} \psi_{11} & \psi_{12} & \psi_{13} & 0 & \psi_{15} & \psi_{16} & \psi_{17} \\ \psi_{21} & \psi_{22} & 0 & \psi_{24} & \psi_{25} & \psi_{26} & \psi_{27} \\ \psi_{31} & \psi_{32} & \psi_{33} & \psi_{34} & \psi_{35} & \psi_{36} & \psi_{37} \end{bmatrix} \begin{bmatrix} 1 \\ \Delta y_t^* \\ (g-y)_{t-1} \\ (\tau-y)_{t-1} \\ (b-y)_{t-1}+\Delta b_{t-1} \\ \Delta q_t^* \\ \Delta i_t \end{bmatrix}$$

or:

$$\underline{z}_t^p \equiv \Psi\, \underline{x}_t^* \qquad (3.8)$$

where $\underline{z}_t^p$ is the vector of budgetary instruments, $\underline{x}_t^*$ the vector of (expected) explanatory variables and Ψ the matrix of policy coefficients. The expressions for the elements of Ψ are given in Table 3.1.

<u>Table 3.1. The Parameters of the Policy Rule</u>

$$\psi_{11} = (\lambda_1+\lambda_4)[\lambda_2\gamma(\tilde{\theta}/\tilde{\beta})+\lambda_3\theta(\tilde{\gamma}/\tilde{\beta})](\tilde{\theta}/\tilde{\beta})/\Phi$$

$$+ (\lambda_3+\lambda_6)[\lambda_1\beta(\tilde{\gamma}/\tilde{\beta})+\lambda_2\gamma]/\Phi \qquad \geq 0$$

$$\psi_{21} = (\lambda_1+\lambda_4)[\lambda_2\gamma(\tilde{\theta}/\tilde{\beta})+\lambda_3\theta(\tilde{\gamma}/\tilde{\beta})](\tilde{\gamma}/\tilde{\beta})/\Phi$$

$$+ (\lambda_2+\lambda_5)[-\lambda_1\beta(\tilde{\theta}/\tilde{\beta})+\lambda_3\theta]/\Phi \qquad \geq 0$$

$$\psi_{31} = \psi_{11}(\tilde{\gamma}/\tilde{\beta})-\psi_{21}(\tilde{\theta}/\tilde{\beta})$$

$$\psi_{12} = (\lambda_1+\lambda_4)[(\lambda_3+\lambda_9)(\tilde{\gamma}/\tilde{\beta})+(\lambda_2+\lambda_8)(\tilde{\theta}/\tilde{\beta})](\tilde{\theta}/\tilde{\beta})/\Phi$$

$$+ (\lambda_3+\lambda_6)[(\lambda_1+\lambda_7)(\tilde{\gamma}/\tilde{\beta})+(\lambda_2+\lambda_8)]/\Phi \qquad \geq 0$$

$$\psi_{22} = (\lambda_1+\lambda_4)[(\lambda_3+\lambda_9)(\tilde{\gamma}/\tilde{\beta})+(\lambda_2+\lambda_8)(\tilde{\theta}/\tilde{\beta})](\tilde{\gamma}/\tilde{\beta})/\Phi$$

$$+ (\lambda_2+\lambda_5)[-(\lambda_1+\lambda_7)(\tilde{\theta}/\tilde{\beta})+(\lambda_3+\lambda_9)]/\Phi \qquad \geq 0$$

$$\psi_{32} = \psi_{12}(\tilde{\gamma}/\tilde{\beta})-\psi_{22}(\tilde{\theta}/\tilde{\beta})$$

$$\psi_{13} = -\lambda_2[(\lambda_1+\lambda_4)(\tilde{\theta}/\tilde{\beta})^2+(\lambda_3+\lambda_6)]/\Phi \qquad \leq 0$$

$$\psi_{33} = \psi_{13}(\tilde{\gamma}/\tilde{\beta}) \qquad \leq 0$$

$$\psi_{24} = -\lambda_3[(\lambda_1+\lambda_4)(\tilde{\gamma}/\tilde{\beta})^2+(\lambda_2+\lambda_5)]/\Phi \qquad \leq 0$$

$$\psi_{34} = -\psi_{24}(\tilde{\theta}/\tilde{\beta}) \qquad \geq 0$$

$$\psi_{15} = -\lambda_1(\lambda_3+\lambda_6)(\tilde{\gamma}/\tilde{\beta})/\Phi \qquad \leq 0$$

$$\psi_{25} = \lambda_1(\lambda_2+\lambda_5)(\tilde{\theta}/\tilde{\beta})/\Phi \qquad \geq 0$$

$$\psi_{35} = \psi_{15}(\tilde{\gamma}/\tilde{\beta})-\psi_{25}(\tilde{\theta}/\tilde{\beta}) \qquad \leq 0$$

$$\psi_{16} = (\lambda_1+\lambda_4)(\lambda_3+\lambda_6)(\tilde{\gamma}/\tilde{\beta})(\tilde{\upsilon}/\tilde{\beta})/\Phi \qquad \geq 0$$

$$\psi_{26} = -(\lambda_1+\lambda_4)(\lambda_2+\lambda_5)(\tilde{\theta}/\tilde{\beta})(\tilde{\upsilon}/\tilde{\beta})/\Phi \qquad \leq 0$$

$$\psi_{36} = \psi_{16}(\tilde{\gamma}/\tilde{\beta})-\psi_{26}(\tilde{\theta}/\tilde{\beta})-(\tilde{\upsilon}/\tilde{\beta})$$

$$\psi_{17} = -(\lambda_1+\lambda_4)(\lambda_3+\lambda_6)(\tilde{\gamma}/\tilde{\beta})r/(1+\pi) \qquad \leq 0$$

$$\psi_{27} = (\lambda_1+\lambda_4)(\lambda_2+\lambda_5)(\tilde{\theta}/\tilde{\beta})r/(1+\pi) \qquad \geq 0$$

$$\psi_{37} = \psi_{17}(\gamma/\beta)-\psi_{27}(\check{\theta}/\check{\beta})+r/(1+\pi)$$

$$\Phi = (\lambda_1+\lambda_4)[(\lambda_3+\lambda_6)(\tilde{\gamma}/\tilde{\beta})^2+(\lambda_2+\lambda_5)(\tilde{\theta}/\tilde{\beta})^2]+(\lambda_2+\lambda_5)(\lambda_3+\lambda_6) > 0$$

<u>Note</u> All ψ_{3j} $(j=1,\ldots,7)$ have been derived using budget constraint (3.7). $\psi_{21},\psi_{22}\geq 0$ only if $(\lambda_1,\lambda_4,\lambda_7)$ is not too large relative to $(\lambda_2,\lambda_5,\lambda_8)$ and $(\lambda_3,\lambda_6,\lambda_9)$.

As expected and intended, the solution contains the usual Error Correction feedback terms on g and τ. The feedback on the debt/income target is perhaps less conventional. Some intuition for the role of this term $[(b-y)_{t-1}+\Delta b_{t-1}]$ may be obtained by writing:

$$(b-y)_{t-1}+\Delta b_{t-1} = (b-y)_{t-1}+\Delta(b-y)_{t-1}+\Delta y_{t-1} \tag{3.9}$$

If we substitute (3.9) in policy rule (3.8), this suggests that the vector of explanatory variables (with appropriate parameter restrictions) would be:

$$[1,\Delta y_t^*,\Delta\Delta y_t^*,(g-y)_{t-1},(\tau-y)_{t-1},(b-y)_{t-1},\Delta(b-y)_{t-1},\Delta q_t^*,\Delta i_t].$$

Therefore, apart from the usual feedback terms this derivation suggests two additional variables in the policy rule: the expected acceleration of income growth ($\Delta\Delta y_t^*$) and recent changes in debt disequilibrium $[\Delta(b-y)_{t-1}]$. The asymmetry between spending and taxation on the one hand and debt on the other is caused by the fact that the first two are flows but debt is a stock.

This entire optimisation procedure has been executed under restriction of the long-run budget constraint (3.7). The intentionally close relationship of (3.7) with the more exact short-run budget constraint (3.6) may help us to detect possible causes of parameter instability. For instance, in reality the interest rate is not constant. We might wish to replace Δi_t by its scaled equivalent $(I_{t-1}/B_{t-1})\Delta i_t$, after appropriate redefinition of ψ_{i7} (i=1,2,3) in Table 3.1. Something similar holds for the presence of the long-run target ratios in the parameters of the policy rule. When we confront this model with a finite set of observations it is to some extent a matter of judgment which parameterisation is most likely to be constant. The explicit formulae for the policy parameters given in

Table 3.1, in combination with the similarity of budget constraints (3.6) and (3.7), will prove helpful for that judgment.

A few special features of policy rule (3.8) are worth mentioning. First, there is no cross-feedback between flow variables g and τ. Second, the signs of most parameters ψ_{1j} and ψ_{2j} (j=1,...,7) are unambiguously given in Table 3.1. This is also the case for ψ_{3j} (j=1,...,7,), except where it concerns the exogenous budget variables Δq_t^* and Δi_t, and the coefficient on Δy_t^*. The latter requires special attention.

The coefficients ψ_{i2} (i=1,2,3) on the variable Δy_t^* reflect the automatically stabilising or countercyclical behaviour of the budget. The degree to which it behaves in a countercyclical way will be greater the more negative ψ_{32} is. The negativity of this coefficient would ensure that budget deficits tended to be larger when economic growth is below trend and smaller when growth is faster than normal. Table 3.1 shows that $\psi_{32}<0$ if and only if $\psi_{22}\tilde{\theta}>\psi_{12}\tilde{\gamma}$. In other words, it requires the positive elasticity of taxation with respect to income growth to be sufficiently larger than that of spending. As we shall see, this has indeed tended to be the case in the Netherlands during most of the last three decades. Further inspection of $(\psi_{12},\psi_{22},\psi_{32})$ in Table 3.1 shows that λ_7, λ_8 and λ_9 freely determine these coefficients and thus the budget's countercyclical behaviour. Recall that they can be thought of as having been determined in the first stage of the planning process.

Interest rates enter the policy only through interest payments. Even though these are not of direct concern, their presence in the budget renders policy responsive to interest rates in an indirect way. By formulating the long-run debt target in terms of interest payments, their role can be made more prominent [Chapter 4].

Our formulation has two distinct advantages in comparison with that of Barro (1979). In the first place, it does not condition on current spending but involves spending in the planning and smoothing process. Secondly, it pays due attention to "tension" in the budget which emanates from the limits on government borrowing in conjunction with the stock-flow dynamics of the budget. The next chapter will illustrate the relevance of this enrichment with calculations for the U.S.

If the government does <u>not</u> have a target for the debt (or for interest payments), then the debt feedback term disappears from the model ($\psi_{i5}=0$, i=1,2,3). However, this does not eliminate the role of public debt, because it may remain costly to have a strongly fluctuating deficit ($\lambda_4 \neq 0$). If in addition these costs are negligible and capital markets can cope with unlimited volatility of government recourse, then "tension" disappears from the model which reduces to simple Error Correction equations for tax and spending individually ($\psi_{i5}=\psi_{i6}=\psi_{i7}=0$, i=1,2,3). Only then is debt the passive buffer. In reality one would expect the debt parameters ($\lambda_1,\lambda_4,\lambda_7$) to be positive but small relative to the others. In that case capital markets can carry substantially more volatility than the environments on which taxes and spending impinge, but their absorptive capacity in that respect is not unlimited and excessive volatility is costly. Furthermore, with a small λ_1 the government is more flexible about its long-run debt target than about disequilibria in spending and taxation. However, if the public debt got <u>far</u> out of line then "tension" would increase and other budgetary considerations would be overshadowed by the imperative to get the public debt back to an acceptable level. This type of budgetary dynamics seems quite plausible, and this model is designed to capture them.

3.4. Planning and Uncertainty

Control rules of the form derived in the preceding section have recently received ample attention in the economics literature, where they have been called Proportional-Integral-Derivative (PID) control rules [Salmon (1982)]. An attractive feature of this type of rule is its potential capability to serve as the "automatic pilot" on a system in an environment affected by random shocks. Whether it will be capable of doing so in a practical situation depends on its environment. PID control models have been applied successfully to a number of economic phenomena. It will be interesting from a theoretical point of view to study the conditions under which the PID rule of this chapter could automatically guide the government budget in a stochastic, dynamic environment. From an empirical point of view, it will be interesting to study whether rules of this type have been applied in reality. Theoretical insight into circumstances under which the rule would not operate satisfactorily may provide insight in practical difficulties facing governments whose task it is to control the budget in a turbulent world.

There are two sources for deviations between plans and outcomes: expectation errors and planning errors. I assume that the public and the private sector hold the same expectations, and that plans and expectations do not diverge from their realisations in any systematic way [Hendry and Richard (1983)]. As an approximation (see below) this can be formalised in the following form:

$$\begin{bmatrix} y_t - y_t^e \\ q_t - q_t^e \\ g_t - g_t^p \\ \tau_t - \tau_t^p \\ b_t - b_t^p \end{bmatrix} \equiv \begin{bmatrix} u_t^y \\ u_t^q \\ v_t^g \\ v_t^\tau \\ v_t^b \end{bmatrix} \sim NI \left[\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_y^2 & & & & \\ \sigma_{qy} & \sigma_q^2 & & & \\ 0 & 0 & \sigma_g^2 & & \\ 0 & 0 & \sigma_{\tau g} & \sigma_\tau^2 & \\ 0 & 0 & \sigma_{bg} & \sigma_{b\tau} & \sigma_b^2 \end{bmatrix} \right]$$

$$\equiv NI \,(\, \underline{0} \,,\, \Sigma \,) \qquad (3.10)$$

The variable u_t denotes an expectation error, while v_t stands for a planning error. Planning and expectations errors are uncorrelated. However, the two expectations errors may be correlated, and the same is true for the three planning errors. Hence the matrix Σ is block-diagonal. I denote the (2x2) expectations error block by Σ_e, and the (3x3) planning error block by Σ_p. We can now write the observable version of policy rule (3.8) as:

$$\underline{z}_t \equiv \Psi \, \underline{x}_t + \underline{w}_t \qquad (3.11)$$

where $\underline{w}_t$ denotes the error process:

$$\underline{w}_t \equiv \begin{bmatrix} w_t^g \\ w_t^\tau \\ w_t^b \end{bmatrix} = \begin{bmatrix} -\psi_{12} & -\psi_{16} & 1 & 0 & 0 \\ -\psi_{22} & -\psi_{26} & 0 & 1 & 0 \\ -\psi_{32} & -\psi_{36} & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} u_t^y \\ u_t^q \\ v_t^g \\ v_t^\tau \\ v_t^b \end{bmatrix}$$

$$\equiv \Gamma \,(\underline{u}', \underline{v}')' = \Gamma_e \underline{u}_t + \underline{v}_t \sim NI \,(\, \underline{0} \,,\, \Omega \,) \qquad (3.12)$$

with $\Omega \equiv \Gamma \, \Sigma \, \Gamma' = \Gamma_e \Sigma_e \Gamma_e{}' + \Sigma_p$, where $\Gamma \equiv [\Gamma_e, I_{(3\times3)}]$.

The fact that in the optimisation procedure the planned variables g_t^p, τ_t^p, b_t^p and the expectation variable q_t^e are assumed to satisfy the long-run budget constraint (3.7) rather than the more precise short-run budget constraint (3.6) is just an approximation. Since the observed values by definition satisfy the short-run budget constraint (3.1) exactly, these approximations do have consequences for the specification of the stochastic processes in $\underline{w}_t$. This means that (3.10) and hence (3.11) must be seen as approximations as well. Appendix 3A addresses the question how good these approximations are likely to be. It also derives an ensuing restriction on the stochastic specification (3.12).

3.5. Buffers in the Budget

During the period for which budget plans have been made, there will be random shocks to the budget. These shocks originate from the government's errors in predicting national income and the exogenous variable Q_t, and from random deviations between plans and realisations. The uncertainty which is introduced by these shocks will have to be absorbed in the budget during its execution. Budget variables which absorb a major part of that within-period variance I call budget buffers.

Two aspects of budgetary uncertainty seem to be of particular relevance here. In the first place, it is sensible for government to minimise uncertainty around the budget, so that the private sector can make plans and develop activities in a stable and predictable environment. Even though the public and private sectors are assumed to share their expectations so that government has no information advantage, there are many reasons why it is worthwhile for government to stick to its plans [Bomhoff (1982), Wildavsky (1983)], especially if these impinge on areas of the private sector where medium- to long-term decisions are taken which are costly to reverse. In the second place, however, the government wishes to miss its budgetary targets by as little as possible. Recall that a missed target today implies a larger role for disequilibrium feedback tomorrow. If, in the present setup with certainty equivalence due to the quadratic cost function, we also assume the duration of public and private sector contracts to be equal, then these two aspects of budgetary uncertainty will not be in conflict. This can be seen by using (3.12) to write the policy rule (3.11) as:

$$\underline{z}_t = \Psi\, \underline{x}_t + (\Gamma_{\bullet}\underline{u}_t + \underline{v}_t) \qquad (3.13i)$$

$$= \underline{z}_t^p + \underline{v}_t$$

$$= E_{t-1}(\underline{z}_t) + \underline{v}_t \qquad (3.13ii)$$

Since the processes $\{\underline{u}_t\}$ and $\{\underline{v}_t\}$ are independent, a reduction of uncertainty around the budget [the variance of $\underline{v}_t$ in (3.13ii)] also contributes to reduced future disequilibrium feedback due to current random shocks [the variance of $\underline{w}_t=\Gamma_{\bullet}\underline{u}_t+\underline{v}_t$ in (3.13i)].

Before proceeding to the determinants of both these types of budgetary uncertainty, a brief digression may serve to sharpen perspective on the present issue. To begin with, suppose that the government replans its behaviour once a year, and that the private sector also behaves on the basis of annual contracts. The public sector does not have any opportunity advantages over the private sector, nor does it have an information advantage. Now suppose that subsequently the government decides to increase its replanning frequency to quarterly rather than annual budgets. For example, excessive disequilibrium feedback on public expenditure could induce the policymaker to monitor spending on a closer basis. If the private sector's opportunity set remains restricted to annual contracts, then the resulting asymmetry between the two sectors can bring about a conflict between the minimisation of uncertainty around the budget and the minimisation of future disequilibrium feedback due to current and past random shocks. The minimisation of uncertainty around the budget requires minimal within-year replanning. However, the minimisation of future disequilibrium feedback is obviously served by a full use of the government's opportunity set, i.e. by quarterly replanning as a reaction to hitherto unanticipated developments in the economy and the public budget. An interesting way of formalising this trade-off could be to represent uncertainty around the budget explicitly in a more general loss function than that of this study, which would also embody the latter's targets and adjustment costs [see e.g. Turnovsky (1983) for this type of goal function].

In the setup of this chapter, we assume certainty equivalence and block-diagonality of variance-covariance matrix Σ in (3.10). The policy instruments are g_t^p, τ_t^p and b_t^p, and the elements of Σ are fixed parameters. (3.12) shows that the variance-covariance matrix Ω of the total errors $\underline{w}_t$ will depend on the elements of Σ and on the coefficients of the budgetary policy rule which are present in $\Gamma_\bullet$. Observed changes in the estimated matrix Ω will be interpreted in terms of changes in Σ and $\Gamma_\bullet$ in Chapter 6.

In general, the variance of the i-th budget instrument will be large if that instrument reacts strongly to (uncertain) real income growth (ψ_{i2} large, i=1,2,3) and the exogenous variable Q_t (ψ_{i4} large, i=1,2,3), and if its planning error has a large variance. In addition, there are two channels through which the error <u>covariances</u> affect the variance of the i-th budget instrument. First, a strong positive correlation between the expectation errors on income growth and the exogenous budget variable (σ_{qy} large) will reduce the variance of w_t^i ($i=g,\tau,b$) if ψ_{i2} and ψ_{i6} ($i=1,2,3$) have the same sign, but raise it if they are of opposite sign (and the reverse for negative σ_{qy}). Second, (3.12) suggests that the variances of the w_t^i are not affected by planning error covariances ($\sigma_{\tau g},\sigma_{bg},\sigma_{b\tau}$), but this is incorrect. Recall that the stochastic structure must satisfy the budget constraint. Appendix 3A shows that one of these covariances enters the expressions for the diagonal ($\omega_g^2,\omega_\tau^2,\omega_b^2$) and other elements of Ω in (3.12). Expression (3A.6) illustrates that the total variance ω_b^2 of w_t^b will be reduced by a large positive covariance between spending and taxation planning errors ($\sigma_{g\tau}$). Equivalently and through the same channel, ω_g^2 would be reduced by a large negative $\sigma_{\tau b}$, and ω_τ^2 by a large positive σ_{gb}. Of course the signs stem from the respective positions of these variables in the budget equation.

These considerations on buffers in the budget will help us to interpret the estimated variance-covariance structure of the model for the Dutch public finances in Chapter 6.

<u>3.6. Conclusion</u>

The model of this chapter serves three purposes. First, it clarifies the distinction between budget plans and budget buffers. Second, it formalises the idea of "tension" due to the stock-flow dynamics of debt and deficits. Third, it suggests a type of functional form plus a number of regressors for the empirical analysis. Although the presentation is conditional on some simplifying assumptions, it seems that the major findings would carry through to more general settings. Since the results of this analysis will be used for the guidance of our empirical work in a flexible way, this presentation suffices to bring out the main concepts. I proceed by mentioning a number of potentially interesting extensions, and finish the chapter with some observations of an econometric character as a transition to Chapters 4 and 6.

One straightforward extension would be to endogenise the fluctuations of Y_t around trend as being dampened by well-timed budget deficits. The representation of those fluctuations with a positive coefficient in loss function (3.5) would lead to a policy rule of the same character as that derived above. Further extension towards complete integration of planning stages is suggested and analysed by Salmon (1982) and seems worthwhile in the present context as well. Such a project would seem particularly interesting in view of the fact that in Chapter 6 this <u>type</u> of policy rule will appear to capture actual policy behaviour quite well. The underlying philosophy of this stable but contingent policy rule would seem to combine quite naturally with strands from the recent literature on the role of reputations in public policy [<u>cf.</u> Barro (1985), Engel (1985), and also Buiter (1981) on the desirability of contingent rather than closed-loop rules].

It may, incidentally, not only be interesting to integrate both stages of the <u>economic</u> optimisation process, but also to involve political factors in an explicit way. This model abstracts from <u>explicit</u> electoral influences, although one could of course argue that voters share the government's preference for an economically "sound" budget. Nevertheless, some impact of elections will be found in the empirical analysis of Dutch public financing and a more systematic approach to that aspect would seem interesting [see e.g. Van der Ploeg (1984)].

An alternative way of using the insights from this chapter could be to incorporate budget "tension" in theoretical macromodels such as for example that of Van der Ploeg (1984) or Rau (1985). Dynamic models often do not contain a government budget constraint at all, or only one in present value terms. The acknowledgement of the fact that there are limits to the extent to which budgets for any finite period of time can get out of line with what is sustainable in the long run, and the consequent influence of "tension" in the budget, may enrich or even alter the insights to be gained from those models. In any case, this "tension" expresses the practical experience that macroeconomic stabilisation (as different from structural) policy has a significant but limited potential to run deficits and to stimulate the economy, and that exactly because of those limits it is crucial to get the timing of stimulative policies right.

Explicit attention to expectations formation would enrich the model. That is especially so because it would allow us to estimate the whole variance-covariance structure given in (3.10). This links in with recent work on the interpretation and generalisation of Error Correction Mechanisms, which leads us to the econometric approach of Chapters 4 and 6.

The model of this chapter makes a distinction between long-run and short-run strands in economic policy. The recent literature on

Error Correction Models [see e.g. Hendry (1983) and (1985) and references] and Co-Integration [see Granger (1983), Granger and Weiss (1983) and Granger and Engle (1984)] provides econometric techniques for the empirical identification of these two different strands. The concept of Co-Integration will be applied in Chapter 4 on the long-run stability of the U.S. Federal debt, while Chapter 6 models Dutch public financing along the "Error Correction" lines. Nevertheless, this area of research is still very much in progress. In the course of the following empirical analyses, I shall mention some points on which further development of econometric insight can be expected to lead to progress on the present issue.

Finally a note on the dynamic stability of our policy rule. If we assume explanatory variables such as national income, prices and interest rates to be exogenous, then the stability of rule (3.8) can be analysed in the standard way. The three-dimensional setup and the dependence of the policy parameters on the underlying parameters of the goal function make an analytical derivation of conditions for stability quite cumbersome. The two-dimensional case has been analysed by Hendry and von Ungern-Sternberg (1981). With reasonable parameter values our three-dimensional system converges in the long run, which we shall utilise in Chapter 6 to calculate the hypothetical long-run solution of an estimated policy rule.

Nevertheless, all this is under the assumption that macroeconomic variables are exogenous, an assumption which is unrealistic and unnecessary. The present model is derived <u>conditional</u> on the development of those variables, but does not make any exogeneity assumptions. Therefore, the question whether the whole <u>system</u> is stable will be more suitably addressed in a setup which integrates both planning stages. If the countercyclical policy is well-timed, then the system will be stable. The fact that no *a priori* exogeneity assumptions have been made will be reflected in the econometric approach of the following chapters.

Appendix 3A. Approximations of the Budget Constraint

Rewrite budget (3.1) as:

$$G_t^p V_t^g + r_{t-1} B_{t-1} = T_t^p V_t^\tau + (B_t^p V_t^b - B_{t-1}) + Q_t^e U_t^q \qquad (3A.1)$$

where U and V are multiplicative errors, defined as the antilogs of the corresponding logarithmic errors. Equation (3A.1) forms a restriction on distribution (3.10). Assume that u_t^q, v_t^g and v_t^τ are exactly normally distributed. This implies that their antilogs are lognormally distributed [see Atkinson and Brown (1957), Jones and Miller (1966), and Johnson and Kotz (1972)]:

$$u_t^q \sim NI(0,\sigma_q^2) \rightarrow U_t^q \sim \Lambda I(0,\sigma_q^2)$$

$$v_t^g \sim NI(0,\sigma_g^2) \rightarrow V_t^g \sim \Lambda I(0,\sigma_g^2)$$

$$v_t^\tau \sim NI(0,\sigma_\tau^2) \rightarrow V_t^\tau \sim \Lambda I(0,\sigma_\tau^2) \qquad (3A.2)$$

where $\Lambda I(\mu,\sigma^2)$ denotes an independent lognormal process with parameters μ and σ^2. It is not straightforward to subsequently derive the exact distribution of V_t^b. Nevertheless, V_t^b will contain two components. The first stems from the assumption that planned variables satisfy long-run budget constraint (3.7), whereas in fact they satisfy (3.1). The second component is a combination of U_t^q, V_t^g and V_t^τ and follows from the exact ex post budget constraint (3A.1). The mathematical expectation of V_t^b, conditional on information available at t-1, can be derived from (3A.1) as follows. The identity:

$$E_{t-1}[B_t^p V_t^b] = E_{t-1}[(1+r_{t-1})B_{t-1} + G_t^p V_t^g - T_t^p V_t^\tau - Q_t^e U_t^q]$$

can be approximated by:

$$B_t^p[\ln\{E_{t-1}(V_t^b)\}+1] \simeq (1+r_{t-1})B_{t-1} + G_t^p[\ln\{E_{t-1}(V_t^g)\}+1]$$

$$- T_t^p[\ln\{E_{t-1}(V_t^\tau)\}+1] - Q_t^*[\ln\{E_{t-1}(U_t^*)\}+1] \qquad (3A.3)$$

since for the lognormal distribution it is true that $E_{t-1}(V_t^g) = \exp(\sigma_g^2/2)$ and the equivalents for V_t^τ and U_t^q. I assume that σ_g^2, σ_τ^2 and σ_q^2 are small. Because the model is in logs, these are percentage errors and the assumption seems reasonable. I also assume that $E_{t-1}(V_t^b)-1$ is small, which is the case if the <u>sum</u> of deviations from targets in (3A.4) below is small. Using (3.2) and (3.4) we can write (3A.3) as:

$$E_{t-1}(V_t^b) \simeq \exp\left[\frac{G_t^p-\tilde{\gamma}Y_t^*}{B_t^p} - \frac{T_t^p-\tilde{\theta}Y_t^*}{B_t^p} - \frac{Q_t^*-\tilde{\upsilon}Y_t^*}{B_t^p} + \frac{(1+r_{t-1})B_{t-1}-\frac{1+r}{1+\pi}\tilde{\beta}\,Y_t^*}{B_t^p} - \frac{B_t^p - \tilde{\beta}\,Y_t^*}{B_t^p}\right] *$$

$$* \{E_{t-1}(V_t^g)\}^{\frac{G_t^p}{B_t^p}} \{E_{t-1}(V_t^\tau)\}^{-\frac{T_t^p}{B_t^p}} \{E_{t-1}(U_t^q)\}^{-\frac{Q_t^*}{B_t^p}} \qquad (3A.4)$$

The exponential term is a correction factor, stemming from divergences between long- and short-run budgets. If the budget is developing along its long-run equilibrium growth path, this term is unity. The last three terms relate the expectation of V_t^b to the expectations of the other errors. If, as assumed, the expectations of these errors are independent of time, then the expectation of V_t^b will <u>not</u> be time-independent. Similarly, taking the log of V_t^b in (3A.1), the expectation of the public debt planning error v_t^b will <u>not</u> generally be zero, nor will it generally be a constant. It seems hard to see why governments would make plans which in all likelihood are not going to be executed. It is therefore relevant to assess how large the planning error on B_t is likely to be. For that purpose, rewrite (3A.1) as:

$$V_t^b = (1+r_{t-1})B_{t-1}/B_t^p + (G_t^p/B_t^p)V_t^g$$
$$- (T_t^p/B_t^p)V_t^\tau - (Q_t^e/B_t^p)U_t^q$$

The three stochastic variables on the right-hand side are lognormal variates. Their measures of divergence from normal variates (skewness and kurtosis) are an increasing function of their respective variances only. For sufficiently small variances we can therefore approximate V_t^b by a non-central weighted average of normal variates. In that case V_t^b will be approximately normally distributed, with time-dependent variance and a time-dependent mean $(1+r_{t-1})B_{t-1}/B_t^p$ [$\cong(1+r)/(1+\pi)$ along the equilibrium growth path]. The variance will depend not only on the variances of V_t^g, V_t^τ and U_t^q, but also on their covariance structure. If V_t^b is approximately normal, then v_t^b may be approximately normal as well if its variance is sufficiently small.

To sum up, the consequences of our approximations seem to be the following. It may be reasonable to approximate the planning errors by normal variates. However, at least one of these variates will have time-dependent mean and variance. Empirically, this may be a source of heteroskedasticity. Recall that part of this potential problem is related to how good an approximation budget constraint (3.7) is to budget constraint (3.6). I already suggested that an appropriate choice of scaling may be productive in this context. For now, I assume that (3.10) is a reasonable approximation if we <u>define</u> v_t^b in the spirit of (3A.4) as:

$$v_t^b \equiv \ln[(1+r)/(1+\pi)] + (\tilde{\gamma}/\tilde{\beta})v_t^g - (\tilde{\theta}/\tilde{\beta})v_t^\tau - (\tilde{\upsilon}/\tilde{\beta})u_t^q \qquad (3A.5)$$

which <u>approximately</u> represents restriction (3A.1). It can easily be incorporated in the specification of the error process by substituting (3A.6) into (3.10):

$$\sigma_{be} = [\tilde{\gamma}\sigma_e^2 - \tilde{\theta}\sigma_{re}]/\tilde{\beta}$$

$$\sigma_{br} = [\tilde{\gamma}\sigma_{re} - \tilde{\theta}\sigma_r^2]/\tilde{\beta}$$

$$\sigma_b^2 = [\tilde{\gamma}^2\sigma_e^2 + \tilde{\theta}^2\sigma_r^2 + \tilde{\upsilon}^2\sigma_q^2 - 2\tilde{\gamma}\tilde{\theta}\sigma_{re}]/\tilde{\beta}^2 \qquad (3A.6)$$

CHAPTER 4. ON THE STABILITY OF THE U.S. FEDERAL DEBT

4.1. Introduction

Many OECD economies have experienced a steady decline in the ratio of public debt over GNP since the Second World War, followed by an upturn in the 1970s. This upturn has stimulated concern over the economic effects of growing public indebtedness, but at the same time there seems to be general disagreement on what would be a desirable level of the public debt. Moreover, it has been argued that in the past the debt has not moved towards any target level, but has rather been a resultant of the general course of events in macroeconomic policymaking.

The latter claim has been defended with empirical evidence by Barro (1979), who argues that the ratio of U.S. Federal debt over GNP 'does not have a "target" value but rather moves "randomly" in accordance with the realisations for the federal expenditure and income shocks' [Barro (1979, p. 966)]. On the other hand, a recent OECD study by Price and Muller (1984) suggests that some stable ratio of government debt to national income could be taken as a norm by which to judge the longer-run adequacy and sustainability of budgetary policy. That study emphasises the fact that 'constraints on action caused by a past or prospective accumulation of debt reduce the flexibility available to governments in setting structural deficit targets', but it does not discuss whether governments have actually been targeting the debt/income ratio.

Nevertheless, empirical research of past policy patterns and their operating characteristics forms an important input into the evaluation of the merits of alternative public financial policies. In Chapter 3 we formulated a general approach to modelling regular patterns in public financial behaviour. The model presented there serves as the theoretical background for the empirical work of this study. In the present chapter, it is argued that the U.S. Federal debt since the Civil War has <u>not</u> just been following the course of events. There is empirical evidence for long-run "tension" in the budget associated with the level of the debt, which favours extending the Barro theory of public financial behaviour along the lines set out in Chapter 3.

After a brief assessment of the Barro evidence against the presence of a debt/income target in Section 4.2, I present some considerations concerning the Federal debt since the Civil War in Section 4.3. The section that follows employs a recently developed econometric technique for testing the existence of long-run relationships to argue that in the U.S. there have been debt/income targets for more than a century now, and that the <u>type</u> of target has changed drastically in the 1930s.

Whereas up to the 1930s U.S. governments have headed for a very small ratio of the <u>stock</u> of Federal debt over national income, governments after the 1930s have focussed their attention on <u>interest payments</u>. The data support the presence of a target for the ratio of inflation-corrected interest payments over national income. This may reflect transfer smoothing or interest rate stabilisation objectives.

It should be mentioned at the outset that this chapter does not estimate a model of short-run public financial behaviour. In an endeavour to discern one long-run strand in that behaviour, it will prove profitable not to work exclusively within a framework where a possible misinterpretation of the short run could lead to misguided ideas about the long run. When appropriate, short-run aspects will be mentioned in a suggestive rather than a testing fashion. Some short-run estimations within the framework of the Barro model will be presented, but it remains a task for future research to fully embody these long-run findings in a general model of U.S. public financial behaviour such as that for the Netherlands presented in Chapter 6.

4.2. The Barro Evidence Against a Debt Target

Barro (1979) finds evidence against the presence of a target for the debt/income ratio by adding the lagged ratio to an equation which explains nominal debt growth by anticipated inflation, temporary federal spending, temporary national income shortfalls, and a constant [for that model, see also Barro (1980,1984a)]. The recorded insignificance of the lagged debt/income ratio does, however, only adduce evidence against one fairly special target for the public debt. Including the lagged ratio, Barro's debt growth equation can be written as:

$$\begin{aligned} \ln(B_t/B_{t-1}) = \alpha_0 + \alpha_1 \pi_{pt}^* + \alpha_2[P_t(G_t-\bar{G}_t)/\bar{B}_t] \\ - \alpha_3[\ln(Y_t/\bar{Y}_t)(P_t\bar{G}_t+\bar{r}_t\bar{B}_t)/\bar{B}_t] \\ - \alpha_4[B_{t-1}/(P_{t-1}Y_{t-1})] \qquad (4.1) \end{aligned}$$

which corresponds to Barro's equation (10), with B_t the stock of nominal Federal debt outstanding at the end of year t, π_{pt}^{*} the rate of inflation anticipated for year t, P_t the price level, G_t real Federal expenditure, Y_t real GNP, r_t the interest rate, bars indicating trend values, and $\alpha_i \geq 0$, $i=0,\ldots,4$. Along the hypothetical long-run growth path, we can solve the target debt/income ratio out of (4.1) as:

$$B/(PY) = (\alpha_0 + \alpha_1 \pi_p - g_B)/\alpha_4 \qquad (4.2)$$

where g_B is the growth rate of nominal debt and π_p the long-run rate of inflation. The budget will converge on this target if $0<\alpha_4<1$, provided the dynamic impact of B in the scaling factors is of second-order magnitude. For consistency with a constant long-run debt/income ratio, the growth rate of real debt should equal that of real GNP ($g_B - \pi_p = \pi_y$, where π_y is the rate of growth of real GNP). Given the fact that Barro imposes $\alpha_1=1$, we can therefore rewrite (4.2) as:

$$B/(PY) = (\alpha_0 - \pi_y)/\alpha_4 \qquad (4.2')$$

It follows that the Barro test only tests for a constant debt/income target, which would be strictly positive if $\alpha_0 > \pi_y$.[1] It is perhaps not surprising that the U.S. data fail this test. In the remainder of this chapter, I present empirical evidence which favours including the real interest rate in the government's target for the debt/income ratio. The data, essentially the same as those used by Barro, are presented in the next section (and in Appendix A). For now, the regressions 1 through 4 in Table 4.1 show the result of my re-estimation of (4.1), using data from Barro (1984a). The regressions 2 through 4 include the insignificant lagged debt/income ratio.

Table 4.1. Regression Results (Equation (4.1))
Dependent Variable: $\log(B_t/B_{t-1})$

No.	Period	Estimated coefficients							$\hat{\sigma}$	DW
		C	π^e_{pt}	$GVAR_t$	$YVAR_t$	$B_{t-1}/(P_{t-1}Y_{t-1})$	I_{t-1}/Y_{t-1}	IC_{t-1}/Y_{t-1}		
1	1936-1982*	0.010 (0.005)	1	0.33 (0.11)	4.20 (0.35)				0.023	2.06
2	1936-1982*	0.015 (0.012)	1	0.35 (0.12)	4.18 (0.35)	-0.01 (0.02)			0.023	2.07
3	1930-1982*	0.011 (0.012)	1	0.36 (0.12)	4.06 (0.27)	-0.004 (0.024)			0.024	2.02
4	1948-1982	0.018 (0.012)	1	0.42 (0.13)	4.48 (0.42)	-0.01 (0.02)			0.024	2.15
5	1936-1982*	0.011 (0.014)	1	0.33 (0.11)	4.21 (0.35)		-0.08 (1.04)		0.023	2.06
6	1936-1982*	0.019 (0.007)	1	0.37 (0.11)	4.11 (0.34)			-1.49 (0.74)	0.022	2.15
7	1931-1982*	0.020 (0.007)	1	0.40 (0.11)	4.13 (0.26)			-1.54 (0.72)	0.023	2.01
8	1950-1982	0.023 (0.008)	1	0.44 (0.12)	4.43 (0.39)			-1.59 (0.86)	0.022	2.22

Table 4.1. Continued

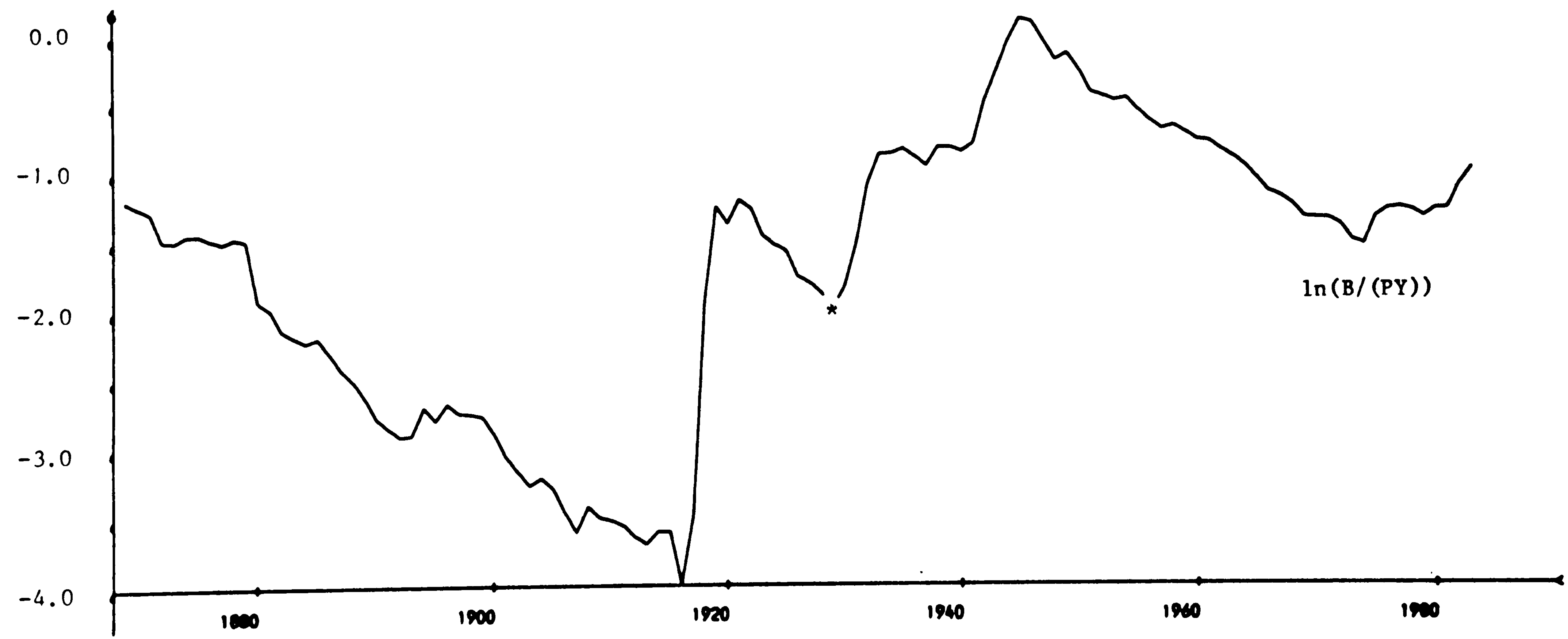
NOTE: GVAR = $P_t(G_t-\bar{G}_t)/\bar{B}_t$, YVAR = $(U_t-0.054)P_t\bar{G}_t/\bar{B}_t$, where U_t is the unemployment rate. This is a cyclical variable slightly different from the one in (4.1). Data are from Barro (1984a) and Appendix A (Table A.2). A '*' indicates that War years have been removed (No. 1,2,3,5: 1941-1947; No. 6,7: 1941-1949). Where $\alpha_1=1$, that restriction could not be rejected and was subsequently imposed. Standard errors in brackets. $\hat{\sigma}$ indicates the standard error of the equation, DW the Durbin-Watson test statistic for autocorrelation.

4.3. A Brief History of the U.S. Federal Debt, 1867-1983

Figure 4.1 shows the ratio of Federal debt over NNP, 1867-1983.[2] Between 1867 and 1916, the ratio declined from the Civil War high of 31% to a low of 2% just before the First World War. This decline did not occur by coincidence. It was a declared and executed policy priority to reduce the debt/income ratio to close to zero [see: Dewey (1924); various articles in the American Economic Review, 1937 (Supp., pp. 49-98) and 1947 (Supp., pp. 118-242); and Patterson (1954)]. As can be seen in Figure 4.2, this target was reached by running budget surplusses during most of the period. The fact that the level of the debt was not just the passive outcome of spending and taxation policies, but had to be reduced to some target, introduced "tension" into the budget. While setting short-run budgetary policies, government kept this long-run debt target in mind. Due to the long decline of interest rates (Figure 4.3), the ratio of interest payments over NNP decreased even more than the debt/income ratio (from 0.6% in 1867 to 0.01% in 1917; see Figure 4.4). There was no persistent inflation as experienced in later periods (Figure 4.5). As a result of the deflation from 1870 until 1895, the real interest rate in that period may have been higher than the nominal one. After correcting the nominal interest payments for the effects of this deflation, the decline of the real interest payment/income ratio was probably somewhat less marked than the nominal one of Figure 4.4.

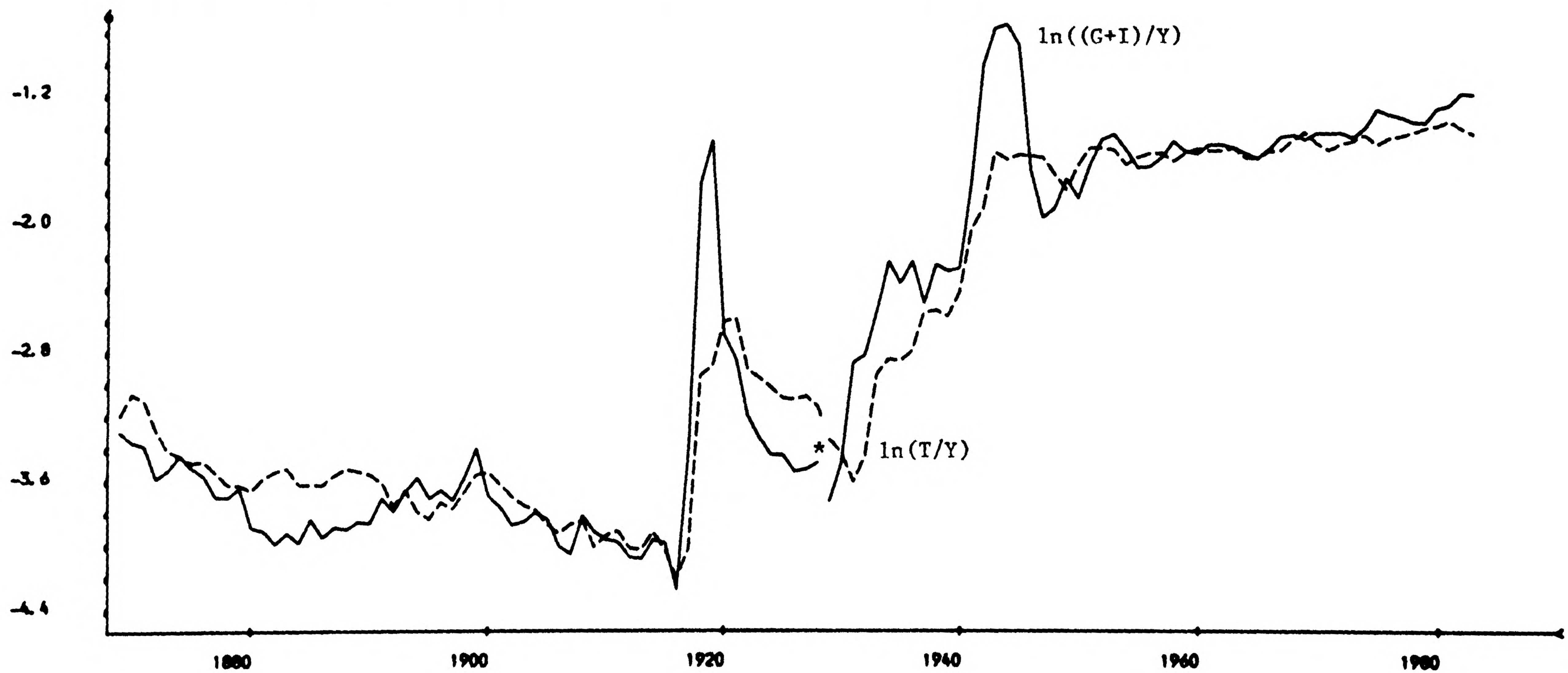
Nevertheless, the stylised facts of debt policy during this period are clear. The debt/income ratio was gradually restored to a target close to zero, and interest payments fell accordingly. The short-run pattern fluctuated around this medium-term path towards a

Fig. 4.1. The debt/income ratio



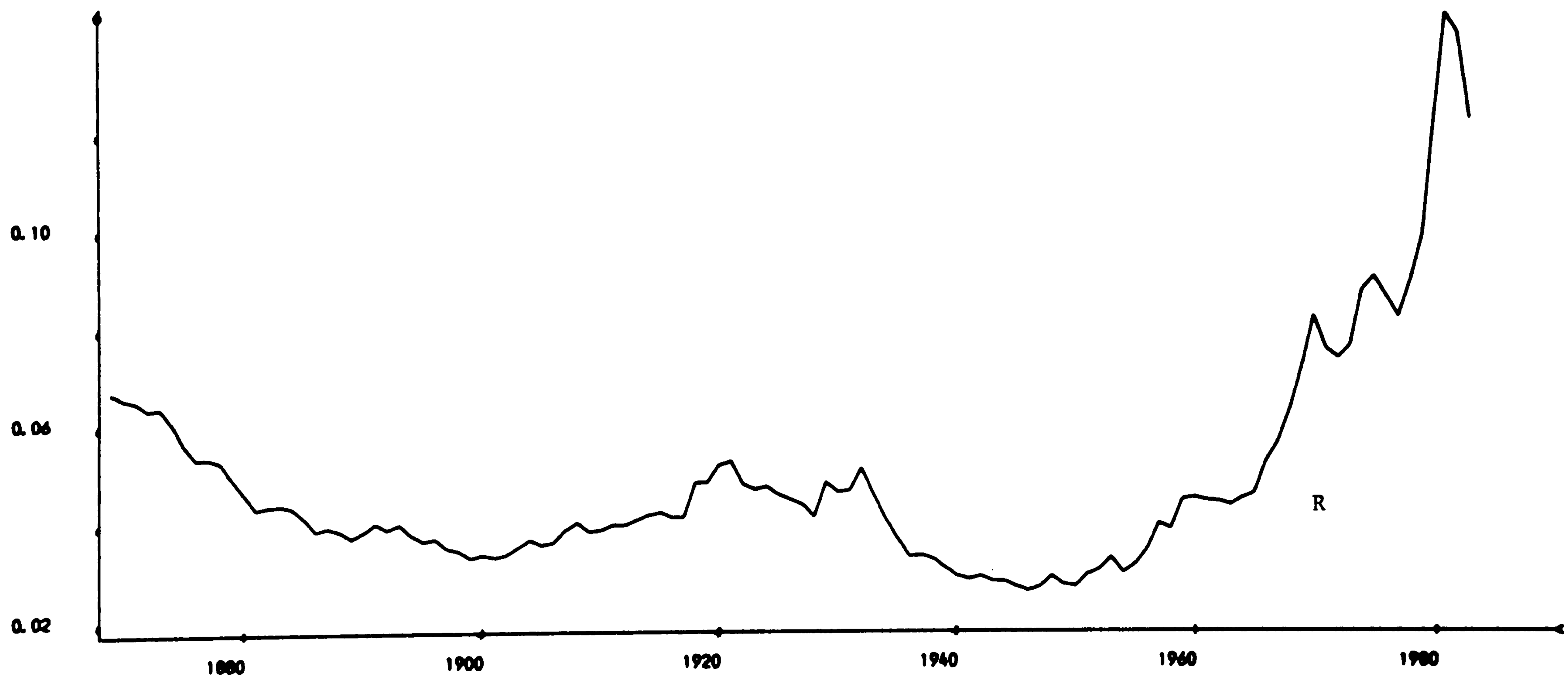
Source: Appendix A

Fig. 4.2. Public spending, taxation and the deficit



Source: Appendix A

Fig. 4.3. The long-run interest rate

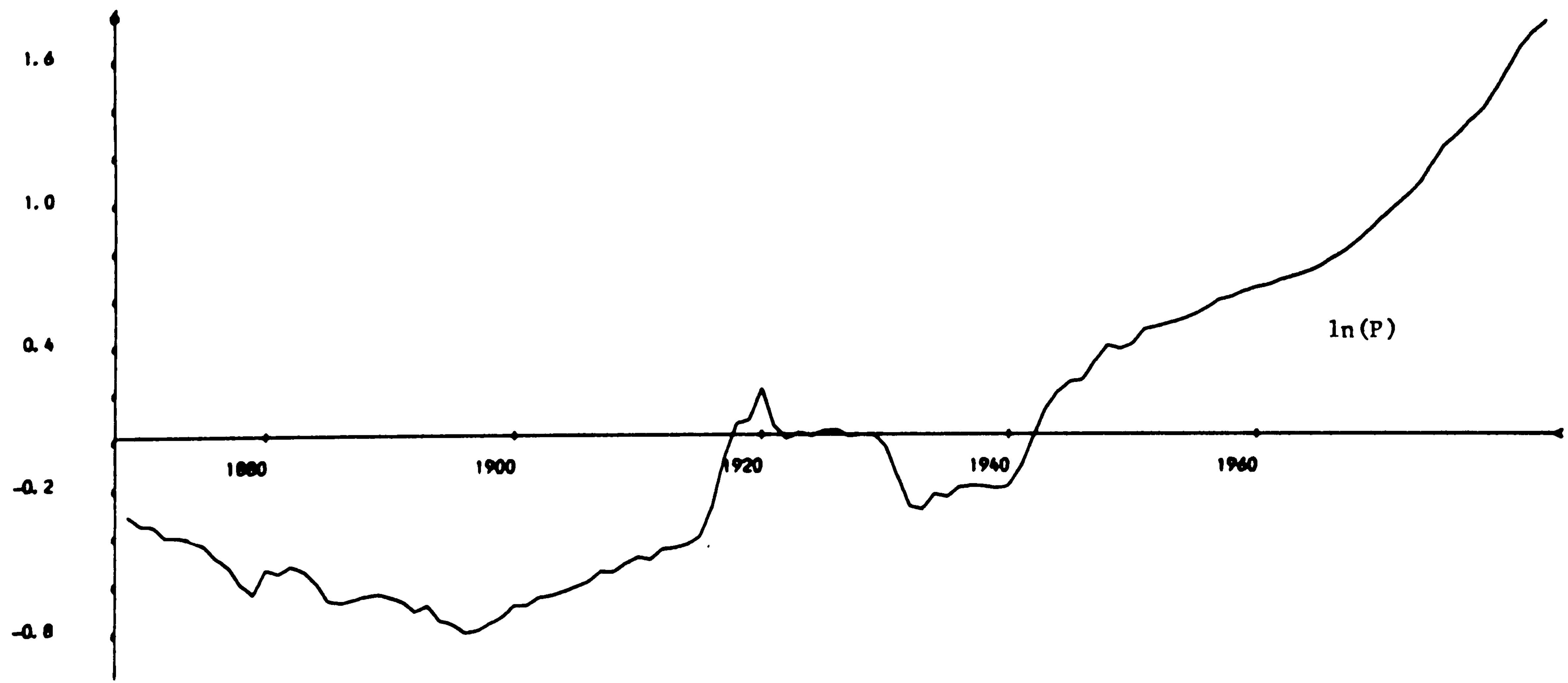


Source: Appendix A

Fig. 4.4. The interest/income ratio

Source: Appendix A

Fig. 4.5. The price level



Source: Appendix A

long-run target. These fluctuations are in accordance with the theory of Barro and of Chapter 3, since in the short run the debt fluctuated due to cyclical movements in public spending and taxation [Studenski (1937), Ratchford (1947)]. However, this does not mean that in line with the Barro theory public spending was exogenous to the debt/tax financing choice, or that this choice was not influenced by the stock of debt. There existed a long-run "tension" in the budget, which may have involved both spending and taxation in an effort to restore the debt to a target level.

Although less clear from the figures, the same approach to debt policy remained in force after the shock of the First World War. Up to the 1930s, a gradual pattern of debt reduction was kept in motion. However, during the Great Depression of the 1930s things changed drastically. This was brought about by a general shift of opinion on the role of macroeconomic policy, which in turn bore relationship to the Great Depression and to the New Deal policies. Up to the 1920s, any government indebtedness in excess of the minimum required for a smooth operation of the financial system was seen as an economic evil, which was to be disposed of as soon as possible. During the late 1920s and the 1930s the attitude towards public indebtedness changed fundamentally.[3] Public debt policy became a part of general macroeconomic policy, and arguments for or against reduction of the debt were cast in terms of possible effects on output, prices and interest rates. Debt policies and interest rate policies became particularly closely associated [Woodward (1947)].

Looking back to Figure 4.1, it appears that the rise in the debt/income ratio caused by the Second World War was followed by a gradual decline until the mid-1970s. Still, the apparent analogy with developments after the Civil War is misleading. Figure 4.2 shows that, except for three years immediately after the Second World War, there has not been any clear policy of running budget surplusses to reduce the debt. In contrast with the aftermath of the Civil War, the ratio of interest payments over national income has not declined since the 1940s (Figure 4.4). Combining Figures 4.1 and 4.4, this partially reflects a long rise in interest rates (Figure 4.3). Again, the role of inflation may have resulted in divergences between real and nominal interest rates (Figure 4.5). As explained more carefully below, this has mitigated the rise of interest payments when expressed in real terms, especially over the past two decades.

Returning to the post-1930s debt/income ratio, Figure 4.1 seems in agreement with the finding of Barro that there has been no constant debt/income target since the drastic shift of opinions on the optimal level of the debt. This does not mean that the debt/income ratio has not been targeted at all. The public debt has several aspects which make its level of relevance to the fiscal policymaker.

Debt servicing costs involve a transfer of financial resources from taxpayers to holders of government debt. By analogy with the Barro (1979,1980,1984a) theory of optimal tax smoothing (not with his empirical specification - see Chapter 6), one could argue that the macroeconomic influence of interest payments consists of the distortionary effects of such transfers. An analogous argument leads to the optimality of smoothing the ratio of annual debt servicing costs over national income. In other words, government sets out to stabilise the cost of its endebtedness relative to national income. If one assumes, as does Barro, that interest rates are exogenous to the debt/tax choice, then this long-run goal of smoothing the ratio of debt servicing costs over national income directly translates into a target for the debt/income ratio. This debt/income target would be inversely related to the effective interest rate, with unit elasticity. Alternatively, if the interest rate is not assumed to be exogenous, one could interpret a long-run policy of stabilising the ratio of debt servicing costs to national income as a long-run interest rate stabilisation policy. In the present context it remains a moot point whether considerations involving distortion minimisation or interest rate stabilisation have guided public financial behaviour (c.f. the two stages of our planning process in Chapter 3).

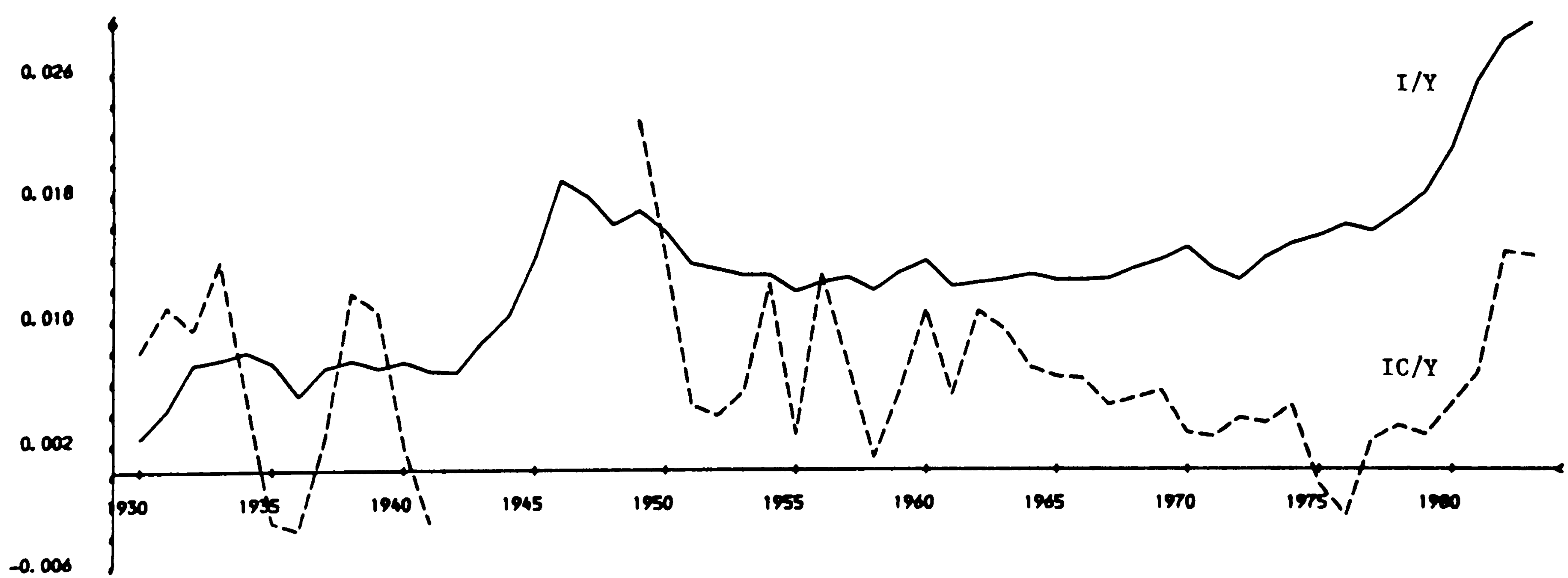
Before proceeding to a more formal examination of this long-run target, some remarks on the correct measurement of debt servicing costs ought to be made. As can be seen in Figure 4.4, the ratio of interest payments over NNP has been far from stable since the 1930s. However, as has been argued forcefully by e.g. Jump (1980), Buiter (1983), Barro (1984b), Eisner and Pieper (1984) and Miller (1985), the true costs of debt servicing may diverge from those as conventionally measured in nominal terms. One may wish to correct measured interest payments for the impact of inflation on the servicing costs of nominally denominated debt. To the extent that anticipated inflation is reflected in nominal interest rates, interest payments on the public debt contain a purely nominal fraction which will have to be removed in order to obtain the real debt servicing costs. For consistency I use the inflation expectations $\pi_{pt}{}^{*}$ generated by the model of Barro (1984a) to construct the series IC_t for real interest payments corrected for inflation [see e.g. Jump (1980) for an exposition]:

$$IC_t = I_t - \pi_{pt} \cdot BM_{t-1}/P_t \qquad (4.3)$$

where P_tI_t represents nominal interest payments as conventionally measured, and BM_t represents the market value of debt outstanding. The latter I have calculated by multiplying the stock at par value (B_t) by the measured market-to-par ratios published by Seater (1981) and De Leeuw and Holloway (1983). The result is shown in Figure 4.6.[4] In contrast with conventionally measured interest payments, those corrected for expected inflation are fairly stable as a fraction of national income.

One problem with this inflation correction is that negative debt servicing costs may occur (1935, 1936, 1941, 1975 and 1976). This is due to the high volatility of the short-run inflation expectations series. In the post-war period, the average length to maturity of the U.S. Federal debt has varied between 3 and 9 years. It may therefore be a worthwhile task for future research to use an inflation expectations series which is more carefully attuned to the average maturity of the debt than the one-year ahead expectations used here. That may produce a smoother series for the real cost of debt servicing, without negative values. Furthermore, one would perhaps expect short-run inflation to be partly reflected in real interest rates. The accompanying short-run capital gains to the government or to the holders of the public debt would presumably also entail some smoothing [Miller (1985)]. Nevertheless, since the present chapter concentrates on the long run, these short-run fluctuations can be assumed to cancel out and attention can be focussed on the debt servicing costs obtained from (4.3).

Fig. 4.6. The inflation correction of interest payments



Source: Appendix A and equation (4.3)

4.4. Tests for Long-Run Targets

For a formal test of the alternative propositions on the stability of the Federal debt reviewed above, I make use of the concept of "Co-Integration". This concept has been introduced by Granger (1983), Granger and Weiss (1983), and Granger and Engle (1984). A variable is defined to be integrable of order d [denoted by I(d)], if d^{th} differencing is required to induce stationarity [I(0)]. A set of I(d) variables is co-integrable if a linear combination of them is I(0).

A "long-run" relationship between a set of variables is only a meaningful concept if short-run deviations from that relationship are stationary. Therefore, if the proposed relation is linear, a simple test for the existence of such a relationship consists of testing the co-integrability of the set.

The variables of this chapter can all be shown to be at most I(1). The long-run relations come in a particularly simple form. We are interested in testing the stationarity of deviations from equations of the form:

$$\ln(B_t) = \beta_o + \beta_1\ln(Y_t) + \beta_2\ln(P_t) + \beta_3\ln(r_t) + u_t \qquad (4.4)$$

By imposing $\beta_1=\beta_2=1$ and $\beta_3=0$, we can test the constancy of the debt/income ratio. By imposing $\beta_1=\beta_2=1$ and $\beta_3=-1$, we can test the constancy of the ratio of interest payments over national income. Other propositions can be formulated in a similar way. Notice that, because our ratio IC/Y has some negative values so that we cannot take its log, we shall use an empirical specification which differs slightly from that in (4.4) (see below).

A number of tests for the stationarity of u_t in (4.4) are discussed by Granger and Engle (1984). In the present context, the Augmented Dickey-Fuller (ADF) test seems appropriate, since the dynamic short-run relationships which underly the long-run ideas of this paper are likely to exhibit a high degree of intertemporal correlation. However, Bhargava (1983) has raised objections against the ADF test, and proposed an alternative. Here I report ADF and BHA (Bhargava) results, which both test for random walk non-stationarity.

Since in our application all the coefficients in (4.4) except the constant are assumed to be known a priori, we do not have to estimate the co-integrating vector β. The ADF test of Fuller (1976) for random walk non-stationarity can be applied to the various ratios under consideration, and critical values are given in his Table 8.5.2. Critical values of the BHA test are given in Bhargava (1983), Table II.

Before proceeding to the results, note that this approach to testing for long-run "tension" in the government budget does not rely on any assumptions with respect to the exogeneity of any of the variables involved. It simply tests whether there are forces in government behaviour which move, say, the debt/income ratio back to a particular target level. This method does not require a model of short-run dynamics, which can be a great attraction in circumstances where the "long run" does not clearly present itself and where modelling the short-run dynamics is elaborate. On the other hand, the long-run feedback discovered in this way should subsequently be recoverable in a short-run model as well. For example, if Co-Integration tests discover a long-run debt/income target, this should have shown up in Barro's equation (4.1) above. Stock (1984) has explained that a discovered true long-run constant debt/income ratio, say, would have been consistently disclosed by Barro's Error Correction coefficient α_4 in (4.1), even if the short-run dynamics of his model were misspecified. These two approaches to testing long-run relations are complementary, and will shortly be shown to provide interesting opportunities for cross-checking.

The test outcomes are given in Table 4.2. Since the test equations carry little intrinsic interest, I present only the ADF and BHA statistics. Values suggesting stationarity are underlined. Wherever possible, tests are conventionally conducted in logs. Because of some negative values, the tests involving IC/Y have only been computed in non-log form. The tests which were executed and are reported in log-form lead to the same qualitative conclusions when performed in a similar non-log form.

Notice first that the non-stationarity of the debt/income ratio cannot be rejected for any of the periods. This confirms the findings of Barro (1979). In addition to the periods reported, the exact replication of the period analysed by Barro also indicates non-stationarity. We do not find a constant debt/income target close to zero for 1870-1916, because that episode contains only a single move back towards equilibrium. All tests for 1870-1916 cannot reject non-stationarity for this reason. The inclusion of a trend term does not help, indicating that the equilibrating process has not led the budget back to target along a proper trend. Furthermore, all tests for the entire period do not reject stationarity either. In view of the arguments presented in the previous section, this must reflect a change of regime within the period.

Table 4.2. Stationarity Test Results

Target	Period	Estimated constant	ADF	BHA
log(B/(PY))	1870-1983	-1.72	-1.33	0.04
	1870-1916	-2.63	-0.48	0.03
	1936-1983	-0.88	-1.45	0.05
	1936-1983*	-1.13	-1.56	0.14
log(I/Y)	1870-1983	-5.14	-1.44	0.06
	1870-1916	-6.01	-0.33	0.02
	1936-1983	-4.31	-1.09	0.09
	1936-1983*	-4.38	0.85	0.14
IC/Y	1936-1983*	0.005	<u>-3.40</u>	<u>1.16</u>
	1952-1983	0.005	<u>-3.19</u>	<u>1.13</u>

NOTE: ADF = Augmented Dickey-Fuller test statistic (5% critical values: -2.93 (50 observations); -2.89 (100 observations)). BHA = Bhargava test statistic (5% critical values: 0.86 (45 observations); 0.40 (100 observations)). A '*' indicates that War years (1942-1951) have been removed. Values indicating stationarity are underlined.

Indeed, the apparent contrast between the pre-1930s and the post-1930s is witnessed by the behaviour of the ratio of inflation-corrected interest payments over national income. For the post-1930s, the non-stationarity of this ratio is firmly rejected. Notice furthermore that the non-stationarity of the uncorrected interest/income ratio can not be rejected for any of the periods. It is hoped that data on inflation expectations and on the market value of the public debt in the pre-1930s will soon become available, which would make it possible to compute these tests for the pre-1930s as well. The institutional and graphical evidence seems to indicate a change of regime.

The tests reported here do support the conclusion that since the 1930s there has been a target for the debt/income ratio dependent on the real interest rate. This is confirmed by the remaining regressions 5 through 8 in Table 4.1. The lagged uncorrected interest/income ratio is insignificant (No. 5), but the lagged ratio of corrected interest payments over national income is significant with the expected sign (No. 6, 7 and 8). This Error-Correction term represents the usual weak but significant long-run feedback from disequilibria incurred in the past. In comparison with regression 1, its impact on the coefficients of GVAR and YVAR is negligible, but the estimated constant is doubled to 2%. The econometrics of these equations could be improved, and the results reported in this chapter seem to indicate that further work on the U.S. similar to that on the Netherlands in Chapter 6 would be worthwhile.

It is reassuring to see that all the non-stationarity propositions cannot be rejected, except the one which incorporates the inflation correction. This is consistent with Barro's finding, that governments finance the nominal component of interest payments simply by creating nominal debt [$\alpha_1=1$ in (4.1)]. The long-run findings of this chapter are confirmed within the short-run framework of the Barro model. Combining the evidence from Tables 4.1 and 4.2, it appears that U.S. governments since the 1930s have been heading for an underlying target for inflation-corrected interest payments amounting to about 0.5% of GDP.

4.5. Conclusion

This chapter has set out to establish that the stock of U.S. Federal debt is not a variable without any target level, which just follows the course of events. Ever since the Civil War, there has been "tension" in the budget to bring the debt back to a desired level. Before the 1930s, this desired level was determined as a target ratio of the debt over national income of close to zero. There is evidence that, since the 1930s, governments have not been concerned anymore about a constant debt/income ratio, but have instead targeted that ratio as a function of the real interest rate. This function takes the form of a positive target ratio of inflation-corrected interest payments over national income.

Such behaviour is compatible with the Barro idea of optimal tax smoothing, but it is not compatible with the way in which Barro operationalises this idea (see below). It may also be viewed as an interest rate stabilisation policy. Further research into the short-run aspects of the model is required to clarify this point.

Further research may also pay attention to the role of monetary policy in this context. Government financing by money creation could have been an important instrument to establish a long-run constant interest/income ratio. As is well known, governments can inflate their way out of undesired indebtedness by pursuing excessive money financing resulting in inflation. This aspect will have to be incorporated into the model. Levy (1981) and Hamburger and Zwick (1981,1982) argue that at least during part of the postwar period money financing has been used to mitigate the impact of deficits on interest rates. This is consistent with the findings of Blinder (1982). King and Plosser (1985) find little evidence for a reaction of money financing to deficits or any other variable in the budget, but they emphasise that further work is required. Joines (1985) reaches conclusions similar to those of King and Plosser. These conflicting empirical results do not seem to provide conclusive evidence on the role of money financing in the present context of a long-run real interest/income target. The explicit consideration of money financing as an instrument for pursuing such a target may lead to new insights. Furthermore, the authors quoted above confine their attention to the relationship between deficits and very narrow definitions of the money stock. This seems an unjustified restriction, and attention to wider definitions is required [Friedman (1978,1983,1985), Wellink and Halberstadt (1985), Kremers (1985) and Chapter 6].

Meanwhile, the conclusion that there _is_ a target for the stock of debt has some interesting implications. If one accepts Barro's tax smoothing theory, the implication of this result is either that money financing, ignored by Barro, is used to achieve the debt target conditioned on the real interest rate, or that, contrary to Barro, government expenditure is not exogenous and reacts to the debt position, or that both these statements are true. It seems reasonable to assume that <u>all</u> the instruments in the budget share the burden of absorbing undesired disequilibria incurred in the past. How that burden is distributed over the various instruments remains an important empirical question. The approach of Chapter 3, which is designed to capture such budget-wide "tension", may provide a productive framework for further attention to this issue. The empirical analysis of Chapter 6 forms an application of that framework to the public finances of the Netherlands.

Footnotes Chapter 4.

1. In the Barro model, a zero debt/income target would apply in the likely case where real Federal expenditure in the long run grows at the same rate as real GDP [substitute $\alpha_0=\pi_y$ in (4.2'); see Barro (1979, p. 955)]. However, this zero target is not imposed on the data, whereas the constancy of the target is.
2. Data sources are given in Appendix A. Some of the series incorporate a break in 1928/9. While this is indicated with a '*' whenever relevant, the graphical presentation is designed such that the two subperiods are comparable in single figures.
3. The following three quotes are typical for three stages of that process. 'The common notion among public finance writers is that the quicker the debts are paid the better. Dalton and Young have both likened the national debt to a toothache with the admonition to get rid of it as soon as possible' [Leland (1937)]. In his evidence to the Colwyn Committee on National Debt and Taxation in 1924, J.M. Keynes argued against rigorously heading for a low debt/income target in the U.K.: 'Since it is sound policy always to have a certain margin in budgeting, it is right that a certain amount of debt should, if possible, be repaid every year. But it is not advisable to attempt blindly to repay large sums merely on the ground that the debt is something to be got rid of. [...] I think it is a relic of mid-nineteenth-century sound financial maxims which have extremely little application to the present day. [...] It is unsound to base the policy of the future on the decaying conventions of the past' [Keynes (1924, pp. 295-322)]. The definitely different post-1930s attitude was expressed by A.P. Lerner: 'the absolute size of the national debt does not matter at all' [Lerner (1943)].
4. Barro (1984a) does not provide inflation expectations for War years 1941-1947, so there is a gap in Figure 4.6 between 1941 and 1949.

CHAPTER 5. THE DUTCH DISEASE OF THE NETHERLANDS: DEVELOPMENTS IN ECONOMIC POLICY AND THE MACROECONOMY, 1960-1982

5.1. Introduction

During the past decade or two the Dutch economy has gone through a process of major changes. The involvement of government in the economy has been one important factor in that process. Its increasing role in social and economic life has had effects on a variety of aspects of the economy, such as the sector structure; the functioning of labour markets; conditions on financial markets and the balance of payments. The availability of revenues from the sale of natural gas has reinforced the existing trends in government involvement to a considerable extent. And the gas boom has affected the economy in a direct way as well. This chapter describes the broad lines of those developments. I shall present the description as an analysis of the economic effects of the gas boom. Of course the gas was not the exclusive driving force behind the process of change, but an empirical analysis following the theoretical insights from the Dutch Disease literature offers a clarifying and allround perspective on it. This approach also enables us to introduce the role of government in a natural way; Central Government has spending power over most of the gas revenues. In the second part of the chapter, more specific attention will be given to aspects of monetary and fiscal policy which are relevant for the model of Chapter 3, This chapter thus sets the stage for the econometric analysis of Dutch public financial behaviour in Chapter 6.

I organise the argument as follows. Section 5.2 briefly provides some key characteristics of the Dutch economy. The next section categorises the relevant theoretical issues from Dutch Disease theory, and is followed by Section 5.4 where I describe the spending effects of the gas boom. The consequences for the sector structure of the economy are the subject of Section 5.5. This general economic background serves the evaluation of patterns in budgetary policy. Before introducing those patterns in Section 5.7, the preceeding section gives a concise impression of the tradition by which monetary policy is made in the Netherlands, and of its role in the difficulties of the turbulent 1970s.

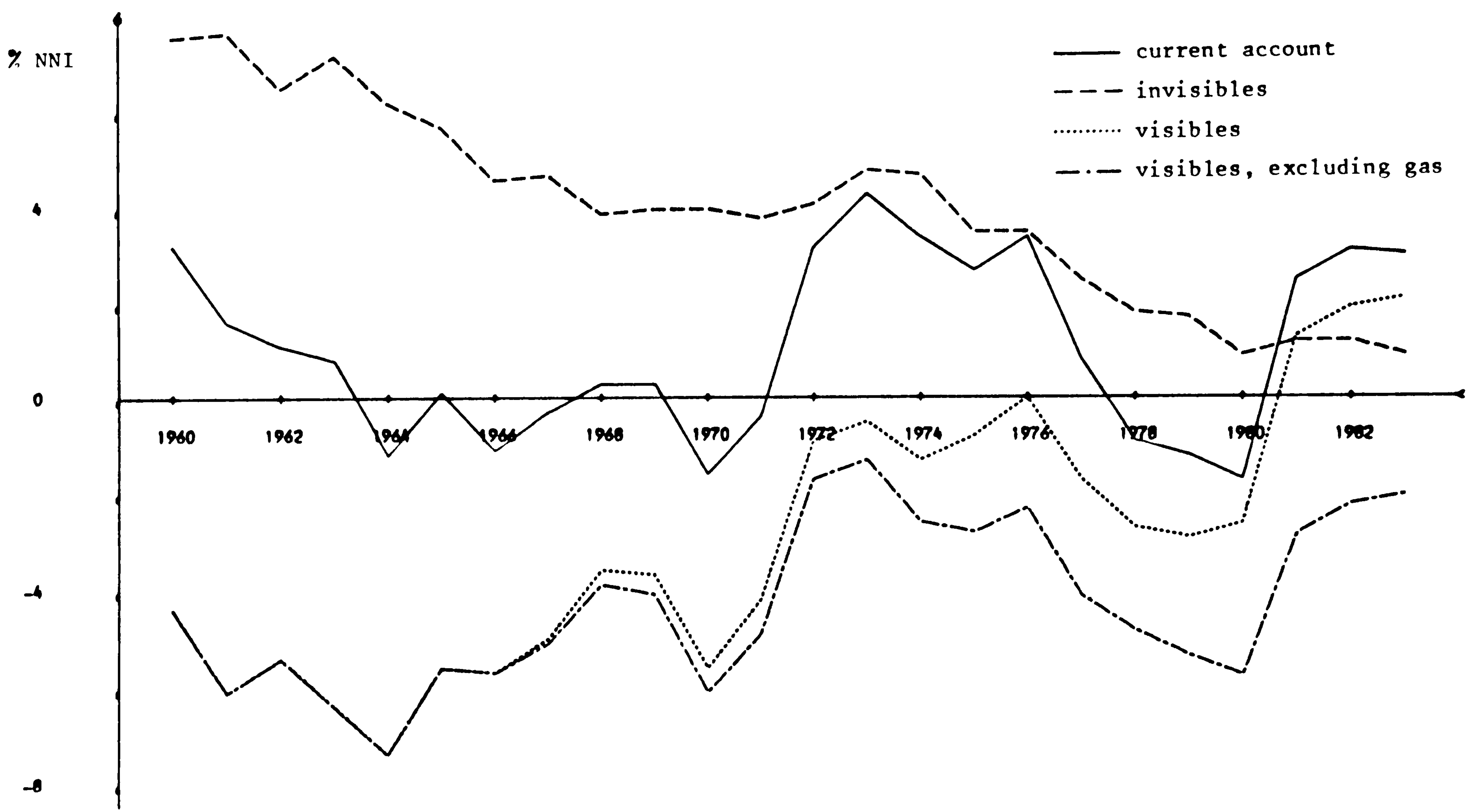
5.2. Some Characteristics of the Dutch Economy

A main feature of the Dutch economy is its great openness.[1] International trade amounts to more than 50% of GNP. Trade contacts extend to all areas of the world, with a strong but recently decreasing concentration on within-EC trade. Germany accounts for about 30% of Dutch exports, Belgium for almost 20%. The balance of traded goods normally shows a deficit, whereas services score surplusses (Figure 5.1). Exports are relatively concentrated on agriculture, mineral fuels, lubricants and related materials, and chemicals. The country reveals comparative advantages in production using relatively little but highly skilled labour, in its natural resources (agriculture and, temporarily, energy), in its history in trade and in its location at the crossroads of Europe [WRR (1980, p. 50), Koekkoek and Mennes (1984)]. Much more about developments in the sectoral structure will be said below.

The public sector is deeply involved in economic life. It takes up a large and until recently increasing share of value added in the private sector, both for exhaustive spending and for redistributive purposes. Regulatory powers of government are considerable and regularly used to guide the private sector in areas such as prices and incomes policy, industrial policy and sometimes even monetary policy. Because of the country's pluriform history and its sympathy with minorities, decisions are preferably taken by agreement of all those involved.

During the 1950s and early 1960s wage increases lagged behind the

Figure 5.1. The Dutch current account



Source: <u>Central Economic Plan</u> 1979, 1984; Wieleman (1982).
Note: Gas revenues do not include energy import substitution.

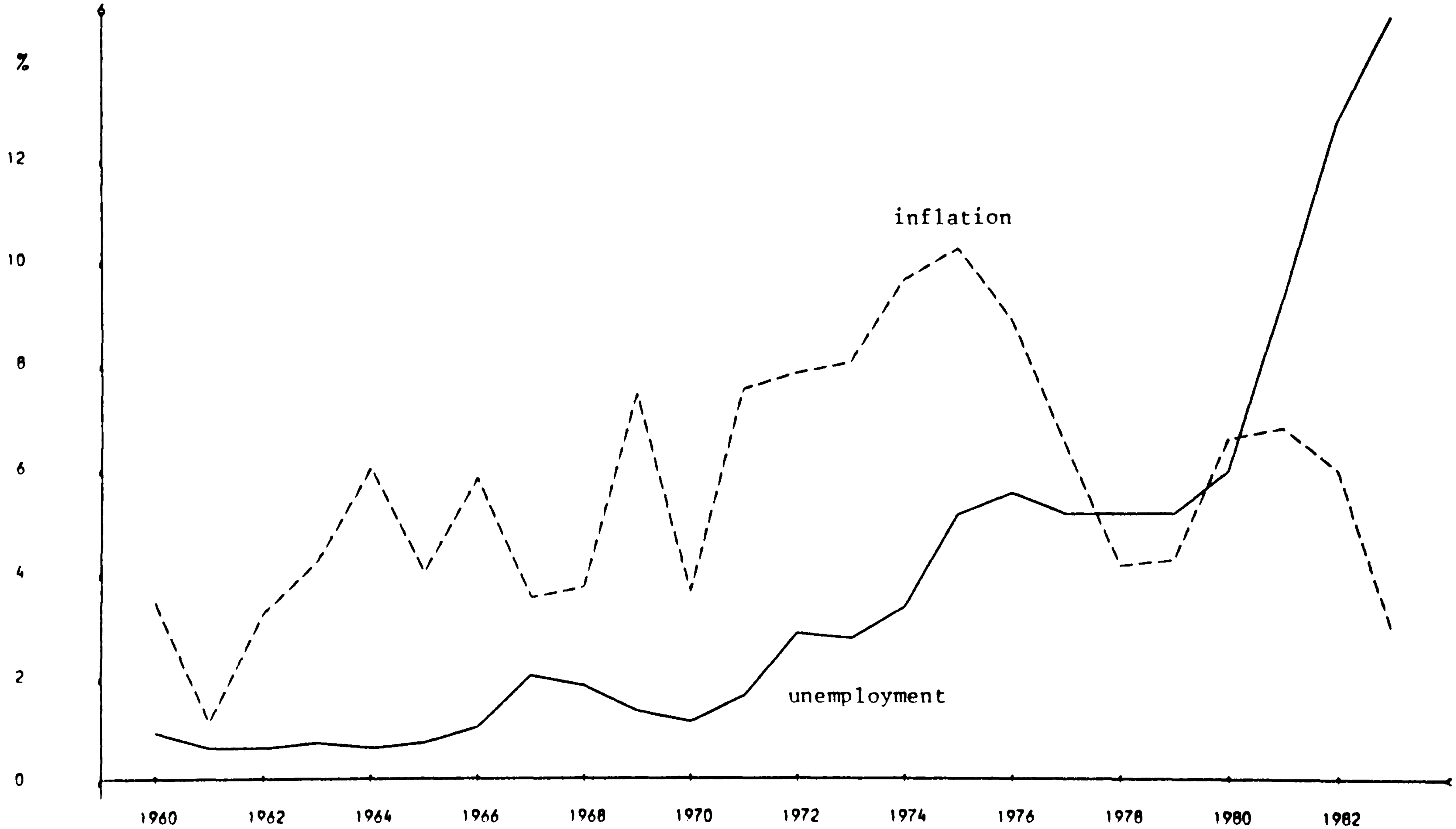
rapid growth of productivity. Later, the 1960s also accomodated a considerable wage explosion, which set in motion a trend rise of the share of labour in net value added (Figure 5.6 and Table 5.2). The exploitation of vast natural gas reserves occurred in a period of rapid growth, an increasing share in world trade, and low unemployment (Figure 5.2). Before the gas started to come on stream, virtually no energy was home-produced. It was estimated that the gas reserves would satisfy total national energy requirements for several decades [Lubbers and Lemckert (1980)].

Initially, depletion policy aimed at rapid exploitation of the gas. World energy prices were expected to fall, and cheap and clean nuclear energy was expected to become available in the near future. Therefore, an aggressive pricing policy was adopted on the Dutch household and business markets, and soon substantial export contracts were signed.

Two justifications were given for exporting gas at prices below that of its oil equivalent at the world level. First, it had to be sold off fast and in large quantities. so that markets had to be conquered rapidly by aggressive pricing. Second, the conversion from other energy sources to gas in the importing countries (mainly Germany, Belgium, France and Italy) involved adjustment costs which had to be reflected in prices. This meant that for the Netherlands the opportunity cost of gas was temporarily below the world energy price level, which made energy a comparative advantage for the Dutch economy of the 1960s. Later, the advantage diminished as export markets had been created and conversion had taken place. However, for contractual reasons export price rises kept lagging behind those of world equivalents, so that some of the advantage remained until today.

In the course of the 1970s the picture changed drastically. Rocketing world energy prices, an Arab oil boycott of the Netherlands, the revealed vulnerability of a country without energy reserves, general concern at the finiteness of natural resources, and a disappointing lack of progress on nuclear energy resulted in a reversal of the depletion policy. Domestic prices

Figure 5.2. Unemployment and inflation in the Netherlands



Source: **ABN Economic Review**.
Note: Inflation as annual % change CPI; Unemployment as % dependent labour force.

were moved up to world levels as much as possible. The strategy shifted from high speed depletion to long-term conservation. No new export contracts were engaged upon, house insulation and economy in energy consumption were promoted. By that time the consequences for the current account had become so enormous, that from that perspective also it was considered wise to cut back on gas exports and smooth its effects over time. Imports of energy reverted to an upward trend. Still, the experience of how to cope with a natural gas boom had only just begun.

5.3 Dutch Disease Theory

While discussing the impact of the gas boom on the Dutch economy, one can in the first place distinguish between resource movement and spending effects [see e.g. Neary (1984) and Corden and Neary (1982)].

Resource movement effects occur if the booming sector directly draws inputs away from the rest of the economy. As it happens, the exploitation of Dutch gas has required limited inputs. The gas sector does not provide much employment. Even though unemployment was low in the 1960s, we may for the purpose of this paper assume that the labour requirements of the gas sector were negligible [Wieleman (1982, p. 82)]. They never put pressure on other sectors.[2] A similar case can be made for capital inputs. Although investment costs constitute the major component of gas production costs, they do not seem to have put any pressure on Dutch capital markets. Total annual investment in the gas sector has never exceeded more than a few percent of national investment, and could increasingly be financed from gas revenues. The spending effects of capital goods purchases themselves will be discussed below. On the financial side, further recall that the Netherlands has a small and very open economy with, in principle, free international movement of capital. Potential capital market pressure could have been offset from abroad. Therefore. the Dutch Disease in the Netherlands may be studied in a model without inputs to the booming sector.[3]

The spending effect involves a variety of issues. In theory it can be separated from the optimal depletion problem, but in practice this may not be possible. Consider this issue first. As a useful benchmark, Buiter (1983) formulates a concept of the net worth of the public sector, in which the present discounted value of future gas revenues accruing to the government would be one constituent asset. As the result of an intertemporal optimisation problem (e.g., maximise intertemporal citizens' utility subject to the intertemporal public budget constraint - which contains the present value of gas - and the dynamic model of the economy), government normally ought to smooth the benefits of the gas boom over time. In a world of rational expectations, perfect financial, factor and product markets, and sufficiently operative intergenerational chains, the problem of maximising the present value of future gas revenues can be solved separately from the overall government optimisation problem. These conditions are sufficient but not necessary for the optimal depletion and general optimal budgetary policy problems to be solvable in a recursive way. If these conditions are not satisfied, it will in general depend on the specific features and parameters of the economy's model whether a recursive solution is feasible.

In the Dutch natural gas case, it was not possible to plan general macroeconomic policy conditional on an optimal solution of the depletion problem. The two were interrelated in a complicated way [Withagen (1982)]. To see this, recall that initial depletion policy was aiming at rapid exploitation. Since the export strategy required gas export prices to be below import prices of alternative sources of energy, it was attractive to absorb a large part of the gas reserves in the domestic economy. However, the absorptive capacities of the economy and of export markets were limited. It was decided to increase both. On the export side this was effected by aggressive pricing, and a similar strategy was followed with respect to domestic energy consumption. These two aspects of depletion policy were thus conditioned by short-run economic considerations. Influences also ran in the opposite direction. The originally low household prices changed the pattern of energy consumption and thus affected general macroeconomic relationships. Furthermore, government charged industry low energy prices to promote rapid depletion. This changed the industrial structure in favour of energy-intensive production and exports. another macroeconomic effect. Thus, optimal gas revenue generating and spending policies were intimately linked. Against this background, Section 5.4 will give further quantitative insight into the way revenues have been spent. The conditioning role of depletion policy will have to be kept in mind.

The conventional Dutch Disease entails a relative decline of the traded goods sector in favour of tne nontraded goods sector. This occurs in combination with an increase in the price of nontraded relative to that of traded goods, or a real appreciation of the currency. It hinges on the presumption that the energy boom results in an improvement of the energy balance of trade, and that at least part of the gas revenues are spent on nontraded gooas. On the basis of the description of spending patterns in Section 5.4, the subsequent Section 5.5 evaluates the extent to which the tradeables sector has been affected by the gas boom in the Netherlands. Sections 5.6 and 5.7 give a general outline of monetary and fiscal policy, and comment on the appropriateness of policy reactions to the natural gas boom.

Before first proceeding to a description of spending patterns, two important divergences of Dutch experience from standard theoretical models remain to be emphasised. First, Dutch Disease theory tends to ignore the impact of the booming commodity as an intermediary input. In the Netherlands, the role of gas as a partly nontraded input is of great importance. This has tended to reinforce the contractionary impact of the oil price rises on the tradeables sector, since that sector had meanwhile become more energy intensive [Corden and Neary (1982, pp. 840-1)]. It has also been instrumental in Dutch sectoral policy as we shall see below. Second, the Netherlands has experienced a great deal of inflexibility in real wages and prices. This has profound implications for the issues involved [Van Wijnbergen (1984b,c,d)], and will be given ample attention in Sections 5.5, 5.6 and 5.7.

5.4. The Spending Effects of Gas Revenues

The share of government in actual gas revenues has risen from 65% to more than 75% between the 1960s and today. At the margin, government's share is over 85%. The remainder accrues to the oil companies.

It is difficult to trace the way in which the latter category has been spent, although initially a large part must have been devoted to exploitation investments. That investment demand was to quite an extent met by imports [Wieleman (1982, p. 129)]. Relatively speaking, however, the amounts were still small.

Before concentrating on the way government spent its share in the revenues, it must be noted that actual revenue does not necessarily equal total potential revenue. The latter is the economically relevant concept. Since government has major power over price setting, any pricing below the revenue maximising level can be counted as a subsidy to energy costs. It is difficult to determine whether particular pricing policies have been adopted for reasons of general macroeconomic and industrial policy, or in order to maximise revenues.

Pricing policies have roughly been as follows [for details, see Lubbers and Lemckert (1980) and Wieleman (1982)]. Domestic prices, both for households and for industry, have always been above export prices. Gas export prices have always been below world energy equivalent prices.[4] Before 1973, domestic prices were far below world levels, partly in order to induce substitution towards gas. Agriculture and some parts of industry enjoyed substantially lower prices than households. For the pre-1973 period the policy stance taken was apparently to set gas export prices with a view to revenue maximisation (i.e., fast depletion). Household and business prices were below those of world equivalents. Reasons for the low domestic prices were partly of the revenue maximisation type (i.e., the stimulation of substitution), and partly of a general macroeconomic character. To the extent that the latter were significant, it seems that government has spent part of its potential revenue in this fashion as a transfer to households. The relatively low business prices must be seen as part of general industrial policy. In order to promote the utilisation of the Dutch comparative energy advantage (recall that the gas was expected to be replaced soon by other energy sources) in the form of an investment for the future, government stimulated energy-intensive production by spending part of the potential gas revenue on low energy pricing for business. In combination with direct public investment, this led to rapid growth of energy-intensive industries such as chemicals, oil refining, steel and horticulture.

As explained in Section 5.2, after the 1973/4 oil shock the depletion, pricing and spending policies changed. Slow depletion became the motto, and domestic prices went up to world levels. The argument of a Dutch comparative energy advantage lost ground as conversion towards gas had taken place and markets had been gained. Thus the opportunity cost of Dutch gas moved closer to the world energy price level. Low energy prices for industry would now be similar to a plain subsidy to industry, linked to the relative energy-intensity of the recipient's production. In the 1960s- as the comparative energy advantage was significant since foreign conversion and market penetration were still taking place, industrial prices were low partly in order to exploit this advantage. In the 1970s, as the advantage diminished, industrial prices rose accordingly. Although on theoretical grounds this may seem sensible, it represented a serious problem for the energy-intensive sectors set up in the 1960s.

Returning to the analysis of actual gas revenues, the government's share, amounting to approximately three quarters, remains to be accounted for.

Since these revenues were treated as current government receipts, it is difficult to trace their specific destination. Table 5.1 gives an impression of the significance of gas revenues in the budget, and of general public financing patterns. It appears that after the first oil crisis gas revenue became a substantial element in government receipts (from 3% of total receipts just before the first oil crisis up to 17% in 1982!). These revenues have not been set aside for investment. Over the relevant period, net public capital spending as a percentage of national income has declined somewhat. Taxation has stayed roughly constant (it increased up to 1980 but has fallen since), so that current spending has increased. Indeed, the bulk of growth can be found in net income transfers, wages and purchases of goods and services. Except for the expenditure on education, which is included in the last category and may be considered investment in human capital, most of the increase was therefore spent on consumption.

To sum up, it appears that before the first oil price rise part of potential gas revenue was invested by means of direct investment (footnote 2) and low energy prices for agriculture and industry. Not much was spent on consumption yet, but total gas revenues were still limited. After the first oil crisis, as revenues increased, it is evident that a large part thereof was spent on income transfers and consumption. Of course, if income recipients are sufficiently rational, the fact that government spent a large part of the revenues on income transfers does not necessarily mean that it indirectly spent it on consumption. Private individuals might increase their savings when faced with such windfall incomes. However, household savings have remained fairly stable at around 10% of net national income [Eizenga (1983)]. It seems, therefore, that consumers have not been all that rational, or at least that their effective time horizons have prevented them from being so. Figure 5.3 shows the pattern of consumption.

In addition, net public capital spending decreased somewhat, and on top of that the public sector started to run larger budget deficits just as

Table 5.1. The Budget of Total Government 1965-1982

	1965/9	1970/4	1975/9	1980	1982
	(average % of net national income)				
Wages, purchases goods and services	16.7	17.5	19.0	19.2	18.7
Interest payments	3.0	3.3	3.4	4.1	5.7
Price subsidies (house rent, etc.)	1.0	1.5	2.3	2.7	2.5
Net income transfers	3.5	4.3	8.4	9.5	10.5
Net current spending	24.2	26.6	33.1	35.5	37.4
Taxation	26.8	29.0	29.4	30.0	27.4
Gas revenues	0.2	1.0	3.2	4.5	6.1
Investment income	1.7	1.7	1.9	2.1	2.7
Current receipts	28.7	31.7	34.5	36.6	36.2
Net investment	4.6	4.0	3.1	2.8	2.6
Net capital transfers	0.8	0.9	1.6	2.8	2.6
Net loans	3.7	2.7	2.1	2.5	2.7
Net capital spending	9.1	7.6	6.8	8.1	7.9
Budget deficit (-)	-4.6	-2.5	-5.4	-7.0	-9.1
Memo: Social Security contributions (not included in Taxation)	14.0	17.5	19.7	20.2	22.1

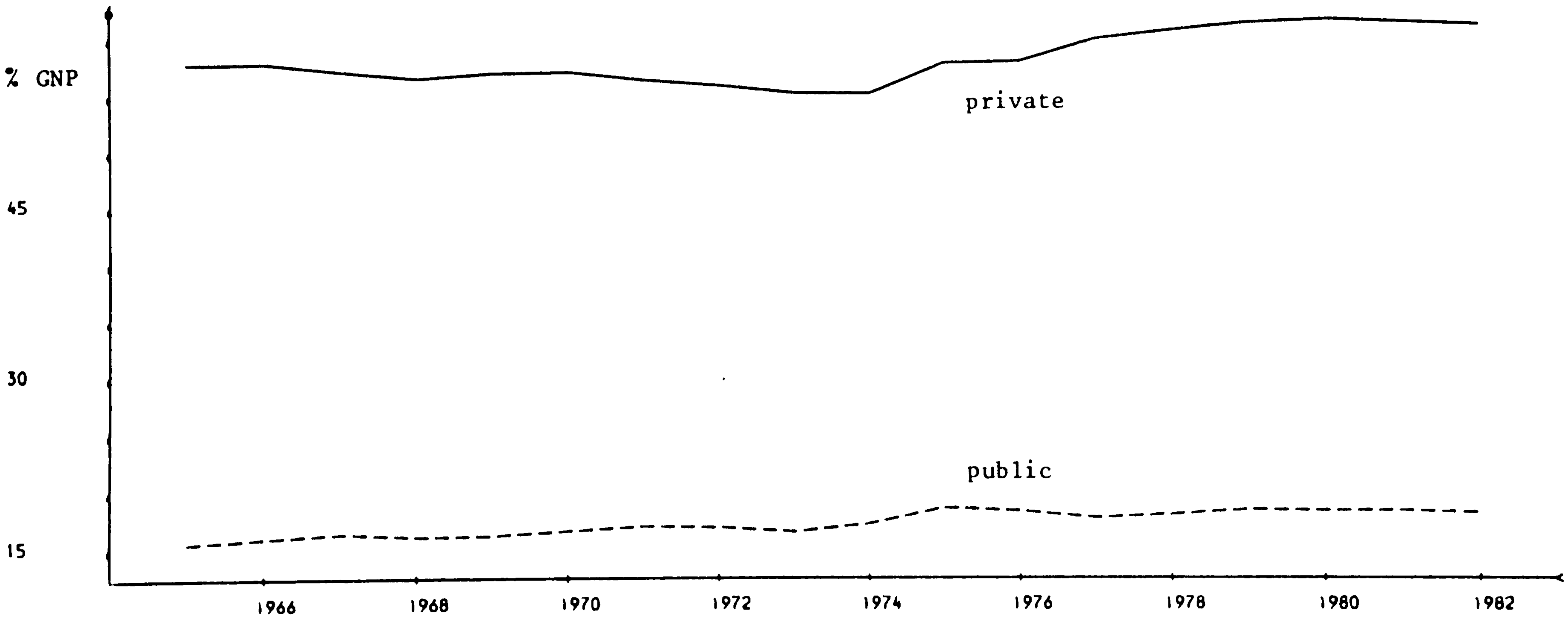
Source: Central Planning Bureau, Macro Economische Verkenningen 1983
(excluding Social Security Funds)

Table 5.2. Labour's Share in Value Added, 1964-1983

	1964/8	1969/73	1974/78	1979/83
	(average % of total value added)			
Manufacturing (excluding Construction, Electricity, Gas and Water, Natural Gas)	72.5	74.5	84	92
Services	75	78.5	79	74

Source: Central Planning Bureau, Central Economic Plan 1979, 1984
(Labour's share equals total labour cost including employers' contributions to Social Security and an imputed income of self-employed, divided by net value added at factor cost)

Figure 5.3.Consumption in the Netherlands



Source: De Nederlandsche Bank, <u>Kwartaalconfrontatie Middelen en Bestedingen</u>.

gas revenues approached their maximum. A channel by which some of the gas proceeds may have been saved is through the balance of payments. This channel will be highlighted in Section 5.6. For now, the general conclusion is that gas revenues have tended to be put to consumptive purposes. A mix of traded and nontraded goods was purchased.

5.5. The Sector Structure of the Dutch Economy

The core of the Dutch Disease literature focusses on the decline of the tradeables relative to the nontradeables sector, assuming that no compensating action is undertaken by the government. Table 5.3 shows the broad lines of developments in sectoral structure in the Netherlands. This table is in volume terms. It appears that the output of manufactures has grown somewhat more rapidly than that of services in 1963-1973. In value terms services have grown slightly faster, because prices of services have tended to rise more [Central Economic Plan, Appendices D5/6]. The latter development has become much more pronounced in the period after the first oil price rise (1973-1978), as services grew relative to manufacturing both in value and in volume terms.

The pattern of services vs. manufacturing up to about 1977 was not peculiar to the Netherlands. Albeit taking off from different starting levels, similar developments occurred in other EC countries [EC, Basic Statistics]. Belgium's experience is very similar to the Dutch, even though Belgium has not enjoyed an energy boom. This changed around 1978. The decline of Dutch manufacturing accelerated, and the international discussion of the Dutch Disease began [The Economist (1977), OECD (1978)].

The crucial separation in that literature does not run between services and manufacturing. It is drawn between traded and nontraded goods. Most Dutch manufacturing is indeed involved in exporting, or is at least exposed to import competition.[5] It is difficult to divide total services into traded and nontraded services. An attempt has been made by the Scientific

Table 5.3. Production Volume: Composition and Growth per Sector, 1963-1983

	Share 1980	1963/73	1974/78	1979/83
		(average annual % change)		
1 Agriculture	4.2	3.5	2.7	4.5
2 Animal Products	0.3	4.0	1.0	3.0
3 Other Food	2.0	3.5	2.4	2.3
4 Beverages, Tobacco	1.6	7.5	3.2	4.3
5 Textile, Clothing, Footwear, Leather	0.9	-0.5	-5.5	-4.7
6 Paper and Printing	2.4	4.0	4.2	-0.4
7 Wood and Construction Materials	1.6	5.0	-0.4	-4.2
8 Chemicals, Plastics, Rubbers	2.8	12.0	2.7	2.7
9 Basic Metals	0.9	9.5	-0.8	-1.4
10 Metal Products, Precision Instruments	3.9	5.5	1.0	-0.6
11 Electric Equipment	2.6	8.0	2.6	3.4
12 Transport Equipment	1.3	5.0	-3.2	0.1
13 Oil Refining	1.4	9.0	-1.9	-3.3
2-13 Manufacturing	21.7	6.5	0.9	0.3
14 Mining (including Natural Gas)	6.9	11.0	0.8	-2.4
15 Electricity, Gas and Water	2.6	13.5	4.2	0.5
2-15 Industry	31.2	7.0	1.1	-0.3
16 Construction	8.5	3.0	0.0	-4.4
17 Owner-Occupied Dwellings	6.0	3.0	2.4	4.0
18 Trade	15.2	5.5	4.3	-0.9
19 Sea and Air Transport	1.3	2.5	2.8	0.1
20 Other Transport and Communication	6.5	6.0	3.6	2.3
21 Banking and Insurance	5.8	8.0	4.1	2.8
22 Medical and Veterinary Services	6.9	6.0	4.7	2.7
23 Other Services	14.4	3.0	3.0	1.3
17-23 Services	56.1	5.0	3.8	1.4
Total Private Sector	100.0	5.7	2.9	0.8

Source: Own calculations based on Central Planning Bureau, Central Economic Plan 1979, 1984

Council for Government Policy [WRR (1980, p. 42)]. They select as internationally oriented services the categories 18, 19 and 20: Trade, Transport and Communication. Agriculture should also be counted as a tradeables sector, whereas Electricity, Gas and Water and Construction are largely nontraded.

The following picture emerges. Before the first oil crisis the output of tradeables as well as nontradeables grew considerably. Beverages and Tobacco, Chemicals, Basic Metals and Oil Refining were particularly successful. Textile and Clothing lost ground as import penetration was high in this sector [Kol and Mennes (1980, Table 2)]. Notice that the successful sectors tended to be energy-intensive and labour-extensive, whereas the opposite was true of declining sectors. Services show a general growth. Agriculture and Construction lost some ground, while Electricity and Gas thrived.

After the oil price explosion of 1973/4 these patterns change. First, there is an across-the-board decline in growth rates. The decline is generally stronger in tradeables than in nontradeables. Exceptions on the tradeables side are Agriculture, Food and Beverages, and traded services. Nontradeables appear more sheltered from decline. The post-1979 period presents basically similar developments, except that the traded services join in the general decline of tradeables. The decline was least in Agriculture, Food and Beverages, Chemicals and Electrics.

The Dutch experience is thus characterised by a squeeze on tradeables in favour of nontradeables. What are the main causes of this development? Is it the standard Dutch Disease case of a boom in a tradeables sub-sector, which squeezes traded production by raising the relative price of nontraded goods? One major ingredient has already been identified above: a significant part of gas revenues was spent on nontradeables. The next question is whether this fed through via an appreciation of the real exchange rate to a loss of domestic and export markets. Events on the export side will now be examined in some detail. Since those on the import competing front are very similar, they will be treated only briefly afterwards.

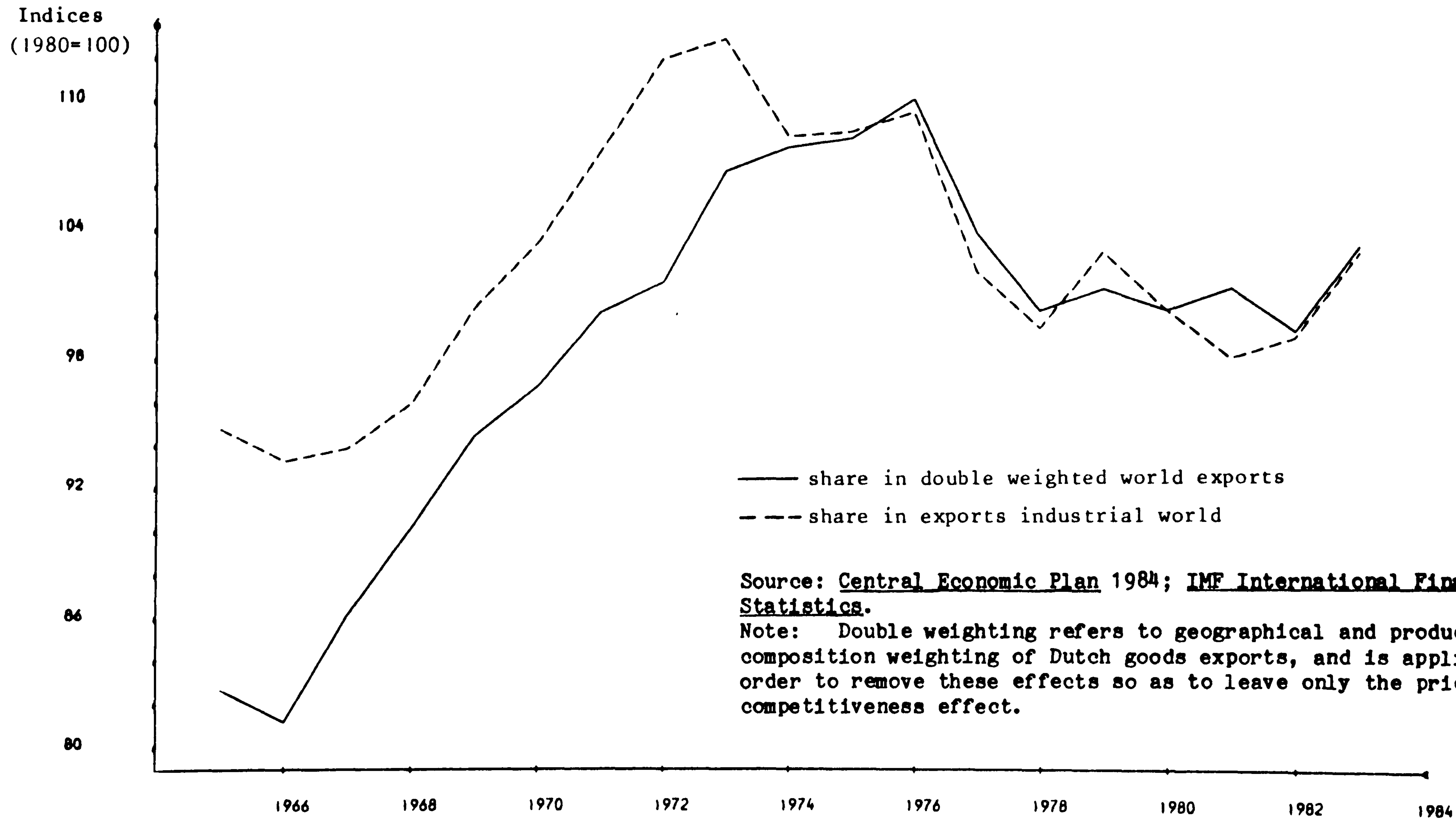
Some insight into Dutch export performance is given by Figures 5.4 and 5.5. The steady gain in market share, which had already started before 1965, came to a sudden halt in 1973/4. Both graphs in Figure 5.4 are in volume terms so as to eliminate some of the effects of price fluctuations following the oil crises.[6]

The dramatic loss of market share (about 15% in five years) of course stimulated research and discussion in the Netherlands [Gerards and Jager (1980), Groot and Janssen (1980), Brakman et al. (1982)]. Two strands of that literature are of relevance here. The first concentrated on the role of the exchange rate in the market loss. The second argued that changes in the product composition of Dutch exports, brought about by the availability of cheap gas in the 1960s, may have played a special role in the overall export performance.

The upsurge of the Guilder after the collapse of the world's system of stable exchange rates in the early 1970s is shown in Figure 5.5. There has been little formal empirical research into the relationship between natural gas and the exchange rate. The Guilder rate is very much a result of exchange rate policy, which links the Guilder to the Deutschmark (Section 5.6). The Central Bank has always commented that this policy has been successful thanks to the availability of gas with its present and expected future effects on the current account.[7] I shall adopt that loosely specified relation in this paper, foregoing any attempt to determine exactly how much of the appreciation is due to gas and how much to other causes. This also implies that I shall not examine in detail the exact timing of appreciations [cf. Sheffrin and Russell (1984)], or the determinants of the long-run equilibrium value of the Guilder. The actual upsurge of the Guilder continued throughout the 1970s, and came to an end only in 1979 as the upward move of the Dollar began.

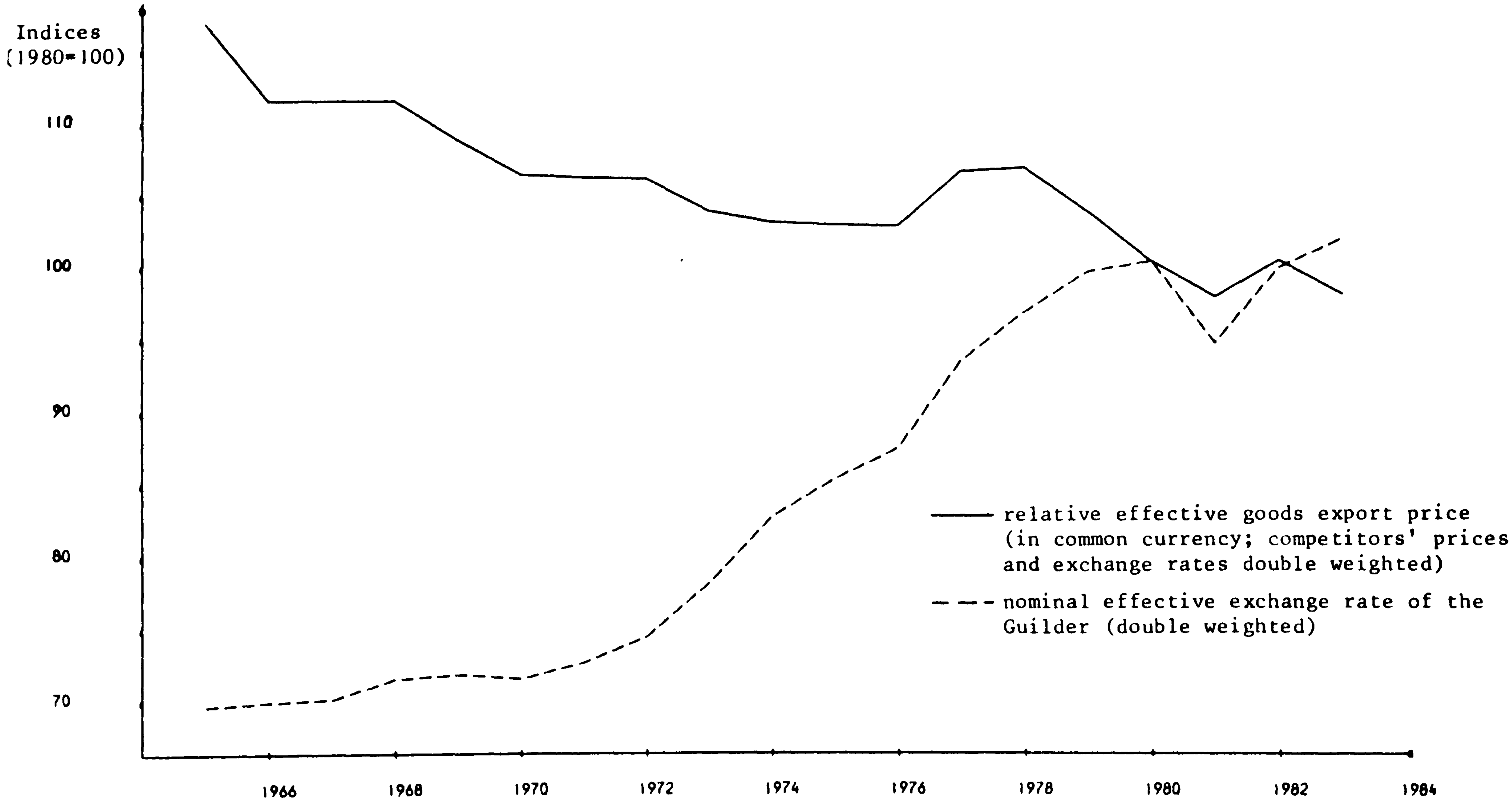
The price variable which is relevant for export competitiveness is not

Figure 5.4. Dutch goods export market shares



Source: Central Economic Plan 1984; IMF International Financial Statistics.
Note: Double weighting refers to geographical and product composition weighting of Dutch goods exports, and is applied in order to remove these effects so as to leave only the price competitiveness effect.

Figure 5.5. Dutch price competitiveness and the exchange rate



Source: <u>Central Economic Plan</u> 1984.
Note: Double weighting: See Note Figure 5.4.

the nominal rate, but the relative price which Dutch exporters charge on foreign markets. In order to concentrate on these price effects, Figure 5.5 shows the relative effective export price, weighted by the geographical distribution and product composition of Dutch exports. The weighting is meant to remove effects on export performance which are due to the particular composition of the markets on which the Dutch operate, and the particular set of products they sell. One should, however, not grant the resulting double weighted statistics too much significance in explaining export performance. That is because some of the market gains or losses to be explained are already reflected in the statistic via the their presence in the weights. Double weighted variables will only be used in a descriptive fashion.[8]

Keeping this caveat in mind, Figures 5.4 and 5.5 do appear to express the main conclusions of the Dutch discussion on export performance.[9] Up to 1973, Dutch exports gained market share because of generally positive influences from all three factors: geographical distribution, product composition, and price competitiveness. The price factor tended to be dominant, which can be recognised in the similar slopes of both market share curves in Figure 5.4.

After 1973, price competitiveness continued to exert a positive influence up to 1976, whereupon it suddenly turned to the opposite. The deterioration in price competitiveness hampered exports in the mid- to late 1970s. Later, there has been a distinct improvement of the price factor, but the earlier adverse circumstances remain a handicap for Dutch exporters.[10] Losses of competitiveness and market share have lagged effects as well. The decline between 1973 and 1977 was partly due also to stagnation in the EC, which is the main trading area of the Netherlands, and to a German recession in particular.

The contribution of the product composition of exports requires separate attention. The reactions of different product categories to oil price rises vary greatly. Strong reactions and heavy fluctuations occur especially in energy-intensive sectors. This is connected to large-scale international inventory movements in sectors such as primary energy, chemicals and oil products. The Dutch relative concentration in these sectors made a substantial positive contribution to export shares just before and during the oil crises, but a negative contribution just afterwards. Apart from these temporary fluctuations, it seems that in volume terms the typical energy-intensive sectors have not prospered in the 1970s and early 1980s. In value terms they did better, despite major price substitution effects away from these products on the demand side. Still, the energy-intensity of Dutch industry (excluding gas of course) has with hindsight not been beneficial during that period.[11] In the following sections this will be evaluated from the policy point of view.

The relationship between price competitiveness and import competition was similar to that in the export field, although the nominal effective appreciation relative to import competitors was smaller than that relative to export competitors [De Nederlandsche Bank, Quarterly Statistics 1981, No. 1]. As the mirror image of increasing export market shares, import penetration was already rising in the 1960s [Groot and Janssen (1980), Kol and Mennes (1980)]. This was not discouraged by the government, since it was seen as part of a general movement towards an improved international allocation of production. For example, labour-intensive sectors such as textiles were slowly, reluctantly, but steadily given up to the low-wage countries. These ideas were particularly alive in the 1960s as the Netherlands enjoyed virtually full employment.

Increasing imports were not only a consequence of price effects. The expansionary fiscal policy stance (Table 5.1) fed through to imports of a mainly consumptive nature. For example, a major factor behind the deteriorating invisibles balance (Figure 5.1) was the sharp rise of foreign travelling by Dutch citizens.

Figure 5.5 leaves one puzzle. Despite a continuously hardening Guilder, price competitiveness for prolonged periods improved rather than deteriorated. This begs the question of export price setting.[12] In order to see the significance of this question, return for a moment to the standard theory of the Dutch Disease. As an optimal reallocation of resources, the tradeables sector declines relative to the nontradeables sector. This is brought about by a relative price rise of nontraded goods, which initially entails a higher traded product wage (so lower profitability in that sector), and a lower nontraded product wage (higher profitability). This stimulates the shift of labour from tradeables to nontradeables. If wages and prices are flexible, they will adapt so as to bring about an equilibrium with full employment, a larger nontradeables sector with more employment and a smaller tradeables sector with less employment than before the gas boom. If, however, wages and prices are <u>not</u> sufficiently flexible, there exists a risk that profitability in the traded sector will <u>decline</u> more than necessary, and that profitability in the nontraded sector will not <u>rise</u> enough to absorb all the labour shed in the tradeables sector [Van Wijnbergen (1984b,c,d)].

Broadly speaking, this is indeed what has happened in the Netherlands. The findings of Driehuis' (1975) study of wage formation in the Netherlands can be summarised as follows [see also Van den Beld (1978)]. In the 1960s, wages became virtually completely indexed to the Consumer Price Index (CPI), which contained indirect taxes and the cost of household energy consumption. Increments in direct taxes and employees' Social Security contributions tended to be passed on in higher wage claims throughout the economy. In the generally centralised wage bargaining process, an aggregate indicator of labour productivity played a central role. This put upward pressure on product wages in all but the most productive sectors. Even productivity in the natural gas sector, where employment is minimal and production very high, was a constituent of the productivity indicator. In addition, employers' contributions to Social Security increased steadily, thus contributing to the rise in total labour costs.

This process, which originated in the 1960s, remained in operation throughout most of the 1970s. The implications for the diagnosis of unemployment, and for the medicine one could successfully prescribe, will be further analysed in Section 5.7. Here, the consequences of the rigidities for the profitability of enterprise will be described.

If there are upward pressures on labour costs. which can not be passed on in higher sales prices, there are several possible consequences for a firm faced with this problem. First, it can make labour-saving investments so as to increase labour productivity and decrease unit labour costs. Second, if an increasing labour share in value added causes the firm to incur losses. it can absorb these losses by borrowing or by temporarily eating into its reserves. These two strategies will only be followed if the firm expects a future reversal of these temporarily adverse circumstances. If a firm does not have sufficient confidence in the likelihood of sound returns in the future, or if the short-run liquidity pressure caused by the lack of profitability becomes too heavy, then it will go out of business or leave the country.[13]

In order to get some insight into what has happened to profitability in Dutch manufacturing, I follow Sachs (1983) and decompose changes in the labour share of value added into three components:

$$\dot{s}_L = (\dot{w}-\dot{p}_C) - (\dot{y}-\dot{l}) + (\dot{p}_C-\dot{p}_Y) \qquad (5.1)$$

where s_L denotes the labour share, w the nominal hourly wage rate, p_C the CPI, l total hours worked, y net value added and p_Y the value added deflator. Dots denote annual rates of change. The first term gives an impression of developments on the wage formation side. The second expresses the contribution of labour productivity. The third, which I call the 'composite term', is a variable which covers 'changes from several sources: supply shocks, in which input prices change in real terms; changes in indirect tax rates; changes in exchange rates, which vary prices of non-traded goods relative to manufacturing tradables; and demand shifts away from or toward manufacturing'

[Sachs (1983)].

In the Dutch case, the composite term covers selling-price pressure from foreign competition due to the rising Guilder, influences from changing demand patterns, and indirect taxes. Of course only part of these phenomena is caused by the impact of gas on spending behaviour and the exchange rate.

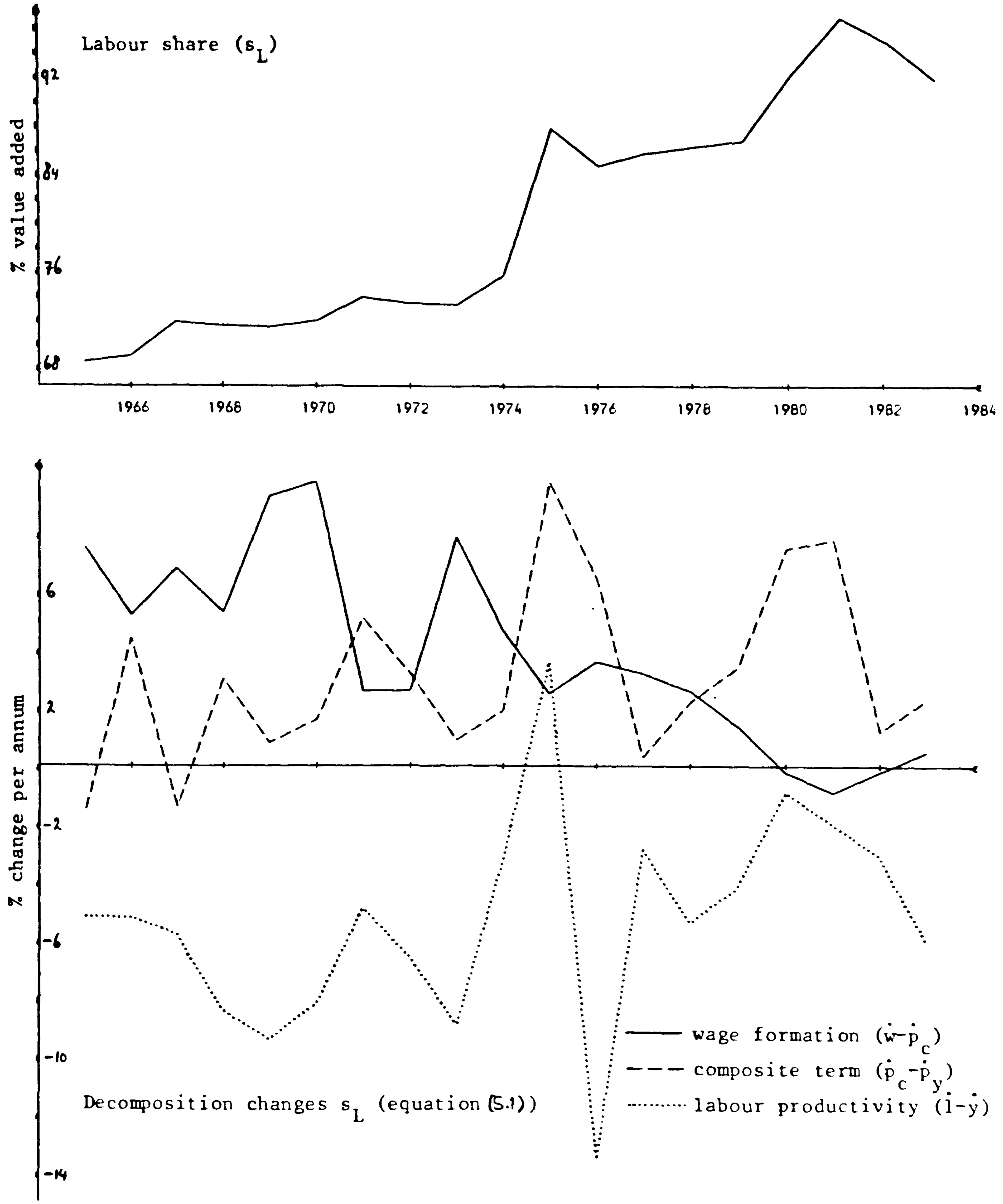
The result of the decomposition is shown in Figure 5.6. The trend rise of real labour costs (deflated by the CPI and including employers' Social Security contributions) throughout the 1960s and 1970s was initially compensated by improving labour productivity. In combination with a moderate upward trend in the composite term, the labour share in value added increased slowly but steadily. It would be interesting to follow Sachs (1983) and decompose the three factors of Figure 5.6 in trend and cycle components. Since, however, the Dutch economy has experienced more than moderate structural change over the 1970s, this would be a difficult venture. For now, I try to interpret the actual patterns as shown in the figure.

The improvement of labour productivity in the 1960s was a result of labour-saving investments. However, in 1975 the labour share jumped by more than 10%. This was caused by a combination of cyclical capacity under-utilisation, labour cost rises, and an increasing influence from the composite term. This reflects rapid structural change in the real and nominal economy, consisting partly of the effects addressed in this book. Until 1979, the labour share remained fairly stable at 85%. A slowdown of the improvements in labour productivity and an intensified cost/price squeeze were responsible.

The second oil crisis brought another jump, this time to a historic high of 96%.[14] A productivity slowdown and the composite term are to blame. Labour cost restraint was not sufficient to keep the share from rising. Only as productivity increased and cost/price squeeze effects declined by 1982/3 was there some improvement in profitability.

Returning to the options open to firms faced with increasing costs and decreasing sales prices, the following rough sketch seems to capture Dutch

Figure 5.6. Labour share Dutch manufacturing value added



Source: Central Economic Plan 1979, 1984 (own calculations 1965-1973).
Note: Definition labour share: See Table 5.3.

experience. In the 1960s and early 1970s, a period of an optimistic business outlook, rising labour costs were met by labour-saving investment.[15] Some erosion of profit margins began, but this was accepted against a background of general optimism. Since profit margins were used as a buffer, and at the same time net investments were still made, this affected the financial structure of the business sector. Though not the sole reason, the slow process of profit erosion added to an almost continuous rise of the share of debt capital in total capital [Figure 5.7; also Den Dunnen (1981a) and Wellink (1982)]. As can be seen from Table 5.4, labour was shed while production still grew.

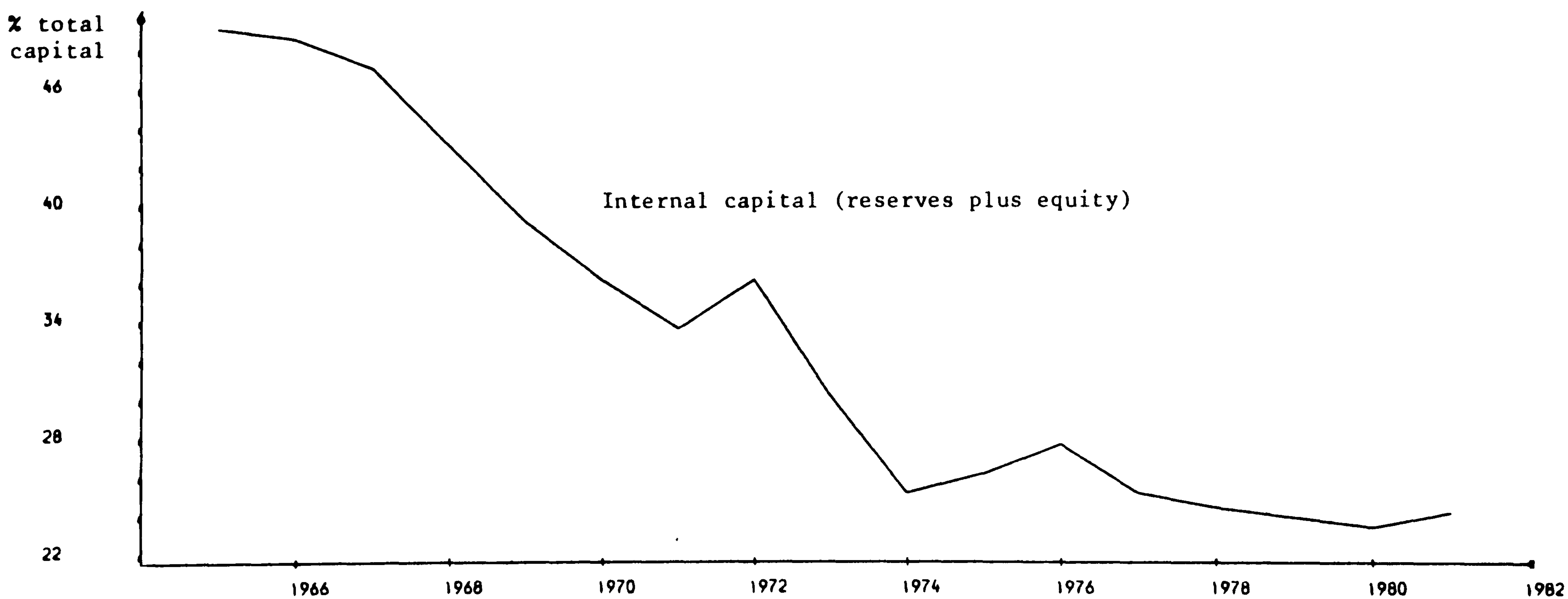
The process continued in 1974-1983, although with a shift of emphasis. With the optimism concerning future demand prospects fading and financing becoming more and more of a problem, net investment declined.[16] Firms started to leave the market, production growth stagnated, and more labour was shed (see also Figure 5.2). Market exit often meant going abroad, as we shall see in Section 5.6 where international capital movements appear in the analysis.

I have emphasised the impact of Dutch Disease type of developments (in combination with expectations of future sales) on the profit and financial position of business for two reasons. First, this phenomenon introduces lags into the channels through which usual Dutch Disease patterns operate. Although we have already observed the usual changes in sectoral structure occurring in the 1970s, there may be more to come. Second, concern for the financial state of the private sector has been one of the factors determining the policies of De Nederlandsche Bank, an aspect of the Dutch Disease in the Netherlands to which we shall turn in the next section.

5.6. Monetary Policy

In the previous sections I have presented the basic economic problems of the Netherlands: stagnating growth, unemployment and major shifts in sectoral structure. I have shown that natural gas has had an impact through

Figure 5.7. The financial structure of Dutch industry



Source: Central Bureau of Statistics, Statistisch Zakboek.
Note: Industrial firms on Amsterdam Stock Exchange, excluding Internationals.

Table 5.4. Employment: Composition and Growth per Sector, 1963-1983

	Share 1980	1963/73	1974/78	1979/83
		(average annual % change)		
1 Agriculture	6.8	-3.0	-1.7	-1.1
2 Animal Products	1.2	1.0	-2.0	-3.0
3 Other Food	2.7	-1.5	-2.9	-1.2
4 Beverages, Tobacco	0.5	-1.5	-2.3	-2.6
5 Textile, Clothing, Footwear, Leather	1.7	-6.0	-9.2	-8.8
6 Paper and Printing	2.7	0.5	-1.3	-1.4
7 Wood and Construction Materials	2.2	-1.0	-3.0	-4.9
8 Chemicals, Plastics, Rubbers	2.7	1.5	-3.2	-1.4
9 Basic Metals	1.0	3.5	-1.6	-2.4
10 Metal Products, Precision Instruments	5.0	0.5	-1.9	-2.8
11 Electric Equipment	2.7	1.0	-2.1	-2.1
12 Transport Equipment	1.7	0.0	-2.2	-3.2
13 Oil Refining	0.2	0.5	-1.5	1.9
2-13 Manufacturing	24.3	-0.5	-2.7	-2.8
14 Mining (including Natural Gas)	0.2	-13.0	-9.2	2.7
15 Electricity, Gas and Water	1.2	1.5	0.0	1.3
2-15 Industry	25.7	-1.0	-2.8	-2.5
16 Construction	11.0	1.0	-0.7	-5.2
17 Owner-Occupied Dwellings	-	-	-	-
18 Trade	18.8	1.5	-0.3	-1.2
19 Sea and Air Transport	1.0	-5.0	-1.2	-1.1
20 Other Transport and Communication	6.8	1.0	0.7	0.4
21 Banking and Insurance	4.2	4.0	2.1	1.1
22 Medical and Veterinary Services	7.6	6.0	3.9	2.3
23 Other Services	18.1	2.0	1.3	1.0
17-23 Services	56.5	2.0	0.9	0.3
Total Private Sector	100.0	0.5	-0.3	-1.1

Source: Own calculations based on Central Planning Bureau, *Central Economic Plan* 1979, 1984 two channels. First, via its direct influence an an intermediate input. Second, via spending effects, which have affected demand conditions and the real exchange rate. This brings us to the role of fiscal and monetary policy. Since this study is focussed on fiscal policy and considers monetary matters only inasfar as they are directly connected with the government budget, I first give a fairly brief account of the Dutch monetary tradition and its role in recent economic adversities. In Section 5.7 this is followed by attention for budgetary policy.

Monetary policy has only a relatively modest role to play in the Netherlands [Den Dunnen (1973,1979,1981a,b)]. This stems from the openness of the economy. The country is highly dependent on international trade, and is a supporter of stable exchange rates. It participated in the 'snake' and is now a member of the EMS. International capital movements are perhaps the most liberalised in the world, although in tne mid-1970s some restrictions on capital imports were imposed temporarily as we shall see below. Except from short-run divergences, all this renders monetary conditions dependent on developments in West Germany [Budd and Warburton (1981)].

The actual attachment of the Guilder to the Deutschmark is much tighter than imposed by the EMS. This is a Dutch policy choice. It has been made in order to provide a stable environment for trade (notice that Belgium, the second Dutch trading partner, is also in the EMS), and also to limit the import of inflation by associating with a major low-inflation economy [Figure 5.2 and Kessler (1980)].

Against this background, monetary policy is mainly quantity-oriented. The Central Bank monitors its broad liquidity concept, M2, and has credit rationing at its disposal as one of its instruments. Through institutional arrangements, the money and capital markets used to be two almost strictly separate markets. This facilitated short-run exchange rate intervention without significant direct effects on domestic monetary conditions. However, recent financial innovations and the further internationalisation of Amsterdam as a financial centre seem to have blurred the separation between money and capital markets. It will be interesting to see how monetary policy adapts.

Even though the Central Bank monitors and influences the liquidity of the economy, this does not mean that it publishes monetary targets to which it subsequently adheres rigorously. Its policy is, roughly speaking, directed at avoiding any inflationary pressure emanating from monetary conditions. This implies that cost-push inflation is not seen as a monetary phenomenon and therefore is not in principle deemed the responsibility of the monetary authorities. Finally, the capital market is seen as the marketplace where relative scarcity of long-term financial funds is reflected in the long-term interest rate without any government intervention.

This is not the place for an evaluation of the Dutch monetary tradition, and for more detailed accounts I refer to Den Dunnen et al. (1981) and the articles by the same author which are quoted in the Bibliography. Two aspects may be borne in mind for the econometric analysis in Chapter 6. Dutch monetary policy is quantity-oriented, and in this context the monetary influence of the public finances and of the balance of payments can both play an important part. Furthermore, interest rates are accepted as the flexible outcomes of market forces, and they are generally not managed by the authorities except money market rates in view of short-run exchange rate stabilisation. I shall leave the monetary dimension of budgetary policy to Section 5.7.

Let us proceed to a brief look at the role of monetary policy in the economic difficulties of the 1970s. In the Dutch Disease framework, two aspects of that policy require special attention. The first relates to the money supply, the second to the exchange rate and the balance of payments.

It has been argued that a resource boom which is met by a restrictive monetary policy may lead to a recession [Buiter and Purvis (1983), Neary and Van Wijnbergen (1984)]. Neary (1984) has called the mechanism giving rise to this the liquidity effect of a resource boom. Essentially, if the nominal stock of money remains constant, the spending effect of the boom is dampened by the increased demand for real balances. The exact channels depend on the exchange rate regime and on price and wage adjustment mechanisms.

In the Netherlands, the first oil shock was accomodated by a rising money supply. This may have had a stimulative impact, as witnessed by the temporary increase in output growth after 1975 (Figure 5.8). In contrast, the second oil shock was met by contractionary policy. A recession followed, to which monetary policy may have contributed. In both cases, however, fiscal policy worked in similar directions, so that the separate influence of monetary policy should not be overestimated. The exact extent to which these cyclical money supply and output patterns were related remains under discussion [compare e.g. the views of Den Dunnen (1981b, Graph 3) and Bomhoff (1983, Par. 2.4)]. In any case, the money supply policy of De Nederlandsche Bank has usually operated carefully and gradually. Rigorous formal empirical evidence with respect to its role in the Dutch Disease context is lacking. Nevertheless, the major choices presented by the gas boom have been made by the fiscal policymaker.

Before proceeding to those choices, the Central Bank's exchange rate policy requires attention. This policy has been a contentious issue. This is not the place to go into the intricacies of the exchange rate debate.[17] The aspects which are relevant in the resource boom context have been analysed theoretically by Corden (1981a,b). One of the ways to protect the tradeables sector from pressure caused by appreciation is simply to prevent the appreciation itself from occurring. Corden calls this exchange rate protection: spend gas export revenues to finance a balance of payments surplus and build up a reserve of foreign assets.

It is clear that such a policy on a large scale is unsustainable in the long run.[18] However, if exchange rate pressure is expected to be only temporary because of the finiteness of the resource boom, it may be sensible to protect the tradeables sector during this period of pressure by keeping the

Figure 5.8. Real growth of Dutch and world GDP

Source: IMF International Financial Statistics.

exchange rate down and investing in foreign assets. There are sound practical arguments for the possible superiority of that form of protection over alternative forms such as tariffs, quotas and subsidies [administration, reversibility and international commitments; see Corden (1981a)].

It is difficult to determine to what extent Dutch exchange rate movements and policy reactions have been connected with the gas boom. The link with the Deutschmark has been the overriding policy goal. Pleadings in favour of Guilder _de_preciation to boost competitiveness have always been countered on two grounds. First, depreciation in the heavily indexed and very open economy was feared to lead to inflation. This would worsen rather than improve competitiveness.[19] Moreover, the real inroads on profitability in the business sector were considered to be the combined responsibility of the fiscal policy-maker and the wage formation process. Second, depreciation would affect international confidence in the Guilder. This confidence is deemed to allow the Netherlands relatively low interest rates, which are considered desirable in view of the financial state of the business sector alluded to above [Duisenberg (1982)].

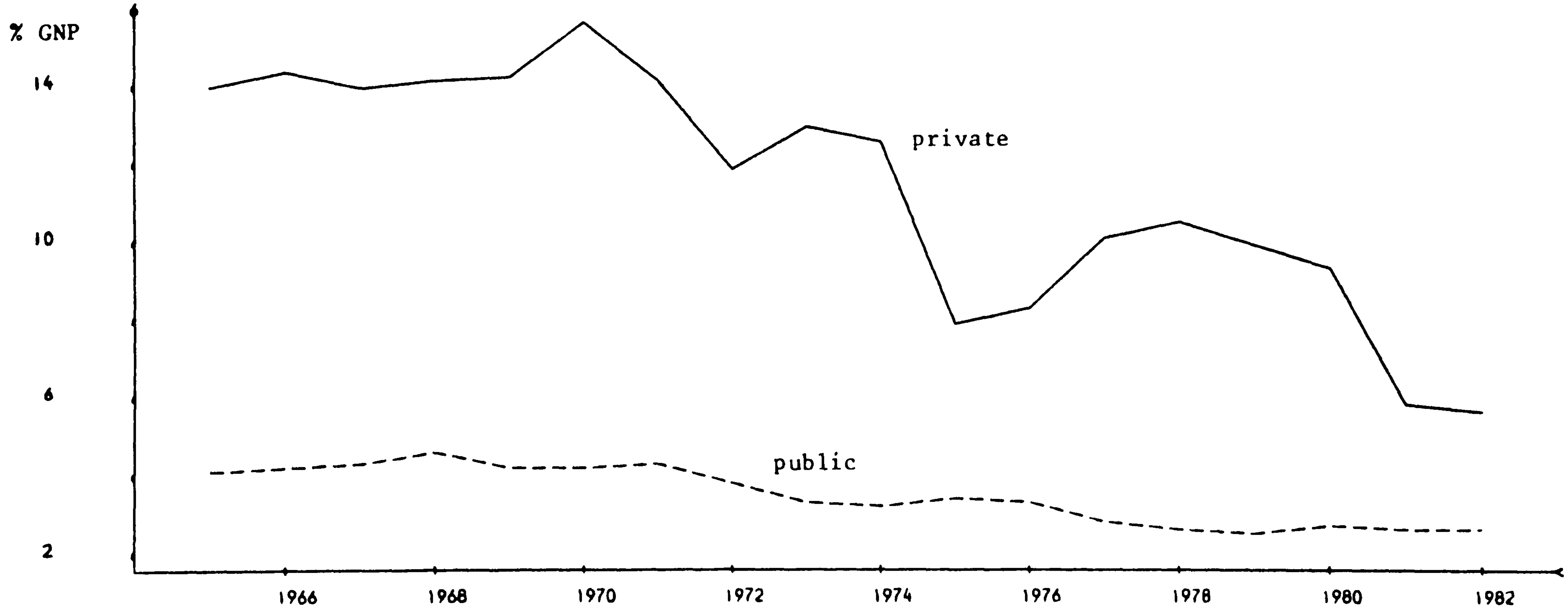
All this seems to lead to the conclusion that _reverse_ exchange rate protection may have been pursued. However, that has not generally been so. Over the 1970s, the Guilder _de_preciated somewhat relative to the Deutschmark. The _effective_ appreciation is the result of a collective appreciation of the 'snake' and later the EMS currencies relative to the Dollar and others. Periods of upward pressure were followed by periods of downward pressure on the Guilder. Thus, only short-run (stabilisation) exchange rate protection may to some extent have been provided by De Nederlandsche Bank.

As remarked above, it is difficult to attribute exchange rate and policy developments explicitly to the gas boom. In practice, a resource boom does not result in a surplus _per se_, but rather adds to surplusses and reduces deficits which follow from the general course of events. Figure 5.1 indicates that the positive contribution of gas revenues to a fluctuating current account has increased steadily over the 1970s. During the period of substantial surplusses of the mid-1970s, both the government and De Nederlandsche Bank stimulated a compensating outflow of capital (see below). This may create the misleading impression that much of the gas revenues has been invested via the balance of payments, not in foreign reserves but by capital exports. In order to see the falsity of that impression, reconsider briefly the broad lines of spending effects during the 1970s.

Most of the gas revenue accrued to the government. Within the fiscal budget, on balance this came down to growing income payments and transfers. That development was enhanced by increasing budget deficits. There is no evidence that income and transfer recipients have smoothed the gas benefits over time by investing in assets with future returns.[20] On the contrary, the ratio of saving (both private and public) to national income has declined until recently, and consumption has increased accordingly (Figure 5.3). The current account surplusses of the mid-1970s, which by definition equal the balance of national saving and national investment, were to a large degree a reflection of stagnating domestic investment (Figure 5.9). There is no sign of a significant channel of gas revenues via government income and transfer payments through increased national saving to investment in foreign assets. At best, therefore, the temporary capital outflow of 1972-1977 would _temporarily_ have replaced some domestic investment.[21]

However, the actual form of capital outflow was somewhat of a mixed blessing. A brief look at international financial flows will clarify this point [for details, see Van Nieuwkerk (1981) and Van Nieuwkerk _et al._ (1982)]. The current account surplus of 1972-1977 was largely reflected in net private capital outflows. These were the outcome of diverging developments. The net outflow was triggered off in 1972/3 by restrictions on foreign purchases of Guilder securities in the Netherlands. Subsequently, during 1974-1975 Dutch direct investment abroad increased, but only temporarily. The net outflow was sustained from 1975 until 1977 by a _permanent_ reduction of foreign direct

Figure 5.9. Net investment in the Netherlands



Source: De Nederlandsche Bank, Kwartaalconfrontatie Middelen en Bestedingen.
Note: Net investment including Dwellings and Stock.

investment in the Netherlands. Net capital outflows declined by 1977, partly because Dutch direct investment abroad had returned to previous levels. However, the main factor in the 1977 decline in capital outflow was a trend rise in purchases of Guilder securities by foreigners after the abolition of restrictions.

Of all the securities available, purchases of bonds increased, whereas those of equity decreased. A large part of the bonds were government securities, issued to finance rising budget deficits. Finally, there was a trend rise in short-run foreign liabilities of Dutch commercial banks, which had already started to increase around 1971.

In conclusion, and admittedly as a rough sketch, it seems that apart from an outflow of foreign direct investment, one underlying current of international financial flows consisted of a substitution of debt capital for risk capital by foreign investors in the Netherlands. Second, the rise in the short-run foreign liabilities of commercial banks is interesting in connection with changes in the financial structure of Dutch business in the direction of debt financing. To the extent that the banks have acted as intermediaries in this process, it does not seem surprising that the major Dutch commercial banks have recently suffered from domestic rather than South-American or East-European defaults. From a national perspective, it is fairly immaterial whether the banks or the business firms have gained from such a scheme. Finally, the shedding by foreigners of risk-bearing involvement in the Netherlands is compatible with the declining profitability described in previous sections of this chapter [and with evidence in McKinsey and Company (1978)].

Of course, a net capital outflow remains a net capital outflow, however one may care to look at it. Still, the underlying causes and patterns must affect one's judgment of how successfully gas revenues have been invested abroad. Recall that gas export revenue has been rising continuously, so that its investment abroad should not necessarily have coincided with current account surplusses originating from other sources. There is no evidence that a substantial part of gas revenues has systematically been invested, either abroad or domestically.[22]

5.7. Fiscal Policy

Major changes in general budgetary policy took place in the early 1970s. The origins of these changes go back to the late 1960s. From 1960 onwards, budgetary policy was executed along the lines of Structural Budget Policy (SBP) [Dixon (1972), Burger (1975), Diamond (1977), and Den Dunnen (1981b)]. This policy can be summarised by the objective of a long-run government deficit in line with the normal private sector savings surplus, after allowance for a desired surplus on the current account of the balance of payments for development aid. This can easily be expressed in terms of the National Accounts identities - see Burger (1975). The underlying philosophy of SBP meant that actual short-run deficits were of limited concern. Roughly speaking, public spending was kept on a trend which was compatible with the long-run or structural deficit, while taxes fluctuated with the business cycle - also along a trend compatible with the structural deficit. Therefore, _actual_ deficits absorbed cyclical movements in tax revenues.

This policy was designed to exert an automatically stabilising influence on the economy. For example, with a unit elasticity of taxes with respect to national income, and public spending on a proper trend, a larger than average growth of income is reflected in larger than average tax revenues and thus in a smaller than average deficit. With income growth below trend the converse is true, and as a result the deficit evolves in a countercyclical fashion. If the income elasticity of taxation is larger than unity, this pattern will be even more pronounced.

The practical application of SBP made the Netherlands one of the very few countries where budgetary policy has been conducted along _ex ante_ and fairly stable rules over a prolonged period of time.[23] The implementation of the policy required a detailed categorisation of budget items; conventions for the treatment of inflation, off-budget items and temporary measures outside the SBP framework; and a number of other practical directives and procedures. Many of these ingredients are explained in the references which I mentioned above. I shall not go into details here, because it is the purpose of this study to analyse the underlying patterns, not the details. Wherever the knowledge of a particular practical aspect is helpful, I shall mention the necessary background information. Apart from the basics which I described above, three additional points should still be made.

First, it was soon realised that inflation could affect nominal variables without altering the underlying magnitudes in real terms. As a result, the policy came to include allowances for inflation which may have rendered SBP essentially inflation-neutral. At least, that is what we find in Chapter 6, but further attention for relative movements of prices in tne public sector and in the private sector may sharpen this judgment.

Second, the policy was intended to keep the long-run development of the deficit in line with the country's long-run savings potential, and tnerefore, in practice under the assumption of unaltered savings behaviour, with the long-run development of national income. This implies that in the long run public spending and taxation were to be kept in line with each other, but not necessarily with national income. SBP did not contain any judgment on desired ratios of public expenditure and taxation over national income. These ratios were considered to be a matter of political choice, whereas SBP was seen as a matter of 'sound finance'.[24]

As indicated above, the progression of the tax system was one of the sources of automatic stabilisation since it involved a larger than unit elasticity of taxes with respect to national income. However, in a growing economy tax progression leads to a long-term rise of the share of taxes in national income if no counteracting measures are taken. In SBP it was left to the discretion of the politicians to decide whether any compensating action ought to be taken, *i.e.*, whether the 'progression head' of tax revenues ought to be compensated by tax rate reductions or other tax rebates in order to keep the tax burden on a constant trend relative to national income.

Within the SBP framework, the additional revenues due to tax progression could thus be designated to compensatory tax reductions or to additional public spending. In practice, political pressure usually led policymakers to follow the latter route, and this will be reflected clearly in our econometric model below. In the theoretical setup of Chapter 3, a larger than unit long-run income elasticity of spending and taxation can be incorporated by rewriting the long-run target ratios. This results in the specification used in Chapter 6, but it should be noted that the share of government in national income cannot grow forever so that there is bound to come an end to such a policy. Chapter 6 suggests a way of reconciling a larger than unit but declining elasticity with shares which are constant in the long run. Still, the policy change of the early 1970s is undoubtedly linked to the unsustainability of this aspect of SBP in the 1960s.

The countercyclical behaviour of the budget is represented by the parameters ($\psi_{12}, \psi_{22}, \psi_{32}$) in policy rule (3.8). As explained there, countercyclical behaviour would prevail if $\psi_{32}<0$, so that on impact the deficit is negatively related to deviations of real income growth from trend. This requires $\psi_{22}\tilde{\theta} > \psi_{12}\tilde{\gamma}$, or an impact reaction of taxation to income growth (ψ_{22}) which is sufficiently larger than that of expenditure (ψ_{12}). If no error correction feedback would be present; taxation would be progressive; and spending would be on a proper trend, then the parameter values could for example be: $\psi_{12}=0$, $\psi_{22}=1.1$, and $\tilde{\gamma}-\tilde{\theta}$ close to zero [see long-run budget (3.4)]. However, in practice one would expect at least some error correction both on taxation and on public spending to keep them on their desired paths. The *long-run* income elasticity of taxation could still be larger than unity, but the impact elasticity might be smaller (*cf.* the discussion in Chapter 3).

Furthermore, a value of ψ_{32} of the order of magnitude of -1 seems excessive; one might expect spending to move somewhat closer with taxation so that $0<\psi_{12}<\psi_{22}$ and $-1<\psi_{32}<0$. This would still indicate a countercyclical reaction on impact.

Of course, whether the policy rule is actually <u>effective</u> as a countercyclical device does not depend on its impact reaction only. A countercyclical impact reaction could be disturbed by error correction feedback as a reaction to undesired disequilibria incurred in the past, which emphasises the importance of well-tuned dosage and timing in public financial policy. We shall return to this issue in the following two chapters.

The third and last ingredient of Structural Budget Policy which requires some attention is its monetary aspect. Strictly speaking, this did not exist. Or, as Dr. Holtrop, who was President of De Nederlandsche Bank from 1946 to 1967, once put it: 'A budget deficit, by itself, has no monetary meaning. The important point is out of which resources it is financed' [Holtrop (1963)]. In the 1960s, Central Government was in principle supposed to fund its deficits on the long-term capital market. However, as we shall see in Section 6.6, this was done through a gradual recourse to the capital market, where the government steadily borrowed the amount it would need to finance the underlying long-run deficit. Budgetary policy thus contributed to monetary management through a relative emphasis on money financing during the economic downswing, when deficits are relatively large, and the opposite during the upswing. Nevertheless, the considerations guiding the deficit <u>financing</u> choice were strictly separate from those determining the <u>size</u> of the deficit, as we shall formalise and test in Chapter 6.

A rigorous separation between these policies seems feasible in practice only if the deficit is under control along a steady long-run pattern. In the 1970s, the government's adherence to the principles of SBP broke down and the Central Bank began to emphasise the potential threat of excessive monetary financing if excessive deficits would grow beyond the government's control [cf. a joint paper by one of the Directors of De Nederlandsche Bank, Wellink and Halberstadt (1985), and the Bank's Annual Reports]. The model of Chapter 6 will suggest an approach to measure this aspect of budgetary behaviour. The equation for debt management which we estimate for the 1960s breaks down in the 1970s as deficits and the pressure to monetise them increase.

Officially, SBP was abandoned in the Budget for 1979. In practical terms, this had already happened before the mid-1970s. The prime reason was the fact that government spending had to a considerable degree become endogenous to the economic process, in a way which proved unsustainable and uncontrolled. The origins of the loss of control lie in the late 1960s. Government started to endogenise spending by initiating an ambitious welfare program, indexation, and legal measures such as minimum wages [CED (1982), Halberstadt et al. (1982a,b), Van der Wielen (1983)]. This was done in a period of economic optimism, generated by prosperous growth and expectations of future gas revenues. The research reported in Chapter 6 indicates that the shocks to the economy around the 1973/4 oil crisis first brought the effective abandonment of Structural Budget Policy out in the open [for an early result, Kremers (1983)]. Up to then, it still looked as if government could set expenditure at its discretion. The fact that discretion was increasingly slipping was initially veiled by rapid economic growth and the gas revenues.

The mechanisms installed in the late 1960s implied important restrictions on the degrees of freedom of future policymakers. Because of their substance and open-endedness, the discounted value of those policies later proved a liability which exceeded the discounted value of normal revenues [Le Blanc Committee (1983)].

Before proceeding to an econometric analysis of this subject, I briefly return to the appropriateness of fiscal policy reactions to the 'Dutch Disease' difficulties of the 1970s. For a correct assessment of Dutch Disease type of developments in the Netherlands, the endogeneity of budgetary policy must not be lost sight of. It has been argued that government embarked on a misguided expansionary fiscal policy in the mid-1970s [e.g., Van Wijnbergen (1984c)]. Although policy indeed became increasingly expansionary, it was to some extent simply the continuation of a pattern rooted in the 1960s.[24] A variety of constructions served to give what were later realised to be autonomous developments an appearance of discretion. In the Budget, expected future effects of current economic policies were already recorded as revenues even before any indication as to their likelihood of success was available ('inverdieneffecten'). A calculated normal degree of future under-exhaustion of budgeted expenditure was entered as additional revenue ('onderuitputting'). Substantial heads of expenditure were debudgeted. Rates of economic growth were 'consistently' overpredicted, and gas revenues were more and more treated as current receipts rather than temporary windfalls. All this illustrates a failure to cope with increasing pressure on the Budget.

The expansionary policy stance was rationalised on the view that the Netherlands suffered Keynesian Unemployment, due to deficiencies on the demand side. Before examining the appropriateness of the policy itself, first recall how it was executed (Section 5.4 and Table 5.1). While relying heavily on boosting consumption demand, special support for industry was provided but at the cost of public saving and investment.

Van Wijnbergen (1984b,c,d) analyses the consequences of a resource boom in a model with real wage rigidity.[25] He finds a considerable risk that under circumstances such as the Dutch an economy will move into a situation of Classical Unemployment, which is not due to demand deficiencies but rather to a lack of profitability in the business sector. In reality of course unemployment is unlikely to occur in such pure forms. The Netherlands definitely suffered a lack of effective demand due to the world recession of 1974/5. Still, that recession was immediately followed by an international upswing in which the Netherlands did not fully take part. Furthermore, even without the expansionary policy, consumption would have remained fairly strong. Domestic demand slackened because of collapsing investment, which was by itself a result of the lack of immediate profitability and the lack of profitable demand prospects. Under these circumstances, expansionary fiscal policy boosting demand tends to put additional upward pressure on the real exchange rate, if non-tradeables constitute a relatively large share of the demand boost. The formal analysis of Van Wijnbergen shows that such demand policy will not facilitate the necessary adjustments of the economy, but only exacerbate the difficulties.

The temporary nature of the gas boom, the size of the Dutch economy, and its dependence on international trade provide reasons for temporary government support to industry. The Dutch Disease literature stresses the optimality of a reallocation of resources from tradeables to nontradeables, but this is of course very much a matter of degree. Especially when the boom is temporary one should be careful with such a reallocation, even if gas revenues are being invested abroad with high returns (wnich was not really the case in the Netherlands). For a small country, it is quite a risk to step out of rapidly developing industries if it might have to step back in later [this is the Learning-by-Doing argument of Van Wijnbergen (1984a)]. It depends on the exact policy objectives and on practical opportunities what type of support for industry is preferable. In the Netherlands, industrial policy has had some success. Though criticised for a lack of strategic coherence and a generally defensive attitude [WRR (1980). Wagner-Committee (1981), Koekkoek *et al.* (1981)], it has helped some sectors with a future through the difficult 1970s (Steel, Agriculture, Chemicals, Car Manufacturing). However, it has been argued to have been too late, too little, and to have been carried out at the cost of public investment.

If government is particularly concerned about employment, labour cost subsidies are an effective tool. Against this background, Dutch fiscal policy was ineffective in a double sense. Expansionary policy could have been expected to exacerbate the difficulties. In addition, it was accompanied not by labour cost <u>subsidies</u> mimicking the required wage adjustments, but if anything by <u>taxation</u> of work. Social Security contributions rose rapidly, income differences and margins between remuneration for activity and nonactivity declined. An abundance of regulations and the institution of a minimum wage operated in the same direction. Thus both the incentive to hire labour and the incentive to work were undermined [Corden (1984, fn. 14)]. As a result, both the number of economically active and the number of economically inactive income recipients in the public sector rose dramatically (Table 5.5). Only <u>after</u> restoration of the supply side could expansionary policies have been foreseen to produce lasting positive results.

Taken together with the unfit financial state of the private sector, it has become clear that the fiscal policies initiated in the late 1960s became unsustainable. Present policy seems to be focussing on restoring balance to the public finances, and on the supply side of the economy. This is not the place for an evaluation of present policies, but a general acceptance of the unsustainability of past patterns seems an essential step towards restoring equilibrium. The role of natural gas in the process has been highlighted in this chapter. However, the developments which we have described illustrate the importance of attention to regular patterns in economic policy. An evaluation of the Dutch experience can benefit from an understanding of the motivations and limitations of budgetary policy, so that policy initiatives are not seen in isolation but rather in a dynamic perspective.

Table 5.5. The Shift from the Private to the Public Sector

	1963	1973	1983
	(thousands)		
Income recipients in the public sector	1995	2890	4205
- economically active	605	820	1070
- economically inactive	1390	2070	3135
Income recipients in the private sector	3560	3575	3240

Source: De Nederlandsche Bank, Annual Report 1983
[The public sector comprises Government, Social Security, and Semi-Public Sector. Benefit recipients are those registered under AOW (old age), WAO (incapable to work), WW (unemployed), VUT (early retirement), etc.]

Footnotes Chapter 5

1. Detailed introductions can be found in Den Dunnen (1981a), The Economist (1982) and Posthumus (1983).

2. On the contrary. As a result of the rapid conversion of energy consumption to gas, the government decided to close the country's coal mines. This cost about 50,000 jobs. Within a brief period, this would have added more than 20% unemployment in the mining region Limburg. The government used gas revenues to set up alternative employment. The main projects were DSM, now one of Europe's largest chemical companies, and Volvo Car. The blow of the mine closures could thus be accomodated, although the welfare system has had to carry a substantial part of the cost [for an interesting account of this regional policy in english, see European Commission (1978)]. Even though this employment effect is nothing like a "negative resource allocation" effect, the assumption that the gas sector did not put pressure on the labour market seems warranted. The coal mine closures can be categorised as a direct substitution effect between gas and coal in household and business energy consumption.

3. Models such as that of Neary and Purvis (1983), in which the real exchange rate overshoots due to real inertia of factor movements, do not seem applicable here.

4. I.e., the world market price of oil of the same calorific content as some quantity of gas, plus a premium for some advantages of natural gas over oil.

5. Market penetration for industry as a whole (defined as the ratio of imports over domestic absorption) has increased from 42% to 50% in 1970-1982. Penetration in 1978 was more than 25% for each subsector of industry, except Animal Products (18.3%) [Kol and Mennes (1980)].

6. The volume of gas exports is included. Without gas, the basic patterns are very similar, except that after 1980 somewhat higher gains are made [De Nederlandsche Bank, Annual Report 1982, p. 57]. Of course market shares in value terms also have their significance, especially as far as profitability is concerned. This issue will be followed up shortly.

7. The current account effects of the gas which are shown in Figure 5.1 do not contain direct energy import-substitution effects. Weitenberg (1975) and Brouwer (1979) show that import-substitution effects far exceeded gas export revenues in the 1970s.

8. In addition, effective exchange rates can differ per sector. Anema and Jepma (1978) calculate that the effective rate using the relevant sector weights for Fuels and Lubricants increased by 2% between 1971 and 1976, whereas the increment for Beverages and Tobacco amounted to 23%. The other sectors cover the range in between. For analysing sector performance, the aggregate numbers appear of limited value.

9. The test statistics quoted in the three mentioned papers do not give much insight into the econometric rigour of the empirical results. It seems likely that in this type of macroeconometrics simultaneity, exogeneity and dynamics are major issues. I shall only quote results which the three studies have in common, and which in broad lines seem supported by evidence from other sources.

10. If one excludes gas, the improvement in price competitiveness after 1978 is less marked (Figure 5.5), and some share of the world market is gained back

(Figure 5.4, and footnote 6).

11. Notice in Table 5.3 how remarkably well Dutch Chemicals have fared in the 1970s. Adverse developments occurred mainly in Steel, Transport Equipment, and Oil Refining. All these sectors, including Chemicals, suffered overcapacity.

12. The argument that follows goes through for import competition as well.

13. The two important variables are therefore total value added and its distribution. As argued below, expectations of future growth in value added kept business investment going in the 1960s, whereas they had a negative impact after the early 1970s. Apart from distributive aspects, the gas also affected value added directly via asymmetric effects of exchange rate appreciation on export and import prices. The latter tended to decrease more slowly than export prices increased in the first half of the 1970s, making imports of raw materials relatively expensive and thus reducing value added [De Ridder (1978). Kessler (1980)]. This was reversed in the second half [De Nederlandsche Bank, Quarterly Statistics, December 1981, p. 7].

14. The U.K., in a similar energy position as the Netherlands, seems to have experienced similar jumps of the labour share in manufacturing value added after the two oil crises [Buiter and Miller (1984)]. Because of differences in measurement and institutions, international comparisons should be made with care. The level of the labour share in Dutch manufacturing exceeded that of any major OECD country in the 1960s, and its subsequent rate of growth exceeded those in the countries with the highest initial levels [Sachs (1983), Duisenberg (1984)]. Van Laer (1981) argues that the non-labour share in Dutch manufacturing has been less than half that in the U.K. in 1976-1980 (both excluding the energy sectors).

15. As explained above, gas was sold cheaply as an input to industry. This did not only change the sectoral structure, but also the production process in general. In a three-factor model, Magnus (1979) shows that energy was a substitute for unskilled labour and complementary to capital as an input to Dutch enterprises 1950-1976 (excluding the energy sector itself). If this was also true just for manufacturing (which seems most likely), it helps explain high labour productivity growth in an environment of high labour and low energy costs. In view of the figures in Table 5.4, it seems that government has indirectly been stimulating labour out of manufacturing into services. Indeed, Van Gemert et al. (1983) argue that whereas the reaction on the availability of domestic energy away from manufacturing into services is by itself a normal phenomenon, the intensity of that reaction has been particularly strong in the Netherlands. The OECD is the reference group.

16. Instead of increasing capacity, firms improved utilisation rates.

17. A survey of the exchange rate debate has been provided by Szasz (1981). The original of Kessler (1980) offers a defense of the Central Bank's policy in english by one of its Directors (paper presented at the Conference on Employment Policy and Employment Theory, Groningen 1980). See also Den Dunnen (1979, 1981a,b) and the Bank's Annual Reports.

18. Moreover, Corden (1981a) shows that there are superior ways of protecting a lagging tradeables sector. Essentially, this follows from the fact that exchange rate protection does not only benefit the lagging tradeables sector, but also boosts the booming sector.

19. Central Bank President Dr. Zijlstra warned that depreciation would be a mixed blessing, comparing the freedom gained by depreciation with the freedom

of a helter-skelter with uniform acceleration [*cf.* the experience of Indonesia: Van Wijnbergen (1984b), and model results for the Netherlands: Knoester (1980, pp. 162-7)].

20. An exception is the temporary boom on the housing market.

21. An exception is the period 1973-1974, when there was a temporary increase in the private savings ratio. This did lead to increased direct investment abroad, but the amounts involved - though substantial in absolute terms - are minor compared to total gas revenues. In 1974-1975, the Dutch direct investment capital outflow was sustained by the collapse of domestic investment.

22. The fact that in 1978/9 the Netherlands was the largest foreign investor in the U.S. [*The Economist* (1982), Atkinson and Hall (1983)], was more the result of a geographical reallocation of Dutch foreign investment from the E.C. to the U.S. and of a general withdrawal of foreign direct investment from the Netherlands than anything else [Van Nieuwkerk *et al.* (1982)].

23. The German Konjunkturneutrale Offentliche Haushalt and the American High Employment Budget are comparable, but tend to be used more as indicators than as *ex ante* rules [for a comparative analysis, see Sterks (1984)]. The Medium Term Financial Strategy of the U.K. has not been used over a prolonged period of time.

24. One of the motivations behind SBP was to strengthen the position of the Minister of Finance within the Cabinet. Dr. Zijlstra, the Minister and later Prime Minister who introduced SBP in 1960, expressed another rationale for a not too complicated but open-loop policy rule as follows: 'One cannot expect our Members of Parliament to have studied and mastered the textbooks on business cycle policy... In other words: modern anticyclical policy also has an educational aspect... For that purpose, simple rules are required' [Zijlstra (1962)].

25. The Dutch Disease literature has formulated the relevant phenomena in an elucidating framework, but not all the ideas themselves are novel. Though in a different terminology, Prof. Stevers has been analysing Dutch difficulties exactly along these lines since 1970 in his annual comments on the Budget [Stevers (1979)]. It seems hard to argue that policies failed because they were misguided by a lack of analytical insight at the time.

CHAPTER 6. AN ECONOMETRIC ANALYSIS OF PUBLIC FINANCIAL BEHAVIOUR IN THE NETHERLANDS

6.1. Introduction

In Chapter 4 we used U.S. data to illustrate the relevance of one aspect of our general model for public financial behaviour: the fact that there may be "tension" in the budget due to the combination of debt-related long-run budget targets and the stock-flow dynamics of debt and deficits. We utilised simple Co-Integration tests in order to identify this long-run phenomenon. We also illustrated its short-run consequences by including the relevant Error Correction term in the short-run model of Barro (1984a). Still, the short-run dynamics of the Barro model do not correspond to those proposed in Chapter 3. The present chapter estimates the short-run model of Chapter 3 with quarterly data on the Dutch public finances of the last few decades.

The presentation of a short-run econometric model with an appropriately rigorous approach to testing and interpretation requires the consideration of a substantial amount of detail. It may therefore be worthwhile to reiterate the major questions at the outset.

Since we adopt a flexible transition from theory to econometric estimation [cf. Hendry (1983, 1985)], the model of Chapter 3 serves as a background to suggest particular types of explanatory variables, rather than as a straightjacket to which we must rigorously confine ourselves. The main ingredients of our model are the explicit attention to both tax and expenditure smoothing (the Error Correction terms on those variables); the impact reaction to the business cycle (the real rate of growth of national income); their relative contributions to actual budget patterns; their implications for the pattern of the public debt; and any possible "tension" emanating from a debt-related long-run target. In addition, we pay attention to inflation, from which we abstracted in Chapter 3, and to the way in which deficits are financed. These two issues may obviously be related.

Our integral approach to the government budget requires attention to the econometrics of the system as a whole. In principle, anything that "happens" in a particular equation should be reflected in at least one other equation. Of course, if there are n budgetary instruments, the budget identity reduces the number of independent instruments to n-1. We can therefore drop any one of the three equations when estimating policy rule (3.8). However, in a process of single-equation specification search it is not *a priori* clear which of the equations to drop, as the analysis of this chapter will illustrate. Furthermore, with our volatile quarterly data, the high level of aggregation of the budget variables which may have its imperfections, and our log-linear approximation to the budget, we require a flexible attitude towards specification and estimation. This will be reflected in the approach of this chapter.

Before proceeding to the empirical analysis, Section 6.2 presents a rough sketch of the data and their salient features. It also introduces some new notation which is necessary to deal with the quarterly data. Section 6.3 contains estimation results for public spending, while Section 6.4 concentrates on taxation. The deficit is the subject of Section 6.5, and the way it is financed that of Section 6.6. Section 6.7 further evaluates our econometric findings against the historical background.

6.2. The Quarterly Budget and the Dutch Data

A precise documentation of the data and their sources can be found in Appendix B. Here we provide a brief sketch of the variables which are used, and highlight some of their noticeable features. Before doing so, however, some remarks on the time period we chose to analyse are in place.

Preliminary estimations along the Co-Integration lines of Chapter 4 did not reveal any long-run strands in Dutch public financial behaviour such as that isolated for the U.S. The data used for those preliminary explorations are annual and run from 1920 through 1982. The Co-Integration tests which I computed were tests for stable ratios of spending, taxation, public debt, interest payments and inflation-corrected interest payments, all over national income. I have not tested more complicated long-run targets as functions of other relevant variables. The reason for that is twofold. First, the small-sample properties of Co-Integration tests which involve the estimation of a multidimensional Co-Integrating vector are not yet fully documented [Granger and Engle (1985), Banerjee _et al._ (1985)]. It seems too early to base sustainable inference on these tests, except if the Co-Integrating "vector" is just a constant as in Chapter 4 or if the sample is very long.

The second reason for limiting the efforts using Co-Integration tests reinforces the first and refers to the heterogeneity of the Dutch data. One experience that distinguishes the Dutch economy from the American is the German occupation during the Second World War. After the War it took the Dutch economy and public finances longer than their American counterparts to revert to a "normal" state of affairs. This reduces the available sample. In addition, there were major changes in public financing during the 1970s, as we have seen in the previous chapter and as we shall further explore below. To the extent that these changes have affected the long-run relations within the budget and between the budget and the economy, it would be inappropriate to run the usual Co-Integration tests over the entire period.

The Co-Integration tests for constant long-run ratios, which I did not allow to be functions of any other variables and which I calculated after deletion of War years 1940-1947, are not reported here because they lead to the following unsurprising conclusions. None of the ratios mentioned above seem to have been stable throughout the entire period. Furthermore, none have been stable during 1951-1982. The only sign of stability which I recorded was that of the Dutch equivalent of the U.S. result in Chapter 4: the ratio of inflation-corrected interest payments over national income. However, this concerns long-run tests over a period as short as 1961-1979. It would seem hazardous to base inference on this outcome. Recall that the shortest period considered in Chapter 4 was 1952-1983, and that the result of that test could be confirmed with an equivalent test for 1936-1983.

On the basis of these insights I decided to confine the analysis to the postwar period, and to exclude the War's immediate aftermath. A natural breakpoint in the Dutch public finances occured in 1959, as Dr. Zijlstra became Minister of Finance. Shortly after his appointment he introduced Structural Budget Policy, which I have described in the previous chapter. Quarterly data on most of the relevant variables are available from 1957:1 through 1982:4. This chapter thus presents a model of the Dutch public finances which covers the period 1960:1-1982:4.

Reconsider budget constraint (3.1), which, cast in quarterly terms, reads as:

$$G_{it} + I_{it} = T_{it} + (B_{it}-B_{i-1t}) + Q_{it} \tag{6.1}$$

The conventions on notation will be as follows. The first subscript denotes the quarter (i=1,...,4), and the second denotes the year (t=1960,...,1982). A lag in the second subscript simply refers to the previous year, but a lag in the <u>first</u> subscript refers to the previous <u>observation</u>. This will normally be the previous quarter in the same year, but if we lag a first quarter we end up in the previous year. Furthermore, a variable with just <u>one</u> subscript refers to an <u>annual total</u>. For example, $G_t=G_{1t}+G_{2t}+G_{3t}+G_{4t}$. I use this notation because we shall combine quarterly and annual data in single equations. The public financial year in the Netherlands coincides with the calendar year, so that G_t refers to total public spending in fiscal and calendar year t. Finally, Δ_j still denotes the difference operator: $\Delta_j G_{it}=G_{it}-G_{i-jt}$ (i=1,...,4), and $\Delta_j G_t=G_t-G_{t-j}$. Notice that $\Delta_4 G_{it}=G_{it}-G_{i-4t}=G_{it}-G_{it-1}$.

Lowercase letters still denote natural logs. This means that we can approximate fourth (<u>i.e.</u> annual) differences of (6.1) as:

$$[\Delta_4 b_{it} - (B_{i-1t-1}/B_{it-1})\Delta_4 b_{i-1t}] =$$

$$(G_{it-1}/B_{it-1})\Delta_4 g_{it} - (T_{it-1}/B_{it-1})\Delta_4 \tau_{it}$$

$$- [(Q_{it-1}/B_{it-1})\Delta_4 q_{it} - (I_{it-1}/B_{it-1})\Delta_4 i_{it}] \tag{6.2}$$

Not surprisingly, the annual aggregate of (6.2) yields the annual budget constraint (3.6) since:

$$\Delta g_t = \Sigma^4{}_{i=1}(G_{it-1}/G_{t-1})\Delta_4 g_{it}$$

$$\Delta \tau_t = \Sigma^4{}_{i=1}(T_{it-1}/T_{t-1})\Delta_4 \tau_{it}$$

$$[\Delta b_t - (B_{t-2}/B_{t-1})\Delta b_{t-1}] = \Sigma^4{}_{i=1}(B_{it-1}/B_{t-1})[\Delta_4 b_{it} - (B_{i-1t-1}/B_{it-1})\Delta_4 b_{i-1t}] \tag{6.3}$$

and for Q_t and I_t equivalently. Notice that $B_t = B_{4t}$, since B is an end-of-period stock. Budget constraint (6.2) will be a central equation in this chapter.

Two important requirements have guided the selection of budget data for this analysis. First, they should correspond as closely as possible to the aggregate concepts of budget restriction (6.2). Second, the definition of the deficit should be such that we can disaggregate total deficit financing into capital market financing and money financing. Furthermore, it would be desirable to have measured series for the cumulative stocks of these two sources of finance, so that we do not have to derive those cumulative series and have measurement errors in the deficit feeding their way through the entire period. The quarterly data published by De Nederlandsche Bank roughly satisfy these requirements (Appendix B). They are on a cash basis so as to provide the desired integration with the Bank's financial data and monetary analysis.

The data cover Central Government only. This choice does not reflect an assumed macroeconomic irrelevance of Local Government, but it seems that Central Government is the single unit of authority which is most appropriately described by the model of Chapter 3. In the Netherlands Central Government makes contributions to the Social Security Funds, so that these Funds are reflected in our data insofar as they affect the Central Government's finances. The Social Security Funds were not consolidated with Central Government in Structural Budget Policy of the 1960s [Pallada (1984)]. Finally, the substantial part of Social Security which is not funded is included in our data on public expenditure (*cf.* Chapter 5).

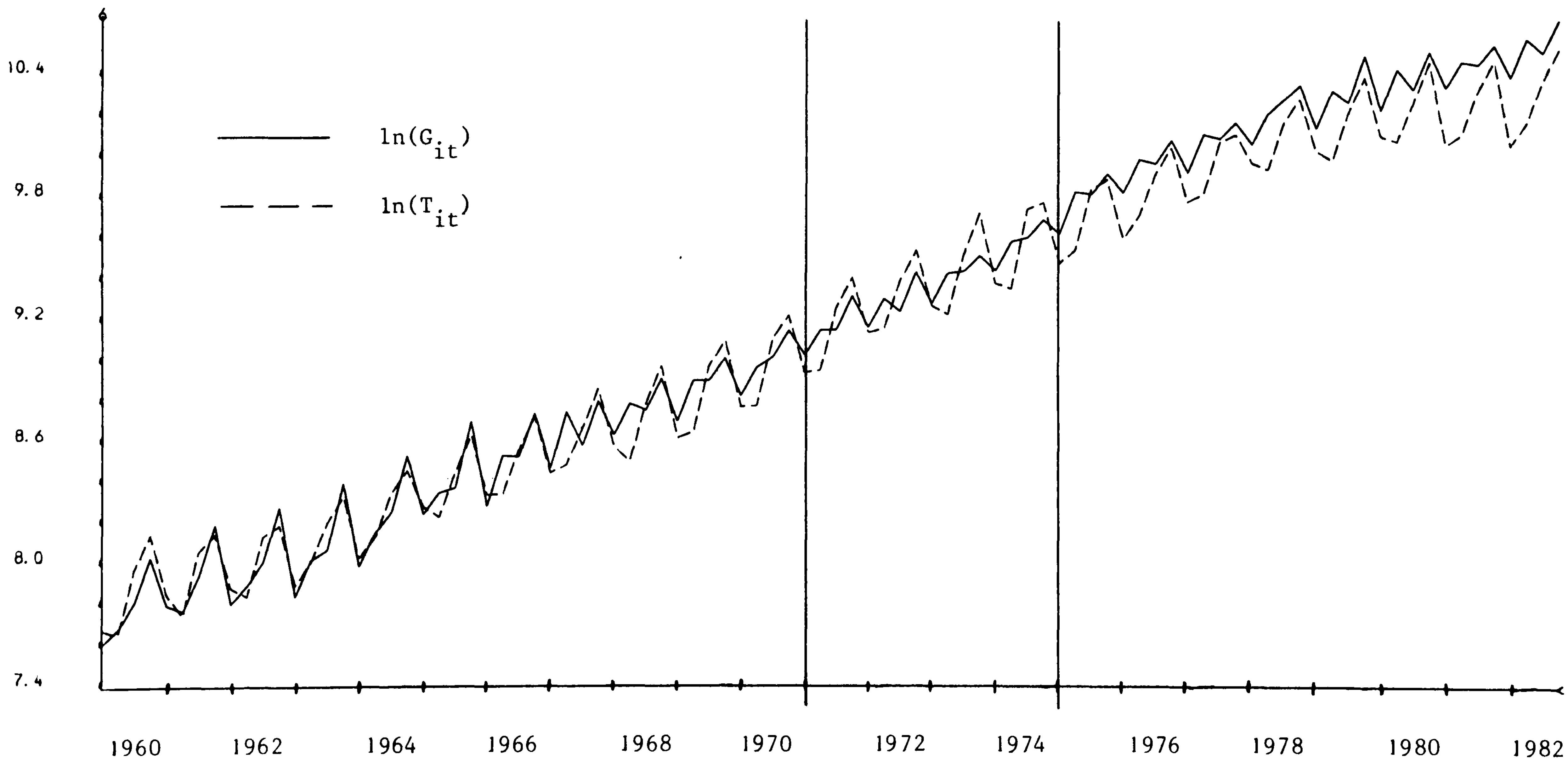
The highest level of aggregation of spending and taxation is selected, again on grounds of what seems likely to be the level at which a feedback rule involving the entire budget would be monitored and executed. I distinguish only the variables of budget constraint (6.2), where Q_t covers the Central Government's revenue from natural gas sales.

One source of support for this classification is an article by Selody and Lynch (1983), who model fiscal policy in Canada along the lines of Sims (1980). They find that too little aggregation tends to underestimate the degree of macroeconomic endogeneity of fiscal policy, because many interdependencies between budget variables are overlooked. This backs the idea that a fiscal policymaker who endeavours to control the budget as a whole operates on aggregates. Of course, less aggregated variables such as unemployment benefits, business subsidies, and income and value added tax revenues are not unrelated to what happens in the economy. In the approach presented here the conduct of variables at a lower level of aggregation is seen as the execution of policies which are formulated at the highest level. Still, there is considerable insight to be gained from a careful analysis of the way in which the behaviour of constituent variables supports or obstructs the aggregate policy. Much of the breakdown of Structural Budget Policy in the Netherlands must be ascribed to a lack of attention to this operational aspect. In Chapter 7 I shall suggest how the present framework may be employed to gain insight in this matter.

A broad look at the Dutch public finances was presented in the previous chapter. Although the data presented in that chapter are not exactly the same as those used in the econometric analysis, the main developments are similar and a general outlook has therefore already been given. More precise accounts will be provided in the figures and comments accompanying regression results in the following sections of this chapter. Meanwhile, Figures 6.1 through 6.6 give an impression of the salient features of the data. Figures 6.1 and 6.2 show the developments of quarterly and annual public spending and taxation, while Figures 6.3 and 6.4 provide insight into the patterns of gas revenues and interest payments. The significance of the vertical lines drawn after 1970:4 and 1974:4 will soon become clear when we present our econometric results. Further comment on these graphs will be made in the course of the argument that follows.

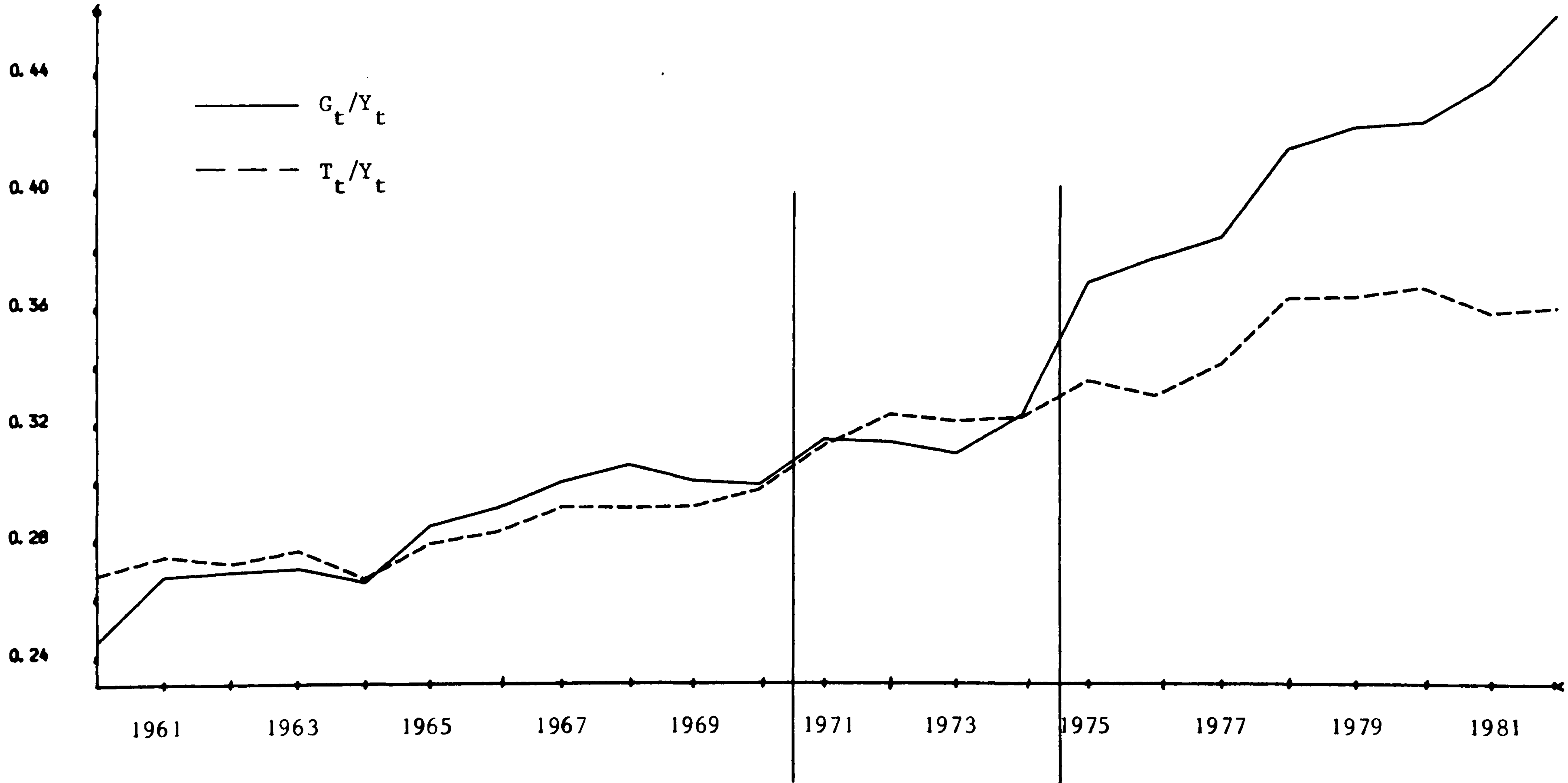
The only part of the budget which has not yet received much numerical attention in Chapter 5 is the distinction between debt and money financing. As already remarked in our theoretical Chapter 3, this distinction can easily be incorporated by writing total debt creation as:

Figure 6.1. Public spending and taxation



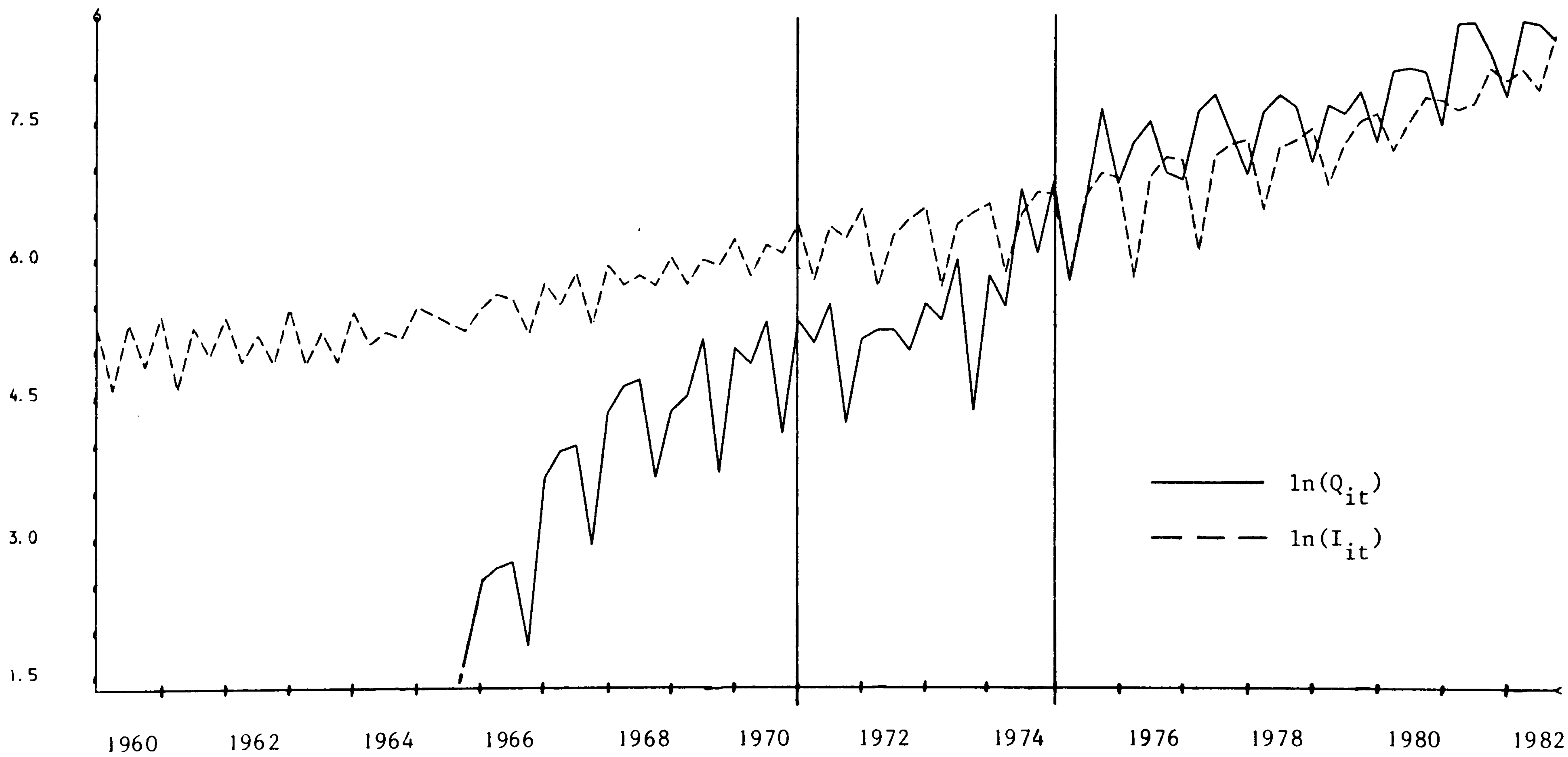
Source: Appendix B

Figure 6.2. Spending, taxation and the deficit (annual)



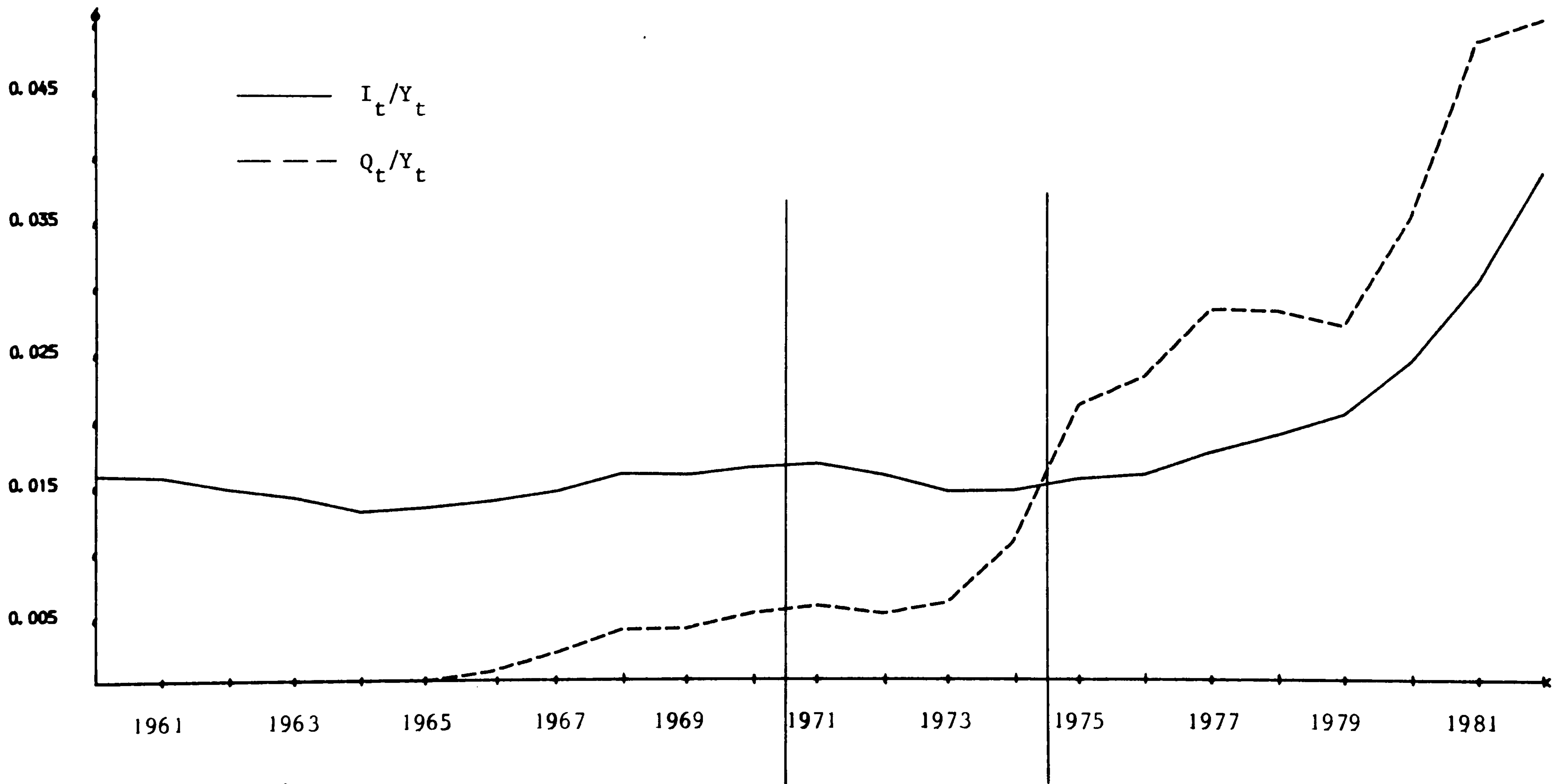
Source: Appendix B

Figure 6.3. Gas revenues and interest payments



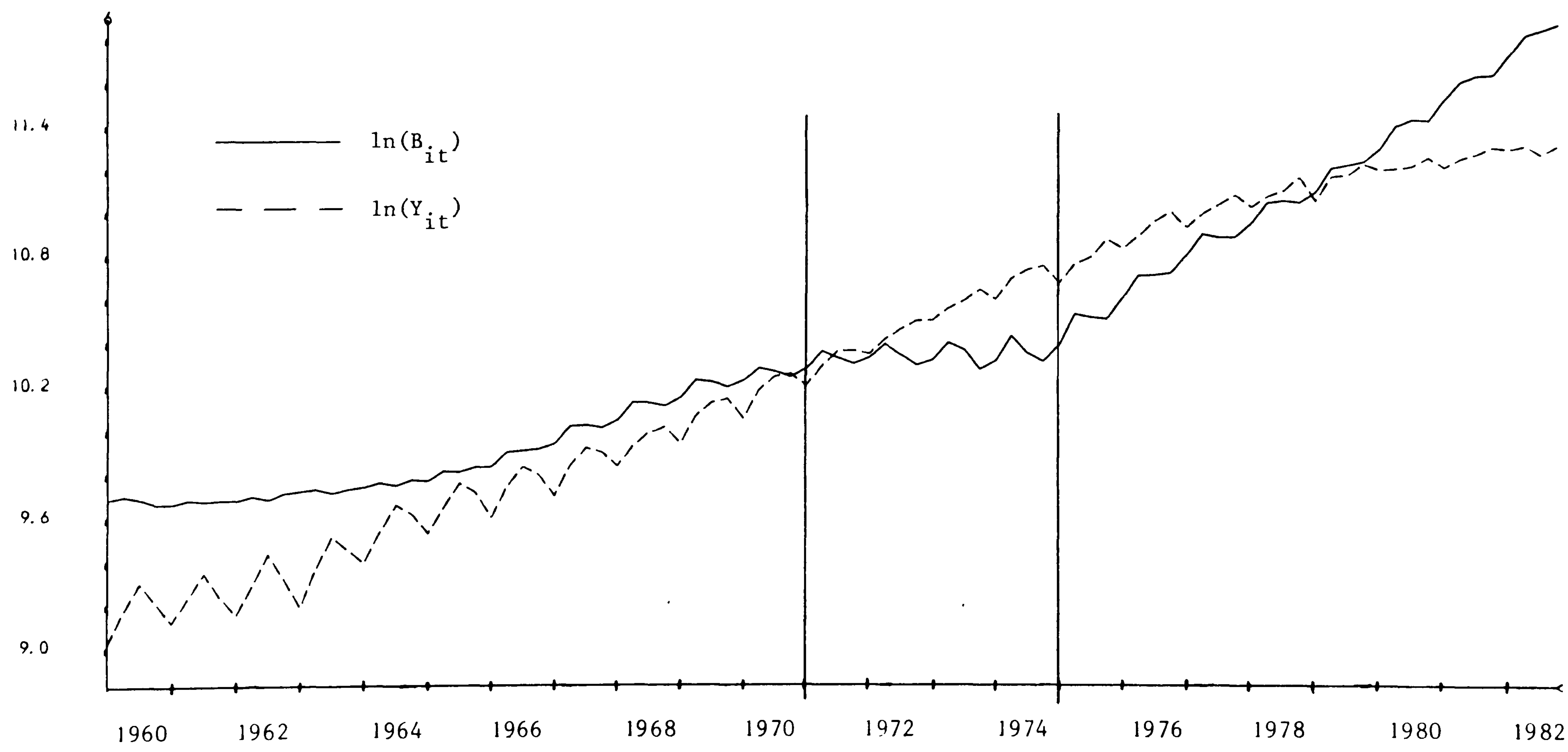
Source: Appendix B

Figure 6.4. Interest payments and gas revenues (annual)



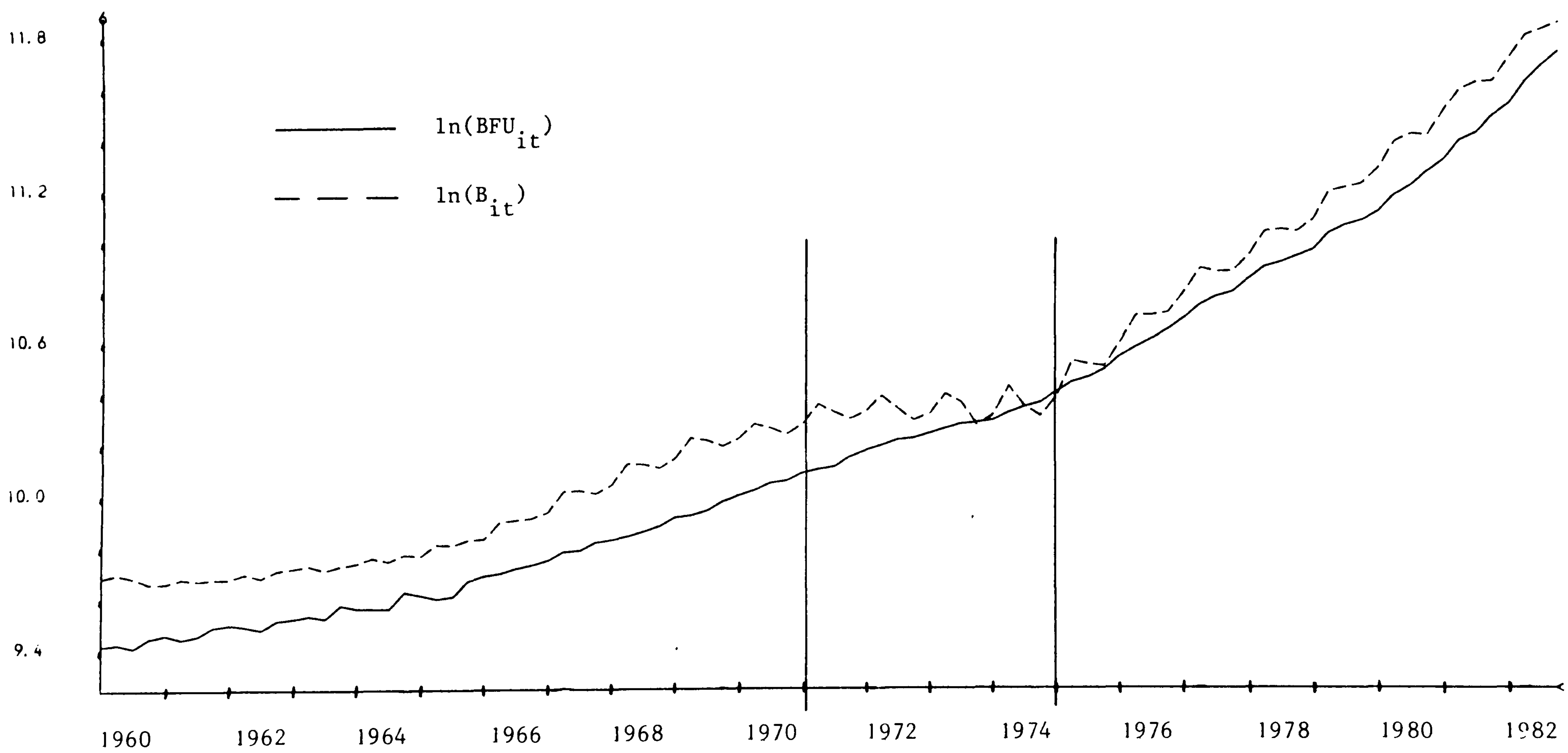
Source: Appendix B

Figure 6.5. National income and the total public debt



Source: Appendix B

Figure 6.6. Funded and total public debt



Source: Appendix B

$$[\Delta_4 b_{it} - (B_{i-1t-1}/B_{it-1})\Delta_4 b_{i-1t}] =$$

$$(BFU_{it-1}/B_{it-1})[\Delta_4 bfu_{it} - (BFU_{i-1t-1}/BFU_{it-1})\Delta_4 bfu_{i-1t}]$$

$$+ (BFL_{it-1}/B_{it-1})[\Delta_4 bfl_{it} - (BFL_{i-1t-1}/BFL_{it-1})\Delta_4 bfl_{i-1t}] \qquad (6.4)$$

where BFU_t stands for funded or long-run public debt and BFL_t represents floating or short-run public debt. In order to obtain a precise correspondence between government money financing and the concept of money which is the focus of monetary policy, I have drawn the line between BFU_t and BFL_t exactly such that BFL_t is entirely part of Dutch M2, while BFU_t is entirely outside that Dutch concept of money or liquidity M2. I leave further discussion to Section 6.6, where I focus on the financing side of the budget deficit. In the meantime, Figure 6.5 shows the development of national income and the total stock of public debt. Figure 6.6 gives an impression of the separate paths of the stocks of funded and of total debt. For now, nevertheless, our first task will be to assess the empirical significance of our theoretical models for public spending (Section 6.3) and taxation (Section 6.4).

6.3 The Model for Public Spending

The theoretical model of Chapter 3 can serve as a useful guide for the empirical analysis, but that does not mean that the transition from theory to the data is straightforward. A brief description of two difficulties in this transition may justify the subsequent pragmatic approach to specification search.

From a practical point of view, the method of general-to-specific modelling [Hendry (1985) and other articles by the same author] would seem to be the natural strategy to set about estimating the Dutch model. However, if one has strong a priori suspicions that there may be a significant change of regime somewhere in the middle of the period under consideration, then this method applied to the period as a whole is likely to produce a model which subsequently fails our diagnostic tests. Moreover, it might trigger off an analysis conditional on an erroneous initial impression. Against this background, the most sensible modelling strategy would seem to be to approach both subperiods separately, and, during the process, to keep a close eye on differences and similarities of the two subperiods. The latter aspect is important because, as the mirror image of our arguments against focussing on the period as a whole, too strong a concentration on the separate subperiods may also lead to incomplete inference. Aspects of public financial behaviour which persist throughout the entire period are more efficiently estimated using information covering the entire period than using information on a subperiod only. There seems to be a risk that the exclusive concentration on each period separately could "allow both models to drift apart", essentially because of the efficiency loss due to our failure to impose valid cross-period constraints. Of course this risk would be small if both subsamples were long. However, under present circumstances they are short and uncertainty around the exact point of regime switching makes them even shorter.

How does one combine a process of specification search with an effort to determine the timing of a change of regime? On the basis of the historical evidence presented in Chapter 5, we suppose that profound changes in the Dutch economy and public finances took place sometime after, say, 1970, but it remains unclear how and exactly when which particular aspects of public financial behaviour were affected. Against this background of "informed ignorance" I opted for the following strategy. On the basis of historical insight, and in an effort to balance a safe margin away from regime changes against the requirement of sufficient degrees of freedom for sustainable econometric inference, I set out to estimate the model for the period 1960:1-1970:4. Similarly, I paid separate attention to the period 1975:1-1982:4. Although the 1970s were a volatile decade, the choice of 1975 again seeks to strike the balance mentioned above. In 1975 new budgetary policies were initiated as a reaction to the first oil crisis, and some earlier evidence [Kremers (1983)] indicates that the period 1975-1982 may have been more homogeneous than generally perceived. The margin left for changes of regime was therefore 1971-75, and as we shall see below this appeared to be a reasonable preliminary assessment.

Before proceeding to the second difficulty with the transition from theory to the data, it may be noted that the margin we initially leave between the two regimes also serves to allow for a fairly gradual change of regimes. We shall later pin the dates of changes down rather more precisely, but further econometric refinement of the way I deal with regime changes may be worthwhile [e.g. Judge et al. (1980, p. 388)].

The second problem in the transition from the theory to our data stems from the difference between annual and quarterly budget plans. It seems that the use of quarterly data could be appropriate to model the short-run aspects of the theory. A prominent short-run aspect is the impact effect of real national income growth on taxation, spending and the deficit (see Chapter 3). In this respect, there do not seem to be any differences in kind between modelling public financial behaviour and, for example, private consumption [see e.g. Davidson et al. (1978) for an Error Correction Model of consumption with ample attention to within-year patterns]. Still, the fact that government budgets exist which are planned, published and evaluated on an annual basis would seem to justify a role for annual budget aggregates as well. In particular, it seems quite conceivable that the Error Correction disequilibrium feedback would operate on perceived disequilibria in the previous annual budget rather than on disequilibria in some recent quarter. Indeed, this expectation will be supported by the data.

It is not difficult to find an econometric expression for this idea, but it does have implications for the general-to-specific modelling strategy. The annual logarithmic Error Correction feedback terms are a weighted, non-constant average of the corresponding quarterly terms. Therefore, in order to have a "fully general" general model, we would have to include a large number of both annual and quarterly variables in a single equation. Our limited samples will not sustain such a specification. This does not make the modelling exercise and its presentation any easier. On the modelling side, the search for a robust specification for our model necessarily consisted of a process of trial and error, with the theoretical model, historial background knowledge and rigorous testing as the guiding principles. As regards presentation, I shall not report general models against which to test the finally preferred specifications. Nevertheless, comparative evidence will be mentioned whenever comparable rival models are available, and the conventionally reported diagnostic tests can naturally fulfil their evaluating role.

There is one type of variable which will play a role in the estimated equations and which has not yet been introduced. It originates from the existence of seasonal habits within the fiscal year. Our dependent variables will be four-quarter rates of growth as in budget constraint (6.2). Although one might expect this choice of specification to remove the seasonal aspects entirely, this is not the case for the following reason. Suppose that because of a random shock last year's first quarter showed exceptionally high public spending relative to the annual total, and that therefore public spending in the other quarters was relatively low. For unusual causes, the seasonal pattern was different from the average. If, in addition to quarterly budget management, the public finances are also monitored on an annual basis, this will probably result in a relatively low four-quarter rate of growth in this year's first quarter, and relatively high rates in the remaining quarters. This is due to the fact that the level of spending in each quarter of last year forms the basis for this year's four-quarter rates of growth.

More formally, we can approximate the consequences for our empirical equations as follows. Suppose government devotes attention to the hypothetical four-quarter rates of growth based on an "equilibrium" or "usual" seasonal distribution in the previous year. This seems quite plausible. Rather than allowing an unusual seasonal pattern to pervade into the future, the government plans on the basis of the "normal" patterns so that each year the impact of an unusual pattern in the previous year is counteracted. Notice that this is not equivalent to saying that government monitors annual variables only. As the empirical results will show, Dutch governments appear to have corrected partly but not fully for this difference between actual and "normal" four-quarter rates of growth. Moreover, the thus corrected quarterly budget variables react to other variables such as national income on a quarterly basis.

The normal rate of growth of, for example, the i-th quarter's public expenditure can be written as:

$$(G_{it}-\gamma_i G_{t-1})/(\gamma_i G_{t-1}) = [(G_{it}-G_{it-1})/G_{it-1}][G_{it-1}/(\gamma_i G_{t-1})] + [G_{it-1}/(\gamma_i G_{t-1})-1] \qquad (6.4)$$

where γ_i denotes the "normal" seasonal pattern $[0 \leq \gamma_i \leq 1,\ i=1,\dots,4;\ \Sigma^4_{i=1}(\gamma_i)=1]$. Since the variation of the first term on the right-hand side will be due mainly to the first term in square brackets, we can approximate the hypothetical "normal" rates of growth as:

$$(G_{it}-\gamma_i G_{t-1})/(\gamma_i G_{t-1}) \simeq \Delta_4 g_{it} + [G_{it-1}/(\gamma_i G_{t-1})-1] \qquad (6.5)$$

Just as in (6.3) above, the hypothetical quarterly rates aggregate to the annual ones if weighted by the <u>normal</u> seasonal pattern:

$$\Sigma^4_{i=1}\ \gamma_i(G_{it}-\gamma_i G_{t-1})/(\gamma_i G_{t-1}) \cong \Delta g_t \qquad (6.6)$$

and the second term on the right-hand side of (6.5) similarly aggregates to zero on an annual basis:

$$\Sigma^4_{i=1}\ \gamma_i[G_{it-1}/(\gamma_i G_{t-1})-1] = 0 \qquad (6.7)$$

Equation (6.5) expresses the fact that, if governments actually monitor the "normal" rates of growth but we model actual rates, it may be worthwhile to include the second term of (6.5) as a correction factor in our model. I have included $GCO_{it-1}=G_{it-1}/(\gamma_i G_{t-1})$, where I have simply substituted the average γ_i $(i=1,\dots,4)$ for the seasonal pattern. These patterns seem to be fairly stable, but still it would be more appropriate to estimate the γ_i together with the other parameters of the model. For the 1960s the weights for spending are (0.21, 0.24, 0.25, 0.30), and for the post-break period they are (0.22, 0.25, 0.25, 0.28).

I have used the Ordinary Least Squares option in the GIVE estimation programme from the AUTOREG library [Hendry and Srba (1980), Hendry et al. (1983)] for all the single-equation estimates of this chapter (some multi-equation estimates will be presented in Section 6.5). Since all regressions are linear and have errors which are innovations, all the lagged explanatory variables are weakly exogenous and OLS is indeed appropriate [Engle et al. (1983)].

The only current dated variable in the models is $\Delta_4(y-p)_{it}$, the four-quarter rate of growth of real national income. It is appropriate to estimate the coefficients on that variable using Instrumental Variables in order to avoid potential inconsistency. However, the IV estimations using lagged real income growth and world trade or world exports as instruments left the estimated coefficient on this variable unchanged. This led to the further use of OLS for the following reasons [see Sargan (1958) for an explanation of these considerations]. The main attraction of IV lies in the fact that it generates consistent estimates. However, the relatively large IV standard errors on the coefficient for $\Delta_4(y-p)_{it}$ are difficult to interpret because of the infinite number of potential instruments. The standard errors decline as the number of well-chosen instruments increases, but especially in our small samples this may introduce bias (though not inconsistency) into our estimates. I decided to confine myself to presenting only OLS results on the basis of the fact that the OLS estimates appeared to lie well within IV confidence intervals. Under these circumstances the inconsistency due to the formally inappropriate use of OLS is likely to be limited [see Sargan (1958) for this rule of thumb]. Some informal support for this decision lies in the fact that it probably takes budgetary policy longer than three months to influence the national product, as also argued by Sahni and Singh (1984). For estimates using annual data these matters might have been quite different, however.

I now proceed to the empirical results in view of the theory of Chapter 3. Our modelling strategy has led to the estimated equations for real public spending given in Table 6.1. A list of explanations of test statistics is provided in Appendix C. Standard errors appear in round brackets, and are heteroskedasticity-consistent [White (1980)]. The figures in square brackets are squared partial correlations. The bracketed figures accompanying test statistics are the relevant degrees of freedom (two for an F-test and one for a χ^2-test).

The first column of Table 6.1 shows the spending equation for 1960:1–1974:4. I first highlight the main features of this equation, and subsequently comment on the character and exact timing of the regime change. Most of the principal ingredients of our theoretical model can be found in the estimates for the first subperiod. During this era of Structural Budget Policy, the pattern of public expenditure essentially evolved along a standard Error Correction model with an underlying long-run elasticity of spending with respect to national income of approximately 1.36 (=1.03/0.76). The Error Correction feedback consists of a reaction to disequilibria in previous <u>annual</u> budgets $[(g-y)_{t-1}]$, and the long-run elasticity follows from its combination with annual real national income $[(y-p)_{t-1}]$. If we incorporate $[(Y/P)_{t-1}]^{-1}$ instead of $(y-p)_{t-1}$, the results are hardly

Table 6.1. The Model for Spending (Subperiods)

Dependent variable: $\Delta_4(g-p)_{it}$

	1960:1–1974:4	1975:1–1982:4
$\Delta_2\Delta_4 p_{it}$	−1.00	
$\Delta_3\Delta_4 p_{it}$		−1.00
CNST	−3.88 (.76) [.28]	0.74 (.19) [.33]
$(g-y)_{t-1}$	−0.76 (.14) [.33]	
$(y-p)_{t-1}$	0.27 (.05) [.31]	
$\Delta_4(y-p)_{it}$	0.43 (.15) [.13]	
$[(G-T)/Y]_{t-1}$		−1.96 (.23) [.57]
$\Delta_4(g-p)_{i-1t}$	−0.40 (.09) [.29]	−0.30 (.13) [.17]
GCO_{it-1}	−0.27 (.06) [.19]	−0.59 (.19) [.24]
DUM72-3	−0.06 (.01) [.17]	
DUM67:2	0.16 (.01) [.29]	
T	60	32
$\bar{R}^2$	0.56	0.56
$100\hat{\sigma}$	3.24%	3.13%
BP	12.74 (12)	9.17 (12)
η_2	1.18 (6,46)	1.06 (6,22)
ξ_2	8.02 (6)	7.15 (6)
η_4		0.26 (6,21)
ξ_4		2.19 (6)
ARCH	0.43 (1)	2.53 (1)
SK	−0.19	0.79
EK	−0.56	0.92
NORM	0.98 (2)	3.87 (2)
η_1	1.45 (8,44)	0.43 (8,20)
ξ_1	16.80 (8)	3.68 (8)
η_1 (1975–76)	3.13 (8,52)	
ξ_1 (1975–76)	66.25 (8)	

Table 6.2. The Model for Spending (Total Period)

Dependent variable: $\Delta_4(g-p)_{it}$

	1960:1-1974:4 (free)	1975:1-1982:4 (free)	1960:1-1982:4 (constrained)
$\Delta_2\Delta_4 p_{it}$	-1.00		
$\Delta_3\Delta_4 p_{it}$		-1.00	
CNST	-3.82 (.76)	0.77 (.19)	
$(g-y)_{t-1}$	-0.75 (.14)		
$(y-p)_{t-1}$	0.27 (.05)		
$\Delta_4(y-p)_{it}$	0.44 (.15)		
$[(G-T)/Y]_{t-1}$		-2.05 (.19)	
$\Delta_4(g-p)_{i-1t}$			-0.37 (.07)
GCO_{it-1}	-0.27 (.06)	-0.61 (.19)	
DUM72-3	-0.06 (.01)		
DUM67:2	0.15 (.01)		
T			92
$\bar{R}^2$			0.58
$100\hat{\sigma}$			3.19%
BP			10.58 (12)
η_2			1.20 (6,75)
ξ_2			8.09 (6)
η_4			
ξ_4			
ARCH			0.94 (1)
SK			0.14
EK			0.02
NORM			0.25 (2)
η_1			0.48 (8,73)
ξ_1			4.26 (8)

Table 6.3. Standard Deviations of Spending

	1960:1-1974:4	1975:1-1982:4	1960:1-1982:4
$\Delta_4 g_{it}$	5.18%	6.22%	5.56%
$\Delta_4 (g-p)_{it}$	5.20%	5.59%	5.37%

Table 6.4. Correlation Matrix of Variables in Table 6.1

		1	2	3	4	5	6	7	8
1	$\Delta_4 g_{it} - \Delta_4 p_{i-2t}$								
2	$\Delta_4 g_{it} - \Delta_4 p_{i-3t}$			−0.65	−0.52	0.13	$\underline{-0.66}$	$\underline{0.17}$	$\underline{-0.32}$
3	$(g-y)_{t-1}$	$\underline{-0.19}$			0.85	−0.07	0.95	−0.54	−0.01
4	$(y-p)_{t-1}$	$\underline{-0.09}$		$\underline{0.93}$		−0.34	0.74	−0.53	−0.01
5	$\Delta_4 (y-p)_{it}$	$\underline{0.27}$		$\underline{-0.04}$	$\underline{-0.08}$		−0.05	0.37	−0.23
6	$[(G-T)/Y]_{t-1}$	−0.15		0.63	0.41	0.00		$\underline{-0.56}$	$\underline{0.00}$
7	$\Delta_4 (g-p)_{i-1t}$	$\underline{-0.28}$		$\underline{-0.16}$	$\underline{-0.10}$	$\underline{-0.12}$	−0.07		$\underline{-0.11}$
8	GCO_{it-1}	$\underline{-0.35}$		$\underline{0.08}$	$\underline{0.08}$	$\underline{0.01}$	0.03	$\underline{0.14}$	

Note: Bottom left: 1960:1–1974:4.
Top right: 1975:1–1982:4.
Variables used in the estimations are underlined.

different. The long-run elasticity which we obtain in that way also exceeds unity, but it decreases with increasing real income to converge on unity in the long run. Our samples are too short to distinguish between the two alternatives. Moreover, I do not see any difficulties in modelling a policy which is unsustainable in the long term, if exactly that unsustainability seems to have been a reason for its breakdown. Similar considerations are valid for the tax model presented below.

There is a positive impact effect of real income growth [$\Delta_4(y-p)_{1t}$], and as anticipated this effect exists on a quarterly basis [see also Merkies and Weitenberg (1970) on the macroeconomic endogeneity of public spending in the Netherlands]. As an automatic stabiliser the positive coefficient on this variable may seem odd, but of course this issue should be addressed in conjunction with the model for taxation presented below. Notice, as remarked above, that the IV estimate was just as positive.

Furthermore, the seasonal correction term fulfils its anticipated role, though not with a unit coefficient. A degree of slack in that phenomenon seems plausible. The remaining variables are a lagged dependent variable, two dummy variables and a price acceleration term. The lagged real growth of spending appears with a negative coefficient. This may be related to the fact that our data are measured on a cash basis. The negative coefficient on the lagged dependent variable could partly pick up a technical accounting phenomenon by which the registration of expenditure may sometimes be shifted between quarters (see also Appendix B).

The first dummy variable is unity during 1972:3-1973:2 and zero elsewhere. During that period the Minister of Finance Dr. Nelissen temporarily cut public spending in order to reduce the deficit. I shall shortly comment on the extent to which this can be seen as a deviation from our modelled policy pattern. The second dummy is unity only in 1967:2, and relates to major political upheaval about public spending to which I shall return. Deletion of this dummy does not seriously affect the results.

The treatment of price deflation is data-based and its result indicates that public spending was fully indexed, albeit with a lag of about half a year [write: $\Delta_4(g-p)_{it}+\Delta_2\Delta_4 p_{it}=\Delta_4 g_{it}-\Delta_4 p_{i-2t}$]. The unit coefficient is easily acceptable statistically. More insight in this issue could be obtained if quarterly price indices for public spending were available. The analysis of Chapter 5 suggests that price developments in the public sector may have diverged from those in the private sector, but our use of the National Product deflator seems suitable for present purposes. Den Dunnen (1981) suggests as one major explanation of the apparent indexation the fact that civil servants' wages and salaries were indexed. This indexation was applied retroactively, which helps to explain the lag which we discover [Den Dunnen (1981, p. 186)]. The lagged but full indexation is consistent with results of Hubbard (1983) on the Dutch public finances. He finds that, internationally, the indexation of public spending is a fairly though not perfectly general phenomenon. However, see Beck (1979) and Pallada (1984) for a cautionary note.

For the first subperiod I have not found any Error Correction feedback from either the debt/income ratio, the interest/income ratio, or the deficit/income ratio. The "tension" in the budget, which I found in the U.S. data by using Co-Integration tests, is not present in the Dutch data if we confine outselves to the functional forms suggested by Chapter 3. It may, nevertheless, be the case that this "tension" would only become effective in the Netherlands as the debt or a related variable reached a particular threshold. Therefore, further analysis using other than log-linear Error Correction forms may lead to further insight. Current research into the statistical properties of non-log-linear Error Correction Mechanisms is hoped to provide the background for further progress [see e.g. Granger (1983)].

As expected, there is a change of regime sometime in the early 1970s. This is witnessed in the first place by the Chow and χ^2 tests for parameter stability during 1973-74 and 1975-76, respectively, relative to the first subperiod as a whole. The fact that the equation fails the χ^2 parameter constancy test for 1973-74 at 5% is entirely due to spending growth in 1973:4 (see below for an interpretation). The equation clearly breaks down after 1974. However, it is not clearcut that we should pin the regime shift precisely at 1974/75, since the presence of DUM72-3 indicates that there were earlier changes in the 1971-74 interval. Nevertheless, apart from the temporarily tight budget in 1972:3-1973:3 there was no clear policy of abandoning the regular planning procedures of the 1960s until after the first oil crisis. Against this historical background I made the naturally somewhat artificial choice of estimating the first policy up to 1975. A sequence of Chow tests for parameter constancy and other data analyses as suggested by Dufour (1982) confirm this choice, even if the dummy variable for 1972:3-1973:2 is deleted. In view of the fact that some aspects of the regime transition will probably have been less abrupt than we model here, it might have been sensible to delete the entire 1971-74 interval altogether. However, there is no clear evidence that our more parsimonious solution is unwarranted. In any case, the exact timing and characterisation of the regime change itself is not the subject of this study, and the latter's results are robust to placing the change slightly earlier. Selody and Lynch (1983) find a break in Canadian fiscal policy after the oil crisis in 1973. Further evidence for a break after 1974 is provided by Pallade (1984), who presents subcategories of spending which showed uncontrollable growth after that date [see also Clerx and Maas (1984) and Sterks (1984)].

The equation for 1960:1-1974:4 satisfies the usual statistical criteria. There is minimal evidence of autocorrelation, ARCH-type heteroskedasticity, non-normal errors or parameter instability. As mentioned, the fact that the equation fails the χ^2 parameter constancy test at 5% is entirely due to spending growth in 1973:4. Again, political factors may have played a role as suggested below. This is true for a number of large residuals. I have not removed more than the excessive one in 1967:2 because I try to analyse the extent to which the model of Chapter 3 can explain the regular patterns of public financial policy. If there are also regular political factors at work, it would be interesting to represent them in a systematic way rather than through data-based dummy variables. In any case, such large errors are limited in number and they affect the predictive accuracy rather than the parameter stability of our model. For the 1973-74 stability test, this is consistent with the rejection on the χ^2 but acceptance on the Chow test [cf. Kiviet (1981) and Hendry (1983)]. Notice also that the first oil shock and OPEC's oil boycot of the Netherlands occurred in the fourth quarter of 1973.

Before proceeding to the second part of the estimation period, let us briefly consider some further features of the model for 1960:1-1974:4. An idea of its variance-reducing ability can be gained from a look at Table 6.3. It appears that the model reduces the standard deviation of the level of public spending by about 40%.

The interpretation of the squared partial correlations and especially of their differences between periods will prove interesting. Acknowledging the usual objections against the multiple correlation coefficient as a measure of goodness of fit, we can follow Theil (1979, p. 175) and write:

$$R^2 - R_h^2 = r_h^2(1-R_h^2) \qquad (6.8)$$

where on the left we have the incremental contribution of the h-th regressor to the explanation of the dependent variable. R_h^2 is the squared multiple correlation coefficient after variable h has been deleted. On the right side, r_h^2 denotes the squared partial correlation (given all the other variables except the h-th). The incremental contribution of variable h is positively related to its partial, but less so to the extent that the other variables without h account for the behaviour of the dependent variable. As can be seen from Table 6.1, Column 1, there is a fairly even distribution of "explanatory contributions" from all the variables, although the contribution of real income growth is somewhat less than that of most of the others. The latter stands in contrast with the role of income in the tax equation which we discuss below. Furthermore, these squared partials can be contrasted between subperiods within the spending and tax models individually, so as to provide an impression of how the "explanatory" contributions have changed (cf. the role of the deficit in the second subperiod of Table 6.1).

Our explanatory variables are specified such that there is no problem of multicollinearity, except between (g-y) and (y-p). This is witnessed by the low correlation coefficients in Table 6.4. Only the non-unit long-run elasticity of spending with respect to income growth is not determined very precisely. In our modelling process, the other coefficients appeared to be very robust to moderate changes in the specification and the estimation period. I have calculated a large number of additional tests on all the models of this chapter which are not reported. These tests concern the addition of groups of lagged variables such as prices, income, and public spending. Although one has to be careful not to assign too much value to the outcome of a t- or an F-test for adding one or more variables to a model [Kiviet (1985)], it seems that their repeated insignificance, in combination with the overall strength of the model, is not entirely without value. In any case, it does not suggest any alterations to the model.

In addition to further lags on variables which are in the preferred equations, I have also tried to find a role for interest rates (see Appendix B and Figure 6.12). Their absence from the tables indicates that those efforts remained "without success". I shall comment on the notable budget-wide absence of interest rates in the section on public debt creation.

The second column of Table 6.1 shows the preferred model for 1975:1-1982:4. This model stands in stark contrast with that of the first subperiod. The equation again satisfies the usual statistical criteria. The standard error of the equation is virtually identical to that of the first subperiod. The stark contrast lies in what happened to the explanatory variables. The only explanatory variables to remain are the lagged dependent variable and GCO - both of which are of a technical nature.

In addition, we find a strong negative impact from the previous fiscal year's budget deficit (as a percentage of national income). Both in the spending equation and in the tax equation below, the deficit feedback consists of a reaction to a "wide" definition of the deficit: (G–T). There are two sources of evidence for the relevance of this particular deficit variable. First, I have also tried (G+I–T), (G–T–Q) and ΔB=(G+I–T–Q) in the regressions, but the data clearly show that (G–T) is the deficit to which the policymaker reacted in this period. Second, historical evidence points in the same direction. The policies which were adopted to redress the excessive growth of spending, taxation and the deficit usually took the temporary character of the gas revenues into account. For example, in the "1% Operation" to limit the growth of the collective burden, the proceeds from gas sales were excluded from total government revenue [Compaijen and Van Til (1978, p. 289)]. Attention was focussed on spending exclusive of interest payments and taxation exclusive of gas revenues.

As indicated by the squared partials, the contribution of the deficit feedback to the explanation of the variation of spending growth is relatively important. Although this equation does not contain any direct target for public spending anymore, the deficit feedback does imply a spending target when combined with the target for taxation which we discuss in the next section.

It appears that only the coefficient on the lagged dependent variable has not changed significantly, and the same holds for σ. This has been tested (as in the section which follows) with a joint Likelihood Ratio test; with an unconditional F–test for the constancy of σ; and with an F–test for the coefficient conditional on constant σ [see Pesaran <u>et al.</u> (1985)]. For the sake of efficiency, Table 6.2

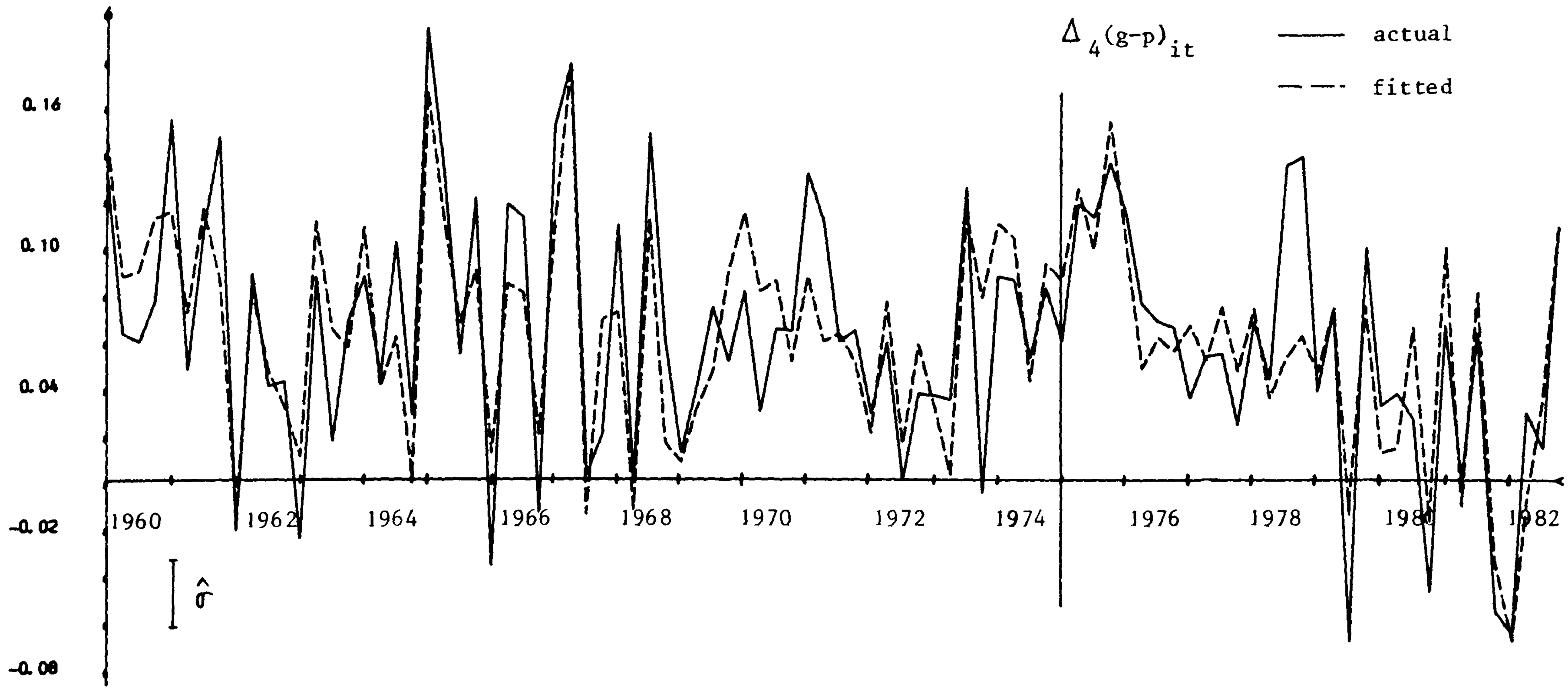
records the estimation of the entire model after imposing these two restrictions. Figure 6.7 shows the actual and fitted values of this restricted equation.

The model for the period 1975-1982 pictures a government which is not reacting to the business cycle as in the 1960s, but rather has sufficient difficulty in keeping its spending under control in the first place. This makes perfect sense against the historical background, for which I refer to Chapter 5.

First notice in Table 6.4 that the low correlations between explanatory variables still allow reliable estimation. The table also shows that the correlation between (G-T)/Y and (g-y) is high. However, if we replace the former by the latter the equation deteriorates slightly, so we proceed with (G-T)/Y [$\hat{\sigma}$ becomes 3.26, η_2 becomes 1.92 and ξ_2 becomes 10.69]. The deficit feedback also makes sense against the historical background and in view of the estimated stochastic structure which we discuss below.

The strength of the model in relation to the standard deviations given in Table 6.3 has improved compared to the first subperiod. Furthermore, the model as a whole variance-dominates that of Hubbard (1983), who finds a $\hat{\sigma}$ of 3.2% for his annual model of Dutch public spending over 1960-1979. His model explains real spending growth by trend growth of national income, departures of income from that trend, and the anticipated budget deficit (which he estimates by instrumenting the actual one). Since our model has no significant autocorrelation, the aggregation of quarterly to annual data according to (6.3) and (6.6) will approximately halve our equation standard error to 1.6% on an annual basis. This is half that of Hubbard. Moreover, our estimated equation standard error will be

Figure 6.7. Actual and fitted real spending growth



Source: Table 6.2

further reduced by the joint estimation with the tax equation reported in Section 6.5. Essentially, this improvement on the estimates of Hubbard reflects our theory which introduces the Error Correction; our allowance for a regime change; and our use of quarterly data which offer the opportunity to make a sharper judgment on the patterns during these two rather brief subperiod [cf. the difficulties of Kremers (1983) with annual Dutch data]. Further comparison with the results of Hubbard is difficult, since he reports only t-values, $\hat{\sigma}$ and the R^2; since his sample does not include the aftermath of the second oil crisis; and since his data may be slightly different.

I shall leave further interpretation until after having considered the model for taxation. The underlying long-run development of public spending will be discussed together with that of taxation in Section 6.5.

6.4 The Model for Taxation

After the detailed presentation of the model for public expenditure, we can build on the general remarks made in the previous section and proceed with a more concise presentation of the results for taxation. The estimates for the two subperiods separately are given in Table 6.5. $TCO_{i\,t-1}$ is the tax equivalent of $GCO_{i\,t-1}$ for spending above. The weights throughout the period are (0.21, 0.21, 0.27, 0.31). As with spending, the error feedback appears on an annual basis. The value of its coefficient is constant over the two subperiods.

Table 6.5. The Model for Taxation (Subperiods)

Dependent variable: $\Delta_4(\tau - p)_{it}$

	1960:1-1970:4	1971:1-1982:4	1971:1-1982:4 (no deficit)
$\Delta\Delta_4 p_{it}$	-1.00		
CNST	-1.74 (.95) [.05]		
$(\tau-y)_{t-1}$	-0.56 (.27) [.08]	-0.54 (.09) [.41]	-0.37 (.06) [.35]
$(y-p)_{t-1}$	0.13 (.05) [.09]		
$\Delta_4(y-p)_{it}$	0.66 (.20) [.24]	0.36 (.14) [.11]	0.30 (.14) [.07]
$[(G-T)/Y]_{t-1}$		0.68 (.27) [.13]	
$TCO_{i\,t-1}$	-0.48 (.11) [.22]	-0.58 (.11) [.38]	-0.38 (.06) [.32]
DUM82:1		-0.15 (.01) [.25]	-0.12 (.01) [.18]
T	44	48	48
$\bar{R}^2$	0.42	0.55	0.50
$100\hat{\sigma}$	3.26%	3.68%	3.90%
BP	11.05 (12)	19.70 (12)	17.69 (12)
η_2	0.86 (6,33)	1.01 (6,37)	1.01 (6,38)
ξ_2	5.95 (6)	6.74 (6)	6.61 (6)
η_4	1.07 (10,28)	0.54 (9,33)	0.45 (7,36)
ξ_4	12.20 (10)	6.14 (9)	3.88 (7)
ARCH	2.21 (1)	1.20 (1)	0.27 (1)
SK	-0.36	0.01	-0.11
EK	-0.25	-0.66	-0.40
NORM	0.96 (2)	0.78 (2)	0.39
η_1	0.85 (8,31)	0.37 (3,40)	0.31 (3,41)
ξ_1	6.98 (8)	1.32 (3)	0.94 (3)
η_1 (1971)	1.71 (4,39)		
η_1 (1972)	0.22 (4,43)		
η_1 (1973)	1.76 (4,47)		
η_1 (1974)	3.77 (4,51)		

Table 6.6. The Model for Taxation (Total Period)

Dependent variable: $\Delta_4(\tau-p)_{it}$

	1960:1-1970:4 (free)	1971:1-1982:4 (free)	1960:1-1982:4 (constrained)
$\Delta\Delta_4 p_{it}$	-1.00		
CNST	-1.52 (.40)		
$(\tau-y)_{t-1}$			-0.51 (.07)
$(y-p)_{t-1}$	0.12 (.03)		
$\Delta_4(y-p)_{it}$	0.63 (.20)	0.36 (.14)	
$[(G-T)/Y]_{t-1}$		0.63 (.24)	
TCO_{it-1}			-0.55 (.08)
DUM82:1		-0.15 (.01)	
T			92
$\bar{R}^2$			0.55
$100\hat{\sigma}$			3.45%
BP			15.15 (12)
η_2			0.90 (6,78)
ξ_2			5.93 (6)
η_4			
ξ_4			
ARCH			0.00 (1)
SK			-0.13
EK			-0.47
NORM			1.01 (2)
η_1			0.42 (3,81)
ξ_1			1.47 (3)

Table 6.7. The Model for Taxation (Total Period, No Deficit Feedback)

Dependent variable: $\Delta_4(\tau-p)_{it}$

	1960:1-1970:4 (free)	1971:1-1982:4 (free)	1960:1-1982:4 (constrained)
$\Delta\Delta_4 p_{it}$	-1.00		
CNST	-1.26 (.39)		
$(\tau-y)_{t-1}$			-0.40 (.05)
$(y-p)_{t-1}$	0.10 (.03)		
$\Delta_4(y-p)_{it}$	0.68 (.19)	0.28 (.14)	
TCO_{it-1}			-0.40 (.06)
DUM82:1		-0.12 (.01)	
T			92
$\bar{R}^2$			0.51
$100\hat{\sigma}$			3.58%
BP			12.57 (12)
η_2			0.69 (6,79)
ξ_2			4.58 (6)
η_4			0.50 (15,69)
ξ_4			9.05 (15)
ARCH			0.00 (1)
SK			-0.23
EK			-0.15
NORM			0.83 (2)
η_1			0.38 (3,82)
ξ_1			1.16 (3)

Table 6.8. Standard Deviations of Taxation

	1960:1-1970:4	1971:1-1982:4	1960:1-1982:4
$\Delta_4 \tau_{it}$	5.01%	6.15%	5.61%
$\Delta_4 (\tau - p)_{it}$	4.86%	5.55%	5.36%

Table 6.9. Correlation Matrix of Variables in Table 6.5

		1	2	3	4	5	6	7
1	$\Delta_4 \tau_{it} - \Delta_4 p_{i-1t}$							
2	$\Delta_4 \tau_{it} - \Delta_4 p_{it}$			$\underline{-0.53}$	-0.49	$\underline{0.45}$	$\underline{-0.38}$	$\underline{-0.36}$
3	$(\tau - y)_{t-1}$	$\underline{0.05}$			0.93	$\underline{-0.38}$	$\underline{0.83}$	$\underline{-0.08}$
4	$(y - p)_{t-1}$	$\underline{0.14}$		$\underline{0.87}$		-0.49	0.83	0.08
5	$\Delta_4 (y - p)_{it}$	$\underline{0.54}$		$\underline{0.16}$	$\underline{0.09}$		$\underline{-0.38}$	$\underline{-0.07}$
6	$[(G-T)/Y]_{t-1}$	0.04		0.82	0.92	0.01		0.08
7	TCO_{it-1}	$\underline{-0.54}$		$\underline{-0.01}$	$\underline{-0.01}$	$\underline{-0.32}$	0.02	

Note: Bottom left: 1960:1–1970:4
Top right: 1971:1–1982:4
Variables used in the estimations are underlined.

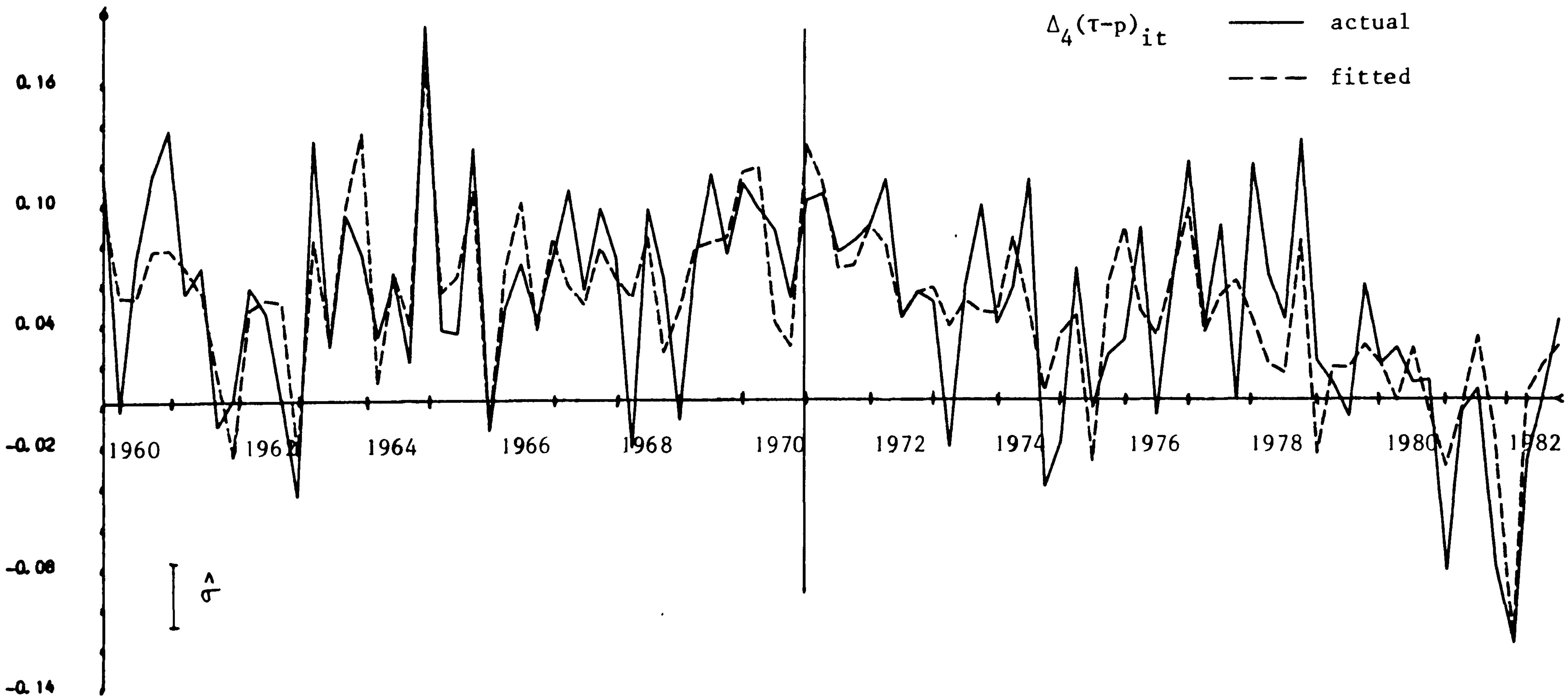
The regime change of taxation in the early 1970s involved three aspects of the taxation process. First, the positive excess of the long-run income elasticity over unity vanished. Second, the impact effect of real income growth was halved. Third, just as for public spending, taxation in the second subperiod reacted to pressure emanating from the previous year's budget deficit. In addition, the lag on indexation seems to have decreases to less than a quarter (see below). The precise timing of the policy change is a matter of judgment. While the model for the first subperiod passes parameter stability tests up to 1973, it fails any which go beyond that point. I chose to estimate the equation for the first subperiod up to 1971 for several reasons. There was evidence that the numerical values of some of the estimated coefficients start to change (towards those found for the second subperiod below) if we include observations for 1971 and beyond. Since the model for the second subperiod starting in 1971:1 is satisfactory, we must consider the possibility that the changes in the patterns of taxation and spending did not occur simultaneously. The arrival of Dr. Nelissen as Minister of Finance in 1970 led to budget deficit reductions through special spending cuts and tax rises. However, the tax rises were easier to implement and seem to have preceded the spending cuts. They were easier to implement, because in 1971 the so-called "Wobble Tax" Law was introduced [Compaijen and Van Til (1978, pp. 287-8)]. This law gave the Minister of Finance the power to simultaneously change a broad scala of tax rates by a maximum of 5% without prior authorisation by Parliament. The use of this tax measure was accounted <u>outside</u> the Structural Budget Policy planning procedures. A positive Wobble Tax was applied during a number of years beginning in 1971. This seems to have been the first departure from the framework of Structural Budget Policy.

However, the public spending cuts introduced by Dr. Nelissen do not seem to have changed SBP procedures on the spending side of the budget. The pattern of public spending was not yet altered by the Nelissen move: a constant dummy variable sufficed in the expenditure model above. All this links in quite straightforwardly with the Dutch experience of buoyant spending growth in a stagnating economy [Halberstadt et al. (1982)].

The standard error of the equation for the first subperiod is virtually identical to that of the public expenditure equation. The tax equation error seems to have increased during the second subperiod. Since, however, tests such as those mentioned for spending above indicate that this increase is insignificant, I have proceeded to re-estimate the model over the entire period under the constraint of a constant σ, and of constant parameters for $(\tau-y)_{t-1}$ and TCO_{1t-1}. Figure 6.8 displays the actual and fitted values.

The model for the 1970s shows a sign of negative autocorrelation of an order between 7 and 12 quarters. There is no sign of autocorrelation below that order, and I suspect that this peculiarity reflects a few large residuals to which I shall pay some historical attention in Section 6.7. As shown in the third column of Table 6.5, the deletion of the deficit feedback variable reduces the value of the Box-Pierce statistic, albeit only by a moderate amount. Nevertheless, unlike the model for spending, the deficit feedback does not play a central role in the tax equation. The estimates predominantly express an effort to stabilise the tax burden ("1% Operation").

Figure 6.8. Actual and fitted real taxation growth



Source: Table 6.6

Price deflation is again data-based. It is wellknown that tax revenues in the Netherlands tend to be indexed, and that indexation comes with a lag. The Central Planning Bureau (1983, p. 85 ff.) suggests a lag of 2 months, which is consistent with the timing in Tables 6.5 and 6.6 (i.e., about a quarter in the 1960s and less than that in the 1970s). This treatment of inflation statisfies present purposes, although more precision could again be obtained by incorporating special price indices which are closely associated with Central Government tax revenues.

Just as with spending, I fail to detect any outright anti-inflationary strands in taxation. More explicit attention for expected inflation would seem required in this context. Nevertheless, a number of efforts using the inflation predictions of the Central Planning Bureau [thus avoiding the criticism of Kelly (1985)] have not led to any significant role for inflationary expectations in the tax or spending models. The proposition, that these published figures reflect general inflation anticipations rather well, receives support in Section 6.6, where I show that they played an important role in the choice between debt and money financing of the deficit [see also Kremers (1983)]. These results suggest that budgetary policy in the Netherlands has not taken the strain of anti-inflationary policy, which is consistent with the background sketched in Chapter 5.

The correlation between regressors is sufficiently low to assume the absence of multicollinearity problems, except for collinearity of lagged real income with tax feedback in the 1960s and deficit feedback with tax feedback in the 1970s (Table 6.9). Consequently, the long-run income elasticity of taxation during the 1960s and the deficit feedback during the 1970s are not very well determined. The hypothetical underlying trends of our tax model will be considered in Section 6.5.

Notice that, unlike the estimates of the spending model, the coefficients in the tax equation allow us to rewrite the two disequilibrium feedback terms for i=1,...,4 as:

$$[(\tau-y)_{t-1}+TCO_{i\,t-1}] = [(\tau-y)_{t-1}+T_{i\,t-1}/(\theta_i T_{t-1})]$$

$$\simeq [(\tau-y)_{t-1}+\ln\{T_{i\,t-1}/(\theta_i T_{t-1})\}-1]$$

$$= [\ln\{T_{i\,t-1}/(\theta_i Y_{t-1})\}-1]$$

What we in fact discover is an Error Correction feedback from four-quarter lagged taxation, scaled up to its "normal" annual equivalent in order to be comparable with annual national income. This is a different interpretation of the estimated combination of annual and quarterly feedback, which, again, does not apply to the spending model. One aspect which both models do have in common is that the deletion of disequilibrium feedback terms badly affects their predictive and dynamic performance. In view of earlier experience with Error Correction models this is an unsurprising observation, which nevertheless carries its relevance for the present study.

The partial correlations of Table 6.5 give the impression that the term $\Delta_4(y-p)_{i\,t}$ really "does most of the explanatory work" in the tax equation of the 1960s. This impression is correct. If we delete all the variables except real income growth from the equation, the standard error increases though not dramatically. As indicated above, the dynamics do deteriorate. The fact that real income growth is the central variable of course reflects the endogeneity of taxation through the tax system. As expected, Error Correction feedback gains weight in the 1970s when government sets out to stabilise the "ever increasing" tax burden. This clearly reflects the so-called "1% Operation" of the mid- to late 1970s, by which the tax/income ratio was intended to rise by at most one percentage point per year as a first step towards stabilising it.

Although for reasons mentioned in the previous section it is difficult to make a sharp comparison with the results of Hubbard (1983), the annual equivalent of our quarterly equation standard error is again smaller than that of the taxation model of Hubbard. The contrast is not, however, as spectacular as in the spending model. This in the first place reflects the prominent role in the 1960s of real income growth, which Hubbard's equation incorporates as well, and also the fact that his model does not cover 1980-82. As can be seen from Table 6.5, the second subperiod tends to have a larger variance. In addition to the lack of diagnostic information on the Hubbard model, it is also difficult to make direct comparisons because his model does not distinguish two different regimes and consequently does not lead to the presentation of estimations for the two subperiods separately. Hubbard explains real taxation by the trend of real national income, departures of income from that trend, and the anticipated budget deficit (which he estimates by instrumenting the actual one).

6.5. Closing the Budget: The Deficit

In this section we combine the findings on patterns of spending and taxation in order to gain insight in the behaviour of the budget deficit. The starting point is budget constraint (6.2), which allows us to derive a model for the deficit from those for spending and taxation. This derivation, however, is not trivial. It involves some econometric issues which I shall address to begin with. After this examination of the budget as a whole, I proceed to an analysis of the deficit financing choice in Section 6.6. In other words, we first consider total debt creation, which in our terminology includes both long-run and short-run debt or money, and subsequently focus on the choice between debt and money financing.

The transition from our models for spending ($\Delta_4 g_{it}$) and taxation ($\Delta_4 \tau_{it}$) to a model for the debt acceleration variable [$\Delta_4 b_{it} - (B_{-1t-1}/B_{it-1})\Delta b_{-1t}$] involves two matters of judgment. The first concerns the choice of appropriate scaling factors so as to link these three variables in budget constraint (6.2) or a rescaled version thereof. The second matter concerns the treatment of the remaining variables in the budget, viz. interest payments ($\Delta_4 i_{it}$) and gas revenues ($\Delta_4 q_{it}$).

Let us first address the latter point, on which the theoretical model of Chapter 3 can offer some guidance. In the course of our modelling procedure, we have not found any evidence of a long-run target for the public debt or a debt-related variable during the 1960s. In terms of the theoretical model, this implies a value for λ_1 (the parameter on the long-run debt target in the loss function) which is insignificantly different from zero. This can be seen in Table

3.1, where the combination of $\psi_{15}=\psi_{25}=\psi_{35}$ and $(\lambda_3+\lambda_6)\neq 0\neq(\lambda_2+\lambda_5)$ implies $\lambda_1=0$. The second condition stems from the estimated presence of long-run targets for spending ($\lambda_2>0$) and taxation ($\lambda_3>0$). Still, the absence of a long-run debt target does not yet imply the total absence of "tension" in the budget. If, apart from changing spending and taxation, it is also costly to change the deficit ($\lambda_4>0$), then the coefficients on expected gas revenues and expected interest payments in the spending and tax equations will not be zero ($\psi_{16},\psi_{17},\psi_{26},\psi_{27}>0$). These coefficients will only be zero if, in addition to the absence of a significant debt _target_, it is also not significantly costly to have a great deal of fluctuation in the government's recourse to the financial markets ($\lambda_4=0$). This matter would of course be resolved in a straightforward manner if we _knew_ the values of $(\psi_{16},\psi_{17},\psi_{26},\psi_{27})$. However, we don't so they will have to be estimated. This is not entirely straightforward, because these coefficients concern the impact of _expected_ interest payments and _expected_ gas revenues on the budget, and we do not have any measured data on these variables. There seem to be two ways out. The first is to follow the same strategy as we used for the coefficients on real income growth $(\lambda_{12},\lambda_{22})$, where we encountered essentially the same problem. Assuming that the government's anticipations of interest payments and gas revenues do not diverge from their realisations in any systematic way, we can replace Δi_{1t}^{*} and Δq_{1t}^{*} by their actual values. Just as in the real income case, potential simultaneity could induce inconsistency in our estimates but this we can counter by using IV estimation. Still, for the usual reasons inference on the _significance_ of the resulting estimates is difficult (see Section 6.3 above). Using both IV and OLS, our estimates for the 1960s suggest that $(\psi_{16},\psi_{17},\psi_{26},\psi_{27})$ may all have equalled zero in that period. Since most interest is paid at annual intervals, we can refer to similar arguments as for real income growth above to support the assumption that the use of OLS on the quarterly data does not induce significant inconsistency for the estimated coefficient on interest payments. On the basis of these considerations interest payments are absent from the models for public spending and taxation.

The same is true for gas revenues, which are not represented individually either. I am more reluctant to propose a priori reasons for the appropriateness of OLS regressions to support this feature of the model. It is true that in the medium term these revenues were simply maximised (see Chapter 5), which induced me to call them "exogenous" in Chapter 3. However, the short-run pattern by which these revenues are transferred from revenue collecting agencies to the government's accounts carries some arbitrariness[1] (see Figure 6.3). It may well be true that short-run budget financing pressure is sometimes alleviated by early transfers of gas revenues. This renders any a priori statement on the short-run exogeneity of gas revenues rather hazardous. Of course, the second and only fully satisfactory way to solve this matter would be to formulate models for the expectations of real income growth, interest payments and gas revenues, or to obtain measured data on these variables.[2]

Unlike the spending and tax equations for the 1960s, we do find clear evidence for "tension" in the budgets of the 1970s. Error Correction on past excessive budget deficits is the driving force of the second-period spending equation, and seems to play a role for taxes as well. This again poses the question of how to deal with the remaining variables in the budget. Again, the answer is pragmatic, but on different grounds. Unlike the 1960s, there now seems to be some short-run association of these variables with spending and taxation. However, the coefficients are poorly determined and quite sensitive with respect to the exact sample. This is not surprising, in view of the 1970s' budget pressure and the arguments on the potential economic arbitrariness of gas revenue transfers mentioned above. On the basis of these considerations I have decided to follow the same line as I did for the 1960s, and aggregate gas revenues and interest payments with debt creation to form a "wide" concept of the budget deficit. In addition, there is a small third remaining variable of items which have not yet been allocated to a specific budget category (see Appendix B), for which these arguments hold a fortiori. Therefore, I define the "wide" budget deficit as:

$$[\Delta_4 b_{it} - (B_{-it-1}/B_{it-1})\Delta_4 b_{-it}] + [(Q_{it-1}/B_{it-1})\Delta_4 q_{it} - (I_{it-1}/B_{it-1})\Delta_4 i_{it}]$$

where q_{it} includes the uncategorised items. The budget deficit which appears in the equations for spending and taxation during the second subperiod is this "wide" deficit, and that choice is supported by the data. Of course, the presence of gas revenues in the budget has allowed spending and taxation to drift apart in the medium term. The suggestion that short-run fluctuations in these revenues seem to have been reflected mostly in the public debt should not be misread to imply that gas revenues have only resulted in medium- to long-term debt reduction.

The choice of scaling factors, which are required to link the variables in budget constraint (6.2), is determined by the constancy of parameter estimates and further statistical properties of the model. On this score, the models for $\Delta_4 g_{it}$ and $\Delta_4 \tau_{it}$ which we presented in previous sections appear to be the most satisfactory ones. Using (6.2), the derived model for the deficit will thus incorporate all the explanatory variables from the spending and tax models, but with scaling factors (G_{it-1}/B_{it-1}) and (T_{it-1}/B_{it-1}) respectively. This means that we cannot simply subtract the coefficients on variables which both models have in common in order to obtain single representations for those variables in the deficit equation. This minor nuisance could be avoided by estimating a model for $(T_{it-1}/G_{it-1})\Delta_4\tau_{it}$ instead of $\Delta_4\tau_{it}$, or by an equivalent scaling of $\Delta_4 g_{it}$. Budget constraint (6.2) shows that we would then be able to derive the model for a scaled deficit as a linear combination of the models for spending and taxation. I have tried to estimate a satisfactory model for scaled spending or taxation growth, but, although the results are not very different from those reported in previous sections, the models do deteriorate after such scaling. The deterioration (larger estimated standard errors, some sign of autocorrelation) is sufficient to accept our minor nuisance and proceed with the specification as it stands.

Our earlier choice of dependent variables is reaffirmed by these results. We can also interpret this in terms of the coefficient formulae in Table 3.1. There we assumed that the scaling factors would be sufficiently close to their long-run values to be treated as constants, and thus derived constant coefficients on the same explanatory variables for each of the three equations of our model. It appears, however, to be preferable to use slightly different explanatory variables in the deficit equation. In our relatively short samples, the actual ratios for which there appear to be underlying long-run targets are simply not all that constant (see Figures 6.2, 6.4 and 6.5). This illustrates the fact that the interpretation of the underlying long-run solutions is conditioned by the size of our sample. In present circumstances this renders the underlying long run definitely a hypothetical though no less interesting phenomenon.

Before further considering the underlying trends, I combine the spending and tax equations and comment on patterns of the deficit. In the present setup, the deficit can simply be derived from spending and taxation through the budget constraint. Although there are no cross-equation restrictions on the spending and tax equations, their errors may be correlated so that joint estimation would be more efficient than the single-equation estimates reported thus far. Using Full Information Maximum Likelihood, I have jointly estimated the equations for spending (Table 6.2) and taxation (Table 6.6) over the whole sample. As a result, the coefficient estimates remain unaffected (which is to be expected since single-equation OLS is inefficient but not inconsistent), and the estimated standard errors hardly decline. The latter is not surprising either, since the estimated correlation coefficient of the spending and tax errors [$\hat{r}_{g\tau}=\hat{\omega}_{g\tau}/(\hat{\omega}_g\hat{\omega}_\tau)$ of the stochastic specification (3.12) in theoretical Chapter 3] is only 0.08.

However, this result is misleading and again illustrates the danger of neglecting a change of regime. Separate consideration of the two subperiods revealed the following. Joint estimation of spending (Table 6.1) and taxation (Table 6.5) for 1960:1–1970:4 again leaves coefficient estimates and standard errors largely unaffected. The estimated $\hat{r}_{g\tau}$ is 0.02. In sharp contrast, the joint estimation for 1975:1–1982:4 results in $\hat{r}_{g\tau}=0.41$. The estimates for this subperiod are shown in Table 6.10, where I also report single-equation estimates of the tax model for the same subperiod. The coefficient estimates are

Table 6.10. Simultaneous Estimation, 1975:1–1982:4

Dependent variable:	$\Delta_4(g-p)_{it}$ (simultaneous)	$\Delta_4(\tau-p)_{it}$ (simultaneous)	$\Delta_4(\tau-p)_{it}$ (single for comparison)
$\Delta_5\Delta_4 p_{it}$	−1.00		
CNST	0.80 (.18)		
$(\tau-y)_{t-1}$		−0.55 (.11)	−0.53 (.12)
$\Delta_4(y-p)_{it}$		0.31 (.15)	0.40 (.17)
$[(G-T)/Y]_{t-1}$	−2.02 (.21)	0.69 (.33)	0.64 (.34)
$\Delta_4(g-p)_{i-1t}$	−0.34 (.11)		
GCO_{it-1}	−0.65 (.18)		
TCO_{it-1}		−0.59 (.13)	−0.57 (.14)
DUM82:1		−0.15 (.01)	−0.14 (.01)
$100\hat{\sigma}$	2.94%	3.65%	3.96%

Residual Correlation Coefficient: $\hat{r}_{g\tau}=\hat{\omega}_{g\tau}/(\hat{\omega}_g\hat{\omega}_\tau)=0.41$

Note: Residuals satisfy the usual statistical criteria as in Tables 6.1 and 6.5.

little affected, but standard errors decline. Especially the estimated equation standard errors decrease by fair amounts.

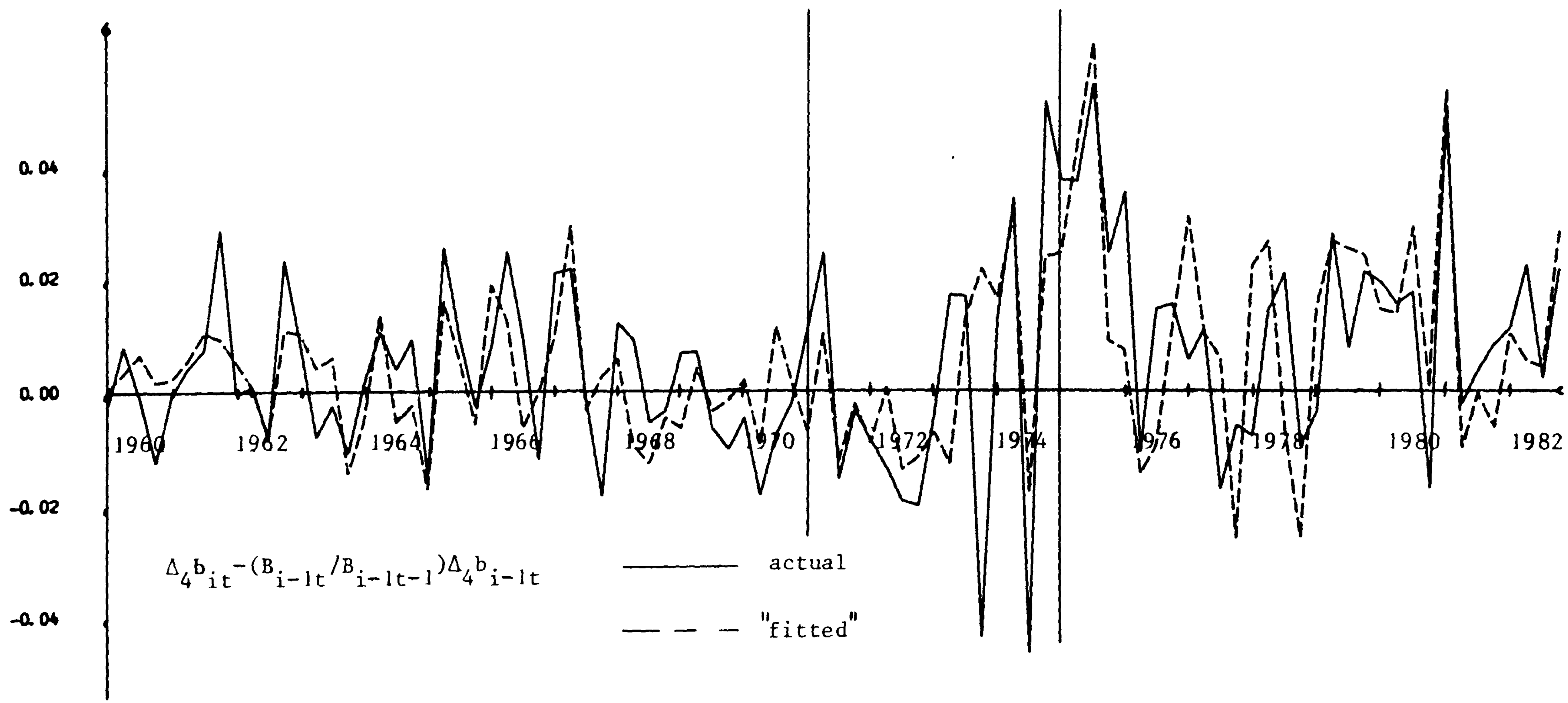
The interpretation of the distinctive shift in the covariance structure seems straightforward, particularly in the light of the shift of explanatory variables in the two equations. The late 1970s was a period in which government had two joint first priorities: to stabilise the tax burden and to control the deficit. Our tax model clearly represents the first priority, and taxation also contributed to the second. However, with increasing tension in the budget the government came to experience that, given the desire to stabilise the tax burden, a controlled deficit requires control over public spending. Our spending equation sketches a strong autonomous growth of expenditure subsumed in the constant on the one hand (average real spending growth was 5.1% per annum during 1975-1982, while real national income grew by 0.7% on average - see Table 6.11), and a strong error correction feedback from deficits to spending on the other hand. It was difficult to check the autonomous growth, and at some point even short-term cash limits were imposed on all the governmental departments. This may be reflected in the large correlation coefficient of the residuals on spending and taxation, which we shall place in the perspective of the stochastic structure proposed in Chapter 3 at the end of this section.

The equation for the deficit can now easily be obtained by substituting the models for spending and taxation given in Tables 6.1 and 6.6 into budget constraint (6.2). Figures 6.9 and 6.10 show the actual and "fitted" values, where the latter have been derived using the budget constraint. Notice, against the background of Chapter 3, that our way of estimating the deficit equation through joint

Table 6.11. The Averages of Some Key Variables

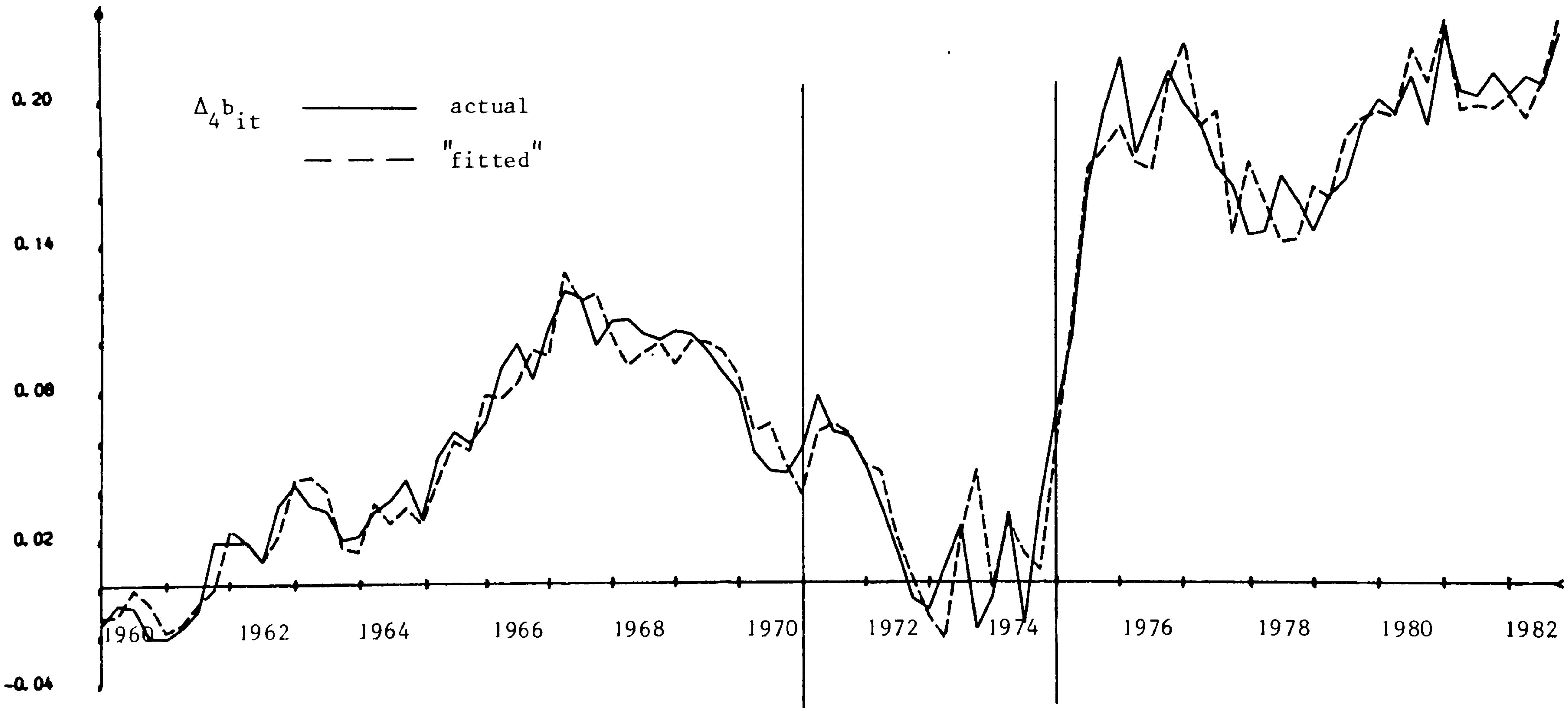
	1960-1970	1960-1974	1971-1982	1975-1982
$\Delta_4(g-p)_{it}$	0.070	0.068	0.055	0.051
$\Delta_4(\tau-p)_{it}$	0.061	0.061	0.035	0.021
$\Delta_4(y-p)_{it}$	0.052	0.049	0.019	0.007
$(G/Y)_t$	0.280	0.288	0.376	0.407
$(T/Y)_t$	0.278	0.287	0.338	0.348
$(I/Y)_t$	0.015	0.015	0.020	0.022
$(Q/Y)_t$	0.001	0.003	0.024	0.032

Figure 6.9. Actual and "fitted" debt acceleration



Source: Tables 6.2 and 6.6; Budget constraint (6.2)

Figure 6.10. Actual and "fitted" debt growth



Source: Tables 6.2 and 6.6; Budget constraint (6.2) estimation of the spending and tax equations does not necessarily mean that the deficit fulfils the role of buffer in the budget (see below on the stochastic structure). The government's plans for the three instruments have been made simultaneously.

In general, the estimated standard errors can best be obtained from joint estimation. I shall not derive the explicit expression for the deficit here. The picture seems clear. In the 1960s, budgetary policy resembled that modelled in Chapter 3. There was a negative impact effect of real income growth on the budget deficit. This countercyclical aspect would be blurred if the values of the smoothing and feedback variables in the spending and tax equations were substantial. It will be interesting to analyse the effectiveness of this stabilisation policy, for instance in the context of the econometric model of the Dutch economy.

In the 1970s there still existed a negative impact effect of income growth on the deficit, but this was probably mostly overridden by feedback pressure on spending and taxation. Especially this contrast between periods would seem to justify the incorporation of the equations in a general econometric model of the Dutch economy: the regime change may allow us to identify how the economy reacts to individual aspects of budgetary policy.

Consider the long-run solutions of the spending and tax equations (derived in the usual way by setting long-run rates of growth equal to π_y and short-run effects equal to zero):

1960-1974: $(G/Y) = 0.32\ [(Y/P)/164776]^{0.36}\ \exp[-1.90\pi_y]$

1960-1970: $(T/Y) = 0.30\ [(Y/P)/147752]^{0.24}\ \exp[-1.18\pi_y]$

1975-1982: $(G/Y) = 0.078 - 0.69\pi_y + 0.34\ \exp[0.078-1.94\pi_y]$

$$(T/Y) = 0.34 \exp[0.078-1.94\pi_y]$$

which have been derived using the coefficients in Tables 6.2 and 6.6, and the averages for (Y/P) over the relevant periods. The long-run targets for the second subperiod have been derived from the two-dimensional simultaneous system which links the targets for (G-T)/Y and T/Y from the tables, using the approximation: $\exp(x) \simeq (1+x)$ for x small. Substituting the relevant averages from Table 6.11, we can provide an impression of the orders of magnitude of these targets:

<u>1960-1974</u> $(G/Y) = 0.29\ [(Y/P)/164776]^{0.36}$

<u>1960-1970</u> $(T/Y) = 0.28\ [(Y/P)/147752]^{0.24}$

<u>1975-1982</u> $(G/Y) = 0.44$

$(T/Y) = 0.36$

The fact that the underlying deficit implied by these targets is much larger for the 1970s than for the 1960s reflects the stagnation of income growth which has an important impact on the implicit targets for spending and taxation. This again reflects the inability of spending to adapt to lower income growth during the 1970s. If income had grown at the rate of the 1960s, then the average deficit relative to income of the late 1970s would have been halved.

Finally, even though we have not combined our budget model with explicit data or models for <u>expected</u> interest payments, gas revenues, and income growth, we can still make some comments on uncertainty around the budget. Table 6.12 shows the estimated variance-covariance structure in the notation of Chapter 3. In view of the fact that we found $\psi_{16}=\psi_{26}=0$ for both subperiods, we can write the elements of variance-covariance matrix Ω in (3.12) as:

Table 6.12. Estimated Model Variance-Covariance Structure

	1960:1-1970:4	1975:1-1982:4
$\hat{\omega}_g$	2.99%	2.94%
$\hat{\omega}_\tau$	3.07%	3.65%
$\hat{\omega}_b$	4.24%	3.63%
$\hat{r}_{\tau g}$	0.02	0.41
$\hat{r}_{bg}$	0.82	0.39
$\hat{r}_{b\tau}$	-0.71	-0.68

Note: Derived from Table 6.10, and for comparability from an unreported joint estimation for 1960:1-1970:4 as well. $\hat{r}_{g\tau} \equiv \hat{\omega}_{g\tau}/(\hat{\omega}_g \hat{\omega}_\tau)$; $\hat{r}_{gb}$ and $\hat{r}_{\tau b}$ equivalently. I used equation (3A.6) for the derivation of $\hat{\omega}_b$, $\hat{r}_{gb}$ and $\hat{r}_{\tau b}$.

$$\omega_g^2 = \psi_{12}^2\sigma_y^2 + \sigma_g^2$$

$$\omega_\tau^2 = \psi_{22}^2\sigma_y^2 + \sigma_\tau^2$$

$$\omega_b^2 = \psi_{32}^2\sigma_y^2 + \psi_{32}\psi_{36}\sigma_{qy} + \psi_{36}^2\sigma_q^2 + \sigma_b^2$$

$$\omega_{\tau g} = \psi_{12}\psi_{22}\sigma_y^2 + \sigma_{\tau g}$$

$$\omega_{bg} = \psi_{12}\psi_{32}\sigma_y^2 + \sigma_{bg}$$

$$\omega_{b\tau} = \psi_{22}\psi_{32}\sigma_y^2 + \sigma_{b\tau} \qquad (6.9)$$

Since we do not have any estimates of the stochastic structure of expectations formation (Σ_e), it is clearly impossible to fully identify the stochastic structure of the planning process (Σ_p) from our estimated variance-covariance matrix Ω . However, given the fact that the positive ψ_{12} of the 1960s has vanished to zero in the second subperiod, it can unambiguously be inferred from (6.9) and the estimated constancy of ω_g^2 that uncertainty around public spending (σ_g^2) must have increased. This has indeed been a common complaint in the Netherlands during the last decade [Bomhoff (1982), Clerx and Maas (1984)].

In order to gain some further insight, it seems reasonable to assume that both σ_y^2 and σ_q^2 have increased between the first and second subperiods, or that at least they have not decreased. The deteriorating precision of national income forecasts is generally quoted as a major factor behind the breakdown of Structural Budget Policy in the 1970s. If we additionally make the supposition that σ_{qy} has roughly remained unaltered, then our parameter estimates seem consistent with the following sketch of changes in the stochastic structure around the planning process between the 1960s and the late 1970s [the verification in (6.9) is left to the reader].

The uncertainty around public spending (σ_g^2) has definitely increased, whereas that around taxation (σ_τ^2) seems to have remained fairly constant. A shift of the buffer role from the deficit towards public spending is reflected in the decreased uncertainty around the former (σ_b^2). As far as the covariance structure is concerned, there seems to have been a decline of the positive σ_{bg} and an increase of the positive $\sigma_{\tau g}$. Finally, the negative $\sigma_{b\tau}$ seems unaffected.

All this points at a shift of the buffer role from the deficit to spending, which is supported by historical evidence. Nevertheless, the apparent changes in the <u>co</u>variances of the planning errors should be interpreted with care. Recalling the digression on the frequency of budget planning in Section 3.5, it may well be true that Dutch governments decreased their planning period for spending and the deficit to less than a quarter by the late 1970s. This could be reflected in our covariance "estimates". The short-term cash limits on spending departments, which were imposed briefly around 1980, may have been one phenomenon through which the planning frequency was effectively increased. Notice, finally, that of course our error terms by construction contain everything which our model does not explain. This means that the precision of our statements on uncertainty around the budget will improve with the quality of the model itself. Further work along the lines suggested in Section 3.5 seems worthwhile.

6.6. Financing the Deficit

In the previous section we have seen that during the 1960s the deficit (or better: debt acceleration) variable $[\Delta_4 b_{it} - (B_{i-1t-1}/B_{it-1})\Delta_4 b_{i-1t}]$ was intended to behave in a countercyclical fashion. Since, however, it also absorbed the consequences of tax and expenditure smoothing and of short-run fluctuations in gas revenues and interest payments, it remains a question whether the policy was also effective as a countercyclical tool. While the identification of these regular patterns in budgetary behaviour in fact completes the task we set ourselves in this chapter, it appears interesting to go one step further and consider a second level at which the Dutch budget hehaved countercyclically in the 1960s. We shall do that in this section.

As explained, our total debt variable B_{it} has been measured such that it comprises both funded (BFU_{it}) and floating debt (BFL_{it}). The distinction between these two components coincides with the distinction, made by the fiscal and monetary authorities, between debt and money financing of the government deficit. BFL_{it} is part of the domestic liquidity supply (M2). It appears that during the 1960s the choice between these two means of financing the deficit was influenced by countercyclical macroeconomic considerations. Let us quote Drs. Den Dunnen of De Nederlandsche Bank: 'By keeping their capital market borrowing in line with the average long-term savings surplus of the personal and business sector and not with the actual surplus, the public authorities can bring about an interest rate development which exerts an additional balancing influence on the economy. In the case of excessive economic growth, with the savings surplus of the private sector relatively small, the capital market will not spontaneously accomodate public sector borrowing of a size equal to the long-run fiscal deficit. If, nevertheless, an attempt to that effect is made, interest rates will be pushed up, and contribute to a slow-down of private expenditure. Conversely, if in periods of a cyclical slow-down the actual financial deficit exceeds the long-term deficit, and the public authorities do not attune their capital market borrowing (entirely) to the relatively large actual savings surplus of the private sector, interest rates will fall, facilitating a recovery in private sector expenditure' [Den Dunnen (1981b)].

Therefore, suppose that, given the total financing requirement and thus the time path of the total public debt, the government smoothes its recourse to the capital market. I formalise this as a conventional Error Correction Mechanism of the form:

$$\Delta bfu_t = \alpha_1 + \alpha_2 \Delta b_t - \alpha_3 (bfu-b)_{t-1} \qquad (6.11)$$

where $\alpha_i \geq 0$, i=1,2,3. As explained for the analogous Error Correction models of Chapter 3, the development of BFU will be smooth relative to that of B if α_2 is close to zero. If α_2 is close to unity, the ratio BFU/B is smoothed. In view of the description by Den Dunnen, we should expect α_2 to be close to zero.

Furthermore, if there were one aspect of the fiscal budget which we might expect to behave in an anti-inflationary way, it would seem to be the way in which the government finances its deficits. However, I shall find evidence that during the 1960s this aspect was intended to be inflation-neutral, no more than that.

The result of estimating (6.11) is shown in the first column of Table 6.13. The correlations of the explanatory variables can be

Table 6.13. The Model for Funded Debt, 1960:1-1971:1

Dependent variable: $\Delta_4 bfu_{it} - \Delta_4 p_{it}^*$

	(1)	(2)
$(bfu-b)_{i\,t-1}$	−0.16 (.01) [.87]	−0.16 (.01) [.91]
$\Delta(bfu-b)_{i\,t-1}$	−0.20 (.05) [.20]	−0.18 (.05) [.23]
$(bfu-y)_{i-1\,t-1}$	−0.07 (.01) [.48]	−0.07 (.01) [.61]
$\Delta_2\Delta_4(y-p)_{it}$		0.12 (.03) [.15]
$\Delta_4 BOP_{i-2t}$		−0.21 (.06) [.23]
T	48	48
$\bar{R}^2$	0.52	0.64
$100\hat{\sigma}$	1.24%	1.07%
BP	14.14 (12)	9.92 (12)
η_2	1.20 (6,39)	1.30 (6,37)
ξ_2	7.48 (6)	8.33 (6)
η_4	0.38 (6,38)	1.11 (15,27)
ξ_4	2.73 (6)	18.31 (15)
ARCH	0.49 (1)	2.77 (1)
SK	0.39	−0.27
EK	−0.17	−0.82
NORM	1.19 (2)	1.74 (2)
η_1 (1970-71)	0.86 (8,37)	1.26 (8,35)
ξ_1 (1970-71)	7.27 (8)	11.38 (8)
η_1 (1972-73)	5.59 (8,45)	8.67 (8,43)
ξ_1 (1972-73)	58.25 (8)	94.79 (8)

Table 6.14. Correlation Matrix of Variables in Table 6.13

		1	2	3	4	5
1	$\Delta_4 bfu_{it} - \Delta_4 p_{it}^*$					
2	$(bfu-b)_{it-1}$	−0.29				
3	$\Delta(bfu-b)_{it-1}$	−0.30	0.28			
4	$(bfu-y)_{i-1t-1}$	−0.46	−0.35	−0.22		
5	$\Delta_2\Delta_4(y-p)_{it}$	0.22	−0.08	−0.10	0.05	
6	$\Delta_4 BOP_{i-2t}$	−0.16	0.08	0.07	−0.24	0.12

Note: 1960:1–1971:4.

found in Table 6.14. The dependent variable is the annual rate of growth of the stock of funded debt at the end of each quarter, deflated by expected annual inflation. This series is documented in Appendix B: it consists of the inflation predictions which are published by the independent Central Planning Bureau each year at the presentation of the Government Budget in September (Macro Economische Verkenningen). The series is smooth in the sense that I have used a moving average over the last two years. The value of the series is constant from the fourth quarter until the fourth quarter of next year. If we use a four-quarter moving average instead, the equation remains virtually unaffected. A t-test for the inclusion of expected inflation inflation $\Delta_4 p_{1t}^{*}$ in Column (1) has a value of 0.89, and for the inclusion in Column (2) a value of 0.34, indicating that the unit restriction on this variable cannot be rejected. Its presence is consistent with the results in Kremers (1983), where in the same context I compared the performance of inflation predictions from an estimated equation for inflation with these and other predictions published by the Central Planning Bureau and with that of actual inflation. A further evaluation of the results of that study in the light of Table 6.13 will be provided shortly.

The chosen lag structure is again data-based and seems reasonable. There is nothing mystic about the five-quarter lag on $(bfu-y)_{1-1t-1}$; a three-quarter moving average of (bfu-y), lagged by four quarters, leads to very similar results. This variable represents the idea that government has the tendency to finance a larger proportion of its deficit by money creation if the ratio of funded (or total) debt over national income is relatively high. This could reveal two intentions. First, it could represent a tendency of the government to seek its way out of excessive real indebtedness through inflation provoked by excessive money financing. With increasing U.S. deficits, this option currently receives ample attention (see the references quoted in Chapter 4). However, our feedback from (bfu–y) could equally well indicate a more conventional countercyclical policy, whereby relatively more money financing occurs when income is below trend. The latter possibility would seem to be the more likely one in the Dutch case, since it would be consistent with the underlying philosophy quoted above.

Indeed, the extended version of (6.11) which appears in the second column of Table 6.13 supports this claim. The positive coefficient on the acceleration of real income growth has a straightforward interpretation. The variable BOP_{it} denotes the quarterly National Liquidity Surplus scaled by BFU_{it}. The National Liquidity Surplus equals the total quarterly increase of the broad money supply (M2), minus domestic money creation. In other words, it represents money creation through the balance of payments. The Dutch monetary tradition assigns a major equilibrating role to the monetary influence of the balance of payments. When the balance of payments is in deficit, monetary policy tends to be tight, and in times of surplus the reverse tends to be the case. This is intended to restore equilibrium through the impact of monetary conditions on spending and output [see e.g. Kessler (1958) and Knoester and Van Sinderen (1985)]. The presence of the National Liquidity Surplus in our equation indicates that in the 1960s the fiscal policymaker has apparently supported this monetary policy through its deficit financing behaviour.

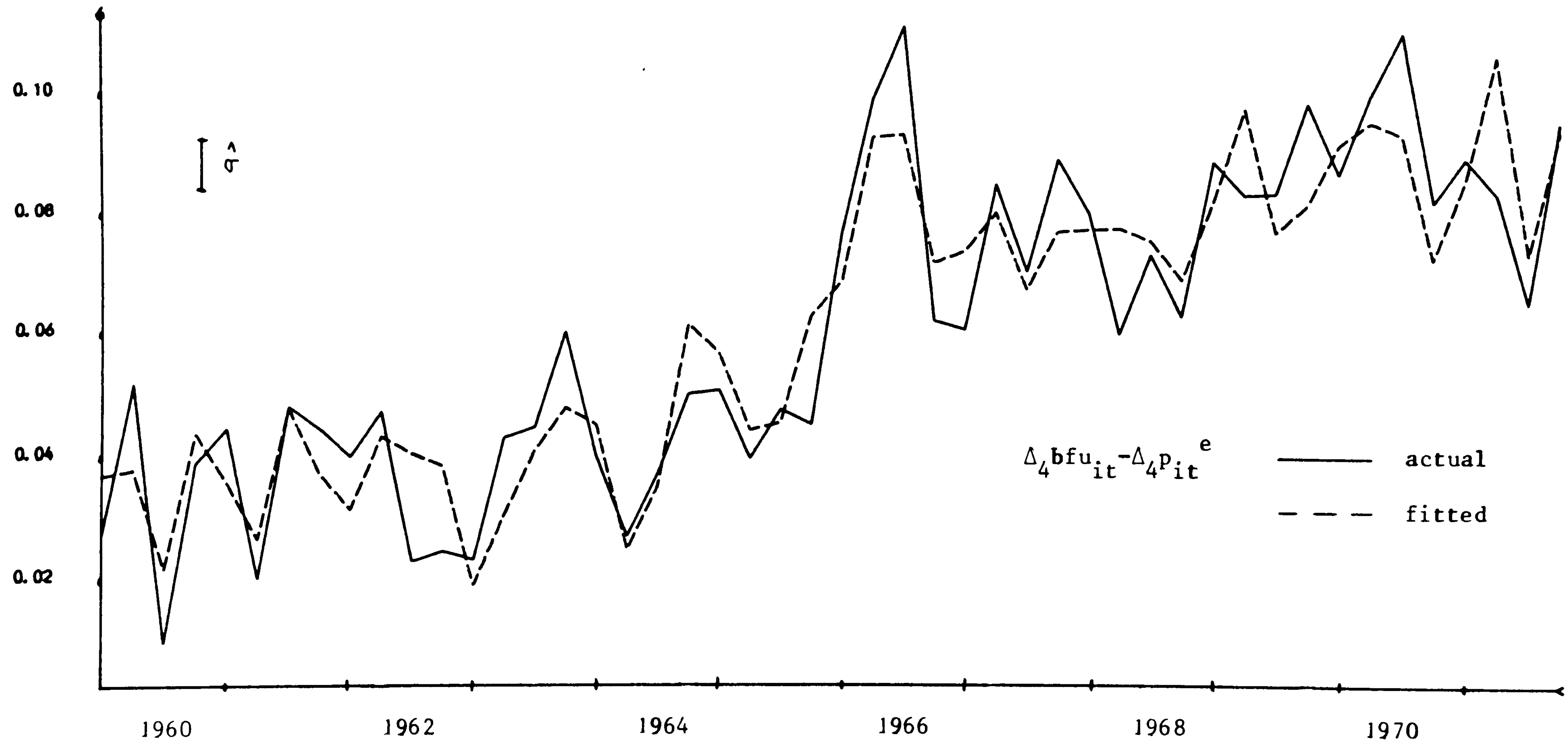
The addition of these two variables is a general improvement (see also Figure 6.11 for the actual and fitted values), although we do find a sign of ARCH-type heteroskedasticity entering the equation. This does not represent a major problem, but nevertheless indicates that there may have been systematic effects which we have not yet uncovered. I suspect that the apparent tendency of relatively large residuals to be followed by small ones, and vice versa, may be related to the occurrence of short-term speculative international capital movements. The government was supposed to counteract these speculative movements through borrowing and lending in the capital market. I have not yet been able to find a proper representation for this aspect of our equation, but it will probably be related in some way to the role of BOP_{it}. Finally, as in previous sections, I have not found a systematic reaction to interest rates (Figure 6.12).

The standard error of the equation is approximately 1.1% of the stock of funded debt. This compares favourably with the 2.5% which I estimated for the Barro model with roughly the same data as in this chapter, but over an inappropriately longer period [Kremers (1983)]. I shall comment on this issue below. For further comparison, the standard error which Barro (1979) obtains for the U.S. over 1948-1976 is 2.2%. In Barro (1984a) and in Chapter 4, Table 4.1, the standard error for the same period remains about the same, and Barro (1984) finds an improvement to 1.9% for 1951-1982.

It is interesting to contrast the short-run counter-cyclical nature of the financing rule with its underlying hypothetical long-run path. Setting the long-run real rate of debt growth to π_b, and $\Delta(bfu-b)_{it-1}=\Delta_2\Delta_4(y-p)_{it}=\Delta_4 BOP_{i-2t}=0$, we obtain:

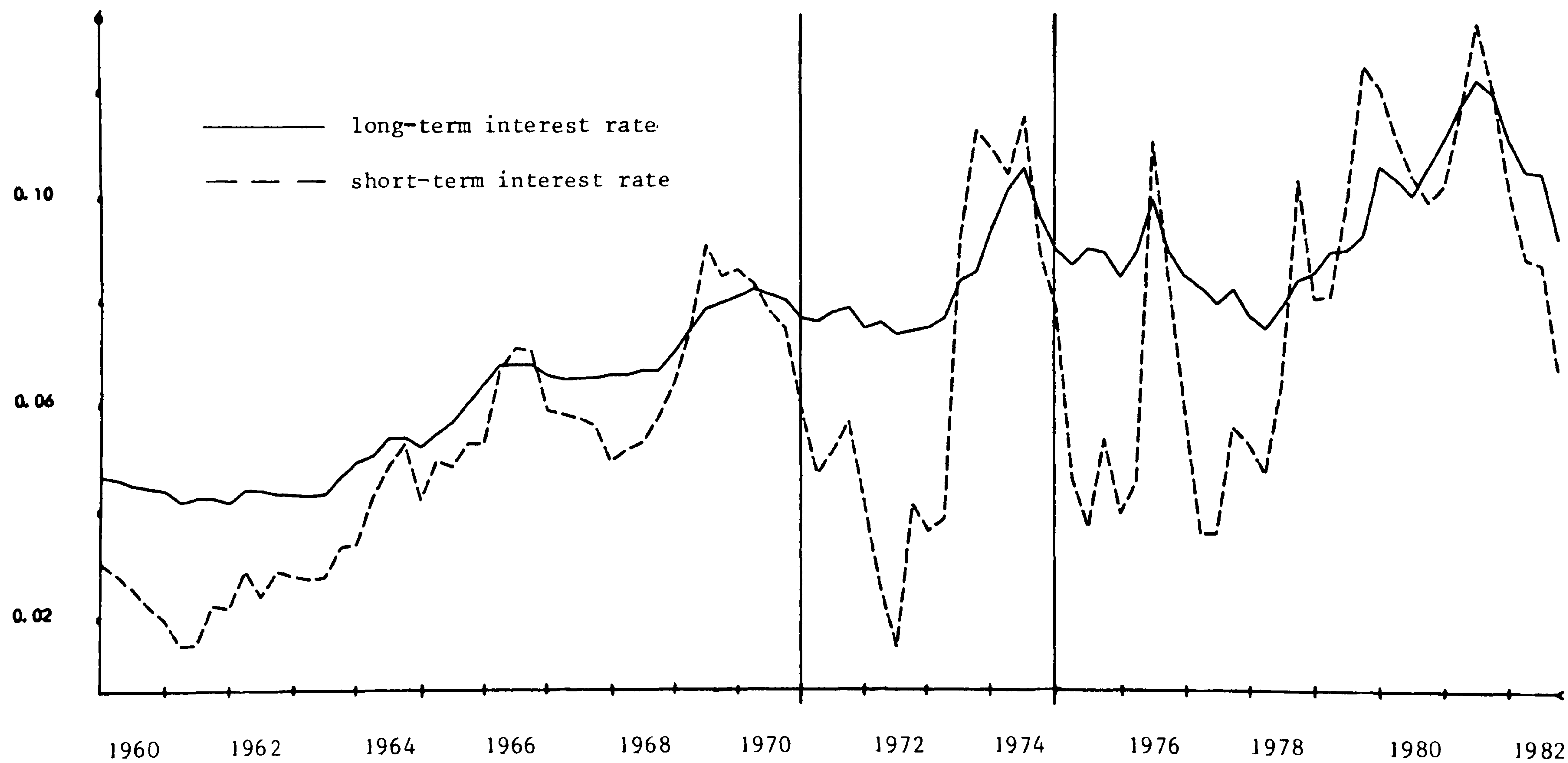
$$(BFU/B) = (B/Y)^{-0.31} \exp[-4.34\pi_b]$$

Figure 6.11. Actual and fitted funded debt growth



Source: Table 6.13, column (2)

Figure 6.12. Interest Rates



Source: Appendix B

Our model embodies a target for BFU/B as a function of the long-run ratio B/Y, or, equivalently, of BFU/Y. As reported in previous sections, we have not found any evidence of a long-run target for the debt/income ratio. Figure 6.5 shows that this ratio declined during the 1960s, and Figure 6.6 shows that BFU/B increased during most of that period. These favourable developments may have been the "rewards" for a successful countercyclical policy, but, as remarked, the actual effectiveness of the policies modelled in this study remains to be determined by further empirical research. Of course, these developments could also be seen as evidence of an overly restrictive policy, but in view of the strong growth of the Dutch economy in the 1960s (Figure 5.8) this does not seem reasonable. Incidentally, the insignificance of a proper trend-term in the equations indicates that (bfu-y) does not just proxy a trend: there seems to be a genuine relationship between the long-run paths of BFU/B and B/Y.

As the prediction tests for 1972-73 show, the equation breaks down in the early 1970s. In the course of that decade, the pattern of the funded debt started to follow that of the total debt much more closely than the smooth pattern of the 1960s. This is not so surprising in a period of increasing pressure on the budget and especially on the deficit. With the arrival of this pressure and of 'front-loading' of capital market borrowing within the fiscal year, and with the occurrance of an unprecedented conflict between the Cabinet and the Central Bank over government money financing in the late 1970s, it becomes difficult to discern a stable underlying pattern such as that of the 1960s.

As a more general point, however, the setup of this chapter seems to have its merits. The distinction between total deficit financing and funded debt creation appears a fruitful one. It explains why I rejected the Barro model for the 1960s in Kremers (1983). The model of Barro assigns debt creation the role of buffer in the budget, and following the work of Barro (1979,1980,1984a) I estimated it with data on the funded debt. This section explains that in the 1960s the pattern of the funded debt was quite different from that of the total debt. I have tested this formally by including the explanatory variables of the model for the funded debt in that of the total debt, and *vice versa*. The resulting insignificance of both additions clearly demonstrates the difference between the two patterns.

The disappearance of that difference during the 1970s explains why the Barro model *appeared* to work fairly satisfactorily for that period [Kremers (1983)], as mere regaining of control over the budget became the dominant policy objective.

6.7. Concluding Remarks and Some Further Historical Perspective

Let us first summarise the progress of the model of this chapter relative to earlier work, and then proceed to some observations of an historical character.

The appropriateness of analysing the budget as a whole has already been emphasised, and demonstrated by the empirical results of this chapter. Consider how far an alternative analysis along the Barro line could have brought us in the present context. In our approach, we have revealed the coefficients of the derived deficit equation through separate models for public spending and taxation. If we would have restricted ourselves to estimating an equation for the deficit only, several of the correctly specified coefficients might have appeared insignificant since we would have utilised substantially less information. Furthermore, as our treatment of scaling and the role of the coefficient formulae of Table 3.1 have demonstrated, it remains to be seen whether such an approach would naturally have guided us to the appropriate explanatory variables and their scalings in the debt equation. Moreover, a number of explanatory variables (such as for instance the Error Correction feedbacks on spending and taxation) appear to share a high degree of multicollinearity over the relevant subsamples. In a single debt equation this would have introduced identification problems, which we have avoided through a more appropriate parameterisation. The tax smoothing idea is modelled explicitly, and the resulting equation for the deficit corresponds to the total public debt which includes the consequences of money creation.

An additional advantage of our approach to analyse the behaviour of the deficit through separate models for public spending and taxation lies in the operational insight it may offer. In practice, a policymaker executes his budget by operating on tax rates and on expenditure programmes, not on the deficit which by its very nature is a balancing item [see Goudswaard and Halberstadt (1982) for this practical aspect].

A potential problem with the setup of Barro (1979,1980,1984a) is highlighted by our distinction between debt and money financing. Barro presents his model of public debt creation as the empirical specification of his <u>tax</u> smoothing theory. This specification does not only require the assumption that public spending is sufficiently exogenous to the deficit/tax choice, but it also assumes that there is no systematic role for money financing. Barro estimates his debt growth equation with data on funded Federal debt in the hands of the public. Our results for the 1960s in this chapter, in combination with our estimations along the Barro line in Kremers (1983), show that the latter is an assumption which cannot be made on <u>a priori</u> grounds.

Furthermore, we have found that the Dutch spending/income and tax/income ratios have actually been smoothed towards their underlying long-run targets. Using U.S. data we showed in Chapter 4 that there can be tension in the budget which is connected with the level of the public debt (in the U.S. case in the form of a target for the ratio of real interest payments over national income). There are forces in the public finances which move spending, taxation and the debt towards long-run developments in line with the path of national income.

The model proposed in this study may serve as a framework for further empirical and theoretical research. The extension in the direction of endogenising macroeconomic variables such as national income and the interest rate has been suggested in Chapter 3. Another aspect which may benefit from an explicit and systematic treatment is the political side of budgetary policy. I end this chapter by throwing some historical light on this aspect of our empirical results on the Netherlands.

During the period under consideration there have been parliamentary elections in 1963:2, 1967:1, 1971:2, 1972:4, 1977:2 and 1982:2. A superficial glance over the actual and fitted values of public spending (Figure 6.7), taxation (Figure 6.8) and the ensuing debt acceleration (Figure 6.9) does not show a markedly similar pattern around those quarters. A further look offers the following insights.

Only the 1967:1 and 1971:2 elections seem to have provoked exceptionally high public spending growth. The first occasion does not show in Figure 6.7, but recall that we removed 1967:2 from the sample by including a dummy for that quarter (see below). The overprediction of spending during 1969:4–1970:3 and the subsequent underprediction during 1970:4–1971:2 may be related to the election of 1971:2.

As regards taxation, there is a large residual just after the 1972:4 election, but it is questionable whether there exists a direct relation between the two (see below).

In the debt acceleration figure, significance may again be attached to the underprediction of the two quarters just before the election of 1971:2.

I have not tested formally whether these residuals are significantly different from zero, primarily because political influences may require more systematic attention. Our preliminary glance does not suggest any obvious approaches, but an extension of our model in Chapter 3 may lead to as yet unexpected results.

This crude attempt to assess the direct impact of elections on the budget is not intended to imply an assumed irrelevance of political events which are not directly connected with an election. Several such events occurred during the two decades under consideration. Those related to the comings and goings of innovative Ministers of Finance have already been highlighted, and two further occasions seem worth mentioning.

The large unexplained residual for 1967:2 which justified the presence of a dummy variable in the spending equation is undoubtedly related to the so-called "Night of Schmeltzer", during which the Roman (Catholic) Red (Socialist) Cabinet-Cals was sent home by its own Catholic supporters led by Dr. Schmeltzer in a turmoil over the alledgedly excessive growth of public expenditure. The Night itself took place in 1966:4. Between the demise of the Cals Cabinet and the elections of 1967:1, a temporary cabinet under Dr. Zijlstra postponed some projected tax cuts and raised additional revenues in order to alleviate pressure on the budget deficit. Our model underpredicts taxation during this period, albeit only slightly. The proposed tax cuts may have been executed later, which could help explain the large 1968:2 residual in our tax model. The excess of actual spending growth over that fitted by our model for 1967:2 could similarly reflect postponed public spending.

In 1973:4 the model overpredicts public spending and underpredicts taxation, resulting in a large overprediction of the deficit. This is the volatile period of the first oil shock and the OPEC oil boycot of the Netherlands. In addition, during this period the so-called "Machtigingswet" (Enabling Act) granted government exceptional and temporary powers in order to reduce budget deficits.

These are some examples of how the residuals of our model may be placed against an historical background. Although statistically the residuals seem truely random, further historical clarification (for instance of the spending and taxation overpredictions in 1978) could be interesting.

Footnotes Chapter 6

1. As indicated by Drs. Wieleman of the Ministry of Economic Affairs, which deals with gas exploitation.

2. After completion of this study, I found a model for expected gas revenues in Central Planning Bureau (1983). It is unclear whether its data set would be compatible with that used in this study. Nevertheless, further attention to this issue could benefit from the work at CPB, and also at the Ministry of Finance where estimates of future gas revenues and interest payments should be available.

CHAPTER 7. CONCLUSION AND PERSPECTIVE

A number of evaluating remarks, placing our findings in the light of the task we set ourselves in Chapter 1, have already been made in the concluding sections of the individual chapters. I shall not repeat them here, but just highlight the salient points and proceed to a brief sketch of a perspective for further research.

Chapter 2 formulated a theoretical foundation for the tax smoothing notion which underlies the model of Barro (1979,1980,1984a) and of Chapter 3 and 6. However, Chapter 3 presented a transition from long-run budgetary targets to observed policy patterns which diverges from that of Barro in major respects. We distinguished between reactions of the budget to short-run developments in the economy and reactions to disequilibria incurred in the past. Instead of confining ourselves to debt creation only, we modelled the budget as a whole. In Chapters 4 and 6 we illustrated the relevance of this approach with empirical studies of the public finances in the U.S. and the Netherlands. It appears to be feasible to identify short-run and long-run strands in public financial behaviour empirically. The same is true for budget "tension" due to temporary conflicts between long- and short-run targets and the stock-flow dynamics of debt and deficits. In view of Buiter's requirements for measuring the stance of fiscal policy (Section 1.4), the insights and opportunities for empirical measurement offered by our approach seem to form a step in the right direction.

The attraction of our flexible treatment of econometric specification was reflected in the quality of the empirical model of

Chapter 6. While allowing the identification of relevant aspects from the theory of Chapter 3, the model is sufficiently flexible to capture the Dutch quarterly data in a satisfactory way. It clearly identifies changes of regime during the early 1970s, which were "overlooked" by F-tests in the model of Hubbard (1983). Finally, it explains why previous efforts to model public debt creation in the Netherlands along the lines of the Barro approach had run into difficulties [Kremers (1983)]. The various aspects of our model were carefully scrutinised and found to be interpretable against the historical background of the Dutch economy and public finances presented in Chapter 5.

Let us now highlight some implications of these results, and offer suggestions for further work.

As far as economic theory is concerned, current research indicates that it may be interesting to supplement dynamic macro models such as that of Rau (1985) with "tension" in the budget. The idea is that governments do not only observe an intertemporal budget constraint which extends into the infinite future, but that there are also limits to the degree to which budgets can diverge from long-run sustainable values over any finite period of time. Looking back to Chapter 6, we find that this tension may persist across different short-run regimes. Therefore, it will be worthwhile to study the theoretical merits of alternative short-run reactions of the budget within the confines of such long-run tension.

Further evidence for the relevance of this proposal is provided by the studies on natural resources and the macroeconomy collected by Neary and Van Wijnbergen (1986). One of the main conclusions of that volume concerns the difficulty of evaluating "Dutch Disease" problems and making policy recommendations if constraints on policy are not systematically taken into account (see the Round-Table Discussion reported in Chapter 10).

There seem to be a number of ways in which our approach could be utilised in further empirical research. First, it offers an improved and important ingredient for the Barro (1977,1978,1980) type of macroeconomic analysis, which builds on the distinction between anticipated and unanticipated components in public policy. By computing the difference between the short-run fitted values of our model and its underlying long-run solution, we may also be able to distinguish between permanent and transitory components [Buiter (1985)]. In addition, it will be interesting to incorporate aspects of our model into more general macroeconometric models such that of De Nederlandsche Bank [Fase (1982)] and the Central Planning Bureau (1983). Neither of these models pays much attention to regular patterns of economic policy, although the Central Planning Bureau seems to acknowledge that under particular circumstances it ought to do so (pp. 85, 92). Furthermore, if we extended our model with an explicit specification of expectations formation we could identify uncertainty around the budget more precisely than in Chapter 6 and study its economic effects [Bomhoff and Veugelers (1982) use Kalman Filter methods for this purpose].

The Error Correction approach may also be further applied to analyse the relationship between budget deficits and money financing. Most authors quoted in Section 4.5 concentrate on a contemporaneous relationship only, but specifications built on the "gradual" Error Correction mechanism may be more appropriate (Section 6.6).

Chapters 5 and 6 provide a fairly complete picture of recent difficulties in the public finances of the Netherlands. Now that the troublesome equilibrating process of the late 1970s and the early 1980s is nearing its completion, voices are heard to formulate a new and improved version of Structural Budget Policy to guide the public finances into the 1990s [Van Muiswinkel (1979), Meys (1981), Goudswaard and Halberstadt (1982), Halberstadt <u>et al.</u> (1982b), Kremers (1984b,1986)]. Drs. Meys, who is the former Director of the Budget, recently (1983) wrote that, while by now the <u>diagnosis</u> of the Dutch difficulties seems clear, a lot of research still remains to be done before we shall understand <u>why</u> things went wrong, and before we can make sure that future policies will not make past mistakes. Our analysis suggests a few lessons and may form an input into that research. We find that the formation of a sustainable countercyclical policy should not only pay attention to the budget's <u>impact</u> reaction to the business cycle (this was the emphasis of SBP), but also to its disequilibrium feedback. This has implications for the policy's effectiveness. The countercyclical efficacy of an impact reaction, which is by itself well-timed relative to the business cycle, may be disturbed by disequilibrium feedback (<u>e.g.</u> on the stock of debt). The Netherlands came to realise this in the 1970s, as the latter started to dominate the budgetary pattern in a period when some counter-recession leeway would have been very valuable.

The difference between these two aspects of budgetary policy also carries implications for its operational dimension. It is generally perceived in the Netherlands that unchecked developments of public expenditure were at the core of the breakdown of SBP. However, this is only partly true. As we have seen, the first systematic departures from the policy occurred in the early 1970s under the Minister of Finance Dr. Nelissen, motivated by concern for alledgedly excessive budget deficits rather than public spending. The fact that we have not been able to uncover any systematic feedback from debt, interest payments or the deficit during the 1960s is suggestive for the proposition that this aspect may have been overlooked in the original SBP setup. Again, it emphasises the importance of focussing on the <u>budget-wide</u> implications of public financial policy rules. Had there been agreement in the 1960s on a place for gradual disequilibrium feedback, both related to the debt/deficit and to public spending, then the abrupt and costly changes of the early 1970s could perhaps have been avoided.

Our analysis is formulated at a high level of aggregation. For practical purposes, our comprehensive variables will have to be disaggregated into manageable categories. We may disaggregate, say, total expenditure into well-chosen categories and compare their dynamic behaviour with that of the aggregate [<u>cf.</u> Dunne <u>et al.</u> (1984) on public spending categories in the U.K.]. This could help to identify which areas of the budget have tended to contribute to desirable aspects of the aggregate pattern, and which have been a source of undesired disturbances. It does not seem meaningful to study the regular and stochastic interrelationships of subcategories in the budget without an aggregate background against which to evaluate them. The framework of this study may thus also contribute to the practical operationalisation of an improved set of rules to guide aggregate public financial policy.

Appendix A. The U.S. Data

Data series for 1867-1983 are given in Table A.1 below. For Figure 4.3 I used the Yield on Long-Term High-Grade Corporate Bonds from Friedman and Schwartz (1982, Table 4.8, Column 8) for 1867-1975, and Moody's Aaa Index of Corporate Bond Rates from U.S. Council of Economic Advisers, Economic Report to the President, for 1976-1983.

In the context of inflation-corrected interest payments (1930-1983), I used the same data on the stock of debt (B) and nominal interest payments (PI) as for 1867-1983. For convenience, these are also shown in Table A.2, which contains data and sources on the market value of the stock of debt (BM) and inflation as anticipated in year t-1 for year t (π_{pt}^e). For compatibility with Barro (1979,1984a), the regressions reported in Table 4.1 use data on GNP rather than NNP which were used in the computations for 1867-1983. Data on GNP and their source are given in Table A.2 as well.

Table A.1. U.S. Data, 1867-1983

	B	PG	PT	PI	PY	P
1867	2.692	0.2032	0.463	0.1438		
1868	2.636	0.2296	0.376	0.1404		
1869	2.657	0.1903	0.357	0.1307	8.89141	0.72000
1870	2.480	0.1648	0.396	0.1292	8.64443	0.69307
1871	2.353	0.1574	0.374	0.1256	8.52093	0.69000
1872	2.253	0.1536	0.365	0.1174	10.00284	0.65854
1873	2.235	0.1802	0.322	0.1048	10.00284	0.65854
1874	2.252	0.1939	0.300	0.1071	9.63236	0.65000
1875	2.232	0.1719	0.284	0.1031	9.50887	0.63636
1876	2.180	0.1648	0.290	0.1002	9.63236	0.60465
1877	2.205	0.1439	0.281	0.0971	10.00284	0.58273
1878	2.256	0.1345	0.257	0.1025	9.87934	0.54054
1879	2.349	0.1617	0.272	0.1053	10.49680	0.51829
1880	1.919	0.1692	0.334	0.0958	13.33711	0.57447
1881	1.820	0.1775	0.361	0.0825	13.33711	0.56545
1882	1.675	0.1869	0.404	0.0711	14.32505	0.58291
1883	1.539	0.2058	0.398	0.0592	13.83108	0.57143
1884	1.439	0.1894	0.349	0.0546	13.46061	0.54500
1885	1.375	0.2086	0.324	0.0514	12.47267	0.50500
1886	1.282	0.1928	0.336	0.0502	12.96664	0.50000
1887	1.175	0.2203	0.371	0.0477	13.46061	0.50698
1888	1.063	0.2153	0.379	0.0447	13.21362	0.51442
1889	0.976	0.2410	0.387	0.0410	13.70759	0.51869
1890	0.891	0.2619	0.403	0.0361	14.57203	0.51082
1891	0.852	0.3174	0.393	0.0376	14.94251	0.50207
1892	0.842	0.3216	0.355	0.0234	15.68346	0.48289
1893	0.839	0.3567	0.386	0.0273	15.43647	0.49407
1894	0.899	0.3402	0.298	0.0278	13.58410	0.4641
1895	0.902	0.3250	0.313	0.0310	14.94251	0.4566
1896	0.955	0.3166	0.327	0.0354	14.07806	0.4418
1897	0.987	0.3282	0.347	0.0378	15.55997	0.4452
1898	1.027	0.4054	0.405	0.0376	16.30092	0.4583
1899	1.155	0.5657	0.516	0.0393	18.64726	0.4704
1900	1.108	0.4478	0.567	0.0402	20.25266	0.4939
1901	1.045	0.4777	0.588	0.0323	22.59900	0.4945
1902	0.970	0.4419	0.562	0.0291	23.33995	0.5108
1903	0.925	0.4774	0.560	0.0286	24.57487	0.5155
1904	0.967	0.5074	0.541	0.0246	24.45138	0.5238
1905	0.990	0.5384	0.544	0.0246	26.92121	0.5343
1906	0.964	0.5247	0.595	0.0243	31.11993	0.5454
1907	0.879	0.5275	0.663	0.0245	32.72533	0.5686
1908	0.938	0.5996	0.601	0.0214	29.14406	0.5673
1909	1.024	0.6402	0.604	0.0218	34.33072	0.5877
1910	1.046	0.6387	0.676	0.0213	35.81262	0.6029
1911	1.016	0.6327	0.701	0.0213	36.05960	0.5971
1912	1.028	0.6324	0.692	0.0226	39.64087	0.623
1913	1.029	0.6601	0.724	0.0229	41.74023	0.627
1914	1.027	0.6771	0.735	0.0229	38.15897	0.635
1915	1.090	0.7081	0.698	0.0229	40.50531	0.654
1916	0.989	0.7021	0.780	0.0229	53.71893	0.739

Table A.1. Continued

	B	PG	PT	PI	PY	P
1917	1.938	2.0423	1.118	0.0247	64.58621	0.91274
1918	11.533	13.5715	4.174	0.1975	81.62807	1.05087
1919	24.200	18.3243	4.648	0.6157	86.32076	1.06718
1920	23.300	5.1120	6.695	1.0240	93.48329	1.21704
1921	22.400	3.3253	5.573	0.9967	76.31793	1.03691
1922	21.600	2.0486	4.106	1.0264	77.79983	0.98592
1923	20.800	2.1000	4.598	1.0560	91.50742	1.00816
1924	19.800	1.9211	4.382	0.9689	92.86583	0.99471
1925	19.800	2.1292	4.278	0.8818	97.06455	1.01682
1926	17.700	1.9363	4.575	0.9927	104.47406	1.02174
1927	16.600	1.9961	4.578	0.9239	102.62168	0.99402
1928	15.800	2.2514	4.390	0.8546	104.96803	1.00118
1929	14.900	2.3000	3.800	0.3000	111.51309	1.00000
1930	14.800	2.6000	3.000	0.2000	94.96519	0.95528
1931	16.100	3.9000	2.000	0.3000	76.19444	0.83946
1932	18.200	2.8000	1.700	0.4000	55.32433	0.74295
1933	21.400	3.6000	2.700	0.4000	52.73100	0.73368
1934	25.300	5.9000	3.500	0.5000	62.11637	0.78106
1935	30.200	6.0000	4.000	0.5000	71.87222	0.77188
1936	33.500	8.3000	5.000	0.4000	84.34489	0.80353
1937	34.500	6.8000	7.000	0.6000	92.74234	0.81014
1938	36.000	8.0000	6.500	0.6000	84.96236	0.80562
1939	38.600	8.3000	6.700	0.6000	91.13695	0.79957
1940	41.500	9.3000	8.600	0.7000	101.01629	0.80830
1941	53.000	19.7000	15.400	0.8000	122.25687	0.87379
1942	94.900	55.1000	22.900	1.0000	159.67490	0.98702
1943	142.600	84.2000	39.300	1.6000	194.49957	1.11702
1944	192.600	93.4000	41.000	2.1000	211.78844	1.20014
1945	228.200	81.7000	42.500	2.9000	213.64081	1.25272
1946	207.200	31.7000	39.100	3.9000	198.20433	1.26378
1947	201.000	25.7000	43.200	4.1000	221.05031	1.36537
1948	193.600	30.8000	43.200	4.1000	245.00772	1.45668
1949	200.399	37.0000	38.700	4.3000	242.16740	1.43768
1950	197.600	36.4000	50.000	4.4000	269.08862	1.46537
1951	194.000	53.4000	64.300	4.4000	310.45837	1.56149
1952	197.700	66.6000	67.300	4.5000	325.77136	1.58059
1953	201.500	72.5000	70.000	4.6000	343.06021	1.60393
1954	204.100	65.2000	63.700	4.6000	341.82529	1.62632
1955	204.000	63.5000	72.600	4.6000	373.31570	1.66099
1956	198.100	66.8000	78.000	5.1000	391.71597	1.70813
1957	195.899	74.1000	82.000	5.5000	411.10419	1.76605
1958	202.399	83.7000	78.700	5.2000	415.17941	1.7902
1959	209.600	84.8000	89.800	6.2000	451.73300	1.8308
1960	206.600	86.3000	96.100	6.8000	470.13327	1.8643
1961	211.300	95.7000	98.100	6.2000	486.43417	1.8828
1962	215.300	103.6000	106.200	6.8000	526.56903	1.9224
1963	216.399	106.9000	114.400	7.3000	556.45404	1.9514
1964	218.100	110.2000	114.900	8.0000	596.21838	1.9835
1965	216.100	115.4000	124.300	8.4000	646.85004	2.0270
1966	214.899	134.3999	141.800	9.2000	709.08990	2.0956

Table A.1. Continued

	B	PG	PT	PI	PY	P
1967	218.899	153.8999	150.500	9.8000	748.11328	2.15741
1968	225.600	169.2000	174.399	11.3000	815.16937	2.24830
1969	220.000	175.7000	196.899	12.7000	875.06287	2.35337
1970	228.000	190.2000	191.899	14.1000	914.58026	2.47609
1971	246.100	206.8000	198.600	13.8000	989.53973	2.59320
1972	260.500	229.8999	227.500	14.4000	1093.27283	2.71315
1973	259.600	246.2000	258.600	18.0000	1219.48145	2.85487
1974	269.899	278.6000	287.799	20.7000	1308.39563	3.09614
1975	348.399	333.5000	287.299	23.1000	1389.90015	3.34473
1976	408.500	358.0000	331.799	26.8000	1543.03003	3.49706
1977	461.299	392.0000	375.200	29.1000	1723.20447	3.69838
1978	508.600	425.7999	431.600	35.2000	1941.41455	3.87599
1979	540.500	467.2999	493.600	42.4000	2161.72388	4.20490
1980	616.400	548.7000	540.900	53.4000	2338.56421	4.58745
1981	694.500	615.7999	624.799	73.3000	2627.53491	5.03836
1982	848.400	680.5000	616.700	84.4000	2710.39795	5.34535
1983	1022.599	725.5000	641.099	94.2000	2927.62012	5.56895

NOTE - B= end-of-year value in billions of dollars of privately held interest-beari Federal debt at nominal par value (1867-1916: Dewey (1924), Treasury cash netted ou 1917-1918: own calculation; 1919-1976: Barro (1979); 1977-1983: IMF International Financial Statistics, 88-88aa). PG = nominal total Federal expenditure, net of PI, billions (1867-1921: Dewey (1924); 1922-1928: own calculations based on Firestone (1960); 1929-1983: U.S. Department of Commerce, T. 3.2). PT = nominal total Federal receipts, billions (1867-1921: Dewey(1924); 1922-1928: own calculations based on Firestone (1960); 1929-1983: U.S. Department of Commerce, T. 3.2). PI = nominal net interest paid on Federal debt, billions (1867-1921: Dewey (1924); 1922-1928: own calculations based on Newcomer (1937) and Ratchford (1947); 1929-1983: U.S. Department of Commerce, T. 3.2). PY = nominal Net National Product, billions (1867-1975: Friedman and Schwartz (1982), T. 4.8; 1976-1983: U.S. Department of Commerce, T. 1.7). P = Implicit Price Deflator, 1929 = 1.0 (1867-1975: Friedman and Schwartz (1982), T. 4.8; 1976-1983: U.S. Department of Commerce, T. 1.7).

Table A.2. U.S. Data, 1930–1983

	B	BM	π^{e}_{pt}	PI	PY
1930	14.8	16.7	-0.031	0.2	90.4
1931	16.1	15.9	-0.030	0.3	75.8
1932	18.2	16.6	-0.008	0.4	58.0
1933	21.4	17.5	-0.021	0.4	55.6
1934	25.3	18.6	0.010	0.5	65.1
1935	30.2	20.0	0.040	0.5	72.2
1936	33.5	25.8	0.036	0.4	82.5
1937	34.5	26.1	0.016	0.6	90.4
1938	36.0	30.3	-0.014	0.6	84.7
1939	38.6	35.9	-0.011	0.6	90.9
1940	41.5	40.9	0.015	0.7	100.0
1941	53.0	55.7	0.030	0.8	125.0
1942	94.9	97.3		1.0	158.5
1943	142.6	145.4		1.6	192.1
1944	192.6	189.2		2.1	210.6
1945	228.2	234.3		2.9	212.3
1946	207.2	212.8		3.9	209.8
1947	201.0	203.3		4.1	233.1
1948	193.6	196.1		4.1	259.5
1949	200.3	200.9	-0.008	4.3	258.2
1950	197.6	200.6	0.002	4.4	286.5
1951	194.0	192.5	0.015	4.4	330.7
1952	197.7	196.0	0.017	4.5	348.0
1953	201.5	201.3	0.014	4.6	366.7
1954	204.1	204.6	0.001	4.6	366.7
1955	204.0	200.5	0.018	4.6	400.0
1956	198.1	190.2	-0.001	5.1	421.7
1957	195.8	193.5	0.013	5.5	444.0
1958	202.3	194.1	0.025	5.2	449.7
1959	209.6	197.1	0.019	6.2	487.8
1960	206.6	203.5	0.008	6.8	506.5
1961	211.3	206.0	0.018	6.2	524.5
1962	215.3	212.8	0.005	6.8	565.0
1963	216.3	211.4	0.009	7.3	596.7
1964	218.1	213.5	0.018	8.0	637.7
1965	216.1	208.3	0.020	8.4	691.0
1966	214.8	208.5	0.023	9.2	756.0
1967	218.8	208.2	0.031	9.8	799.5
1968	225.6	213.8	0.035	11.3	873.4
1969	220.0	202.5	0.037	12.7	944.0
1970	228.0	221.5	0.058	14.1	992.7
1971	246.1	243.6	0.052	13.8	1077.5
1972	260.5	255.0	0.043	14.4	1185.9
1973	259.6	251.1	0.055	18.0	1326.4
1974	269.8	262.3	0.059	20.7	1434.1
1975	348.3	343.1	0.094	23.1	1549.1
1976	408.5	409.6	0.093	26.8	1718.0
1977	461.2	455.2	0.062	29.1	1918.3
1978	508.6	487.7	0.064	35.2	2163.8
1979	540.5	507.4	0.076	42.4	2417.8
1980	616.4	569.4	0.084	53.4	2631.6
1981	694.5	652.0	0.097	73.3	2957.8
1982	848.4	868.8	0.065	84.4	3069.3
1983	1022.5		0.058	94.2	3304.8

Table A.2. Continued

NOTE - For B and PI, see Table A.1; BM = market value of debt outstanding, calculated by multiplying B by the market-to-par ratios published by Seater (1981) and De Leeuw and Holloway (1983); π^{e}_{pt} = anticipated inflation (Barro (1984a), T. 4); PY = nominal Gross National Product, billions (U.S. Council of Economic Advisers).

Appendix B. The Dutch Data Used in Chapter 6

This appendix contains exact source references for data which are readily available, and only lists those data which are not.

To begin with, reconsider the government budget:

$$G_t+I_t=T_t+(BFU_t-BFU_{t-1})+(BFL_t-BFL_{t-1})+GR_t+UNCAT_t \qquad (B.1)$$

The main data source for these variables (quarterly, in current Guilders) is: De Nederlandsche Bank, Monetaire en Financiële Jaar- en Kwartaalreeksen, 1957-1983, Amsterdam: 1985 (abbreviated as MFJK). This publication contains the most up-to-date material, and all empirical results reported in Chapter 6 use those data. However, much of the work was originally done with the equivalent data from: De Nederlandsche Bank, Quarterly Statistics, various issues. The latter is available in english, and the classification of tables is the same in both publications. I proceed by giving the exact sources per variable in MFJK. All data refer to Central Government ('Rijk'). Stocks are end-of-period.

Budget flows are measured on a cash rather than on a transactions basis. Measurement on transactions basis would record flows of goods and services, while on cash basis one records financial flows [Compaijen and Van Til (1978)]. The difference consists of temporary credit. The National Accounts are mostly on transactions basis, but even there payments of interest and tax are on cash basis. Measured data on these variables on transactions basis do not exist. Furthermore, the data on cash basis provide the desired exact connection of the budget variables and deficit financing with the monetary analysis of De Nederlandsche Bank. The sources are as follows.

G = total public expenditure, million (MFJK, Table 5.1: Row 3); minus interest payments (Table B.1 below). I = interest payments on public debt, million (Table B.1). T = total tax and other (mainly transitory) revenue, million (MFJK, Table 5.1: Row 1 plus Row 2); minus gas revenues (Table B.1). BFU = stock of funded public debt, million (Table B.1). BFL = stock of floating public debt, million (Table B.1). GR = gas revenues, million (Table B.1). UNCAT = uncategorised items; this includes a number of relatively minor items which De Nederlandsche Bank records separately (MFJK, Table 5.1: Rows 4, 5 and 6: 'Deficit of e.g. the Municipalities Fund', 'Surplus Investment Account Fund', and 'Special receipts and expenditures'). This variable does not play any explicit role in our empirical analysis; its exact numerical value can be derived as the rest term in (B.1) above.

For 'national income' I use data on the Net National Product at current market prices (De Nederlandsche Bank, Kwartaalconfrontatie van Middelen en Bestedingen, 1957-1980, Amsterdam: 1982, which contains an explanation in english; recent updates can be found in the Bank's Quarterly Statistics which has recently been renamed Quarterly Bulletin). The NNP series is compiled from the National Accounts of the Central Bureau of Statistics, in which there is a break in 1977. I have corrected for the break by subtracting the pre- and post-break difference on pivot observation 1977:1 from the observations for 1977:2-1982:4. As an alternative, one could scale the post-break period. This choice has been checked not to affect our empirical results to any significant extent.

The data for the price level were derived by dividing the nominal NNP data by real NNP in 1977 prices, which can be found at the same place as the data on nominal NNP.

The National Liquidity Surplus is in MFJK, Table 4.2: Row 4.

At various points in the analysis, I mention that interest rate variables do not play a significant role. For the long-run interest rate, I used the Yield on Long-Term Central Government Bonds (weighted average of the latest three long-term loans: International Monetary Fund, International Financial Statistics, Row 61; also in MFJK, Table 9). The short-run rate is that on short-term Cash Loans to Local Authorities (MFJK, Table 9, end-of-quarter monthly averages).

Table B.1. Dutch Data, 1957:1-1982:4

	I	BFU	BFL	GR	$\Delta_4 p^e_{it}$
1957:1	154.570	11584	4395		
1957:2	105.534	11536	4773		
1957:3	131.651	11461	4459		
1957:4	141.245	11606	4020		
1958:1	209.509	11613	4388		
1958:2	115.374	11510	4764		
1958:3	149.814	11378	4859		
1958:4	98.728	11651	4471		
1959:1	178.079	11882	4309		0.0060
1959:2	98.050	11694	4583		0.0060
1959:3	142.039	12011	4053		0.0060
1959:4	111.830	12114	3788		0.0075
1960:1	189.000	12205	3726		0.0075
1960:2	94.800	12307	3837		0.0075
1960:3	194.400	12119	3795		0.0075
1960:4	121.200	12589	2970		0.0200
1961:1	210.672	12753	2827		0.0200
1961:2	94.677	12550	3309		0.0200
1961:3	185.592	12708	3035		0.0200
1961:4	136.059	13154	2682		0.0175
1962:1	207.623	13267	2583		0.0175
1962:2	127.866	13149	2993		0.0175
1962:3	171.543	12995	2902		0.0175
1962:4	125.333	13473	2893		0.0200
1963:1	229.642	13570	2942		0.0200
1963:2	124.362	13720	2951		0.0200
1963:3	176.343	13582	2802		0.0200
1963:4	127.652	14301	2370		0.0200
1964:1	220.836	14116	2727		0.0200
1964:2	154.872	14088	3092		0.0200
1964:3	177.099	14090	2869		0.0200
1964:4	164.910	15027	2374		0.0325
1965:1	233.164	14841	2471		0.0325
1965:2	213.460	14650	3454		0.0325
1965:3	194.577	14767	3283		0.0325
1965:4	179.799	15712	2731		0.0450
1966:1	228.903	16018	2479	12	0.0450
1966:2	268.593	16167	3603	14	0.0450
1966:3	251.978	16485	3414	15	0.0450
1966:4	173.523	16706	3343	6	0.0450
1967:1	301.740	17007	3521	37	0.0450
1967:2	238.609	17585	4686	49	0.0450
1967:3	339.190	17673	4685	52	0.0450
1967:4	189.390	18245	3849	18	0.0375
1968:1	369	18413	4428	74	0.0375
1968:2	298	18655	6140	98	0.0375
1968:3	329	18996	5750	105	0.0375
1968:4	295	19411	4986	37	0.0350
1969:1	400	20097	5212	75	0.0350

Table B.1. Continued

	I	BFU	BFL	GR	$\Delta_4 P^e_{it}$
1969:2	300	20250	7189	88	0.03500
1969:3	391	20624	6583	163	0.03500
1969:4	366	21388	5198	39	0.03900
1970:1	489	21886	5477	147	0.03900
1970:2	327	22343	6606	125	0.03900
1970:3	458	22979	5516	198	0.03900
1970:4	420	23182	4636	59	0.04550
1971:1	571	23888	5020	199	0.04550
1971:2	312	24245	7002	157	0.04550
1971:3	563	24490	5829	240	0.04550
1971:4	493	25447	4096	66	0.06150
1972:1	677	26064	4298	163	0.06150
1972:2	289	26583	5672	180	0.06150
1972:3	508	27168	3552	180	0.06150
1972:4	608	27355	1986	144	0.07250
1973:1	688	27868	2164	239	0.07250
1973:2	289	28418	4051	201	0.07250
1973:3	573	28923	2530	389	0.07250
1973:4	651	29052	-266	75	0.07750
1974:1	715	29302	555	325	0.07750
1974:2	336	30185	3236	233	0.07750
1974:3	638	30848	82	837	0.07750
1974:4	807	31367	-1602	414	0.08750
1975:1	793	32701	-684	900	0.08750
1975:2	315	33972	2955	306	0.08750
1975:3	771	34592	1799	737	0.08750
1975:4	991	35668	448	1983	0.09000
1976:1	941	37566	2136	885	0.09000
1976:2	316	38935	5089	1393	0.09000
1976:3	952	40186	3941	1726	0.09000
1976:4	1172	41705	2826	988	0.07750
1977:1	1133	43574	4724	917	0.07750
1977:2	418	45906	7200	1933	0.07750
1977:3	1184	47406	4889	2279	0.07750
1977:4	1342	48241	4135	1497	0.06500
1978:1	1404	50753	4900	965	0.06500
1978:2	660	53226	8046	1896	0.06500
1978:3	1286	54180	7553	2255	0.06500
1978:4	1387	55526	5694	1995	0.05125
1979:1	1571	56894	7331	1094	0.05125
1979:2	853	60835	10918	2007	0.05125
1979:3	1330	62721	10031	1838	0.05125
1979:4	1693	63871	9904	2305	0.05125
1980:1	1833	66013	12190	1353	0.05125
1980:2	1230	70416	16478	2879	0.05125
1980:3	1670	73024	16381	2947	0.05125
1980:4	2158	77117	11760	2838	0.06500
1981:1	2099	80652	17267	1604	0.06250
1981:2	1889	87135	19009	4659	0.06250

Table B.1. Continued

	I	BFU	BFL	GR	$\Delta_4 p_{it}^e$
1981:3	2018	89581	19398	4705	0.06250
1981:4	2907	95735	13597	3415	0.06750
1982:1	2554	100003	19458	2166	0.06250
1982:2	2862	109015	21338	4740	0.06250
1982:3	2309	115893	17518	4571	0.06250
1982:4	4050	122058	14559	3877	0.06250

NOTE: I = interest payments, million (1957:1-1967:4: annual totals from Central Bureau of Statistics, 80 Jaren Statistiek in Tijdreeksen, The Hague: 1979, distributed over quarters using percentage indicators obtained from Ministry of Finance, The Hague; 1968:1-1982:4: quarterly data, consistent with annual above, obtained from Ministry of Finance, The Hague). BFU = funded Central Government debt, approximate accumulation of recourse to capital market, million (MFJK, Table 5.1: Row 9) (measured as quarterly stock equivalents from De Nederlandsche Bank, as in Annual Report, Table 5.4: Row 1 minus Row 1c; minus accumulation of MFJK, Table 5.1: Row 8, with 1957:1=-1350). BFL = floating Central Government debt, approximate accumulation of recourse to money (M2) financing, million (MFJK, Table 5.1: Row 10) (measured as end-of-quarter stocks MFJK, Table 2.1a: Row 3a; minus MFJK, Table 2.1b: Row 10; minus accumulations of MFJK, Table 5.1: Rows 10c, 10e and 10f, with 1957:1=0; minus MFJK, Table 2.1c: Row 5; minus MFJK, Table 2.1e: Row 12; minus 155 for 1959:2-1974:4). GR = gas revenues, million [obtained from Ministry of Finance, The Hague, for 1968:1-1982:4; for 1966:1-1967:4 estimated from Wieleman (1982); negligible for 1957:1-1965:4]. $\Delta_4 p_{it}^e$ = anticipated inflation [Bomhoff (1979), p. 137; recent observations and also the data of Bomhoff are the inflation predictions by the Central Planning Bureau, Macro Economische Verkenningen, The Hague, which appears annually in September with the predictions for the next year; I have averaged those data over the latest two years].

APPENDIX C. THE TEST STATISTICS OF CHAPTER 6

This Appendix contains a list of test statistics used in Chapter 6, and mentions their sources. The relevant number of degrees of freedom can be found in brackets behind the test values in the tables of Chapter 6. Two numbers indicate that the statistic can be compared against an F-distribution, while a single number suggests a χ^2-distribution. The tests used in Chapter 4 are explained in the text of that chapter.

Autocorrelation

BP = Box-Pierce (1970) residual correlogram statistic, to be evaluated against χ^2-distribution. However, in our models with lagged dependent variables small values must be treated with caution as the statistic may be biased towards zero.

η_2 = Lagrange Multiplier test, F-form of Harvey (1981).

ξ_2 = Lagrange Multiplier test, χ^2-form of Godfrey (1978).

Heteroskedasticity

η_4 = White (1980) and Domowitz and White (1982) test, F-form.

ξ_4 = White (1980) and Domowitz and White (1982) test, χ^2-form.

ARCH = Lagrange Multiplier test for Autocorrelated Squared Residuals, χ^2-distribution, Engle (1982).

Normality Residuals

SK = Skewness.

EK = Excess Kurtosis.

NORM = χ^2-test for normality of residuals, Jarque and Bera (1980).

Parameter Constancy

η_1 = Chow test.

ξ_1 = χ^2-test. As explained by Kiviet (1981), this test can be used as a general model specification test, whereas η_1 is more a measure of numerical parameter stability [see Hendry *et al.* (1983)].

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