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Searching for Non-Monotonic Effects of Fiscal Policy: New Evidence

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Abstract

Data revisions and the availability of a longer sample offer the opportunity to reconsider the empirical findings that suggest that in the OECD countries national saving responds non-monotonically to fiscal policy. The paper confirms that the circumstance most likely to give rise to a non-monotonic response of national saving to a fiscal impulse is a "large and persistent impulse", defined as one in which the full employment surplus, as a percent of potential output, changes by at least 1.5 percentage points per year over a two-year period. This particular circumstance remains the only statistically significant one even when we allow for non-monotonic responses to arise when public debt is growing rapidly or interest rate spreads are widening. We find that non-monotonic responses are similar for fiscal contractions and expansions. In particular, an increase in net taxes has no effect on national saving during large fiscal contractions or expansions. For government consumption there is a large, albeit in some specifications less then complete, offset during expansions or contractions.

Keywords: Fiscal policy; national saving
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1. Introduction

The idea that fiscal consolidation can bear fruit in the short term is controversial. Not long ago, the *Financial Times* described the situation very well: "In one corner we have the political left, armed with a multiplier, and in the other we have the right, armed with a Laffer curve. The left insists that increased public spending boosts output via demand — the famous multiplier effect. The right asserts that tax cuts and curbs on public spending stimulate private sector effort via supply."

Commenting on this remark in the FT, Rodrigo de Rato, the Managing Director of the IMF, appropriately observed that the subject is much more complicated than that: "It is true that the starting point should be the standard Keynesian tenet that fiscal adjustment is contractionary. However, some years ago, in a surprising departure from this orthodox stance, Giavazzi and Pagano (1990) pointed to Denmark and Ireland in the 1980s as examples of expansionary fiscal contractions, as their respective fiscal adjustments were followed immediately by an increase in growth. Their explanation was firmly rooted in the tradition of the turnaround in rational expectations. The argument is that a decisive policy for reducing both the fiscal deficit and high levels of indebtedness can shore up market confidence and create expectations among the public about future income."[1]

The possibility that fiscal contractions may be a source of economic growth immediately attracts those who doubt the effectiveness of traditional Keynesian fiscal policies, arguing that many empirical studies have shown the limited magnitude of fiscal multipliers, and point to many instances, above all in the case of Japan, where the response of the economy to a fiscal expansion has been weak or non-existent. But how common are expansionary fiscal contractions, or contractionary expansions, and when do they occur? This question has induced many institutions, including the IMF, the OECD and the European Commission, to take a closer look at episodes, in particular of expansionary fiscal contractions.

In previous work, we search for the circumstances in which the private sector response to fiscal policy impulses is non-monotonic (Giavazzi and Pagano, 1990 and 1996; Giavazzi, Pagano and Jappelli, 2000, GJP from now on). The results drawn from the experience of OECD countries show that a non-monotonic response is more likely to arise when fiscal impulses are large and persistent and that non-monotonic effects are larger and more precisely estimated for changes in net taxes than for changes in public consumption.

In this paper we reconsider, extend and update the evidence analyzed in GJP. There are several reasons to extend and update our previous results. First of all, the data used in GJP ended in 1996. Eight more years of data have since become available, and these include several new episodes of fiscal contractions and expansions: among them the fiscal contractions in Europe to meet the Maastricht criteria in the run-up to EMU and the subsequent fiscal expansions in 2000-02; the Japanese fiscal expansion that lasted through most of the 1990s; the U.S. fiscal expansion

[1] "Benefits of Fiscal Consolidation", remarks by Rodrigo de Rato y Figaredo to the Real Academia de Doctores Barcelona, Spain, November 25, 2004.

during the first Bush administration. By extending the sample, we are able to increase from 109 to 128 the number of episodes characterized by a "large and persistent fiscal impulse", defined in GJP as one in which the full employment surplus, as a percent of potential output, changes by at least 1.5 percentage points per year over a two-year period. The updated sample includes 5 more "large and persistent" contractions and 14 more "large and persistent" expansions with respect to GJP.

Secondly, since GJP was written, the OECD has revised backwards some of the relevant series. In particular its measure of the cyclically adjusted primary budget surplus has changed significantly, as the correlation between the old and the new series between 1970 to 1996, the original sample, is 0.874. Some of the episodes of large and persistent fiscal impulse considered in GJP have thus disappeared from the sample, replaced by a few new ones. The series for potential output has also been revised, as have other variables. It is thus interesting in itself to check whether the original results survive when using the revised data.

Finally, we check the robustness of the results by allowing for a different source of non-monotonic response of national savings to fiscal impulses: the possible role of the risk premium on government bonds — either exchange rate risk premium or default risk. This channel is suggested by the findings in Ardagna (2004) and by models of debt default (Blanchard, 1990) and liquidity (Caballero and Krisnhamurty, 2004).

Our findings suggest, in a nutshell, that the hypothesis of a non-monotonic response of national savings to fiscal impulses is confirmed in the updated and revised OECD dataset. They also confirm that the circumstance most likely to give rise to a non-monotonic response of national saving is a "large and persistent fiscal impulse", defined as one in which the full employment surplus, as a percent of potential output, changes by at least 1.5 percentage points per year over a two-year period. On the other hand, fiscal impulses that are "relatively small" tend to be associated with Keynesian effects.

The rest of the paper is organized as follows. We survey the relevant literature in Section 2, present the data in Section 3, report the econometric estimates in Section 4 and summarize the results in Section 5.

2. What have we learnt from the analysis of large fiscal adjustments ?

A recent study by the European Commission covering 14 EU countries in the period 1970-2002 finds that roughly half of the 49 episodes of fiscal consolidation they identify, have been followed by an acceleration in growth (Giudice et al., 2003). This result is robust with respect to the criteria used to identify the consolidation episodes and to classify such episodes as expansionary. Using the Commission's macroeconomic model (QUEST) to understand the mechanisms that could give rise to an output expansion, they conclude that the source of non-Keynesian effects mostly lies in the response of private consumption to expected future income.

Similar work at the Central Bank of Poland (Rzonca and Cizkowicz, 2005) looks at seven episodes of strong fiscal adjustment (in this case both expansions and contractions) that occurred since the mid-90's in eight new EU member countries: Estonia, the Czech Republic, Hungary, Latvia, Lithuania, Poland, the Slovak Republic and Slovenia. The paper finds evidence that discretionary fiscal consolidation "contributes substantially to the acceleration of output growth even in the short run", but is unable to identify unambiguously the channels through which non-Keynesian effects occur.

The IMF has also looked at the effects of large fiscal consolidations — measured as a cumulative primary fiscal adjustment of more than 5 percent of GDP — and concluded that they appear to be associated quite frequently with a positive macroeconomic response (Martinez, 2004). The study covers more than 160 countries in the last 30 years and identifies 155 episodes of large fiscal adjustment. About 40 percent of these episodes were linked to an upturn in short-term growth — although it is once again difficult to identify the likely sources of the observed output expansion.

Work at the OECD has examined the extent to which fiscal policy actions may be offset by simultaneous, anticipatory changes in private saving, as well as the determinants of that offset (De Mello et al, 2004). Based on a sample of 21 OECD countries spanning the period 1970-2002, the study finds strong evidence of partial, yet substantial, offsetting movements in private saving. The overall offset is estimated at between about one-third and one-half, depending on model specification, and applies both to public consumption and to shifts in tax revenue. The magnitudes of these estimated offsets suggest that, in response to a fiscal tightening of approximately 5 per cent of GDP - comparable to that of the OECD area as a whole during the upturn that occurred between 1993- and 2000 — private saving is expected to fall by about 2½ per cent of GDP over the period. The effect on national saving of a fiscal easing of this magnitude is therefore of a rise of about 2½ per cent of GDP, other things equal. The saving offset appears to be greater over the longer term, with changes in fiscal stance being almost totally offset by changes in private saving, leaving national saving largely unaffected.

As for the conditions under which such effects are more likely to occur, the OECD paper finds that: (i) private saving offsets appear to have been somewhat *lower* at *higher* levels of indebtedness; (ii) the revenue/expenditure composition of the fiscal shift matters for the private saving offset; (iii) private saving appears to respond in relatively equal proportion to changes in current revenue and expenditure, but public investment does not elicit an offsetting response of saving.

Investigating the response of consumers to a fiscal impulse, Giavazzi and Pagano (1996) find that private consumption appears to respond in a non-monotonic way to fiscal impulses. Their results suggest that such non-monotonic effects tend to be associated with large and persistent fiscal impulses, and appear to be stronger for fiscal contractions than for fiscal expansions.[2] While in normal times an increase in net taxes (that is, taxes net of government

[2] There are several explanations for such non-monotonic effects. Spending cuts or tax increases can produce an increase in private consumption only if they raise the market value of non-human wealth or consumers' perception of

transfers) tends to depress consumption, during large fiscal contractions the effect on consumption of an increase in net taxes is not statistically different from zero. For government spending they find that an increase (a cut) in public spending stimulates (lowers) consumption in normal times, but reduces (raises) it during a large fiscal impulse.

GJP (Giavazzi, Jappelli and Pagano 2000) also study the response of consumers to a fiscal impulse, but from a slightly different angle, that is looking at the effects of fiscal policy on national savings. This allows them to interpret the results with reference to the predictions of Ricardian equivalence. As is well known, models with infinite horizons imply that (for a given level of government spending) taxes and transfers have no effect on national saving; that is, the Ricardian proposition holds. On the other hand, the standard overlapping generations model with finite horizon predicts that an increase in taxes (or a reduction in transfers) raises national saving. But the sign and size of the effect of fiscal policy on national saving might also depend on the level and sustainability of government debt, on the size and persistence of the fiscal impulse, or on the change in composition of the budget. In some situations (for instance in the model described in Blanchard, 1990) an increase in net taxes may even produce a decline in national saving, by generating a boom in private consumption.

GJP search systematically for the circumstances in which national saving responds non-monotonically to fiscal policy impulses, using two dataset, one which includes OECD countries, another which looks instead at emerging market economies. The results drawn from the OECD sample show that a non-monotonic response of national saving is more likely to arise when fiscal impulses are large and persistent and that non-monotonic effects on national saving are larger and more precisely estimated for changes in net taxes than for changes in public consumption. Furthermore, non-monotonic effects also appear to be asymmetric, and stronger and more precisely estimated for fiscal contractions than for fiscal expansions; in particular, during large fiscal contractions an increase in net taxes has little or no effect on national saving. They also find that a rapidly growing public debt is not, per se, a good predictor of non-monotonic responses.

These findings about the effect of the size and composition of the fiscal impulse are not entirely consistent with those found in other studies. Alesina and Perotti (1995, 1997) and Alesina and Ardagna (1998) find that the private sector response is larger if the budget is cut by slashing public sector wages and reducing social security benefits, rather than by raising taxes and cutting public investment. Along the same lines, Ardagna (2004) finds that fiscal adjustments effected by government spending cuts and generating a permanent and substantial decrease in government debt are associated with larger reductions in interest rates and increases in stock market prices — thus suggesting that the increase in the market value of non-human wealth is the channel through which such fiscal impulses raise output growth. Perotti (1999) finds that the

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their permanent income. Changes in permanent income depend on expectations. A spending cut that is sufficiently large and believed to be persistent can signal a future reduction in the tax burden, and therefore an increase in permanent disposable income (A point first made in Feldstein, 1982). But even small changes in public spending could produce large changes in private consumption in the opposite direction if they signal a change in regime or are sufficient to bring the economy over a critical threshold., as in the model of Bertola and Drazen (1993). See Giavazzi, Jappelli and Pagano (2000) for a review of various model that produce these results.

outcome of a consolidation is more likely to be expansionary when public debt is high or growing rapidly, but De Mello et al. (2004), as mentioned above, report findings that are more consistent with the results shown in GJP.

Finally, the presence of credit market imperfections constraining household borrowing may also affect the non-monotonic response of saving and consumption to fiscal policy. A non-monotonic response of private consumption and saving to a large and persistent fiscal contraction requires well-functioning household credit markets. Consider the case of a large increases in net taxes that leads households to update the estimate of their permanent income: if the household is prevented from borrowing against the expectation of higher future income, it will be unable to increase its actual spending. Ferraro (2005) tests whether the non-monotonic response of national saving depends on the ease with which households can tap on financial markets and borrow. He splits the sample in two, distinguishing countries based the maximum "loan-to-value ratio" - the ratio between the maximum mortgage loan that a typical household could obtain, and the value of the house for which the loan was extended (reported in Table I of Jappelli and Pagano, 1994). He finds that non-monotonic effects are more likely to arise in countries characterized by a relatively high loan-to-value ratio, and are smaller and less precisely estimated in countries with a relatively lower loan-to-value ratio. This accords with the prediction that the functioning of the market for household credit affects the presence and magnitude of the non-monotonic effects of fiscal policy.

Summarizing, while episodes of contractionary fiscal expansions, and expansionary contractions, are a rather common finding, there is still disagreement on the conditions under which a fiscal consolidation can raise output growth — or a fiscal expansion reduce it — and on the channels through which such effects might occur. Understanding these issues is obviously essential if one wishes to know which policies might improve the likelihood of a non-Keynesian outcomes. One purpose of the present paper is to test the robustness of the findings which suggest that a prerequisite for such non-Keynesian outcomes is the magnitude and persistence of the fiscal impulse, and that the channel through which fiscal impulses affect the economy is private consumption.

3. A first look at the data

We start with a visual impression of our data. Figure 1 plots the distribution of the first differences in the full-employment government surplus scaled by full-employment output. Positive numbers correspond to fiscal contractions, negative numbers to fiscal expansions. The sample and OECD countries considered are reported in the Appendix.

Most fiscal impulses — from one year to the next — are relatively small: contractions and expansions that do not exceed 1.5 per cent of potential output. But there are many episodes outside this range, particularly in the case fiscal expansions, and some contractions are as large as 5 per cent of potential output in a single year.

Our definition of a "large and persistent" fiscal impulse uses a subset of the episodes in the tails of the distribution reported in Figure 1: those that lie outside the –1.5/+1.5 range, and among them only those where a change of at least that magnitude has occurred for at least two subsequent years. This gives us 73 episodes of "large and persistent" fiscal contraction and 55 episodes of "large and persistent" fiscal expansion. The individual episodes are reported in the Appendix.

[INSERT FIGURE 1 ABOUT HERE]

How were these "large and persistent" contractions and expansions implemented? By acting on revenues, government consumption or public investment? Table 1 compares the growth rate of net taxes (taxes net of government transfers), of government consumption and of public investment (each defined as a fraction of potential output) in years characterized by large contractions and large expansions, relative to normal times.

Fiscal expansions are typically driven by large reduction in taxes (relative to normal times) and by some growth in expenditure, both investment and consumption (also relative to normal times). But tax cuts account for the lion's share in a fiscal expansion. Instead, when governments slash the budget, they mostly do it by cutting public investment. During a typical contraction the growth rate of public investment, as a share of potential output, is 4 percentage points lower than in normal times. Net taxes increase during a contraction and government consumption falls, but by a much smaller amount than public investment.

[INSERT TABLE 1 ABOUT HERE]

Figure 2 plots the change in gross national saving during episodes of "large and persistent" fiscal contraction (in the upper panel) and expansion (in the lower panel). The "normal" situation would be one in which a fiscal contraction raises national saving, and a fiscal expansion reduces it. Figure 2 shows that in the majority of episodes national savings is unaffected by the change in fiscal policy, indicating that private saving offset the change in public saving one for one. But there are observations on both tails.

During episodes of large fiscal contraction (the upper panel), although the instances in which the fiscal contraction raises national savings (along the right-hand tail) are relatively more frequent, there is some mass in the left-hand tail, indicating episodes in which the offset is more than one for one. Symmetrically, during episodes of large fiscal expansion (the lower panel) there is some mass in the right-hand tail, which correspond to episodes where the private sector offset was more than complete–although once again most of the fiscal expansions appear to lower national saving (the left tail). The bottom line is that the "normal" response to large fiscal impulses appears prima facie more frequent in the data, but there are also instances of non-monotonic responses.

[INSERT FIGURE 2 ABOUT HERE]

4. Empirical results

We estimate, as in GJP, the following reduced-form equation, whose dependent variable is the national saving rate as a ratio to potential output:[3]

$$\frac{S_t}{Y_t^*} = \alpha_o + \alpha_1 \frac{S_{t-1}}{Y_{t-1}^*} + \alpha_2 \frac{Y_t - Y_t^*}{Y_t^*} + \alpha_3 r_t + \beta_1 \frac{T_t}{Y_t^*} + \beta_2 d_t \frac{T_t}{Y_t^*} + \gamma_1 \frac{G_t}{Y_t^*} + \gamma_2 d_t \frac{G_t}{Y_t^*} + \gamma_3 d_t + \varepsilon_t \qquad (1)$$

Y^* denotes potential output, $(Y_t - Y_t^*)/Y_t^*$ the output gap, r_t the real interest rate, T/Y^* net taxes (taxes net of government transfers) as a fraction of potential output and G/Y^* government purchases, also as a fraction of potential output.[4]

The variable d_t is a dummy designed to capture the conditions that may give rise to a non-monotonic response of national saving to fiscal impulses. Since we want to discriminate across various conditions that may trigger such non-monotonic response, our specifications include a set of such dummies, each corresponding to one such condition, rather than a single dummy. One dummy variable is set equal to 1 during years characterized by a "large and persistent" fiscal impulse (as in GJP), and 0 otherwise. A second dummy is equal to 1 only if the growth rate of the ratio of (cyclically adjusted) gross public debt to trend GDP exceeds 4 percent for two consecutive years (as in Perotti, 1999). A third dummy is 1 only if the change in the spread between the yield on long-term government bonds denominated in domestic currency and the yield on U.S. 10-year Treasuries exceeds the sample mean by more than 1.5 standard deviations. Note that each dummy d_t enters equation (1) both interacted with the two fiscal variables and by itself, to make sure that the interacted variable only captures the effect of the interaction rather than a possible independent effect of the dummy on national saving.

In equation (1), the lagged value of the national saving rate is expected to capture the dynamics of the dependent variable,[5] while the output gap should reflect the response of private saving and of the government surplus to transitory changes in income. The (ex post) real interest rate is the difference between the domestic short term nominal rate and inflation, based on the

[3] One advantage of using the national saving as dependent variable is that it does not depend on the particular definition used for private saving. De Mello et al. (2004) find that the estimated offset of private saving depends on the definition used. For instance, they find lower offset coefficients when using household, rather than private saving. The finding however is sensitive to the elimination of outliers, suggesting that measurement errors may be particularly pronounced. Measurement problems are due to the difficulty in accurately demarcating the household and corporate sectors, given extensive household ownership of businesses via equity and mutual/pension fund participation. These problems are avoided using national saving as the dependent variable. Furthermore, national saving is not affected by the redistribution between private and public saving that is induced by the effect of inflation on the public debt.

[4] We scale national saving and fiscal variables by potential output to avoid problems of heteroskedasticity. Dividing by actual rather than potential output would introduce an endogeneity bias due to the correlation between the error term and the right-hand-side variables.

[5] Equation (1) only allows for very simple dynamics of national saving. De Mello et al. (2004) use an error correction model and allow for more complex dynamics in the adjustment towards the long-term equilibrium.

private consumption deflator. It is introduced to control for the direct effect on saving of changes in wealth induced by monetary policy. Since the interest rate is potentially endogenous, we use its lagged value as instrument.

Finally, following the specification in GJP, all regressions include a full set of country fixed effects, to account for the possibility that the response of national saving to a fiscal impulse might depend on the particular characteristics of a country, such as its size and degree of openness to trade. Understanding the effects of fiscal policy maybe be easier in a small country, and indeed some of the famous episodes of "non-Keynesian" effects have occurred in small countries, such as Ireland and Denmark. Countries that trade more, either in goods or in assets, may be more subject to capital market "discipline", in the sense that it may be easier for saving to fly out of the country when fiscal policy looks "bad".

One problem in estimating equation (1) is the potential endogeneity of the fiscal variables. Such endogeneity may arise from two different sources. Because of the automatic stabilizers built in the existing tax code, tax revenues and government transfers from and to the economy (which enter our definition of *T*) fluctuate with the business cycle, and are thus affected by the same shocks which affect national savings.[6] We deal with this first source of endogeneity by using the full-employment government surplus net of interest payments, as estimated by the OECD, as instrument for net taxes.

A second potential source of endogeneity arises from the possibility that the country's fiscal rules themselves respond to the business cycle, which in standard models is positively correlated with national saving. Our instrumental variables procedure does not handle this potential bias; GJP further discuss how the bias might affect the coefficient estimates.[7]

Our data are an unbalanced panel of OECD countries. The sample used in the estimation and the variables' definitions are reported in the Appendix. For each regression we report results for three sample periods. "Up to 1996" defines the sample that is closest to our earlier results and thus comparable with the regressions reported in GJP, although several series have been revised. The other two samples – "Up to 2000" and "Up to 2003" – extend our previous results to the more recent period.

4.1. The effect of fiscal policy during large and persistent fiscal episodes

We start by estimating a benchmark specification where we do not interact the fiscal variables with the dummy *d*, so that the effects of *G/Y** and *T/Y** are constrained to be linear. Which signs

[6] Government consumption, on the contrary, is unlikely to fluctuate systematically with the business cycle: fluctuations in unemployment, for instance, affect government transfers, but are unlikely to be correlated with government purchases of goods and services.

[7] There have been a few attempts at constructing measures of exogenous fiscal policy shocks that are not based on the full-employment surplus. Blanchard and Perotti (1999) identify tax and spending shocks in U.S. quarterly data by assuming that implementing fiscal policy changes requires at least one quarter and by relying on historical information on large discretionary changes in fiscal policy (such as the tax cut in the second quarter of 1975).

should we expect on the coefficients of the fiscal variables? Finite horizon models suggest that an increase in net taxes should raise national saving ($\beta_1>0$), whereas an increase in government consumption should reduce it ($\gamma_1<0$). In the benchmark infinite horizon model with lump-sum taxes, taxes have no effect on national saving ($\beta_1=0$): this is the Ricardian equivalence proposition. Also, in the infinite horizon model, for a given path of pre-tax income, *Y*, government consumption does not affect national saving either ($\gamma_1=0$)[8].

The results are in Table 2. Column (1) uses the sample that is closer to that originally used in GJP; columns (2) and (3) update the sample to 2000 and 2003, respectively. The coefficient of *T/Y** is positive and statistically different from zero at the 1 percent level in each regression. When we extend the sample to 2003 the point estimate becomes smaller, but so does the coefficient of the lagged national saving, so that the long run effect of taxes - estimated as $\beta_1/(1-\alpha_1)$ - is similar in columns 1 and 3 (0.51 and 0.53 respectively).

Thus, when we constrain the effect of net taxes to be linear ($\beta_2=0$), the results run against the infinite horizon model and are consistent with the predictions of finite horizon models.

[INSERT TABLE 2 ABOUT HERE]

The coefficient of *G/Y** is negative and also statistically different from zero at the 1 percent level in both regressions. Contrary to the predictions of infinite horizon models with non-distortionary taxes, the fall in private consumption does not fully compensate the increase in government consumption, thereby reducing national saving. In this case too the point estimate becomes smaller (in absolute value) when we extend the sample to 2003, but, as in the case of net taxes, the long-run response is similar.

The results in Table 2, however, are potentially biased because by omitting the interaction terms they impose that the response of national saving to fiscal variables is linear. Table 3 investigates this issue and contains the main results of the paper. Each of the three regressions reported in Table 3 tests the hypothesis that fiscal policy coefficients are stable during periods of protracted and sizable fiscal impulse or during periods of rapid debt growth. Our hypothesis (supported by our previous findings) is that non-monotonic responses mostly appear during episodes of protracted and sizable fiscal impulse, as defined above.

Consider first the sample up to 1996. In this sample (column 1) the effect of both *T/Y** and *G/Y** is highly non-monotonic. During "normal" times, the effect of net taxes on national saving is positive (β_1 = 0.684), but during sharp shifts in fiscal policy the response of private saving virtually cancels any effect of public saving on national saving: $\beta_1+\beta_2$= 0.684 – 0.665 = 0.019, and we cannot reject the hypothesis that $\beta_1+\beta_2$ =0 (the p-value of the F-test is 0.88). The same happens for fiscal impulses induced by changes in *G/Y**. During "normal" times, an increase in

[8] Recall that national saving is the difference between national income and total consumption (private plus public): $S = S_G + S_P = (T-G) + (Y-T-C) = Y - (C+G)$.

government spending reduces national saving (γ_1 = – 1.060) but during sharp shifts in fiscal policy the response of private saving greatly dampens the fall in national saving: $\gamma_1 + \gamma_2 = -1.060 + 0.777 = -0.283$; in this case the offset is less than complete, as the hypothesis $\gamma_1 + \gamma_2 = 0$ is rejected at the 5 percent confidence level (the p-value of the F-test is 0.027).

National saving does not appear to respond differently to fiscal impulses carried out by changing government consumption or net taxes: what matters is the size of the impulse, not its composition. When we tried to split the "net taxes" variable into "direct plus indirect taxes" and "transfers" the two coefficients were less precisely estimated, but the results suggest that most of the action in the "net tax" variables comes from shifts in transfers, confirming one of the findings in Alesina and Ardagna (1998) — namely that what appears to matter most are changes in social security rules.

On the contrary, and confirming the findings in GJP, the coefficient of the dummy for rapid debt growth, interacted with net taxes or government consumption, is not statistically different from zero, suggesting that a non-monotonic response of fiscal policy is more likely to arise when the cyclically adjusted surplus changes significantly, rather then when public debt grows rapidly.

Columns (2) and (3), where we extend the sample to 2000 and 2003, respectively, show that the general pattern of these results survives to the more recent data. The evidence confirms the full offset of the tax coefficient during large fiscal episodes. In the more recent samples, contrary to the earlier one, we no longer reject the hypothesis of a full offset of the effect of government consumption during large fiscal episodes. Finally, the result that rapid debt growth is not a condition giving rise to a non-monotonic effect of fiscal impulses is confirmed: in none of these regressions are the interacted coefficients with the dummy for rapid debt statistically different from zero.

4.2. Are the effects of large contractions different from those of large expansions?

The private sector's response to a fiscal impulse could differ depending on the sign of the impulse. To test for the possibility of asymmetric behavior, we interact T/Y^* and G/Y^* with two separate dummies, one for large fiscal expansions and one for large fiscal contractions (the two dummies are then also entered separately). In each regression we keep the dummy for rapid debt growth interacted with net taxes or government consumption. The results in Table 4 report again estimates for three samples.

[INSERT TABLE 3 ABOUT HERE]

In column 1 (up to 1996), during episodes of large swings in fiscal policy, private saving consistently offsets the effects of changes in public saving, independently of whether the fiscal impulse is an expansion or a contraction. During *contractions* induced by an increase in taxes the offset is complete, as we do not reject the hypothesis that taxes do not effect national saving: the

sum between the tax coefficients (0.640 – 0.723 = -0.083) is not statistically different from zero (the p-value of the test is 0.68). In case of *fiscal expansions* the point estimate of the sum of the tax coefficients is also close to zero and, again, we don't reject the hypothesis that during expansions the difference between the tax coefficients (0.640 – 0.630 = 0.010) is not statistically different from zero (the p-value of the test is 0.94). These results confirm the original GJP findings with the updated series.

During fiscal impulses induced by a change in government spending we find complete offset during large contractions: the sum of the two coefficients on government spending (–10.71+0.853=–0.218) is not statistically different from zero. On the other hand, in the case of expansions induced by large increases in government spending, the offset is less than complete: the sum of the coefficients (–1.071+0.731=–0.340) is statistically different from zero (the p-value of the test is 0.033).

Also when the sample is extended to 2000 and 2003 (columns 2 and 3) we find that the response of national saving to large fiscal impulses is non-monotonic and symmetric for large expansions and large contractions. In the case of fiscal impulses induced by large changes in net taxes the offset is complete both in the case of expansions and contractions; in the case of fiscal impulses induced by large changes in government spending the offset is complete in the case of fiscal contractions and, in the sample extending to 2003, also in the case of fiscal expansions.

Finally, in this specification too the evidence is consistent with the hypothesis that "rapid debt growth" is not associated with a non-monotonic response of national saving to fiscal impulses.

4.3. Interest rate spreads

For spending cuts or tax increases to produce a fall in private saving (and viceversa) either the market value of non-human wealth must rise, or households must anticipate a higher permanent income. This could happen if fiscal impulses affected households' expectations. For instance, a spending cut that is sufficiently large and (believed to be) persistent could signal a future reduction in the tax burden, and therefore an increase in permanent disposable income (Feldstein, 1982).

Could there be other circumstances under which a fiscal impulse could induce a change in households' estimate of their permanent disposable income? One possibility (discussed in Blanchard, 1990) is that the response of consumers to fiscal impulses may differ depending on the perceived sustainability of the fiscal regime. For instance, when the debt-income ratio is growing rapidly, a fiscal contraction may provide the signal that a debt default will be avoided: it this may induce a large revision in permanent disposable income.

The results in Tables 3 and 4 have shown that a rapidly growing debt-GDP ratio is not per se a condition for the response of national saving to fiscal impulses to be non-monotonic. One

possibility is that consumers become concerned about rapid debt growth only when this starts inducing the risk of a default, in other words only when interest rate spreads start widening.

In the regressions reported in Table 5 we allow for the possibility that the response of national saving to fiscal impulses becomes non-monotonic when the change in the spread between the yield on long-term government bonds denominated in domestic currency and the yield on U.S. 10-year Treasuries. Such yields reflect either expectations of currency depreciation or default premia: when the yield widens it thus signals that the markets is becoming more concerned about fiscal sustainability.[9] In this case, our specification includes an additional dummy that equals 1 when the spread exceeds the sample mean by more than 1.5 standard deviations, and 0 otherwise. The specifications also include the dummies that were already present in the regressions of Table 3, and therefore still allow for non-monotonic responses to be associated with the size and persistence of fiscal impulses and debt growth.

[INSERT TABLE 5 ABOUT HERE]

The results in Table 5 tend to confirm that the circumstance most likely to give rise to an offsetting response of private saving remains the size and persistence of the fiscal impulse. The offset coefficients, however, are much less precisely estimated, possibly because of collinearity between the dummy for rapid debt growth and the dummy for the widening of spreads. The dummies set equal to 1 when debt is growing rapidly and when spreads widen are not statistically different from zero. Distinguishing between expansions and contractions (as in Table 4) does not change the results.

5. Conclusions

Data revisions and the availability of a longer sample offer the opportunity to reconsider the empirical findings which suggest that in the OECD countries the response of national savings to fiscal policy is non-monotonic. Our main results can be summarized as follows.

Before considering the possibility of a non-monotonic response — that is when we constrain the effect of net taxes to be linear — we find, contrary to the predictions of infinite horizon models with non-distortionary taxes, that an increase in taxes raises national saving, and that an increase in government purchases lowers it.

[9] Caballero and Krisnhamurty (2004) suggests a different reason why the effects of a fiscal expansion might depend on the response of bond prices. In countries characterized by relatively thin financial markets a fiscal expansion that is large enough to absorb significant amounts of liquidity will be accompanied by a sharp increase in interest rates and corresponding reductions in households' financial wealth. Ardagna (2004) finds that stock market prices surge around times of substantial fiscal tightening and plunge in periods of very loose fiscal policy — and that such effects are more likely to occur in country-years with high levels of government deficit, and when consolidations are implemented by cutting government spending, and that generate a permanent and substantial decrease in government debt.

The new data confirms that the circumstance most likely to give rise to a non-monotonic response of national saving to a fiscal impulse is a “large and persistent impulse”, defined as one in which the full employment surplus, as a percent of potential output, changes by at least 1.5 percentage points per year over a two-year period. This particular circumstance remains the only statistically significant one even when we allow for non-monotonic responses to arise when public debt is growing rapidly or interest rate spreads are widening.

We find that non-monotonic responses are similar for fiscal contractions and expansions. In particular, an increase in net taxes has no effect on national saving during large fiscal contractions or expansions. For government consumption there is a large, albeit in some specifications less then complete offset during expansions or contractions.

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Appendix: Definition of the variables used in the regressions

All variables are drawn from the March 2005 OECD Economic Outlook database. Public sector data refer to general government. Definition of the variables and sample periods are as follows.

Variables' definition	Name of the corresponding OECD Series (Economic Outlook database)
Private consumption	CP
Government consumption	CG
Government savings	SAVG
Government debt	GGFL
Gross National/Domestic Product	GDPV
Deflator for consumer expenditure	PCP
Taxes net of transfers	SAVG+CG
Government investment	IG
Social security contributions	SS
Social security benefits	SSPG
Full employment government surplus	NLQGA
Potential output	GDPVTR

Countries, sample period used in the estimation, and fiscal episodes

Country	Sample used in the estimation	Episodes of "large and persistent" fiscal expansion	Episodes of "large and persistent" fiscal contraction
Australia	71-03	74-76; 90-93; 00-01	71-72; 79-80; 85-88; 94-97
Austria	73-03	82-83; 93-95	73-74; 84-85; 96-97; 00-02
Belgium	72-03	78-80;	72-73; 81-87; 92-94
Canada	70-03	74-78; 82-85; 00-03	70-71; 80-81; 86-88; 94-98
Denmark	72-03	74-76; 81-82; 90-91; 94-95	72-73; 77-78; 83-87; 98-99
Finland	77-03	79-80; 82-83; 86-87; 90-91; 01-03	77-78; 84-85; 88-89; 92-94; 98-00
France	72-03	77-78; 81-82; 92-93; 02-03;	72-73; 79-80; 95-97
Germany	70-03	74-75; 87-91; 00-02	69-70; 76-77; 81-83; 92-94
Ireland	86-03	90-91; 00-02	80-84; 86-89; 93-94
Italy	64-03	71-73; 78-81; 84-85;98-01	64-65; 76-77; 82-83; 90-93; 95-97
Japan	71-03	75-76; 92-96; 98-00	71-72; 83-85
Netherlands	80-03	86-90; 94-95; 01-02	80-83; 91-93; 96-97
New Zealand	87-03	96-97	87-91
Norway	79-03	89-92; 01-03	79-80; 82-83; 85-86; 93-96; 99-00
Portugal	77-03	89-90; 93-94	77-78; 81-84; 91-92; 01-03
Spain	80-03		80-81; 86-87; 91-92; 95-97
Sweden	80-03	90-93; 01-03	80-84; 86-88; 94-98
United Kingdom	71-01	83-84; 89-93; 01-04	71-72; 74-75; 79- 82; 95-99
United States	66-03	70-71; 74-75; 82-83; 01-03	66-69; 76-77; 87-88; 93-98

Table 1
Taxes and spending during fiscal contractions and expansions, relative to normal times

	Fiscal contractions	*Fiscal expansions*
T/Y*	1.1 %	-5.9 %
G/Y*	- 1.2 %	0.6 %
I/Y*	- 4.0 %	0.6 %
Average length of a fiscal episode	2.95 years	2.98 years
Number of fiscal episodes	73	55

Note. The table reports the yearly percent change in the ratios of taxes and spending to full employment output (T/Y^* and G/Y^*) and government investment (I/Y^*) during episodes of "large and persistent" fiscal contractions and expansions. The numbers are deviation from mean growth rate in "normal times". The sample period is 1970-2004. Countries included in the estimation and variables' definitions are reported in the Appendix.

Table 2
National saving, taxes and government spending: baseline specification

	Up to 1996	*Up to 2000*	*Up to 2003*
Lagged national saving rate	0.534	0.649	0.722
	(0.036)***	(0.033)***	(0.029)***
Output gap	0.267	0.269	0.282
	(0.039)***	(0.039)***	(0.035)***
Real interest rate	0.031	0.006	0.008
	(0.029)	(0.031)	(0.030)
Net taxes (T/Y*)	0.241	0.206	0.152
	(0.066)***	(0.054)***	(0.048)***
Government consumption (G/Y*)	-0.545	-0.380	-0.308
	(0.059)***	(0.056)***	(0.052)***
Observations	425	501	556
Adjusted R-squared	0.94	0.94	0.94

Note. The dependent variable is the ratio of national saving to potential output. Instruments for net taxes and the real interest rate are the full-employment government surplus (scaled by potential output) and the lagged real interest rate. Countries included in the estimation and variables' definitions are reported in the Appendix. All regressions are estimated with fixed effects. Standard errors are reported in parenthesis. One, two and three stars indicate significance levels at 10, 5, and 1 percent, respectively.

Table 3
National savings, taxes and government spending: distinguishing between "normal times", episodes of "large change in primary fiscal surplus" and episodes of "rapid debt growth"

	Up to 1996	*Up to 2000*	*Up to 2003*
Lagged national saving rate	0.576	0.660	0.737
	(0.052)***	(0.042)***	(0.043)***
Output gap	0.213	0.246	0.268
	(0.061)***	(0.047)***	(0.045)***
Real interest rate	0.042	-0.028	-0.036
	(0.065)	(0.052)	(0.054)
Net taxes (T/Y*)	0.684	0.547	0.527
	(0.229)***	(0.170)***	(0.172)***
--- and large change in surplus	-0.665	-0.501	-0.534
	(0.281)**	(0.228)**	(0.221)**
--- and rapid debt growth	0.434	-0.177	-0.489
	(0.574)	(0.511)	(0.608)
Government consumption (G/Y*)	-1.060	-0.777	-0.739
	(0.223)***	(0.185)***	(0.179)***
--- and large change in surplus	0.777	0.613	0.642
	(0.289)***	(0.249)**	(0.241)***
--- and rapid debt growth	-0.348	0.177	0.447
	(0.492)	(0.440)	(0.524)
Dummy for large change in full employment surplus	-2.920	-2.694	-2.593
	(1.073)***	(0.905)***	(0.906)***
Dummy for rapid debt growth	-1.051	-1.071	-1.092
	(0.512)**	(0.439)**	(0.473)**
Observations	425	501	556
Adjusted R-squared	0.89	0.91	0.91

Note. The dependent variable is the ratio of national saving to potential output. Instruments for net taxes and the real interest rate are the full-employment government surplus (scaled by potential output) and the lagged real interest rate. Countries included in the estimation and variables' definitions are reported in the Appendix. All regressions are estimated with fixed effects. Standard errors are reported in parenthesis.

Table 4
National savings, taxes and government spending: distinguishing between "normal times", large fiscal contractions and large fiscal expansions

	Up to 1996	*Up to 2000*	*Up to 2003*
Lagged national saving rate	0.606	0.700	0.765
	(0.066)***	(0.050)***	(0.042)***
Output gap	0.226	0.265	0.279
	(0.067)***	(0.052)***	(0.045)***
Real interest rate	0.051	-0.013	-0.032
	(0.068)	(0.055)	(0.050)
Net taxes (T/Y*)	0.640	0.499	0.478
	(0.237)***	(0.179)***	(0.158)***
-- and large increase in surplus	-0.723	-0.620	-0.559
	(0.339)**	(0.294)**	(0.226)**
-- and large decrease in surplus	-0.630	-0.472	-0.523
	(0.290)**	(0.238)**	(0.219)**
-- and rapid debt growth	0.620	0.204	-0.256
	(0.620)	(0.560)	(0.546)
Government consumption (G/Y*)	-1.071	-0.792	-0.697
	(0.252)***	(0.213)***	(0.172)***
-- and large increase in surplus	0.853	0.785	0.700
	(0.358)**	(0.334)**	(0.256)***
-- and large decrease in surplus	0.731	0.524	0.606
	(0.297)**	(0.248)**	(0.236)**
-- and rapid debt growth	-0.514	-0.166	0.237
	(0.531)	(0.483)	(0.469)
Dummy for large fiscal contraction	-3.250	-3.647	-3.076
	(1.285)**	(1.267)***	(1.086)***
Dummy for large fiscal expansion	-2.813	-1.735	-2.366
	(1.546)*	(1.213)	(1.156)**
Dummy for rapid debt growth	-0.899	-0.820	-0.935
	(0.547)	(0.476)*	(0.468)**
Observations	425	501	556
Adjusted R-squared	0.87	0.90	0.91

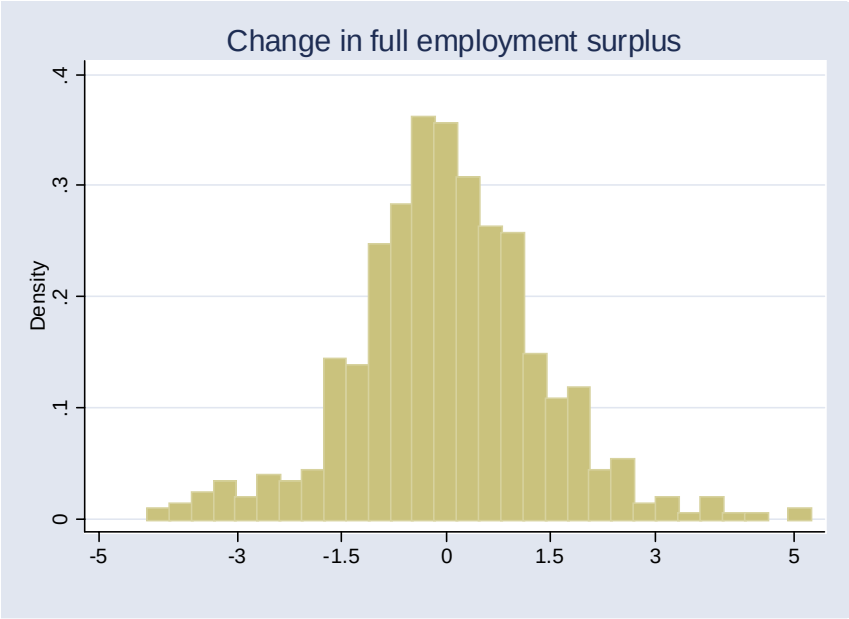
Note. The dependent variable is the ratio of national saving to potential output. Instruments for net taxes and the real interest rate are the full-employment government surplus (scaled by potential output) and the lagged real interest rate. Countries included in the estimation and variables' definitions are reported in the Appendix. All regressions are estimated with fixed effects. Standard errors are reported in parenthesis.

Table 5
National savings during large fiscal episodes, when debt is growing fast and when spreads widen

	Up to 1996	*Up to 2000*	*Up to 2003*
Lagged national saving rate	0.562	0.641	0.740
	(0.075)***	(0.054)***	(0.058)***
Output gap	0.257	0.277	0.296
	(0.083)***	(0.061)***	(0.055)***
Real interest rate	0.032	-0.023	-0.025
	(0.090)	(0.068)	(0.067)
Net taxes (T/Y*)	0.648	0.549	0.516
	(0.327)**	(0.245)**	(0.215)**
-- and large change in surplus	-0.953	-0.721	-0.707
	(0.665)	(0.516)	(0.411)*
-- and rapid debt growth	0.482	-0.091	-0.395
	(0.874)	(0.739)	(0.786)
-- and large change in spread	1.011	0.756	0.645
	(0.978)	(0.804)	(0.693)
Government consumption (G/Y*)	-1.017	-0.787	-0.715
	(0.344)***	(0.292)***	(0.227)***
-- and large change in surplus	1.083	0.861	0.845
	(0.702)	(0.569)	(0.463)*
-- and rapid debt growth	-0.423	0.080	0.347
	(0.763)	(0.648)	(0.686)
-- and large change in spread	-1.419	-1.129	-0.998
	(1.213)	(1.029)	(0.916)
Dummy for large change in full employment surplus	-3.422	-3.269	-3.205
	(1.828)*	(1.532)**	(1.470)**
Dummy for rapid debt growth	-1.794	-1.551	-1.487
	(1.166)	(0.895)*	(0.832)*
Dummy for large change in spread	7.564	7.026	6.792
	(5.098)	(4.818)	(4.801)
Observations	425	501	556
Adjusted R-squared	0.77	0.85	0.87

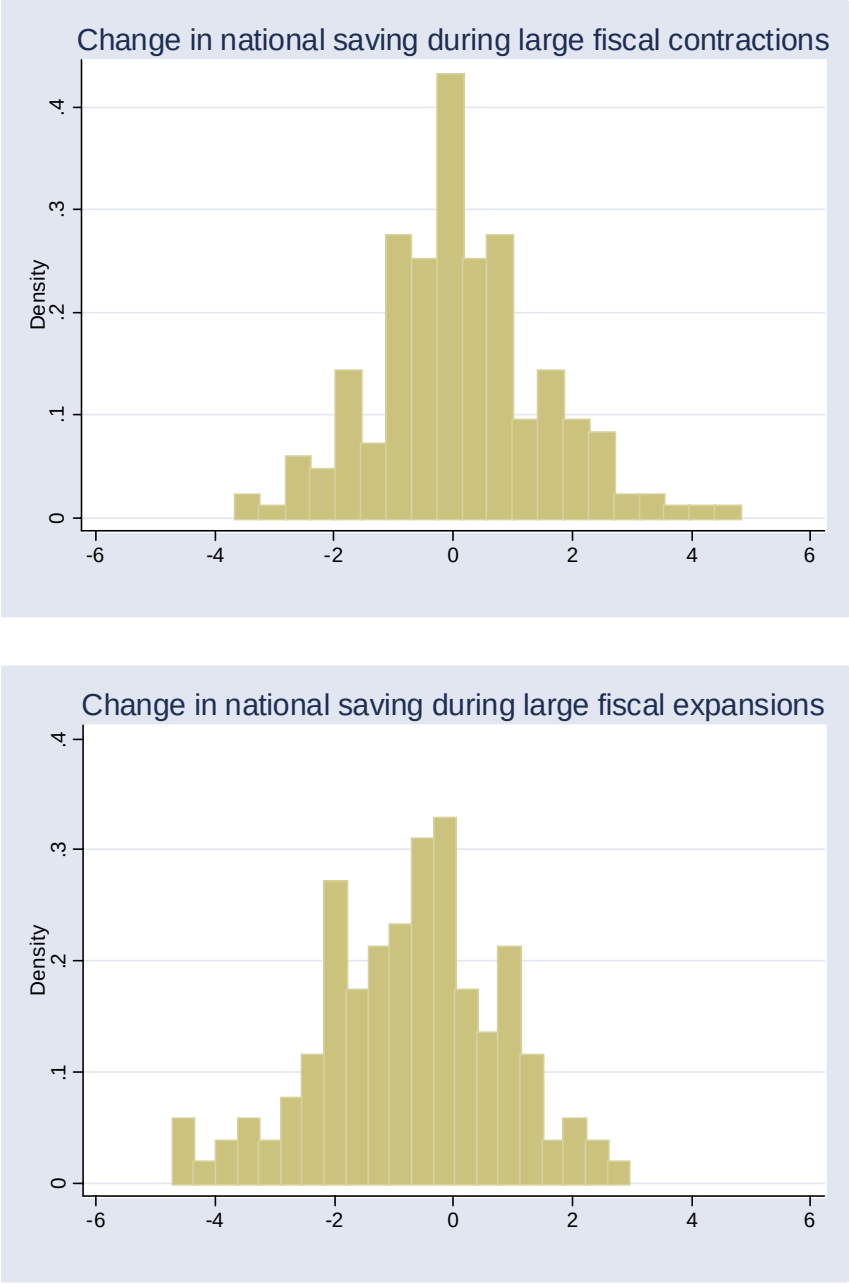
Note. The dependent variable is the ratio of national saving to potential output. Instruments for net taxes and the real interest rate are the full-employment government surplus (scaled by potential output) and the lagged real interest rate. Countries included in the estimation and variables' definitions are reported in the Appendix. All regressions are estimated with fixed effects. Standard errors are reported in parenthesis.

Figure 1
Year-to-Year Change in Full Employment Surplus



Note. The figures plot the change in the full-employment budget surplus scaled by full-employment output. Countries included are reported in the Appendix.

Figure 2
National saving during large fiscal contractions and large fiscal expansions



Note. The figures plot the change in gross national saving during periods of large fiscal contractions and expansions. Episodes of large contractions are defined as years in which the change in the ratio of full employment surplus to potential output is greater than 1.5 percent; large expansions are years in which the change in full employment surplus is lower than –1.5 percent.