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ABSTRACT

This paper evaluates the effects of fiscal policy on investment using a panel of OECD countries. In particular, we investigate how different types of fiscal policy affect profits and , as a result, investment.

We find a sizable negative effect of public spending -- and in particular of its public wage component -- on business investment. This result is consistent with models in which government employment creates wage pressure for the private sector. Various types of taxes also have negative effects on profits, but, interestingly, the effects of government spending on investment are larger than the effect of taxes. Our results have important implications for the so called "non-Keynesian" (i.e. expansionary) effects of fiscal adjustments.

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1 Introduction

In the last three decades, fiscal policy in many OECD countries has experienced large swings. In the seventies and early eighties, fiscal profligacy led to the accumulation of large deficits. Then, from the mid eighties onward, several countries implemented fiscal adjustments which, with different degree of success, slowed the growth of public debts.

Looking at this evidence, a lively recent literature has pointed out the importance of the so called "non keynesian" effects of fiscal policy. Starting with Giavazzi and Pagano (1990), several authors have noted that some (but not all) fiscal contractions have been expansionary, even in the very short run, in contrast to the prediction of standard models driven by aggregate demand. Even though episodes of rapid fiscal expansions have been relatively less studied, Alesina and Ardagna (1998) show evidence of "non keynesian effects" in this direction as well, namely they point out that several fiscal expansions have been contractionary.

Most of the empirical literature has focused on the effects of large fiscal contractions (expansions) on private consumption[1]; however, as noted, for instance, by Alesina, Perotti and Tavares (1998), even a cursory look at episodes of large swings in fiscal policy suggests that private investment explains a disproportionate share of the response of GDP growth to these large changes in the fiscal stance.

The motivation of this paper is that in order to better understand the macroeconomic effects of fiscal policy in OECD countries, one needs to shift the focus of the analysis to business investments.

Needless to say, this is not the first paper on the effects of fiscal policy on investment. A large and important literature studies the effects of taxes on the cost of capital, using either aggregate or firm level data. However, due to the amount of information needed to construct a good measure of the cost of capital, this approach tends to be country specific[2]. In the macroeconomic

[1]For the theorethical work on "non-Keynesian" effects of fiscal adjustments see Blanchard (1990), Drazen (1990), Bertola and Drazen (1993), Sutherland (1997), and Perotti (1999); for empirical work see Giavazzi and Pagano (1990, 1996), Giavazzi, Jappelli and Pagano (1998) and Perotti (1999). All these papers focus on consumption.

[2]See, for example, Hasset and Hubbard (1996) and Chirinko (1993) for a review. For

literature, a recent strand of research uses numerical solutions of real business cycles models with perfectly competitive factor and output markets to evaluate the effects of fiscal policy on investment[3]. This literature focuses on the supply-side responses of capital and labor to changes in spending and taxation and its based on calibration methods.

In this paper, instead, we do not use calibration but we rely on econometric evidence on a panel of OECD countries to assess the effects of taxation and expenditure on investment. We focus on the role of profits as a determinant of investment and we show below that the composition of changes in fiscal policy is particularly important for profits. We share our emphasis on profits and the supply-side with Bruno and Sachs (1985), Blanchard (1997) and Lane and Perotti (1999). We share the focus on composition of fiscal policy with Alesina and Perotti (1995), (1997a), Giavazzi and Pagano (1996), Giavazzi, Jappelli and Pagano (1998), Mc Dermott and Wescott (1996), and Alesina and Ardagna (1998).

We reach several conclusions. First, increases (reductions) of public spending reduce (increase) profits and, therefore, investment. The magnitude of these effects is substantial. A reduction by one percentage point in the ratio of primary spending over GDP leads to an increase in investment by 0.16 percentage points of GDP on impact, and a cumulative increase by 0.50 after two years and 0.80 percentage points of GDP after five years. The effect is particularly strong when the spending cut falls on government wages: in response to a cut in the public wage bill by 1 percent of GDP, the figures above become 0.51, 1.83 and 2.77 per cent, respectively.

Second, increases (reductions) in taxes reduce (increase) profits and investment, but the magnitude of these tax effects is smaller than those on the expenditure side. In accordance to our emphasis on labor markets effects of fiscal policy, taxes on labor have the largest effects on profits. For instance, an increase of one percentage point of GDP of taxes on labor leads to a reduction of the investment over GDP ratio by 0.17 on impact and a cumulative effect of about 0.7 in five years. We argue that this effect is due to the fact that higher labor taxes imply higher pre tax wages demanded by

recent contributions using firm level panel data see Devereux, Keen and Schiantarelli (1994) for the UK and Chirinko, Fazzari and Meyer (1999) for the US. For international evidence see Cummins, Hasset and Hubbard (1995).

[3]See Barro (1989) Baxter and King, (1993), Dotsey and Mao (1994), Ludvigson (1996), Ohanian (1997), Finn (1998), Olivei, (1998).

workers.[4]

Third, the magnitude of our coefficients suggests that there may be nothing special in the behavior of investment at the time of expansionary fiscal adjustments. As shown by Alesina and Perotti (1997) and Alesina and Ardagna (1998), expansionary fiscal adjustments are on average implemented mostly by spending cuts, particularly on government wages and transfers, while contractionary ones are characterized by tax increases. The estimated effect of spending and taxes on investment imply that the different composition of the stabilization package can account for the observed difference in investment growth rates. We do not find significant "non linearities" or structural breaks in the reaction of investment around large fiscal consolidations.[5] This result suggests that we may not need "special theories" to explain episodes of large fiscal adjustments.

This paper is organized as follows. Section 2 develops a model of investment, profits and fiscal policy. Sections 3 discusses the data. Section 4 displays our main results on profits and investment and illustrates the quantitative effects from different types of fiscal policy on investment. Section 5 discusses the sensitivity and robustness of our results. Section 6 relates our results to the empirical evidence on large fiscal adjustments. The last section concludes.

2 Theory

2.1 Profits, investment and fiscal policy

We discuss the link between fiscal policy and investment using a standard investment model with convex adjustment costs as in Abel and Blanchard (1986). A vast literature has investigated the role of the tax code, like depreciation allowances, investment tax credits, and deductability of interest payments, etc. on the computation of the costs of capital. Although the cost of capital has been found to be significantly related to investment, the elasticity tends to be small (see for instance Chirinko and Fazzari (1998)). Thus, the effects of fiscal policy through this channel are not likely to be large. Moreover, it is far from clear that a careful modelling of tax incentives

[4]This effect can occur both in competitive and unionized labor markets. For more discussion of this point and for direct evidence, see Alesina and Perotti (1997).

[5]This result is consistent with the empirical evidence of Ardagna (1999).

makes much difference[6]. Here we depart from this literature by emphasizing effects of fiscal policy which operate mainly through the labor market.

Firms maximize the expected present discounted value of cash flow, V_t:

$$V_t = E_t \sum_{t=0}^{\infty} \prod_{s=0}^{j} (1+r_{t+s})^{-1}(1-\tau_{t+s}) \left[F(K_{t+j}, L_{t+j}) - H(K_{t+j}, I_{t+j}) - w_{t+j}L_{t+j} - I_{t+j}\right] \tag{1}$$

subject to the capital accumulation equation

$$K_t = K_{t-1}(1-\delta) + I_t \tag{2}$$

K_t is the capital stock, I_t the rate of gross investment, L_t is labor input, r_t is the one period (expected) market rate of return, τ_t the tax rate on profits, and δ the rate of depreciation. $F(K_t, L_t) - H(K_t, I_t)$ is the net production function where $H(K_t, I_t)$ describes the cost of adjusting the capital stock which is convex in I_t.

Equation (1) assumes that the firm is perfectly competitive, capital becomes productive immediately, the price of investment goods relative to the output price is one and investment expenditures at time t are fully tax deductible.[7] We also assume that the gross production function $F(K_t, L_t)$ and the adjustment cost function $H(K_t, I_t)$ are linear homogeneous in their arguments so that $F(K_t, L_t)$ can be written as $L_t f(K_t/L_t)$ and $H(K_t, I_t)$ as $K_t c(I_t/K_t)$, with $f', c' > 0$, $f'' < 0$ and $c'' > 0$. Under these assumptions, it is well known that the firm optimal plan satisfies:

$$\frac{I_t}{K_t} = i(\lambda_t - 1); \quad i'(\cdot) \equiv c'^{-1}(\cdot) > 0 \tag{3}$$

where:

$$\lambda_t = E_t \left\{ \Pi_K(\frac{K_t}{L_t}, \frac{I_t}{K_t}) + \sum_{j=1}^{\infty} \left(\prod_{v=1}^{j} \beta_{t+v}\gamma_{t+v} \right) \Pi_K(\frac{K_{t+j}}{L_{t+j}}, \frac{I_{t+j}}{K_{t+j}}) \right\}; \quad \Pi_{K,1} < 0; \Pi_{K,2} > 0 \tag{4}$$

[6]See Devereux, Keen and Schiantarelli (1994) for empirical evidence on this point. However, Cummins, Hasset, Hubbard (1995) present a more upbeat evaluation of the effects of taxation on investment.

[7]If investment expenditures are not tax deductable $(1-\tau_t)$ should not multiply I_t. Most countries, in reality, are somewhere in between these two extreme cases, with depreciations allowances spread over time and with additional deductions for investment expenditures allowed in the first year.

$$\frac{K_t}{L_t} = \psi(w_t); \quad \psi' > 0 \tag{5}$$

The marginal (net) product of capital, Π_K, is a function of the capital/labor ratio and of the investment rate, because $\Pi_K = F_K - H_K = f''(K_t/L_t) + (I_t/K_t)\, c'\,(I_t/K_t) - c\,(I_t/K_t)$. Moreover, $\beta_{t+j} = (1-\delta)/(1+r_{t+j})$; $\gamma_{t+j} = (1-\tau_{t+j})/(1-\tau_{t+j-1})$.

We will call β_t the discount factor and γ_t the corporate tax factor[8]. Note that λ_t equals the shadow value of one additional unit of capital in absence of taxation $\tilde{\lambda}_t$ divided by $(1-\tau_t)$, (i.e.: $\lambda_t = \tilde{\lambda}_t/\,(1-\tau_t)$).

Thus, the investment rate is a function of the (tax-adjusted) shadow value of capital, which depends upon the expected present discounted value of the net marginal product of capital, Π_K (see equations (3) and (4)). Π_K is a decreasing function of the capital labor ratio, which is an increasing function of the real wage rate through the first order condition for labor (see equations (4) and (5)). Ceteris paribus, an increase (current or expected) in the real wage decreases the shadow value of capital and, hence, investment. The fiscal policy channel which we focus on is the effect of public spending and taxes on labor costs and therefore profits.

There are several ways to rationalize this "supply-side" link between fiscal policy and investment. In a competitive labor market increases in taxes on labor income lead to a decrease in the individual's labor supply of hours at each level of the gross wage, assuming the substitution effect dominates. Increases in taxes or unemployment benefits also affect participation decisions and reduce total labor supply. Finally, an increase in public employment increases total labor demand, and therefore puts upward pressure on the equilibrium wage[9]. The opposite holds for reduction in taxes, unemployment benefits or public employment.

In the context of unionized labor markets, similar effects hold.[10] For many specifications of the union objective function and of the nature of the wage bargain, an increase in income taxes or in social security contributions that reduces the net wage of a worker leads to an increase in the pre-tax real wage faced by the firm. Moreover, the spending side of the government budget influences the reservation utility of not being employed by a given

[8]We assume that the market rate of return r is exogenous in the model. Our economy can, thus, be considered a small open economy.

[9]For an analysis of the effect of public employment on investment in a real business cycle model, see Finn (1998).

[10]See, for instance, Jackman, Layard and Nickell, (1991).

firm in more than one way. First, public employment can be an alternative to employment in the private sector. Thus, higher public wages and/or public employment increase the reservation utility of union members. Second, unemployment compensation and various other transfer programs reduce the costs of unemployment. Therefore, higher public spending (particularly on government wages, transfers and welfare) increases the real wage demanded by the unions, thus reducing marginal profits and, hence, investment.

We can summarize in a simple way the effects of fiscal policy on the equilibrium wage at each level of the aggregate capital stock K^T.

$$w_t = W(K_t^T, X_t^G); \quad W_1 > 0, \quad W_2 > 0 \tag{6}$$

where K^T is the total capital stock equal to the capital stock of each individual firm times the number of firms and X^G is a vector of fiscal policy variables, including labor taxes, unemployment benefits, the public sector wage rate and public employment[11]. In the perfectly competitive model K^T enters the wage schedule because it determines the position of the aggregate demand for labor at a given wage rate. W_t in this case equates the demand and supply of labor, which depends upon fiscal variables[12]. Also in a union model it is reasonable to assume that K^Taffects positively the equilibrium wage[13].

If we assume perfect foresight, we can easily represent graphically the effect of changes in the fiscal policy parameters on the capital stock through

[11]See Calmfors and Horn (1986) for a model of a centralized union that bargains both for private and public sector workers and Holmund (1997) for a model with separate unions. In the latter paper there can be wage differences between private and public wages in equilibrium.

[12]Using equation (5) total labor demand equals $L_t^T = \frac{K_t^T}{\psi(w)}$, where $L^T = NL_t$ and $K_t^T = NK_t$ and N denotes the number of firms. Note that we have assumed for simplicity a labor supply that depends only upon the contemporaneous wage.

[13]Under constant returns to scale, standard monopolistic union models imply that the wage is independent of the capital stock of the individual firm for any given level of alternative income. However, in general equilibrium, it is possible to show that, under reasonable assumptions, the alternative income to union members, and hence the union wage, are increasing functions of the capital stock. Note that the solution to the one period union model is also the time consistent contract in a dynamic game in which the union has an intertemporal utility function and acts as the Stackelberg leader facing a firm with convex adjustment costs for capital (see Van der Ploeg (1988)). See also Devereux and Lockwood (1991), Denny and Nickell (1993) on the determination of the capital stock in union models.

the wage channel. The two equations defining the steady state (from (2), (3), (4) and (5)) are

$$i(\lambda - 1) = \delta \tag{7}$$

$$-f'(\psi(w)) - (\lambda - 1)i(\lambda - 1) + c(i(\lambda - 1)) + (1 - \beta)\lambda = 0 \tag{8}$$

Equation (7) is the $\Delta K_t^T = 0$ locus and it implies that in steady state the aggregate capital stock is constant when λ equals $1 + c'(\delta)$. For values of λ greater (smaller) than $1 + c'(\delta)$ the investment rate exceeds (falls short) the depreciation rate δ and the capital stock grows (contracts). Equation (8) defines the $\Delta\lambda_{t+1} = 0$ locus. Since the wage rate is an increasing function of the capital stock K^T (see (6)) and the marginal product of capital a decreasing function of the wage, one can show that the $\Delta\lambda_{t+1} = 0$ locus is downward sloping[14]. For values of λ above (below) the locus, the shadow value of capital increases (decreases). The $\Delta K_t^T = 0$ and the $\Delta\lambda_{t+1} = 0$ loci are represented in Figure 1. The steady state equilibrium is saddle-path stable[15].

When there is an unanticipated permanent increase in public employment, public sector wage, unemployment benefits or labor taxes at a given level of the discount rate, the $\Delta\lambda_{t+1} = 0$ locus shifts downward and the steady state capital stock decreases from K_0^T to K_1^T. The investment rate falls discretely below the depreciation rate, following the discrete fall of λ (see move from point E_0 to D), and then it recovers gradually. The effect of anticipated changes in fiscal policy and of unanticipated temporary changes can be similarly analyzed.

2.2 From theory to testing

In order to take the model to the data, we need to parametrize the adjustment cost function and to select a proxy for the marginal profitability of

[14]More precisely,

$$\frac{d\lambda}{dK^T} = \frac{f''\psi' W_{k^T}}{(1 - (\beta + \delta))} < 0$$

when $\Delta K_t^T = 0$ and $\Delta\lambda_{t+1} = 0$ loci intercept.

[15]Note that, given the discount rate, our assumption of full instantaneous deductability of investment expenditure, yields the result that capital is neutral with respect to the corporate tax rate in the steady state. See Nickell (1978), chapter 9.

capital. Finally, we will have to choose how to model empirically the dependence of marginal profitability on fiscal factors. We will assume that adjustment costs are linear homogeneous and quadratic, i.e. $H(K_t, I_t) = \left[\frac{b}{2}\left(\frac{I_t}{K_t} - \varepsilon_t\right)^2 K_t\right]$ where ε_t is a stochastic shock which is known when firms decide their inputs[16].We will experiment with two proxies for the gross-of-tax marginal profit of capital, Π_K. First, under the assumptions of perfect competition and linear homogeneity we used so far, marginal profits equals the marginal product of capital and can be approximated by average profits per unit of capital.

More precisely,

$$\begin{aligned} \Pi_K(K_t, I_t) &= \left[F(K_t, L_t) - H(K_t, I_t) - w_t L_t\right]/K_t + H_I()(I_t/K_t) \simeq \\ &\simeq \left[F(K_t, L_t) - H(K_t, I_t) - w_t L_t\right]/K_t \equiv \pi_t \end{aligned} \quad (9)$$

where π_t denotes average operating profits. For brevity, we will refer to this as the "benchmark case". Alternatively, if we assume that the production function is Cobb-Douglas, and the firm is imperfectly competitive, marginal profits can be shown to be approximately a multiple of the sales to capital ratio S_t/K_t, i.e.: $\widetilde{\Pi}_K = \theta\,(S_t/K_t)$,where θ equals the elasticity of output with respect to capital times the markup of prices over marginal costs[17]. If we use average gross-of-tax profits to proxy for marginal gross-of-tax profits, and linearize around sample means of π_{t+j}, β_{t+j}, and γ_{t+j}, we obtain:

$$\frac{I_t}{K_t} \simeq \frac{1}{b} E_t \left[\sum_{j=0}^{\infty} (\overline{\beta\gamma})^j \pi_{t+j} + \frac{\overline{\gamma\pi}}{1-\overline{\beta\gamma}} \sum_{j=0}^{\infty} (\overline{\beta\gamma})^j \beta_{t+j+1} + \frac{\overline{\beta\pi}}{1-\overline{\beta\gamma}} \sum_{j=0}^{\infty} (\overline{\beta\gamma})^j \gamma_{t+j+1}\right] + \varepsilon_t \quad (10)$$

where variables with a bar denote sample means. We have omitted additive constants for ease of notation and we have used the approximations $\beta_{t+j} \simeq 1 - r_{t+j} - \delta$ and $\gamma_{t+j} \simeq 1 - (\tau_{t+j} - \tau_{t+j-1})/(1 - \overline{\tau})$. Thus, the optimal rate of investment depends on the present discounted value of future cash flow, of the discount factor, and of the corporate tax factor[18].

[16]In the empirical analysis, we allow for different alternative assumptions about the nature of the error term. In particular, we allow it either to have an AR(1) structure or to be a random walk. Blundell et al. (1992) find evidence of an AR(1) structure for ε_t using panel data.

[17]See also Gilchrist and Himmelberg (1998).

[18]If gross-of-tax profits are proxied instead by the sales to capital ratio, equation (10)

A particularly simple and illuminating case is when in equation (10) β_{t+j} and γ_{t+j} are constant over time, with the latter set equal to one (implying no changes in corporate taxes). In this case, the optimal rate of investment is:

$$\frac{I_t}{K_t} \simeq \frac{1}{b} E_t \left[\sum_{j=0}^{\infty} \beta^j \pi_{t+j} \right] + \varepsilon_t \tag{11}$$

Finally, we must specify an estimable system linking government spending, taxes and profits. Our strategy is to use the estimates of this system to construct a series for λ, which we then use to estimate equation (10)[19]. Starting with the simplest case in which β_{t+j} is constant and γ_{t+j} is set equal to one, we use the following profit equation:

$$\pi_t = a_1 \pi_{t-1} + a_2 \pi_{t-2} + a_3 G_t + a_4 R_t + u_t \tag{12}$$

where G_t and R_t are public spending and revenue (or spending and revenue components) as a share of trend GDP and π is gross/net-of-tax profits or value added in the business sector as a share of the capital stock. Gross-of-tax profits are defined as value added in the business sector minus labor costs. On the basis of the previous discussion, we would expect both a_3 and a_4 to be negative. The evolution of revenue and expenditure is described by a simple VAR system:

$$R_t = d_{11} R_{t-1} + d_{12} R_{t-2} + d_{13} G_{t-1} + d_{14} G_{t-2} + \eta_t \tag{13a}$$
$$G_t = d_{21} R_{t-1} + d_{22} R_{t-2} + d_{23} G_{t-1} + d_{24} G_{t-2} + \omega_t \tag{13b}$$

In estimation G_t and R_t are cyclically adjusted to eliminate the automatic changes in the variable induced by business cycle fluctuations.

However, there could be a second source of endogeneity between profits on one hand, and revenues and expenditures on the other: the discretionary

would still be valid, with θs_t replacing π_t. If investment expenditures are not tax deductable (10) becomes

$\frac{I_t}{K_t} \simeq \frac{1}{b} E_t \left[\sum_{j=0}^{\infty} (\overline{\beta})^j \pi^*_{t+j} + \frac{\overline{\pi}^*}{1-\overline{\beta}} \sum_{j=0}^{\infty} (\overline{\beta})^j \beta_{t+j+1} \right] + \varepsilon_t$

where $\pi^*_{t+j} = (1 - \tau_{t+j}) \pi_{t+j}$ denotes average profits net of taxes.

[19]The q theory of investment has not been always empirically successful. Our emphasis here, however, is not on a test of q theory versus alternatives. We are interested in emphasiszing a link between profits and investment and below we also allow for liquidity effects. For an excellent discussion of the "state of the art" of investment theory and empirics, see Caballero (1999).

response of the policymakers to business cycle fluctuations. We do not have any quantitative estimate of this channel of endogeneity, but we believe that, due to the "long and variable" decision lags in fiscal policy, this source of endogeneity is unlikely to be too serious. The budget for year t is usually discussed and approved during the second half of year $t-1$. Some additional fiscal policy measures are sometimes decided during the year, but they usually represent a small fraction of the budget, and most of the times they become effective only by the end of the year. Thus, our assumption that cyclically adjusted G_t and R_t do not depend on current profits (or GDP) is likely to be a reasonable, although imperfect, approximation to reality.

For the same reasons, we assume that G_t and R_t are known at the beginning of the period. By contrast, we will initially assume that π_t is not in the information set at time t: thus, the first term in the infinite sum that enters the construction of λ_t in equation (10) is the expected value of π_t conditional on the values of the variables on the right hand side of (12). We will routinely check that our estimates of the investment equation are not unduly sensitive to this assumption. That is, we will also allow for the case of π_t in the information set at time t, so that the actual value of π_t can be used in constructing λ_t.[20]

For the more general model with variable discount and corporate tax factors, in section 5 we will augment the system of forecasting equations in (12) and (13) with:

$$r_t = b_1 r_{t-1} + b_2 r_{t-2} + b_3 G_t + b_4 R_t + v_t \tag{14}$$

Moreover, we augment the VAR for G_t and R_t with the corporate tax rate τ_t. Finally, we will experiment with adding an output variable to the profit function and hence to the system of equations generating expectations.

3 Data

All our data are from the OECD 1997 Economic Outlook Database. Our sample includes 18 countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands,

[20]Note that, although η_t and ω_t are uncorrelated with u_t, they need not be uncorrelated with each other. As long as (12) is used to forecast future profits and therefore to construct λ_t, this is not a problem. We will have to take up this issue again when we study the impulse responses of investment to spending or revenue shocks.

Norway, Spain, Sweden, United Kingdom, United States, covering a maximum time span from 1960 to 1996[21]. The data appendix contains the precise definition of all the variables we use and some descriptive statistics.

Each component of revenues — direct taxes on households, business taxes, indirect taxes, and social security contributions — is cyclically adjusted by computing the value of the component if GDP were at its trend level instead than at its actual level, using the GDP elasticities provided by the OECD. We calculate trend GDP separately for each country in the sample, by regressing log GDP in real terms on a constant and a quadratic trend[22]. Hence, for each component of revenues we compute:

$$R_{it}^{CA} = R_{it}^{NCA}(GDPVTR_t/GDPV_t)^{a_i} \tag{15}$$

where R_{it}^{CA} is the cyclically adjusted revenue item, R_{it}^{NCA} is the actual revenue item, $GDPVTR_t$ is trend real GDP, $GDPV_t$ is real GDP, and a_i is the elasticity of the revenue item i to real GDP. A similar adjustment is applied to total primary spending and transfers[23]. We then divide each cyclically adjusted revenue component and each spending component by trend GDP. Investment and profits are divided by the capital stock to obtain the investment and profit rates.

Unit root tests run country by country on all the variables used in the equations did not allow us to reject the presence of a unit root for all the countries. However, given the low power of the Phillips-Perron test in small sample, we also implemented the unit root test proposed by Im, Pesaran and Shin (1995) on the panel. This time, the evidence was in favor of stationarity[24]. We first estimate our model in levels, detrending all the variables,

[21]Two small OECD countries, Luxembourg and Iceland, are excluded, together with the new members of this group admitted only recently. New Zealand, Portugal, and Switzerland are excluded because of data problems.

[22]Thus, we apply the same cyclical adjustment as the OECD, except that we use trend GDP as the reference value of output, rather than 'potential output' as calculated by the OECD. See OECD, *Fiscal Position and Business Cycles, Users' Guide for Statistics* on diskette, for the values of the tax elasticities. We also used the Hodrick-Prescott filter to estimate trend GDP, obtaining similar results.

[23]The OECD does not provide the values of the transfers elasticities. We used the elasticities provided for total primary spending and scaled them up by the ratio of transfers to total primary spending. This is under the reasonable assumption that transfers are the only cyclically sensitive component of government spending.

[24]Note that, by dividing revenues and spending by trend GDP, we implicitly assume that GDP is trend stationary. It is still possible that the ratio between revenues and spending and trend GDP contains a unit root if the numerators contain a unit root.

allowing for country specific linear and quadratic trends[25]. In section 5 we present results of an estimation in first differences and we experiment with allowing country specific constants to account for country specific drifts. Our basic results on fiscal policy and investment are unaffected; in fact, in several respects they are stronger for the model in differences.

4 Empirical results

We consider first the simplest case defined by (11), (12) and (13) above, in which investment depends only upon future expected marginal profits and the discount factors and corporate tax factors are constant.[26]

4.1 The effects of fiscal policy on profits

We begin, in Table 1, by estimating the profit equation (12). Columns 1-3 of this table correspond to different definitions of the dependent variable. Marginal profit Π_K is proxied by average profit gross of corporate tax payments π in column 1, by average profit net of taxes π^* in column 2, and by the sales-to-capital ratio S/K in column 3.

In all three columns, both primary spending and revenues as a share of trend GDP have a negative and statistically significant effect on marginal profits, and their coefficients are quite similar across the three columns. Using a coefficient of 0.10 which is roughly the average across the columns in Table 1, an increase in government spending by 1 percentage point of trend GDP decreases profits as a share of the capital stock by about 1/10 of a percentage point, and an increase in taxes by the same amount has roughly the same effect on profits. At a first look, these effects may not seem very large. However, many episodes of fiscal adjustments in recent years have been quite sizable. For instance, in Ireland 1986-1989, primary spending as share of GDP decreased from 37.9 per cent in 1986 to 29.7 per cent in 1989 and, in the same years, taxes were cut by almost 2.5 percentage points from 37.6 to 35.25. Using the coefficient in Table 1, this change in fiscal policy accounts for

[25]OLS estimation in levels with country specific effects is appropriate since we have a panel with large T.

[26]In this case, we assume the corporate tax factor $\gamma = 1$, and the discount factor $\beta = 1 - \delta - r = 0.88$, where $\delta = 0.1$ and $r = 0.02$, the average value in our sample.

a *ceteris paribus* increase in profits as a share of GDP of almost 2 percentage points[27].

We now consider the effects of the individual budget items. Since the results are very similar across the three columns of Table 1, in the next tables we present our regressions using the average profit rate gross of corporate tax payments (as in columns 1 of Table 1) as our proxy for marginal profits. On the spending side of the budget (Table 2) we consider transfers, the wage and non-wage components of government consumption, and government investment. On the revenue side of the budget (Table 3), we consider in turn labor taxes (defined as the sum of direct taxes on households, and social security and payroll taxes), taxes on business, and indirect taxes.

The point estimates of the coefficients of all spending items are negative and significant at the 5% level, except non-wage government consumption, which is significant at the 10% level. The government wage bill has the strongest negative effect on profits, with a coefficient of -.43 and a t-statistic of 6.33. Thus, a permanent fall in wage government consumption by 1 percent of GDP would lead to a *ceteris paribus* increase in profits as a share of the capital stock by .42 percentage points and an increase in profits as a share of GDP by .82 percentage points on impact and of 2.74 percentage points in the steady state.

Among the revenue items, labor taxes have the strongest negative effect on profits, with a coefficient of -.16 and a t-statistics of 4.25. An increase in labor taxes by 1 percent of trend GDP would lead to a reduction in profits as a share of GDP by about .30 percentage points on impact and .98 in the steady state. These results are consistent with the labor market models discussed above, since the two components of spending and revenues which seems to affect profits more are government wages and labor taxation.

4.2 The investment equation

Table 4 displays estimates of the investment equation (11). Following Abel and Blanchard (1986), and Blanchard, Rhee and Summers (1993), we add some dynamic to our equation by letting the first lag of λ also affect investment. Moreover, we estimate the equation by GLS to account for the presence of a AR(1) error term, with an autocorrelation coefficient that is

[27]We convert the profits/capital ratio into the profits/GDP ratio using the average capital/GDP ratio of 1.89 for the whole sample.

allowed to vary across countries.

Columns 1-3 parallel the corresponding columns of Table 1. Thus, marginal profits are proxied by gross-of-tax average profits in column 1, by net-of-tax average profits in column 2, and by the sales to capital ratio in column 3. Column 4 is exactly like column 1, except that we compute λ assuming that current profits are known at the beginning of the period, rather than with one period delay[28].

Contemporaneous λ is a significant explanatory variable for investment in all columns of Table 4, and the one period lagged value is statistically significant in column 4. The point estimates of the coefficient of contemporaneous λ vary between .05 and .1, and are similar to those implied by the estimates in Blanchard, Summers and Rhee (1993) for the United States[29].

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[28]This implies that the actual value of π_t is used to construct λ_t. Formally, omitting constants, if profits are known with one period delay, λ_t is calculated as

$\lambda_t = a'(I - A\overline{\rho})^{-1}AX_t$

where:

$a' = [1\ 0\ 0\ 0\ 0\ 0]$

$X_t = [\pi_{t-1}\ G_t\ \ R_t\ \ \pi_{t-2}\ G_{t-1}\ \ R_{t-1}]'$

$X_t = AX_{t-1} + \varepsilon_t,$

If current profits are known at the beginning of the period

$\lambda_t = \pi_t + \overline{\rho}a'(I - B\overline{\rho})^{-1}B\widetilde{X}_t$

where:

$\widetilde{X}_t = [\pi_t\ G_t\ \ R_t\ \ \pi_{t-1}\ G_{t-1}\ \ R_{t-1}]',\ \widetilde{X}_t = B\widetilde{X}_{t-1} + \widetilde{\varepsilon}_t$

and A and B are the matrices implied by equations (12 and 13).

[29]Blanchard, Rhee and Summers (1993) adopt a different specification, in that they regress the first difference of the logarithm of the investment to capital ratio on the first difference of the logarithm of λ and its first lag, obtaining a coefficient on the contemporaneous λ of .91 in the full sample and of .54 in the post-war sample. Using an average value for λ of 1, and an average value of the investment to capital ratio of about 6% in the whole period and 8% in the post-war period, an increase of λ by 1% would lead to an increase in investment as a share of capital by .55 percentage points in the whole period and by .43 percentage points in the post-war period. Summing the coefficients of contemporaneous and lagged λ, the effect would be .94 percentage points in the whole period and .83 percentage points in the post-war period. These are very close to the effect of 1 percentage points that we obtain from our estimate in column 1 of Table 4 (note that the coefficient of the first lag of λ is minuscule).

4.3 Fiscal policy, profits and investment

We now provide some quantitative estimates of the dynamic effects of fiscal policy on investment. We discuss two types of experiments. The first is meant to give a rough idea of the order of magnitude of the effects on investment. Suppose primary government spending falls *permanently* by 1 percent of trend GDP: what is the effect on investment? We abstract from the equations for taxes and spending (13a and 13b) and we treat them as if they were set by the government independently of their own (or other variables') past. This back-of-the envelope calculation gives an approximate answer. Starting from the profit equation in column 1 of Table 1, a permanent fall in G by 1 percent of trend GDP causes a permanent fall in profits as share of capital by .09/(1-.67-.03) = .3 percentage points; using a value of β of .88, this leads to a change in λ by .3/(1-.88) = 2.5 percent. Using the estimate of column 1 in Table 4, investment increases by .27 percentage points as a share of the capital stock, and by .55 percentage points as a share of GDP[30]. This is far from a trivial effect.

The second and more precise experiment consists of tracing out the dynamic effects of a unit shock to spending or revenues, using the estimates of the whole system (equations (12) and (13)). Formally, we study the impulse responses of investment to a shock to spending or revenues.

In order to do this, we need to solve a preliminary question.[31] To obtain a meaningful impulse response from the dynamic system ((12) and (13)), we need innovations that are mutually orthogonal. While the reduced form innovations η_t and ω_t are certainly orthogonal to u_t, in general they will be correlated with each other. This means that a shock to, say ω_t is not really a "spending shock", but a linear combination of the underlying structural spending and revenue shocks. We are skeptical about the possibility of recovering the structural, orthogonal shocks to revenues and spending. Thus, we orthogonalize the innovations in two ways: first, by letting revenues "come

[30]Note that here and in what follows, we use the fact that

$$\frac{dI}{dx} = \frac{d(I/K)}{dx}\frac{K}{1-(I/K)}$$

since K is the end of the period capital stock. Dividing by GDP we obtain the change of investment as a percentage of GDP. We set I/K to 0.07 and K/Y to 1.89, the average sample values.

[31]See Blanchard and Perotti (1999) for a more thorough treatment of this issue.

first", i.e. by adding R_t to the rhs of equation (13b); alternatively, by letting spending "come first", i.e. by adding G_t to the rhs of equation (13a). Both procedures give orthogonalized spending and revenue shocks by construction; if the correlation between the reduced form innovations η_t and ω_t is small, then the impulse responses to the two orthogonalized spending shocks obtained with these two procedures will not differ much. In fact, in our sample the correlation between ω_t and η_t is indeed low, .13. As an example, we will present the results obtained when revenues come first[32].

Table 5 displays the changes in investment expressed as a share of GDP, due to a unitary shock at time t, to primary spending, revenues, and their main components, on impact and up to 5 years, and the cumulative change after the first five, ten and twenty years[33]. For instance, a reduction by one percentage point in the ratio of primary spending to GDP leads to an increase in the investment/GDP ratio by .16 percentage points on impact, and to a cumulative increase by .50 percentage points after two years and by .80 percentage points after five years. The effect is also statistically significant[34]. Increases in taxes reduce investment but the magnitude of the tax effects is smaller and statistically significant only on impact. For instance, the cumulative effect on the investment/GDP ratio is -.18 percentage points, compared with -.80 for spending.

The results on the component of spending are also quite instructive. Consistently with our results on profits, the largest effect is from government wages. For instance, in response to a cut in the public wage bill by one per cent of GDP, the impact effect is an increase in the investment/GDP ratio by .51 percentage points; the cumulative effect at the end of the fifth year is 2.77 percentage points. For this reason, if the cut in primary spending were concentrate all on government wages, the magnitude of the effects on investment would be much larger than those computed above. Labor taxes also have a sizable effect on private investment. An increase of labor taxes by one percent of GDP leads to a fall in the investment/GDP ratio by .17 percentage points on impact and by .75 percentage points in the steady state. The effect of a shock to taxes on labor is significant at the 10% level on impact

[32]We also checked (and confirmed) that our results are not unduly sensitive to the orthogonalization procedure.

[33]In other words, the table displays the impulse responses of the investment to GDP ratio at different horizons.

[34]Standard errors are computed by bootstrapping, based on 500 replications. We followed Runkle (1987). See footnote to Table 5 for details.

and after one year.

5 Sensitivity and robustness

Our results are robust to a variety of different specifications. In what follows, we discuss several extensions to our benchmark regressions. We add each extension, one by one, to the benchmark case.

5.1 The profit function

5.1.1 Adding GDP

In Table 6 we augment our basic profit regression with a measure of "private GDP", namely the ratio of total GDP less government consumption divided by the capital stock. This measure of the volume of sales per unit of capital is strongly positively associated with the profit rate. This result holds both in OLS and IV regressions, where the instruments are appropriately lagged values of the included variables (see list at the bottom of the table).

Our results on the effects of fiscal policy on profits are virtually unchanged. If we use this augmented regression of profits to construct λ, our results on investments are also virtually unchanged. The dynamic response of investment to fiscal policy changes is also very close to the one in Table 5. Consider, for example, augmenting the VAR described by equations (12) with an equation for "private GDP" and adding its lagged value to the profit equation. A reduction by one percentage point in spending as a share of GDP reduces the investment/GDP ratio by .17 percentage points on impact, and by .61 after five years. In the benchmark model in Table 5 these values are 0.16 and 0.80, respectively.

5.1.2 Fiscal policy, labor costs and profits

One important fiscal channel which we emphasize is the effect of public wages and employment on labor costs in the private sector. A different test of this channel is to regress profits on real private labor cost instrumented by the government wage bill. This is done in Table 7. The first four columns of this table use as instruments for private labor costs various combinations of variables, always including public wage spending. The results are supportive of our hypothesis and are very robust, (the coefficient of private labor costs is always negative and significant). They hold with and without private GDP as a share of capital in the profit regression (as shown in the table) and for several alternative sets of instruments.

The next four columns use total government spending and/or total revenues rather than public wage spending and/or labor taxes as instruments. What is interesting is that the coefficient of instrumented wage is lower in absolute value than in the previous four columns. The first stage regressions, where the private wages are regressed on alternative sets of instruments, are quite illuminating. In fact, Table 8 shows that private wages increase with taxes and public spending. Moreover, private wages are better explained by public wages rather than by total government spending. Consistently with our discussion in section 2.2, while total revenues do not have a positive and statistically significative effect on private wages, labor taxes do. Finally, our results for the investment regression are virtually unchanged when we use these alternative formulations for the profit function.

5.2 First differences

We have re-estimated all our regressions with variables in first differences rather than in levels. In fact, as discussed above, unit root tests country by country and on the whole panel lead to opposite conclusions about the order of integration of the series.

Tables 9 and 10 display the results. In the profit equation (first panel of Table 9), the coefficient of primary spending is twice and that of revenues is three times as large as the corresponding coefficients in the regression in levels (column 1 of Table 1). However, in the investment equation (second panel of Table 9), the coefficient of contemporaneous λ is about one tenth compared to the one for the model in levels of Table 4. Combining these results, Table 10 reports the effects, at different horizons, on the investment/GDP ratio of a unitary shock to primary spending and revenues, using the same orthogonalization adopted in Table 5. The impulse response to a shock in spending in the first five years is similar to the one obtained for the model in levels. The cumulative effect after the first ten years is 1.49 percentage points for the model in difference and .98 for the model in levels. In the case of a shock to taxes, the difference with the regressions in levels is more marked. For instance, after five years, the cumulative effect on investment is almost five times as large in the model in differences compared to the model in levels (-0.87 versus -.16). Moreover, it is of the same order of magnitude as the effect of a shock in spending. Therefore, the conclusions concerning the quantitative effects of fiscal policy and in particular of taxation would be reinforced if we rely on the model in differences. However, the more powerful tests of the unit root on the panel tend to support the specification in levels.

5.3 Variable discount and corporate tax factors

So far, we have assumed that the firm's discount factor β_t and the corporate tax rate factor γ_t were constant. We now allow these two terms to vary over time; thus, the investment equation we estimate is now (10) instead of (11), and we add equation (14) and the equation for the corporate tax rate to the VAR (13). This allows us to investigate the effects of changes in the interest rate on investment. Table 11 reports the corresponding regressions, estimated in the benchmark case of variables in levels and with marginal profits proxied by average profits gross of taxes. To compute the discount factor β_t, we use the one-period (net of corporate taxes) ex post real interest rate to measure the term r_t , and a value of 0.10 for the depreciation rate δ[35].

Column 1 displays the estimate of equation (14) for the real interest rate, and column 2 of the investment equation (10). In the interest rate equation, the coefficient of R (i.e. tax revenues) is positive and significant, while the one on G (i.e. government spending) is negative and significant. These results are somewhat counterintuitive. However, other authors have also obtained similarly results. For instance, Barro and Sala-i-Martin (1990) in a panel study on OECD countries on the effects of fiscal policy on interest rates find that government deficit is *negatively* associated with the interest rates in many specifications.

In the investment equation, $\lambda prof$ measures the contribution to changes in λ due to changes in average profits, $\lambda rint$ captures, instead, changes due to the net real rate of interest and $\lambda ctax$ changes due to the corporate tax rate (given the net of taxes interest rate). Thus, these terms correspond to the first, second, and third terms on the rhs of equation (10), respectively. As expected the interest rate term has a negative and statistically significant coefficient in the investment equation, while changes in the corporate tax rate term do not have any statistically significant effect on investments.

Turning to the impulse responses (not shown), the reaction of investment

[35] Results would be very similar if we used the ex-post real interest rate gross of taxes.

to a shock in spending is slightly smaller than in the benchmark case. A positive shock to spending reduces investment through its effects on profits, but it also has a negative effect on the real interest rate, thus increasing investment. After the first five years, the cumulative effect on investment as a share of GDP due to a unitary shock in spending is -.73, against -.80 in the benchmark case. By contrast, a shock to revenues has a stronger effect on investment than in the benchmark case. An increase in taxes reduces investment both through its effect on profits and via the real rate of interest; after the first five years, cumulatively, investment as a share of GDP decreases by .3 percentage points, almost twice as much as in the benchmark model.

5.4 Time effects

We added year dummies in the regressions as an additional way of controlling for common shocks to all countries in the sample. Tables 12 and 13 display the profit regressions thus obtained, as usual with the average profit gross of corporate tax as a proxy for marginal profits. In Table 12 the independent fiscal policy variables are primary spending and total revenues (column 1), or primary spending and the individual revenue items (columns 2 to 4). In Table 13, the independent fiscal policy variables are total revenues and the individual expenditure items. The estimated coefficients on public spending are lower than those in the benchmark case and in one case (when labor taxes are used as the tax variable) the coefficient becomes insignificant. The coefficients on the revenue items are unchanged. In Table 13, the coefficients of transfers and non-wage government consumption are now insignificant, but the coefficient of wage government consumption and of government investment are still large and significant. As argued above, taxes on households, social security taxes, and wage government consumption are the items of the budget with the strongest impact on unit labor costs and firms' profitability.

5.5 Country by country results

We have re-estimated the profit and investment equations by dropping one country at a time: none of the resulting 18 regressions for each equation were significantly different from the regressions we present in the paper.

We have also estimated the profit and investment equations country by country. Given the relatively short time series available in each country, results have to be taken with caution. In any case, the basic picture is encouraging. In the level regression, the effect of government spending on profits is negative and significant at the 5 per cent level in 10 out of 18 countries; of the remaining 8 countries, government spending has a negative, but insignificant coefficient in 4 countries. No country has a significant positive coefficient. The results on taxes in the profit equation are slightly less strong. In six countries, the coefficient of revenues is negative and significant (at the 5% level in three countries, at the 10% level in the other three); in seven, it is negative but insignificant; in no country the coefficient is positive and significant.

In the investment equation, in ten countries, contemporaneous and/or lagged values of λ are statistically significant determinants of investment. In seven countries, however, neither contemporaneous nor lagged values of λ are significant, and in one country the coefficient on λ is positive and insignificant, but the coefficient on lagged λ is negative and significant at the 10% level.

We then re-estimated the profit and investment equations country by country in first differences, and the results are similar to those from the regressions in levels, in fact, slightly stronger.

5.6 Expectations of profits, financial constraints and investment

Our specification for λ includes all the discounted stream of expected future marginal profits. There are two reasons why the future may not matter so much. One is financial constraints; some firms may be limited in their access to credit markets. The other one is that beyond one or two years forecasts of future marginal profits and of fiscal policy become so unreliable that are basically not used by the firm[36]. The focus of the present paper is not the role of financial constraints (nor the "optimal" time horizon firms use for investment decisions) and aggregate data are not appropriate to address this issue as it deserves. However, the existence of financial constraints would be relevant for our purposes for two reasons. At the theoretical level, it would reinforce the negative effects of fiscal policy on investment to the extent that changes in taxes or spending affect the firms' cash flow. Empirically, it is important to assess whether our constructed λ in reality capture firms'

[36]This is, of course, equivalent to discounting the future beyond, say (t+1), at a much higher rate.

availability of internal funds, rather than expected returns to investments.

Columns 1-2 of Table 14 investigate the presence of financial constraints by applying a standard methodology in the empirical investment literature. We add the contemporaneous (column 1) or lagged value (column 2) of the profit rate net of corporate tax payments to our benchmark investment equation. When we use current profits as our proxy for financial constraints, we tackle endogeneity by using as instruments the current value and first lag of the fiscal policy variables, of λ, and of the profit rate. In column (1) the coefficient on profits is negative but statistically insignificant and the coefficients on λ and $\lambda(-1)$ are virtually unchanged from the estimates in Table 4. In column (2), the coefficient on lagged profits is 0.07 and significant at the 10% level, consistent with a liquidity effect at work. At the same time, the coefficient of the contemporaneous value of λ falls, relative to the estimates in Table 4, by 30%, and the one on lagged λ by 50%. The overall effect of a shock to fiscal policy on investment is, however, stronger than in Table 4. Accounting for financial constraints, investment as a share of GDP increases approximately by 0.73 percentage points (versus 0.55 in the benchmark case) in response to *permanent* decrease in primary spending by 1 percent of trend GDP.

Columns 3-5 of Table 14 check whether forecasts of future marginal profits beyond one or two years are indeed relevant for investment decisions. We construct λ including just expected marginal profits at time t (column 3), t and t+1 (column 4), t, t+1 and t+2 (column 5), rather than all the discounted stream of expected future marginal profits. In column 3, the magnitude of the coefficient on λ is three times as big as the one in Table 4. When we extend the forecast horizon used to construct λ (column 5), the magnitude of the coefficient declines and it is approximately equal to the benchmark case.

Finally, in column 6 (column 7) expected marginal profits at time t and all the discounted stream of expected future marginal profits (the discounted stream of expected future marginal profits at time t+1 and t+2) enter as separate regressors in the investment equation. Only the coefficient of expected marginal profits at time t has a statistically significant effect on investment and its magnitude is more than twice that in the benchmark model in Table 4. We also compute the dynamic response of investment to fiscal policy changes considering the different specifications in column 3-8. Results are very close to the one in Table 5. In some specifications, changes in public spending and total revenue have slightly lower effects on investment. In conclusion, we find that investment is affected mostly by expected profits for near future. This might be an indication that expectations of profits too far into the future are too unreliable to be used in computing the present discounted value of stream of marginal profits. Although interesting, this finding does not alter our conclusions on the importance of fiscal policy as a determinant of investment decision of firms.

6 Large fiscal adjustments

In this section we discuss whether the fiscal effects which we estimated above are enough to explain the behavior of the economy around the time of large fiscal adjustments. The literature on large fiscal adjustments has highlighted an important empirical regularity. Fiscal adjustments which rely mostly, or exclusively, on spending cuts, and particularly on transfers and government wages, are associated with a surge in growth during and immediately after the adjustment. The opposite occurs in the case of adjustments which are tax based[37].While most of the literature has focused on consumption, Table 15 shows that in fact, business investment displays a very large amount of variability around fiscal adjustments. This table shows the surge in investment during expansionary fiscal adjustments — i.e. those large reductions in the deficit that are associated with an increase in growth — and the collapse of investment during the contractionary adjustments[38]. On average, business investment growth rate is -0.36% in the two years before expansionary fiscal adjustments and it jumps to 5.24% in the two years after the adjustment. In the contractionary episodes, these numbers are respectively 4.59% and 0.29%. In the two years before the expansionary adjustments, on average business investment contributes negatively to the (moderate) increase in GDP growth, while private consumption is responsible for approximately half of that increase[39]. After the adjustment, the average contribution from business investment to the (large) change in GDP growth jumps by almost 24

[37]See for example Alesina, Perotti and Taveres (1998) and the related literature cited therein.

[38]The precise definition of expansionary and contractionary fiscal adjustments is given at the bottom of Table 15.

[39]The contribution to GDP growth from each component of aggregate demand weights its growth rate with the share of each component relative to GDP. This quantity is then expressed as a proportion of the GDP growth rate. See the notes to Table 15 for details.

percentage points, from -6.55% to 17.17%, while the contribution from private consumption shows just a slightly increase from 51.37% to 51.82%. The opposite happens in the contractionary episodes: the contribution to GDP growth by business investment decrease about 15% while the one of private consumption is stable. The downturn which accompanies "contractionary" fiscal adjustments is therefore largely explained by the fall in private business investments. It is also interesting to note how the share of net exports actually falls drastically during expansionary adjustments and increases during contractionary ones. This is evidence against the view that expansionary adjustments are mainly driven by devaluations. In summary, this evidence suggests that private business investment is a critical component of domestic demand in terms of response to fiscal shocks.

In Table 16 we use our estimated model to see how well we "match" the behavior of investment around the episodes of fiscal adjustments described in the previous table. We simply use the fitted value for the investment rate (I/K) together with actual GDP and capital stock figures to calculate the "predicted" growth rate of business investment and the "predicted" investment to GDP ratio for each country. We then average across episodes to make our results comparable with those in Table 15.

We present two models, the benchmark and one with GDP in the profit function and a variable interest rate in the investment equation. Both of them, particularly the latter, do quite well at matching the actual data, particularly in terms of comparison between the immediate aftermath of the fiscal adjustment and the "base" (i.e. immediately before). For instance, with the richer model we predict a difference in the average rate of growth of investment before and after "expansionary" fiscal adjustment of 4.13 compared to 5.60 in the data, and of -4.68 against -4.30 in the case of "contractionary" fiscal adjustments. In some cases the model predicts the "jumps" of the investment share with one year delay relative to the actual data. A more thorough analysis of this timing issue would require quarterly data on fiscal variables, which are not available for many OECD countries.[40]

Finally, we investigated whether the behavior of profits and investment is structurally different following large changes in the fiscal policy stance. We pursued this investigation in a variety of ways. First we checked whether a quadratic term on spending and taxes was significant in the profit equation; it was not. Second, we checked for structural breaks in the profit equation,

[40] See Blanchard and Perotti (1998) for a paper using quarterly fiscal data on the US.

in the form of significant breaks in the constant or in the coefficients of spending and taxes in the profit equations. We also explored the possibility of structural breaks in the investment equations. In both cases, we did not find any evidence of structural breaks.

In summary, the evidence presented in this section suggests that the effect of fiscal policy (and its components) on investment is not different in "normal" times and around major fiscal adjustments. Since much of the effects of the latter on the economy go through investments, this evidence casts doubts on the need of developing special theories on the effects of large adjustments.

Finally, we have also performed the analogous experiments on episodes of loose fiscal policies. Our results (available upon request) are very similar, (with the opposite sign) to those obtained for fiscal adjustments.

7 Conclusions

This paper shows that in OECD countries changes in fiscal policy have important effects on private business investment. Interestingly, the strongest effects arise from changes in primary government spending and, especially, government wages. We provide evidence consistent with a labor market channel through which fiscal policy influences labor costs, profits, investment and, as a consequence, growth. Increases in public wages and/or employment and transfers increase wage pressure in the private sector, both in unionized and competitive labor markets. Also, workers in the private sector may react to tax hikes by asking for higher pre-tax real wages (or decreasing labor supply), once again putting pressures on profits and investment.

These effects on investment go a long way toward explaining those episodes of expansionary fiscal contractions that have recently attracted considerable attention. According to our results, the surge in private investment that accompanies the large spending cuts during these episodes is exactly what one should expect. In fact, we found very little evidence, if any at all, that private investment reacts differently during these large fiscal adjustments than in "normal" circumstances.

The driving channel of our results is the effect of fiscal policy changes on current and future expected profits. This suggests that two issues deserve further examination. One is a more thorough examination on the effects of fiscal policy on interest rates. Even though we allowed for interest rate movements, there is certainly still room for further investigation of the effect of changes (especially large ones) of the fiscal stance on interest rates. This investigation may shed additional light on the role of "credibility effects" of fiscal adjustments on interest rates. The second issue is the change in income distribution which follows large changes in the fiscal stance, and particularly, fiscal adjustments of various types. While there is ample evidence that spending cuts can be expansionary, our evidence on profits may imply that spending cuts may increase income inequality. Whether this is the case or not is an important topic for future research.

8 Data Appendix

Variables' definitions

I/K: Business investment as a share of capital stock
π: Profits gross of corporate tax payments as a share of capital stock Profits are value added in business sector minus labor costs in the business sector.
π^*: Profits net of corporate tax payments as a share of capital stock Profits are value added in business sector minus labor costs in the business sector.
S/K: Sales in the business sector as a share of the capital stock
Labor Costs in the business sector: Labor compensation rate in the business sector times total employment of the business sector. The number of the unpaid family workers are deducted from total employment of the business sector because their output is not measured. We followed Blanchard (1997) in doing this adjustment. When the number of unpaid family workers is not available from the beginning of the sample, for each country, we assume that the ratio of unpaid family workers to total employment is equal to the one in the first year for which the data are available.
WP: log of real labor compensation rate in the business sector. Labor compensation rate in the business sector (variable WSSE in the OECD database) includes total social security payments.
r: Short term nominal interest rate net of corporate tax minus one period ahead (ex-post) inflation, calculated using GDP deflator
G: Primary spending (cyclically adjusted) as a share of trend GDP. Primary spending $= TRAN + GW + GNW + GINV +$ subsidies + other net capital outlays
R: Total revenues (cyclically adjusted) as a share of trend GDP. Total revenues $= TLAB + TBUS + TIND$ +other transfers received by gov
$TRAN$: Transfers (cyclically adjusted) as a share of trend GDP
GW: wage component of current government spending on goods and services, as a share of trend GDP
GNW: non wage component of current government spending on goods and services, as a share of trend GDP
$GINV$: Government investment as a share of trend GDP
$TLAB$: Labor taxes (direct taxes on households + social security and payroll taxes, cyclically adjusted), as a share of trend GDP
$TBUS$: Direct taxes on business (cyclically adjusted) as a share of trend

GDP

$TIND$: Indirect taxes (cyclically adjusted) as a share of trend GDP

Summary statistics

	Nobs.	mean	st. dev.
I/K	635	0.07	0.03
$\tilde{\Pi}$	606	0.15	0.12
$\tilde{\Pi}^*$	601	0.14	0.11
S/K	624	0.42	0.22
r	465	0.02	0.04
G	653	0.37	0.09
R	628	0.36	0.09
$TRAN$	661	0.14	0.06
GW	653	0.11	0.03
GNW	653	0.05	0.02
$GINV$	658	0.03	0.01
$TLAB$	645	0.20	0.07
$TIND$	661	0.13	0.03
$TBUS$	640	0.03	0.01

Source: OECD.

References

[1] Abel A., O. Blanchard, (1986), The Present Value of Profits and Cyclical Movements in Investment, Econometrica, vol.54, n.2, pp. 249-273.

[2] Alesina A., S. Ardagna, (1998), Tales of Fiscal Adjustments, Economic Policy, October, 27.

[3] Alesina A., R. Perotti, J. Tavares, (1998), The Political Economy of Fiscal Adjustments, Brookings Papers on Economic Activity, Spring.

[4] Alesina A., R. Perotti, (1997a), Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects, IMF Staff Papers, June, pp. 210-248.

[5] Alesina A., R. Perotti, (1997b), The Welfare State and Competitiveness, American Economic Review, vol. 87, pp. 921-939.

[6] Alesina A., R. Perotti, (1996), Reducing Budget Deficits, Swedish Economic Policy Review, vol. 3, n.1, Spring, pp.113-138.

[7] Alesina A., R. Perotti, (1995), Fiscal Expansions and Adjustments in OECD Countries, Economic Policy n.21, pp.205-240.

[8] Ardagna S. (1999), Fiscal adjustments: Expectations versus Supply-Side, unpublished.

[9] Barro R, (1989), The Neoclassical Approach to Fiscal Policy, in Barro R. (ed), Modern Business Cycle Theory, Cambridge, Harvard University Press, pp.178-235.

[10] Barro R., X. Sala-i-Martin, (1990) World Real Interest Rtaes, NBER Macroeconomics Annual, pp. 15-74.

[11] Baxter M., R. King, (1993), Fiscal Policy in General Equilibrium, American Economic Review, June, 83, pp.315-334.

[12] Bertola G., A. Drazen, (1993), Trigger Points and Budget Cuts: Explaining the Effects of Fiscal Austerity, American Economic Review, March 1993, pp.11-26.

[13] Blanchard , O., (1997), The Medium Run, Brookings Papers on Economic Activity, Spring, pp.89-158.

[14] Blanchard , O., C. Rhee, L. Summers, (1993), The Stock Market, Profit, and Investment, Quarterly Journal of Economics, pp.115-136.

[15] Blanchard O., (1990), Comment on Giavazzi and Pagano, NBER Macroeconomics Annual 1990.

[16] Blanchard O., and R. Perotti (1999), An Empirical Investigation of the Dynamic Effects of Changes in Government Spending and Reveneus on Output, mimeo, Harvard University.

[17] Blundell R., S. Bond, M. Devereux, F. Schiantarelli, (1992), Investment and Tobin's Q: Evidence from Panel Data, Journal of Econometrics 51, pp.233-257.

[18] Bruno M., J.Sachs, (1985), The Economics of Worldwide Stagflation. Oxford: Blackwell, 1985.

[19] Caballero R., (1997), Aggregate Investment, MIT

[20] Calmfors L., H. Horn, (1986), Employment Policies and Centralized Wage-setting, Economica, 53, pp.281-302.

[21] Chirinko R., S.M. Fazzari, A. P. Meyer (1999), How Responsive is Business Capital Formation to Its User Costs? An Exploration with Micro Data, Journal of Public Economics (1999), forthcoming.

[22] Cummins J., K.A. Hasset, R.G. Hubbard, (1995), Tax Reform and Investment: A Cross-Country Comparison", Journal of Public Economics, vol 62, pp.237-273.

[23] Daveri F., G. Tabellini, (1997), Unemployment, Growth and Taxation in Industrial Countries, Bocconi University.

[24] Drazen A., (1990), Comment on Giavazzi and Pagano, NBER Macroeconomics Annual 1990.

[25] Denny K., S. Nickell, (1992), Unions and Investment in British Industry, Economic Journal, 102, pp.874-887.

[26] Devereux M, M. Keen and F. Schiantarelli (1994), Corporate Tax, Investment and the Role of Tax Asymmetries: Evidence form Company Panel Data, Journal of Public Economics, pp.395-418.

[27] Devereux M., B. Lockwood, (1991), Trade Unions, Non-Binding Wage Agreements, and capital Accumulation, European Economic Review, 35, pp. 1411-1426.

[28] Dotsey M., Mao C. S., (1994), The Effects of Fiscal Policy in a Neoclassical Growth Model, Federal Reserve Bank of Richmond, working paper 94-03.

[29] Finn M., (1998), Cyclical Effects of Government's Employment and Goods Purchases, International Economic Review, vol. 39, n.3, August (1998), pp. 635-657.

[30] Giavazzi F., T. Jappelli, M. Pagano, (1998), Searching for Non-Keynesian Effects of Fiscal Policy.

[31] Giavazzi F., M. Pagano, (1996), Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience, Swedish Economic Policy Review, vol. 3, n.1, Spring, pp.67-112.

[32] Giavazzi F., M. Pagano, (1990), Can Severe Fiscal Contractions Be Expansionary? Tales of Two Small European Countries, NBER Macroeconomics Annual 1990, pp.95-122.

[33] Gilchrist S., C. P. Himmelberg, (1995), Evidence on the Role of Cash Flow for Investment, Journal of Monetary Economics 36, pp. 541-572.

[34] Hasset K., G. Hubbard, (1996), Tax Policy and Investment, NBER working paper n. 5683.

[35] Im K., H. M. Pesaran, Y. Shin, (1995), Testing for Unit Roots in Heterogeneous Panels.

[36] Jackman R., R. Layard, S. Nickell, (1991), Unemployment, Oxford University Press.

[37] Lane P., R. Perotti, (1999), The Importance of Composition of Fiscal Policy: Evidence from Exchange Rate Regimes, mimeo, Columbia University.

[38] Ludvigson S., (1996), The Macroeconomic Effects of Government Debt in a Stochastic Growth Model, Journal of Monetary Economics, 38, pp. 25-45.

[39] Malley J., T. Moutos, (1996), Does Government Employment "Crowd-Out" Private Employment? Evidence from Sweden, Scandinavian Journal of Economics, 98(2), pp. 289-302.

[40] McDermott J., R. Wescott, (1996), An Empirical Analysis of Fiscal Adjustments, IMF Staff papers vol. 43, n.4, pp.725-753.

[41] S.J. Nickell (1978), The Investment Decisions of Firms, Cambridge University Press, Cambridge 1978.

[42] OECD, Economic Outlook, various years.

[43] OECD, Economic Surveys, various years.

[44] Olivei G., (1998), Fiscal Retrenchments and The Level of Economic Activity, Federal Reserve Bank of Boston.

[45] Olivei G., (1998), Anticipated Productivity Shocks, Investment, and the Real Interest Rate, Federal Reserve Bank of Boston.

[46] Perotti R., (1999), Fiscal Policy When Things are Going Badly, Quarterly Journal of Economics, forthcoming.

[47] Schiantarelli F., (1983), Investment Models and Expectations: Some Estimates for the Italian Industrial Sector, International Economic Review, vol.24, n.1, pp.291-312.

[48] Sutherland A., (1997), Fiscal Crises and Aggregate Demand: Can High Public Debt Reverse the Effects of Fiscal Policy?, Journal of Public Economics 65, 1997, pp.147-162.

[49] Van Der ploeg F., (1987), Trade Unions, Investment, and Employment, European Economic Review, 31, pp.1465-1492.

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Table 1: Profits: benchmark regressions.

	(1)	(2)	(3)
$\Pi_K(-1)$	0.67	0.64	0.77
	(17.45)	(16.54)	(21.17)
$\Pi_K(-2)$	0.03	0.04	0.005
	(0.94)	(1.49)	(0.18)
R	-0.09	-0.14	-0.11
	(-3.05)	(-4.73)	(-2.67)
G	-0.09	-0.08	-0.11
	(-4.31)	(-3.72)	(-3.35)
$\bar{R}^2$	0.56	0.55	0.71
$Nobs$	555	555	565

Dependent variable: marginal profit Π_K. Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π) in column 1, by average profit net of the corporate tax rate as a share of the capital stock (π^*) in column 2, by sales to capital ratio (S/K) in column 3. Variables are in levels, and detrended allowing for country specific linear and quadratic term. Revenues (R) and primary spending (G) are cyclically adjusted and in share of trend GDP. T-statistics in parenthesis.

Table 2: Profits: spending components.

	(1)	(2)	(3)	(4)
$\Pi_K(-1)$	0.69	0.66	0.71	0.70
	(17.41)	(17.27)	(18.29)	(18.11)
$\Pi_K(-2)$	0.01	0.04	0.01	0.02
	(0.50)	(1.48)	(0.43)	(0.55)
R	-0.10	-0.10	-0.10	-0.12
	(-3.19)	(-3.27)	(-3.43)	(-3.90)
$TRAN$	-0.11			
	(-2.45)			
GW		-0.43		
		(-6.33)		
GNW			-0.22	
			(-1.91)	
GI				-0.3
				(-3.29)
$\bar{R}^2$	0.55	0.58	0.55	0.56
$Nobs$	555	555	555	555

Dependent variable: marginal profit Π_K. Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π). See also notes to Table 1 and Appendix A. T-statistics in parenthesis.

Table 3: Profits: revenue components.

	(1)	(2)	(3)
$\Pi_K(-1)$	0.66	0.68	0.68
	(17.03)	(17.45)	(17.54)
$\Pi_K(-2)$	0.03	0.02	0.02
	(1.16)	(0.83)	(0.82)
G	-0.07	-0.10	-0.10
	(-3.04)	(-4.56)	(-4.70)
$TLAB$	-0.16		
	(-4.25)		
TYB		0.02	
		(0.31)	
$TIND$			-0.008
			(-0.13)
R^2	0.57	0.56	0.56
$Nobs$	555	555	555

Dependent variable: marginal profit Π_K. Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π). See also notes to Table 1 and Appendix A. T-statistics in parenthesis.

Table 4: Investment equation: benchmark regressions.

	(1)	(2)	(3)	(4)
λ	0.10	0.10	0.05	0.06
	(8.95)	(8.35)	(8.75)	(8.48)
$\lambda(-1)$	0.007	0.008	-0.005	0.05
	(0.63)	(0.68)	(-0.89)	(7.35)
$\bar{R}^2$	0.52	0.51	0.50	0.56
$AR(1)coef.$	0.39,0.78	0.49,0.80	0.43,0.77	0.50,0.80
$Nobs$	537	537	551	537

Dependent variable: investment rate (I/K). Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π) in column 1 and 4, by average profit net of the corporate tax rate as a share of the capital stock (π^*) in column 2, by sales to capital ratio (S/K) in column 3. Variables are in levels, and detrended allowing for country specific linear and quadratic term. We allow the AR(1) coefficient to differ across countries. The lowest and highest values are reported. T-statistics in parenthesis.

Table 5: Dynamic effects of fiscal shocks.

	0 yr.	1yr.	2 yrs.	3 yrs.	4 yrs.	5.yrs.	sum 0 to 5	sum 0 to 10	sum 0 to 20
				Effects of a unitary shock					
G	-.16**	-.17**	-.16**	-.13**	-.10**	-.07*	-.80**	-.95**	-.98**
R	-.07*	-.06	-.04	-.01	0.00	0.00	-.18	-.16	-.16
$Net\ effect$	-.23	-.23	-.20	-.14	-.10	-.07	-.98	-1.11	-1.14
$TRAN$	-.22**	-.24**	-.22**	-.19**	-.15**	-.11*	-1.13**	-1.34**	-1.38**
GW	-.51**	-.64**	-.58**	-.47**	-.34**	-.23*	-2.77**	-3.08**	-3.15**
$GINV$	-.39**	-.38**	-.32*	-.25*	-.18*	-.13*	-1.64*	-1.89*	-1.95*
$TLAB$	-.17**	-.18**	-.14*	-.09*	-.06	-.03	-.69*	-.74*	-.75*

See notes to Table 1 and Appendix A. ** (*) indicates that zero is outside the 95% (68%) confidence band.

Table 6: GDP in the profit equation.

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS
$\Pi_K(-1)$	0.51	0.53	0.56	0.55
	(14.98)	(12.83)	(15.76)	(15.60)
$\Pi_K(-2)$	-0.13	-0.07	-0.08	-0.09
	(-5.11)	(-2.26)	(-2.94)	(-3.33)
R	-0.08	-0.09	-0.08	-0.08
	(-3.09)	(-3.28)	(-3.21)	(-3.20)
G	-0.094	-0.11	-0.09	-0.09
	(-5.27)	(-5.49)	(-5.13)	(-5.18)
$GDPP$	0.27		0.19	0.20
	(16.05)		(8.45)	(9.39)
$GDPP(-1)$		0.15		
		(7.49)		
$\bar{R}^2$	0.70	0.60	0.69	0.69
$Nobs$	555	555	555	555

Dependent variable: marginal profit Π_K. Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π). See also notes to Table 1 and Appendix A. T-statistics in parenthesis.
$GDPP$ =(GDP-Government Consumption)/K
Instruments in (3) $\Pi_K(-1)$, $\Pi_K(-2)$, R, G, $GDP(-1)$
Instruments in (4) $\Pi_K(-1)$, $\Pi_K(-2)$, R, G, $GDP(-1)$, $R(-1)$, $G(-1)$.

Table 7: Profits, labor costs and fiscal policy.

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS	(8) 2SLS
$\Pi_K(-1)$	0.55	0.66	0.54	0.53	0.58	0.66	0.55	0.54
	(12.02)	(16.70)	(15.49)	(15.40)	(12.17)	(16.79)	(15.65)	(15.61)
$\Pi_K(-2)$	0.07	0.03	-0.08	-0.08	0.06	0.02	-0.08	-0.08
	(2.15)	(0.93)	(-2.86)	(-3.02)	(1.86)	(0.83)	(-2.85)	(-3.06)
WP	-0.19	-0.07	-0.08	-0.08	-0.16	-0.07	-0.07	-0.07
	(-6.47)	(-4.62)	(-6.00)	(-6.22)	(-4.88)	(-4.08)	(-5.27)	(-5.14)
$GDPP$			0.18	0.19			0.18	0.18
			(8.56)	(9.04)			(8.26)	(8.72)
$\bar{R}^2$	0.56	0.59	0.71	0.72	0.58	0.59	0.71	0.71
$Nobs$	555	555	555	555	555	555	555	555

Dependent variable: marginal profit $\left(\widetilde{\Pi}_K\right)$. Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π). See also notes to Table 1 and Appendix A. T-statistics in parenthesis.
WP=log of real labor compensation rate of the business sector
$GDPP$ =(GDP-Government Consumption)/K
Instruments in (1) $\Pi_K(-1)$, $\Pi_K(-2)$, GW
Instruments in (2) $\Pi_K(-1)$, $\Pi_K(-2)$, $GW, WP(-1)$
Instruments in (3) $\Pi_K(-1)$, $\Pi_K(-2)$, GW, $WP(-1)$, $GDP(-1)$
Instruments in (4) $\Pi_K(-1)$, $\Pi_K(-2)$, GW, $WP(-1)$, $GDP(-1)$, $TLAB$
Instruments in (5) $\Pi_K(-1)$, $\Pi_K(-2)$, G
Instruments in (6) $\Pi_K(-1)$, $\Pi_K(-2)$, $G, WP(-1)$
Instruments in (7) $\Pi_K(-1)$, $\Pi_K(-2)$, G, $WP(-1)$, $GDP(-1)$
Instruments in (8) $\Pi_K(-1)$, $\Pi_K(-2)$, G, $WP(-1)$, $GDP(-1)$, R.

Table 8: Labor costs and fiscal policy.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Pi_K(-1)$	-0.60	-0.02	0.29	0.31	-0.64	-0.03	0.25	0.24
	(-5.09)	(-0.21)	(2.91)	(3.16)	(-5.37)	(-0.31)	(2.54)	(2.43)
$\Pi_K(-2)$	0.14	0.08	0.26	0.25	0.20	0.10	0.27	0.27
	(1.58)	(1.24)	(3.74)	(3.60)	(2.14)	(1.59)	(3.89)	(3.90)
GW	2.28	0.81	0.92	0.82				
	(11.06)	(4.95)	(5.80)	(5.02)				
$TLAB$				0.20				
				(2.47)				
G					0.61	0.17	0.19	0.19
					(9.26)	(3.37)	(3.79)	(3.83)
R								-0.04
								(-0.62)
$WP(-1)$		0.72	0.75	0.75		0.74	0.78	0.77
		(22.46)	(23.96)	(23.79)		(23.22)	(24.56)	(23.88)
$GDPP(-1)$			-0.29	-0.29			-0.27	-0.27
			(-6.27)	(-6.31)			(-5.76)	(-5.71)
$\bar{R}^2$	0.24	0.60	0.63	0.63	0.20	0.60	0.62	0.62
$Nobs$	555	555	555	555	555	555	555	555

This table displays the first stage regressions for the corresponsing 2SLS regressions of Table 7.
Dependent variable: WP=log of real labor compensation rate of the business sector.
T-statistics in parenthesis. See Table 1 and Appendix A.

Table 9: Profits and investment: estimation in differences.

	(1)		(2)
$\Delta\Pi_K(-1)$	0.28	$\Delta\lambda$	0.01
	(7.02)		(7.97)
$\Delta\Pi_K(-2)$	0.16	$\Delta\lambda(-1)$	0.003
	(5.08)		(2.02)
ΔR	-0.28		
	(-6.61)		
ΔG	-0.17		
	(-4.35)		
$\bar{R}^2$	0.41	$\bar{R}^2$	0.12
$Nobs$	544	$Nobs$	507

Dependent variables: change in marginal profit $\Delta\Pi_K$ in column 1 and change investment rate $\Delta(I/K)$ in column 2. Change in marginal profit proxied by change in average profit gross of corporate taxes as a share of the capital stock $(\Delta\pi)$. Variables are in first differences. Country fixed effects are included. Revenues (R) and primary spending (G) are cyclically adjusted and in share of trend GDP. See also Appendix A. T-statistics in parenthesis.

Table 10: Dynamic effects of fiscal shocks: estimation in differences.

	0 yr.	1yr.	2 yrs.	3 yrs.	4 yrs.	5.yrs.	sum 0 to 5	sum 0 to 10	sum 0 to 20
				Effects of a unitary shock					
G	-.1**	-.13**	-.13**	-.14**	-.14**	-.14**	-.77**	-1.49**	-2.93**
R	-.11**	-.14**	-.15**	-.15**	-.15**	-.15**	-.87**	-1.64**	-3.19**
$Net\ effect$	-.21	-.27	-.28	-.29	-.29	-.29	-1.64	-3.13	-6.12
$TRAN$	-.06	-.08	-.08	-.09	-.09	-.09	-.48	-.95	-1.88
GW	-.35**	-.49**	-.52**	-.53**	-.54**	-.55**	-3.00**	-5.79**	-11.39**
$GINV$	-.21**	-.27**	-.29**	-.30**	-.31*	-.31*	-1.69**	-3.26**	-6.39*
$TLAB$	-.15**	-.20**	-.21**	-.21**	-.22**	-.22**	-1.20**	-2.30**	-4.50**

See notes to Table 9 and Appendix A.

** (*) indicates that zero is outside the 95% (68%) confidence band.

Table 11: Variable discount factor.

	(1)		(2)
$r(-1)$	0.45	$\lambda prof$	0.08
	(9.78)		(6.72)
$r(-2)$	-0.21	$\lambda prof(-1)$	0.03
	(-4.83)		(2.71)
R	0.27	$\lambda rint$	-0.06
	(2.98)		(-5.76)
G	-0.13	$\lambda rint$(-1)	-0.05
	(-2.10)		(-4.28)
		$\lambda ctax$	-0.007
			(-0.58)
		$\lambda ctax$(-1)	0.01
			(1.10)
$\bar{R}^2$	0.20	$\bar{R}^2$	0.59
		$AR(1) coef.$	0.48,0.80
$Nobs$	429	$Nobs$	429

Dependent variables: real ex-post interest rate $r$in column 1 and investment rate I/K in column 2. See also notes to Table 1 and Appendix A. T-statistics in parenthesis.

Table 12: Profits: revenue components, with year dummies.

	(1)	(2)	(3)	(4)
$\Pi_K(-1)$	0.69	0.68	0.70	0.69
	(17.81)	(17.37)	(17.66)	(17.81)
$\Pi_K(-2)$	0.06	0.06	0.05	0.05
	(1.95)	(2.05)	(1.72)	(1.71)
G	-0.04	-0.03	-0.06	-0.06
	(-1.75)	(-1.21)	(-2.66)	(-2.68)
R	-0.12			
	(-4.19)			
$TLAB$		-0.15		
		(-4.27)		
TYB			0.02	
			(0.36)	
$TIND$				-0.12
				(-1.97)
$\bar{R}^2$	0.66	0.66	0.65	0.65
$Nobs$	555	555	555	555

Dependent variable: marginal profit Π_K. Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π). Year dummies are included. See also notes to Table 1 and Appendix A. T-statistics in parenthesis.

Table 13: Profits: spending components, with year dummies.

	(1)	(2)	(3)	(4)
$\Pi_K(-1)$	0.69	0.67	0.69	0.69
	(17.84)	(17.51)	(17.92)	(17.71)
$\Pi_K(-2)$	0.05	0.07	0.05	0.05
	(1.77)	(2.39)	(1.76)	(1.89)
R	-0.13	-0.12	-0.13	-0.13
	(-4.50)	(-4.05)	(-4.70)	(-4.76)
$TRAN$	-0.006			
	(-0.12)			
GW		-0.29		
		(-4.15)		
GNW			-0.001	
			(-0.01)	
GI				-0.18
				(-2.04)
$\bar{R}^2$	0.66	0.67	0.66	0.66
$Nobs$	555	555	555	555

Dependent variable: marginal profit Π_K. Marginal profit proxied by average profit gross of corporate taxes as a share of the capital stock (π). Year dummies are included. See also notes to Table 1 and Appendix A. T-statistics in parenthesis.

Table 14: Investment equation and financial constraints.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
π^*	-0.04						
	(-0.54)						
$\pi^*(-1)$		0.07					
		(1.78)					
λ	0.09	0.07					
	(5.73)	(3.69)					
$\lambda(-1)$	0.03	0.04					
	(1.64)	(0.40)					
$E_{t-1}[\pi_t]$			0.30			0.25	0.25
			(9.38)			(3.56)	(2.38)
$Lag(E_{t-1}[\pi_t])$			-0.005			0.01	-0.05
			(-0.16)			(0.18)	(-0.46)
$E_{t-1}\left[\sum_{j=a}^{b}\beta^j\pi_{t+j}\right]$				0.18	0.14	0.03	0.04
				(9.26)	(9.14)	(0.85)	(0.52)
$LagE_{t-1}\left[\sum_{j=a}^{b}\beta^j\pi_{t+j}\right]$				0.002	0.005	-0.006	0.04
				(0.13)	(0.34)	(0.85)	(0.47)
$AR(1)coef.$	0.45	0.47	0.46,	0.48,	0.46,	0.41,	0.41,
	0.80	0.79	0.73	0.73	0.73	0.78	0.77
$Nobs$	537	537	537	537	537	537	537

Dep. var: Investment rate=(I/K)
(1) Instruments: G, G(-1), R, R(-1), λ, λ(-1), $\pi_K(-1)$
(4) $a = 0, b = 1$
(5) $a = 0, b = 2$
(6) $a = 1, b \to \infty$
(7) $a = 1, b = 2$
T-statistics in parenthesis. See Table 1 and Appendix A.

Table 15: Fiscal adjustments: Fiscal policy and macroeconomic indicators.

	Expansionary				Contractionary			
	Bef.	Dur.	Aft.	Aft.-Bef	Bef.	Dur.	Aft.	Aft.-Bef.
Primary Spending	42.96	41.71	41.36	-1.60	40.32	40.24	40.15	-0.17
	(1.43)	(1.42)	(1.35)	*	(1.36)	(1.37)	(1.40)	
Total Revenue	40.10	41.42	41.57	1.47	36.97	39.03	39.65	2.69
	(1.45)	(1.43)	(1.41)	*	(1.48)	(1.51)	(1.58)	*
GDP Growth rate	-0.79	-0.45	-0.19	0.60	0.82	-1.12	-0.86	-1.68
(deviation from G7)	(0.24)	(0.33)	(0.31)		(0.40)	(0.44)	(0.28)	*
GDP Growth rate	1.31	2.65	3.41	2.10	3.73	1.34	1.91	-1.82
	(0.24)	(0.39)	(0.29)	*	(0.37)	(0.34)	(0.27)	*
Δ Priv.Consumption	1.16	2.30	3.03	1.87	3.76	1.19	1.84	-1.93
	(0.36)	(0.38)	(0.30)	*	(0.55)	(0.45)	(0.31)	*
Δ Bus.Investment	-0.36	3.49	5.24	5.60	4.59	-0.39	0.29	-4.30
	(0.99)	(1.24)	(1.13)	*	(1.22)	(1.60)	(1.31)	*
Contribution to real GDP Growth from								
Priv.Consumption	51.37	51.09	51.82	0.45	58.41	48.92	57.78	-0.63
Bus.Investment	-6.55	16.44	17.17	23.72	13.40	-7.22	-0.84	-14.23
Residen.Investment	-23.78	0.19	2.90	26.69	4.88	-7.07	1.15	-3.73
Stockbuilding	-16.08	1.58	7.60	23.68	2.12	2.16	-12.28	-14.39
Net Export	69.36	29.60	4.08	-65.28	-2.33	30.60	37.04	39.37
Gov.Consumption	28.28	6.37	12.71	-15.57	17.95	27.25	20.01	2.06
Gov.Investment	-6.86	-6.94	2.23	9.09	3.54	-10.95	-4.86	-8.40

Source OECD: Primary Spending and Total Revenue are in share of trend GDP and cyclically adjusted. GDP Growth rate(G7) is real GDP growth in deviation from the average (GDP weights) G7 real growth rate. ΔPriv.Consumption and ΔBus.Investment are growth rate of real private consumption and real business investment. The contributions to real GDP growth from the different GDP components have been calculated using the following formula.
Let sh= the contribution to real GDP growth from the X component:

$$sh = \frac{\sum_j [((X_{jt}-X_{jt-1})/X_{jt-1})*X_{jt-1}/GDP_{jt-1}]}{\sum_j [(GDP_{jt}-GDP_{jt-1})/GDP_{jt-1}]}$$

An episode of fiscal adjustment is expansionary (contractionary) if the primary cyclically adjusted balance as a share of trend GDP improves by at least 2% in one year or by 1.25% in two consecutive years and the average real GDP growth in each adjustment year and in the two years after is greater (lower) than the average real GDP growth in the two years before.

Table 16: Business Investment around fiscal adjustments.

	Expansionary				Contractionary			
	Bef. (a)	Dur. (b)	Aft. (c)	Diff. (c-a)	Bef. (a)	Dur. (b)	Aft. (c)	Diff. (c-a)
Data								
GDP Growth rate	1.31	2.65	3.41	2.10	3.73	1.34	1.91	-1.82
	(0.24)	(0.39)	(0.29)	*	(0.37)	(0.34)	(0.27)	*
Δ Bus.Investment	-0.36	3.49	5.24	5.60	4.59	-0.39	0.29	-4.30
	(0.99)	(1.24)	(1.13)	*	(1.22)	(1.60)	(1.31)	*
Bus.Investment contribution to GDP Growth	-6.55	16.44	17.17	23.72	13.40	-7.22	-0.84	-14.23
Benchmark model								
Δ Bus.Investment	1.01	2.35	4.05	3.04	2.64	4.56	0.08	-2.56
Bus.Investment contribution to GDP Growth	7.11	10.03	13.12	6.01	6.97	41.13	-0.06	-7.04
Model with GDP and variable discount factor								
Δ Bus.Investment	0.06	-0.59	4.19	4.13	3.85	2.82	-0.83	-4.68
Bus.Investment contribution to GDP Growth	-2.50	-4.83	13.12	15.62	11.82	26.79	-5.86	-17.69

See Table 15.

Figure 1

Effect of an increase in public employment, labor taxes, or unemployment benefits