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*Searching for Non-Keynesian Effects  
of Fiscal Policy*

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### *Searching for Non-Keynesian Effects of Fiscal Policy*

**Francesco Giavazzi, Tullio Jappelli, and Marco Pagano**

#### **Abstract**

We search for the circumstances in which the response of national saving to fiscal policy contradicts conventional Keynesian predictions, using data from 18 OECD countries. The data suggest that non-Keynesian effects tend to be associated with large and persistent fiscal impulses. Such responses can be traced to changes in taxes and transfers more than to changes in government consumption and are stronger for fiscal contractions than expansions. During large contractions an increase in taxes has no effect on national saving. High or rapidly growing public debt is not a good predictor of non-Keynesian effects. Finally, the composition of the fiscal impulse matters: the non-Keynesian effects of a large fiscal contraction are amplified when this is carried out primarily by raising taxes.

**Keywords:** Fiscal policy, national saving, contractionary fiscal expansions

**JEL Classification:** E21, E62, H31

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## **Table of contents**

*1. Introduction*

*2. Competing Theories*

2.1. Net Taxes

2.2. Government Consumption

*3. Previous Evidence and Data Description*

*4. Empirical Results*

*5. Conclusions*

*References*

*Appendix*

## 1. Introduction

Even though fiscal policy is a classic theme in macroeconomics, there is no consensus about the size or even the sign of its effects on private sector behavior. Renewed interest in this question has been spurred by the surprising consequences of two instances of fiscal retrenchment in Europe during the 1980s. In Denmark, between 1983 and 1986, a reduction in the full-employment surplus of 7.2 percent of GDP was accompanied by a boom in private consumption and investment which led to a sharp acceleration of growth. In Ireland, between 1987 and 1989, a similar cut in the full-employment surplus (5.7 percent of GDP) was also accompanied by higher growth. Shortly afterwards, in a symmetrical pattern, the Swedish fiscal expansion of the early 1990s was associated with a sharp contraction in economic activity. All three episodes contradict the Keynesian view that an increase in the government surplus is contractionary, and raise two important questions. First, was there something peculiar to the Danish, Irish and Swedish experiences, or were there comparable episodes in other countries as well? If so, can one identify the circumstances in which fiscal policy is more likely to have such non-Keynesian effects?

There is no lack of theoretical models consistent with non-Keynesian outcomes, as we shall see in Section 2. Expansionary fiscal contractions can be explained by the effects of fiscal policy on the market value of wealth and on expectations about future taxes. A fiscal contraction often reduces interest rates, raising the market value of stocks, bonds and real estate, thus stimulating aggregate demand. It can also drastically change people's view of the future and therefore the estimate of their human capital. For instance, in a high-debt country a fiscal correction may prevent a financial crisis, thus improving confidence and increasing consumption and investment. These issues have been investigated by several empirical studies, reviewed in Section 3. They typically confirm that expansionary contractions do indeed happen.

What remains to be understood is the conditions under which a fiscal consolidation induces an expansion or, conversely, a fiscal expansion brings about a contraction. Such conditions fall, in principle, into two classes. First, there are the *circumstances* in which fiscal policy is carried out. Perotti (1997), for instance, shows that the outcome of a consolidation is more likely to be expansionary when public debt is high or growing rapidly. Second is the *size* and *composition* of the fiscal impulse. Giavazzi and

Pagano (1996) find that private sector behavior depends on the size and persistence of the impulse. In principle its composition may also matter: the private sector response may differ depending on whether the budget is cut by slashing public sector wages and reducing social security benefits or by raising taxes and cutting public investment. The aim of this paper is to conduct a systematic search to determine which of these of factors is associated with such non-Keynesian effects.

Previous studies have mainly analyzed the response of private consumption and investment to taxes and government spending. We focus instead on national saving to discriminate between competing hypotheses concerning the effect of fiscal policy on private sector expectations. For instance, the Keynesian view predicts that an increase in taxes raises national saving. Models with infinite horizons suggest that, given government spending, taxes have no effect on national saving. Other models suggest that the sign and size of the effect depend on the level and sustainability of government debt, the size and persistence of the fiscal impulse, and the change in composition of the budget.

Like most past studies, our empirical analysis is based on a panel of national accounts data for the OECD countries over nearly three decades (1970-1996). In Section 4 we propose a simple but flexible framework to analyze the impact of fiscal policy on national saving. In our empirical specification the impact can depend on: (i) the sign of the impulse (budget cut or expansion); (ii) its size and duration; (iii) the previous level or rate of growth of public debt; (iv) the composition of the impulse (changes in taxes and transfers relative to changes in government consumption, changes in public investment or in social security entitlements). The main results of the empirical analysis are summarized in Section 5.

## *2. Competing Theories*

To begin, we outline the main competing hypotheses on the response of national saving to fiscal impulses. The models generally make predictions about private consumption. We map them into hypotheses about the response of national saving, to facilitate the interpretation of the regressions presented in Section 4, where national saving is the dependent variable. Recall that by accounting definitions national saving is the difference between national income and the sum of private and public consumption:

$$S = S_G + S_P = (T - G) + (Y - T - C) = Y - (C + G), \quad (1)$$

where  $S$  denotes national saving,  $S_G$  government saving (or surplus),  $S_P$  private saving,  $Y$  national income,  $T$  taxes net of transfers and  $G$  government purchases of goods and services. The predictions of the main hypothesis are summarized in Table 1.

### 2.1. *Net Taxes*

In the familiar Keynesian model, given public spending, an increase in taxes raises the government surplus and depresses private consumption and saving. But the increase in the government surplus exceeds the fall in private saving (for every additional dollar of tax the private sector reduces its saving by a fraction of a dollar), so that on balance higher taxes translate into higher national saving.

Even in the Keynesian model, however, wealth effects can overturn this prediction. If the increase in the surplus reduces the interest rate - either via a traditional crowding-in mechanism or by reducing the default premium on the public debt - the resulting appreciation of stocks, bonds and real estate can trigger a consumption boom and thus a reduction in national saving.

In full employment models with intertemporally optimizing households, the effect of a tax increase on national saving depends on the planning horizon, on the distortionary effect of taxes and on the perception of future fiscal policy. The benchmark case is that of a temporary lump-sum tax increase in which the additional revenue is used to retire public debt and reduce taxes on future generations, holding government consumption constant. If households have a finite planning horizon, as in overlapping generations models with non-altruistic consumers, net lifetime income for the current generation falls, and households reduce their consumption and saving accordingly. The reduction in saving, however, falls short of the tax increase, as households spread the cut in consumption over their lifetime. The implied increase in the government surplus thus exceeds the fall in private saving, producing a positive correlation between taxes and national saving, as in the Keynesian model.

If, however, households plan over an infinite horizon, one obtains the well-known neutrality result, often labeled as complete tax discounting or

the “Ricardian irrelevance proposition”. A temporary tax increase does not affect private consumption, because the reduction in disposable income reduces private saving one-for-one. National saving is unaffected: the fall in private saving precisely matches the rise in government surplus.

If taxes are distortionary, this neutrality result no longer obtains, even in infinite horizon models. A tax increase today, matched by lower taxes tomorrow, changes the deadweight cost of taxes at different dates and thereby affects the present value of pre-tax lifetime income. Under some circumstances, this can lead to non-Keynesian results, as is illustrated by Blanchard (1990). He assumes that the deadweight cost of taxation is strongly non-linear: it is zero until the tax rate reaches a critical threshold, positive and high above that. If public debt and spending are high compared to tax revenue, an increase in current taxes diminishes the chances that the government will have to raise the tax rate above the critical level in the future. This increases the expected value of households’ future disposable income, and hence private consumption. Since in Blanchard’s model  $Y$  and  $G$  are given, the increase in current taxes reduces national saving (see equation 1 above). This exemplifies the more general point that if the deadweight cost of taxes is an increasing function of the tax rate, a tax rise may translate into lower saving. This effect is more likely if current taxes are low relative to the permanent taxes required by the existing public debt and the level of public spending.<sup>1</sup> The implication is that the impact of higher taxes on national saving may be considerably attenuated (and may even switch from positive to negative) when the debt-income ratio and the public consumption-income ratio are high.

This line of reasoning can be extended to other non-linear effects of fiscal policy. For instance, assume that the current fiscal policy stance is unsustainable and if not corrected will lead to repudiation of the debt, disrupting the financial sector and the real economy. Raising taxes lowers the probability of default. The implied increase in future income raises current private consumption and reduces national saving. In this example the non-Keynesian response of the private sector hinges on people’s confidence on the switch to “sound finance”. If the credibility of the regime

<sup>1</sup> If the government is raising relatively little tax revenue today, given its debt level and spending path, it is implicitly leaving most of the tax burden for the future, inefficiently imposing a very large deadweight cost on future production. Thus shifting part of this burden to the current represents efficient “tax smoothing” and can have beneficial effects on consumption.

shift is enhanced by the magnitude of the fiscal turnaround (as suggested by Feldstein, 1982) sufficiently large changes in current taxes could trigger non-Keynesian effects.

Sutherland (1997) provides another model in which expectations can trigger non-Keynesian policy outcomes. Suppose that consumers have finite planning horizons, so that tax increases normally depress consumption and raise national saving. However, let consumers also expect that when the public debt-income ratio goes above some given threshold, a major stabilization will occur. If the debt-income ratio is near the threshold, a tax increase delays reaching the threshold, and so postpones the “day of reckoning”, making the readjustment more likely to fall on the shoulders of future generations. Paradoxically, the tax increase raises the expected lifetime disposable income and the consumption of the current generation. The effect of taxes on national saving is again attenuated.

## 2.2. *Government Consumption*

There is broader theoretical consensus about the effects of an increase in government consumption than of an increase in taxes. All the standard models predict a nil or negative impact on national saving. In the Keynesian model higher government spending reduces investment and national saving. The negative effect can be attenuated or even reversed by wealth effects. If greater spending drives interest rates up, the market value of wealth falls, inducing households to save more.

In an infinite horizon model with complete tax discounting and no tax distortions, government consumption “crowds out” private consumption one for one: each dollar of extra spending by the government subtracts a dollar from permanent income and hence from consumption ( $\Delta C = -\Delta G$ ). Since without tax distortions the path of pre-tax income  $Y$  is given, from equation (1) we see that an increase in  $G$  leaves national saving unchanged. In the presence of distortionary taxes, the effect will be negative, unless the greater tax distortions also affect the level of investment.<sup>2</sup>

<sup>2</sup> This can happen, for instance, if taxes are also levied on capital income.

Therefore, as in the Keynesian model, the effect of higher public consumption on national saving is nil or negative. Similarly, in a model with finite horizon greater public consumption (whether funded by taxes or debt) reduces private saving. Since the effect on public saving is also negative, an increase in public consumption reduces national saving.

As in the case of taxes, these predictions can be altered by the effects of expectations. Suppose that large increases in public spending are taken as the signal of a transition to a regime of higher permanent spending and therefore higher permanent taxes, while small increases are expected to be reversed in the future. A large increase in public consumption thus has a contractionary effect on private consumption and leaves national saving unchanged (in the benchmark case of complete tax discounting with no distortions). However, a small increase in government consumption does not affect private consumption but reduces the public surplus and national saving. This argument, proposed by Feldstein (1982) and Drazen (1990), suggests potential non-linearity in the effect of government consumption on national saving.

Non-linearities driven by expectations can go even further. Bertola and Drazen (1993) show that expectations could change the sign of the relation between government consumption and national saving. A small increase in public spending could induce a large drop in private consumption and so actually increase national saving. Suppose a fiscal stabilization is expected with some probability when public spending reaches a given threshold.<sup>3</sup> Below the threshold an increase in government consumption reduces private consumption less than one-for-one and therefore leads to a fall in national saving as in a Keynesian model. But if government consumption keeps increasing even after the threshold is reached, consumers will revise the estimates of their permanent income and consumption sharply downward, because the expected stabilization failed to materialize. This model accordingly predicts that the sign of the correlation between government consumption and national saving depends on the level of public spending relative to income.

As summarized in Table 1, the predicted response of national saving to fiscal impulses differs greatly from model to model. The theories surveyed

<sup>3</sup> The difference from the case discussed in Section 2.1 is that here the stabilization only occurs with some probability when the threshold is reached.

in this section, however, direct us to the variables associated with one or another of such responses. We shall use this information as a guide in our empirical search for the conditions under which a fiscal impulse can produce non-Keynesian outcomes.

### *3. Previous Evidence and Data Description*

So far, empirical studies of unusual fiscal episodes have taken one of two approaches. Some distinguish the episodes on the basis of ex post criteria (e.g. the success of a fiscal contraction in reducing the debt-GDP ratio) and describe the characteristics of the fiscal impulse and the associated behavior of various endogenous variables (income growth, interest rates, or the exchange rate). These studies directly ask what makes a stabilization “successful”, without addressing the intermediate question, namely how the private sector responds to a fiscal impulse. This is an important question, considering that the ability of a fiscal contraction to reduce the debt-GDP ratio depends precisely on this. Other studies distinguish fiscal episodes on the basis of an ex ante criterion (e.g. the size or persistence of the fiscal stimulus) and then assess the effect of the government’s action on endogenous variables, such as private consumption and investment.

The latter approach was prompted by the analysis of two episodes of non-Keynesian effects of fiscal policy: the Danish stabilization of 1983-86, and the Irish stabilization of 1987-89. Giavazzi and Pagano (1990) conclude that in those episodes the size of the budgetary contraction was so large as to change expectations about future fiscal policy, and hence people’s estimates of their permanent income. Further evidence in favor of the hypothesis of a non-monotonic response of private consumption to fiscal contractions - recessionary for small contractions, expansionary for large consolidations - is provided in Giavazzi and Pagano (1996), using a panel of OECD countries. This paper shows that the non-monotonicity applies to fiscal expansions as well. Large increases in the full-employment primary deficit dampen private consumption, while moderate ones produce the traditional Keynesian outcome. All these studies rely on the size and

persistence of the change in the budget balance as the ex ante criterion determining the effects of fiscal policy on private consumption.<sup>4</sup>

A different approach is taken by Alesina and Perotti (1995, 1997), Alesina and Ardagna (1998) and the IMF (1996), in studies of fiscal contractions that classify the episodes according to their ex post performance. Alesina and Perotti define as “successful” those contractions which three years out produce a reduction of the debt-GDP ratio of at least 5 percentage points. According to their evidence, fiscal consolidations are more likely to stabilize the debt-GDP ratio when the budget improvement is obtained by cutting public wages and pension benefits. This result is consistent with the view that non-monotonicities in the effects of fiscal policy are associated with a shift in expectations. Slashing these “untouchable” budget items, they argue, signals that a regime shift has occurred.

The IMF (1996), based on McDermott and Wescott (1996), defines “aggressive fiscal impulse” a tightening of the budget of at least 1.5 percentage points of GDP for at least 2 years; it terms “successful” those stabilizations that managed to reduce the debt-GDP ratio by at least 3 points within two years. Out of 63 “aggressive” episodes between 1970 and 1995, the 14 “successful” ones are associated with higher GDP growth, lower unemployment, lower real interest rates and real exchange rate appreciation. This is further evidence that fiscal policy can have non-monotonic effects.

In this paper we analyze the relation between fiscal policy and private saving using ex-ante criteria drawn from the theories surveyed in Section 2. We test whether the relation between fiscal policy and private saving changes when: (i) the fiscal impulse is sizable and protracted; (ii) the debt-GDP ratio has reached a threshold level, or (iii) public debt is growing very rapidly.<sup>5</sup>

<sup>4</sup> In a similar vein, the OECD (1996) asks if similar results obtain with reference to output growth rather than consumption. The study identifies 15 episodes between 1974 and 1995 in which the cyclically-adjusted financial balance improves by at least 3 percentage points of GDP continuously over at least 2 consecutive years. It finds that fiscal consolidation did not uniformly lead to low growth, but the results are inconclusive: “overall there appears to be little relationship between either the extent or the pace of consolidation and growth rates during the process” (p. 39).

<sup>5</sup> Early evidence pointing to a role of the debt-GDP ratio in determining the degree of tax discounting of the private sector is provided by Nicoletti (1988).

Our strategy in the next section is to estimate a saving function by interacting fiscal variables with a set of dummies that capture the various circumstances set forth above: impulses that are “sizable and protracted”, those occurring after the debt-GDP ratio exceeded a given threshold, and so on.

We define a “large and persistent fiscal episode” as one in which the full employment surplus changes by at least 1.5 percent per year over a two-year period. This definition is similar to that used by Giavazzi and Pagano (1996) and by the IMF (1996). As indicated in Table 2, we find 38 expansions and 65 contractions. These are listed in the Appendix.

Table 2 reports averages of selected macroeconomic variables before, during and after these episodes, separately for expansions and contractions. The figures contradict the Keynesian hypothesis on the effects of expansionary and contractionary fiscal policy. For instance, GDP and consumption growth decline relative to their previous average after expansions and contractions alike, but the average decline is sharper after the expansions than after the contractions. GDP and consumption growth are also higher during contractions than expansions. The national saving rate falls considerably following expansions (from 23.29 percent to 20.22 percent), as would be expected under the Keynesian view. However, large fiscal contractions increase national saving only slightly (from 21.89 to 22.70 percent). The descriptive statistics thus uncover important asymmetries in the response of national saving to expansions and contractions. We shall address this issue properly in the next section by regression analysis. Finally, the table indicates that major fiscal consolidations have relied on tax increases rather than spending cuts and that by and large they have managed to stabilize the debt-GDP ratio.

#### 4. *Empirical Results*

We describe the impact of fiscal policy on national saving by estimating the regression:

$$\frac{S}{Y} = \mathbf{a}_o + \mathbf{a}_1 \mathbf{r} + \mathbf{a}_2 r + \mathbf{b}_1 \frac{T}{Y} + \mathbf{b}_2 d \frac{T}{Y} + \mathbf{g}_1 \frac{G}{Y} + \mathbf{g}_2 d \frac{G}{Y} \quad (2)$$

where  $\mathbf{r}$  denotes the rate of growth of national income and  $r$  the real interest rate. The variable  $d$  is a dummy for the circumstances in which fiscal policy can have non-monotonic effects according to the theories surveyed in Section 2. A more detailed description of this variable is provided below.

Our empirical specification can conveniently nest the various hypotheses laid out in Section 2. Keynesian and finite horizon models suggest that an increase in taxes raises national saving ( $\mathbf{b}_1 > 0$ ), whereas an increase in government consumption reduces it ( $\mathbf{g}_1 < 0$ ). In the infinite horizon model with lump-sum taxes, fiscal policy has no effect on national saving ( $\mathbf{b}_1 = 0$  and  $\mathbf{g}_1 = 0$ ). In some circumstances, however, the private sector response to fiscal shocks can be dramatically altered by expectational mechanisms. To capture these circumstances,  $T$  and  $G$  are interacted with appropriately designed dummy variables  $d$ .

Several studies have estimated versions of equation (2) using time series data on individual countries and international cross-sections or panels (Modigliani, 1993; Masson, Bayoumi and Samiei, 1996). The main problem in estimating equation (2) is the potential endogeneity of current taxes. We thus instrument taxes with the full-employment government surplus net of interest payments, as measured by the OECD. We use data on 18 OECD countries from 1970 to 1996, but because of missing values for the full employment government surplus, for some countries the sample is shorter (details are provided in the Appendix). To avoid contemporaneous correlation between output and saving, the growth rate in equation (2) is measured as a moving five year average of lagged growth rates. The dynamics of the national saving rate is captured by its lagged value. The (ex post) real interest rate is the difference between the short term domestic rate and inflation, based on the private consumption deflator. Since the interest rate is also potentially endogenous, we use its lagged value as instrument. Each regression includes dummies to control for country-specific effects. Demographic variables (such as the proportion of the population in the 15-64 age bracket) were found to be not statistically significant, and are not included in the reported results.

Column (1) of Table 3 presents the estimates of equation (2). Initially we do not interact the fiscal variables with the dummy variables  $d$ , so as to have a benchmark specification in which the effects of  $G$  and  $T$  are constrained to

be linear. The coefficient of the growth rate is consistent with several studies that document a positive correlation between saving and growth.<sup>6</sup> The effect of a change in the real interest rate, which in principle is ambiguous, is estimated to be positive (0.050) and significantly different from zero at the 5 percent level. The coefficients of  $T$  and  $G$  are respectively positive (0.300) and negative (-0.637), and both are significantly different from zero at the 1 percent level. These results strongly contradict the infinite horizon model and support the Keynesian view of the effects of fiscal policy. Given the continuing debate over the Ricardian irrelevance proposition, they are of interest in their own right.<sup>7</sup>

The other regressions in Table 3 test the hypothesis that the fiscal policy coefficients are stable. The idea is to identify possible structural breaks in the relation between fiscal policy and saving in the specific circumstances identified by the theories surveyed in Section 2, namely: (i) a protracted and sizable fiscal impulse, as described in Table 2; (ii) a high debt-GDP ratio; (iii) a rapidly growing debt-GDP ratio. In each case we define an appropriate dummy variable.<sup>8</sup>

The results indicate that the effect of both taxes and spending is highly non-linear. During “normal” times, the effect of taxes on national saving remains positive (0.578), but during sharp fiscal contractions or expansions, the effect is greatly attenuated ( $0.189 = 0.578 - 0.389$ ). In these episodes, the effect of government spending is also significantly smaller in absolute value ( $-0.537 = -0.908 + 0.371$ ). Since the results may be sensitive to the values chosen to define a “sizable” change in the full-employment surplus, we also try changes in the surplus of 2.0, 2.5, 3.0, and 4.0 percent. The results obtained are qualitatively similar, and for brevity they are not reported.

<sup>6</sup> Modigliani (1993), Carroll and Weil (1994) and Jappelli and Pagano (1994) find a positive coefficient in a regression of national saving on the contemporaneous or lagged growth rate.

<sup>7</sup> For instance, Bernheim (1987) concludes that the data do not support Ricardian equivalence, while Seater (1993) reaches the opposite conclusion.

<sup>8</sup> We also experimented with a dummy that is equal to one if the effective exchange rate falls by more than 10 percent in the year preceding the fiscal impulse. According to the Keynesian model, a devaluation stimulates aggregate demand. Other things being equal, a devaluation should compensate the recessionary impact arising from a fiscal contraction. However, the interaction terms between this dummy and fiscal variables are not significantly different from zero. For brevity, they are not reported.

The private sector's response may differ depending on the sign of the fiscal impulse (as in Bertola and Drazen, 1990). To test for this asymmetric behavior, we interact  $G$  and  $T$  with two separate dummies, one for large expansions and one for contractions (the threshold is still an average change in the full-employment surplus of 1.5 percentage points for at least two years). The regression in column (3) of Table 3 indicates that the effect of fiscal policy differs between contractions and expansions. In particular, the effect of taxes is positive (0.504) in "normal" times, smaller during large fiscal expansions ( $0.219=0.504-0.285$ ), and almost zero during large contractions ( $0.036=0.504-0.468$ ). The bottom line is that an increase in taxes raises national saving, except during a sizable fiscal contraction. During such contractions, the increase in private consumption fully offsets the positive effect of taxes on the government surplus. The pattern for government spending is very similar. The coefficient is always negative, but its absolute value is larger in normal times (-0.856) than during sizable fiscal expansions ( $-0.600= -0.856+0.256$ ). The effect of government consumption is lowest in absolute value during sizable contractions ( $-0.401= -0.856+0.455$ ).

According to some of the models outlined, the effect of fiscal policy can depend on the size of the public debt. In column (4) we interact taxes and spending with a dummy set equal to 1 if the debt-GDP ratio exceeds 70 percent. The coefficients of the interaction terms are small in size and not significantly different from zero, indicating that a high debt-GDP ratio does not affect the impact of taxes and spending on national saving. Qualitatively similar results were obtained for other values of the debt ratio (such as 80 percent or 100 percent).

The sign and size of the response to fiscal impulses may also depend on the perceived sustainability of the fiscal regime. A regime may be perceived as "unsustainable" if the ratio of debt to GDP at the outset of the fiscal impulse is rising particularly fast. We thus replace the dummy for high debt with a dummy equal to 1 if the growth rate of the debt-GDP ratio exceeds 4 percent for two consecutive years, and 0 otherwise. Perotti (1997) proposes the same definition. The results are reported in column (5) of Table 3. The sign of the interaction terms is consistent with smaller fiscal impact on national saving in the wake of rapid debt accumulation. However, as in

column (4), the magnitude of the interaction terms is small, and their standard errors are large.

The results so far suggest significant departures from the Keynesian model, especially during large fiscal contractions.<sup>9</sup> The evidence that these departures are related to a high or fast-growing debt-GDP ratio is weak at best. In addition, we find that complete tax discounting occurs mainly during large contractions rather than during large fiscal expansions, a correlation not detected by previous empirical studies.

The specifications in columns (3), (4) and (5) do not allow for possible interactions among the ex-ante criteria, which could be complementary sources of the non-linear response of national saving to fiscal policy. The natural next step, therefore, is to estimate a regression that includes all the interaction terms. The estimates obtained from this nested specification are displayed in column (6) of Table 3. The only statistically significant coefficients are those of the interaction terms of taxes and spending during large contractions (-0.443 with a t-statistic of 3.03 and 0.428 with a t-statistic of 3.04, respectively). This confirms that the main source of non-linearity is the size of the fiscal impulse not the level or the growth of public debt. Furthermore, the size and significance of the interaction terms also appear to be stronger during contractions than during expansions.

On the whole, the results strongly support the Keynesian view of fiscal policy in normal times, but reveal that the effects of changes in taxes and spending on national saving are much damped down during large fiscal contractions. The damping is particularly pronounced when the impulse comes on the tax side.

We thus try to learn more about large fiscal contractions. Do they have special features that make a non-linear response by national saving more likely? For instance, the effect on national saving may depend on whether public debt is high or growing rapidly. Or it may depend on the composition of the fiscal impulse: the relative importance of tax hikes and cuts in government consumption, public investment, or pension transfers. These issues are addressed by interacting the dummy for “large fiscal contraction” with dummy variables capturing episodes in which:

<sup>9</sup> These results are consistent with Giavazzi and Pagano (1996), which focuses on private consumption rather than national saving.

- i. the public debt-GDP ratio exceeds 70 percent,
- ii. the average change in the debt-GDP ratio exceeds 4 percent in two consecutive years,
- iii. public investment is growing in real terms during the fiscal consolidation,
- iv. social security benefits are reduced in real terms during the fiscal consolidation,
- v. the consolidation is effected by raising net taxes more than by cutting public consumption.

The results are reported in Table 4. All regressions are directly comparable with our preferred specification of column (3) in Table 3. The five dummies defined above are introduced one at a time into this basic specification. The only coefficients of the additional interaction terms that turn out to be significantly different from zero are those in column (5), where we allow for the effect of the composition of the fiscal consolidation. Specifically, we find that when large fiscal contractions are mainly carried out by raising taxes, the effects of both taxes and spending on national saving are further attenuated.

The best way to understand this result is to plot the estimated impact of taxes ( $T/Y$ ) on national saving. In normal times, this effect is equal to the product of  $T/Y$  and the estimated coefficient  $b_1$ . During sizable fiscal contractions, this effect is supplemented by the interaction of  $T/Y$  with the dummy for large contractions multiplied by the estimate of the coefficient  $b_2$ . When contractions are carried out by raising net taxes more than cutting spending, one must add the further interaction of taxes with the corresponding dummy and coefficient. A similar decomposition of the effect of government consumption can be performed.

In Figures 1 and 2 we plot the national saving rate and the estimated effects of taxes and government consumption in countries that have enacted the largest recent swings in fiscal policy: Denmark, Ireland, Italy and Sweden. We use the coefficients estimated in column 5 of Table 4. Consider the effect of taxes in the case of Ireland, displayed in the upper-right corner of Figure 1. The diamond-line is the national saving rate. The middle circle-line shows the positive effect of taxes in normal times ( $0.481 \times T/Y$ ). The dips represent the effect of the interaction terms. In our sample period, Ireland

had four large contractions (1977-78, 1983-85, 1987-89, and 1991-92). In 1983-85 and 1987-89 the consolidation was achieved mainly by raising net taxes. The effect of taxes in large fiscal contractions is smaller than in normal times  $(0.481-0.339)\times(T/Y)=0.142\times(T/Y)$ , as can be seen from the dips in 1977-78 and 1991-92. When a large contraction consists mainly in raising net taxes, the effect of taxes is negative:  $(0.481-0.339-0.235)\times(T/Y)=-0.093\times(T/Y)$ . In the figure, this corresponds to the dips of 1983-85 and 1987-89, where the line falls below zero. Similar considerations apply to the other three countries. In Denmark and Sweden the consolidations were all achieved mainly via tax increases; in Italy three out of four. The figures clearly convey that the effect of taxes on national saving is markedly non-linear, depending on the size and composition of the impulse.

Similar non-linear effects appear in Figure 2, which plots national saving against the effect of government consumption. In normal times the contribution of government consumption to national saving is large in absolute value and negative  $(-0.788\times G/Y)$ , as is shown by the circle line. The humps marked with crosses indicate that this effect is attenuated in large contractions (for instance, in Ireland in 1977-78 and 1991-92). The effect is further weakened when the consolidation is achieved mainly by raising taxes. In the figure, these consolidations correspond to the largest humps, which come closer to the zero line (for instance, Ireland in 1983-85 and 1987-89).

## 5. *Conclusions*

We search systematically for the circumstances in which national saving responds to fiscal policy impulses in a way that contradicts conventional Keynesian predictions. The evidence of 18 OECD countries confirms some previous findings and complements them with a few new ones.

First, the data confirm that a non-Keynesian response by the private sector is more likely when fiscal impulses are large and persistent. Second, such a response is likely to be due to changes in taxes and transfers more than government consumption. Non-Keynesian effects are larger and more precisely estimated for tax changes than for changes in public consumption, as in Giavazzi and Pagano (1996). Third, non-Keynesian responses appear to be asymmetric, stronger and more precisely estimated for contractions

than for expansions; in particular, during large contractions an increase in taxes has little or no effect on national saving. Fourth, in contrast with many of the relevant theoretical models and the evidence in Perotti (1997), we find that high or rapidly growing public debt is not *per se* a good predictor of these non-monotonic responses. Finally, we find that in large contractions the composition of the fiscal impulse matters. But, in contrast with the usual argument, the non-Keynesian effects of a large fiscal contraction are accentuated when it consists primarily in raising taxes. Reducing pension benefits *per se* does not appear to increase the likelihood of these effects.

Our findings have potentially important policy implications. They highlight that in order to trigger the expectational mechanisms that are at the root of the non-Keynesian response of national saving it is essential to act swiftly, drastically improving the budget, and that reducing the deficit via tax hikes does not reduce the likelihood of these effects compared to a cut in public consumption.

Our results are also relevant for the theories that try to explain the non-Keynesian effects of fiscal policy, which typically predict that these effects should be present when the debt-GDP ratio is historically high. Our evidence does not support this contention. The finding that only strong and persistent fiscal impulses trigger non-monotonic responses can be explained by models of regime changes: only large and politically costly fiscal actions can signal a regime change, and thus have a non-Keynesian impact on private sector expectations and behavior.

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TABLE 1  
 PREDICTED EFFECTS OF A FISCAL IMPULSE ON NATIONAL SAVING IN  
 VARIOUS MODELS

	<i>Increase in net taxes (given government consumption)</i>	<i>Increase in government consumption (given net taxes)</i>
Keynesian	positive	negative
Keynesian with wealth effects	uncertain	uncertain
OLG	positive	negative
Infinite horizon and non distortional taxes	No effect	no effect
Blanchard (1990) Sutherland (1995)	depends on debt-income ratio and on the size of tax increase (positive in normal times; attenuated or negative if debt is high or tax increase is high)	
Bertola and Drazen (1993)	depends on the ratio of public consumption to income (positive if the ratio is small, lower and possibly negative otherwise); non-monotonicity applies only to expansions	

TABLE 2  
LARGE FISCAL EXPANSIONS AND CONTRACTIONS: SUMMARY STATISTICS  
(OECD COUNTRIES: 1970-96)

A large fiscal expansion or contraction is defined as one episode in which the full employment surplus changes by more than 1.5 percent per year over a two-year period. The growth rates before (after) the episode are the average growth rate of the relevant variable in the three years preceding (following) the start (end) of the episode. The debt-GDP ratio and the national saving rate before (after) the episode refer to one year before (after) the start (end). Due to missing values, the number of observations used to compute the averages in the table is in some case less than 38 for expansions and 65 for contractions.

	<i>Expansions</i>	<i>Contractions</i>
<b>Growth rate of GDP</b>		
Before	2.57	2.21
During	1.12	2.36
After	2.00	2.13
<b>Growth rate of private consumption</b>		
Before	2.43	2.38
During	1.91	2.22
After	1.71	2.29
<b>Growth rate of government consumption / GDP ratio</b>		
Before	3.64	3.48
During	3.09	2.48
After	1.86	2.94
<b>Growth rate of taxes</b>		
Before	4.39	2.71
During	0.27	4.19
After	3.40	2.25
<b>Debt / GDP ratio</b>		
Before	48.23	57.23
During	49.12	57.02
After	56.29	56.29
<b>National saving / GDP ratio</b>		
Before	23.29	21.89
During	21.07	22.63
After	20.22	22.70
Number of episodes	38	65

TABLE 3  
DETERMINANTS OF NON-KEYNESIAN EFFECTS OF FISCAL POLICY

The dependent variable is the ratio of national saving to national income. The total number of observations is 417. Instruments for taxes and the interest rate are full employment government surplus and the lagged interest rate. Countries included in the estimation and sample size are reported in the Appendix. See text for the definition of the interaction terms.

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged saving	0.504 (0.039)	0.522 (0.040)	0.582 (0.044)	0.515 (0.039)	0.520 (0.041)	0.588 (0.049)
Growth rate	0.105 (0.047)	0.116 (0.050)	0.134 (0.051)	0.122 (0.046)	0.108 (0.053)	0.148 (0.059)
Interest rate	0.050 (0.024)	0.044 (0.025)	0.026 (0.026)	0.031 (0.027)	0.044 (0.042)	-0.008 (0.046)
Taxes (T/Y):	0.300 (0.075)	0.578 (0.126)	0.504 (0.126)	0.294 (0.070)	0.356 (0.082)	0.496 (0.181)
--- and large change in surplus		-0.389 (0.111)				
--- and large increase in surplus			-0.468 (0.119)			-0.443 (0.146)
--- and large decrease in surplus			-0.285 (0.116)			-0.218 (0.182)
--- and high debt				-0.039 (0.083)		0.042 (0.162)
--- and rapid debt growth					-0.101 (0.607)	-0.673 (0.870)
Government consumption (G/Y):	-0.637 (0.076)	-0.908 (0.117)	-0.856 (0.117)	-0.606 (0.076)	-0.648 (0.079)	-0.822 (0.151)
--- and large change in surplus		0.371 (0.107)				
--- and large increase in surplus			0.455 (0.114)			0.428 (0.141)
--- and large decrease in surplus			0.256 (0.113)			0.183 (0.186)
--- and high debt				0.051 (0.073)		-0.043 (0.159)
--- and rapid debt growth					0.131 (0.472)	0.560 (0.681)
Adjusted $R^2$	0.928	0.922	0.927	0.928	0.926	0.894

TABLE 4  
CHARACTERISTICS OF LARGE FISCAL ADJUSTMENTS AND IMPACT ON  
NATIONAL SAVING

The dependent variable is the ratio of national saving to national income. The total number of observations is 417. Instruments for taxes and the interest rate are full employment government surplus and the lagged interest rate. Countries included in the estimation and sample size are reported in the Appendix. See text for the definition of the interaction terms.

	(1)	(2)	(3)	(4)	(5)
Lagged saving	0.571 (0.043)	0.588 (0.046)	0.585 (0.044)	0.581 (0.046)	0.580 (0.044)
Growth rate	0.103 (0.051)	0.119 (0.056)	0.140 (0.051)	0.136 (0.051)	0.165 (0.055)
Interest rate	0.043 (0.027)	0.029 (0.029)	0.029 (0.027)	0.024 (0.027)	0.015 (0.027)
Taxes (T/Y):	0.517 (0.128)	0.493 (0.126)	0.482 (0.130)	0.511 (0.127)	0.481 (0.127)
--- and large increase in surplus	-0.375 (0.108)	-0.465 (0.129)	-0.469 (0.149)	-0.473 (0.121)	-0.339 (0.131)
---, large increase in surplus, and high debt	-0.192 (0.116)				
---, large increase in surplus, and large change in debt		-0.275 (0.500)			
---, large increase in surplus, and increase in public investment			0.026 (0.143)		
---, large increase in surplus, and increase in pensions				0.064 (0.211)	
---, large increase in surplus, and high taxes					-0.235 (0.139)
--- and large decrease in surplus	-0.286 (0.117)	-0.277 (0.118)	-0.267 (0.119)	-0.289 (0.117)	-0.273 (0.118)
Government consumption (G/Y):	-0.877 (0.119)	-0.863 (0.118)	-0.860 (0.115)	-0.856 (0.117)	-0.788 (0.121)
--- and large increase in surplus	0.371 (0.107)	0.455 (0.126)	0.463 (0.141)	0.459 (0.117)	0.313 (0.131)
---, large increase in surplus, and high debt	0.136 (0.101)				
---, large increase in surplus, and large change in debt		0.179 (0.381)			
---, large increase in surplus, and increase in public investment			-0.040 (0.137)		
---, large increase in surplus, and increase in pensions				-0.034 (0.176)	
---, large increase in surplus, and high taxes					0.245 (0.137)
--- and large decrease in surplus	0.257 (0.113)	0.248 (0.114)	0.239 (0.115)	0.259 (0.113)	0.248 (0.114)
Adjusted $R^2$	0.922	0.921	0.924	0.922	0.920

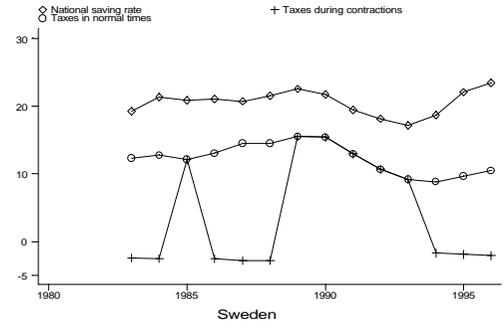
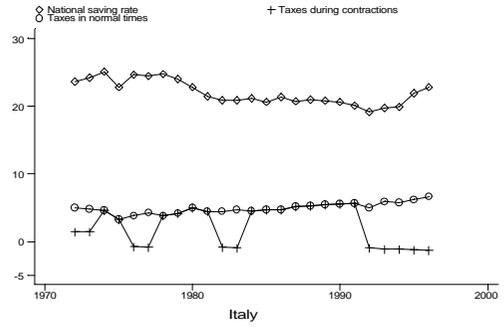
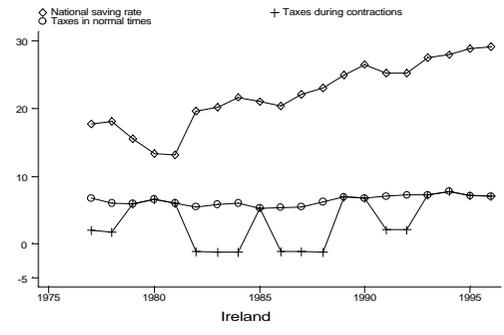
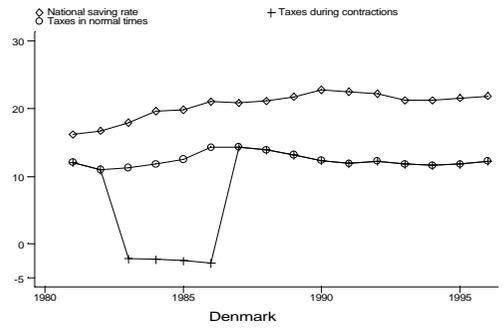


Figure 1: Effect of taxes on national saving

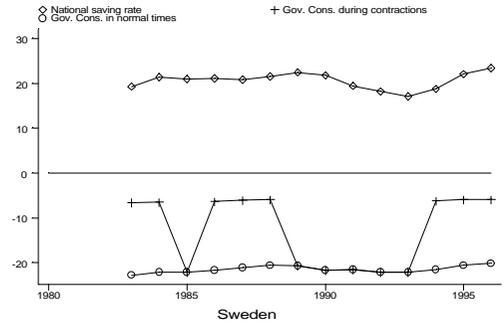
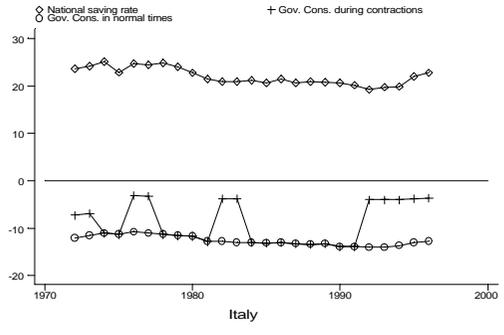
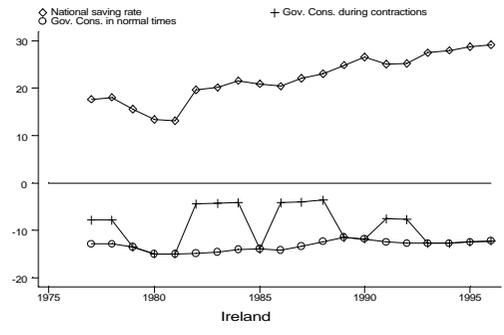
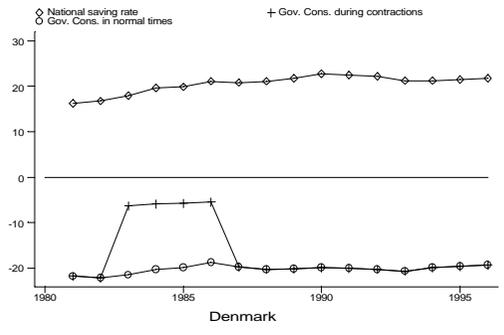


Figure 2: Effect of government consumption on national saving

## Appendix

### 1. Definition of the Variables

All data are drawn from the OECD Economic Outlook database published in June 1997. Government data refer to general government.

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<i>Variable</i>	<i>OECD series</i>
Private consumption	CP
Government Consumption	CG
Government savings	SAVG
Government Debt	GGFL
Gross National/Domestic Product	GDPV
Deflator for consumer expenditure	PCP
Total taxes net of transfers	SAVG+CG
Government investment	IG
Social security contributions	SS
Social security benefits	SSPG
Full employment government surplus	NLQGA

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## 2. Countries and Sample Period Used in the Estimation

Country	Sample period	Expansions	Contractions
Australia	1973-96	83-84; 90-92	73-74; 76-77; 80-82; 86-88; 95-96
Austria	1974-96	93-94	74-75; 77-78; 80-81; 83-85; 95-96
Belgium	1974-96	79-80	74-75; 81-87; 92-94
Canada	1973-96	75-76; 82-85	73-74; 80-81; 86-87; 94-96
Denmark	1981-96	81-82; 87-90	83-86
Finland	1973-96	77-80; 82-83; 86-87; 90-92	73-76; 84-85; 88-89; 93-96
France	1972-96	77-78; 81-82	72-73; 79-80; 83-84; 95-96
Germany	1970-96	74-75; 89-91	71-72; 76-77; 81-83; 92-94
Greece	1975-96	80-81; 84-85; 88-89	75-76; 82-83; 86-87; 90-96
Ireland	1977-96	89-90; 94-95	77-78; 82-84; 86-88; 91-92
Italy	1972-96	74-75; 78-79; 84-85	72-73; 76-77; 82-83; 92-96
Japan	1972-96	75-79; 92-94	72-74; 80-85
Netherlands	1974-96	76-80;	74-75; 81-83; 87-88; 90-92
Portugal	1970-96	72-76; 80-81; 89-90	70-71; 82-86; 91-92; 94-95
Spain	1970-96	81-82; 89-90	86-87; 91-93; 95-96
Sweden	1983-96	90-93	83-84; 86-88; 94-96
United Kingdom	1970-96	72-74; 83-84; 91-93	70-71; 79-82; 89-90; 94-96
United States	1970-96	74-75; 82-83	70-71; 76-77; 94-95