Fiscal Policy and Business Cycles: An Empirical Investigation

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Abstract This paper presents an empirical study of the effects of fiscal policy. We analyze the importance of automatic stabilizers as well as the dynamic effects of discretionary fiscal policy. We present strong evidence in favor of the hypothesis that large governments reduce the volatility of output (total or private). The result is robust to the introduction of controls and the adjustment for possible endogeneity problems. In the second part of the paper we review different methods of identification of discretionary fiscal policy shocks. We find strong and persistent effects of changes in fiscal policy on economic activity.

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1.- Introduction

There has been renewed interest in public debates in the United States, Europe or Japan about the role of fiscal policy. In the United States the discussions on the Balance Budget Amendment have questioned the role of fiscal policy as a tool to stabilize business cycle fluctuations. In Europe, because of the creation of a single currency area and the disappearance of national monetary policies, there has been a debate around whether national fiscal policies can be substitutes for monetary policy and, if not, whether a supranational fiscal federation should be created for that purpose. In Japan, the government has repeatedly used expansionary fiscal policy to boost the economy and there is no consensus on whether it had any significant effects on the economy.

This paper conducts an empirical study of the effects of fiscal policy. We focus our analysis on two separate issues motivated by the above public debates. First, we look at fiscal policy as an automatic stabilizer. We want to understand the extent to which fiscal policy helps stabilizing business cycle fluctuations. We look at data from OECD countries to assess the effects that governments have on the volatility of output. These estimates should provide a benchmark for the discussion of national fiscal policies in the countries members of EMU. The second part of the paper looks into the dynamic effects of discretionary changes in fiscal policy. We construct a measure of discretionary fiscal policy and describe the estimated effects in the economy.

The paper is organized as follows. Section 2 presents some basic stylized facts for fiscal variables for a sample of 20 OECD economies. Section 3 discusses the effects of automatic stabilizers. Section 4 studies the dynamic effects of discretionary policy using quarterly data from the U.S. Section 5 concludes.

2.- Some Stylized Facts

In this section we present some basic statistics on fiscal variables for a sample of 20 OECD economies for which data on different components of fiscal policy are available.[1] Table 1 shows the average size of some of the variables during our sample (1960-1997). As it is clear from the table, there are large cross country differences with respect to the size and composition of the government. Also, with

[1] See the appendix for data sources and definitions of variables used.

Table 1. Size of Government

	Taxes		Transfers		Expenditures	
Country	1960-78	1960-97	1960-78	1960-97	1960-78	1960-97
Germany	38.1	40.9	15.4	17.5	37.6	40.9
France	37.6	41.8	17.1	20.8	38.0	43.3
Italy	28.2	33.9	13.0	15.8	32.2	36.5
Netherlands	40.5	44.2	21.0	25.6	23.9	36.6
Belgium	37.5	43.3	10.6	18.6	23.8	35.9
U.K.	29.2	32.5	8.9	11.3	32.5	35.1
Ireland	18.4	27.1	12.4	15.2	22.8	30.2
Denmark	36.2	44.0	13.9	18.6	35.9	44.0
Spain	21.6	29.0	8.4	12.7	21.7	30.1
Greece	20.9	25.3	8.7	11.6	23.4	28.4
Portugal	19.5	26.8	4.8	8.8	21.3	28.0
U.S.	28.2	29.2	7.9	10.1	30.2	31.6
Canada	28.9	31.7	8.2	10.6	30.0	33.7
Japan	20.2	24.3	5.7	8.9	19.9	24.1
Australia	24.1	27.1	7.1	9.3	26.0	29.6
Norway	35.1	39.7	10.5	13.8	33.8	39.3
Sweden	41.8	47.6	12.7	17.8	37.2	47.5
Finland	34.0	39.3	9.5	14.3	30.8	38.5
Switzerland	29.9	34.5	11.1	14.9	29.0	34.3
Austria	36.6	41.0	15.8	18.3	37.5	41.6

All numbers are % of GDP.

no exception, governments have increased their share of GDP in the second half of our sample period.

How do these variables behave over the business cycle? We have run regressions of some of the components of fiscal policy on the growth rate of GDP.

$$z_{it} = \alpha_i + \beta \, \Delta y_{it} + \nu_{it}$$

Where z represent the fiscal variable and y GDP.[2] Although we have tested different specifications for detrending, the results presented in the paper correspond to the case where both fiscal variables and GDP appear in growth rates, with the exception of the primary deficit, which is expressed as a ratio of GDP. Similar regressions using detrended logs produce very little change in the results. Table 2 shows the results of pooling all the data.[3]

Looking at the coefficients of different components, revenues are clearly pro-

[2] All variables are real, deflated using the GDP delfator.

[3] We run the pooled regression using fixed effects.

Table 2. Cyclicality of Fiscal Variables

$$z_{it} = \alpha_i + \beta\, \Delta y_{it} + \nu_{it}$$

Dependent Variable	β	R^2
Revenues	0.82	0.35
	(0.05)	
Expenditures	0.03	0.13
	(0.005)	
Primary Deficit/GDP (*)	-0.26	0.30
	(0.04)	
Taxes net of Transfers	1.42	0.24
	(0.09)	
Disposable Income	0.70	0.46
	(0.03)	

Sample: 1960-1997. All variables in growth rates except for (*)
Standard errors in parentheses
Pooled regression, $N = 20$, $T = 38$.

cyclical while expenditures are acyclical. For example, a 1% increase in output raises revenues by 0.8% and expenditures by only 0.03%. The primary deficit (measured as a ratio to GDP) decreases by 0.26 percentage points.

Rows 4 and 5 present evidence on the stabilization effect of taxes and transfers on disposable income. The variable taxes net of transfers has the largest elasticity with respect to GDP changes. A 1% increase in output raises taxes net of transfers by approximately 1.42%. This is further corroborated by the last row, which shows that a 1% increase in output translates into 0.70% increase in disposable income. In other words, the behavior of taxes and transfers over the business cycle help smoothing disposable income. This result is comparable to the estimates of Bayoumi and Masson (1995) in regressions similar to the ones of Table 2.[4]

We have also performed all the above regressions by countries. Qualitatively the results are identical for all countries but there are differences in the response of some of the fiscal variables to changes in GDP. Later in the paper we explore some of the implications of these differences.

3.- Fiscal Policy: Automatic Stabilizers

3.1 Introduction

[4] Also, Asdrubali et al. (1996), in the context of analyzing the insurance provided by the federal budget, show how taxes and transfers smooth output fluctuations.

In this section we explore the empirical effects of automatic stabilizers. Although there are several papers in the literature that look at the the theoretical effects of automatic stabilizers and the trade off between stabilization and efficiency, few of them present empirical evidence.[5] We now review the literature before we present our empirical estimates.

3.2 Literature Review

In most macroeconomics textbooks, fiscal policy is introduced when the concept of automatic stabilizers is presented in the Keynesian-cross model of output determination. Automatic changes in government revenues in response to output fluctuations help smoothing business cycles through the traditional demand multiplier. In this model, the key to stabilization is the smoothing effect of taxes on disposable income. In its simplest form, and assuming a proportional tax, which means that average and marginal tax rates are the same, the size of total taxes is a good proxy for the degree of automatic stabilizers.

In a dynamic framework, these effects can vanish as long as the assumptions of Ricardian equivalence are satisified. In a non-Ricardian world, however, one can think about the benefits of automatic stabilizers taking place through the effects they have on the volatility of disposable income and how this helps to smooth consumption. There are several recent empirical analysis that have shown how the U.S. fiscal budget plays an important role in this respect. Most of these papers are part of the debate on the lessons for the future EMU of the stabilization benefits provided by the U.S. federal budget.[6] These studies have focused their analysis in how taxes and transfers smooth disposable income ignoring the possible effects on GDP.

In a market-clearing dynamic general equilibrium model the role of automatic stabilizers is more intricate. The demand multiplier of static models based on the Keynesian cross is not present as such and the effects of automatic stabilizers take place mainly through the impact that they have on the elasticity of labor supply. Most of the stochastic RBC models that study the role of fiscal policy do not specifically analyze the role of automatic stabilizers but they measure the

[5] For a theoretical analyis of automatic stabilizers see, for example, Christiano (1984). Gali (1994) tests empirically the predictions of RBC models regarding the relationship between government size and volatility.

[6] See Sachs and Sala-i-Martin (1992), von Hagen (1992), Fatás (1998) or Asdrubali et al. (1996).

impact of government policies on the volatility of business cycles. In general, the results of these models depend on the relative strength of two different effects. A larger government reduces private wealth and, as a result, decreases the elasticity of labor supply to exogenous shocks. At the same time, a large government, through the distortions caused by higher taxes, reduces steady-state employment which results in a higher elasticity of labor supply.

Gali (1994) calibrates an RBC model to measure the effect of government size on macroeconomic stability. For plausible parameter values, the effect on steady-state employment dominates the wealth effect and larger governments tend to destabilize the business cycle. In that sense, if one identifies automatic stabilizers with the share of government expenditures (or revenues) in GDP, these results question the positive effects of automatic stabilizers. Although one could introduce several elements that could rescue the role of automatic stabilizers, the stylized model of Gali (1994) is a good illustration on the difficulties of justifying the effects of automatic stabilizers in a stochastic general equilibrium model.

3.3 Does Fiscal Policy Stabilize Output Fluctuations?

In this section we want to assess the effectiveness of automatic stabilizers. Do automatic stabilizers help smoothing business cycles? And if the answer is positive, do countries that are exposed to more volatile business cycle make more use of these tools?

To answer the first question we could possibly take two approaches. We can build and estimate a dynamic model of the economy that includes the behavior of automatic stabilizers and then study the counterfactual of measuring output volatility if automatic stabilizers did not exist.[7] We do not follow this approach here but instead we look, in a cross section of countries, for a measure of the degree of automatic stabilizers that we correlate to variables that characterize the volatility of the business cycle.

In our analysis we use several measures that intend to capture the strength of automatic stabilizers starting with the simplest one: the size of governments. Although this is a very crude measure of automatic stabilizers it has several advantages. First, it is easy to measure and therefore can be easily used for cross-country comparisons. Second, although from a theoretical point of view what matters is the response of taxes and transfers to economic shocks, empirically this

[7] This is the approach of Cohen and Follette (1999).

response is very much linked to the size of governments.[8]

Figure 1 plots the volatility of GDP (measured as the standard deviation of real GDP growth) for 20 OECD economies against the share of government expenditures in GDP. The size of the government is inversely related to the volatility of business cycles.

[Insert Figure 1 about here]

Table 3 presents the cross section regression of the volatility of real GDP growth on three alternative measures of the size of the government: expenditures, taxes and transfers.[9] In all cases the fit is good (with R^2 over 0.4 for the case of government expenditures) and the coefficient is significant and large. It is interesting to see that the three measures of government size perform well and, therefore, we cannot associate the stabilization effects to a single component of government expenditures or taxes.

Table 3. Size of Government and Volatility

$\sigma(\Delta y)_i = \alpha + \beta\,\text{Govt.Size}_i + \nu_i$

Variable	β	R^2
Expenditures	-1.805	0.43
	(0.386)	
Revenues	-1.527	0.38
	(0.444)	
Transfers	-0.777	0.19
	(0.283)	

Sample: 1960-1997
Standard errors in parentheses

What about the correlation between government size and the volatility of other measures of economic activity? Looking at other measures of economic activity such as disposable income or consumption can help us understand the

[8] van der Noord (2000) presents evidence for OECD countries and Fatás and Mihov (forthcoming) for US States on the connection between government size and the cyclical elasticity of fiscal variables.

[9] In all the regressions we use the logarithm of government size, measured as a ratio to GDP. We use logarithms to argue that an increase of government size from 5 to 10 % of GDP has a larger effect on volatility than the increase between, say, 40 and 45%. Logarithmic transformation might be seens as somewhat extreme, but in all regressions reported in the paper, we do find that this transformation is not critical for our conclusions.

mechanisms through which automatic stabilizers operate. A priori we expect the effects of automatic stabilizers to be larger on disposable income.

Tables 4 and 5 display the results of using different measures of volatility of economic activity.[10] Surprisingly, there is no evidence that the reduction in volatility is larger when we look at disposable income or consumption.

Table 4. Size of Government and Volatility of Disposable Income

$\sigma(\Delta y^d)_i = \alpha + \beta\,\text{Govt. Size}_i + \nu_i$

Variable	β	R^2
Expenditures	-0.888	0.03
	(0.630)	
Revenues	-0.645	0.00
	(0.703)	
Transfers	-0.319	0.03
	(0.431)	

Sample: 1960-1997
Standard errors in parentheses

Table 5. Size of Government and Volatility of Consumption

$\sigma(\Delta c)_i = \alpha + \beta\,\text{Govt. Size}_i + \nu_i$

Variable	β	R^2
Expenditures	-1.259	0.07
	(0.848)	
Revenues	-0.902	0.02
	(0.838)	
Transfers	-0.649	0.03
	(0.624)	

Sample: 1960-1997
Standard errors in parentheses

There is a negative correlation between the size of the government and the volatility of disposable income but the relationship is weaker than when using GDP. Although the size of the coefficient is practically identical to the regressions using GDP, both the fit of the regression and the significance of the coefficient are much lower. Same is true for consumption.

[10] Volatility is again measured as the standard deviation of the growth rate.

Table 6. Size of Government and Volatility of Private Output

$\sigma(\Delta y)^p = \alpha + \beta\,\text{Govt. Size}_i + \nu_i$

Variable	β	R^2
Expenditures	-1.616	0.27
	(0.408)	
Revenues	-1.339	0.22
	(0.474)	
Transfers	-0.972	0.26
	(0.239)	

Sample: 1960-1997
Standard errors in parentheses

What drives the negative correlation between the volatility of GDP and the size of the government? Is is simply due to the fact that the government sector is more stable, less subject to fluctuations? If this was the case, the explanation would be very mechanical: a larger share on GDP simply reduces the volatility of total output without affecting the volatility of the rest of the economy.

[Insert Figure 2 about here]

Figure 2 plots the volatility of private GDP (measured as GDP minus government expenditures) against the size of the government. Surprisingly, the relationship still holds and the size of the coefficient is indeed very similar. In fact, with the exception of three data points (Denmark, Finland and Sweden) all countries lie very much in a straight line. This confirms that the stabilizing effects or larger governments spread to the private sector and are not simply due to the larger control of resources by a safe and stable government sector.

3.4 What Does Government Size Capture?

Taking as a starting point the results of the previous tables, we now introduce in our analysis more direct measures of fiscal policy in order to understand the economic mechanisms behind the negative correlation between the size of the government and the volatility of output.

We also want to know whether the size of the government is capturing automatic stabilizers or discretionary fiscal policy. The answer to this question depends on what we include in the definition of automatic stabilizers. A narrow definition of automatic stabilizers would only include changes associated to auto-

matic mechanisms built into the tax/transfer system. One of these mechanisms is the progresivity of taxes. If taxes are progressive, a 1% increase in income will increase taxes by more than 1% and, as a result, disposable income will increase by less than 1%.

We use marginal tax rates on labor as a direct measure of automatic stabilizers and check how their cross-country variation relates to the above results.[11] The first thing to notice is that there is a strong correlation between average and marginal tax rates ($\rho = 0.76$).

As expected, a regression of the volatility of GDP on the marginal tax rate produces a negative and significant coefficient. If one includes in the regression both the average and marginal tax rate, it is difficult to conclude which one of the two is more relevant. In general, one finds that the coefficient for the average tax or, more generally, the size of the government, has higher t-statistics. In most specifications, due to the high collinearity, both coefficients become not significant. Table 7 shows the results using government expenditures as the measure of the size of the government.

Table 7. Marginal Tax Rate and Volatility of Output

$$\sigma(\Delta y)_i = \alpha + \beta_1 \, \tau_i^m + \beta_2 \, \text{Government Size}_i + \nu_i$$

Regression	β_1	β_2	R^2
(1)	-1.127		0.20
	(0.458)		
(2)	-0.555	-2.091	0.36
	(0.626)	(0.599)	

Sample: 1960-1997
Standard errors in parentheses
τ^m: Marginal Tax Rate

We now take a broader view on automatic stabilizers and include any change in fiscal variables related to business cycles. The goal is to construct a measure of the responsiveness of fiscal policy to cyclical conditions and see whether this measure is responsible for the correlation between size of government and volatility of GDP.

We measure responsiveness of fiscal policy as the elasticity of fiscal variables to GDP changes. We use the coefficients from regressing, for each country, the

[11] Our measure of marginal tax rates is the marginal tax rate on labor for a single worker as calculated in McKee et al. (1986). The value corresponds to the year 1983.

growth rate of fiscal variables on the growth rate of GDP. More precisely, we run for each country regressions similar to the one presented in Table 2.

$$\text{Fiscal Indicator} = \alpha + \delta\, \Delta y_t + \epsilon_t \tag{1}$$

Where we use as fiscal indicator the primary deficit.[12] We then use the estimate $\hat{\delta}$ for each country as a measure of how responsive fiscal policy is.[13]

The first thing to notice is that the correlation between the size of the government and the responsiveness of fiscal variables ($\hat{\delta}$) is positive but moderate in size. For example, the cross-country correlation between the average ratio expenditures to GDP and the estimates ($\hat{\delta}$) is less than 0.5.

When we regress the volatility of GDP on ($\hat{\delta}$) the significance and fit of the regression are poor. If, in addition, we include in the regression the size of the government as an explanatory variable, we find that the size of the government always comes always as significant and its coefficient is similar to the results of Table 3.

Table 8. Responsiveness of Fiscal Policy and Volatility of Output

$\sigma(\Delta y)_i = \alpha + \beta_1\, \hat{\delta}_i + \beta_2\, (G/Y)_i + \nu_i$

Regression	β_1	β_2	R^2
(1)	-0.379		0.06
	(0.245)		
(2)	0.141	-1.702	0.42
	(0.182)	(0.382)	

Sample: 1960-1997
Standard errors in parentheses

[12] We have also tried the elasticity of taxes or government expenditures and obtained similar results.

[13] We are aware that this regression is subject to many criticisms and possible bias. First of all, there is a very serious issue of endogeneity. Using lagged values of output as instrumental variables does not change the results reported below but it is unclear whether lagged values are good instruments for such a regression. Second, and as suggested by our referee, in the presence of trends to structural budget balances, the above regression is mispecified. We therefore the results from this analysis should be considered as merely suggestive and we are only reporting them because there is a large literature that has relied on estimates as the ones of equation 1 above.

There are two ways of interpreting this lack of correlation between responsiveness of fiscal policy and volatility. First, it can be that our measure of responsiveness is a very imperfect measure of automatic stabilizers. Second, it could be that the stabilizing properties that large governments have are unrelated to the ones captured by those elasticities. One possibility, which moves us away from the notion of automatic stabilizers, is that what the size of the government is capturing is the use of discretionary fiscal policy. Large governments are maybe more likely to intervene to stabilize output.[14] Of course, this assumes that discretionary fiscal policy is succesful on stabilizing output.[15]

3.5 Can Other Variables Explain the Correlation between Government Size and Volatility

Table 9. Government Size and Volatility with controls.

Dependent Variable:	Volatility (1)	GDP (2)	Growth (3)
Govt. Expenditures	-1.805	-2.261	-1.728
	(3.99)	(3.80)	(2.11)
Openness	-	0.272	-0.026
		(1.17)	(0.08)
GDP Per Capita	-		-0.713
			(1.38)
GDP	-		-0.046
			(0.41)
Growth	-		-0.089
			(0.49)
Adjusted R^2	0.439	0.450	0.455

Sample: 1960-1997.
t-statistics in parentheses

The results of the regressions of previous tables have shown that there is a strong negative relationship between government size and the volatility of out-

[14] This is also suggested in Gali (1994).

[15] Notice also that, as argued above, part of this type of discretionary fiscal policy might be already captured in the elasticity of fiscal variables to output.

put. These results are suggestive, but not completely reliable. There might be additional variables that affect both volatility and government size, and what we have reported so far is simply an indirect correlation between volatility and government size.

Table 9 adds several controls in the basic regression of Table 3. Column (1) presents the same coefficient as the one in Table 3.[16] Column (2) of Table 9 includes openness as a control. myfootnoteOpenness is measured as the average sum of exports and imports relative to GDP for the period 1960-1997. Rodrik (1998) suggests that omitting openness from our basic regression would produce a bias towards zero in the coefficient on government size. The reason is that riskier economies would indeed chose larger governments in order to provide enough insurance against the additional risk. Column (2) seems to support this view. The coefficient has increased in absolute value. One has to be careful interpreting this regression given that the argument of Rodrik (1998) goes beyond the need to control for openness and it requires taking seriously the issue of endogeneity. We deal with this issue later in the paper by using instrumental variables.

Column (3) adds three additional controls: GDP per capita, GDP, and average growth over the sample period (Growth). These three basic controls can be correlated with both volatility and government size. First of all, richer countries tend to have larger governments because of the elasticity of government services with respect to income per capita (Wagner's Law) and an argument could be made about the possibility that richer economies are less volatile because of more developed financial systems. Size of the economy, captured by GDP, can also be related to government size and volatility. As long as there is a fixed cost of setting up a government, smaller countries might have larger governments. The fact that size could also be related to volatility means that we need to control for it.[17] Finally, government size and the tax distortions can affect growth, which can be a determinant of volatility. Column (3) in Table 9 shows that the introduction of these three controls does not change our basic result. Moreover, none of the controls are significant.

In Table 10 we report the robustness of our results to further variations of the benchmark specification. First, we introduce two additional controls. A measure

[16] In Table 9 we focus our analysis on government expenditures as a measure of government size because it seems to be the variable with the strongest results.

[17] We discuss later the determinants of government size and elaborate further on these two controls.

of sectoral specialization based on Krugman (1991), which captures differences in sectoral shares across countries.[18] The second one is the standard deviation of the log-changes in terms of trade (ToT6097), a variable used by Rodrik (1998) as a direct measure of the additional volatility associated to openness. Although there is no obvious theoretical explanation of why the absence of these controls should bias our basic regression, we have included them to minimize the chance of having spurious estimate of the stabilizing role of government spending. In both cases, the coefficient on government size is significant and of similar size as in previous regressions.

Column (3) in Table 10 addresses the issue of possible non-linearities in the effects of fiscal policy when governments are highly indebted. By including an interaction term between government size and the debt-to-GDP ratio (Debt*GY), we attempt to establish whether the stabilizing effect of government spending decreases as the debt-to-GDP ratio increases.[19] The results are mildly supportive of this conjecture as the coefficient is positive, although not significant at conventional levels.

Finally, columns (4) and (5) check the robustness of our result for alternative detrending methods. In this case we calculate volatility as the standard deviation of business cycle fluctuations as implied by GDP series detrended using a Hodrick-Prescott filter. Column (5) differs from column (4) by excluding the years 1991-1997 for Finland. The coefficient on government size is still in the vicinity of -2 for both specifications, but the striking improvement in the fit of the regression suggests that the large economic downturn in Finland associated with the collapse of the Soviet Union in the early 90's cannot be properly tackled by the Hodrick-Prescott filter. In both cases, columns (4) and (5), the coefficient remains significant and close in magnitude to our previous estimates. myfootnoteWe have also checked for the robustness of our results from previous tables to the detrending method. Using the Hodrick-Prescott filter does not alter significantly any of our results.

3.6 Endogeneity of Government Size

As argued by Rodrik (1998), the size of government is endogenous to economic conditions, which casts doubts both on the unbiasedness and consistency

[18] The data appendix describes the construction of this variable. It is calculated with 1991 data on sectoral production.

[19] We have used the average debt-to-GDP ratio for the period 1990-97.

Table 10 Government Size and Volatility: Additional Controls.

Dependent Variable:	Volatility		GDP Growth		
	(1)	(2)	(3)	(4)	(5)
Govt. Expenditures	-2.586	-2.344	-2.575	-1.912	-1.964
	(-4.02)	(-3.04)	(-4.02)	(-2.97)	(-4.96)
Openness	0.391	0.281	0.148	0.382	0.369
	(1.69)	(1.15)	(0.58)	(1.51)	(2.37)
Specialization	-0.328	-	-	-	-
	(-1.33)				
ToT6097	-	-0.027	-	-	-
		(-0.18)			
Debt*GY	-	-	0.112	-	-
			(1.45)		
Adjusted R^2	0.492	0.417	0.479	0.273	0.557

Sample: 1960-1997.
t-statistics in parentheses
All regressions include an intercept.

properties of our estimator. If governments stabilize business cycles, economies that are inherently more volatile might end up choosing larger governments. This is the main argument of Rodrik (1998) who emphasizes the link between openness and volatility and therefore government size. To deal with these problems of endogeneity we need to find instruments for government size. Here, we use the political economy frameworks of Rodrik (1998), Alesina and Wacziarg (1998), and Persson and Tabellini (1998).

To determine the sources of endogeneity and to be able to create a list of exogenous instrumental variables, we explore first the determinants of government size. Table 11 reports regressions of government size on openness and several political and economic variables that can serve as instruments. The first column presents a Rodrik-type regression of government expenditures on openness, real GDP per capita, dependency ratio in 1990, and urbanization in 1990. The justification for the initial set of explanatory variables is as follows. Openness affects the size of the government sector for reasons already discussed in the previous section. Namely, faced with higher volatility implied by greater openness, households will vote for an increase in the size of the government sector in order to

minimize their exposure to risk. Turning now to the GDP per capita, according to the Wagner's Law richer countries can afford larger government sectors because some public goods are considered to be income elastic. Finally, the urbanization rate and the dependency ratio are standard determinants of government spending, as countries with larger non-urban population are expected to face bigger costs in providing public goods and also government spending increases with the rise in the ratio of retirees to working-age population. Relative to Rodrik's regression we have slightly changed the time frame with openness being measured as the average sum of exports and imports relative to GDP for the period 1960-1969 and government size is the average for 1970-1997. The results are robust to alternative choices of average openness and average size. Openness enters with the expected positive sign and it is statistically significant at better than 1% level.

Table 11. Determinants of Government Size

Dependent Variable: Government Expenditures	(1)	(2)	(3)
Open6069	0.200	0.167	0.101
	(3.50)	(1.63)	(0.98)
GDP per capita	0.286	0.311	0.623
	(1.75)	(1.73)	(2.58)
Dependency	0.453	0.397	0.724
	(1.18)	(0.95)	(1.62)
Urbanization	0.109	0.138	0.017
	(0.69)	(0.77)	(0.09)
GDP	-	-0.021	-0.011
		(-0.39)	(-0.22)
Presidential	-	-	-0.236
			(-1.58)
Majoritarian	-	-	-0.132
			(-1.36)
Adjusted R^2	0.446	0.413	0.476

Sample: 1960-1997.
t-statistics in parentheses
All regressions include an intercept.

The second column controls for country size by including real GDP. This re-

gression is in the spirit of the work of Alesina and different coauthors (Alesina and Wacziarg (1998), Alesina and Spolaore (1997) and Alesina, Spolaore and Wacziarg (1997)) who also argue that the size of government is endogenous and determined by politico-economic factors. In particular, Alesina and Spolaore (1997) argue that there are fixed costs in setting up governments. This suggests that smaller countries will have larger governments as percentage of GDP. Alesina, Spolaore and Wacziarg (1997) provide a theoretical justification for the well-documented negative correlation between country size and openness: Larger countries can afford not to trade with the rest of the world because their market size can ensure sufficiently high productivity. Hence country size is a joint determinant of both the size of government spending and of the degree of economic openness. Indeed, in a regression controlling for the size of the country the significance of the coefficient on openness is much smaller, thereby confirming the conjecture of Alesina and Wacziarg (1998) that country size might partially account for the correlation between openness and government size. Finally, the third column in Table 11 includes two dummy variables suggested by Persson and Tabellini (1998). The first one controls for the type of the political system – presidential or parliamentary – and takes a value of one for countries with presidential democracies. The second dummy controls for the type of the electoral system – majoritarian versus proportional – and it takes a value of one for countries that have majoritarian elections. Persson and Tabellini (1998) argue that the direct accountability of politicians in presidential systems increases the competition both among politicians and voters and this implies less spending on every budget item and smaller governments. Furthermore, competition for voters in a majoritarian system targets the swing voter and creates incentives for more redistribution at the expense of the provision of public goods. Hence majoritarian systems should be associated with smaller spending on public goods. Both of these variables enter the regression with the expected sign, albeit both of them are insignificant. Yet, there is a significant improvement in the fit of the regression from 41.3% to 47.6%. The inclusion of these variables further reduces the magnitude and the significance of the coefficient on openness.[20]

[20] Rodrik (1998) is aware of the fact that his results do not survive in the OECD sample once controls for government size are included. Our point here is not to judge the sensitivity of his results in different samples, but to find an appropriate set of instrumental variables for government size that is reasonably exogenous and does not suffer from problems associated with weak instruments. Clearly the regressors in column (3) provide one possible list of instrumental variables.

To deal with endogeneity, we can use the regressors from column (3) in Table 11 as instruments for government size. In that list of potential instruments we replace past openness with area and distance because past openness might not be an appropriate instrument if the cross-sectional variation in openness does not exhibit time variation.[21] Table 12 presents the results. Column (1) shows the basic regression while Column (2) introduces openness as a control. In both cases, the coefficient on government size is significant and, as expected, its size is always larger than in the OLS regressions. This increase suggests that taking care of the bias related to endogeneity improves our estimates.

Table 12. Government Size and Volatility.
Estimation by Instrumental Variables

Dependent Variable:	Volatility (1)	GDP Growth (2)
Govt. Expenditures	-1.817	-3.146
	(-3.67)	(-3.75)
Openness	-	0.719
		(2.07)
OID test	1.458	0.656
p-value	(0.984)	(0.995)

Sample: 1960-1997.
Instruments: area, distance, GDP per capita, dependency ratio, urbanization rate, total GDP, and two dummies for political systems.
t-statistics in parentheses

To gain further confidence in the documented negative correlation between government size and volatility we check whether the instruments are uncorrelated with the errors in the second stage equation. A Hansen's test statistic for overidentification is reported in the last row of Table 4 together with its associated p-value. This statistic is distributed as a $\chi^2(k)$ random variable with k degrees of freedom, which are given by the number of overidentifying restrictions. We cannot reject the exogeneity of our instruments.

The results of Tables 9 to 12 confirm our previous conclusions and show that the relationship between government size and volatility of output is robust to the

[21] Area and distance are often used as instruments for openness. See for example Rodrik (1998) or Frankel and Rose (1998).

inclusion of controls and the correction for possible endogeneity biases.

An additional test for robustness of the relationship between government size and volatility can be found in Fatás and Mihov (forthcoming). We present regressions similar to the ones above but for US states. Using intranational data has the advantage that it is not subject to some of the problems of omitted variables and endogeneity of the OECD sample. Because US states share many insitutions such as labor markets, financial markets, the problem of omitted variables is minimized. Moreover, when one looks at measures of government size based on federal taxes, which are determined at the national level, the results are not subject to the problems of endogeneity raised by Rodrik (1998). In Fatás and Mihov (forthcoming) we find that across US states, there is a robust negative relationship between measures of government size and volatility of economic fluctuations. The coefficient of the regression is larger than the one found in the OECD sample.

3.6 Do Governments Stabilize Output Fluctuations?

The results discussed in the previous sections offer strong support for the view that governments stabilize output fluctuations. The robustness across regressions and samples is a fact that cannot be ignored when looking at business cycle properties in these economies. The results are very much in line with a Keynesian view of automatic stabilizers, although there are still unanswered questions about the mechanisms that are behind the results. Our attempts to uncover what is behind government size have not been that successful. Marginal tax rates, cyclical elasticities of fiscal variables, components of the budget related to business cycles (such as transfers) are dominated in our regressions by the simplest measure of fiscal policy: government size. Whether this is simply due to the difficulty of measuring automatic stabilizers properly has is an answered question at this point and will have to be addressed by future research.

4. Discretionary Fiscal Policy

The goal of this section is to study how the economy reacts to various shifts in fiscal policy. The first issue to be resolved in an empirical study of fiscal policy is what indicator to use as a measure of policy stance. A notable ready-made candidate for this role is the budget deficit - either the deficit in the overall financial balance or in the primary balance. There are, however, several well-known problems with this measure that make it a poor indicator of discretionary fiscal

policy. The deficit captures both exogenous policy shifts as well as automatic reaction of fiscal variables to the state of the economy thus confounding policy effects and endogenous economic fluctuations. Furthermore, even when changes in the deficit reflect purely discretionary policy decisions, it is obvious that the source of the change – whether it is a revenue adjustment or a change in government spending – is important for the subsequent reaction of the private sector, as Blanchard and Perotti (1999) argue. Finally, from a theoretical point of view changes in government consumption might have a different macroeconomic effect than changes in investment or increases in transfers, which requires looking at the different components of the budget.[22]

The first criticism – the endogenous nature of the budget balance – can be handled by removing the reactive components, taxes and transfers, from the fiscal balance thus concentrating only on the autonomous components of spending. Admittedly this is a crude way of adjustment that might throw away important and interesting information. An alternative method is to construct a 'cyclically-adjusted' fiscal balance as is the current practice at the IMF and the OECD. The adjustment is carried out by establishing a benchmark cyclical indicator (an output gap, for example) and relating the deficit to the state of the cycle relative to the benchmark.[23] An interesting contribution to this literature is a paper by Blanchard (1993). He also argues that an indicator of discretionary fiscal policy must be relative in nature. The procedure outlined in his paper requires selecting a pre-specified benchmark and estimating elasticities of the different components of the budget with respect to a representative set of macroeconomic variables. The response of the budget deficit to current economic conditions is then constructed by using the estimated elasticities. The difference between this value and the actual budget deficit is a measure of discretionary fiscal policy. The original recommendation is to use unemployment, inflation, and interest rates in the construction of the induced changes in the budget balance. Indeed, a version of this indicator has been recently used in a paper by Alesina and Perotti (1995). In their study of fiscal consolidations in OECD countries they construct an indicator of fiscal policy by using the current rate of unemployment as the driving variable for transfers and taxes. Here we extend their work by taking a slightly agnostic but more general approach. First, we use GDP instead of unemployment, but we

[22] To address this last issue we report the effects of disaggregated fiscal policy variables – taxes, transfers, spending on wages, investment and non-wage spending.

[23] See Alesina and Perotti (1995) for a discussion and criticism of these measures.

also include a measure of the price level and interest rates. Second, we use vector autoregressions (VAR) to summarize the basic comovements in the data and to extract the indicator of fiscal policy stance.

Both Blanchard (1993) and Alesina and Perotti (1995) argue that one of the desirable features of an indicator of discretionary fiscal policy is simplicity. Clearly, our measure is based on a slightly more complicated model than their suggestions, but the trade-off of simplicity is precision and the number of assumptions underlying the construction of the indicator. In this paper, we attempt to see how the introduction of more variables and imposing a less restrictive econometric structure improves the properties of the fiscal policy indicator.

4.1 The Data and the VAR Framework

Throughout this section we use US data to measure the effects of discretionary fiscal policy.[24] The main reason why we focus on the US is the availability of good quarterly data on fiscal variables. Also, there is a established literature that has looked at the US economy and we would like to compare our results to those obtained in these other papers.

Our baseline VAR contains logarithm of private output, logarithm of the implicit GDP deflator, ratio of primary deficit to output and nominal T-bill rate. Based on the Akaike information criterion we select 4 lags (values from 1 to 12 have been tried for the lag length). This composition of the vector of endogenous variables must be regarded as the minimal set of macroeconomic variables necessary for the construction of an indicator of fiscal policy.

In addition to the regular assumptions underlying every vector autoregression, we impose restrictions on the contemporaneous relationship between macroeconomic variables. Our argument follows the semi-structural VAR literature.[25] This framework is summarized by the following two equations:

$$Y_t = \sum_{i=0}^{k} B_i Y_{t-i} + \sum_{i=0}^{k} C_i fp_{t-i} + A^y v_t^y \tag{2}$$

[24] Data is taken from the NIPA files at quarterly frequency and the averaged quarterly T-bill rate. The sample is from 1960:1 to 1996:4.

[25] See Bernanke and Blinder (1992) and Bernanke and Mihov (1998) for an application of semi-structural VARs to the study of monetary policy. The framework used in this section is discussed extensively by Bernanke and Mihov (1998).

$$fp_t = \sum_{i=0}^{k} D_i Y_{t-i} + \sum_{i=0}^{k} g_i fp_{t-i} + v_t^{fp} \quad (3)$$

For the study of fiscal policy, vector Y represents the set of macroeconomic variables necessary for estimating the induced changes in the budget balance. fp is a measure of fiscal policy stance.[26] This set of equations is unrestricted and the fiscal policy shocks denoted by v^{fp} cannot be recovered without further assumptions. Here we follow Leeper, Sims and Zha (1996) in partitioning the vector of endogenous variables in three blocks: (1) A subset of vector Y contains "sluggish" private sector variables, which do not respond contemporaneously to shifts in taxes and transfers or to the primary deficit in the first estimation below. They do react, however, to changes in government spending. In this vector we include output and prices and we impose the restrictions on a combination of C_0, B_0, and A^y to ensure no response to tax and transfer shocks or to shocks to other Y variables; (2) The rest of vector Y contains auction prices which respond immediately to any change in the economic environment. No restriction is imposed for these equations; (3) The fiscal policy equation is restricted not to respond to financial markets shocks within a quarter, but taxes and transfers react to the current state of the economy, while generic spending components like wage spending, investment and non-wage spending do not react immediately to macroeconomic conditions.

An alternative to the VAR approach is advocated by Edelberg, Eichenbaum and Fisher (1998) and Burnside, Eichenbaum and Fisher (1999). They argue against using VAR-based innovations in fiscal variables as measures of policy shifts and propose a study based on dummies for three episodes of military build-ups. These episodes have been isolated by Ramey and Shapiro (1998) and include the Korean War, 1950:3, the Vietnam War, 1965:1, and the Carter-Reagan defense build-up, 1980:1. The effects of fiscal policy are calculated as the response of the economy to an innovation in the dummy for the Ramey-Shapiro episodes. The analysis based on the Ramey-Shapiro episodes produces noticably different results from the VAR, as we document in Fatás and Mihov (2000). We find this methodology interesting, but certainly in need of a closer analysis because the three episodes differ significantly in their implications for the persistence and the

[26] Here we make the Bernanke-Blinder assumption that a scalar measure of policy stance is available. In our future work, we plan to extend this analysis along the lines of Bernanke and Mihov (1988) with the measure of fiscal policy being recovered from a vector of relevant fiscal policy variables.

magnitude of the increase in government spending.[27]

4.2 The Indicator of Policy Stance

The assumptions listed in the previous paragraph provide a simple way of estimating our baseline VAR and extracting a measure of fiscal policy. After estimating the reduced form version of equations (2) and (3) we orthogonalize the residuals from the fiscal policy equation to contemporaneous movements in output and prices. This orthogonalized residual is our measure of unanticipated fiscal policy shifts. Figure 3 presents a smoothed version of this measure in graphic form.[28] Positive values on the graph indicate increases in the primary deficit to output ratio.

[Insert Figure 3 about here]

We can discern on this graph some of the major changes in fiscal policy in the US: The Kennedy-Johnson tax cut in 1964, the Reagan tax cut of 1981, and the Gulf war, among others. Interpretation, however, along these lines is a little bit stretched because most of these events were anticipated as of the previous quarter. The VAR results, however, do suggest that these effects were not fully anticipated. Ideally we would like to construct a measure which takes into account also anticipated policy, but this will require making assumptions that are too much model-specific. At this point we explore what conclusions we can draw from a minimal set of assumptions, which is consistent with the view taken by the researchers on macroeconomic effects of monetary policy.

This indicator of fiscal policy stance turns out to be very highly correlated with the measure based on Blanchard's (1993) suggestions and constructed by Alesina and Perotti (1995). We have used their methodology to calculate a quarterly version of their indicator and we find that the correlation of the indicator on Figure 3 with their measure is 0.82. This result is quite remarkable given the differences in methodology. Fundamentally, of course, the theoretical justification

[27] Another issue that our methodology does not capture is the possibility of non-linearities in the effects of fiscal policy shocks. These non-linearities can be, for example, related to the level of government debt, as suggested by Giavazzi and Pagano (1990). We think that in the case of the US this might be less of an issue but, certainly, if we were to apply this methodology to other countries, one would need to allow for these non-linearities.

[28] We have smoothed the series by a centered seven-quarter moving average of fiscal policy shocks to improve readability of the measure.

of our approach follows the same logic as that of Blanchard (1993). It is, however, quite surprising that the dramatic improvement in the fit in our regressions translates only in marginal improvement in the measure. We take, however, this result as a confirmation of our general strategy of extending the set of macroeconomic variables influencing the budget and of relaxing the lag length restrictions in Alesina and Perotti (1995).

4.3 Responses to Fiscal Policy Shocks

We now go to the study of the economic effects of changes in fiscal policy. First, we use our baseline VAR. Figure 4 shows the responses of the endogenous variables to a one standard deviation shock in the primary deficit to output ratio. The impulse responses are reported for a horizon of ten years with one-standard-deviation error bands calculated with Monte Carlo integration methods with 500 replications. The baseline vector autoregression consists of the following variables: (GDP_t, $PGDP_t$, $PDef_t$, $Rbill_t$), where GDP_t is real GDP, $PGDP_t$ is the GDP deflator,$PDef_t$ is the ratio of the primary deficit to nominal GDP,$RBill_t$ is the ex post real interest rate on three months Treasury bills.[29]

[Insert Figure 4 about here]

There is a strong and persistent reaction of output to a fiscal shock. This persistence is somewhat puzzling given that the primary deficit goes back to its baseline trend less than two years after the shocks. This result is robust to changes in lag structure, estimation period, or inclusion of other variables in the system. Clearly, the increase in output must lead to by construction to a decline in the deficit by increasing the denominator of the fiscal variable. But the dynamics of the deficit cannot be explained purely with this logic: Using the real primary deficit instead of the ratio to output leads to the same result. Another possible channel is working through the tax receipts. To justify on these grounds the closing of the deficit one has to use the explanatory power of the progressivity of taxes or of a Laffer curve relationship. We will return to this issue later.

The response of the price level is never statistically significant, while interest rates move in a counterintuitive way: Contemporaneously with the increase in the primary deficit, interest rates decline by about twenty-five basis points and the return to trend is very slow. It turns out that the result is not very robust and

[29] The data source is the DRI Basic Economics Database and the University of Virginia NIPA web site.

in VARs that account more carefully for the composition of the fiscal shock, the dynamics of interest rates exhibit the expected behavior – expansionary policy increases both real and nominal rates.

To obtain a more detailed picture of the economic effects of fiscal policy we look at components of GDP: Consumption, investment, and government spending. Furthermore, we now look only at spending shocks. As argued above, it is important to disentangle revenues from expenditures, because, in theoretical models, they might have different effects on macroeconomic variables. In Fatás and Mihov (2000) we show, in the context of an RBC model, that a deficit-financed spending increase may lead to a decline in investment as long as labor is relatively inelastic. At the same time, a deficit-financed tax cut generates always an increase in investment irrespective of labor supply elasticity. Empirically, we also document below that output dynamics depend on whether the shock is coming from the revenue or the expenditure side.

[Insert Figure 5 about here]

Figure 5 presents results for GDP components from a vector autoregression that includes the following variables: (G_t, X_t, GDP_t, $PGDP_t$, Tax_t, $Rbill_t$), where X_t is consumption, investment, exports or imports and G_t is real government spending.[30] The identification is obtained by assuming that government spending (excluding transfers) does not react to macroeconomic conditions within a quarter. This identifying restriction has been justified in Blanchard and Perotti (1999), who find no institutional reasons why spending components would react automatically to macroeconomic conditions. Also, this assumption amounts to arguing that tax rate decisions are taken only after spending is determined. This is a plausible, but unfortunately untestable hypothesis. Overall, we find that spending increases exert expansionary influence on the economy – output increases to about 0.3% above trendline and the deviation is quite persistent. More importantly the increase in economic activity is not a purely mechanical result of higher aggregate demand. Indeed, both consumption and investment also increase, albeit the increase in investment is not very pronounced. Trade reacts to expansionary fiscal policy by opening the gap between exports and imports. The most robust result in Figure 5 is the protracted and statistically significant deviation of consumption from its trend.

[30] All variables are deflated with the GDP deflator.

To address in more detail the source of the shift in policy stance we decompose government spending into transfers, government spending on wages, government non-wage spending, and government gross investment. As argued in the previous paragraph, effects of a tax cut in theory have different effects from increases in spending. Regarding the components of spending, theoretical models build in government as pure government consumption of goods or as government spending on investment (see, for example, Baxter and King (1993)) and, therefore, do not produce predictions about the effects of different components of government expenditures. Empirically, there is evidence that for fiscal consolidation what matters are transfers and government employment (see Alesina and Perotti (1995)). As long as the deficit has any economic impact, this suggests that these two components would influence output more than the other components of government spending. Moreover it has been argued that in some cases fiscal consolidation produces expansionary effects.[31] All these propositions require a careful study of the effects of the budget composition. We turn now to this issue.

[Insert Figure 6a about here]

For the study of the effects of different components on economic activity we augment sequentially our baseline VAR with each of the five components of the budget: taxes, transfers, non-wage spending, wage spending and gross investment. These variables are part of the policy block and in a Cholesky-style ordering the spending components enter before the private sector variables, while transfers and taxes enter after the private sector block. Figures 6a and 6b display only the responses of output and the dynamics of the variable that has been shocked for the impulse response analysis. First, we notice that the most effective spending variable is government spending on wages – output deviates persistently amd significantly from trend. Investment and non-wage spending have very little impact on the macroeconomy, which runs against the current practice of analyzing only these variables in theoretical models. A tax hike decreases output, as expected, and an increase in transfers is expansionary.

[Insert Figure 6b about here]

Collectively, these impulse responses pose some interesting questions. The comovements in macroeconomic variables suggest that the largest fiscal impact

[31] Giavazzi and Pagano (1990).

on the economy comes from transfers, taxes, and government employment. Theoretical models, however, build in government as pure consumption of goods and investment. We view our results as a call for introducing government employment in dynamic stochastic general equilibrium models explicitly and for building models with heterogeneous agents to account for the effects of transfers on economic activity. Furthermore, the results on the GDP components suggests that expansionary fiscal policy leads to an increase in consumption. This result, albeit consistent with a textbook presentation of the Keynesian cross, flies in the face of most general equilibrium models. In Fatás and Mihov (2000) we document that under plausible values of calibration parameters, the baseline real business cycle model and its modifications lead inevitably to a decline in private consumption when government spending increases. Certain failures of the Ricardian equivalence could generate the positive effect of spending on consumption, and we expect that future research will address this issue in detail.

5.- Conclusions

This paper studies the effects of fiscal policy on economic activity. The first part of the paper looks at the effects of automatic stabilizers. In a sample of 20 OECD economies, we find that large governments are associated with less volatile business cycles. This effect cannot be directly associated to any specific component of government expenditures or revenues. The stabilizing effects of fiscal policy also carry over to the private sector. Large governments are negatively correlated with the volatility of private GDP.

We look for economic mechanisms that can explain the negative correlation between government size and macroeconomic stability by introducing direct measures of automatic stabilzers. We construct a quantitative measure of the automatic response of fiscal policy to output fluctuations but we find that it cannot explain the correlation between size of government and GDP volatility. Marginal tax rates can explain part of the correlation but given the high collinearity between marginal and average tax rates is difficult to separate both effects.

We check for the robustness of our results by introducing a long list of controls and by taking into consideration the endogeneity of government size. In all cases, our main result, that large governments stabilize business cycles, is present.

In the second part of the paper we construct a measure of discretionay policy.

Our measure uses VAR techniques similar to the ones used in the studies of monetary policy. We find that our estimate of discretionary fiscal policy is highly correlated with a constructed measure following the suggestions of Blanchard (1993) and applied by Alesina and Perotti (1995).

When we calculate the reponse of economic activity to changes in fiscal policy we find that there is a strong, positive and persistent impact of fiscal expansions on economic activity.

We disaggregate fiscal policy into different components and we find that changes in taxes, transfers and government employment are the most effective tools of fiscal policy. Our results are difficult to compare with calibrated stochastic general equilibrium models because, in general, these models do not take into consideration the determinants of different components of government expenditures and taxes.

Overall, our results suggest that further research is needed to build models of fiscal policy that can account for the facts presented in this paper. Explicitly modeling government employment might provide an avenue for explaining some of these facts.

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7.- Appendix

DATA SOURCES. All OECD data from the OECD economic outlook. Original codes and definition of constructed variables.

CGNW= Government Consumption (non-wages)
CGW = Government Consumption (wages)
IG = Government Gross Investment
TSUB = Subsidies
SSPG = Social Security Transfers Paid by the Government
TRPG = Other Transfers Paid by the Government
TY = Direct Taxes
TIND = Indirect Taxes
TRRG = Transfers Received by Government
KTRRG = Capital Transfers Received by Government
RESTG = Other capital Transfers
GNINTP = Net Interest Payments on Government Debt
YPEPG = Income Property Paid by Government
YPERG = Income Property Received by Government
CFKG = Consumption of Government Fixed Capital
NLG = Net Lending by Government
CPAA = Private Consumption
GDP = Gross Domestic Product
PGDP = Deflator of GDP
YDH = Household Disposable Income
EXPENDTURES = CGNW + CGW + IG + TSUB + SSPG + TRPG
REVENUES = SSRG + TY + TIND + TRRG
TRANSFERS = TSUB + SSPG + TRPG
PRIMARY DEFICIT = EXPEND - REVEN - KTRRG - RESTG -
- GNINTP + YPEPG - YPERG - CFKG

All US quartely data from NIPA. Same definitions as above apply.

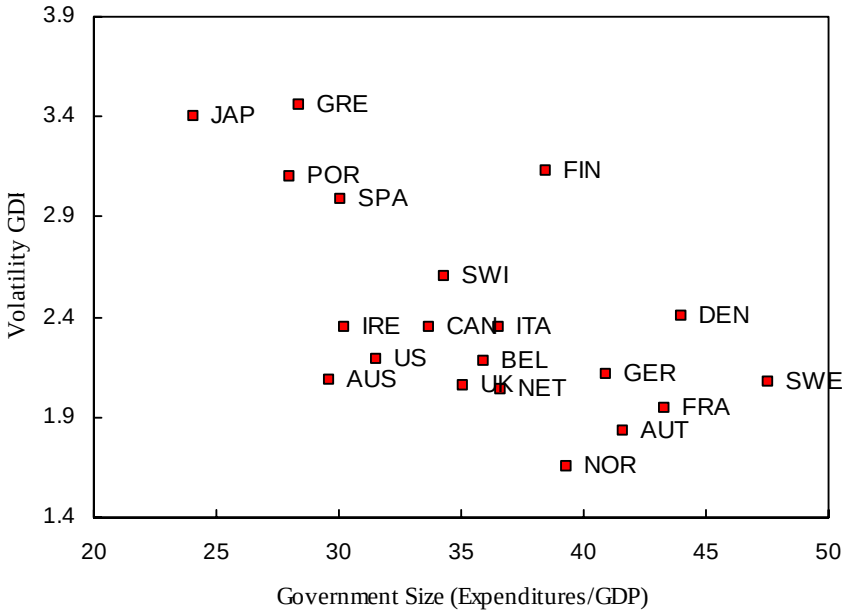


Figure 1. Government Size and Output Volatility

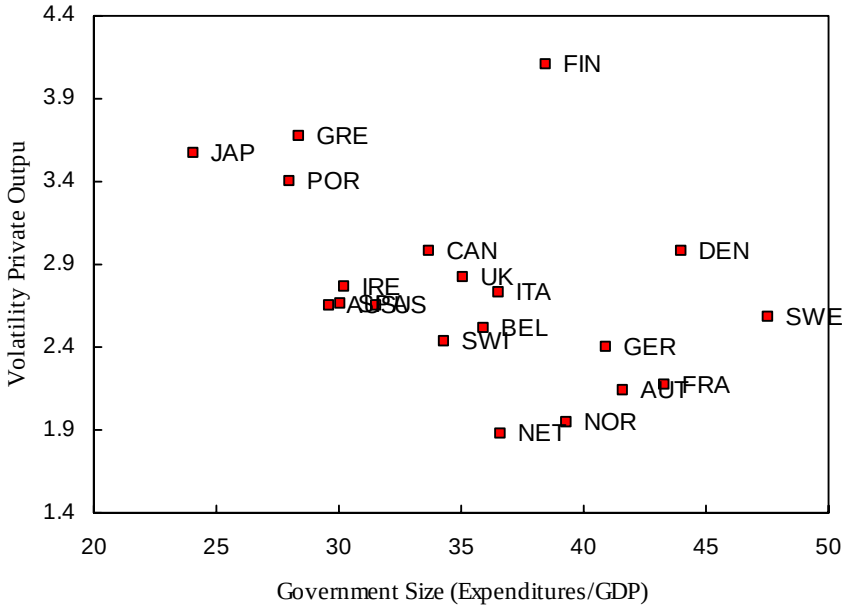


Figure 2. Government Size and Volatility of Private Output

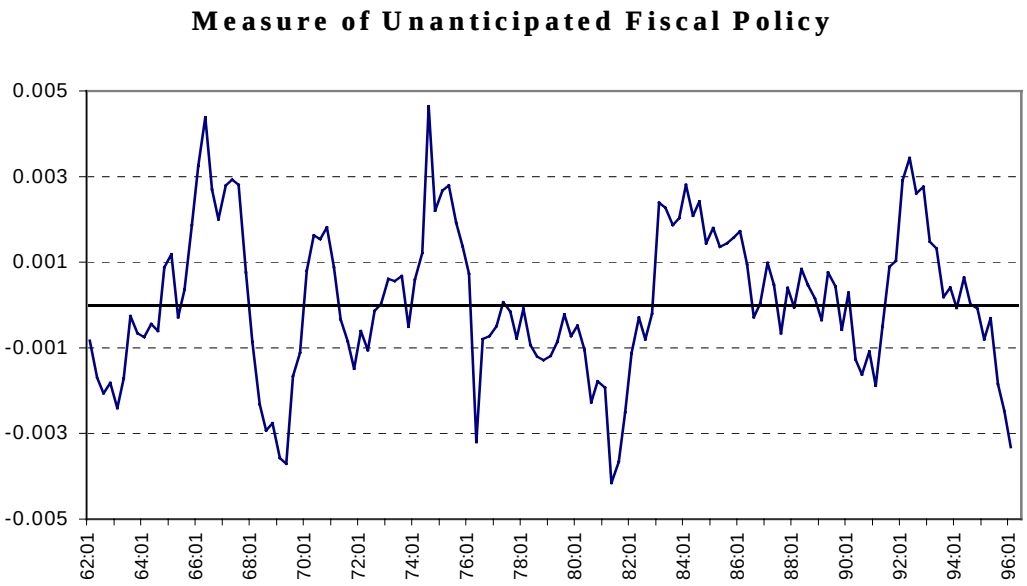


Figure 3. Measure of unanticipated fiscal policy (smoothed)
(Quarterly VAR, 1961:1 - 1996:4)

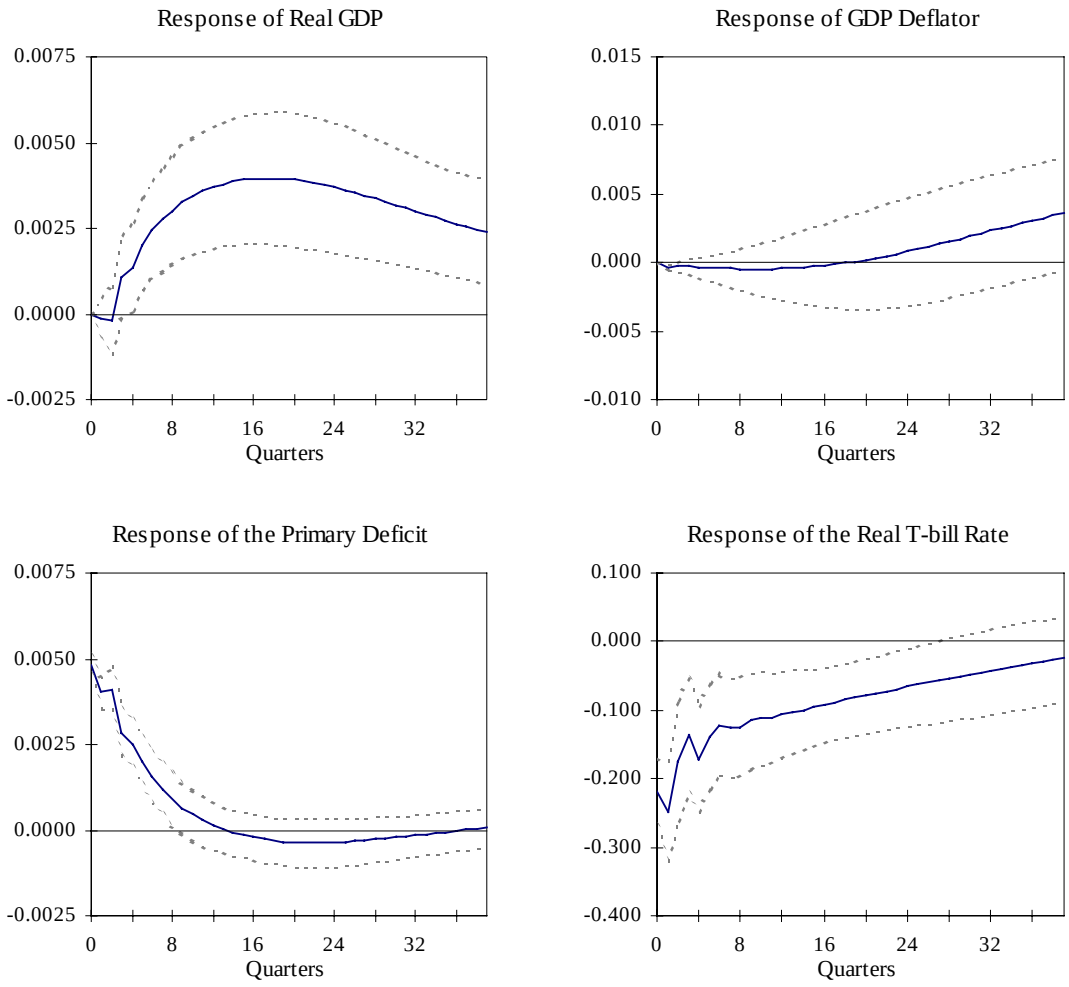


Figure 4. Baseline VAR: Responses to an expansionary fiscal shock (increase in the primary deficit)

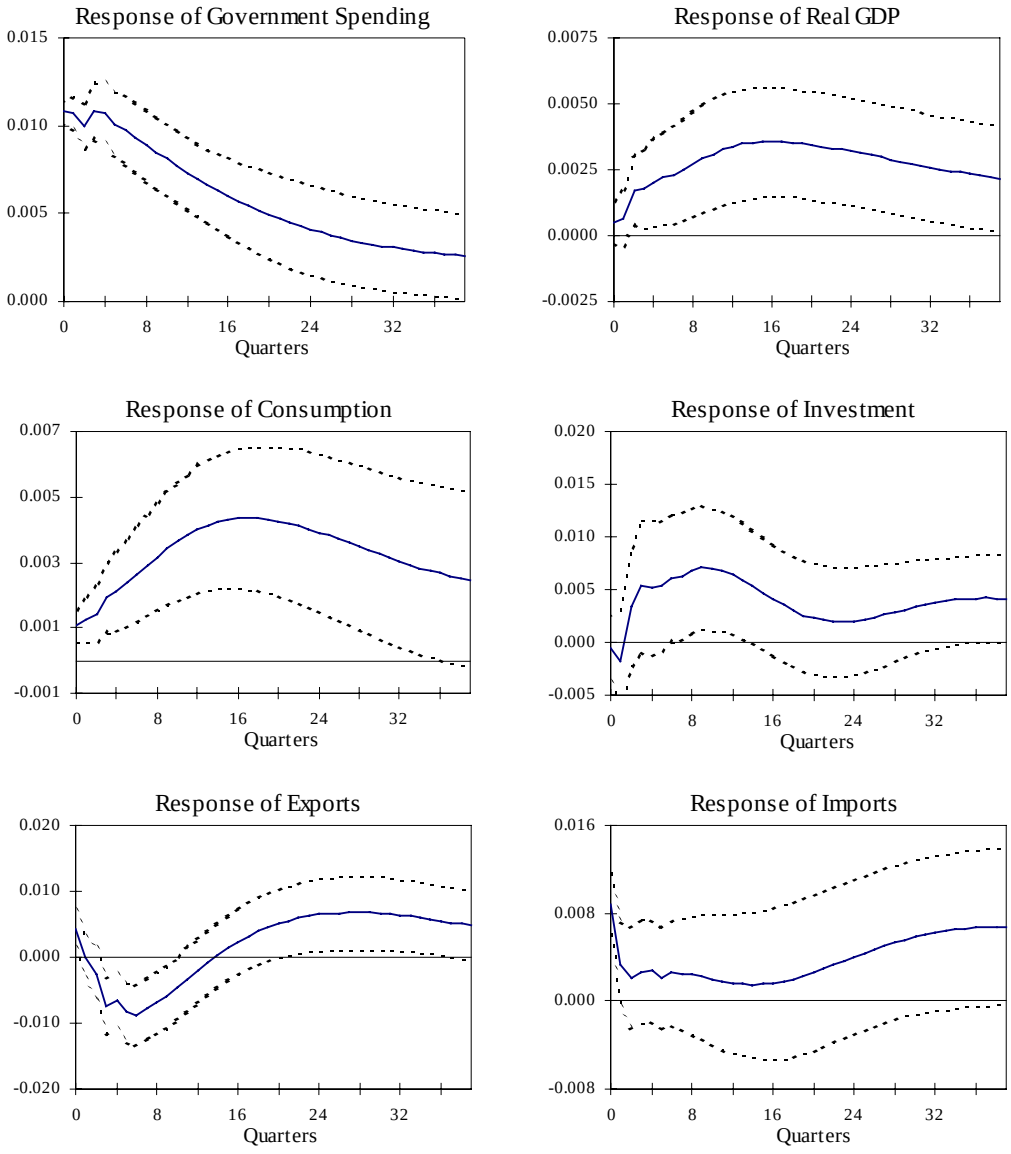
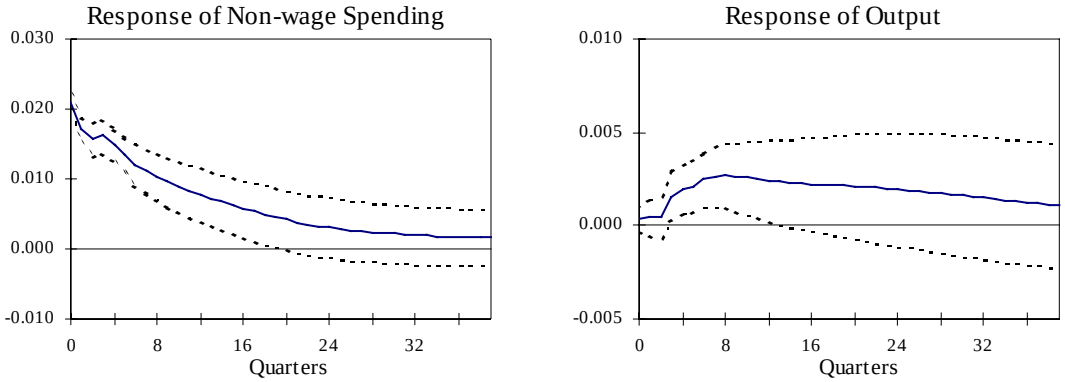
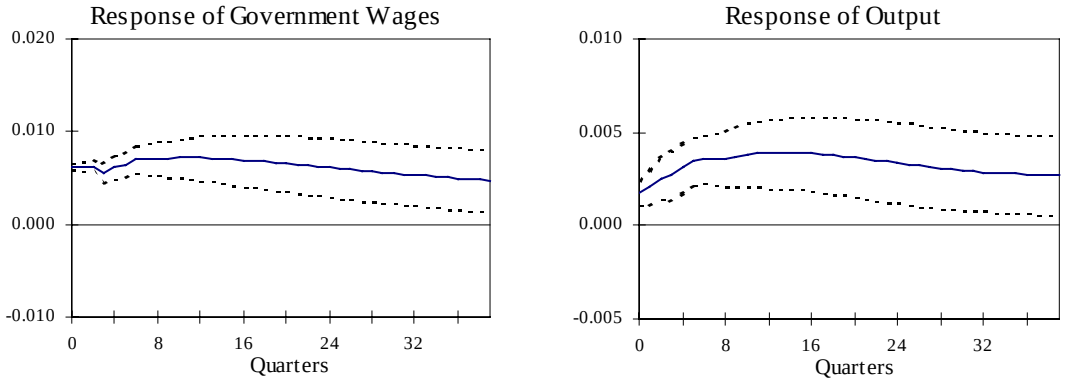


Figure 5. Responses of GDP components to an Increase in Government Spending

Shock to Government Non-Wage Spending



Shock to Wage Spending



Shock to Government Investment

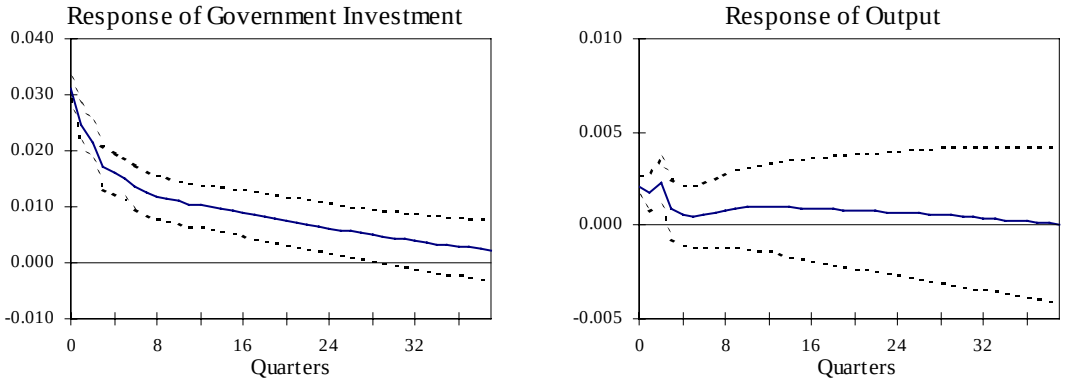
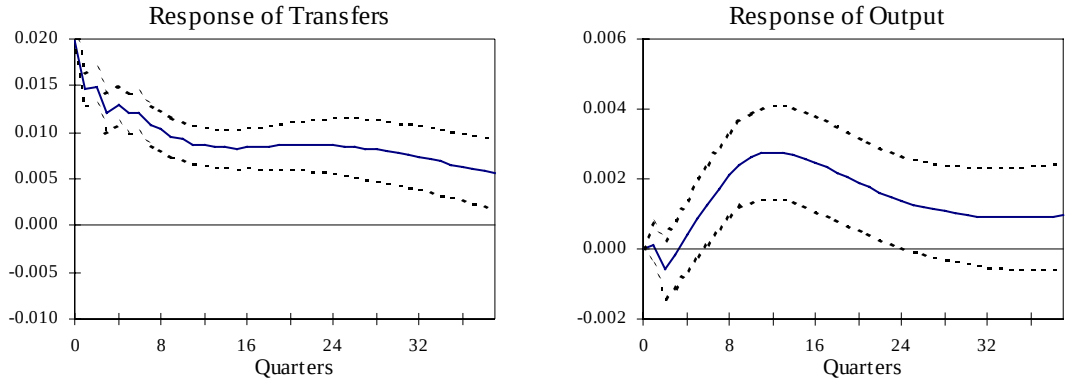


Figure 6a. Responses of GDP and budget components to fiscal shocks

Shock to Transfers



Shock to Taxes

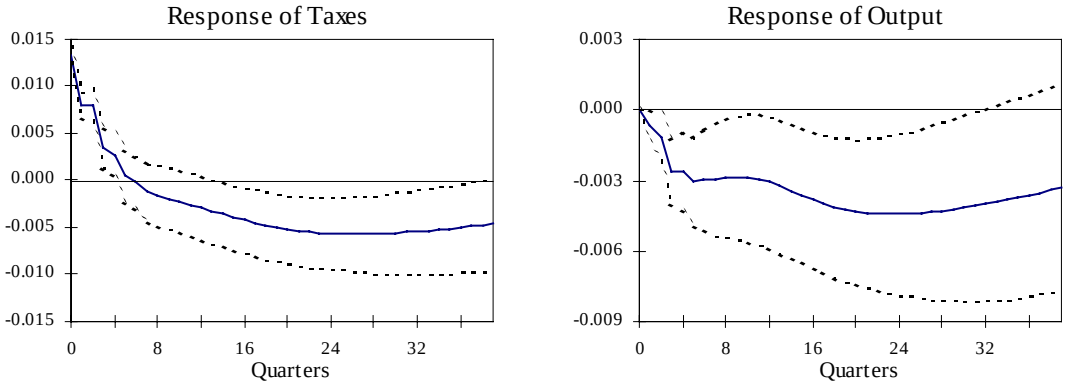


Figure 6b. Responses of GDP and budget components to fiscal shocks