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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@oebn.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 stabilizers¹, 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-

¹We 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.

²See 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.

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8 work but then also investigate whether there is a threshold level beyond which
9 this stabilizing effect might revert. The hypothesis that nonlinearities might exist
10 is partly based on the literature that deals with growth effects of fiscal policy.
11 Here theoretical results (see e.g. Barro, 1990) predict a negative growth effect
12 in countries where the size of government exceeds a certain threshold. Under
13 the assumption that there is a robust negative correlation between volatility of
14 output and long term growth, the resulting inverse U-shaped relationship between
15 government size and growth would translate into a U-shaped relationship
16 between government expenditures and output volatility. While a related non-
17 linearity hypothesis, namely that government size could have a negative *growth*
18 impact when it exceeds a certain threshold level, has been frequently formulated
19 (see e.g. Barro, 1990, Slemrod, 1995), this is the first paper, to the knowledge
20 of the authors, which addresses this issue empirically in the context of fiscal
21 stabilizers.
22

23
24 The paper is organized as follows. Section 2 investigates the impact of fiscal
25 stabilizers on business cycle volatility within a linear framework, also taking account
26 of the potential endogeneity between the variables. Section 3 investigates
27 the possibility of nonlinearities. Section 4 applies the same methodology to the
28 different subcomponents of government expenditures and revenues to examine
29 which of these components can most directly be related to the stabilizing aspect
30 of fiscal policy. Section 5 concludes.
31

32 33 **2 Do fiscal stabilizers indeed stabilize? –** 34 **A first approach** 35

36
37 When investigating the interaction between fiscal stabilizers and the volatility
38 of output growth the first issue is the definition of an appropriate proxy for
39 fiscal stabilizers.³ We will focus on the most general measure: the average ratio
40 of government spending to GDP. Obviously the automatic component of fiscal
41 stabilizers does not only work from the expenditure side, but also from the revenue
42 side, mainly through personal income and corporate taxes. However, there
43 is no clear consensus in the empirical literature which side of the government
44 budget is more appropriate when investigating the impact of fiscal stabilizers:
45 Van den Noord (2000) and Fatás and Mihov (2001a) for instance, argue on the
46 importance of the government expenditure side, while the European Commission
47 (2002) – although in a slightly different context – refers to the revenue side
48 as being the one that is more influenced by the business cycle. We start by
49 focusing on the expenditure side, however, we will also present evidence on the
50 revenue side in section 4.
51

52
53 ³Our basic data set consists of yearly data on 14 EU countries covering the period 1970 to
54 1999. Our data set contains all current EU countries with the only exception of Luxembourg.
55 For some countries the time range is shorter so that the sample is not balanced.
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8 The use of the original, unadjusted government expenditure series as a proxy
9 for fiscal stabilizers is common within this strand of literature. However, total
10 government spending does not only capture a reactive component that can be
11 related to the automatic stabilization function (as well the part of expenditures
12 that is stable irrespective of the stage of the cycle), but also a third, autonomous
13 component of spending that reflects discretionary fiscal policy measures. Em-
14 pirical evidence for a negative relationship between government size and output
15 growth fluctuations could thus, among other reasons, be due to discretionary
16 policy measures. We will therefore focus our analysis only on the part of gov-
17 ernment expenditures that is left after filtering out discretionary policy.
18

19
20 In the literature there are several approaches to extracting the stabilizing
21 component of government expenditure. One option is to look at the subcompo-
22 nents of government spending or revenues that can be related more directly to
23 the automatic stabilizing function. Another approach is the one adopted by the
24 IMF and the OECD. Here a ‘cyclically adjusted’ fiscal balance is constructed
25 by relating the budget deficit to the state of the cycle relative to a cyclical in-
26 dicator such as the output gap (see, e.g. Larch and Salto 2005). Our approach
27 is estimating an unobserved components model following Harvey (1985, 1989)
28 in order to separate a trend, a cyclical component and an irregular part of the
29 government expenditure ratio series. The irregular part is subsequently sub-
30 tracted from the data as it might not represent the automatic stabilizing part
31 of government expenditures. For the rest of the paper we will refer to it as
32 adjusted government expenditure. To get a first impression of the nature of the
33 relationship between fiscal stabilizers and output growth volatility, we divide
34 our data set into six subperiods (1970-74, 1975-79, 1980-84, 1985-89, 1990-94,
35 1995-99) and estimate the following baseline regression:
36

$$37 \quad VOLGROWTH_{it} = \beta(GOVEXP_{it}) + u_{it}, \quad (1)$$

38 where the left hand variable is the standard deviation of output growth in period
39 t ($t = 1, \dots, 6$ stands for each of the subperiods described in the footnote) for
40 country i and $GOVEXP_{it}$ is the logged ratio of government expenditures over
41 GDP, adjusted for the irregular component.
42

43 Insert Table 1 around here
44

45 The regression results for equation (1) – based on different assumptions for
46 the error term – are presented in Table 1. The first column shows the result
47 for the assumption that the error term is independent of the cross-sectional
48 units (countries) and *iid* normal (that is, the panel is estimated as if it were a
49 cross-country regression including a constant). The second column shows the
50 results for the assumption of fixed country effects, and the third column shows
51 the estimated β under the assumption of fixed country and time effects. The
52 results in Table 1 all show a negative coefficient for β , with β being highly
53 significant for the latter two specifications. The results thus seem to confirm
54 that fiscal stabilizers have had a smoothing impact on the business cycle. Still,
55

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:

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

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.

⁴Several 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

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

⁶This 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.

⁷Figure 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:

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

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

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

12
13 To sum up, our results indicate a nonlinear relationship between government
14 size and output growth volatility. For relatively low levels of the government
15 expenditure ratio fiscal stabilizers have the desired impact such that they reduce
16 business cycle fluctuations. For higher levels, however, the effect is, at best, not
17 significant, but it might as well revert.

21 4 Towards a narrower definition of government 22 size – which fiscal components stabilize most? 23

24 Fiscal stabilizers obviously do not only work from the expenditure side but also
25 from the revenue side. The aim of this section is to analyze the nature of the
26 smoothing effect from the revenue side. Using a disaggregated data set allows
27 us to investigate which subcomponents of government expenditure or revenue
28 can be most directly related to the stabilizing aspect of fiscal policy.
29

30 We thus rerun equations (2) and (3) by first substituting government spend-
31 ing by total revenues ($REVEN_{it}$) that is computed as the sum of direct and
32 indirect taxes and social security and other transfers received by the govern-
33 ment. We then repeat this procedure using subcomponents of government ex-
34 penditures, namely non-wage government consumption ($GOVCONS_{nw_{it}}$), wage
35 government consumption ($GOVCONS_{w_{it}}$), government gross investment ($IN-$
36 $VEST_{it}$), subsidies ($SUBSID_{it}$) and social security transfers paid by the gov-
37 ernment ($SOCSEC_{it}$). Furthermore we also use transfers ($TRANS_{it}$) that is
38 the sum of subsidies, social security transfers and other transfers paid by the
39 government. On the revenue side we look at two subcomponents: direct taxes
40 ($TAX_{dir_{it}}$) and indirect taxes ($TAX_{indir_{it}}$).⁸
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43 Intuitively the subcomponents on the spending side that are most directly
44 related to the theoretical definition of fiscal stabilizers are social security trans-
45 fers and subsidies. Investment, on the other hand, can be expected to consist
46 mainly of discretionary measures. $GOVCONS_{w_{it}}$ might contain a discretionary
47 as well as a fiscal stabilizing part while the non-wage fraction should not be
48 closely related to fiscal stabilizers. On the revenue side indirect taxes do not
49 show the standard attributes of fiscal stabilizers so that we expect regression
50

51 ⁸All fiscal measures are used as logs of the share in GDP and those that are expected to
52 contain a significant discretionary part ($INVEST_{it}$ and $GOVCONS_{w_{it}}$) are adjusted following
53 the same approach applied to the government expenditure ratio. In all cases the estimation is
54 done using the same instruments selected for the case of the overall government expenditure
55 measure.
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8 results to deviate substantially from the ones derived in the previous sections.
9 Direct taxes, on the other hand, should show a high degree of stabilizing prop-
10 erties, possibly also leveling out beyond a certain threshold.
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12 Insert Table 4 around here

13 The results for the various subcomponents of government expenditures and
14 revenues are given in Table 4. The results for total revenues show the same
15 characteristics as those of the government spending ratio: Accounting for the
16 possibility of endogeneity, the coefficient for total revenues is negative but not
17 significant. Using a nonlinear model, however, the coefficients are highly signifi-
18 cant for the linear as well as for the quadratic term. Thus the same implication
19 holds namely that the smoothing effect of fiscal stabilizers from the revenue
20 side may vanish for higher levels. The fact that a similar result applies to direct
21 taxes while this is not the case for indirect taxes supports the hypothesis that
22 personal and corporate income taxes are most directly related to the theoret-
23 ical definition of fiscal stabilizers. One can interpret this result in the light of
24 the discussion on tax reforms that usually assume a trade-off between efficiency
25 and stabilization effects. Our results suggest that, for countries with a high tax
26 burden, tax cuts can both increase efficiency and contribute to a less volatile
27 business cycle at the same time. Concerning the subcomponents on the ex-
28 penditure side there is evidence for nonlinearities only for non-wage government
29 consumption whereas the other components do not show any parabolic relation-
30 ship. It is interesting to note, though, that wages seems to smoothen output in a
31 linear fashion, as indicated by the negative and significant sign in the regression.
32
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34 The main result is therefore that of those subcomponents that are expected
35 to be most directly related to fiscal stabilizers, only revenues and direct taxes
36 show the hypothesized smoothing impact (for lower levels). This effect, however,
37 reverts for higher levels and could actually increase cyclical volatility. Subsidies
38 and social security transfers, on the other hand, do not have a smoothing im-
39 pact, neither in the linear nor in the nonlinear model setting.
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41

42 5 Conclusions

43 The effect of fiscal stabilizers (proxied by the government expenditure share
44 adjusted for discretionary policy) on cyclical volatility is tested for a panel of
45 EU-member states in the last three decades within a linear as well as a non-
46 linear framework. Evidence from the linear model is mixed: While the basic
47 OLS results confirm the finding that fiscal stabilizers have reduced business cy-
48 cle fluctuations this effect is no longer significant when accounting for potential
49 endogeneity of government size.
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52 However, the results based on a nonlinear model setting indicate a smoothing
53 effect for lower levels of government size, but the ‘returns to smoothing’ dimin-
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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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10 Economic Studies and the Oesterreichische Nationalbank the for many helpful
11 comments and discussions.
12

13 Appendix: Data sources

14
15 The data on government expenditures and revenues were taken from the OECD
16 Economic Outlook database. Real GDP per capita and GDP growth were com-
17 puted in 1995 prices using data from the World Development Indicators 2001
18 (World Bank) except the data for West Germany (1970-91), which were built
19 from the International Financial Statistics (International Monetary Fund). The
20 openness variable was retrieved from the World Development Indicators 2001
21 (World Bank) except the data for West Germany (1960-91), which were taken
22 from the Penn World Tables 5.5. The source of data concerning population is
23 the Penn World Tables 5.5. Data on unemployment and inflation were taken
24 from the OECD Main Economic Indicators. The data on political variables are
25 from Huber, Kocher and Sutter (2002).
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For Peer Review

Table 1: GDP growth volatility and adjusted government size

Variable	Common intercept	Fixed effects (one-way)	Fixed effects (two-way)
<i>GOVEXP</i>	-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
<i>GOVEXP</i>	-3.14 ** (1.39)	-2.94 (1.93)
<i>UNEMPL</i>	0.17 *** (0.05)	0.17 *** (0.05)
<i>VOLINFL</i>	0.24 ** (0.11)	0.24 *** (0.07)
<i>GDPpc</i>	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
<i>GOVEXP</i>	-2.94 (1.93)	-36.57 ** (16.74)
<i>GOVEXP</i> ²		5.03 ** (2.47)
<i>UNEMPL</i>	0.17 *** (0.05)	0.19 *** (0.05)
<i>VOLINFL</i>	0.24 *** (0.07)	0.21 *** (0.07)
<i>GDPpc</i>	2.47 * (1.54)	2.84 * (1.46)
Observations	72	72
R_{adj}^2	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
<i>GOVCONS_{sw}</i>	-4.28(2.70)	-13.01*** (4.37)
<i>GOVCONS_{sw}²</i>		3.17** (1.34)
<i>GOVCONS_w</i>	-4.31** (1.72)	-19.91 (15.83)
<i>GOVCONS_w²</i>		3.14(3.33)
<i>INVEST</i>	-0.94(0.66)	-5.93(5.60)
<i>INVEST²</i>		2.51(2.69)
<i>SUBSID</i>	0.56(1.12)	-0.40(0.47)
<i>SUBSID²</i>		-0.84(0.54)
<i>SOCSEC</i>	-4.49(2.93)	-7.13(11.11)
<i>SOCSEC²</i>		0.98(2.31)
<i>TRANS</i>	0.21(0.86)	-4.01(4.51)
<i>TRANS²</i>		0.81(0.84)
<i>TAX_{dir}</i>	-0.26(0.73)	-6.49** (2.81)
<i>TAX_{dir}²</i>		1.43* (0.73)
<i>TAX_{indir}</i>	-2.81** (1.24)	8.80(24.38)
<i>TAX_{indir}²</i>		-2.21(5.17)
<i>REVEN</i>	-2.37(1.53)	-36.43** (16.61)
<i>REVEN²</i>		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.

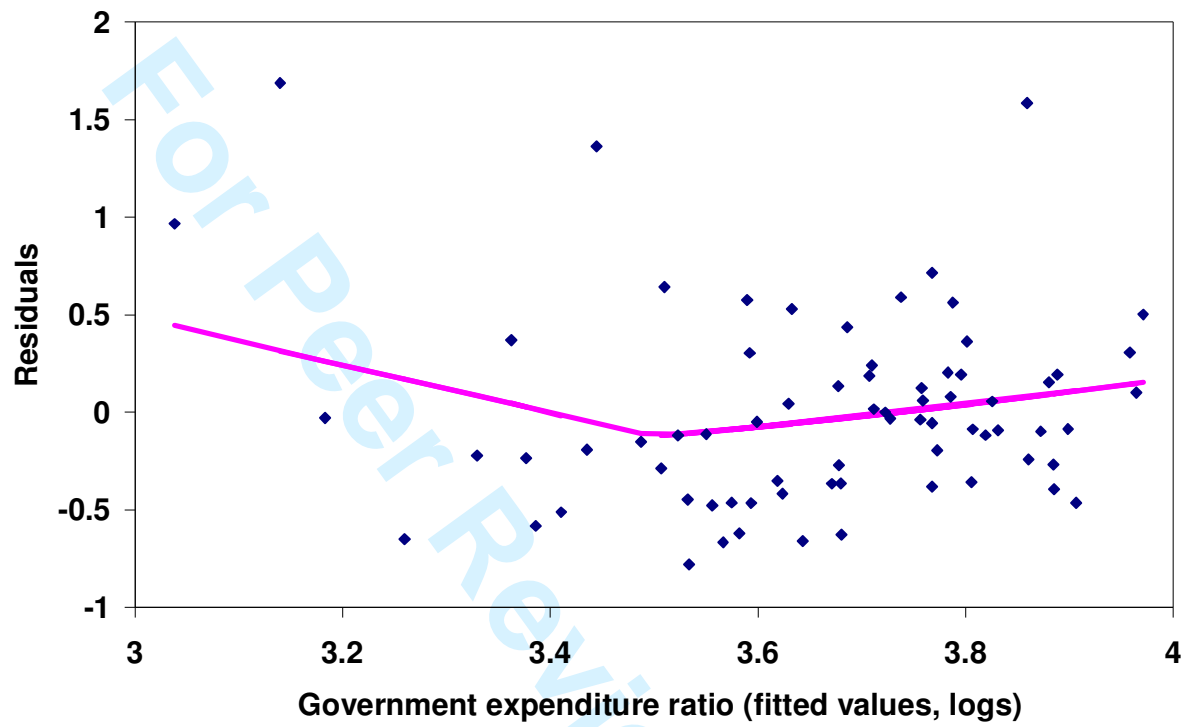


Figure 1: The Nearest Neighbor Fit curve

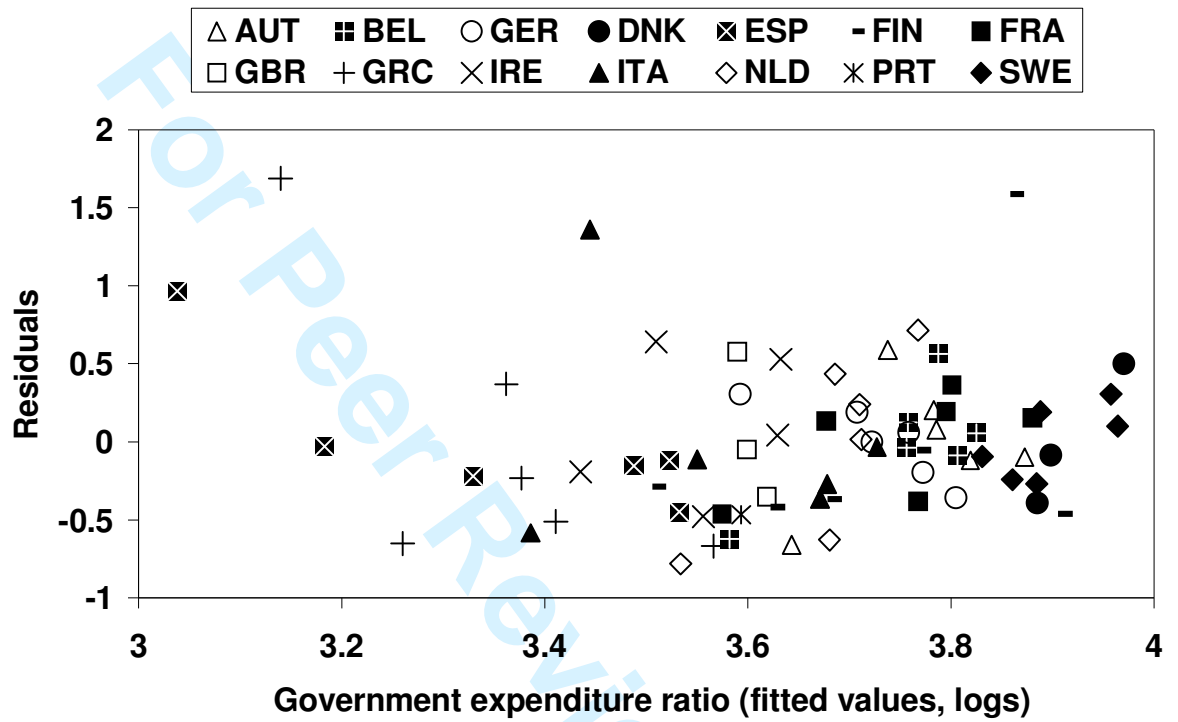


Figure 2: The parabolic curve: decomposition into single countries