NBER WORKING PAPERS SERIES

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Working Paper No. 3658

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 1991

Paper prepared for the National Bureau of Economic Research and Tokyo Center of Economic Research Conference on Fiscal Policies in Open Macro Economies, Tokyo, January 7 and 8, 1991. We thank Kyoji Fukao, Lisa Schineller and the participants to the Conference for helpful comments. Giancarlo Corsetti gratefully acknowledges financial support from the Consiglio Nazionale delle Ricerche. This paper is part of NBER's research program in International Studies. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #3658
March 1991

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ABSTRACT

This paper discusses different empirical tests of public sector solvency and applies them to a sample of 18 OCED countries. Provided that the government solvency constraint need to be imposed, these tests develop from the idea of verifying whether the intertemporal budget constraint of the public sector would be satisfied a) had the fiscal and financial policy in the sample been pursued indefinitely and b) were the relevant macro and structural features of the economy stable over time. If solvency is not supported by the empirical evidence, a change either in the policy or in the relevant macro and structural variables (growth, inflation, interest rates, demographic factors) must occur at some point in the future. Among the G-7 countries, public sector solvency seems a serious issue in Italy, while does not appear to be a problem in the cases of Germany and Japan. The evidence for the U.S.A. is mixed. Problems of sustainability of the current path of fiscal policies are also present in Belgium, Ireland, the Netherlands and Greece.

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A growing public debt is often associated with widespread concern over the ability of the government to sustain its current fiscal and financial policy. While among the requirements for the sustainability of some given pattern of public debt and deficits, the intertemporal budget constraint imposes only mild restrictions on the behavior of the public sector. In practice, almost any short run path of revenue and expenditure can be consistent with the constraint. Large and persistent deficits today can always be offset by running large surpluses at some time in the future. Indeed, a general discussion of sustainability must take into account broader questions such as possible threats to financial stability and the political acceptability of the distributive effects a given policy may involve. At the same time, a more focused and empirically oriented consideration of the public sector intertemporal budget constraint may help distinguish solvency–related from these other issues concerning the fiscal and financial policy of the government.

This paper applies different empirical tests for government solvency to a large sample of OECD countries, developing the framework of analysis proposed by Hamilton and Flavin (1986), Trehan and Walsh (1989), Wilcox (1989), Buiter and Patel (1990) and Corsetti (1990). Provided that a government solvency constraint must be imposed in the economy, these tests stem from the basic idea of verifying whether the present value budget constraint of the public sector would be satisfied a) had the fiscal and financial policy in a given time period been pursued indefinitely *and* b) were the relevant features of the macro economic environment characterizing the sample period stable over time. If solvency is not supported by empirical evidence, a change either in the policy or in the relevant macro economic variables (growth, inflation, interest rate, demography) must occur at some point in the future. It should be obvious that the tests refer to the *feasibility* rather than the *optimality* of the fiscal and financial policy. Also, these tests give no information about the time in which the necessary changes should occur.

Some contributions in the literature have approached solvency–related issues from a different vantage point. This literature argues that high levels of the public debt may be

associated with a risk premium on government bonds reflecting fears of repudiation. Sustainability of current policies can therefore be tested by focusing on the existence of such risk premia (see for instance Alesina, Prati and Tabellini (1989)). The differences between such an approach and the one followed in this paper are evident. First, risk premia on government bonds may reflect much more than the violation of a long run budget constraint: distributional and political considerations, for instance. In this case, we may observe risk premia on bonds regardless of government solvency. Second, unexpected temporary shocks within the sample may lead to rates of growth of the public debt which are not sustainable in the long run. If the market correctly perceives these rates of growth as temporary, insolvency of the public sector stemming from the definition given above may not be reflected in the pricing of the public debt.

The plan of the paper is as follows. The first section provides a general background on the fiscal performances of the OECD countries in the past 30 years, with some reference to secular trends. The next three sections discuss the logical and econometric structure of the solvency tests. Section 2 develops the arithmetic of the public sector intertemporal budget constraint and discusses its meaning and relevance in dynamically efficient economies. It then relates solvency to traditional indicators of sustainability of public debt and states solvency–related implications for the pattern of fiscal deficit. Sections 3 and 4 discuss alternative testing frameworks and the statistical tests. The empirical evidence is presented in section 5. Appendix 1 briefly describes the data.

1. Patterns of Debt and Deficits in the OECD Countries: 1960–1989.

1.1. Government expenditure and the secular rise in the size of the government.

In the past thirty years there has been an extraordinary increase in the share of government spending in total national income throughout the industrial world. The tendency for budgetary expenditures to grow more rapidly than national income has long been noted, at least since Wagner formulated his famous "law" of a rising share of

government. What is notable about the past twenty five years has been the extraordinary rate at which this increase has taken place. Consider, for example, the evidence in Table 1, which shows the share of government expenditure in GDP for several major countries during the past half–century. In every country, the increase in this share is much more rapid during the twenty five years between 1960 and 1985 than during the twenty two years between 1938 and 1960.

If we look within subperiods during 1950–1985, we see that the increase was generally modest in the 1950s, somewhat higher on average in the 1960s, most rapid in the 1970s, and slow or negative in the 1980s. In 1960, the size of the general government sector as a share of GDP was rather similar in most OECD countries (25 percent on average, and 31 percent for the European OECD countries) (see table 2). In only two countries, France and the Netherlands, was the ratio of expenditures to GDP over one third. By 1988, the ratio in all of the OECD countries was above one third, and the average had risen to 40.0 percent (51 percent for the European OECD countries). As seen in Table 2, the countries with a government expenditure above 50% in 1985 were Italy, the Netherlands, Sweden, Ireland, Norway, Denmark, Belgium, France and Austria. The group of countries with a ratio between 40 percent and 50 percent included Germany, UK, Finland, Canada, Greece and Spain; while the countries with the smallest size of the government (below 40 percent of GDP) were the U.S.A., Japan and Australia.

1.2. Patterns in the Fiscal Balances.

In the period 1960–1973, the performance of most OECD economies is characterized by large and sustained growth of real GDP, low inflation rates, low or negative real interest rates and primary surpluses in the fiscal balances. All the OECD countries, with the exception of Italy and Germany, show a declining debt to GDP ratio in the period between 1960 and 1973. Under these favorable macroeconomic conditions, the OECD countries do not appear to face problems of the sustainability of the public sector debt; the solvency of

the public sector does not appear to be an issue.

The year 1973 marked the end, at least for the following decade, of the high and noninflationary growth that characterized the industrial world in the 1950s and 1960s. Almost every industrialized country experienced a significant slowdown in average growth, together with a rise in unemployment rates and higher inflation. This high inflation began to abate in the early 1980s, but the slowdown in growth and the higher unemployment in Europe have proved to be more persistent.

The reasons for the growth slowdown and the rise in unemployment are still a matter of debate, but it seems clear that adverse supply shocks have played a significant role. All of the OECD economies experienced a steep decline in total factor productivity growth beginning in the early 1970s, and almost all suffered a terms–of– trade deterioration following the oil shocks of 1973 and 1979. These supply shocks posed a multi–faceted adjustment problem of profound economic and political consequence in the industrial countries. After 1973 real incomes in the aggregate could not grow as fast as they did before 1973.

The period after 1973 is also characterized by the rapid increase in the ratio of government expenditures to GDP and the emergence of very large and persistent budget deficits in many OECD economies. These large budget deficits have in turn resulted in an unprecedented peacetime rise in the public debt to GDP ratio in many countries. If it is maintained that public sector goods are luxury goods (with an income elasticity grater than 1), the public sector growth rate should have decreased even more than the GDP growth rate over the period. Rather, public sector spending failed to fall in line with GDP, leading to a sharp increase in the ratio of public spending to GDP in almost all of the industrial economies (see table 2). As spending jumped ahead of tax collections (see table 3), large peacetime budget deficits led to a rapid accumulation of public–sector debt (see tables 4

and 5))[0]. During the postwar period up to 1973, and indeed during most peacetime periods in the past two centuries, public sector debt actually fell as a percentage of GDP in most industrial countries. After 1973, the debt to GDP ratio rose sharply in most countries, even reaching extraordinary levels of around 100 percent of GDP by 1989 in some countries (Belgium, Ireland, and Italy).

As the ratio of government spending to output was perceived to have risen above the long term "equilibrium" level (a spending "overshooting"), many countries undertook a severe retrenchment of the public sector in the 1980s. For the first time in decades, the ratio of public spending to GDP has been dropping in many OECD economies in the past five years. The decline, which is evident in table 2, is very slight in many countries, but it is still notable when compared with the previous trend.

It has been argued that the varying economic and political institutions of the OECD economies help to account for the differences in patterns of public sector spending and deficits after 1973 (Sachs and Roubini (1989a, 1989b)). In particular, it has been argued that the prevailing political institutions of OECD countries determined the extent to which higher spending–to–GDP ratios were financed by a higher tax–to–GDP ratio or by higher budget deficits. According to this view, the large deficits that have been observed in the 1970s and 1980s in many countries were not the result of optimal public finance decisions (as in the "equilibrium theory of budget deficits", for example) so much as the result of political weakness, where weakness is signified by governments with a short tenure in office and a dispersion of political power across many coalition partners.

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[0] Table 4 reports the conventional overall budget balance. This measure does not include seigniorage revenue and does not correct for the inflation component in the interest bill. Therefore, it is not a very informative indicator of the fiscal stance of the country. Estimates of the seigniorage–adjusted inflation–adjusted deficits are provided later on in the paper. By the same token, the measure of public debt in Table 5 includes the government debt held by the Central Bank. In the analysis to follow, the tests for solvency will be carried out by subtracting base money from the general government debt.

1.3. The Emergence of Fiscal Deficits in the Post–1973 Period and the Fiscal Retrenchment in the Eighties.

As discussed above, the period after 1973 is notable not only for the rapid rise in the ratio of government expenditures to GDP but also for the emergence of very large and persistent budget deficits in many OECD economies. These large budget deficits in turn resulted in a major rise in the public debt to GDP ratios in many countries. At the core, the rise in the expenditure ratio and the emergence of budget deficits after 1973 were reflections of a common phenomenon: the sharp slowdown in GDP growth that was not matched by a comparable slowdown in the real growth of government expenditures.

The first major burst in the ratio of expenditures to GDP occurred in the aftermath of the first oil shock. In the two years between 1973 and 1975 the ratio of total outlays of the government as a share of GDP rose from 33.0 percent to 38.0 percent for the overall OECD area (see table 2) . This increase in two years equaled 75 percent of the total increase of the ratio between 1970 and 1985. In the same two years the increase in government revenues as a percent of GDP lagged far behind the increase in spending (revenues rose from 32.2 percent of GDP to 33.1 percent as can be seen in table 3). As a consequence, the general government financial balances in OECD economies worsened rapidly, moving from a surplus of 0.1 percent of GDP in 1973 to a deficit of 0.5 percent in 1974 and to a deficit of –3.8 percent in 1975 (see table 4). As a result of these large fiscal deficits we observe an increase in the debt to GDP ratios. With the exception of Italy and Germany, all the OECD countries show a declining debt to GDP ratio in the 1960–1973 period, but by 1975 all of the OECD countries show increases in their debt–GDP ratios (table 5).

The 1976–1979 years can be characterized overall as a period of fiscal consolidation. In this period the ratio of expenditures to GDP stabilized (rising slightly from 38.0 percent of GDP in 1975 to 38.1 percent of GDP in 1979 for the OECD as a whole) while tax revenues increased by 1.8 percent of GDP (from 33.1 percent to 34.9 percent as shown in

table 3). As a consequence the average negative financial balances were cut by 2 percent of GDP as well (from –3.8 percent in 1975 to –1.8 percent in 1979). These OECD averages, however, conceal a wide variance of country–specific experiences.

The stabilization in the ratio of expenditures to GDP in the 1976–79 period came to an end following the second oil shock. In the years from 1979 to 1982, this expenditure ratio rose from 38.1 percent of GDP to 41.4 percent of GDP (corresponding to 45 percent of the total increase in the ratio between 1970 and 1985). Once again, the increase in revenues is much smaller than in expenditures, so that the overall deficit in the public–sector financial balance more than doubles – from –1.8 percent of GDP in 1979 to –4.2 percent in 1982.

In the years between 1980 and 1982 almost all of the OECD countries move to rising real fiscal deficits. Only the two recipients of North Sea oil revenues, the U.K. and Norway, are exceptions. Deficits, and the ensuing increase in debt to GDP ratios, are particularly severe in Italy, Belgium, Ireland, the Netherlands, Sweden, Denmark and Japan (in all these countries the debt–GDP ratio increase by more than 10 percentage points in the three years between 1979 and 1982).

The years from 1983 to 1986 are a second period of fiscal consolidation for most countries, characterized by a marginal contraction of the expenditure ratio and an increase of the revenue ratio for most, but not all of the OECD countries. Once again, the experience of the OECD countries presents a wide variance. Countries with declining debt–GDP ratios in the 1980–1982 period (U.K. and Norway) have maintained these real surpluses through 1986. Several countries with a rapid rise in debt–GDP ratios in the 1980–82 period have moved to balance or small surplus by 1986 (among these are Germany and Japan among the largest ones and Finland and Austria among the smaller OECD countries). On the other side, the fiscal balances of the United States seriously worsened between 1981 and 1986 (in the U.S. the real deficit stabilized at around 2.0 percent of GDP through 1986). One therefore observes a divergence in fiscal policies of the main OECD

countries with fiscal retrenchment in Japan and Germany on one side and fiscal expansion in United States on the other side.

Fiscal adjustment has been especially dramatic in two countries that experienced a large debt buildup in the early 1980s. Real fiscal balances moved from a deficit of over 9.0 percent of GDP in Sweden and Denmark in 1982 to a real surplus in 1986. In five of the countries with the largest real deficits in the 1980–82 period (Italy, Belgium, Ireland, the Netherlands, Spain), the rate of increase in the debt to GDP ratio remained very high all the way through 1985. As a result of debt buildup in these high deficits countries, the debt to GDP ratios were close to or over 100 percent in Belgium, Ireland and Italy in 1986.

The 1986–1990 period is characterized by the partial continuation of previous trends. Among the countries with the largest debt to GDP ratio, the rise in this ratio continued in Italy, Greece and the Netherlands (reaching a level of 94.3%, 75.0% and 57.2% respectively in 1989). In Spain and Belgium the debt to GDP ratio peaked in 1988 (to 30.5 % and 123.7% respectively) and then stabilized. In Ireland, the debt to GDP ratio, after peaking in 1987 (to 110.6% of GDP), has started to fall. For the other OECD countries, in the period 1986–1990, one observes a stabilization of the debt to GDP ratio around the 1986 levels for the United States, Germany, France, Norway, Austria and Canada. Significant reductions occur in Japan, the United Kingdom, Denmark, Finland, Sweden and Australia led by significant real fiscal surpluses.

On the basis of this analysis, serious issues of fiscal adjustment and government sector solvency appear to exist in Italy, Belgium, Ireland, Greece and, probably, the the Netherlands. We will move next to a formal theoretical analysis of the issue of solvency. In the empirical section of the paper, we will then test which countries appear to be on an unsustainable path of fiscal policies.

2. The Public Sector Budget Constraint.

This section has three main objectives. First, it will develop the arithmetic of the public sector's budget constraint, with the goal of highlighting important accounting–related aspects of solvency. Second, it will discuss the conditions under which the intertemporal budget constraint for the public sector should or should not be imposed. Third, it will relate solvency to traditional indicators of sustainability of the public debt.

The definition of the public sector includes central and local government, the central bank, public agencies, social security funds and public enterprises. The consolidated public sector budget identity will then be as follows:

$$(2.1) \qquad \frac{B_t - B_{t-1}}{P_t} + \frac{M_t - M_{t-1}}{P_t} + \frac{V_t(B^*_t - B^*_{t-1})}{P_t} +$$

$$- \frac{V_t(F^*_t - F^*_{t-1})}{P_t} - [K_t - K_{t-1} - (P^k_t - 1)SK_t] \equiv$$

$$\equiv C_t - T_t + i_{t-1}\frac{B_{t-1}}{P_t} + i^*_{t-1}\frac{V_t}{P_t}(B^*_{t-1} - F_{t-1}) - (\rho_{t-1} - \delta_{t-1})K_{t-1}$$

where B and B^* are the stocks of domestic and foreign currency denominated public debt (nominal), M the stock of monetary base (nominal), F^* the stock of foreign reserves (nominal), K the stock of public capital, evaluated at current reproduction costs, SK_t public assets sold in the market at the price P^k_t; C is the real consumption flow of the public sector within the period, T the real net current revenue; i and i^* are the domestic and foreign interest rates, V the foreign exchange rate, P the domestic price level, ρ the *cash* rate of return on public assets and δ the public capital depreciation rate. The left hand side of (2.1) refers to stock adjustments, the right hand side to the current account. Note that the total net rate of return to capital supposedly consists of its *cash* rate net of depreciation

($\rho-\delta$) plus a component in the form of either net tax revenue or reduction in expenditure. From an accounting point of view, the holding period rates i and i^* are implicitly defined by the interest bill effectively paid during the period divided by the stock of net debt outstanding at the beginning of the period, in domestic and foreign currency, respectively.

Define the public sector *net financial debt* as total interest bearing liabilities minus financial assets owned by the sector. This measure is generally known as public sector *net debt* (ND). As far as solvency is concerned, however, the appropriate measure of the public sector net liabilities should also be net of the value of publicly owned real assets. Denote this measure as *net debt net of real assets* (NDNRA). Let $A_t \equiv K_t - (1-\delta_{t-1})K_{t-1} - (P_t^k SI_t)$ and rearrange (2.1) as follows:

$$(2.2) \qquad \frac{B_t - B_{t-1}}{P_t} + \frac{V_t(B_t^* - B_{t-1}^*)}{P_t} - \frac{V_t(F_t^* - F_{t-1}^*)}{P_t} \equiv$$

$$\equiv C_t + A_t - T_t + i_{t-1}\frac{B_{t-1}}{P_t} + i_{t-1}^*\frac{V_t}{P_t}(B_{t-1}^* - F_{t-1}) - (\rho_{t-1} - \delta_{t-1})K_{t-1} + \frac{M_t - M_{t-1}}{P_t}.$$

The left hand side of the expression now refers to the evolution of the *net financial debt*, or *net debt* (ND). Obviously, if the public sector owned no assets, there would be no difference between ND and NDNRA. However, borrowing while investing changes the former variable, but it may not change the latter. The evolution of the two measures of debt may be quite different over time. These considerations will be important in the practical set up of solvency accounting, since the available information refers almost exclusively to the Net Financial Debt (ND). With a limited sample size, an investment project undertaken at some point in the sample may not recover its costs within the sample period. If public investment is not constant, this may lead either to an under–estimation or to an over–estimation of the government net liabilities.

Let D_t denote total financial liabilities less foreign reserves evaluated in domestic currency, that is, $D_t \equiv B_t + V_t(B^*_t - F_t)$. Let $S_t \equiv \frac{M_t - M_{t-1}}{P_t}$. Expression (1.2) can be re–written as follows:

$$\frac{D}{P_t} \equiv C_t + A_t - T_t - (\rho_{t-1} - \delta_{t-1}) K_{t-1} - S_t + \tag{2.3}$$

$$+ (1+i_{t-1}) \frac{B_{t-1}}{P_t} + (1+i^*_{t-1}) \frac{V_t}{P_t} (B^*_{t-1} - F_{t-1})$$

or, more compactly,

$$d_t \equiv \Delta_t - S_t + \frac{(1+i^{im}_{t-1})}{(1+\pi_{t-1})} d_{t-1} \equiv \tag{2.4}$$

$$\equiv \Delta_t - S_t + (1+\xi_{t-1})\, d_{t-1}$$

where $d_t \equiv \frac{D_t}{P_t}$ and $(1+\pi_t) \equiv \frac{P_t}{P_{t-1}}$; Δ_t is the primary deficit; i^{im}_{t-1} the nominal implicit interest rate paid on the net liabilities outstanding at the beginning of the period with ξ_{t-1} denoting the corresponding rate in real terms. Expression (2.4) is the usual dynamic equation for debt. The stock of government liabilities in real terms will grow in the period if the total deficit net of seigniorage is positive. As long as the nominal implicit interest rate is non negative, (2.4) can always be solved forward recursively. This yields

$$d_t = \sum_{i=0}^{\infty} \prod_{j=0}^{i} (1+\xi_{t+j}) (-\Delta_{t+1+i} + S_{t+1+i}) + \tag{2.5}$$

$$+ \lim_{i \to \infty} \prod_{j=0}^{i} (1+\xi_{t+j})^{-1} D_{t+1+j}$$

Consider now the definition of *solvency*. The public sector is *solvent* when the present discounted value of future primary surpluses minus seigniorage revenue is at least equal to the value of the outstanding stock of net financial debt. Therefore, solvency implies that the last term of (2.5) be non positive:

$$\lim_{i \to \infty} \prod_{j=0}^{i} (1+\xi_{t+j})^{-1} D_{t+1+j} \leq 0. \tag{2.6}$$

In other words, the public sector cannot be a net debtor in present value terms, which means, the stock of debt cannot grow at a rate higher than the interest rate on the debt. Note that the measurement unit is irrelevant with respect to this criterion. In (2.5)–(2.6) both the stock of debt and the interest rate are in real term, but we could re–do the accounting in nominal terms (in either domestic or foreign currency) or in ratios to GDP. The crucial point is that *Ponzi schemes* in the form of systematic financing of the interest bill with additional borrowing are ruled out.

Negative values of the limit (2.6) will result in a sort of *supersolvency*, since in the limit the public sector will be a net creditor. While this circumstance may not be considered plausible, it cannot be ruled out *a priori*. If it occurs, however, some other sector in the economy must be violating its solvency constraint. On the basis of this argument, (2.5) may well be written with an equality sign.

Notice the analogy between (2.5) and a *no bubble* condition in asset pricing, which inspired the pioneering work of Hamilton and Flavin (1986). The transversality condition in asset pricing requires that the present discounted value of the terminal price go to zero in the limit. However, the analogy may obscure an important difference between the two conditions. In the asset pricing case, we price the income stream accruing from an asset by

using a term structure which is independent of this stream. As the arithmetic of government solvency makes clear, the discount factor and the debt outstanding are *not* independent of each other, because the former is a function of interest income effectively paid out by the public sector on its debt. Therefore, the two terms in (2.5) are inherently linked and there is no freedom to choose arbitrary (say, market related) discount rates.

When the assumption of perfect foresight is dropped, an expectation operator conditional on the information available at time t is generally added to expression (2.5) and (2.6). In this case, the condition for solvency becomes

$$\lim_{i\to\infty} E_t \prod_{j=0}^{i} (1+\xi_{t+j})^{-1} D_{t+1+j} = 0. \tag{2.6'}$$

Condition (2.6') is certainly met if the public sector can be expected to be solvent in every state of nature at any possible date. However, this interpretation of (2.6') is rather strong. It is relatively easy to provide examples in which the expression is true only if the public sector is a net financial creditor, a situation which by–passes the solvency issue altogether. Nonetheless, abandoning this excessively restrictive view of (2.6') leads us to accept (realistically) that solvency in expectation is compatible with actual insolvency in some particular evolution of the world.

Consider now the conditions under which the public sector faces a present value budget constraint. It is well known that if an economy had too much capital and a decumulation could improve welfare — which is the definition of dynamic inefficiency —, a benevolent government would actually play a Ponzi Game and (2.6') would not hold. There would be no theoretical reason for the present value government budget constraint to be met. The link between debt today and collecting the resources necessary for its repayment through budget surpluses and seigniorage revenue in the future would be severed.

So the question becomes, do OECD economies suffer from an over–accumulation of capital? In a model *a la* Diamond, the stationary state for a dynamically inefficient economy is characterized by a net marginal productivity of capital which is lower than the growth rate of output. In an efficient economy, the inequality is reversed. In the absence of uncertainty and taxes, the net marginal product of capital and the real interest rate coincide. Therefore a simple test of dynamic efficiency in a Diamond model–like economy consists of checking whether the real interest rate is above the growth rate.

Nevertheless, dealing with real economies, both uncertainty and taxes can make the net real interest rate, which is the relevant cost of debt service, diverge from the before tax rate of return to capital. Indeed, all OECD countries are characterized by prolonged periods in which the ex post real interest rate falls below the growth rate. The ex post rate is even negative in some years. At the same time, however, the mean return to capital has constantly outpaced growth. This is supported by empirical evidence suggesting that gross profits have persistently exceeded gross investment; tests based on this (strong) sufficient condition for dynamic efficiency are carried out by Abel et al. (1989) for the G–7 countries. We will therefore proceed under the maintained hypothesis of dynamic efficiency for the countries in our sample.

A second point, raised by Blanchard and Weil (1990), is the possibility for the government to provide intergenerational insurance by issuing debt in the presence of incomplete markets. In this case, permanent rollover of the debt can be feasible and welfare–improving even when capital is not overaccumulated. Again, we rule out this circumstance as a maintained hypothesis.

It is important to stress that a real interest rate below the growth rate does not provide a test of dynamic efficiency. However, it does have important implications for the dynamics of the debt to GDP ratio, which is the common indicator of the sustainability of fiscal and monetary policies. We now discuss the relationship between this indicator and the solvency constraint.

Solvency is a weak criterion to evaluate the sustainability of the public debt. It is well known that (2.6') can be satisfied also when the debt to GDP ratio increases without bound. All we need for solvency is that the growth rate of the real debt be lower than the real interest rate. Whether the debt to GDP ratio increases or not depends on whether the real interest rate is higher than the GDP growth rate *and* whether the latter is outpaced by the rate of growth of the real debt. A strict solvency criterion, therefore, does not bound the debt to GDP ratio, which may continue to increase without violating the public sector intertemporal budget constraint. Public sector solvency can then be logically justified by stressing three important elements implied by the analysis. First, when the debt to GDP ratio grows unboundedly, the interest bill will at some point be larger than the whole GDP. Solvency thus requires that the tax base consist of both GDP *and* the interest income. Second, taxes must be non distortionary and there should be no relevant costs of collection and enforcement. In this case, the increasing tax burden has no effect on the availability and allocation of resources. Third, the analysis ignores both the distributive effects which may accompany increasing debt *and* the political acceptability of those effects.

These and similar considerations support the common view that only finite values of the debt to GDP ratio are sustainable. Therefore, it could be useful to use a solvency condition stronger than (2.6'), and to make a distinction between a *strict* and a *practical* criterion (Buiter and Patel 1990). The first is based on (2.6'), the second on the expected debt to GDP ratio in the limit. Infinite values of this expectation must be ruled out. The two criteria impose quite a different set of restrictions on the path of deficits. Consider three concepts of financial deficit: conventional, operational and primary. The following are analytical expressions corresponding to the three measures:

$$(2.7) \qquad CFD_t = C_t + A_t - T_t - \rho_{t-1}B_{t-1} + i_{t-1}\frac{B_{t-1}}{P_t} + i^*_{t-1}\frac{V_t}{P_t}(B^*_{t-1} - F_{t-1})$$

$$(2.8) \qquad OFD_t = C_t + A_t - T_t - \rho_{t-1}B_{t-1} - S_t +$$

$$+ \frac{(1+i_{t-1})}{(1+\pi_{t-1})(1+n)}\frac{B_{t-1}}{P_t} + \frac{(1+i^*_{t-1})(1+\epsilon_t)}{(1+\pi_{t-1})(1+n)}\frac{V_t}{P_t}(B^*_{t-1} - F_{t-1})$$

$$(2.9) \qquad \Delta_t = C_t + A_t - T_t - \rho_{t-1}B_{t-1}$$

where CFD stands for Conventional Financial Deficit, OFD for Operational Financial Deficit, Δ for Primary Deficit; n is the output growth rate and ϵ the depreciation rate of the foreign exchange rate.

The question is whether a positive outstanding debt in an efficient economy requires a promise by the public sector to run budget surpluses for each alternative definition at some future date. For simplicity, assume first zero seigniorage revenue, unless otherwise specified.

Neither solvency criterion necessarily implies a conventional budget surplus at any time, even when seigniorage revenue is ignored. This is not to say that a surplus cannot be optimal or desirable in some circumstances. The point is that in principle, the solvency constraint in a dynamically efficient economy *can* be satisfied by an infinite series of conventional budget deficits without resorting to seigniorage revenue.

By correcting the interest payments for both the inflation and the output growth rates, the Operational Financial Deficit (2.8) includes the public sector interest bill only to the extent it adds to the debt to GDP ratio. By definition, then, an infinite series of operational deficits would make the debt to GDP ratio grow without limit. It would therefore be logically inconsistent with the *practical* solvency criterion, but in principle

may not violate the *strict* one.

Intuitively, a solvency constraint simply says that the the public sector will honor its liabilities. If the debt outstanding is positive today, primary surpluses must be run at some point in the future; this is a necessary condition for the *strict* solvency criterion to be satisfied. However, when the growth rate is higher than the interest rate, primary surpluses are not *per se* sufficient to rule out increasing debt to GDP ratios, and the *practical* criterion is not met.

It is important to note that the conclusions referring to the operational and the primary deficits do not apply when seigniorage revenue is brought into the picture.

3. Testing for solvency.

As shown in section 1, the present value budget constraint implies that the series of discounted debt be zero in expectation. In a rational expectations framework, the representative agent would evaluate government solvency by solving the model of the economy making efficient use of all the available information. In principle, if we had a Lucas critique–proof structural model of the economy, describing both economical and political processes, we could closely approximate the agent's view about the issue.

Nevertheless, a time–series analysis setting leads to a more direct (but rather mechanical) way of building the solvency test by focusing on the series of the discounted debt. Using sample information, we will estimate its distribution under the maintained hypothesis that this is stable. We will then test whether the unconditional mean of the series is zero (or non positive).

As a preliminary step, the series of net debt should be discounted back to some base period. The next step will be to test whether the Data Generating Process (DGP) which describes the behavior of the series over the sample period is covariance stationary. If it is, one can test whether the unconditional mean in the process is zero (or non positive). Either a positive drift or a time trend will eventually imply insolvency.

If non stationarity of the process cannot be rejected, we have to consider two cases, depending on whether or not deterministic components also belong in the DGP of the series. A process with a unit root, but no drift or time trend is in principle compatible with both insolvency and supersolvency, depending on the value of the debt in the sample. When the unit root coexists with positive deterministic components in the DGP of the series, however, there will be some additional evidence against solvency.

A conservative albeit arbitrary approach to the interpretation of the test results consists of considering the case of a non deterministic but non stationary process as inconclusive. We will reject solvency only when a positive drift or time trend exists in addition to a unit root. Since non stationarity *per se* rules out (2.6') for a non zero debt, other contributions to the literature consider it sufficient to rule out the hypothesis of solvency regardless of the presence of a deterministic components in the DGP (Wilcox 1989, Buiter and Patel 1990). However, as we will see later in the paper, this approach magnifies the power–related problems in the actual implementation of the test[1]. In fact, given a small sample size, available tests for non stationarity will tend to accept the null hypothesis of a unit root too often.

As far as the interpretation of the test is concerned, therefore, insolvency will follow from positive deterministic components in the DGP of the series of the discounted debt – but only in the absence of structural changes in the process at some point in the future. In other words, either the fiscal and financial policy or some relevant features of the economy must change at some point in time for the intertemporal budget constraint of the public sector to be satisfied[2].

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[1] Non stationarity of the series can be related to roots strictly greater than one. In this case, non stationarity will still lead to insolvency for a positive value of the variable. This is the case discussed in Buiter and Patel (1990) with respect to India. On the other hand, the tests we perform are carried out under the maintained assumption that non stationarity will be related only to the presence of a root equal to one, as opposed to roots strictly larger than one. Empirically, the estimate of the coefficient for the autoregressive term in the test regression is very close to one for all countries.

[2] As a good example of structural variables affecting the public sector solvency constraint,

It should be clear by now that the test is not aimed at forecasting *Staatsbankrott*. *Ex post* solvency can always be enforced by resorting to a variety of policy options: fiscal and monetary reforms, which can be more or less politically acceptable; drastic policy measures which violate outstanding contracts between the public sector and the other sectors of the economy, such as debt repudiation; policy measure which do not formally repudiate government financial liabilities but may conflict with previous government commitments, such as high inflationary debt monetization or a capital levy.

Moreover, the test sheds no light about when the necessary fiscal and financial policy corrections *should* happen. These changes may have already occurred within the sample period. Unfortunately, traditional tests of structural breaks in the data generating process can be carried out only for covariance–stationary series. If non stationarity cannot be rejected, the stability of the DGP in the whole sample will be implicitly assumed as a maintained hypothesis.

A general framework for the empirical analysis is provided by Wilcox, who was the first to base solvency tests on the series of the discounted debt (Wilcox 1989). He assumes that the series D_t is represented by the following ARIMA model

$$[1-\rho(L)]\,[(1-L)^d Z_t - \alpha_0] = [1-\theta(L)]\,v_t \tag{3.1}$$

where $\rho(L)$ is a p–th order polynomial, $\theta(L)$ a q–th order polynomial, Z_t is a random vector whose first element is D_t, α_0 is a vector of constants and v_t is a vector white noise process. Assume that the series $(1-L)^d Z_t$ is covariance stationary, so that Z_t is integrated

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consider the effects of the population age structure on Social Security. Given the forecasted increase in the number of retired people per worker over the next decades in the industrialized world, we may expect an important reversal in the pattern of budget surpluses that Social Security Funds currently exhibit in many OECD countries. This of course challenges the out–of–sample stability of the observed features of our economies. However, note that including the social security funds in the public sector accounting framework without correcting for the present value of their future liabilities should bias the test towards accepting the null hypothesis of solvency.

of order d. Thus $[1-\rho(L)]$ and $[1-\theta(L)]$ have all their roots outside the unit circle, while $\rho(L)$ and $\theta(L)$ are assumed to satisfy the conditions for stationarity and invertibility.

Thus, the autoregressive representation of the process is

$$[1-\theta(L)]^{-1}\,[1-\rho(L)]\,[(1-L)^{d}\,Z_t - \alpha_0] = v_t \tag{3.2}$$

this is operational if the process can be approximated by a finite order autoregressive process. Note that a_0 is the unconditional expectation of $(1-L)^{d}\,Z_t$.

Testing for solvency involves the following steps. First, test whether Z_t is stationary, i.e. whether its order of integration d is less than 1/2. In a univariate representation of the process, a unit root in the DGP governing the variable will make the process non stationary. Evidence against solvency will follow if also a positive drift or time trend belong in it. In their absence, the test does not allow us to draw a definite conclusion. If the process is stationary, the second step consists of estimating its unconditional expectation α_0 and testing whether this is zero (or non positive).

The main advantage of Wilcox's framework is that it points out synthetically a sufficient condition for solvency: a stationary and purely non deterministic process for the series of the discounted debt.

Mutatis mutandis, the above methodology can be applied to the debt to GDP ratio, in the spirit of the *practical* solvency criterion. This will be our second set of tests for solvency. A third and a fourth set can be obtained by using data on the fiscal balances, rather than on stock of liabilities.

Hamilton and Flavin's work on empirical analysis of solvency focuses on the discounted primary deficit, rather than on the discounted debt. Let X_t be the series of the discounted *cum seigniorage* primary surplus. Expression (1.5) and (1.6) can be combined as follows

$$(3.3) \qquad D_t = \sum_{i=0}^{\infty} \prod_{j=0}^{i} (1+\xi_{t+j})(-\Delta_{t+1+i}+S_{t+1+i}) = \sum_{i=0}^{\infty} X_{t+1+i}.$$

It is important to stress that in this case a purely non deterministic stationary process for the series will not be sufficient to ensure solvency. The present value of the infinite series of the *cum seigniorage* primary surpluses must also be equal to D_t[3]. The test procedure should then be modified to include this condition.

As in the case of discounted debt, positive deterministic components in the series rules out solvency. A non deterministic, non stationary process is in principle compatible with both outcomes, depending on the initial conditions. We treat the latter result as inconclusive.

Notice that the Hamilton Flavin (1986) test could be equivalently carried out in terms of the undiscounted *cum seigniorage* total surplus. By definition, we can write

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[3] Consider the following example provided by Wilcox (1989). Suppose X_t follow a simple autoregressive process in the form $X_t=\alpha X_{t-1}+\eta_t$ with $|\alpha|<1$ and η white noise. Then

$$E_t \sum_{i=0}^{\infty} X_{t+1+i} = \frac{\alpha}{1-\alpha} X_t$$

which implies

$$D_t = \frac{\alpha}{1-\alpha} X_t$$

and

$$D_t - D_{t-1} = -X_t + \frac{1}{1-\alpha}\eta_t.$$

The latter expression is inconsistent with $D_t=-X_t+D_{t-1}$, expression that follows from the solvency constraint. Thus, a simple stationary first order autoregressive process for the series of the discounted augmented primary deficit net of seigniorage would not be consistent with solvency.

$$(3.4) \qquad D_t = \sum_{i=0}^{\infty} \{(-\Delta_{t+1+i} + S_{t+1+i}) - (1+\xi_{t+i})\, D_{t+i}\}$$

and focus on the series of the cum interest surplus without discounting. This is the approach taken by Trehan and Walsh (1988).

An important issue in the empirical implementation of the Wilcox–type test is the absence of data on debt net of both real and financial assets (NDNRA). The value of real assets owned by the public sector are not subtracted from the sector's net liabilities. Suppose, however, that the net return on the public sector capital is equal to the interest rate. Then borrowing in order to finance investment will not affect the net worth of the public sector. This net worth can also change drastically with capital gains on real assets and the value of natural resource property rights.

Given short sample periods, a sustained increase in the discounted net financial liabilities does not necessarily imply the need for an active change in the fiscal and financial strategy at some point in the future. For instance, to the extent that there is a capital formation, the trend will be modified automatically as soon as the acquired capital becomes productive. In other words, if the investment projects guarantee a rate of return (in cash or more generally in term of net reduction in the primary deficit) at least equal to the borrowing rate, budget deficits to support capital expenditure are irrelevant in terms of the present value budget constraint.

Notice that in principle, regardless of the rate of return on public capital, subtracting the value of public sector's physical assets from the net financial debt rules out the risk of misinterpreting trends in the discounted. Indeed, the whole analysis in section 2 can be re–cast in terms of this measure of net government liabilities. Of course, this would lead to quite different results, depending on how we value public assets. These could be valued at reproduction cost or at market value, under the assumption that each asset will remain publicly owned or will be sold to the private sector. Valuation under alternative

assumptions would possibly give upper and lower boundaries to the debt, boundaries which will convey valuable information for government solvency.

In practice, though, formidable empirical difficulties are present in assessing the value of and the return to real assets owned by the public sector: current available information refers mainly to the net financial debt. Nevertheless, the Hamilton and Flavin – Trehan and Walsh (HF–TW) approach can provide a simple framework to shed some light on this issue. Instead of estimating the stock of the debt net of real assets, it is possible to obtain some measure of the increase in financial debt controlling for the change in the stock of publicly owned real assets, as approximated by the net public capital formation.

Consider the series of the first differences in the real undiscounted debt and subtract seigniorage revenue from it. This will produce a measure of the seigniorage –adjusted, inflation–adjusted real deficit. Then, if we disregard capital gains, the change in the real value of publicly owned assets is given by the expenditure for capital formation net of depreciation. The approximation error will depend crucially on the nature of the public real assets. Under the maintained assumption that the net return to public capital is equal to the interest rate, a HF–TW type test can therefore be carried out on our measure of the real deficit minus net investment.

As mentioned above, a non–deterministic stationary series will not be sufficient for solvency. However, if carrying out tests on the deficit with and without investment leads to different results, we can suspect that the capital formation issue plays some role in determining the debt path and that the fiscal stance of the country may depend on the explicit consideration of the public sector's real assets. Nonetheless, from a practical point of view, expenditure on public sector's capital formation have a very different economic content across countries so that public capital related–results should be considered with caution.

4. Econometric Methodology.

The test concerns stationarity of the data generating process of the series as well as the presence of deterministic components in it.

Stationarity with or without deterministic components is tested by using the Phillips–Perron approach (Phillips and Perron 1987; Phillips 1987; Perron 1988). The regression models to be estimated are:

$$y_t = \alpha_1 y_{t-1} + u_t^1 \tag{4.1}$$

$$y_t = \mu_2 + \alpha_2 y_{t-1} + u_t^2 \tag{4.2}$$

$$y_t = \mu_3 + \beta(t - \frac{T}{2}) + \alpha_3 y_{t-1} + u_t^3 \tag{4.3}$$

where T is the sample size. The conditions imposed on the sequence $\{u_t^i\}_{t=0}^{\infty}$ for i=1,2,3 are very general. A wide variety of data generating mechanisms for y_t are permitted, including virtually any ARMA with a unit root. The advantage of the Phillips–Perron test is that, without loss of generality, the test statistics require only the estimation of a first order autoregressive model by OLS and a correction factor based on the structure of the residuals from the regression.

Two classes of statistics are possible. The null hypothesis for the first class is $H_0: \alpha_i = 1$. This is tested by using either $Z(\alpha_i)$ which is based on the standardized and centered least squares estimates of α_i, or $Z(t_{\alpha_i})$, based on the t–statistics on α_i.

The second class of statistics builds on the regression F–tests studied by Dickey and Fuller (1981) for the general class of error process u^i. The null hypothesis for $Z(\Phi_1)$ in model (4.2) is $H_0: (\alpha_2 = 1, \mu_2 = 0)$. In model (4.3), two statistics are possible: $Z(\Phi_2)$ for the joint null $H_0: (\alpha_3 = 1, \beta = 0)$ within a maintained hypothesis which permits a non zero drift,

$Z(\Phi_3)$ for the joint null H_0:(α_3=1,β=0,μ_3=0). The source of critical values is Fuller (1976:371–373) for $Z(\alpha_i)$ and $Z(t_{\alpha_i})$, Dickey Fuller (1981:1062–63) for the other statistics[4].

If non stationarity can be rejected, a deterministic trend and drift can be tested by fitting an appropriate linear ARMA model. When the variable shows a monotonic trend, a possible testing strategy is that proposed by Perron (1988). Starting with the statistics related to the most general model (4.3), if rejection of the null is possible, there is no need for further testing. The series is stationary and deterministic components can be tested by using OLS estimates.

If the null is not rejected, it is still possible that either a deterministic drift or a trend belongs in the DGP. These can be tested by using the $Z(\Phi_2)$ and $Z(\Phi_3)$ statistics. If, again, the null H_0:(α_3=1,β=0,μ_3=0) cannot be rejected, we can make use of the statistics for both the model (4.2) and, for a mean zero process, the model (4.1). Further testing for a non zero drift is possible by using $Z(\Phi_1)$.

When the variable does not show a monotonic trend, model (4.3) may not be the most general one. Perron's strategy may not be appropriate and we will make use of the full range of available statistics.

Note three important *caveats*. First, the Phillips–Perron tests are asymptotic, while sample information is limited to yearly observations starting from 1960. Second, the power of these tests is very low against an alternative hypothesis of stationarity with a root close to one. Third, these tests requires that the Data Generating Process is stable over the sample period.

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[4] These statistics are influenced by the choice of a lag truncation number (λ). In some cases, results will depend on the number of lags allowed. These cases will be highlighted in the tables.

5. Empirical Evidence.

In the analysis to follow, we will perform four alternative solvency tests:

1) tests on the discounted debt (Wilcox (1989), Buiter and Patel (1990), Corsetti (1990));

2) tests on the debt to GDP ratio along the lines of the "practical solvency" criterion discussed in Buiter and Patel (1990);

3) tests on the real inflation–adjusted and seigniorage–adjusted overall balance of general government (the fiscal balance inclusive of interest payments), as suggested by Trehan and Walsh (1988);

4) tests on the real inflation–adjusted and seigniorage–adjusted current balance of the general government (the fiscal balance inclusive of interest payments but net of capital formation minus depreciation).

The first set of tests is based on a measure of discounted debt. Available OECD data refer to the general government financial liabilities, including and excluding government financial assets. These series are defined as Gross and Net Debt, respectively. The absence of data on the consolidated public sector is the first major difficulty in carrying out empirical studies of solvency. For some countries, publicly owned enterprises account for a substantial fraction of the domestic capital stock. Both series of general government debt are subject to measurement errors. However, there is some evidence that these errors are more severe in the case of the net debt. For this reason, the test will be carried out by using both series, where, from a logical point of view, only the net debt would be appropriate. Since published data do not consolidate the central bank, we have subtracted the stock of base money from the measure of debt.

The correct interest rate to be used in the discounting is the rate effectively paid by the government on its liabilities. We obtain alternative *implicit* interest rates by dividing the interest bill in a given year by the stock of outstanding debt at the beginning of that year. This produces two series of the *implicit* interest rates, referring to the gross

and the net government debt. Of course, while these *average* effective interest rates are formally more appropriate than *marginal* rates associated to new issues of government bonds, their correct estimate requires data on interest payments that exactly match the measure of liabilities used in the calculation. Due to the unavoidable measurement errors in estimating the implicit rates, we also construct a discount factor based on the gross yield on long term government bonds. All interest rates are before–tax, leading to an over–estimation of the discount factor. The magnitude of the over–estimation varies across countries.

Consider now the third and fourth set of tests. A measure of the real inflation–adjusted and seigniorage–adjusted deficit is obtained by first differencing the end of period stocks of net (gross) debt in real terms and subtracting seigniorage. This definition of the real deficit has the advantage of purging the government interest bill of its inflation–related component. Net investment refers to general government gross capital formation minus depreciation.

The graphs at the end of the paper show, for each country, the discounted debt, the debt to GDP ratio and the real deficit, with and without net investment, over the sample period. Results for the alternative tests are shown in tables 6 through 9. For the sake of simplicity, we report only the probability value at which the null hypothesis can be rejected. A brief scheme containing the corresponding null hypothesis is published as a footnote to the tables. Sometimes results depend on the lag truncation number in the statistics. These cases will be highlighted in the text.

Table 6 presents for the Wilcox–type test on the discounted debt. According to the discussion in section 3, we consider evidence for insolvency the presence of a deterministic positive trend or drift in the Data Generating Process (DGP) of the series. Solvency will be associated either with a non deterministic stationary process (*strict solvency*) or with negative deterministic components in the DGP of the series (*supersolvency*). In the case of non deterministic but non stationary processes, the test results will be considered

inconclusive.

Results in Table 6 refer to the net interest bearing debt (net liabilities minus base money) discounted with the interest rate obtained by dividing the *passive* interest bill by the *gross* debt. This discount factor is preferred over the alternative one based on the published series of *net* interest payments and *net* debt because these series seem to exacerbate problems of mismatched accounting criteria and definitions. Nevertheless, we have performed the tests on a variety of measures of discounted debt, to which we will occasionally refer in the analysis to follow.

We will first discuss the empirical evidence for the G–7 and Belgium. For these countries, available OECD data go back to the early 1960s. We will begin with the two cases in which the results of the test are against solvency: Italy and Belgium.

The test provides strong evidence against the sustainability of current policies in Italy. While $Z(t_{\alpha_3})$ does not reject the null hypothesis of a unit root, both $Z(\Phi_2)$ and $Z(\Phi_3)$ reject the joint null of a unit root *and* a zero time trend (*and* a zero drift for the second statistic)[5]. Since in the case of Italy the estimated time trend is positive (the discounted debt is clearly trended upwards), these results reject solvency.

In principle, it is possible that the necessary steps towards a correction of the fiscal stance are already undertaken within the sample period, but the test fails to detect their effects on the series of the discounted debt. However, a simple inspection of the set of graphs referring to Italy does not seem to support this possibility. Primary surpluses are never achieved in the eighties, as implied by a monotonically increasing series of discounted debt. Real overall deficits are around 4% of the GDP at the end of the sample.

Belgian discounted debt follows a non–stationary non–trended process; both the statistics $Z(t_{\alpha_3})$ and $Z(\Phi_3)$ accept the corresponding null hypotheses. However, the statistic $Z(\Phi_2)$ suggests the presence of a deterministic drift, which is positive in the

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[5] Corsetti (1990) reaches the same conclusion by using quarterly data.

estimation. This is evidence against solvency. Note that the set of graphs for Belgium actually shows some degree of fiscal adjustment in the second half of the eighties. The discounted debt path is rather flat after 1985. Nonetheless, the size of the real deficit is always above 5% of the GDP in the last decade.

In the case of Japan, results vary across definitions of discounted debt. While there is evidence of non stationarity for all alternative series, the presence of a positive deterministic trend is supported in the series of net debt but not in that of gross debt. A non zero deterministic component is also rejected by the statistics corresponding to the regression model (4.2). Since the failure to reject a unit root is accompanied by ambiguous results concerning deterministic components in the series, we will consider this case as inconclusive. Indeed, the graphs for Japan show different patterns within the sample period: a steep increase in the discounted debt between 1974 and 1983, a few years characterized by a flat pattern and, eventually, a sharp decrease beginning in 1986.

For the other five countries (U.S.A., Germany, France, U.K. and Canada), the discounted debt appears to follow a drift–less and trend–less non–stationary process. In this case supersolvency and insolvency are equally likely. Evidence for these countries will also be interpreted as inconclusive.

Next, consider the remaining ten countries. Evidence for deterministic components in the DGP of discounted debt appears in Austria, Greece and Ireland. In these cases, the non stationarity of the series cannot be rejected. The statistic $Z(\Phi_2)$ supports the existence of a non zero drift in addition to a unit root in the case of Austria. A positive drift is quite apparent in the corresponding graph. Evidence against solvency is even stronger in the case of Greece and Ireland, where also the statistic $Z(\Phi_3)$ rejects the null ($\alpha_3=1,\beta=0,\mu=?$). This suggests the presence of a non zero time trend in the DGP of the series, which results positive in the estimation.

The case of the Netherlands is interesting from the point of view of assessing the behavior of the test in the presence of within sample structural changes. The statistics

suggest the presence of a non zero deterministic drift if we exclude the last two years in the sample (1987 and 1988), when the government has started a program of fiscal retrenchment. However, the test statistics support a non–deterministic, non–stationary process when the full sample span is considered.

For the other five countries (Norway, Finland, Denmark, Spain, Sweden and Australia), discounted debt appears to follow a drift–less and trend–less non–stationary process, providing no clear evidence against or in favor of solvency. However, note that four countries are net financial creditors throughout most of the sample (Norway, Finland, Sweden and Spain), while a fifth one (Australia) shows a declining pattern in the discounted debt during the second half of the sample. The sustainability of public debt does not appear to be an issue in these cases.

We now move to the "practical" criterion for solvency and analyze the stochastic properties of the debt to GDP ratio. The results for the series of net interest bearing liabilities (net debt minus base money) are presented in table 6. We consider first the G–7 countries and Belgium.

Consistent with the results referring to discounted debt, there is clear evidence against solvency for Italy and Belgium. While both series appear to be non stationary, the statistic $Z(\Phi_2)$ rejects the joint null hypothesis of a zero drift, zero trend and a unit root. In the case of Belgium, the presence of deterministic components in the series is detected also by $Z(\Phi_3)$, which suggests the presence of a time trend. The graphs show a close resemblance in the pattern of discounted and undiscounted debt.

The sharp increase in the Canadian debt to GDP ratio in the eighties may help explain why the test statistics suggest the presence of a deterministic drift in the series (both $Z(\Phi_2)$ and $Z(\Phi_3)$ reject the corresponding null). We have seen that this country is not insolvent based on the discounted debt–related results. However, *strict* solvency does not rule out an ever increasing debt to GDP ratio. Note, though, that for Canada this variable tends to stabilize slightly above 30% in the second half of the eighties, possibly

suggesting the presence of some corrective fiscal measures that the statistical test fails to detect.

Test results are ambiguous for Germany and the United States. Using the regression model (4.3), there is some evidence supporting the presence of deterministic components in the DGP of the series, but only for net debt. The gross debt to GDP ratio appears to follow a non–deterministic non–stationary process. Moreover, for the U.S.A., a deterministic drift seemed to be ruled out if we use statistics corresponding to the regression model (4.2). A conservative interpretation of these results suggests considering this evidence inconclusive.

The statistic $Z(\Phi_2)$ supports the presence of a deterministic component in the Debt to GDP ratio for the U.K.. Even if the statistics fails to reject the null hypothesis, it could be possible that a deterministic trend still belongs to the series. This is suggested by the fact that the variable is monotonically decreasing from above 100% in 1960 to below 30% in 1989. This suggests that the hypothesis of solvency based to the practical criterion should not be rejected. Both France and Japan are characterized by a pure non stationary process for the debt to GDP ratio. Test results are therefore inconclusive.

As far as the other countries in the sample are concerned, strong evidence against solvency is found in the case of Austria, the Netherlands, Ireland and Greece. A positive drift appears to belong in the DGP of the series. In the case of Ireland, there is also evidence of a positive time trend. The case of Australia is more complex. The set of statistics referring to the regression model (4.3) suggest the that the debt to GDP ratio is a non–stationary process with a deterministic drift. However, non stationarity tends to be rejected by the statistics referring to regression models (4.1) and (4.2). Unambiguous conclusions cannot be drawn.

For the remaining five countries (Sweden, Finland, Denmark, Norway and Spain), a pure non stationary process for the series makes the evidence inconclusive. However, as pointed out in discussing the results for the discounted debt, it is important to note that

four of these countries are net financial creditors throughout most of the period.

The third and fourth types of tests focus on the government budget deficit, rather than on the stock of debt. Wilcox (1989) and Buiter and Patel (1990) convincingly argue that the only testable implication of the government intertemporal budget constraint is (2.6'), so that tests should be carried out on the series of discounted debt. In fact, if we consider budget deficits, a pure non–deterministic stationary DGP of this series will not be sufficient for solvency. The infinite sum of the series should also be at most equal to the negative of the outstanding debt.

The reason why we follow the Hamilton and Flavin – Trehan and Walsh approach is that it allows us to control to some extent for the public sector capital formation given the absence of time series on the value of the general government real assets. The previous discussion pointed out that available information suffers from a major defect: it does not consolidate public enterprises. We can reasonably expect that in some cases, such as Italy, the consolidation of the entire public sector in a unique accounting framework may change drastically the perception of its net worth. Available data refer at most to the general government. However, even in this case, there is little or no information about the value of the real assets the government owns.

The crucial point is that in principle the return on government investment projects may repay for their costs, without requiring increases in tax rates. The bench–mark case is one in which the rate of return on capital is equal to the interest rate on government debt. In this case, solvency should be assessed on a measure of debt *net* of government real assets. Taking the first differences of this series, we now focus on the real deficit net of investment. Note that this approach implies the maintained assumption that capital gains on real assets are not relevant. In addition, we again stress that the economic content of the government investment expenditure varies across countries. These considerations should be kept in mind when assessing the results to follow.

We perform tests on the real inflation–adjusted seigniorage–adjusted government

deficit, with and without net investment. A different behavior of the two series may convey some information about the role of capital formation in government solvency. As in the case of the stock of debt, insolvency will follow from positive deterministic components in the series. Nevertheless, tests results will now be inconclusive in all other cases.

Table 8 refers to the fiscal balance including net investment computed by using the series of net debt. In no case we will be able to provide unambiguous evidence against solvency. As far as the group of the G–7 countries *plus* Belgium is concerned, a stationary process with a negative drift (surplus) for the series of the overall deficit seems to characterize France and U.K. While this is not *per se* sufficient for solvency, it certainly provides some evidence in its favor.

In the case of the U.S.A. and Germany, the test statistics provide mixed evidence in favor of the stationarity of the series, depending on which regression model is used. Non stationarity in the absence of deterministic components in the DGP of the series characterizes the remaining countries. In this case, test results are inconclusive.

For the remaining ten countries, some evidence of stationarity of the process can be found in the cases of Spain, Finland, Norway, Ireland and Greece. Non stationarity is rejected consistently for all regression models for Spain. The Spanish government has been a net financial creditor until 1985. This should be indicative of the limited fiscal problems this country has faced in the last two decades. Evidence of stationarity is not unambiguous for Finland. However, the government of this country has been a net financial creditor throughout the period as well.

The results referring to Norway vary with the series of debt used in the calculation of the real deficit. Non stationarity is never rejected if we use the net debt, but is rejected quite consistently if we use the gross debt series. Notice that Norway attains overall fiscal surpluses in all but five years within the sample period. Moreover, the net debt is negative and diminishing in the eighties.

The results for Greece and Ireland are somehow surprising. There is some evidence

in favor of stationarity which does not allow a definite conclusion against solvency. However, strong evidence against solvency was found in the context of the Wilcox and Buiter and Patel –type tests. One of the striking features of the data for Greece is the heavy use of seigniorage in the budget process. This is possibly the key factor driving the inconsistency in the results across different tests.

Inconclusive evidence for Sweden, Austria, the Netherlands, Denmark and Australia stems from the fact that all the statistics fail to reject the null hypothesis of a pure non–deterministic non–stationary process. In the case of Sweden, however, the general government is a net creditor in all but a few years in the sample period.

The final battery of tests focus on the real inflation–adjusted seigniorage–adjusted current balance of the general government, namely, the fiscal balance inclusive of interest payment but excluding net investment. Results are reported in Table 9. First, note that in no case we find evidence *rejecting* solvency, that is, we find no positive deterministic component in the DGP of the series. In principle, then, as in the previous test, results are inconclusive.

In the group including the G–7 countries and Belgium, all countries but France and Canada are characterized by non–deterministic non–stationary processes for the adjusted *current* balance. Although this result does not allow us to draw any conclusion, it could be informative to analyze the data in greater detail.

Consider first the case of the United States. Looking at the U.S. data we observe a string of current fiscal surpluses in the period from 1960 to 1981, followed by a string of current fiscal deficits up to the present. Yet, the period after 1985 is characterized by a phase of fiscal retrenchment with falling current deficit to GDP ratio. The inflation–adjusted seigniorage–adjusted budget is almost balanced by 1989. Note the difference in the measure of U.S. fiscal imbalance when we compare our measures of fiscal balance with the published conventional financial budget balance (table 4). The latter measure is not corrected for seigniorage revenue and includes interest payments which are

not purged of their inflation component. While the continuation of the process of fiscal adjustment in the U.S. might be important for other macroeconomic reasons, the stabilization of the net debt to GDP ratio to a value around 24% since 1987 is an indication that the short term solvency of the public sector might not be an issue for the United States. In the case of Japan, the current real fiscal balance has been in surplus in all the years in the sample. Moreover, even without considering the value of the public capital stock, the Japanese general government is a net creditor by 1989.

The data for Germany show current fiscal surpluses in most years in the sample, with the exceptions of 1975, 1980 and 1981. Moreover, while the German government has become a net financial debtor in 1978, the debt to GDP ratio has stabilized around the 10–13% since 1982. In the United Kingdom, the net debt to GDP ratio systematically falls from 116% in 1960 to 28.6% in 1989. The current fiscal balance is in surplus in all years between 1960 and 1989, with the exclusion of 1975, 1983 and 1984. The overall evidence is therefore quite consistent with public sector solvency in Germany and the U.K..

Both Italy and Belgium show large and often increasing current real fiscal deficits. Belgium shows continuous current deficits since 1977. In Italy, despite the high public investment to GDP ratio, even the current balance of the general government is negative since 1982. Given these large and persistent current fiscal deficits and a debt to GDP ratio around 100% in both countries, fiscal insolvency is very likely in the absence of a major shift in fiscal policies.

In the cases of France and Canada, all the statistics provide evidence in favor of the stationarity of the processes followed by the adjusted current balance. France shows current fiscal surpluses in all but 4 years in the last three decades. The case of Canada is slightly more complex: the current fiscal balances of Canada show surpluses in the years from 1960 to 1981 and current deficits since then. However, the large current deficits of the early 1980s have been significantly reduced and Canada has reached a virtual current balance in 1989. The stabilization of the net debt to GDP ratio to a value around 33%

since 1986 is another signal of stable fiscal conditions.

Among the smaller OECD countries, Norway, Finland and Australia do not appear to need fiscal retrenchments. While Finland alone shows statistical evidence of stationarity, these countries are characterized by current surpluses in all the years for which data are available (Australia shows minor current deficits in 1983, 1984 and 1987). Moreover, both Norway and Finland have been net creditors throughout the sample period. In the case of Australia only data on gross debt are available: its ratio to GDP has moved in a low and narrow range of 15–20% in the last decade. This, and the systematic evidence of current surpluses suggest that short term solvency might not be an issue in the Australian case. The tests for Sweden, Austria and Denmark fail to reject the unit root hypothesis in all cases. Sweden shows current surpluses or virtual balances in all years but those going from 1980 to 1983. Moreover, this country was a net creditor throughout the 1970s and became net creditor again in 1988. In the case of Austria we observe current fiscal surpluses in most of the years in the sample; the observed increase in the debt to GDP ratio (from 6.2% in 1970 to 42.1% in 1988) can be partially explained by the divergence between current and overall fiscal balances. While the current fiscal balance is mostly in surplus, the overall (capital expenditures inclusive) fiscal balance is in deficit throughout most of the period. The assessment of general government solvency in Austria, therefore, could depend on whether or not one excludes the stock of public capital from the debt of the government. In the case of Denmark, years of severe fiscal imbalances in the 1979 to 1984 period have been followed by a serious fiscal retrenchment and surpluses in current (overall) fiscal balances since 1984 (1985). After peaking to 34% of GDP the net debt to GDP ratio has rapidly fallen to 17.6% of GDP in 1988. The results for Spain do not seem inconsistent with public sector solvency: stationarity cannot be rejected. The data for Spain also show current fiscal surpluses for all years but 1984 and 1985, a net creditor position for the public sector until 1983 and a small net debt (8.6% of GDP as of 1988) since then.

6. Conclusions

This paper addressed both methodological and empirical aspects of tests for public sector solvency and provided an application to a large sample of OECD countries in a unified framework.

Among the methodology–related issues that have been mentioned throughout the paper we want to stress the following. Meeting the intertemporal budget constraint is a long run concern. The tests used in the paper are aimed at assessing whether sample policies will eventually lead to a rejection of solvency, if pursued over the distant future. Intuitively, we expect the rejection of solvency to become less likely as the sample size increases. Past behavior will have more weight and, even in the case of financially troubled governments, can reflect ex post solvency. Testing over samples covering a short span, however, decreases the power of the tests. In particular, non stationarity of the series will be difficult to reject.

The statistical tests of the long term solvency of the general government for a sample of 18 OECD countries in the 1960–1989 period show a wide variety of patterns of fiscal policy. We detected wide differences across countries in the long term sustainability of present trends of spending and taxation. Among the G–7 countries, a serious problem of solvency was found only for the case of Italy. With a debt to GDP ratio near 100% and the presence of still large primary deficits, a major improvement of the fiscal balances of Italy is required to assure solvency.

In the case of the United States formal statistical tests of solvency do not allow us to draw unambiguous conclusions. Nevertheless, a close examination of the data suggested that short term solvency of the general government might not be an issue for the United States. A few caveats in the U.S. case are, however, required. First, our data refer to the consolidated general government; this includes state and local fiscal balances. It should be noted that for the U.S. general government a large fiscal deficit by the Federal government

is dampened by the fiscal surpluses of state and local authorities. Second, the transfer to off–budget accounts of many federal liabilities (such as the liabilities associated with the savings and loans bailout) might understate the fiscal problems faced by the United States government.

Solvency does not appear to be an issue for the other two major OECD countries, Japan and Germany. The large Japanese fiscal deficits of the 1970s were followed by a strong fiscal retrenchment in the 1980s; by 1989, the general government in Japan appeared as being a virtual net creditor. With a debt to GDP ratio stabilized around 10% since 1982, Germany does not appear to face serious solvency problems either. However, our analysis has been based on past trends and is not able to capture the potential implications of the recent German unification for the future fiscal balances of the united German state or the future social security liabilities of Japan. The overall analysis of the data also suggest that solvency is not an issue in France, the United Kingdom and Canada.

Among the smaller OECD countries, problems of sustainability of the present paths of fiscal policy appear to exist in Belgium, Ireland, the Netherlands and Greece. These countries have in common a large debt to GDP ratio (above 100% in Belgium and Ireland); they however, differ in that that two of them, Ireland and Belgium, started in the mid 1980s a process of fiscal adjustment that has led to primary surpluses and to a minor reduction of the debt to GDP ratio in the case of Ireland. Conversely, primary deficits still persist in the other two countries, more seriously in Greece than in the Netherlands; this is clearly inconsistent with long term solvency.

Finally, solvency does not appear to be a problem for the rest of the OECD countries in the sample. They are all characterized by primary fiscal surpluses plus low and falling debt to GDP ratios. Finland, Norway and Sweden, in particular, appear to be net creditors.

Appendix 1

This appendix explains the data used in the tests and shown in the graphs. These refer to the general government. The general government data consolidate the accounts of the central government, the social security agencies and the state and local authorities.

We show two graphs for each country. The one on the top of the page plots the general government net interest bearing liabilities (net debt minus base money), both discounted at the implicit interest rate (passive interest payments divided by gross debt), *and* as a ratio to GDP. For some countries only the *gross* debt is available.

The scale of the two variables is different. In order to plot them in the same graph, the discounted debt has been re–scaled.

The second graph plots the inflation–adjusted, seigniorage–adjusted deficits, with and without net investment. The measure of the deficits is obtained by first differencing the series of end of period *net* debt in real terms and subtracting seigniorage. Estimated end of period GDP deflators are used in the calculation of real debt.

Thus, these measures of general government debt and deficit are not directly comparable with the data shown in Tables 4 and 5, which relies on published OECD data.

The sources of the data are as follows: OECD National Income Accounts for the General Government and GDP statistics; IMF IFS for base money and long term government bond yields; OECD Economic Outlook and OECD (unpublished) for General Government debt data. All data are yearly.

The largest sample span is 1960–1989 for the G–7 countries and Belgium; for the other OECD countries data on public debt are available only from 1970 on.

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Table 1. Public Expenditures (as a Share of GDP) in Selected OECD Countries

Level

Year	1938	1950	1965	1973	1982	1985
Country:						
France	21.8	27.6	38.4	38.5	51.1	52.4
Germany	42.4	30.4	36.6	41.5	49.4	47.2
Japan	30.3	19.8	19.0	22.4	33.7	32.7
Netherlands	21.7	26.8	38.7	45.8	61.6	60.2
United Kingdom	28.8	34.2	36.1	40.6	48.2	47.7
United States	18.5	22.5	27.4	30.6	36.5	36.7
Italy	29.2	30.3	34.3	37.8	47.6	50.8

Average Change per Year

Period:	1938-1950	1950-1965	1965-1973	1973-1982	1982-1985
Country:					
France	0.48	0.72	0.01	1.40	0.43
Germany	-1.00	0.41	0.61	0.87	-0.73
Japan	-0.87	-0.05	0.42	1.25	-0.33
Netherlands	0.42	0.79	0.88	1.75	-0.46
United Kingdom	0.45	0.12	0.56	0.84	-0.16
United States	0.33	0.32	0.40	0.65	0.06
Italy	0.09	0.26	0.43	1.08	1.06

Source: Lybeck and Henreckson (1988) (page 189) for 1938,1950,1960,1985 figures. OECD Economic Outlook for 1973 and 1965 figures.

Table 2. Total Outlays of the General Government (as as share of GDP)

YEAR	US	GERMANY	FRANCE	UK	ITALY	JAPAN	CANADA	NORWAY	AUSTRALIA
1965	27.4	36.6	38.4	36.1	34.3	19.0	28.5	NA	NA
1966	28.5	36.7	38.5	35.3	34.3	19.1	29.5	NA	NA
1967	30.5	38.6	39	38.2	33.7	18.2	31.5	NA	NA
1968	30.7	39.1	40.3	39.2	34.7	18.3	32.3	NA	NA
1969	30.4	38.6	39.6	41.2	34.2	18.3	32.7	39.9	24.1
1970	31.6	38.6	38.9	39.8	34.2	19.4	34.8	41.0	26.8
1971	31.6	40.1	38.3	38.9	36.6	20.9	36.1	43.0	27.5
1972	31.3	40.8	38.3	40.5	38.6	22.1	36.6	44.6	27.1
1973	30.6	41.5	38.5	41.5	37.8	22.4	35.4	44.6	27.7
1974	32	44.6	39.7	45.7	37.9	24.5	36.8	44.6	31.6
1975	34.6	48.9	43.5	47.3	43.2	27.3	40.1	46.2	33.6
1976	33.4	47.9	44	46.6	42.2	27.7	39.1	48.1	34.1
1977	32.2	48	44.2	44.7	42.5	29	40.1	49.6	35.2
1978	31.6	47.8	45.2	44.2	46.1	30.5	40.3	51.8	34.2
1979	31.7	47.6	45.5	43.9	45.5	31.6	39	50.4	33.4
1980	33.7	48.3	46.4	46	41.6	32.6	40.5	48.3	33.8
1981	34.1	49.2	49.1	48.7	45.5	33.5	41.5	47.9	34.6
1982	36.5	49.4	51.1	48.2	47.6	33.7	46.4	48.3	37.1
1983	36.9	48.3	52	48.1	48.8	34.1	46.9	48.4	37.6
1984	35.8	48	52.7	48.9	49.5	33.2	47	46.3	38.7
1985	36.7	47.5	52.2	47.7	50.8	32.7	47	45.6	38.8
1986	37.0	46.9	51.6	47.0	50.9	33.1	46.6	50.0	38.6
1987	36.9	46.9	51.3	44.7	50.7	33.4	45.5	51.1	36.4
1988	36.3	46.6	50.3	na	50.8	32.9	44.4	NA	34.5

Table 2 (cont.)

YEAR	BELGIUM	NETHER	AUSTRIA	SPAIN	DENMARK	IRELAND	SWEDEN	FINLAND	GREECE	OECD
1965	32.3	38.7	37.8	NA	29.9	33.1	36.1	30.8	NA	29.5
1966	33.5	40.7	38.3	NA	31.7	33.6	38.3	32	NA	30.1
1967	34.5	42.5	40.5	NA	34.3	34.8	40.2	32.9	NA	31.5
1968	36.3	43.9	40.6	NA	36.3	35.2	42.8	32.8	NA	31.8
1969	36.1	44.4	40.3	21.7	36.3	36.6	43.2	31.2	22.5	31.7
1970	36.5	43.9	39.2	22.2	40.2	39.6	43.3	30.5	22.4	32.4
1971	38	45	39.7	23.6	43	40.5	45.3	32	22.8	32.9
1972	38.8	45.6	39.8	23.2	42.6	38.8	46.2	32.4	22.0	33.1
1973	39.1	45.8	41.3	23.0	42.1	39	44.7	31	21.1	33
1974	39.4	47.9	41.9	23.1	45.9	43	48.1	32	25.0	34
1975	44.5	52.8	46.1	24.7	48.2	46.5	48.9	36.1	26.7	38
1976	45	52.9	46.9	26.0	47.8	46	51.7	37	27.4	37.4
1977	46.5	53	46.8	27.5	48.9	43.7	57.5	38.2	29.0	37.2
1978	47.8	54.4	49.7	29.3	50.6	44.3	59.2	37.7	29.9	37.6
1979	49.3	55.8	48.9	30.5	53.2	46.8	60.7	36.6	29.7	38.1
1980	50.8	57.5	48.9	32.9	56.2	50.9	61.6	36.5	30.5	39.3
1981	55.1	59.7	50.3	35.6	59.8	52.5	64.6	37.3	35.9	39.9
1982	55.3	61.6	50.9	37.5	61.2	55.8	66.6	39	37.0	41.3
1983	55.0	62.2	51.2	38.8	61.6	55.8	66.2	40.3	38.2	41.4
1984	54.1	61.0	50.8	39.3	60.7	53.9	63.5	39.9	40.2	40.4
1985	53.7	59.7	51.7	42.1	59.3	55.2	64.3	41.6	43.7	40.7
1986	53.4	59.6	52.7	41.7	55.7	55.1	62.6	42.2	43.1	41.1
1987	52.5	60.7	52.8	NA	57.6	53.4	59.0	42.2	44.6	41.0
1988	50.7	57.9	50.6	NA	60.2	NA	NA	40.2	45.7	39.8

Source: OECD Economic Outlook, various issues.

Table 3. Current Receipts of the General Government (as a share of GDP).

YEAR	US	JAPAN	GERMANY	FRANCE	UK	ITALY	CANADA	AUSTRIA
1966	26.7	19.1	36.1	38.4	34.3	29	28.8	39.3
1967	27.1	19.3	36.7	38.2	36.2	31	30.3	39.1
1968	28.7	19.6	37.8	38.8	37.6	31.6	31.7	38.9
1969	29.9	19.6	39.3	39.8	39.5	30.7	33.7	39.6
1970	28.9	20.7	38.3	38.5	41.2	30.4	34.2	39.7
1971	28.2	21.6	39.4	37.7	39.1	31.1	34.7	40.5
1972	29.3	21.5	39.8	37.9	37.5	30.9	35.2	41.2
1973	29.6	22.5	42.2	37.8	36.8	30.4	34.9	41.9
1974	30.3	24.5	42.7	38.4	40.6	30.6	37.2	42.5
1975	28.8	24	42.7	39.7	41.3	31.2	36.1	42.9
1976	29.5	23.6	44	41.8	40.0	32.9	35.8	42.4
1977	29.7	24.7	45	41.4	39.1	34.3	36.1	43.7
1978	29.9	24.5	44.7	41.1	37.7	36	35.7	46.2
1979	30.5	26.3	44.4	42.7	38.2	35.7	35.5	45.8
1980	30.8	27.6	44.7	44.5	40.1	32.9	36.2	46.4
1981	31.6	29.1	44.8	45.1	42.4	33.8	38.5	47.8
1982	31.1	29.5	45.4	45.9	43.0	36	39	46.7
1983	30.7	29.8	45.1	46.6	42.3	37.8	38.7	46.4
1984	30.7	30.4	45.4	47.5	42.3	37.7	38.7	47.5
1985	31.1	31.2	45.4	47.6	42.3	38.2	38.7	48.5
1986	31.4	31.5	44.9	47.1	41.5	38.9	39.5	48.2
1987	31.9	33.4	44.4	47.6	40.7	39.3	39.6	47.8
1988	31.5	34.3	43.7	47.1	na	39.9	40.4	46.8

Table 3 (cont.)

YEAR	BELGIUM	DENMARK	FINLAND	NETHERL	NORWAY	SWEDEN	IRELAND	SPAIN
1966	32.4	33.5	32.8	39.2	38.3	41.3	30	NA
1967	33.2	34.1	34.6	40.6	40.5	42.7	30.6	NA
1968	33.8	36.9	34.8	42.4	41.1	45.7	31	NA
1969	34.3	37.2	33.8	43.2	43.3	46.7	31.6	21.9
1970	35.2	41.7	34.1	42	43.5	46.6	35.3	22.5
1971	35.7	46.4	35.7	43.3	46.6	49.4	36.3	22.6
1972	35.5	45.9	35.4	44.5	48.4	49.5	34.9	23.0
1973	36.4	46.8	36	45.9	49.6	47.7	34.5	23.7
1974	37.7	48.4	35.7	47	48.5	48.8	35.2	22.8
1975	40.4	46.1	37.8	49.2	48.7	50.5	34.6	24.3
1976	40.2	46.9	41	49.5	49.8	55.1	37.9	25.3
1977	41.6	47.6	40.3	50.5	50.0	58	36.4	26.5
1978	42.4	49.6	38	50.9	50.8	57.5	35.2	27.1
1979	43.1	50.8	36	51.4	50.8	56.4	35.9	28.4
1980	42.8	52.2	35.9	52.8	53.2	56.3	38.8	29.7
1981	43.6	52.1	37.6	53.5	51.8	57.7	39.6	31.2
1982	45.3	52.1	37.5	53.8	51.9	58.3	41.9	31.4
1983	44.6	53.6	37.5	55.3	51.8	59.5	43.6	33.5
1984	45.6	55.5	39.1	54.3	53.0	59.2	43.7	33.2
1985	45.9	56.5	40.5	54.3	55.1	59.2	43.7	34.5
1986	45.1	58.3	41.8	53.0	54.7	60.7	43.6	35.0
1987	45.6	59.2	39.7	53.4	53.7	61.8	43.8	NA
1988	44.3	59.5	40.3	52.2	NA	NA	NA	NA

Table 3 (cont.)

YEAR	GREECE	AUSTRALIA	TOTAL OECD
1966	NA	NA	NA
1967	NA	NA	29.2
1968	NA	NA	30.3
1969	27.2	26.5	31.3
1970	26.8	26.6	30.8
1971	26.6	27.3	30.6
1972	26.6	25.2	31
1973	25.4	26.7	32.1
1974	27.0	28.5	33.2
1975	27.4	29.1	33.1
1976	29.5	29.9	33.7
1977	29.9	30.3	34.1
1978	30.1	29.1	34.0
1979	30.6	29.8	34.9
1980	30.5	30.7	35.6
1981	29.1	31.9	35.9
1982	32.3	32.4	36.0
1983	33.6	31.7	35.7
1984	34.8	33.4	35.6
1985	34.6	34.0	36.0
1986	35.7	35.0	36.5
1987	36.9	34.9	37.4
1988	35.1	34.4	36.6

Source: OECD ECONOMIC OUTLOOK, Table 15R.

Table 4. General Government Financial Balances (as a share of GDP).

YEAR	OECD	US	JAPAN	GERMANY	FRANCE	UK	ITALY	CANADA
1970	0.1	-1	1.8	0.2	0.9	2.5	-3.7	0.9
1971	-0.5	-1.8	1.2	-0.2	0.7	1.4	-5.5	0.1
1972	-0.5	-0.3	-0.1	-0.5	0.8	-1.8	-7.9	0.1
1973	0.1	0.6	0.6	1.2	0.9	-3.4	-7.4	1
1974	-0.5	-0.3	0.4	-1.3	0.6	-3.8	-7.5	1.9
1975	-3.8	-4.1	-2.7	-5.7	-2.2	-4.7	-12.4	-2.4
1976	-2.7	-2.2	-3.7	-3.4	-0.5	-4.9	-9.5	-1.7
1977	-2.1	-1	-3.8	-2.4	-0.8	-3.4	-8.4	-2.4
1978	-2.3	0	-5.5	-2.4	-1.9	-4.2	-10.3	-3.1
1979	-1.8	0.5	-4.7	-2.5	-0.7	-3.3	-10.1	-2
1980	-2.5	-1.3	-4.4	-2.9	0	-3.5	-8.5	-2.8
1981	-2.7	-1	-3.8	-3.7	-1.9	-2.8	-11.5	-1.5
1982	-4.0	-3.5	-3.6	-3.3	-2.8	-2.3	-11.3	-5.9
1983	-4.2	-3.8	-3.7	-2.5	-3.2	-3.6	-10.7	-6.9
1984	-3.4	-2.8	-2.1	-1.9	-2.7	-3.9	-11.5	-6.6
1985	-3.4	-3.3	-0.8	-1.1	-2.9	-2.9	-12.6	-7
1986	-3.3	-3.5	-0.9	-1.2	-2.9	-2.4	-11.7	-5.5
1987	-2.3	-2.4	0.7	-1.8	-1.9	-1.2	-11.1	-4.4
1988	-1.6	-2.0	2.1	-2.1	-1.8	1.1	-10.9	-2.6

YEAR	BELGIUM	DENMARK	FINLAND	NETHERL	NORWAY	SWEDEN	IRELAND	AUSTRIA
1970	-2	3.2	4.3	-0.8	3.2	4.4	-3.7	1
1971	-3	3.9	4.5	-0.5	4.3	5.2	-3.5	1.5
1972	-4	3.9	3.9	-0.6	4.5	4.4	-3.2	2
1973	-3.5	5.2	5.7	0.6	5.7	4.1	-4.2	1.3
1974	-2.6	3.1	4.6	-0.4	4.7	1.9	-7	1.3
1975	-4.7	-1.4	2.6	-3	3.8	2.7	-11.3	-2.5
1976	-5.4	-0.3	4.8	-2.9	3.1	4.5	-7.5	-3.7
1977	-5.5	-0.6	3.1	-2.1	1.7	1.7	-6.9	-2.4
1978	-6	-0.3	1.4	-3.1	0.6	-0.5	-8.8	-2.8
1979	-7.3	-1.7	0.4	-3.5	3.4	-3	-10.7	-2.4
1980	-9.2	-3.2	0.5	-4	5.7	-3.7	-12.2	-1.7
1981	-13.4	-6.9	1.3	-5.5	4.7	-4.9	-13.3	-1.8
1982	-11.2	-9.1	-0.4	-7.1	4.4	-6.3	-14.1	-3.4
1983	-11.4	-7.2	-1.6	-6.4	4.2	-5	-12.0	-4.2
1984	-9.3	-4.1	0.3	-6.2	7.5	-2.6	-10.1	-2.7
1985	-8.7	-2.1	0.1	-4.8	10.4	-3.8	-11.8	-2.5
1986	-8.8	3.4	0.8	-6.0	5.9	-1.3	-11.6	-3.7
1987	-7.2	2.5	-1.2	-6.5	4.8	4.2	-9.2	-4.3
1988	-6.8	0.3	1.4	-5.0	3.1	3.4	-2.6	-3.1

Table 4 (cont.)

YEAR	SPAIN	GREECE	AUSTRALIA
1970	0.0	-0.1	2.8
1971	-1.0	-0.9	2.3
1972	-0.1	-0.3	2.1
1973	0.8	-1.4	-0.2
1974	-0.4	-2.2	2.3
1975	-0.5	-3.4	-0.6
1976	-1.1	-2.6	-2.9
1977	-1.4	-2.1	-0.8
1978	-2.4	-1.7	-2.8
1979	-2.2	-2.5	-2.6
1980	-2.6	-2.9	-1.9
1981	-3.9	-10.9	-1.2
1982	-5.6	-7.6	-1.0
1983	-4.8	-8.6	-4.5
1984	-5.5	-10.2	-4.0
1985	-7.0	-14.0	-3.3
1986	-6.1	-12.7	-3.0
1987	-3.2	-12.0	-1.1
1988	-3.1	-14.5	0.7

Source: OECD Economic Outlook, Table 13R.

Table 5.

Net Debt of the General Government (as a % of GDP). 1960-1989.

YEAR	US	GERMANY	FRANCE	UK	ITALY	CANADA	BELGIUM	SPAIN	GREECE
1960	45.0	-13.2	29.1	128.2	NA	NA	82.3	NA	NA
1961	44.7	-15.4	25.8	120.9	NA	21.8	80.0	NA	NA
1962	42.5	-15.5	22.2	116.1	NA	20.7	76.8	NA	NA
1963	40.4	-13.3	19.9	109.2	NA	20.9	74.5	NA	NA
1964	38.3	-14.8	18.0	102.6	26.6	18.9	68.9	NA	NA
1965	35.3	-12.8	16.1	96.7	30.2	16.7	66.6	NA	NA
1966	32.5	-11.9	15.0	92.5	34.2	15.3	65.1	NA	NA
1967	32.4	-10.1	14.6	92.4	34.1	15.2	63.3	NA	NA
1968	30.7	-8.8	14.8	86.8	36.9	13.2	62.2	NA	NA
1969	28.3	-8.9	13.4	82.1	36.7	9.2	59.2	NA	NA
1970	27.8	-8.1	11.4	74.8	39.1	6.1	55.5	2.8	21.3
1971	27.9	-7.1	11.0	70.1	43.9	4.6	54.6	2.9	21.8
1972	25.8	-5.7	9.1	65.3	49.9	4.2	52.6	2.1	23.1
1973	23.0	-6.7	8.3	57.9	45.1	2.6	50.9	1.6	19.4
1974	22.2	-4.7	8.7	54.9	42.7	1.1	47.5	1.3	20.2
1975	24.6	1.0	11.1	57.2	51.9	4.3	49.8	1.3	22.4
1976	24.4	4.6	10.9	56.0	52.7	5.2	50.1	0.7	22.1
1977	23.3	7.0	10.2	55.7	52.6	7.5	53.7	2.0	22.4
1978	21.3	9.4	10.2	53.4	55.3	10.3	57.5	3.0	29.4
1979	19.1	11.5	9.7	48.7	55.2	10.9	62.5	5.0	27.6
1980	19.1	14.4	9.1	48.1	53.5	11.6	70.0	7.1	27.7
1981	18.5	17.5	9.9	47.2	57.3	10.0	83.5	11.8	32.7
1982	21.4	19.8	11.3	46.6	63.3	16.5	92.6	14.6	36.0
1983	23.8	21.4	13.4	47.2	68.8	22.5	103.6	18.6	41.2
1984	24.7	21.8	15.2	48.9	74.9	26.1	108.6	23.2	49.5
1985	26.7	21.9	16.8	47.4	81.3	32.8	112.3	27.9	57.9
1986	28.7	21.6	18.2	46.7	86.2	37.2	116.8	30.5	58.9
1987	30.0	22.9	18.4	44.0	89.9	37.6	121.8	30.4	64.6
1988	29.8	23.6	18.6	38.5	92.2	37.3	123.7	30.5	68.4
1989	29.8	21.9	18.4	34.1	94.3	38.0	122.4	29.3	75.0

Table 5 (cont.)

YEAR	FINLAND	AUSTRIA	NETHERL	SWEDEN	NORWAY	JAPAN	DENMARK	IRELAND	AUSTRALIA
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA
1961	NA	NA	NA	NA	NA	NA	NA	NA	NA
1962	NA	NA	NA	NA	NA	NA	NA	NA	NA
1963	NA	NA	NA	NA	NA	NA	NA	NA	NA
1964	NA	NA	NA	NA	NA	NA	NA	NA	NA
1965	NA	NA	NA	NA	NA	-5.6	NA	NA	NA
1966	NA	NA	NA	NA	NA	-5.6	NA	NA	NA
1967	NA	NA	NA	NA	NA	-7.0	NA	NA	NA
1968	NA	NA	NA	NA	NA	-6.3	NA	NA	NA
1969	NA	NA	NA	NA	NA	-5.5	NA	NA	44.4
1970	-5.0	19.4	28.9	-24.0	2.5	-6.5	-2.8	35.7	41.7
1971	-7.3	18.2	27.7	-27.5	2.6	-7.2	-5.9	35.1	38.3
1972	-8.0	17.5	24.5	-29.5	0.6	-6.5	-9.0	33.2	35.9
1973	-10.7	17.5	21.0	-31.1	-1.4	-6.1	-12.2	32	31.8
1974	-10.5	17.6	19.0	-30.1	-1.8	-5.3	-13.6	37.1	29.1
1975	-9.5	23.9	19.7	-28.7	0.7	-2.1	-10.1	45.9	28.5
1976	-10.5	27.4	20.3	-29.7	3.5	1.9	-7.7	51.6	27.7
1977	-9.9	30.0	19.2	-28.8	9.5	5.5	-5.0	50.6	29.0
1978	-8.3	33.8	20.0	-25.3	14.0	11.3	-2.1	56.3	30.2
1979	-6.8	35.9	21.8	-19.8	16.8	14.9	1.8	64.9	28.0
1980	-6.0	37.1	24.9	-13.5	6.9	17.3	7.2	64.9	25.2
1981	-4.6	39.2	27.3	-5.2	3.9	20.6	16.5	75.1	22.3
1982	-1.8	41.6	31.3	4.4	1.3	23.2	26.3	81.2	22.1
1983	0.4	46.4	36.5	10.5	-2.4	26.2	34.1	88	24.1
1984	0.7	47.8	39.9	12.6	-9.6	27.0	37.5	94.6	25.1
1985	0.9	47.3	43.0	16.1	-19.0	26.7	35.2	103.6	26.3
1986	0.0	47.7	46.5	16.1	-24.4	26.4	28.4	108.2	26.5
1987	2.4	51.2	52.1	10.8	-27.7	21.7	25.1	110.6	23.5
1988	0.7	52.3	54.8	6.5	-29.9	18.0	23.9	108.4	20.1
1989	-2.1	51.5	57.2	0.6	-29.3	14.1	23.1	101.0	16.5

Source: Elaboration on OECD data.

Note: The data for Greece, the Netherlands, Austria and Australia are for the gross debt since data on the net debt are not available.

Table 6

Tests Results for the series of Discounted General Government Net Interest Bearing Liabilities.

	Regression model 4.1.		Regression model 4.2			Regression model 4.3			
	$Z(\alpha 1)$	$Z(t\alpha 1)$	$Z(\alpha 2)$	$Z(t\alpha 2)$	$\Phi 1$	$Z(\alpha 3)$	$Z(t\alpha 3)$	$Z(\Phi 2)$	$Z(\Phi 3)$
Belgium	<90	<90	<90	<90	>99	<90	<90	>99	<90*
Canada	<90	<90	<90	<90	<90	<90	<90	<90	<90
France	<90	<90	<90	<90	<90	<90	<90	<90	<90
Germany	<90	<90	<90	<90	<90	<90	<90	<90	<90
Italy	<90	<90	<90	<90	>99	<90	<90	>99	>99
Japan	<90	<90	<90	<90	<90	<90	<90	>99**	>99**
United Kingdom	<90	<90	<90	<90	<90	<90	<90	<90	<90
United States	<90	<90	<90	<90	<90	<90	<90	<90	<90
Australia (1)	<90	<90	<90	<90	<90	<90	<90	<90	<90
Austria (1)	<90	<90	<90	<90	>99	<90	<90	>95	<90
Denmark	<90	<90	<90	<90	<90	<90	<90	<90	<90
Finland	<90	<90	<90	<90	<90	<90	<90	<90	<90
Greece (1)	<90	<90	<90	<90	>99	<90	<90	>99	>99
Ireland	<90	<90	<90	<90	>99	<90	<90	>99	>99
Netherlands (1)	<90	<90	<90	<90	<90	<90	<90	<90	<90
Norway	<90	<90	<90	<90	<90	<90	<90	<90	<90
Spain	<90	<90	<90	<90	<90	<90	<90	<90	<90
Sweden	<90	<90	<90	<90	<90	<90	<90	<90	<90

Null Hypotheses:
- Model 4.1. H0:α=1
- Model 4.2 H0:α=1 for $Z(\alpha)$ and $Z(t\alpha)$; H0:α=1 and μ=0 for $\Phi 1$
- Model 4.3 H0:α=1 for $Z(\alpha)$ and $Z(t\alpha)$; H0:α=1 and β=0 (μ=?) for $Z(\Phi 3)$; H0:α=1 and β=0 and μ=0 for $Z(\Phi 2)$

(1) Only the General Government Gross Debt is available.

* Results depend on the lag truncation number.

** Results are not consistent across definitions of debt.

Table 7

Tests Results for the series of (undiscounted) General Government Net Interest Bearing Liabilities as share of GDP.

	Regression model 4.1.		Regression model 4.2			Regression model 4.3			
	Z(α1)	Z(tα1)	Z(α2)	Z(tα2)	Φ1	Z(α3)	Z(tα3)	Z(Φ2)	Z(Φ3)
Belgium	<90	<90	<90	<90	>95	<90	<90	>99	>99
Canada	<90	<90	<90	<90	<90	<90	<90	>97.5	>95*
France	<90	>90**	<90	<90	<90	<90	<90*	>99**	>99**
Germany	<90	<90	<90	<90	>99**	<90	<90	>95**	<90
Italy	<90	<90	<90	<90	>99	<90	<90	>99	<90
Japan	<90	<90	<90	<90	<90	<90	<90	<90	<90
United Kingdom	<90	>99	<90	>97.5*	>99	<90	<90	<99	<99**
United States	<90	<90	<90	<90	<90	<90	<90	>97.5**	>97.5**
Australia (1)	<90	>97.5	<90	<97.5*	>99	<90	<90	>95*	<90
Austria (1)	<90	<90	<90	<90	>99	<90	<90	>99	<90
Denmark	<90	<90	<90	<90	<90	<90	<90	<90	<90
Finland	<90	<90	<90	<90	<90	<90	<90	<90	<90
Greece (1)	<90	<90	<90	<90	>95	<90	<90	>99	<90*
Ireland	<90	<90	<90	<90	>99	<90	>99**	>99	>99**
Netherlands (1)	<90	<90	<90	<90	<90	<90	<90	<90	<90
Norway	<90	<90	<90	<90	<90	<90	<90	<90	<90
Spain	<90	<90	<90	<90	<90	<90	<90	<90	<90
Sweden	<90	<90	<90	<90	<90	<90	<90	<90	<90

Null Hypotheses:
- Model 4.1. H0:α=1
- Model 4.2 H0:α=1 for Z(α) and Z(tα)
  H0:α=1 and μ=0 for Φ1
- Model 4.3 H0:α=1 for Z(α) and Z(tα)
  H0:α=1 and β=0 (μ=?) for Z(Φ3)
  H0:α=1 and β=0 and μ=0 for Z(Φ2)

(1) Only the General Government Gross Debt is available.

* Results depend on the lag truncation number.

** Results are not consistent across definitions of debt.

Table 8

Tests results for the series of real seigniorage-adjusted and inflation-adjusted overall budget deficit.

	Regression model 4.1.		Regression model 4.2			Regression model 4.3			
	Z(α1)	Z(tα1)	Z(α2)	Z(tα2)	Φ1	Z(α3)	Z(tα3)	Z(Φ2)	Z(Φ3)
Belgium	<90	<90	<90	<90	<90	<90	<90	<90	<90
Canada	<90	<90	<90	<90	<90	<90	<90	<90	<90
France	>99*	>99	>97.5**	>99**	>95**	<90*/**	<90*/**	<90*/**	<90*/**
Germany	>95**	>97.5**	<90	<90	<90	<90	<90	<90	<90
Italy	<90	<90	<90	<90	<90	<90	<90	<90	<90
Japan	<90	<90	<90	<90	<90	<90	<90	<90	<90
U.K.	>97.5**	>99**	>95**	>95**	>95**	<90	<90**	<90	<90
United States	<90**	>95**	<90	<90	<90	<90	<90	<90	<90
Australia (1)	<90	<90	<90	<90	<90	<90	<90	<90	<90
Austria (1)	<90	<90	<90	<90*	<90	<90	<90	<90	<90
Denmark	<90	<90	<90	<90	<90	<90	<90	<90	<90
Finland	<90**	>95*/**	<90	<90	<90	<90	<90	<90	<90
Greece (1)	>95	>97.5	<90	<90	<90	<90	>97.5*	<90	<90
Ireland	<90**	<90**	<90	<90**	<90	<90	>99	<90*/**	<90*/**
Netherlands (1)	<90	<90	<90	<90	<90	<90	<90	<90	<90
Norway	<90**	<90**	<90**	<90**	<90**	<90	<90**	<90	<90
Spain	>97.5*	>99	<90*	>99**	>95**	<90	>99	<90*/**	<90*/**
Sweden	<90	<90	<90	<90	<90	<90	<90	<90	<90

Null Hypotheses: Model 4.1. H0:α=1
Model 4.2 H0:α=1 for Z(α) and Z(tα)
H0:α=1 and μ=0 for Φ1
Model 4.3 H0:α=1 for Z(α) and Z(tα)
H0:α=1 and β=0 (μ=?) for Z(Φ3)
H0:α=1 and β=0 and μ=0 for Z(Φ2)

(1) Data are derived from the General Government Gross Debt.
* Results depend on the lag truncation number.
** Results are not consistent across definitions of deficits.

Table 9

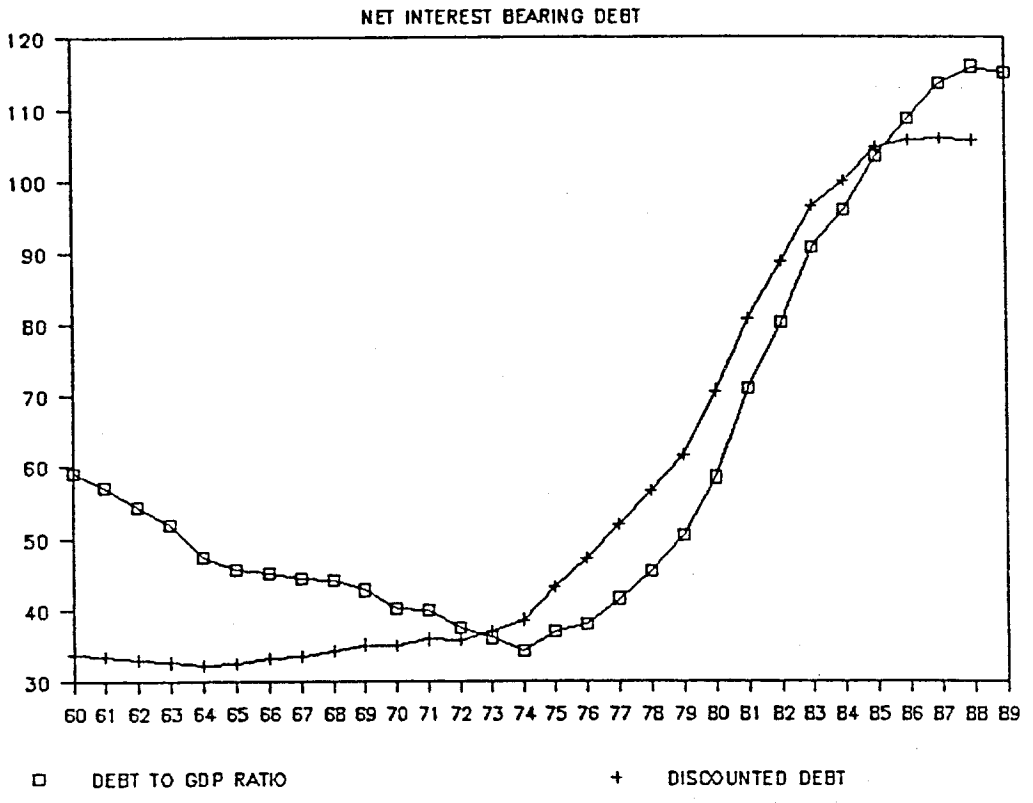
Tests results for the series of real seigniorage-adjusted inflation-adjusted current deficit (overall deficit minus net investment).

	Regression model 4.1.		Regression model 4.2			Regression model 4.3			
	Z(α1)	Z(tα1)	Z(α2)	Z(tα2)	Φ1	Z(α3)	Z(tα3)	Z(Φ2)	Z(Φ3)
Belgium	<90	<90	<90	<90	<90	<90	<90	<90	<90
Canada	<90	>90**	<90	<90	<90	<90	<90	<90	<90
France	<90	<90**	>95*/**	>97.5*/** >95**		<90*/**	>99	<90*/**	<90*/**
Germany	<90	>90**	<90	>90**	<90	<90	<90*	<90	<90
Italy	<90	<90**	<90	<90	<90	<90	<90	<90	<90
Japan	<90**	>90**	<90	<90	<90	<90	<90	<90	<90
United Kingdom	<90	<90	>90*	>95**	<90	<90	>90**	<90	<90
United States	>90*	>90	<90	<90	<90	<90	<90	<90	<90
Australia (1)	<90*	>90	<90	<90	<90	<90	<90	<90	<90
Austria (1)	>90*	>97.5*	<90	>90*	<90	<90	<90	<90	<90
Denmark	<90	>90**	<90	<90	<90	<90	<90	<90	<90
Finland	>90*	>90*	<90*	<90	<90	<90	<90	<90	<90
Greece (1)	>95	>97.5	<90	<90	<90	<90	>97.6*	>90*	>90*
Ireland	<90	<90	<90	<90**	<90	<90**	>99	<90*/**	<90*/**
Netherlands (1)	<90	<90	<90	<90	<90	<90	<90	<90	<90
Norway	<90**	<90**	<90**	<90**	<90**	<90**	<90**	<90**	<90**
Spain	>90**	>97.5**	>90**	>90**	>99	<90	>99	<90*/**	<90*/**
Sweden	<90	<90	<90	<90	<90	<90	<90	<90	<90

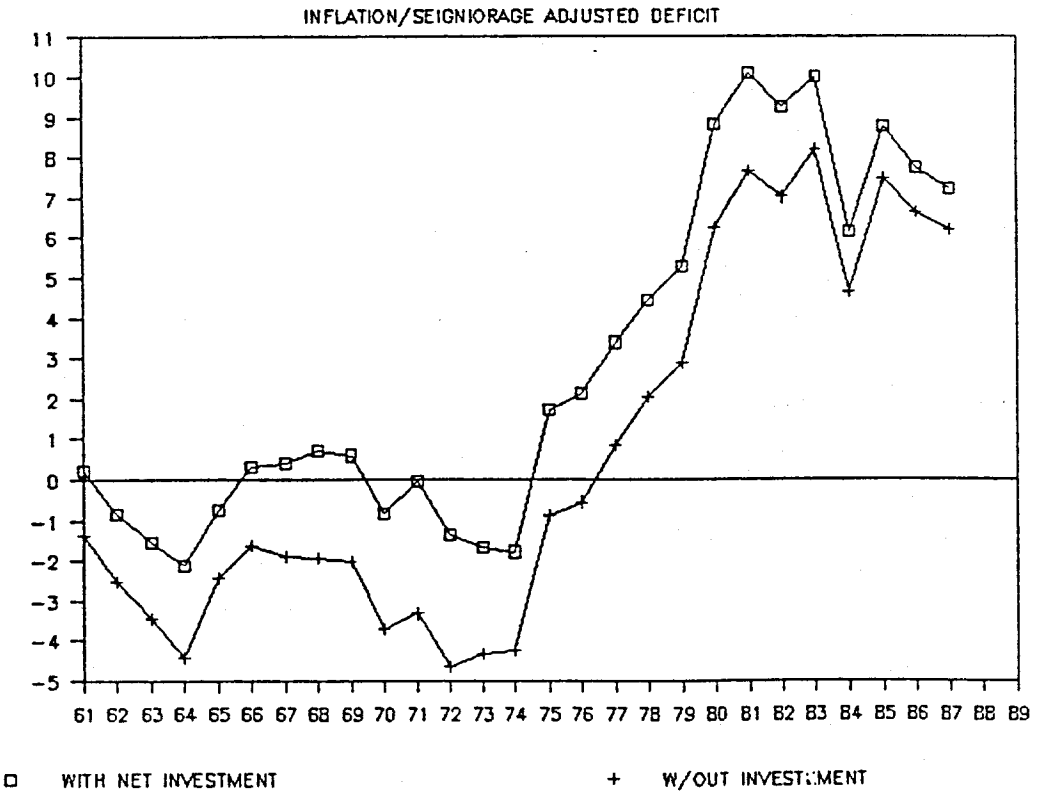
Null Hypotheses: Model 4.1. H0:α=1
Model 4.2 H0:α=1 for Z(α) and Z(tα)
H0:α=1 and μ=0 for Φ1
Model 4.3 H0:α=1 for Z(α) and Z(tα)
H0:α=1 and β=0 (μ=?) for Z(Φ3)
H0:α=1 and β=0 and μ=0 for Z(Φ2)

(1) Data are derived from General Government Gross Debt.
* Results depend on the lag truncation number.
** Results are not consistent across definitions of debt.

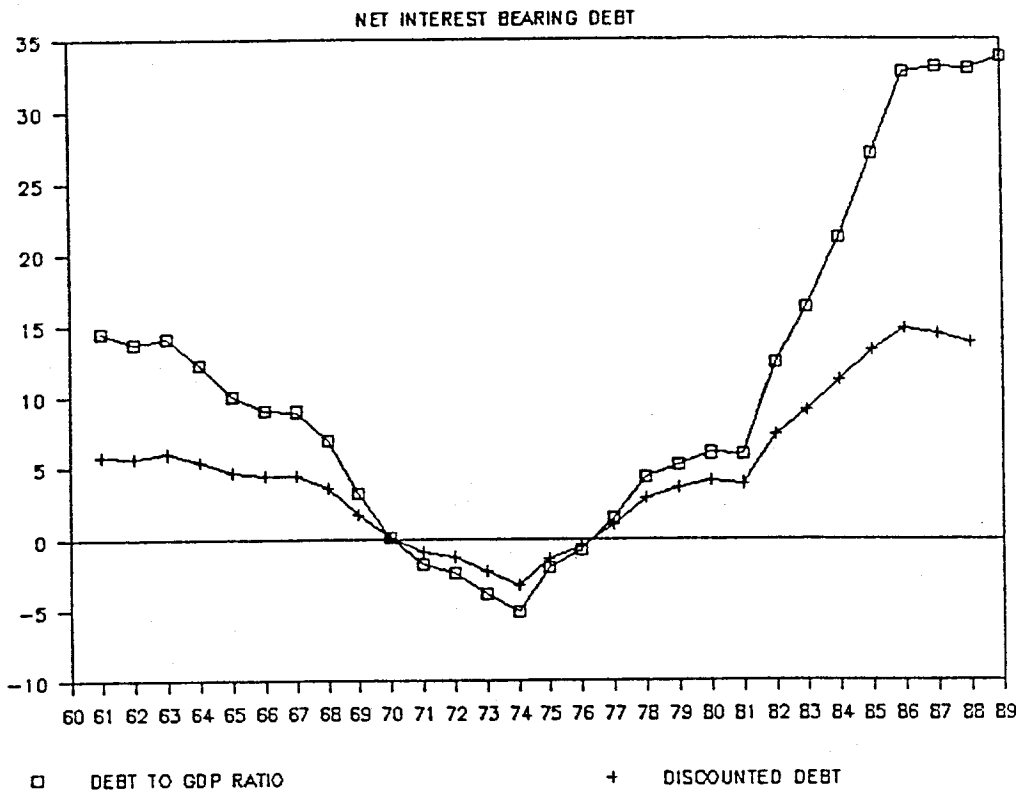
BELGIUM: DISCOUNTED DEBT AND DEBT/GDP



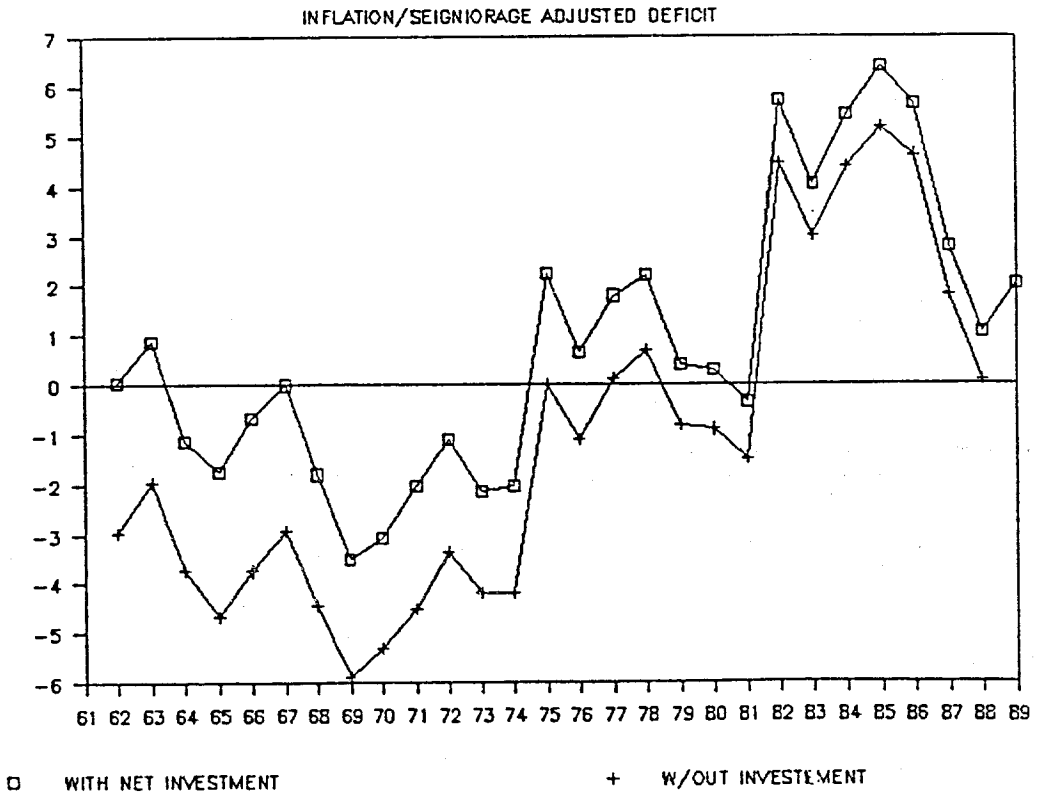
BELGIUM: DEFICIT TO GDP RATIO



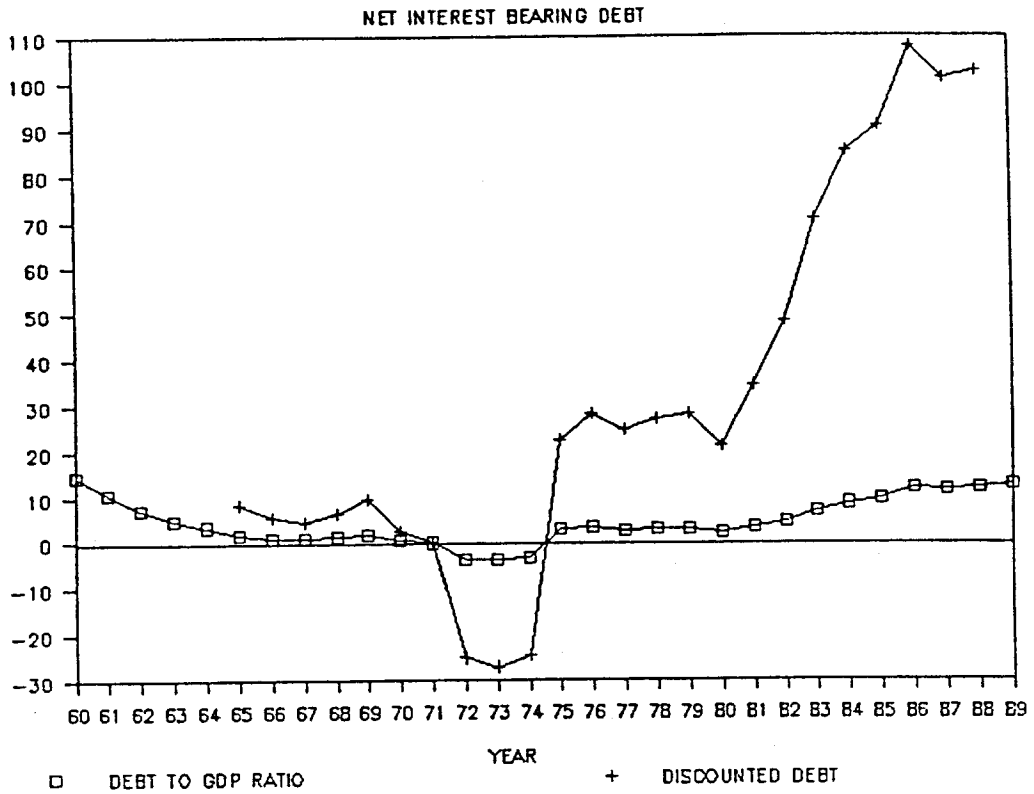
CANADA: DISCOUNTED DEBT AND DEBT/GDP



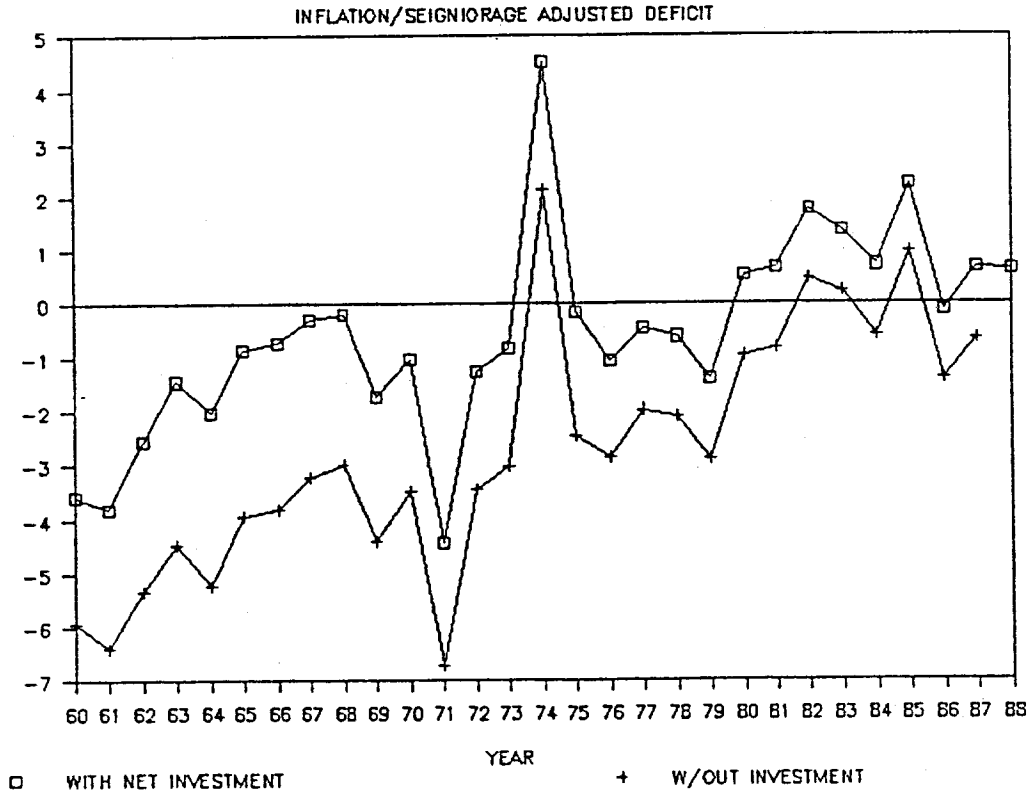
CANADA: DEFICIT TO GDP RATIO



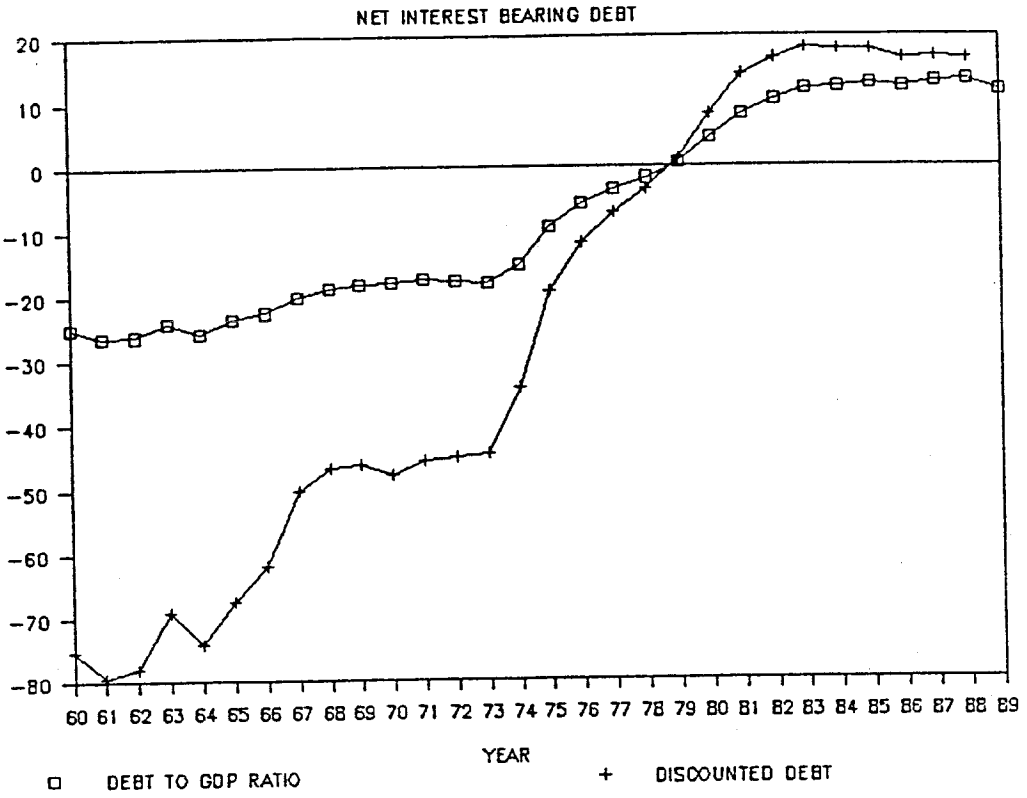
FRANCE: DISCOUNTED DEBT AND DEBT/GDP



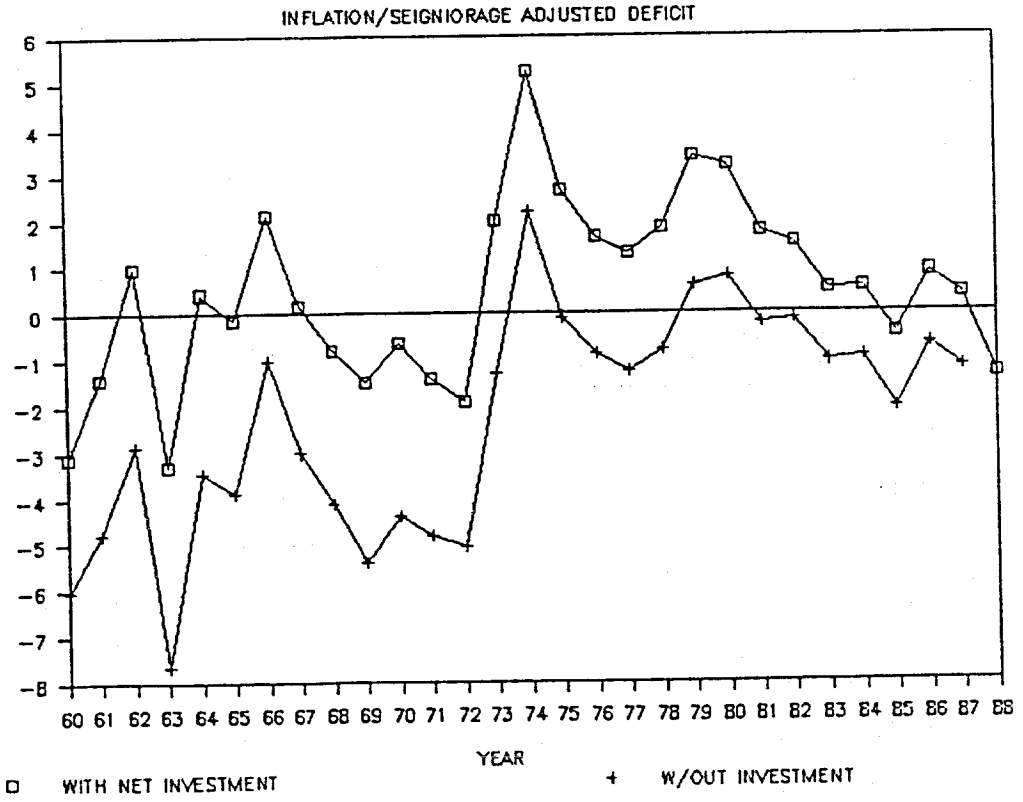
FRANCE: DEFICIT TO GDP RATIO



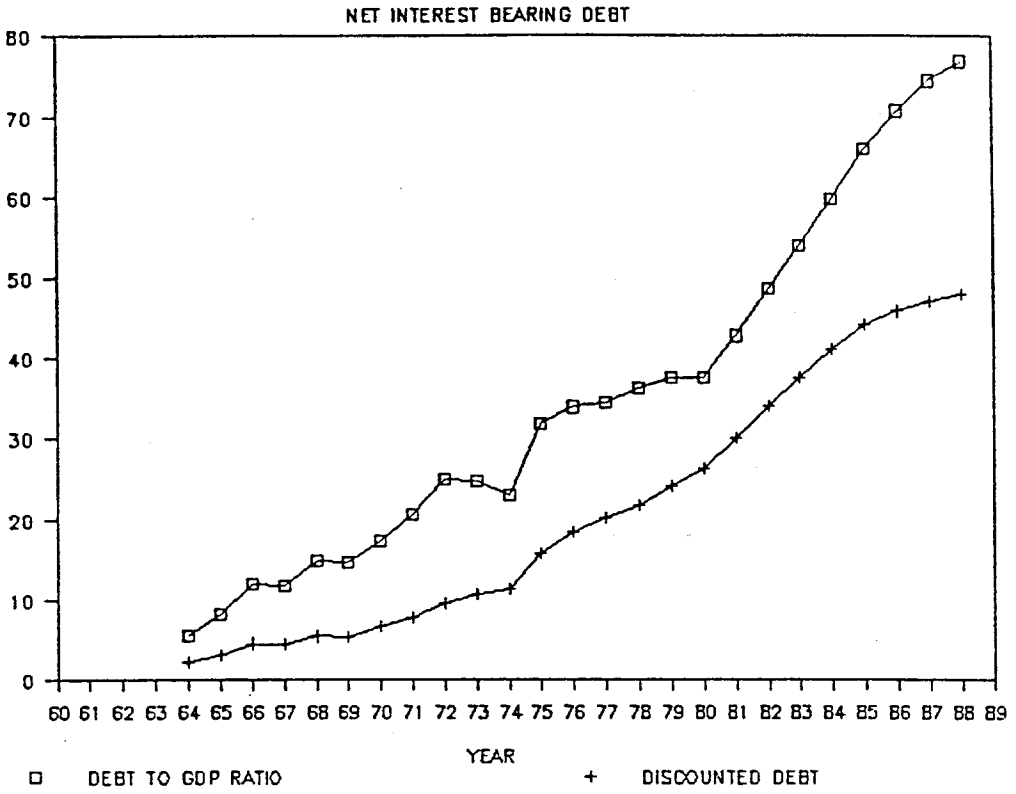
GERMANY: DISCOUNTED DEBT AND DEBT/GDP



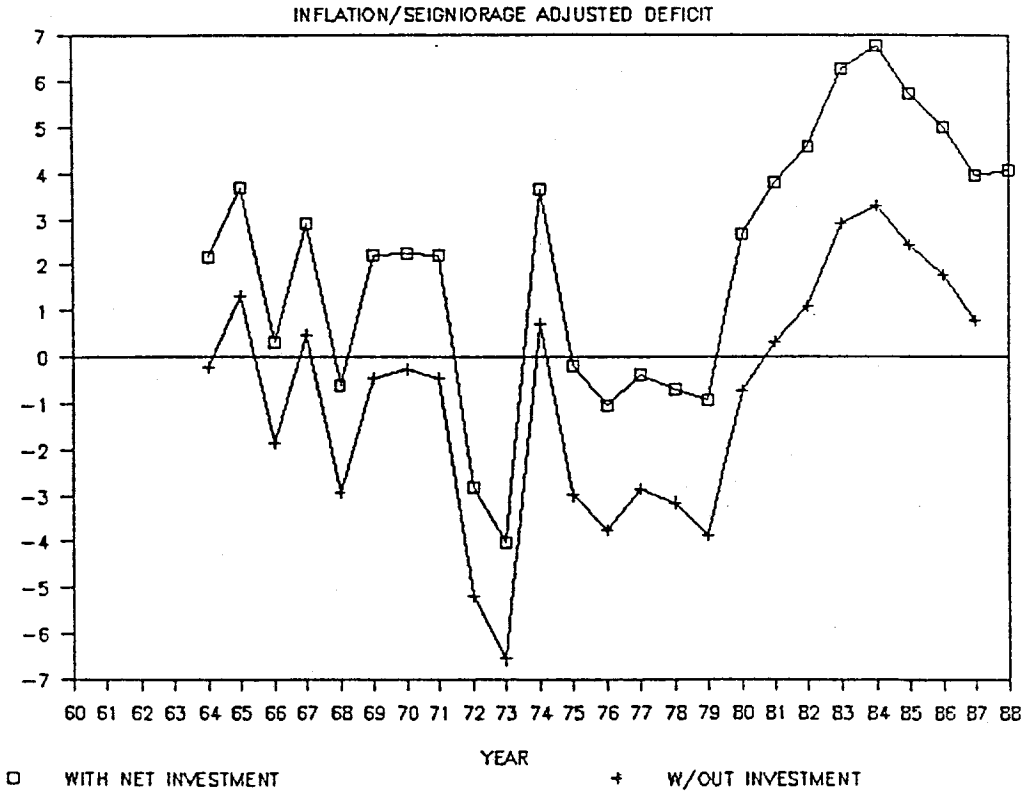
GERMANY: DEFICIT TO GDP RATIO



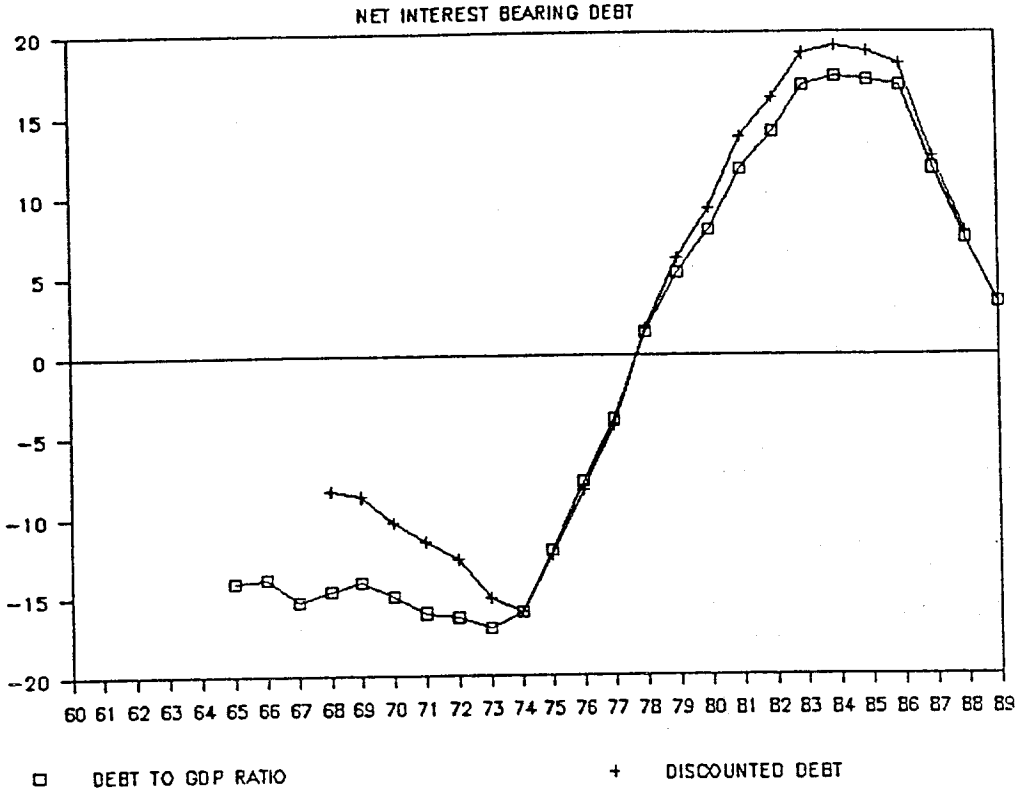
ITALY: DISCOUNTED DEBT AND DEBT/GDP



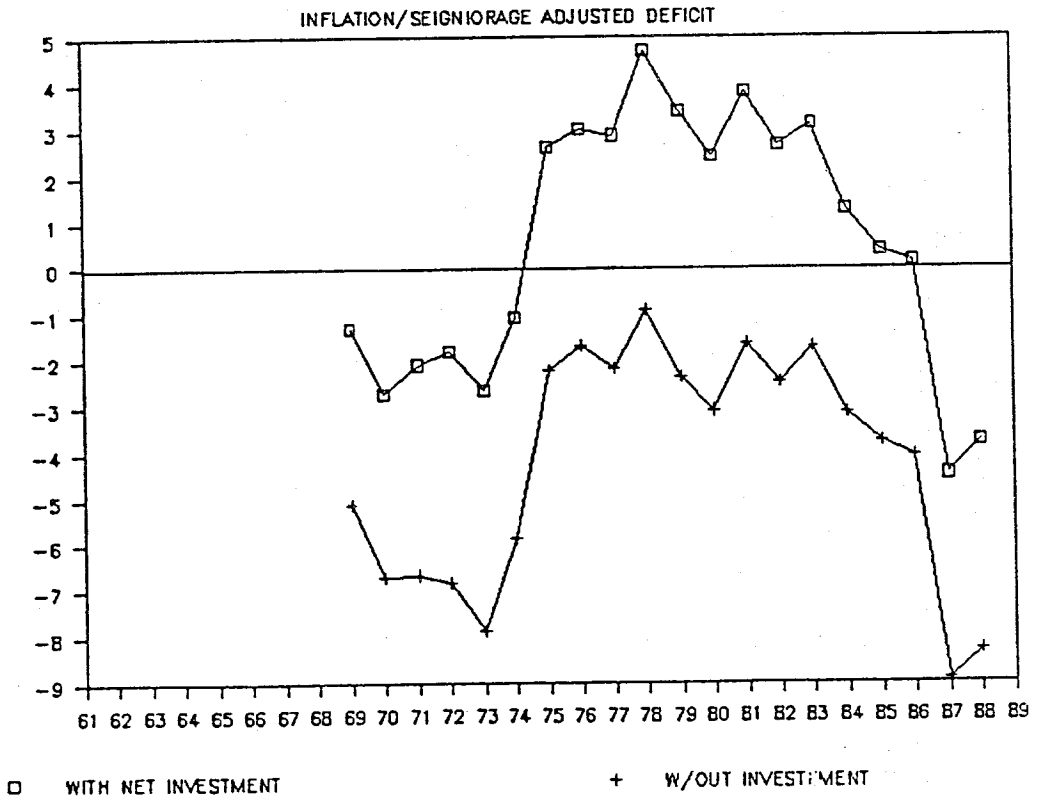
ITALY: DEFICIT TO GDP RATIO



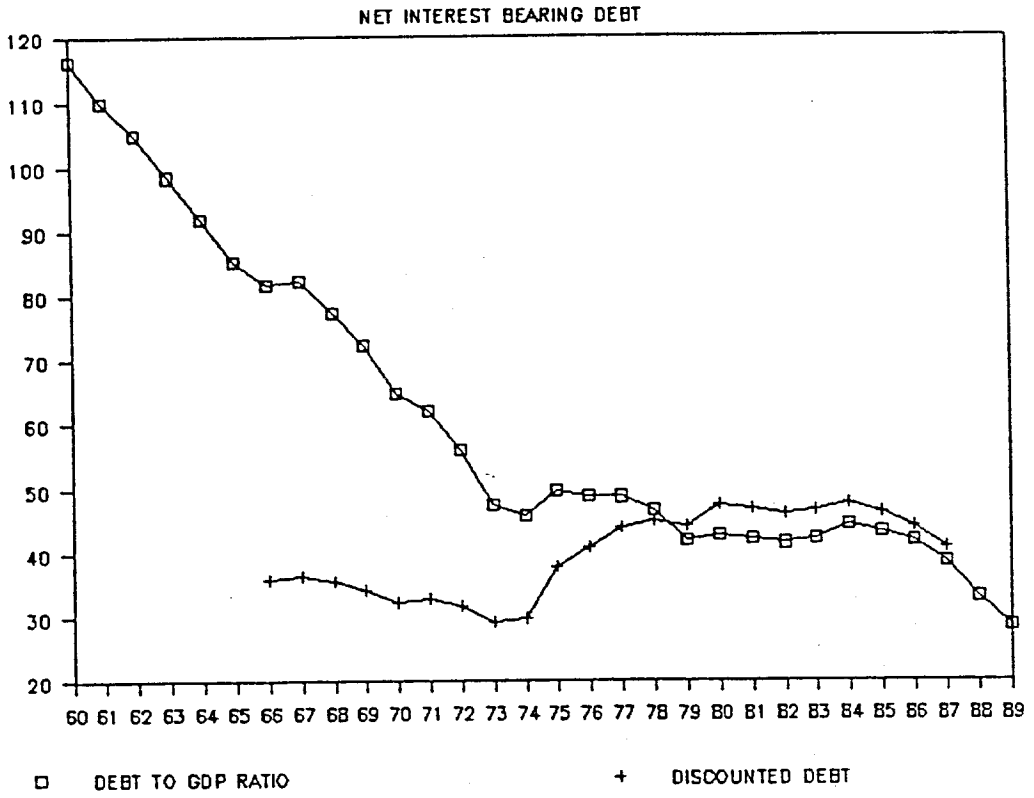
JAPAN: DISCOUNTED DEBT AND DEBT/GDP



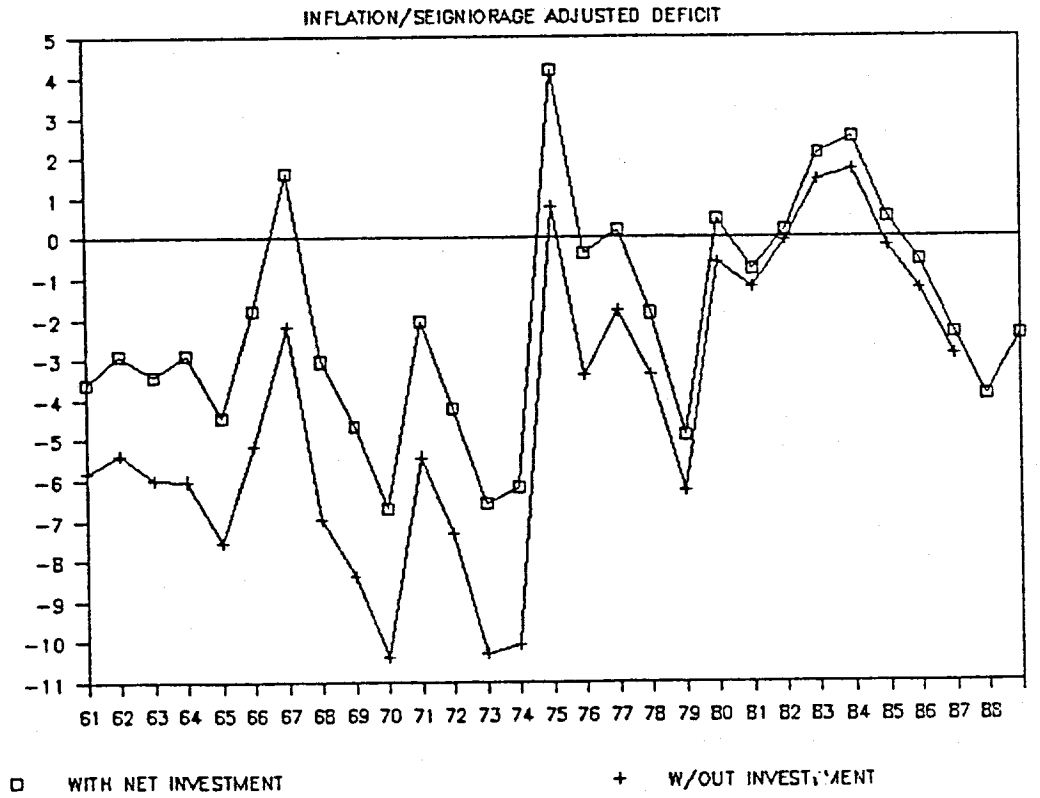
JAPAN: DEFICIT TO GDP RATIO



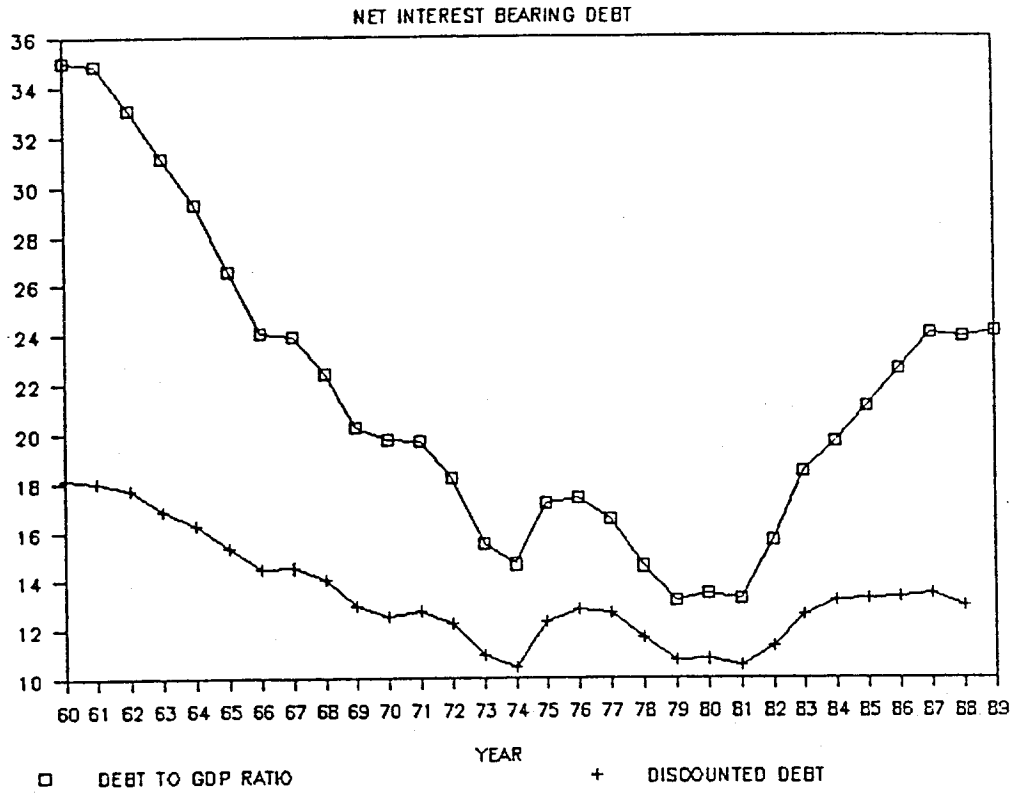
UK: DISCOUNTED DEBT AND DEBT/GDP



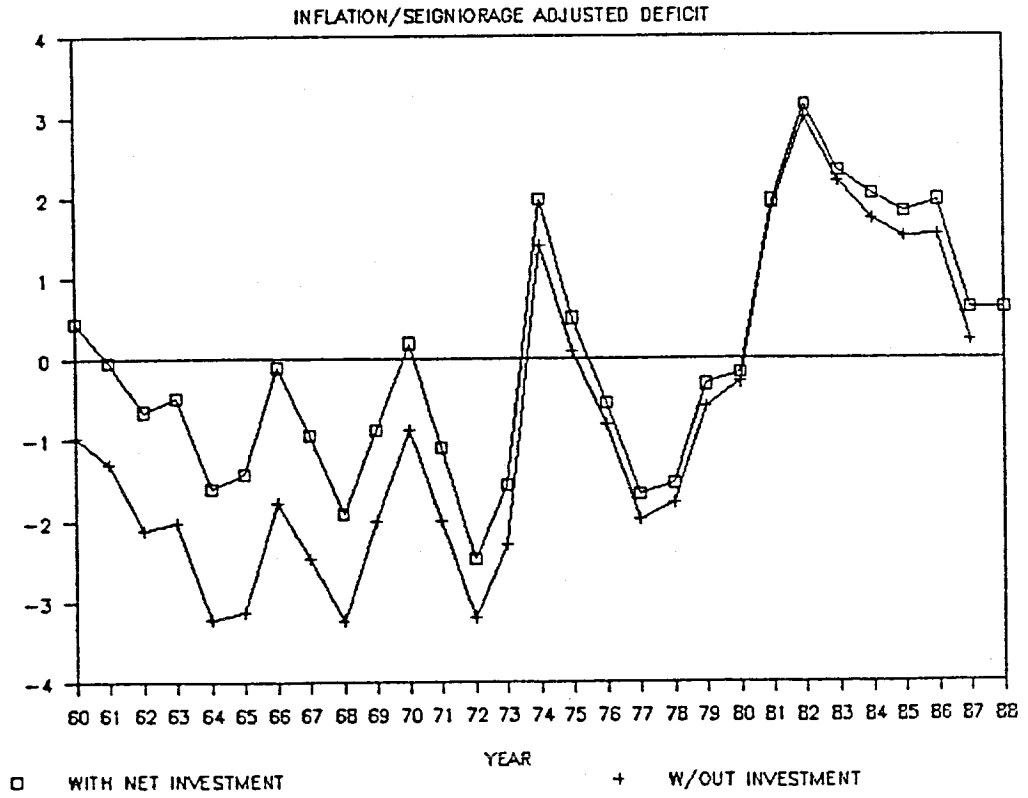
UK: DEFICIT TO GDP RATIO



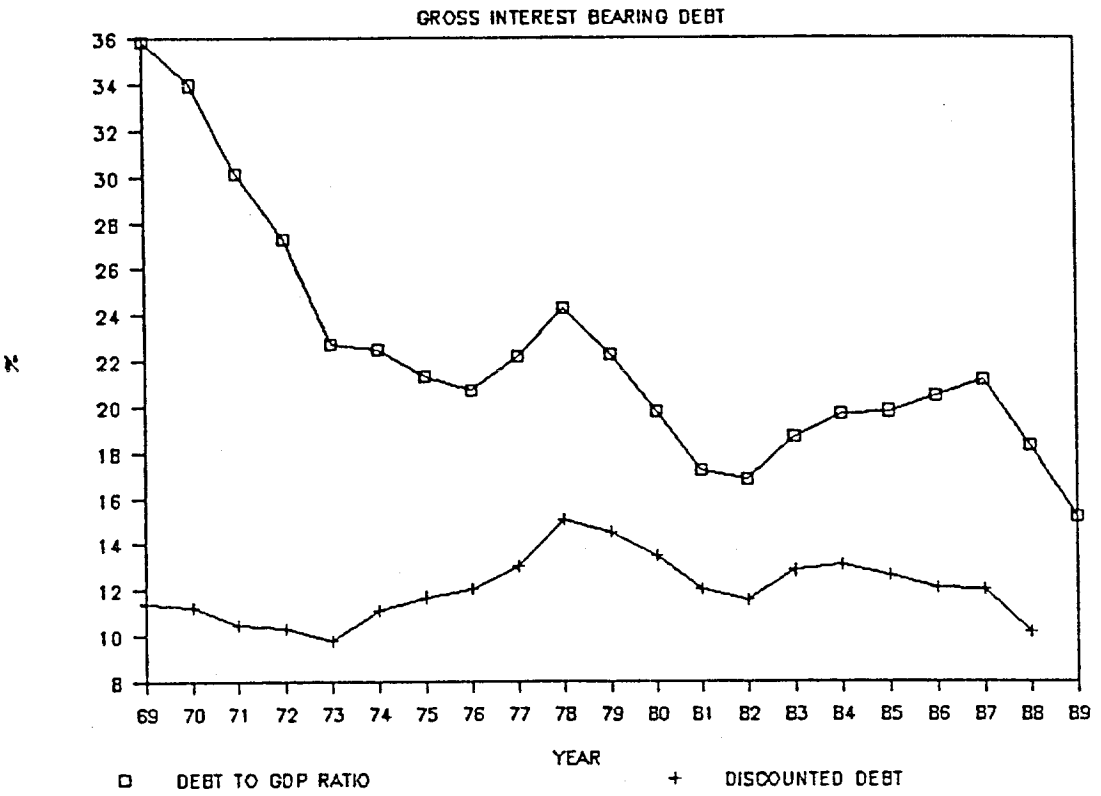
USA: DISCOUNTED DEBT AND DEBT/GDP



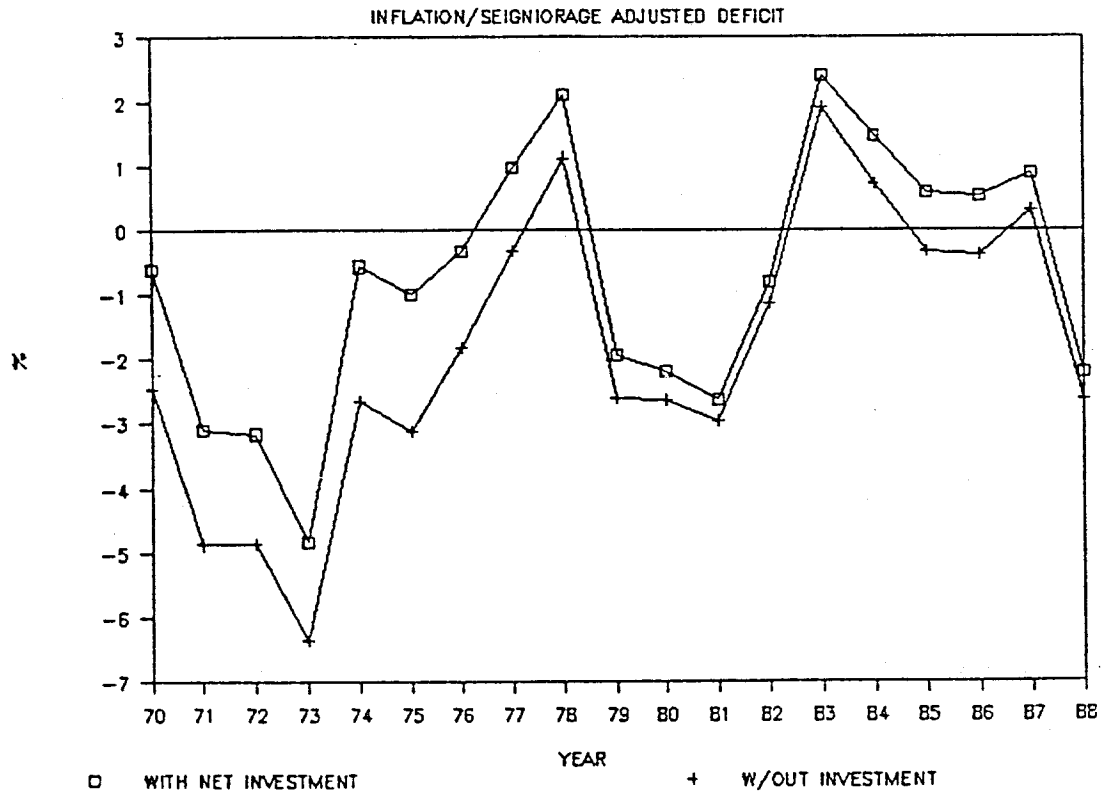
USA: DEFICIT TO GDP RATIO



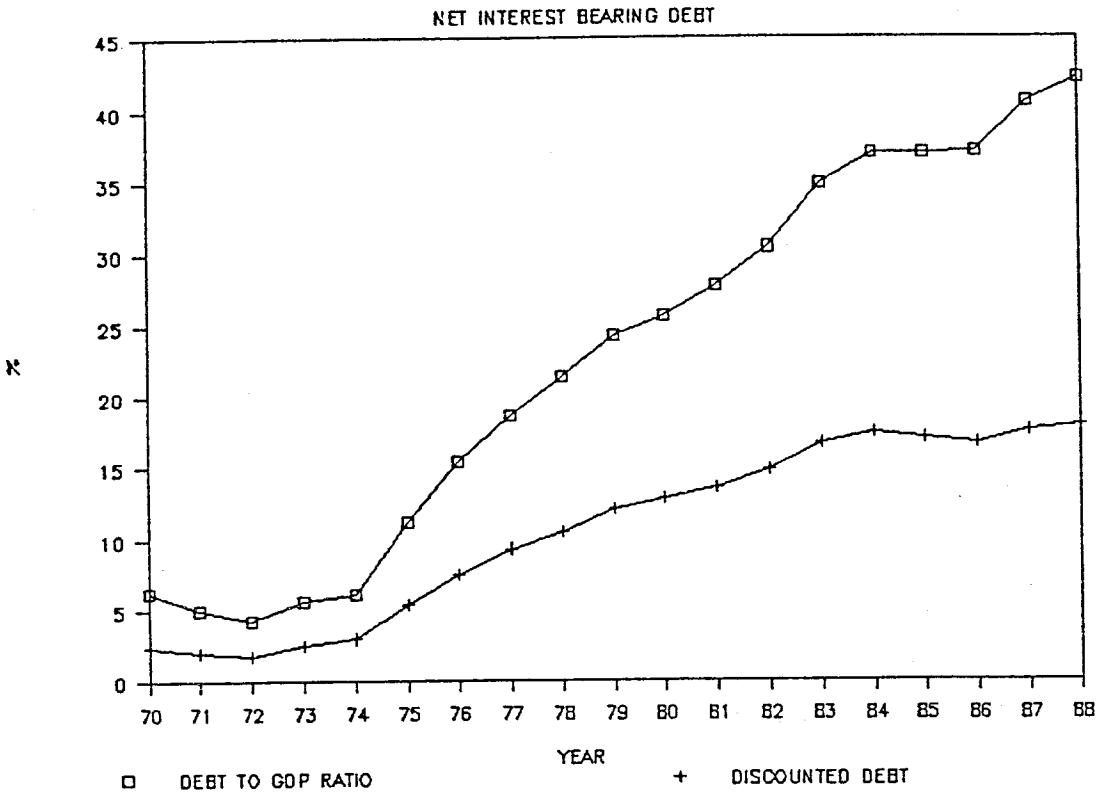
AUSTRALIA: DISCOUNTED DEBT AND DEBT/GDP



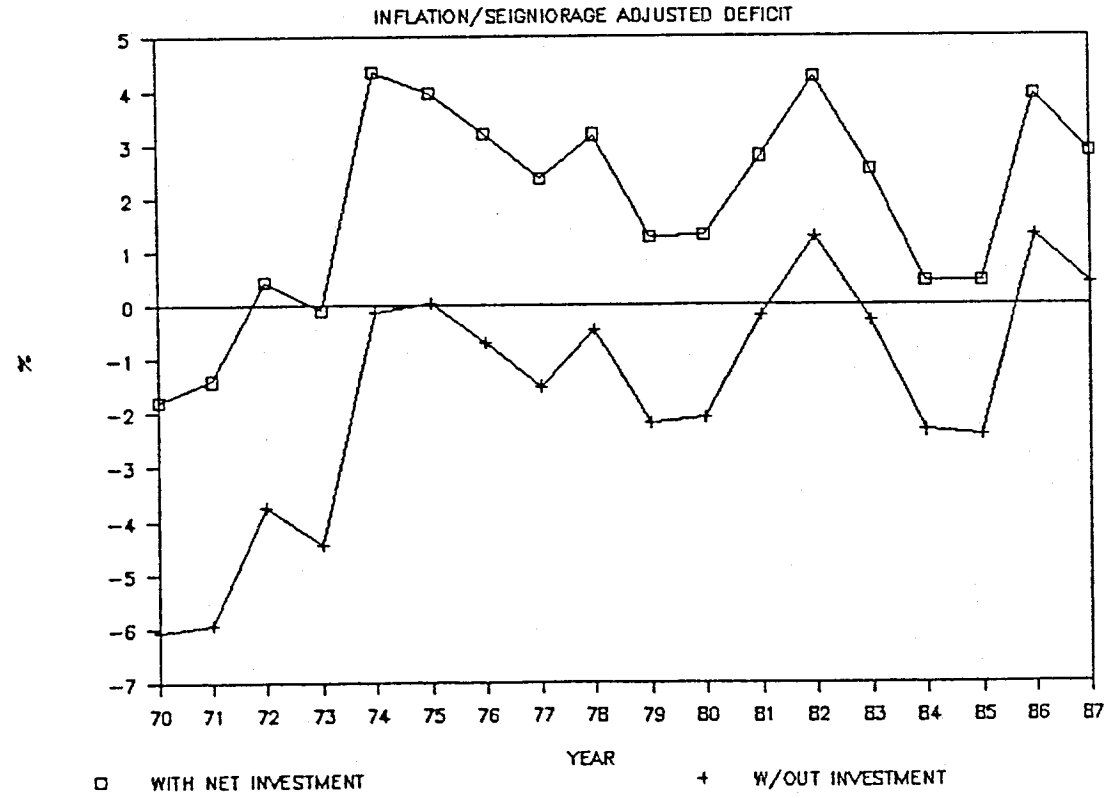
AUSTRALIA: DEFICIT TO GDP RATIO



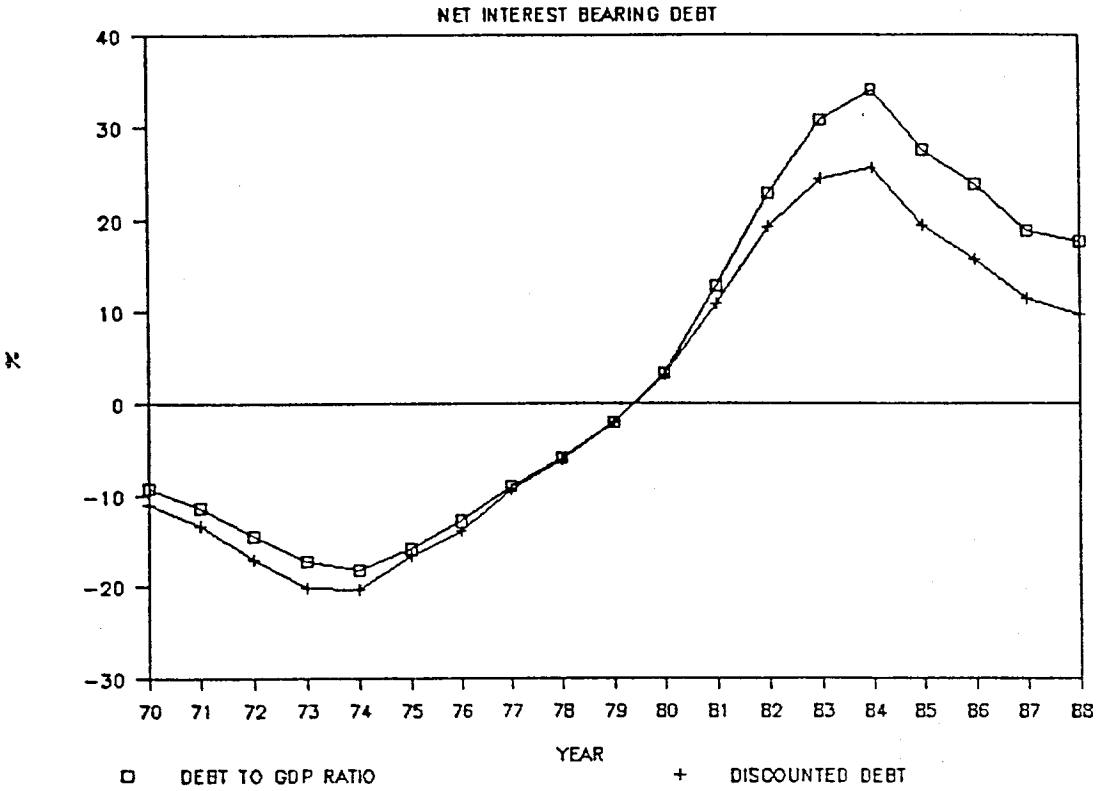
AUSTRIA: DISCOUNTED DEBT AND DEBT/GDP



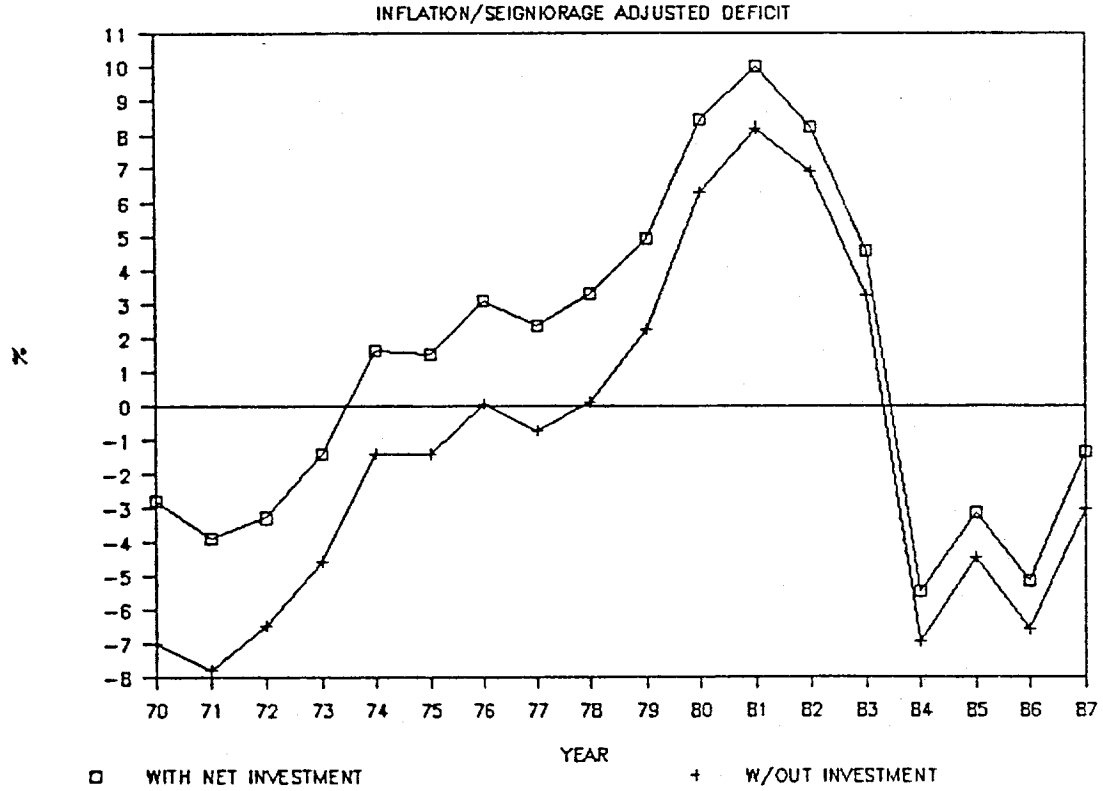
AUSTRIA: DEFICIT TO GDP RATIO



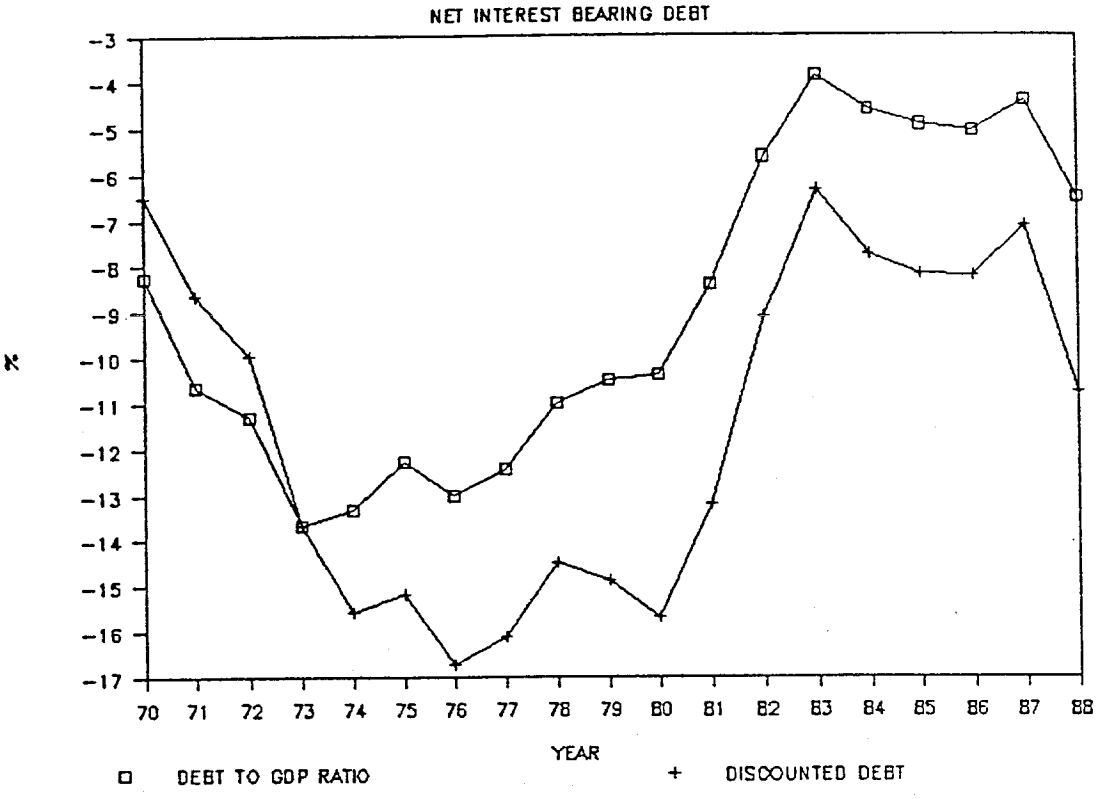
DENMARK: DISCOUNTED DEBT AND DEBT/GDP



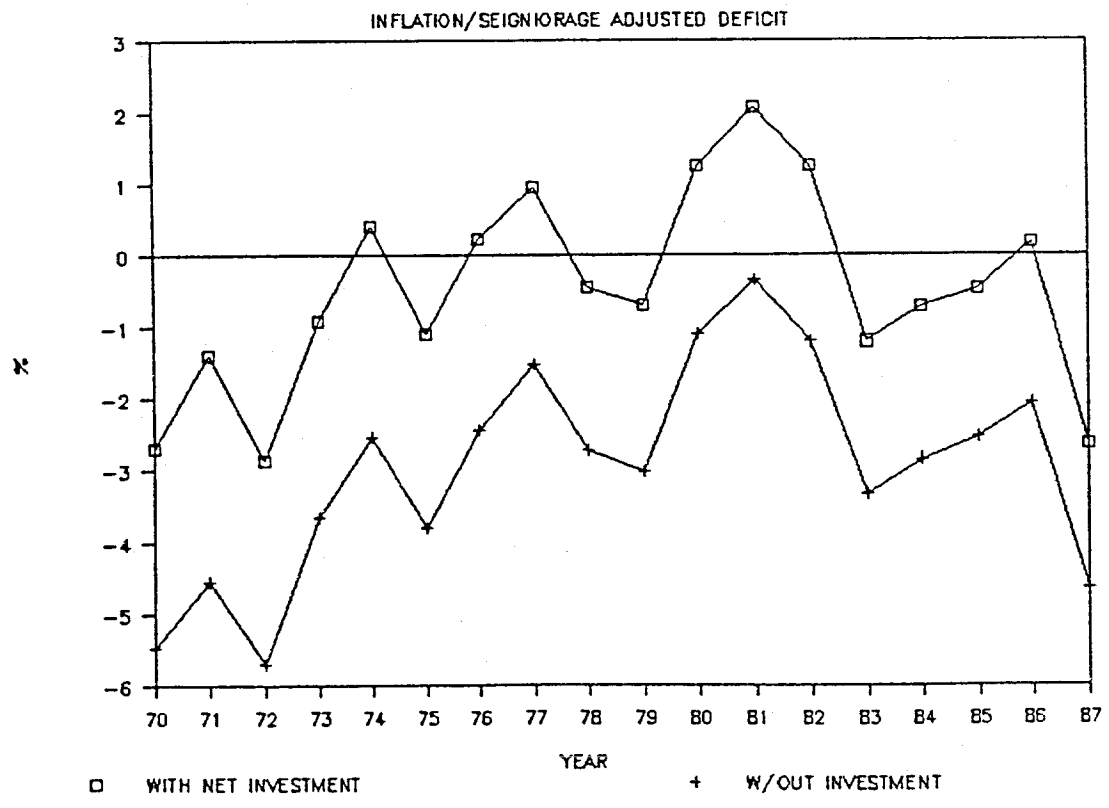
DENMARK: DEFICIT TO GDP RATIO



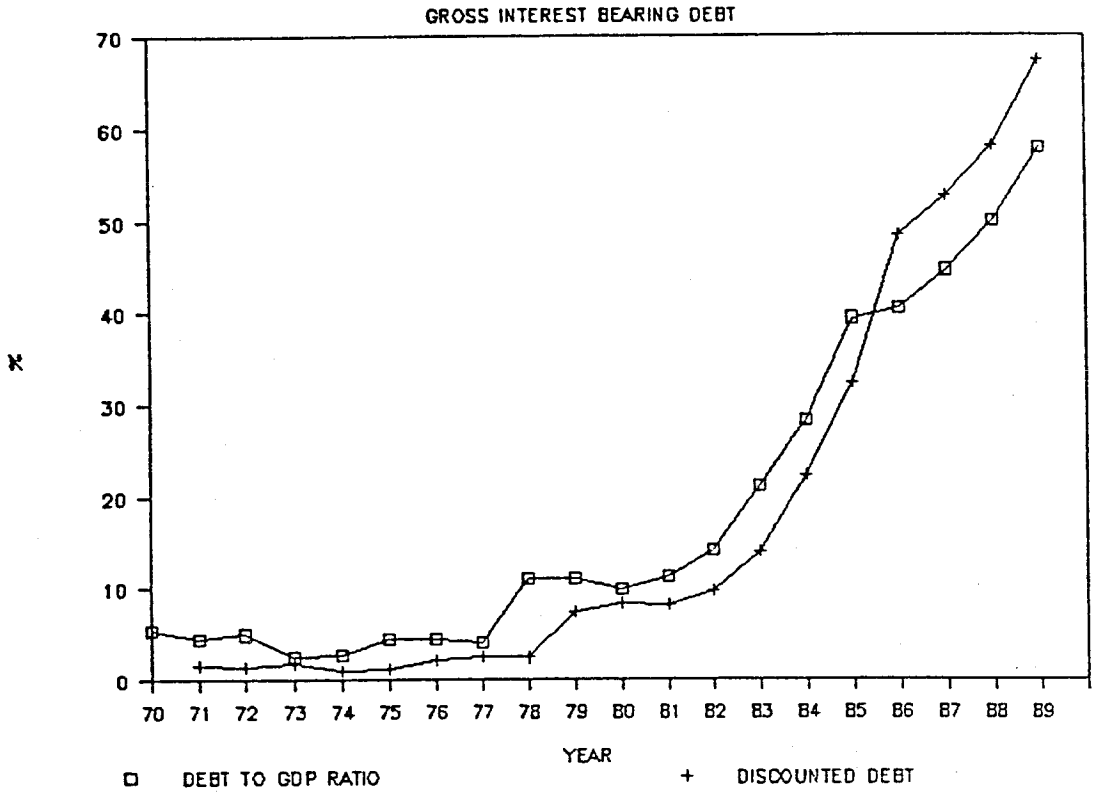
FINLAND: DISCOUNTED DEBT AND DEBT/GDP



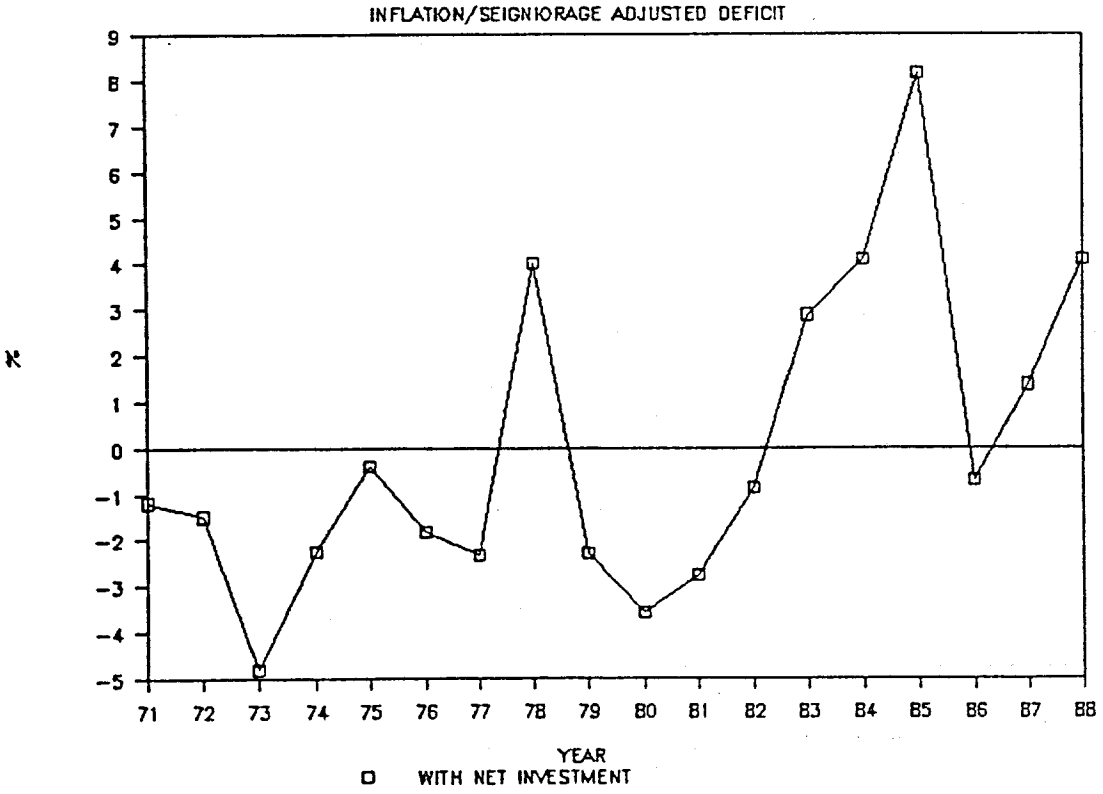
FINLAND: DEFICIT TO GDP RATIO



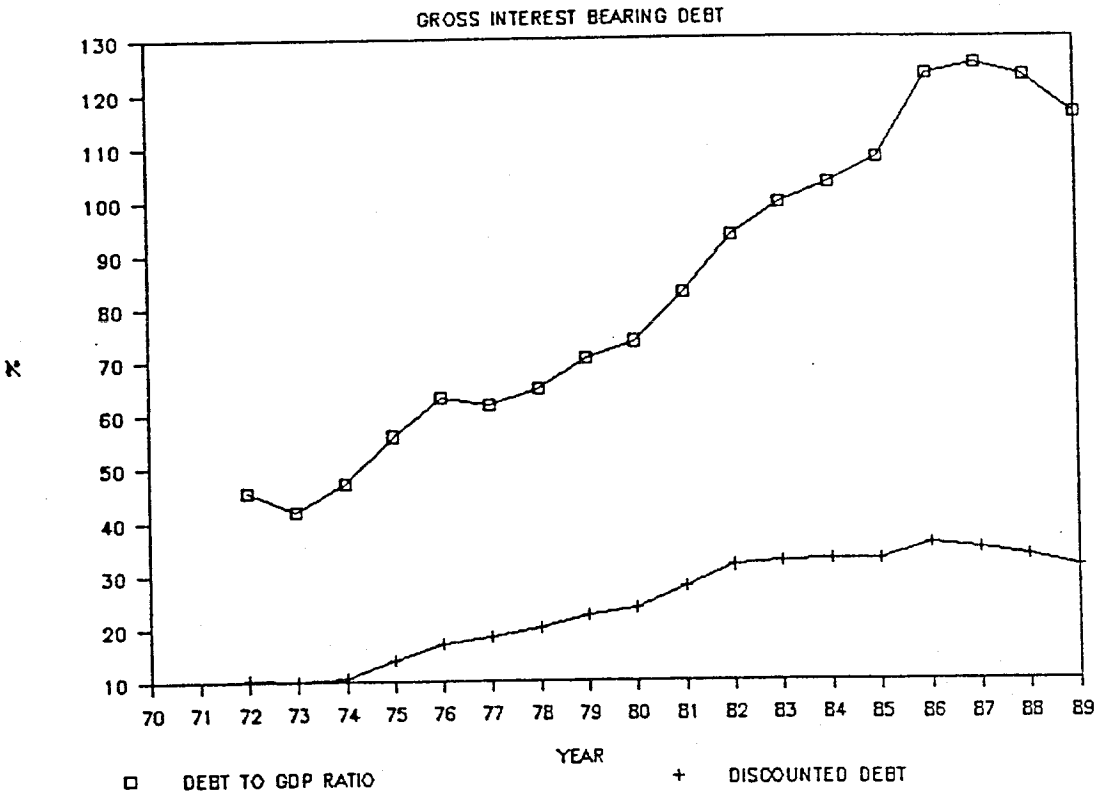
GREECE: DISCOUNTED DEBT AND DEBT/GDP



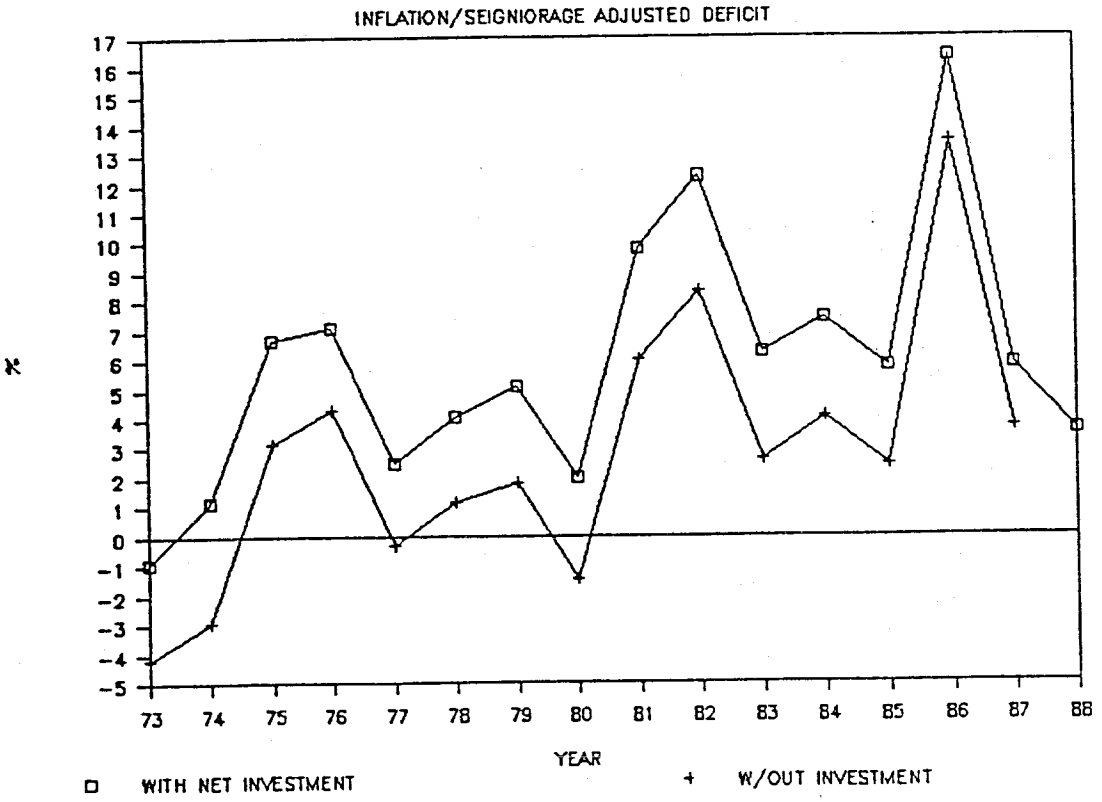
GREECE: DEFICIT TO GDP RATIO



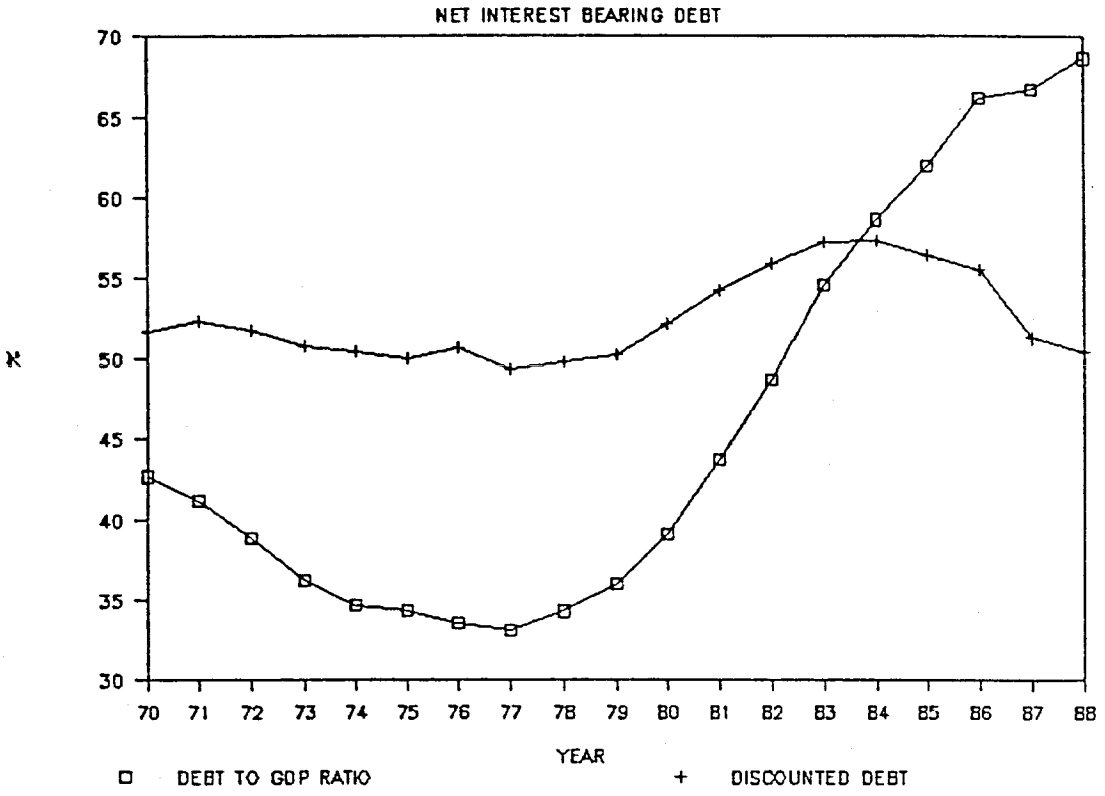
IRELAND: DISCOUNTED DEBT AND DEBT/GDP



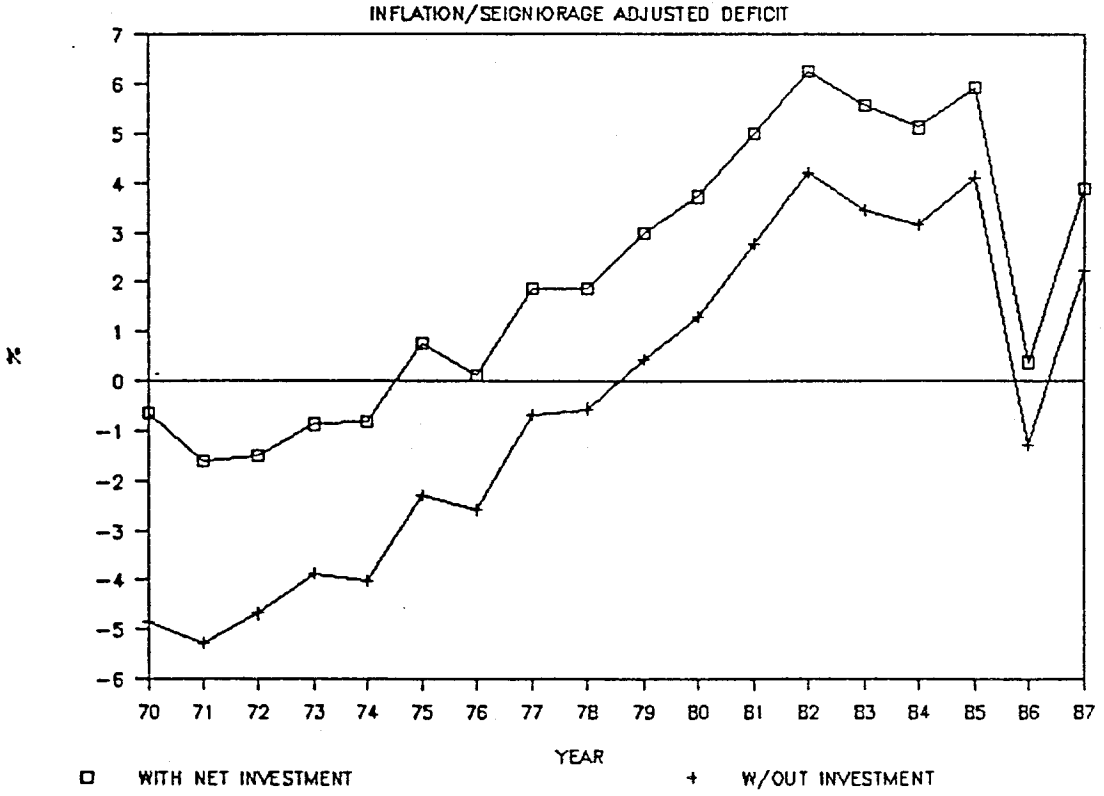
IRELAND: DEFICIT TO GDP RATIO



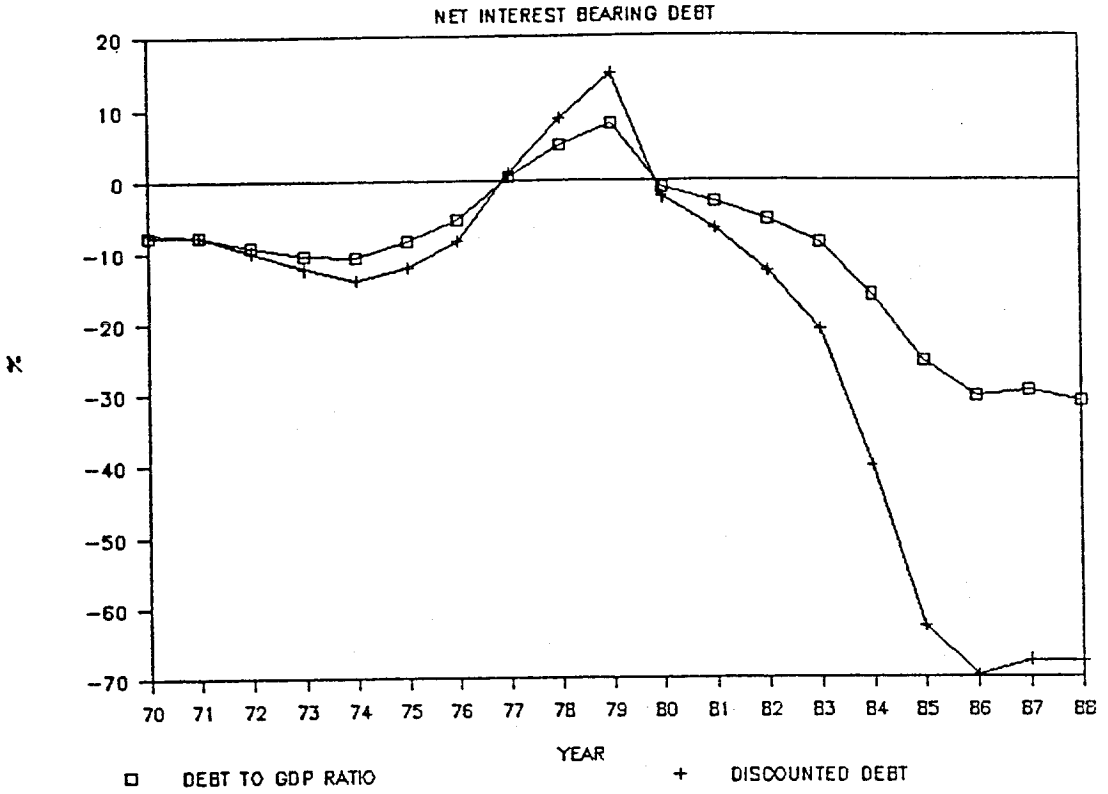
NETHERLANDS: DISCOUNTED DEBT & DEBT/GDP



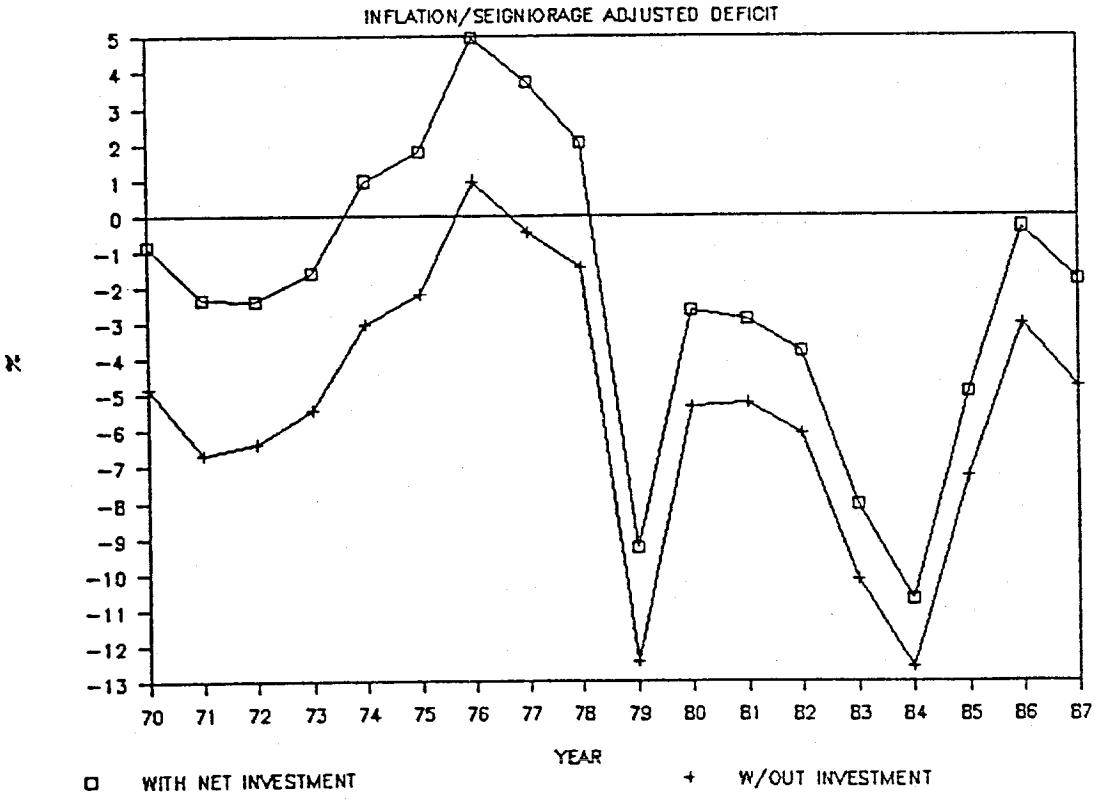
NETHERLANDS: DEFICIT TO GDP RATIO



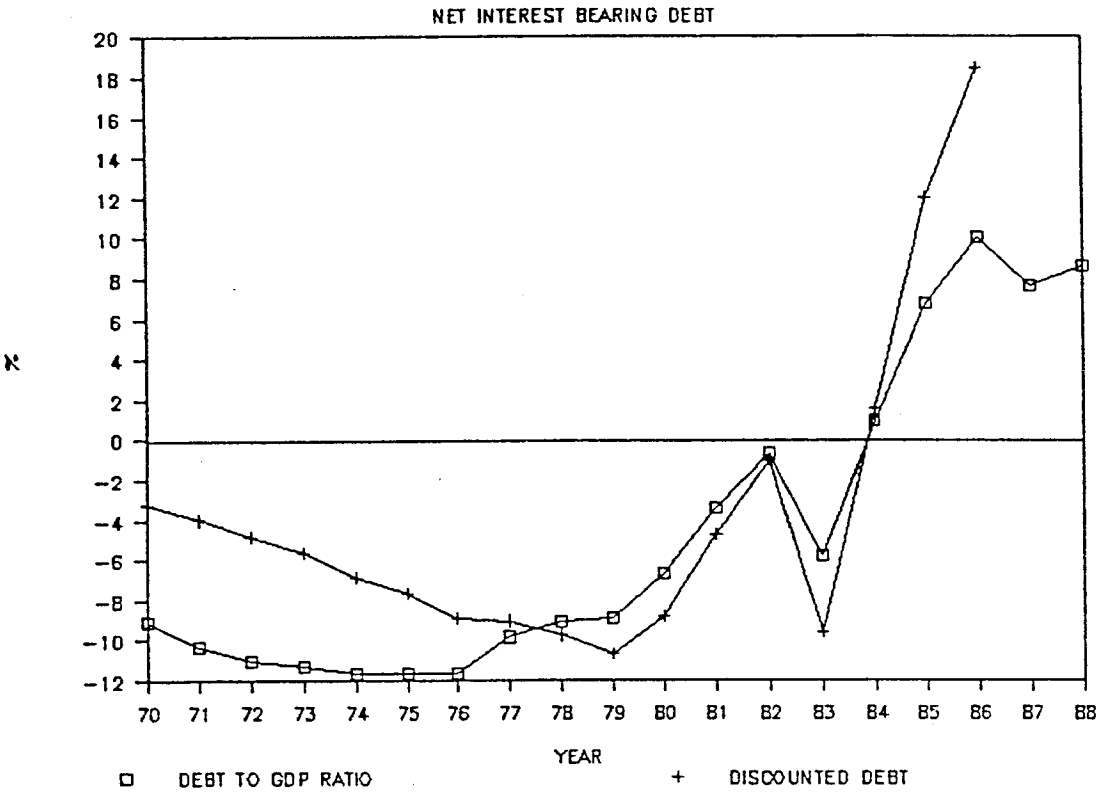
NORWAY: DISCOUNTED DEBT AND DEBT/GDP



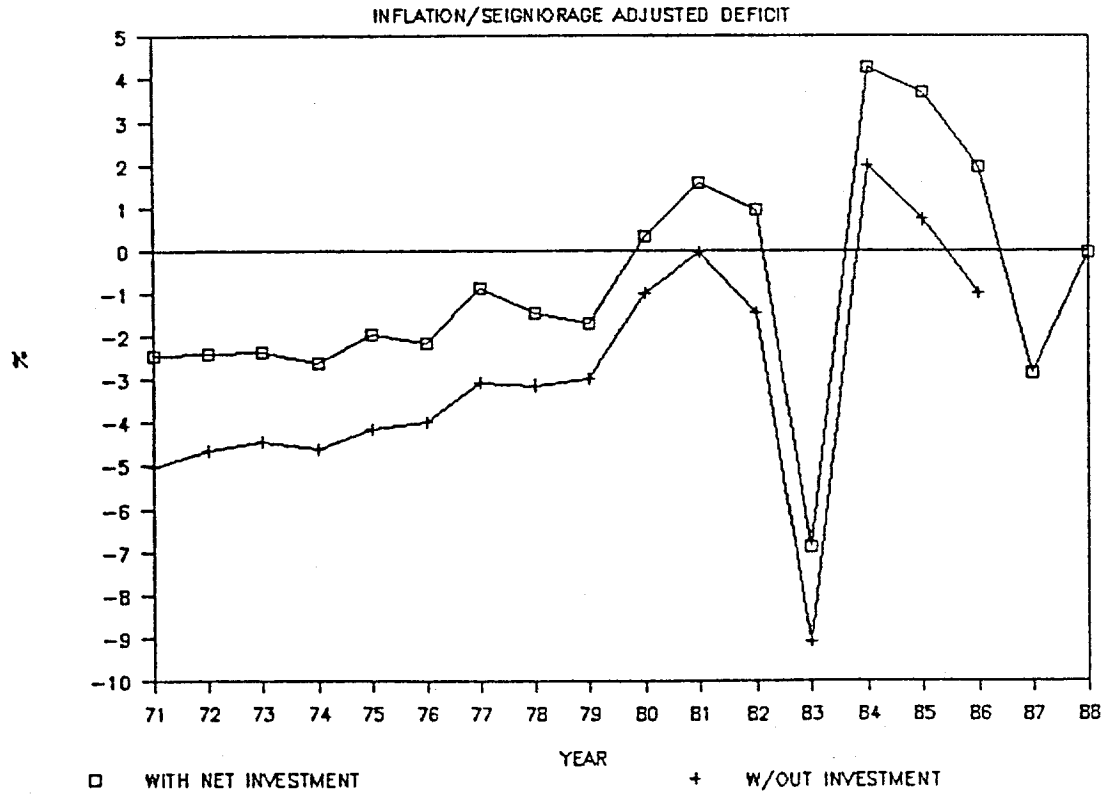
NORWAY: DEFICIT TO GDP RATIO



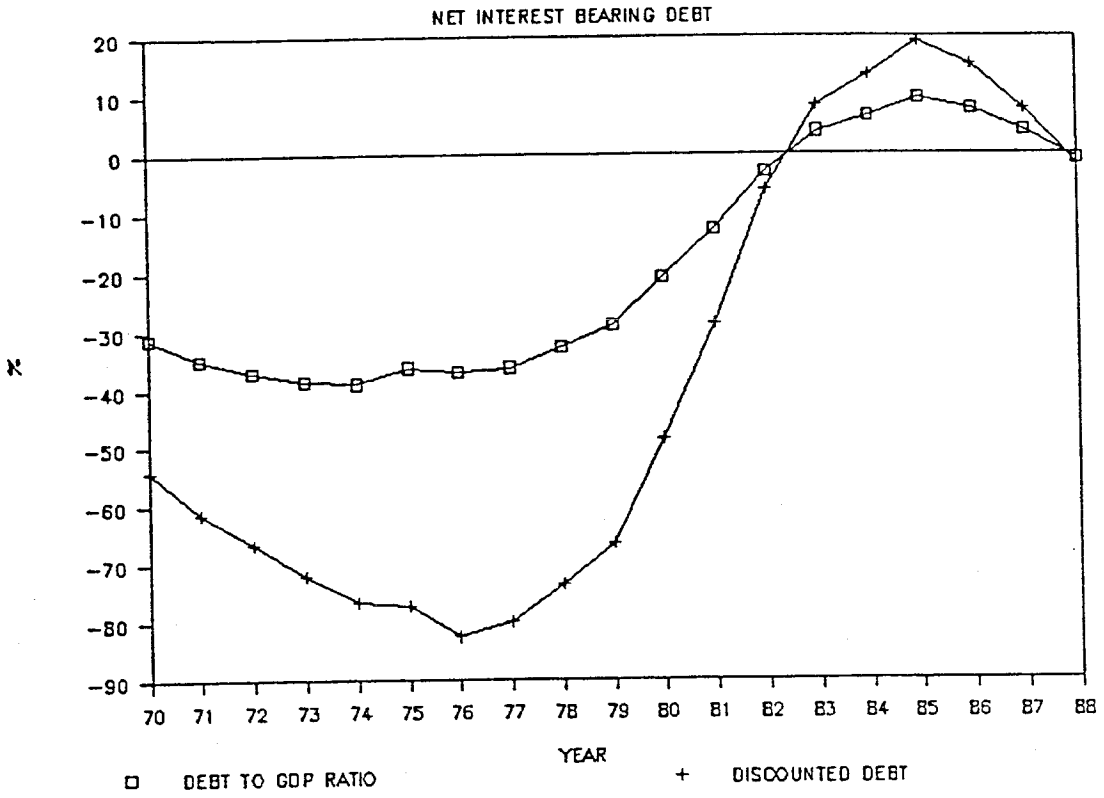
SPAIN: DISCOUNTED DEBT AND DEBT/GDP



SPAIN: DEFICIT TO GDP RATIO



SWEDEN: DISCOUNTED DEBT AND DEBT/GDP



SWEDEN: DEFICIT TO GDP RATIO