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Reitschuler, Gerhard; Crespo Cuaresma, Jesus; Silgoner, Maria Antoinette

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On the effectiveness and limits of fiscal stabilizers

Jesús Crespo Cuaresma* Gerhard Reitschuler†
Maria Antoinette Silgoner‡

Abstract

The smoothing impact of fiscal stabilizers (proxied by government expenditures) on business cycle volatility is studied for a panel of EU countries in the period 1970-1999. Special emphasis is put on the investigation of possible nonlinearities in the relationship between GDP growth volatility and fiscal stabilizers. The results show that the business cycle volatility smoothing effect of fiscal stabilizers may revert at high levels. The results hold when using government revenues as a proxy for fiscal stabilizers.

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*Jesús Crespo Cuaresma, *Department of Economics, University of Innsbruck*, Universitätsstrasse 21, A 6020 Innsbruck, Austria, *Phone* (+43 512) 507 7350, *E-mail address*: **jesus.crespo-cuaresma@uibk.ac.at**

†Gerhard Reitschuler, *Department of Economics, University of Innsbruck*, Universitätsstrasse 21, A 6020 Innsbruck, Austria, *E-mail address*: **gerhard.reitschuler@uibk.ac.at**

‡Maria Antoinette Silgoner, *Oesterreichische Nationalbank, Foreign Research Division*, Otto-Wagner-Platz 3, POB 61, A-1011 Vienna, Austria, *Phone* (+43 1) 40420 5231, *Fax*: (+43 1) 40420 5299, *E-mail address*: **maria.silgoner@oenb.at**

1 Introduction

Many economists see the main goal of fiscal policy in the stabilization of business cycle fluctuations. The usual underlying argument is that output volatility has a negative impact on long-term growth (see e.g. Ramey and Ramey, 1995). This assumption is inspired by several theoretical underpinnings, e.g. skill losses due to temporary unemployment (Martin and Rogers, 1997), an increase in political uncertainty due to high business cycle volatility (Alesina et al., 1992), credit-market imperfections that may force firms to cut their expenditure on research and development (Stiglitz, 1994) or increased uncertainty with respect to investment (Dixit and Pindyck, 1994). The stabilization of business cycle fluctuations through fiscal policy can work through several different channels. The most common channel are automatic stabilizers which smooth economic activity through an automatic response via taxes and the transfer system but there are also other components in the budget that may be stabilizing. Especially international institutions seem to have consensus on the fact that automatic stabilizers are effective in stabilizing the business cycle, as opposed to discretionary fiscal policy measures which tend to have destabilizing (procyclical) effects due to, e,g., implementation lags (see, e.g. Badinger, 2008).

Empirically there are three broad categories of contributions dealing with the issue of the effectiveness of fiscal stabilizers[1], some of them focusing on the expenditure side, some of them on the revenue side of the budget. Many international institutions use their large-scale macro-models to estimate the elasticity of tax revenues or public expenditures with respect to changes in output or the output gap.[2] The second approach is to characterize the response of output to tax and spending shocks in the past by means of structural vector autoregressive models in order to derive impulse-response functions (see e.g. Blanchard and Perotti, 2002, De Castro, 2006). Finally, Fatás and Mihov (2001a, 2001b) test the correlation between government size and output growth volatility within cross country as well as panel data studies.

This paper re-assesses empirically the smoothing impact of fiscal stabilizers using a panel of EU countries. Our model setting partly builds on earlier work by Ramey and Ramey (1995) and Fatás and Mihov (2001a, 2001b). However, it extends it in several ways. First of all, while earlier work is mostly based on cross-sectional data and uses panel data only for selected aspects, our paper relies on pooled estimation. Second, we use an extended set of economic and political variables that has not been used in this context so far.

We initially test the effectiveness of fiscal stabilizers within a linear frame-

[1] We use the broader term fiscal stabilizers instead of automatic stabilizers since we do not only use the classical categories representing automatic stabilizers, namely direct taxes and unemployment benefits, but test all subcategories of the revenue and expenditure side.

[2] See e.g. Van den Noord (2000), using the OECD-INTERLINK model, or Barrell and Pina (2003), using the NiGEM model. Brunila et al. (2002), using the EC-QUEST model.

work but then also investigate whether there is a threshold level beyond which this stabilizing effect might revert. The hypothesis that nonlinearities might exist is partly based on the literature that deals with growth effects of fiscal policy. Here theoretical results (see e.g. Barro, 1990) predict a negative growth effect in countries where the size of government exceeds a certain threshold. Under the assumption that there is a robust negative correlation between volatility of output and long term growth, the resulting inverse U-shaped relationship between government size and growth would translate into a U-shaped relationship between government expenditures and output volatility. While a related nonlinearity hypothesis, namely that government size could have a negative *growth* impact when it exceeds a certain threshold level, has been frequently formulated (see e.g. Barro, 1990, Slemrod, 1995), this is the first paper, to the knowledge of the authors, which addresses this issue empirically in the context of fiscal stabilizers.

The paper is organized as follows. Section 2 investigates the impact of fiscal stabilizers on business cycle volatility within a linear framework, also taking account of the potential endogeneity between the variables. Section 3 investigates the possibility of nonlinearities. Section 4 applies the same methodology to the different subcomponents of government expenditures and revenues to examine which of these components can most directly be related to the stabilizing aspect of fiscal policy. Section 5 concludes.

2 Do fiscal stabilizers indeed stabilize? – A first approach

When investigating the interaction between fiscal stabilizers and the volatility of output growth the first issue is the definition of an appropriate proxy for fiscal stabilizers.[3] We will focus on the most general measure: the average ratio of government spending to GDP. Obviously the automatic component of fiscal stabilizers does not only work from the expenditure side, but also from the revenue side, mainly through personal income and corporate taxes. However, there is no clear consensus in the empirical literature which side of the government budget is more appropriate when investigating the impact of fiscal stabilizers: Van den Noord (2000) and Fatás and Mihov (2001a) for instance, argue on the importance of the government expenditure side, while the European Commission (2002) – although in a slightly different context – refers to the revenue side as being the one that is more influenced by the business cycle. We start by focusing on the expenditure side, however, we will also present evidence on the revenue side in section 4.

[3] Our basic data set consists of yearly data on 14 EU countries covering the period 1970 to 1999. Our data set contains all current EU countries with the only exception of Luxembourg. For some countries the time range is shorter so that the sample is not balanced.

The use of the original, unadjusted government expenditure series as a proxy for fiscal stabilizers is common within this strand of literature. However, total government spending does not only capture a reactive component that can be related to the automatic stabilization function (as well the part of expenditures that is stable irrespective of the stage of the cycle), but also a third, autonomous component of spending that reflects discretionary fiscal policy measures. Empirical evidence for a negative relationship between government size and output growth fluctuations could thus, among other reasons, be due to discretionary policy measures. We will therefore focus our analysis only on the part of government expenditures that is left after filtering out discretionary policy.

In the literature there are several approaches to extracting the stabilizing component of government expenditure. One option is to look at the subcomponents of government spending or revenues that can be related more directly to the automatic stabilizing function. Another approach is the one adopted by the IMF and the OECD. Here a 'cyclically adjusted' fiscal balance is constructed by relating the budget deficit to the state of the cycle relative to a cyclical indicator such as the output gap (see,e.g. Larch and Salto 2005). Our approach is estimating an unobserved components model following Harvey (1985, 1989) in order to separate a trend, a cyclical component and an irregular part of the government expenditure ratio series. The irregular part is subsequently subtracted from the data as it might not represent the automatic stabilizing part of government expenditures. For the rest of the paper we will refer to it as adjusted government expenditure. To get a first impression of the nature of the relationship between fiscal stabilizers and output growth volatility, we divide our data set into six subperiods (1970-74, 1975-79, 1980-84, 1985-89, 1990-94, 1995-99) and estimate the following baseline regression:

$$VOLGROWTH_{it} = \beta(GOVEXP_{it}) + u_{it}, \tag{1}$$

where the left hand variable is the standard deviation of output growth in period t ($t = 1, ..., 6$ stands for each of the subperiods described in the footnote) for country i and $GOVEXP_{it}$ is the logged ratio of government expenditures over GDP, adjusted for the irregular component.

Insert Table 1 around here

The regression results for equation (1) – based on different assumptions for the error term – are presented in Table 1. The first column shows the result for the assumption that the error term is independent of the cross-sectional units (countries) and *iid* normal (that is, the panel is estimated as if it were a cross-country regression including a constant). The second column shows the results for the assumption of fixed country effects, and the third column shows the estimated β under the assumption of fixed country and time effects. The results in Table 1 all show a negative coefficient for β, with β being highly significant for the latter two specifications. The results thus seem to confirm that fiscal stabilizers have had a smoothing impact on the business cycle. Still,

additional variables might affect both volatility and government size, we hence add three control variables common in the literature to our baseline regression, namely the unemployment rate (see e.g. Feldman, 2008), inflation volatility (as an indicator for monetary policy) and GDP per capita.[4] The new specification thus is:

$$\begin{aligned} VOLGROWTH_{it} &= \beta_1(GOVEXP_{it}) + \beta_2(UNEMPL_{it}) + \\ &\quad \beta_3(VOLINFL_{it}) + \beta_4(GDPpc_{it}) + u_{it} \end{aligned} \tag{2}$$

Table 2 (column 1) shows the results of equation (2). The negative and significant coefficient for government size confirms the previous results.

Insert Table 2 around here

The main problem with equation (2) is the potential endogeneity of government size. Rodrik (1998) comments that as long as one of the goals of governments is to reduce output growth volatility, economies that display higher volatility might choose larger governments to stabilize their cycles. In this case equation (2) would be subject to an endogeneity problem and OLS estimation could lead to biased results.

To account for potential endogeneity we need to find instruments for government size. This is done by estimating an equation which relates government size with a set of economic and political variables. All variables that display a robust and significant relationship with government expenditures but are not correlated with the error term are obvious candidates for instruments. The following variables were tested: GDP per capita, the unemployment rate, openness, interest payments on public debt, an indicator for government strength (represented by the Banzhaf Index), the number of elections and the size of the economy (measured through population). As interest payments, openness, government strength and population came out significant, they were taken as instruments in equation (2).The Sargan test for the validity of instruments cannot reject the null of no correlation between the instruments and the errors in equation (2). The results of the re-estimation of (2) using instrumental variables are presented in Table 2 (second column). Even though the coefficient for government size is still negative, it is now insignificant, which casts doubt on the results from the OLS-estimation above. However, it could also be an indication for nonlinearities in the relationship between government size and economic volatility that have not been explicitly modelled.

[4] Several more variables were tested as a robustness check, e.g. openness, population, average inflation levels, average levels of core inflation and GDP growth. The coefficients never appeared significant and left the other coefficients basically unchanged.

3 A nonlinear effect of fiscal stabilizers?

The results of the previous section provide no clear cut picture concerning the smoothing capacity of fiscal stabilizers suggesting that nonlinearities not included in the baseline model may be a present. The linear model already gives evidence for diminishing returns to the stabilizing property of government spending. We could, however, hypothesize that the effectiveness of this fiscal policy tool is subject to extra diminishing returns that go beyond the ones already implied by the use of the logarithm of government expenditures, possibly even reverting beyond a certain threshold. If such nonlinearities exist, the conclusion of a smoothing impact of fiscal stabilizers of previous studies may not hold for all levels of government expenditures but has to be investigated with reference to the size of the government.[5]

As a very first attempt to examine empirically the evidence for nonlinearities in the relationship between business cycle volatility and government size we apply the linearity test proposed by Hansen (1999). We test the linear model against a piecewise linear model where the effect of government expenditure on growth volatility depends on the level of government expenditure, and explicitly estimate the threshold level of government expenditures separating the two regimes. Although the methodology in Hansen (1999) does not account for instrumental variable estimation, it could provide first evidence for nonlinearities in the relationship. The threshold estimation procedure identifies exactly one threshold at a (logged) government expenditure ratio of 3.67, and rejects the null of linearity at the usual 5% significance level. For government size levels below the threshold there is a significant negative relationship between the government expenditure ratio and GDP growth volatility. Beyond the threshold level, however, the coefficient is negative but not significant, indicating that the smoothing effect of fiscal stabilizers does not apply in this region. This first evidence opens the question of the specific nonlinear form to be tested. Here a useful econometric tool is the Nearest Neighbor Fit method (see e.g. Cleveland, 1993 and 1994).[6] The resulting nonlinear curve is presented in Figure 1.[7] The parabolic form suggests a leveling out of the smoothing capacity of fiscal stabilizers with the possibility of a reversed effect beyond the minimum.

Insert Figure 1 around here

[5] Buti and Van den Noord (2003) provide a theoretical framework that explicitly predicts a nonlinear relationship between government size and GDP growth volatility.

[6] This non-parametric approach fits for each data point in the sample a local linear regression line, weighting the other observations: Data points that are relatively far from the point being evaluated get small weights in the sum of squared residuals, while closer data points get higher weights.

[7] Figure 1 shows the residuals of equation (2), estimated under the restriction $\beta_1 = 0$ (that is the part of GDP growth volatility that cannot be explained by the right hand side variables other than $GOVEXP_{it}$ in equation (2)) against the fitted levels of government expenditures over GDP using the instruments and exogenous variables. This is the variable actually used instead of $GOVEXP_{it}$ for the instrumental variables estimation.

Based on this evidence we modify our model given by (2) by letting the government expenditure ratio enter in a quadratic form to account for these nonlinearities:

$$\begin{aligned} VOLGROWTH_{it} &= \beta_1(GOVEXP_{it}) + \beta_2(GOVEXP_{it})^2 + \\ &\quad \beta_3(UNEMPL_{it}) + \beta_4(VOLINFL_{it}) + \\ &\quad \beta_5(GDPpc_{it}) + u_{it} \end{aligned} \tag{3}$$

The estimation is carried out using the same set of instruments as in equation (2), augmented with the squared instruments.Table 3 shows the results of the linear model and the model with the quadratic specification. The coefficient for government size is highly significant for the linear as well as for the quadratic variable, thereby confirming the evidence for nonlinearities. The fitted parabolic curve has its low point at 3.63 (in logs) which is corresponding to a government expenditure ratio of approximately 38 percent, a value close to the one indicated by the threshold technique.

Insert Table 3 around here

In order to provide an intuition about the magnitudes of the nonlinearity effect the following exercise was performed: For a country displaying a government expenditure ratio corresponding to the median value of the distribution in our panel (40.63%), an increase of public spending by one percentage point will, ceteris paribus, raise the standard deviation of output growth by 0.02 points. The same increase in government spending for a country situated at the 25% percentile of the distribution (expenditure ratio: 35.87%) will lead to a decrease in business cycle volatility of 0.01 points. A country at the 75% percentile (spending ratio: 44.14%) finally would increase cyclical volatility by 0.04 points when expanding government expenditures by one percentage point.

Insert Figure 2 around here

Even though due to data limitations fitting curves to single countries is not possible, it is an additional useful visual illustration to assign to each country a different symbol, as shown in Figure 2. To be more specific: The point cloud may not consist of single country cases that actually support the estimated parabolic curve individually, but it could be the cross country differences that pay responsible for the U-shaped curve. Figure 2 reveals several clusters of countries. Spain and Greece are countries with a sufficiently low government spending ratio to experience a stabilization effect of an increase in public expenditures. A larger group of countries lying at the right part of the curve (Sweden, Denmark, Netherlands, France, Belgium) seem to support the finding that a further increase in the size of the government can have destabilizing effects once a certain level is reached. Two further countries (Italy and Finland) actually mimic the parabolic curve. There is, however, the interesting case of Germany and Austria, who seem to show a negative relationship between government size and

volatility although the data points almost entirely lie to the right of our estimated low point of the curve. This may raise the issue of whether an efficient use of government revenues and an appropriate design of the tax system could shift the curve to the right.

To sum up, our results indicate a nonlinear relationship between government size and output growth volatility. For relatively low levels of the government expenditure ratio fiscal stabilizers have the desired impact such that they reduce business cycle fluctuations. For higher levels, however, the effect is, at best, not significant, but it might as well revert.

4 Towards a narrower definition of government size – which fiscal components stabilize most?

Fiscal stabilizers obviously do not only work from the expenditure side but also from the revenue side. The aim of this section is to analyze the nature of the smoothing effect from the revenue side. Using a disaggregated data set allows us to investigate which subcomponents of government expenditure or revenue can be most directly related to the stabilizing aspect of fiscal policy.

We thus rerun equations (2) and (3) by first substituting government spending by total revenues ($REVEN_{it}$) that is computed as the sum of direct and indirect taxes and social security and other transfers received by the government. We then repeat this procedure using subcomponents of government expenditures, namely non-wage government consumption ($GOVCONSnw_{it}$), wage government consumption ($GOVCONSw_{it}$), government gross investment ($INVEST_{it}$), subsidies ($SUBSID_{it}$) and social security transfers paid by the government ($SOCSEC_{it}$). Furthermore we also use transfers ($TRANS_{it}$) that is the sum of subsidies, social security transfers and other transfers paid by the government. On the revenue side we look at two subcomponents: direct taxes ($TAXdir_{it}$) and indirect taxes ($TAXindir_{it}$).[8]

Intuitively the subcomponents on the spending side that are most directly related to the theoretical definition of fiscal stabilizers are social security transfers and subsidies. Investment, on the other hand, can be expected to consist mainly of discretionary measures. $GOVCONSw_{it}$ might contain a discretionary as well as a fiscal stabilizing part while the non-wage fraction should not be closely related to fiscal stabilizers. On the revenue side indirect taxes do not show the standard attributes of fiscal stabilizers so that we expect regression

[8] All fiscal measures are used as logs of the share in GDP and those that are expected to contain a significant discretionary part ($INVEST_{it}$ and $GOVCONSw_{it}$) are adjusted following the same approach applied to the government expenditure ratio. In all cases the estimation is done using the same instruments selected for the case of the overall government expenditure measure.

results to deviate substantially from the ones derived in the previous sections. Direct taxes, on the other hand, should show a high degree of stabilizing properties, possibly also leveling out beyond a certain threshold.

Insert Table 4 around here

The results for the various subcomponents of government expenditures and revenues are given in Table 4. The results for total revenues show the same characteristics as those of the government spending ratio: Accounting for the possibility of endogeneity, the coefficient for total revenues is negative but not significant. Using a nonlinear model, however, the coefficients are highly significant for the linear as well as for the quadratic term. Thus the same implication holds namely that the smoothing effect of fiscal stabilizers from the revenue side may vanish for higher levels. The fact that a similar result applies to direct taxes while this is not the case for indirect taxes supports the hypothesis that personal and corporate income taxes are most directly related to the theoretical definition of fiscal stabilizers. One can interpret this result in the light of the discussion on tax reforms that usually assume a trade-off between efficiency and stabilization effects. Our results suggest that, for countries with a high tax burden, tax cuts can both increase efficiency and contribute to a less volatile business cycle at the same time. Concerning the subcomponents on the expenditure side there is evidence for nonlinearities only for non-wage government consumption whereas the other components do not show any parabolic relationship. It is interesting to note, though, that wages seems to smoothen output in a linear fashion, as indicated by the negative and significant sign in the regression.

The main result is therefore that of those subcomponents that are expected to be most directly related to fiscal stabilizers, only revenues and direct taxes show the hypothesized smoothing impact (for lower levels). This effect, however, reverts for higher levels and could actually increase cyclical volatility. Subsidies and social security transfers, on the other hand, do not have a smoothing impact, neither in the linear nor in the nonlinear model setting.

5 Conclusions

The effect of fiscal stabilizers (proxied by the government expenditure share adjusted for discretionary policy) on cyclical volatility is tested for a panel of EU-member states in the last three decades within a linear as well as a nonlinear framework. Evidence from the linear model is mixed: While the basic OLS results confirm the finding that fiscal stabilizers have reduced business cycle fluctuations this effect is no longer significant when accounting for potential endogeneity of government size.

However, the results based on a nonlinear model setting indicate a smoothing effect for lower levels of government size, but the 'returns to smoothing' dimin-

ish in a stronger fashion than the one implied by the logarithmic specification. For countries with a high government expenditure ratio the smoothing effect vanishes and cyclical volatility may thus even rise. The results appear robust to the exclusion of outliers, modifications in the specific non-linear form, the use of a different set of control variables and instruments as well as a generalization of the adjustment mechanism for the government expenditure ratio. On a disaggregated level, we find that the wage government consumption and indirect taxes smoothen volatility in a linear fashion, the non-wage government consumption, direct taxes and total revenues display the nonlinearity mentioned above, namely a stabilizing property up to an estimated threshold which then eventually reverts. The validity of the main findings on the revenue side strengthens our results against the background of the discussion on which side of the budget to use as a proxy for fiscal stabilizers.

Our results suggest that it may be necessary to reassess the role of the fiscal stabilizers in the nonlinearity context. The preference of international institutions for rules-based fiscal policy (tantamount to letting the automatic stabilizers play), notably in Europe, stems from the fact that the last three decades were marked by prolonged periods of pro-cyclical fiscal policy. This asymmetric reaction of fiscal policy to the economic cycle led institutions to the conclusion that a purely rules-based fiscal policy (in the same reign as monetary policy) would lead to a better economic outcome in the sense of reduced volatility. Given the negative relationship between government size and cyclical volatility in prior studies, this notion seems justified. However, the nonlinear model setting of our paper reassesses this view in a critical way. The discussion on the effect of fiscal stabilizers and optimal government size may gain realism by taking into account nonlinearities such as the ones modeled in this study. Thus the main conclusion is that policy recommendations to let fiscal stabilizers play fully should be supplemented by taking into account a second dimension: the absolute level of fiscal stabilizers. One should be aware of the fact that the government size plays a crucial role in determining the nature of the returns to smoothing of fiscal stabilizers. Therefore, although the full operation of fiscal stabilizers could be desirable, their overall extent may have to be reconsidered.

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Appendix: Data sources

The data on government expenditures and revenues were taken from the OECD Economic Outlook database. Real GDP per capita and GDP growth were computed in 1995 prices using data from the World Development Indicators 2001 (World Bank) except the data for West Germany (1970-91), which were built from the International Financial Statistics (International Monetary Fund). The openness variable was retrieved from the World Development Indicators 2001 (World Bank) except the data for West Germany (1960-91), which were taken from the Penn World Tables 5.5. The source of data concerning population is the Penn World Tables 5.5. Data on unemployment and inflation were taken from the OECD Main Economic Indicators. The data on political variables are from Huber, Kocher and Sutter (2002).

References

[1] Alesina, A., S. Ozler, N. Roubini and P. Swagel (1996), Political instability and economic growth, *Journal of Economic Growth*, **1**, 189-212.

[2] Badinger, H. (2008) Fiscal rules, discretionary fiscal policy and macroeconomic stability: an empirical assessment for OECD countries, *Applied Economics*, forthcoming

[3] Barrell, R. and A. M. Pina (2003), How important are automatic stabilisers in Europe? A stochastic simulation assessment, *Economic Modelling*, **21**, *1-35.*

[4] Barro, Robert J. (1990), Government spending in a simple model of endogenous growth, *Journal of Political Economy*, **98**, S103–S125.

[5] Blanchard, O. and R. Perotti (2002), An empirical investigation of the dynamic effects of changes in government spending and taxes on output, *Quarterly Journal of Economics, **117**, 1329-1368.*

[6] Brunila, A., M. Buti and J. in't Veld (2002), Fiscal policy in Europe: How effective are automatic stabilisers?, *European Economy, Economic Papers*, 177.

[7] Buti, M. and P. Van den Noord (2003), What is the impact of tax and welfare reforms on fiscal stabilisers? A simple model and an application to EMU, *EC-Working Paper 187.*

[8] Cleveland, W. S. (1993), *Visualizing Data*, Hobart Press.

[9] Cleveland, W. S. (1994), *The Elements of Graphing Data*, Hobart Press.

[10] De Castro, F. (2006), The macroeconomic effects of fiscal policy in Spain, *Applied Economics*, **38**, 913-924.

[11] Dixit, A. K. and R. S. Pindyck (1994), *Investment under Uncertainty*, Princeton, Princeton University Press.

[12] European Commission, 2002, *Public Finances in EMU*, Brussels.

[13] Fatás, A. and I. Mihov (2001a), Government size and automatic stabilizers: International and intranational evidence, *Journal of International Economics*, **55**, 3-28.

[14] Fatás, A. and I. Mihov (2001b), Fiscal policy and business cycles: An empirical investigation, *Moneda y Credito*, 212.

[15] Feldman, H. (2008), Government size and unemployment in developing countries, *Applied Economics Letters*, forthcoming.

[16] Hansen, B. (1999), Threshold effects in non-dynamic panels: Estimation, testing and inference, *Journal of Econometrics*, **93**, 345-368.

[17] Harvey, A. (1985), Trends and cycles in macroeconomic time series, *Journal of Business and Economic Statistics*, **3**, 216-227.

[18] Harvey, A. (1989), *Forecasting, Structural Time Series and the Kalman Filter*, Cambridge, Cambridge University Press.

[19] Huber, G., M. Kocher and M. Sutter (2003), Government strength, power dispersion in governments and budget deficits in OECD-countries: A Voting Power Approach, *Public Choice*, **116**, 333-350.

[20] Larch, M. and M Salto (2005), Fiscal rules, inertia and discretionary fiscal policy, *Applied Economics*, **37**, 1135-1146.

[21] Martin, P. and C. A. Rogers (1997), Stabilization policy, learning by doing and economic growth, *Oxford Economic Papers*, **49**, 152-166.

[22] Ramey, G. and V. A. Ramey (1995), Cross country evidence on the link between volatility and growth, *American Economic Review*, **85**, 1138-1151.

[23] Rodrik, D. (1998), Why do more open economies have bigger governments?, *Journal of Political Economy*, **106**, 997-1032.

[24] Slemrod, J. B. (1995), What do cross-country studies teach about government involvement, prosperity, and economic growth?, *Brookings Papers on Economic Activity*, **2**, 373–431.

[25] Stiglitz, J. E. (1994), Endogenous growth and cycles, in: Shionoya, Yuichi and Mark Perlman (eds.): *Innovation in Technology, Industries and Institutions*, University of Michigan Press, 121-156.

[26] Van den Noord, P. (2000), The Size and Role of Automatic Fiscal Stabilizers in the 1990s and Beyond, *OECD Working Paper*, ECO/WKP 230.

Table 1: GDP growth volatility and adjusted government size

Variable	Common intercept	Fixed effects (one-way)	Fixed effects (two-way)
$GOVEXP$	-0.95 (0.71)	-2.68 ***(1.01)	-3.04***(1.02)
Observations	72	72	72
R^2_{adj}	0.03	0.09	0.37

The dependent variable is the standard deviation of GDP growth rates in all specifications. OLS estimation. White heteroskedasticity/serial correlation-corrected standard errors in parenthesis. Specification (3) includes only significant time dummies. ***(**)[*] stands for 1% (5%) [10%] significant.

Table 2: GDP volatility and adjusted government size: OLS and IV Estimation

Variable	OLS	IV
$GOVEXP$	-3.14 ** (1.39)	-2.94 (1.93)
$UNEMPL$	0.17 *** (0.05)	0.17 *** (0.05)
$VOLINFL$	0.24 ** (0.11)	0.24 *** (0.07)
$GDPpc$	2.49 * (1.45)	2.47 * (1.54)
Observations	72	72
R^2_{adj}	0.66	0.66

The dependent variable is the standard deviation of GDP growth rates in all specifications. The column labelled IV shows the estimates using instrumental variables. Instruments used: openness, interest payments on debt, government strength, population. Two-way fixed effects error component. ***(**)[*] stands for 1% (5%) [10%] significant.

Table 3: GDP volatility and adjusted government size: quadratic model

Variable	Linear model	Quadratic model
$GOVEXP$	-2.94 (1.93)	-36.57 ** (16.74)
$GOVEXP^2$		5.03 ** (2.47)
$UNEMPL$	0.17 *** (0.05)	0.19 *** (0.05)
$VOLINFL$	0.24 *** (0.07)	0.21 *** (0.07)
$GDPpc$	2.47 * (1.54)	2.84 * (1.46)
Observations	72	72
R^2_{adj}	0.66	0.69

The dependent variable is the standard deviation of GDP growth rates in all specifications. Instruments used: openness, interest payments on debt, government strength, population. Two-way fixed effects error component. ***(**)[*] stands for 1% (5%) [10%] significant.

Table 4: GDP volatility and different measures for automatic stabilizers

	Linear	Nonlinear
$GOVCONSnw$	$-4.28(2.70)$	$-13.01^{***}(4.37)$
$GOVCONSnw^2$		$3.17^{**}(1.34)$
$GOVCONSw$	$-4.31^{**}(1.72)$	$-19.91\ (15.83)$
$GOVCONSw^2$		$3.14(3.33)$
$INVEST$	$-0.94(0.66)$	$-5.93(5.60)$
$INVEST^2$		$2.51(2.69)$
$SUBSID$	$0.56(1.12)$	$-0.40(0.47)$
$SUBSID^2$		$-0.84(0.54)$
$SOCSEC$	$-4.49(2.93)$	$-7.13(11.11)$
$SOCSEC^2$		$0.98(2.31)$
$TRANS$	$0.21(0.86)$	$-4.01(4.51)$
$TRANS^2$		$0.81(0.84)$
$TAXdir$	$-0.26(0.73)$	$-6.49^{**}(2.81)$
$TAXdir^2$		$1.43^{*}(0.73)$
$TAXindir$	$-2.81^{**}(1.24)$	$8.80(24.38)$
$TAXindir^2$		$-2.21(5.17)$
$REVEN$	$-2.37(1.53)$	$-36.43^{**}(16.61)$
$REVEN^2$		$5.01^{**}(2.46)$

The dependent variable is the standard deviation of GDP growth rates in all specifications. Instruments used: openness, interest payments on debt, government strength, population. Two-way fixed effects error component. $^{***(**)[*]}$ stands for 1% (5%) [10%] significant.

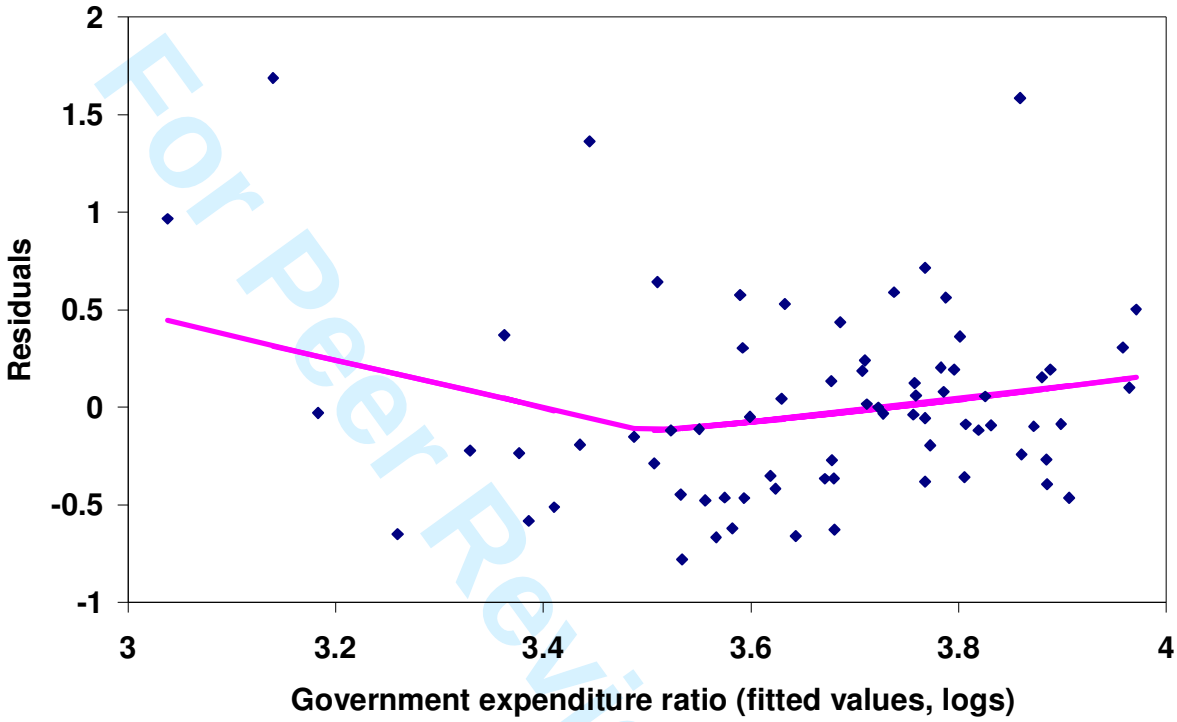

Figure 1: The Nearest Neighbor Fit curve

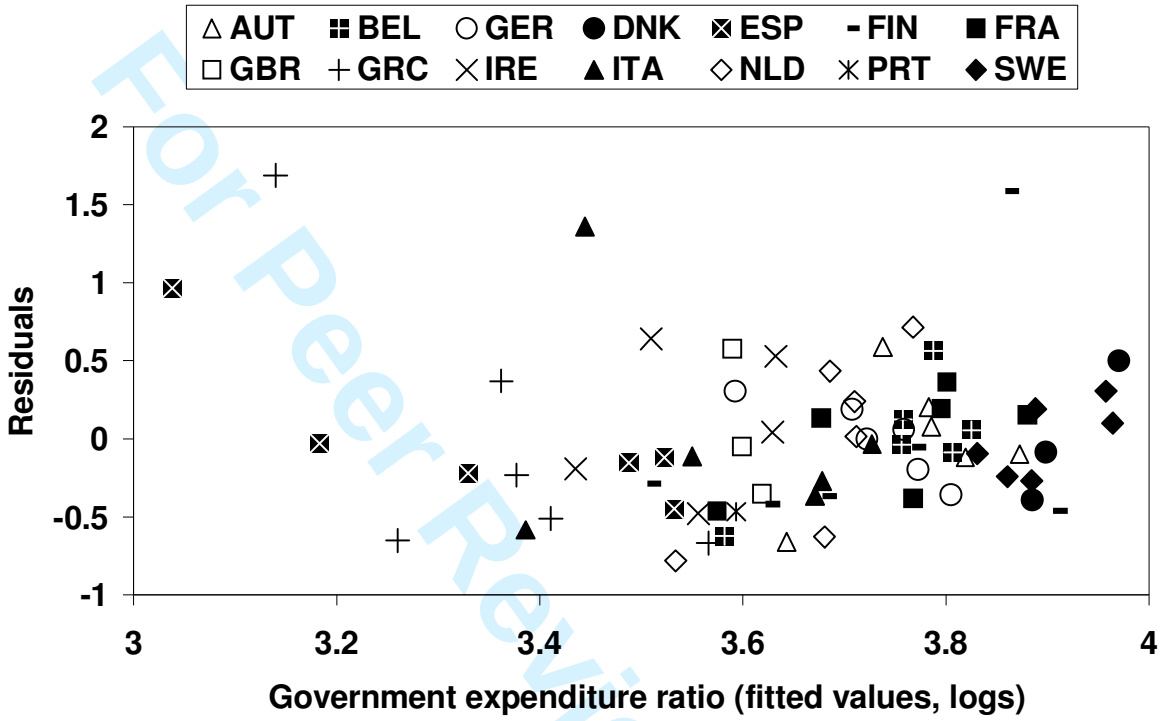

Figure 2: The parabolic curve: decomposition into single countries