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GOVERNMENT SIZE AND OUTPUT VOLATILITY: SHOULD WE FORSAKE AUTOMATIC STABILISATION?

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Non-Technical Summary

Prior to the launch of the euro, academics and policymakers were concerned that the loss of the monetary policy instrument would deprive participating countries of a vital tool to respond to country-specific economic shocks. This concern was rooted in the generally accepted proposition that market-based adjustment channels—i.e. labour mobility and capital flows—tended to be weaker among euro area countries than among regions of existing monetary unions such as the United States.

Against this background, it was hoped that European countries could rely on the stabilizing role of large government sectors to smooth fluctuations –the so-called automatic stabilizers. Those stabilizers were generally considered as having contributed significantly to the decrease of output volatility witnessed in Europe and in the United States after World War II, when the size of governments increased substantially on both sides of the Atlantic. This view was supported by a seemingly robust and well-documented stylised fact: that countries with large governments tended to exhibit more macroeconomic stability.

However in the 1980s and the 1990s the US and most European countries experienced a sharp slowdown in output volatility – the so-called *great moderation* – without having experienced any significant increase in the size of government. In this paper, we start by reviewing and bringing together the two strands of the literature. This highlights that while government size contributes to macroeconomic stabilisation, it can be substituted by monetary policy and financial development. Indeed, what accounts for the great moderation (apart from luck) seems to be a combination of monetary policy improvements and financial developments.

We therefore look at both the cross-section and time-series evidence and find that although in the 1970s and 1980s output volatility was larger in big-government countries, this relationship seems to have vanished in the 1990s, especially in relatively closed economies. Bivariate analysis confirms that the correlation does not hold anymore after 1995 because the decline in volatility was especially pronounced for small-government countries. That reduction in the variance of primary income, rather than government transfers, played the main role is confirmed by an analysis of which components of spending account for the decline in aggregate volatility in the US and four major European economies.

The next step is to proceed with econometric analysis. We start by replicating previous estimates and find again that the negative relationship between government size and output volatility was strong prior to 1990 but vanishes afterwards. We next introduce financial development and the quality of monetary policy as two other determinants of output volatility and find that they do contribute to reducing it. We also find evidence of substitutability between automatic stabilisation and monetary policy. Our next step is to check how these alternative determinants interact with government size, that is, whether for example the quality of monetary policy is more important as a determinant of aggregate volatility when the government is small. We do find that this is the case, especially for monetary policy. This supports the idea that other channels of stabilisation can be found (and have been found) in small-government countries. Finally, we provide an

estimate of the stabilisation gain from an increase in government size and find that it decreases as the size of government grows. Specifically, we find that a one percentage point increase in the size of government is unlikely to yield a reduction in output volatility exceeding 0.1 percentage point once public expenditures reaches around 40% of GDP. This suggests that the impact of a marginal change in the size of government is bound to be very small for most countries in the euro area.

Government Size and Output Volatility: Should We Forsake Automatic Stabilisation?*

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1. Introduction

Prior to the launch of the euro, academics and policymakers were equally concerned that the loss of the monetary policy instrument would deprive participating countries of a vital tool to respond to country-specific economic shocks. This concern was rooted in the generally accepted proposition that market-based adjustment channels—i.e. labour mobility and capital flows—tended to be weaker among euro area countries than among regions of existing monetary unions such as the United States.

Those arguing that the Economic and Monetary Union (EMU) would nonetheless be capable of coping with idiosyncratic shocks (Emerson et al., 1990 or Buti and Sapir, 1998) built their case on two main arguments. First, they claimed that EMU would actually reduce the occurrence of country-specific shocks, not only because it would decrease country specialisation, but also because it would limit the possibility of policy-induced shocks. There would, by definition, be no more policy-related disturbances emanating from national monetary authorities, whereas EMU fiscal rules would limit the scope for major fiscal slippages (including procyclical impulses) by national governments. Second, it was claimed that the new macroeconomic policy framework, and in particular the fiscal rules, would enable automatic stabilisers to operate more effectively as fears of persistent deteriorations in fiscal positions following bad times would dissipate.

Automatic stabilisers had long been regarded as playing a key role in macroeconomic stabilisation, mainly because they are not subject to the typical lags (information, decision and implementation) undermining the effectiveness of discretionary stabilisation measures. In particular, they were generally considered as having contributed

significantly to the decrease of output volatility witnessed in Europe and in the United States after World War II, when the size of governments increased substantially on both sides of the Atlantic. Hence it was hoped that improved national fiscal policy could partly make up for the loss of monetary policy in stabilising national macroeconomic conditions.

That said, of the three traditional goals of public finances detailed by Musgrave (1959), macroeconomic stabilisation is arguably "residual," in the sense that it is only a by-product of choices regarding the size, the structure and the financing of government spending that are dictated by either efficiency or distributive considerations. This led to concerns that euro area countries would actually be torn between the need to ensure adequate macroeconomic stabilisation and the reduction in the size of governments that often accompanied efforts to boost market efficiency and promote long-term growth. EMU countries would thus face a difficult trade-off between maintaining large governments to ensure sufficient automatic fiscal stabilisation and leaner ones to ensure efficiency and growth: in EU jargon, there could be a tension between the 'Maastricht' and the 'Lisbon' goals (Buti et al., 2003). Such a trade-off would be particularly unfavourable in countries where growth performance was deemed dismal and the perceived need for reforms correspondingly large.

The aim of this paper is to discuss this issue in the light of recent experience. It is divided into five sections.

In section 2, we briefly discuss the economic benefits of macroeconomic stability and the rationale for government policies playing an active role in delivering it. Section 3 reviews

the economic literature on the determinants of output volatility and its link with government size. Two separate strands of the literature are surveyed: cross-country studies focusing on OECD members and time-series studies of a single country, typically the United States. The cross-section studies confirm that countries with large governments tend to enjoy less output volatility, but also that there may be a threshold level beyond which the negative relationship disappears or even reverses. The studies that focus on the United States show, however, that the country has recently experienced an important reduction in output volatility, despite probably lying below this threshold and having witnessed a less pronounced increase in government size than most OECD countries. This suggests that something other than automatic stabilisation has been at work: an exogenous fall in volatility, an increase in market-based stabilisation, or an improvement in monetary policy.

Section 4 shows descriptive evidence on the size of government, macroeconomic volatility and the role of fiscal stabilisation policies in supporting consumption smoothing in the OECD countries, including 11 euro area members. The evidence confirms the contrast between time-series and cross-sectional studies. The main finding, however, is that the negative correlation between government size and output volatility, which is a major finding of the literature, seems to vanish for more recent cross-country data. In the traditionally volatile, small government countries, volatility has decreased substantially while government size has grown less than elsewhere.

Section 5 builds on these stylised facts to present new econometric estimates of the relationship between government size and output volatility using both time-series and cross-country information. We first confirm that the traditional link between government

size and macroeconomic volatility disappeared during the 1990s. We then explore possible reasons for this breakdown, focusing on the role of improvements in the quality of monetary policy and on progress in financial development. The evidence suggests that monetary policy and financial development can both be substitutes for government size as a stabilising force, and that once this substitutability is taken into account, the relationship between government size and macroeconomic stability remains strong, though non-linear: the marginal effect of an increase in government size on output volatility is found to be negligible for public expenditure levels above 40 percent of GDP. Conclusions and policy implications are given in Section 6.

2. Does Volatility Matter? Does Government Matter?

The Musgravian perspective of the 1960s took it for granted that more stabilisation is always better and that delivering it is the job of governments. Both of these assumptions deserve discussion.

The Keynesian paradigm of the times assumed that the private economy is inherently unstable and that output volatility involves significant economic costs. A bigger government could perhaps imply microeconomic inefficiencies but it was regarded as a macroeconomic blessing because it contributes to stability. As James Tobin reportedly said, “it takes a lot of Harberger triangles to fill an Okun gap”.

A completely different perspective was offered by the literature of the 1980s. The real business cycle models first emphasised that fluctuations could be originating on the supply side rather than the demand side, thereby questioning the wisdom of containing them—a view later reinforced by the Schumpeterian approach to growth. Second, Lucas (1987) proposed a micro-founded evaluation of the welfare cost of US post-war macroeconomic fluctuations in a model with infinitely lived representative agents, and found that the utility gain from eliminating fluctuations in consumption was equivalent to the gain from a permanent increase in the consumption level by 0.1 percent only. This led him to conclude that “economic instability of the level [the US had] experienced since the Second World War [was] a minor problem”.

The Lucas result has been challenged by a number of papers pointing out that it is not robust if changes are made to several restrictive assumptions, including the absence of unemployment, perfect financial markets, and the functional form of preferences and risk

aversion (see for example Otrok, 2001, for a survey). The empirical literature on the relationship between volatility and growth has also suggested that volatility may have detrimental effects on long-term growth (Ramey and Ramey, 1995), at least for countries where financial markets are not fully developed (Aghion et al., 2006).

The purpose of the present paper is more modest than assessing the welfare consequences of economic fluctuations. We only seek to examine the impact of government size on economic fluctuations. However, bearing in mind that what matters ultimately is the welfare consequence of government intervention on economic fluctuations, we retain from the Lucas argument the need to assess volatility of consumption, not output. We will therefore look at both and confirm that they are highly correlated.

Turning to the second assumption, that bigger governments are needed to deliver macroeconomic stability, we note that it rests on two further hypotheses: that there are no available substitutes to government-induced stabilisation; and that the demand for stabilisation remains constant over time, regardless of changes in the structure of the economy.

Both are questionable. The reason why public budgets provide an automatic stabilisation function is that governments face no liquidity constraint and can therefore behave as infinitely durable agents engaged in intertemporal optimisation. It is not their governmental character that matters but the fact that, barring exceptional situations, they enjoy unrestricted access to the capital market and can therefore borrow to smooth out fluctuations in income.

In this role, however, there can be various alternatives to a big government: monetary policy may take up the role devoted to fiscal policy by the traditional literature; financial

liberalisation may allow more households to have access to financial intermediation and "self-insure" against the impact of economic fluctuations; private insurance institutions that substitute for government insurance may manage their budget constraint in an intertemporal manner. Moreover, structural changes can reduce the magnitude of shocks or help in absorbing them: lean management techniques may reduce the procyclical behaviour of inventories; firms may make use of financial deepening and invest countercyclically; openness to trade and capital flows may reduce the multiplier effects of domestic shocks.

This discussion suggests that the relationship between government size and the cyclical behaviour of the economy is unlikely to be constant over time because it probably adjusts to a host of structural changes. This is what we intend to explore in the remainder of the paper.

3. Automatic Stabilisers and the Great Moderation

The cyclical pattern of Western economies underwent a profound transformation during the twentieth century. As carefully documented by Romer (1999) or Blanchard and Simon (2001) for the United States, recessions have become less frequent and business expansions have tended to last longer since the 1950s. In addition, the variance of output growth has declined substantially. Similar trends have been observed in some European countries, most clearly in the case of Germany and the UK (Stock and Watson, 2003); although output volatility in the early post-WWII decades was generally even lower than in the United States (Sapir et al., 2004).

Researchers have explored the links between economic structures, economic policy and volatility. Two different, unrelated approaches emerged in the literature. Adopting a

cross-country perspective, the first focused on the link between government size and macroeconomic stability. The second approach is longitudinal and has aimed at explaining the steady decline in the volatility of US output.

While we are primarily concerned with the first question, we cannot ignore the second one. Automatic stabilisers are deemed important because economies are subject to shocks and prone to volatility. If volatility vanishes, so does the importance of automatic stabilisers. In what follows, we review the two strands of the literature, starting with the relationship between the size of government and macroeconomic stability.

3.1. Do bigger governments deliver greater macroeconomic stability?

In line with the Keynesian tradition, economists have long argued that the growing size of governments after World War II contributed to greater macroeconomic stability because of the near proportionality between the magnitude of automatic fiscal stabilisers and the size of government expenditure (Blinder and Solow, 1974).[1] The basic idea of this literature is that, by reducing the effects of the liquidity constraint faced by households, automatic stabilisers—including the income-based tax system and unemployment insurance benefits—alleviate the impact of exogenous shocks to aggregate income on aggregate current consumption and output.

3.1.1. A negative relationship between government size and volatility...

The paper by Gali (1994) was a seminal contribution to both empirical and theoretical research on the link between government size and macroeconomic stability. Empirically,

[1] This reflects the fact that the elasticity of government revenues to output growth is close to one—Girouard and André (2005)—while expenditure is largely inelastic to growth—because it reflects commitments made during budget preparation. As a result, the revenue to GDP ratio is broadly insensitive to the business cycle, whereas the expenditure to GDP ratio moves in the opposite direction to GDP. The overall budget balance (in percent of GDP) thus tends to be countercyclical (deteriorating in bad times and improving in good times), with a semi-elasticity to GDP roughly equal to the share of government expenditure in GDP.

it seems to be the first to systematically investigate the relationship between fiscal aggregates and output volatility for a cross-section of countries. More specifically, the paper examines the role of income taxes and government purchases as automatic stabilisers in 22 OECD countries over the period 1960-1990.[2] The basic finding is that government size is negatively associated with output volatility: economies with large governments (such as the Netherlands, Norway and Sweden) experience milder economic fluctuations than economies with small governments (such as Japan, Portugal and Spain). This finding appears to be robust to the use of alternative measures of government size and output variability.

The theoretical contribution of the paper was an attempt to build a non-Keynesian model capable of generating predictions that fit the results of the cross-country regressions. Gali's idea is to introduce the concept of automatic stabilisers in a basic real business cycle (RBC) model. In particular, he examines whether income taxes and government purchases respond in a stabilising way to technology shocks in a model with perfect markets. The canonical RBC model fails to match the empirical results.[3] There are, obviously, two possible conclusions from the exercise undertaken by Gali (1994). One is that the empirical findings of the paper were flawed. The other is that RBC models are ill-designed to account for the available evidence, pointing to the importance of introducing market imperfections and other frictions in these models. The recent literature has pursued both avenues.

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[2] It uses two indicators of fiscal intervention (the standard deviation of both the tax revenues/GDP and government purchases/GDP ratios) and two measures of output variability (the standard deviation of both linearly de-trended log GDP and GDP growth). The study reports ordinary-least-squares (OLS) estimates of regressions using the two measures of output variability as the dependent variable and alternative combinations of fiscal intervention as regressors.

[3] In all its specifications, the model predicts a positive relationship between the size of income taxes and the degree of output volatility. By contrast the model is capable of replicating the empirical finding of a negative relationship between the size of government expenditure and the degree of macroeconomic instability, but the magnitude of the predicted effect is far smaller than the empirical evidence suggests.

One potential problem with Gali's empirical approach is that it fails to account for a possible simultaneity bias in OLS estimates of the relationship between government size and macroeconomic stability. One reason for that is provided by Rodrik (1998) who argues that precisely because governments tend to stabilise output, one should expect the size of government to be relatively larger in more open economies, which are also more volatile because of their specialisation and their exposure to international shocks. Ignoring such reverse causality may result in a downward bias of the estimated impact of government size on macroeconomic stability.

Several recent studies have explicitly attempted to address the simultaneity issue. In a widely cited study, Fatás and Mihov (2001) replicate Gali's exercise on a cross-section sample of 20 OECD countries over the period 1960-1997, using regressions with instrumental variables to solve the possible simultaneity problem. Government size is measured as the (logarithm of the) average ratio of government spending to GDP for the period, while volatility is measured as the standard deviation of the growth rate of real GDP for the same period. Their main finding is that the negative effect of government size on output volatility becomes larger in absolute value and more precisely estimated when the simultaneity bias is corrected. This result is robust to various measures of output volatility and government size.

Kim and Lee (2007) use a Keynesian framework to estimate the impact of government size (measured by the share of total government expenditure in GDP) on economic uncertainty (measured by intersectoral income fluctuation). Their estimates, based on a cross-section sample of 15 OECD countries over the period 1981-1998 and on estimation

techniques taking into account the simultaneity argument, confirm that a larger government reduces economic uncertainty.

Having validated (and amplified) Gali's (1994) empirical finding, we now turn to its theoretical puzzle, namely the absence of a clear connection—or even, under some reasonable assumptions, a positive correlation—between government size and volatility in the context of a standard RBC model.

The failure of RBC models to predict basic stylised facts of the relationship between fiscal policy and private behaviour has led researchers to incorporate realistic frictions, including market imperfections, nominal rigidities, and non-Ricardian behaviours. For instance, Andrés, Doménech and Fatás (2007) show that adding nominal rigidities and costs of capital adjustment to a standard RBC model can generate a negative correlation between government size and output volatility. However, in their augmented model, the stabilising effect of government is only present because of a 'composition effect'. In fact, increasing the share of government spending in GDP produces two effects in opposite directions. On the one hand, it increases the share of the non-volatile component of GDP; on the other, it increases the volatility of consumption (and investment) in contrast with the empirical findings cited above.

To address this oddity of their model, Andrés, Doménech and Fatás further introduce credit-constrained (or 'rule-of-thumb') consumers, who cannot borrow and lend in financial markets and are therefore constrained to optimise on a period-by-period basis. They find that the modified model is capable of generating a fall in output and consumption volatility when the size of government rises, provided that the rigidities and the proportion of rule-of-thumb consumers are both sufficiently large. This leads them to conclude that models with Keynesian and non-Ricardian features can better replicate the

empirical evidence about the effects of fiscal policy on the volatility of output fluctuations than pure RBC models.

3.1.2. ...but the relationship is likely to be a complex one

The basic relationship between government size and output volatility has been extended in several directions.

Several researchers have examined the role of the composition of taxes and government expenditure. An important step in this direction is the paper by Buti et al. (2003), which argues that automatic stabilisers operate not only on the demand side through their (positive) impact on disposable income, but also on the supply side through the (negative) impact of taxes on production. Distortionary taxes tend to increase the level of equilibrium unemployment and lower potential output. What is more important, however, in the present context is that distortionary taxes also affect the economy's supply response to economic shocks: the more progressive the tax system, the less responsive the supply response because workers demand higher wages to compensate for higher taxes and to maintain their net wages.

Incorporating the supply-side channel of automatic stabilisers in the standard AD/AS model leads to interesting results. Although automatic stabilisers continue to stabilise output in the event of demand shocks, it turns out that they may in fact be destabilising in the event of supply shocks. Whether or not this is the case depends on the level of taxes. If taxes are above a critical level, a further increase due to the working of automatic stabilisers may result in perverse stabilisation effects. Buti and his co-authors find that the critical tax level depends primarily on the size of the economy: the larger the economy,

the larger the demand impact of automatic stabilisers relative to the supply impact, and therefore the higher the tax threshold.

Martinez-Mongay and Sekkat (2005) attempt to test the potentially destabilising effect of taxes on output. They begin by estimating the same equation as Fatás and Mihov (2001), using total tax revenues as a percentage of GDP to measure government size and the standard deviation of the output gap as a percentage of trend GDP to measure volatility. After corroborating the negative relationship between government size and output volatility, they examine whether the tax mix affects this relationship. In particular, they are interested in testing whether countries with high distortionary taxes display destabilisation effects. Since they are focusing on supply effects, they use the effective tax rate on labour to measure the importance of distortionary taxes. They find weak evidence in support of their hypothesis.

The traditional macroeconomic literature on automatic stabilisers tends to focus on taxes and to dismiss the relevance of government spending other than unemployment benefits. Yet the studies reviewed here indicate that researchers who econometrically analyse the link between government size and macroeconomic stabilisation use indiscriminately taxes and government spending as measures of government size.

Darby and Mélitz (2007) systematically evaluate the contribution of individual tax and government spending items on automatic stabilisation for a cross-country sample of 20 OECD countries for the period 1980-2001. The data used by Darby and Mélitz allow a distinction between four revenue[4] and seven expenditure[5] items. The degree of

[4] Household direct taxes, other direct taxes, social security contributions, and indirect taxes.

stabilisation provided by each tax and spending item is measured by the coefficient of the output gap in regressions of (first differences in) individual budgetary items on a number of macroeconomic variables, including (first differences in) the output gap. The regressions are estimated by instrumental variable techniques in order to account for the potential simultaneity problem between (non-discretionary) fiscal policy and the business cycle. Seemingly unrelated techniques are also used to correct the potential correlation between residuals across individual budgetary items.

Darby and Mélitz estimate two sets of equations: one with budgetary items in levels (constant dollars), the other with items in ratios to GDP. The results they obtain differ substantially between the two specifications. When working with levels, they assign most of the stabilisation to taxes; when working with ratios, they find that all the contribution to stabilisation comes from the spending side. This is clearly an effect of the choice of specification. Because ratios fully reflect GDP fluctuations (through the denominator), public expenditure—which is tied to budget commitments in nominal terms—will *mechanically* exhibit a rising GDP ratio in bad times and a declining one in good times. By contrast, *nominal* revenues automatically decrease in bad times and increase in good times, giving a more stable ratio to GDP. The correct measure of *stabilisation* (i.e. the proportion of output shocks effectively *absorbed* by government) is clearly the second one.[6] Looking at their nominal evidence, they find aggregate automatic stabilisation in the OECD of around 68 percent: a positive output gap of one dollar produces 50 cents more

[5] Current spending (besides health), health expenditure, age-related benefits, incapacity-related benefits, unemployment benefits, sick pay benefits, and subsidies.

[6] The first one is fundamentally flawed because it *presumes* that only the private sector can be a source of shock in the economy (essentially suppressing the widely documented tendency of governments to behave in a pro-cyclical fashion). Pushing this argument to the limit, if the government sector were to represent 100 percent of the economy, budget ratios would be constant, with no guarantee that the nominal figures would not fluctuate.

tax revenue and 18 cents less expenditure. Household direct taxes (which constitute 28 percent of total government revenue) alone produce nearly half the total stabilisation effect. The authors also present results for the sub-sample of EU15 countries, which broadly agree with those for the full OECD sample.

Silgoner, Reitschuler and Crespo-Cuaresma (2002), attempt, like Martinez-Mongay and Sekkat (2005), to test for the presence of a nonlinear threshold effect in the relationship between government size and output stabilisation. The authors start by estimating the same (linear) equation as Fatás and Mihov (2001), but with a number of modifications. First, they remove discretionary fiscal measures from government spending, their measure of government size. Second, they introduce additional instrumental variables to deal with possible reverse causation. Third, their sample covers 12 EU countries for the period 1970-1999. Finally, they use five-year averages for the dependent and explanatory variables, instead of averages for the entire period, and do pooled estimation in order to obtain sufficient observations. Their regression results are somewhat surprising. While they obtain OLS estimates for the coefficient of government size that are very similar in size and level of significance to those of Fatás and Mihov (2001), their instrumental variable estimates are very different. They turn out to be smaller than the OLS estimates—which runs counter to the expectation that OLS produces a downward bias when there are simultaneity problems—and not statistically significant.

Silgoner, Reitschuler and Crespo-Cuaresma interpret their results as supportive of the fact that the relationship between government size and output volatility may not be linear. They re-estimate, therefore, a nonlinear model of output variability, where the ratio of government spending (net of discretionary measures) to GDP enters as an explanatory variable in both linear and quadratic forms. They obtain highly significant coefficients for

both the linear and the quadratic variables, thereby confirming the existence of nonlinearities. Their results imply a threshold level for government expenditures of about 38 percent. For government sizes below this threshold there is a significant negative relationship between the government expenditure ratio and GDP growth volatility. Beyond this level, however, the relationship turns positive: an increase in public spending will, ceteris paribus, raise the variability of output growth. Since the median value of the government spending to GDP ratio in the study sample is almost 41 percent, the possibility of destabilising non-discretionary public expenditure in Europe seems real.

3.2. Fiscal stabilisation is not a free lunch

It is generally recognised that large government size may have detrimental effects on economic efficiency and growth. Most of the related arguments developed in the literature focus on the potential disincentive effects of high taxation and the perverse effects of inappropriate stabilisation. There is a longstanding theoretical (e.g. Barro, 1990) and empirical (e.g. de la Fuente, 1997) literature showing that high levels of taxation tend to impair the allocation of resources, mainly by depressing incentives to work, to invest and/or to save.

There is also some literature arguing that large governments may impinge on efficiency and growth through the working of automatic stabilisers. In particular, van den Noorde (2002) sees two potential pitfalls associated with automatic stabilisers. First, there is a risk that automatic stabilisers operate more during slowdowns than booms, which may result in adverse debt dynamics leading eventually to higher taxation and long-term interest rates. Second, large automatic stabilisers may delay necessary adjustment to structural changes if they are associated with public spending and revenue that tend to reduce the flexibility of markets, especially the labour market.

Afonso et al. (2005) review the extensive empirical literature on government size and growth in the OECD countries. The authors conclude that: “The evidence on size effects of fiscal variables supports the case for quantitative consolidation with a view to reducing total spending, thus in turn enabling reductions of deficits and lower levels of taxation.” (p. 24). At the same time, they insist that: “The review of empirical findings on growth effects of the composition of government activities clarifies that not all kinds of government spending should be treated alike when consolidating public finances.” (pp.

24-25). In other words, provided it targets wasteful spending, the reduction in the size of government is likely to raise economic efficiency and growth (see also Tanzi and Schuknecht, 2000).

The debate on the need to reduce the size of government for efficiency reasons has been particularly lively in Europe, where large public spending combined with a rapidly ageing population have often led to unsustainable fiscal positions. The fiscal retrenchment was politically facilitated during the 1990s by the willingness of most EU member states to accept and fulfil the Maastricht criteria in order to qualify for EMU membership. After the introduction of the euro, the consolidation of public finances has continued, although generally less vigorously than before as the Stability and Growth Pact (SGP) has proved to be a softer constraint than the Maastricht entry criteria.

The question raised by Buti et al. (2003) is whether there is a potential conflict between efficiency and stabilisation in EMU. The question is pertinent because efforts to reduce the size of government by EMU members risk jeopardising their automatic stabilisers, precisely when they are most needed to compensate for the loss of national monetary policy.

As already alluded to, Buti et al. find that this trade-off may not always be relevant because there may be a critical level of the tax burden beyond which a reduction in taxation may increase the effectiveness of automatic stabilisers. This leads them to conclude that, under certain circumstances, a reduction in the tax burden may in fact result in a ‘double dividend’: gains in efficiency and better automatic stabilisers. The empirical studies by Martinez-Mongay and Sekhat (2005) and Silgoner, Reitschuler and

Crespo-Cuaresma (2003) lend some tentative evidence in support of Buti et al.'s conclusion.

3.3. The Great Moderation: Why has output volatility declined?

A widely reported stylised fact of the early post-war period was the higher volatility of the US economy in comparison to the European economies—a fact that was often attributed to lower government spending. Yet starting in the mid-1980s, there was a significant decline in US output volatility—what has been dubbed the *Great Moderation* (Bernanke, 2004). Since the late 1990s, the causes of this decline have been discussed in a series of papers, most of which exclusively address developments in the US. More recently, similar analyses have been conducted in a cross-country perspective.

3.3.1. A large decline in volatility

Basic facts are not a matter for discussion. It is generally recognised that US output volatility has declined by about one half in comparison to the 1960s and the 1970s (and by about two-thirds in comparison to the 1950s); that the break occurred around 1984 (Kim and Nelson, 1999; McConnell and Perez-Quiros, 2000); that popular explanations such as the increasing share of services in the economy are of little relevance; and that the main proximate causes of the decline in aggregate volatility have been a lower variance of consumption and residential investment, as well as a lower covariance between them (Blanchard and Simon, 2001; Stock and Watson, 2003; IMF, 2007). Figure 1, which updates and complements a figure from Blanchard and Simon, illustrates the magnitude of the decline in the historical volatility of US GDP. It shows that consumption volatility followed a roughly similar evolution (the correlation between the rolling standard

deviation of output growth and that of consumption growth is 0.8) and that volatility remains at a historically low level in the 2000s.

There is also consensus on the framework best suited to analyzing the reasons for the decline. Stock and Watson (2003), Bernanke (2004) and IMF (2007) all rely on a "Taylor curve" that corresponds to monetary policy's efficiency frontier. The downward-sloping curve represents the combinations of output and inflation volatility attainable for a given distribution of shocks and a given structure of the economy. The distance between an observation, say point A, and the efficiency frontier characterises the quality of macroeconomic stabilisation. There can also be different combinations such as B and C of output and inflation volatility along the efficiency frontier, which therefore depicts a trade-off.

3.3.2. Possible explanations

Where there is disagreement is on the causes of the decline in output volatility. Three main categories of explanations have been put forward:

a) an improvement in the performance of macroeconomic (especially monetary) stabilisation in comparison to the volatility-generating policy mistakes of the 1970s;

b) structural changes in the economy, resulting for example from a relaxation of the liquidity constraints that affect consumer spending or from leaner inventory management; and

c) a temporary reduction in the magnitude of shocks, at least in comparison to the oil shocks period of the 1970s, which is generally referred to as the 'good luck' factor.

Those three categories of explanation are not mutually exclusive, as indicated by Figure 2: better macroeconomic stabilisation can result in a move closer to the efficiency frontier (for example from A to B or from A to C), but at the same time there can be an inward shift of that frontier (from TT to T'T'), either as a permanent consequence of a permanent change in the economic structure or as a result of temporary luck.

Research has not reached agreement on the main factors behind the observed reduction in US output volatility. Each of the three main views has supporters: good policies (Bernanke, 2004), structural change (Blanchard and Simon, 2001), and good luck (Stock and Watson, 2003); there are also more eclectic views that attribute the change in output volatility to a combination of good policies and structural changes (IMF, 2007).

3.3.3. Why there is disagreement

There are two reasons why consensus not been reached on what is after all an essentially empirical matter. First, policy improvements are hard to isolate from structural and random factors. Figure 2 helps to understand why. Let us leave for the moment the discussion on whether the frontier shift is temporary or permanent and assume that the observed combination of output and inflation volatility has moved from A to D. Then policy and structures (or luck) must both be part of the explanation. But decomposing between the two requires determining which combination of inflation and output volatility would have been optimal, had the TT frontier not shifted. Assuming the move has been from A to B and D would lead to ascribing the bulk of the reduction in output volatility to structures (or luck). Assuming it has been from A to C and D would result in ascribing the main role to policy improvements instead. So deciding on what has mattered implies making a judgment on policy optimality, thereby on preferences.

James Stock and Mark Watson's assessment that luck was the main factor behind the reduction in output volatility is not based on a denial of the improvements in monetary policy. On the contrary, they estimate that starting in the mid-1980s the reactions of monetary policy to shocks to output and inflation became more stabilising (essentially thanks to a rise in the coefficient of inflation in the Taylor rule in comparison with the policy behaviour of the 1970s). But they conclude from counterfactual simulations with the policy rules of the 1970s that this change did not play a major role in the observed reduction of aggregate volatility. In other words, they view that reduction as resulting from a move along A-B-D. However the IMF (2007) reaches a different conclusion on the basis of a similar, yet more satisfactory, method. Instead of using just one

counterfactual policy rule, they construct the efficiency frontier by simulating the outcome of an optimal policy rule for different relative weights of inflation and output volatility. Their conclusion is that improvements in monetary policy account for one-third of the total reduction in output volatility.

The second reason why the empirical analysis does not yield unambiguous results is that structural and random factors are hard to disentangle from each other. Discussion on this issue often tends to rely on an unsystematic reading of the empirical evidence. Exceptions are IMF (2007), which assesses changes in the distribution of shocks, and Cecchetti, Flores-Lagunes and Krause (2006), who estimate the share of credit-constrained agents in the economy and the evolution over time in a sample of industrialised countries. The IMF concurs with Stock and Watson (and disagrees with Blanchard and Simon) in concluding that luck dominates structural changes. By contrast, Cecchetti et al. concur with Blanchard and Simon in ascribing an important and permanent role in the relaxation of credit constraints. A recent paper by Giannone, Lenza and Reichlin (2008) brings an additional and interesting dimension to the discussion. It points out that the typical reliance on small- or medium-scale models leads to overstating the role of ‘good luck’ compared to structural factors because these models tend to omit structural variables.

Summing up, this literature focuses on the time dimension that is generally neglected in cross-countries studies, and hence complements them. Its most relevant conclusion for the issue we investigate in this paper is that the desirability of automatic stabilisation cannot be taken as exogenous. From a macroeconomic standpoint, government size can be substituted by better discretionary policies (either monetary or fiscal), by financial development (better access to credit) and by more resilient structures (leaner inventory

management). To the extent that those factors have played a role in the reduction of aggregate macroeconomic volatility, they reduce the benefits of automatic stabilisation through bigger governments.

4. Government Size, Fiscal Stabilisation and Volatility

As our selective review of the literature suggests, the relationship between the magnitude of automatic stabilisers (government size) and macroeconomic volatility remains vexingly elusive. On the one hand, theoretical models rely on ad-hoc features to replicate the stylised fact that large governments produce more macroeconomic stability than their leaner counterparts. On the other hand, existing empirical analyses indicate that the relationship between government size and macroeconomic volatility is strong but likely to be complex (non-linear), and that it may have changed over time as time-series evidence appears at odds with cross-sectional regularities.

This section sets the stage for a more formal empirical analysis by providing descriptive evidence on the size of government, macroeconomic volatility, and on the role of fiscal stabilisation policies in supporting consumption smoothing. We illustrate the contrast between time-series and cross-sectional evidence. For data availability reasons and to ensure comparability with the existing literature, we focus on a sample of 20 OECD countries[7] over the period 1960-2006.

4.1. The End of Big Government?

Government size in OECD countries, as measured by the ratio of general government expenditure to GDP, has exhibited strikingly similar time trends over the last four decades

[7] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Japan, the Netherlands, Norway, Sweden, Switzerland, Spain, Portugal, the United Kingdom and the United Sates. OECD data were used throughout.

(Figure 3), with a significant increase until the first half of the 1990s followed by a moderate downsizing. Notable exceptions include the US, where the size of government has remained broadly constant since the mid-1980s, and the UK, where a downward trend began in the mid-80s before being reversed recently. From a cross-country perspective, European countries, and especially the smaller economies (except Ireland and Greece), consistently remained in the higher-end of the distribution, as predicted by Rodrik's (1998) argument. On average, euro area members[8], which make up half of our sample, closely followed the median over the entire period.

Overall, while the cross-country distribution of government size appears to have been fairly stable over time, time trends suggest that "something happened" in the mid-1990s. Why this has taken place is outside the scope of this study.

4.1.1. Is social security the determinant of cross-country differences?

Given our focus on the nexus between fiscal stabilisation and government size, it seems natural to refine the analysis by distinguishing between expenditure items that are by design part of a public insurance scheme—namely social security (SS) transfers—and those that are not. Social security is stabilisation by definition (the very purpose of unemployment insurance, welfare benefits and old-age insurance is to reduce fluctuations in individual income) and the building of large social insurance systems may reflect a greater preference or need for fiscal stabilisation. But it could also be argued that significant portions of social security spending, including the health and pension pillars, are not obviously public by nature and can be placed in private hands without materially affecting their insurance function or the "automatic stabiliser" role of transfers to these

[8] To keep the composition of the euro area constant over time, we include the 11 original members minus Luxembourg.

schemes (health care premiums, pension payments or social security contributions). Under the first hypothesis, the size of SS transfers would be the key to detecting a preference for stability. Under the second, trends in SS spending would simply reflect either changes in the demand for (or relative price of) these insurance products or changes in the relative shares of private and public providers of insurance, not a change in the preference/need for stabilisation (or the perceived cost of it). In both cases, it is instructive to compare trends in social security (SS) and non-SS expenditures (Figure 4).

Broadly similar developments have affected both SS and non-SS spending over the last 40 years. However, it appears that the rise in spending from the 1960s to the 1980s was more pronounced for SS spending (median spending increased by a factor 2.5) and that also the bulk of the recent downsizing took place in non-SS expenditure, whereas SS-related outlays essentially stabilised relative to GDP. Correspondingly, SS spending nowadays typically amounts to one third of total spending compared to one fifth in the early 1960s. If the first hypothesis is correct, this composition shift could have increased the stabilising character of government spending.

From a cross-country perspective, differences in government size appear to be more driven by differences in non-SS spending than by differences in the size of social security systems. Therefore, neither expenditure trends nor cross-country differences can be explained by variations the size of social security systems. A natural implication is that the demand for fiscal stabilisation cannot be disentangled from the general public's appetite for public goods, income redistribution and government intervention.

4.1.2. Openness and government size

Looking into possible determinants of these empirical regularities, Rodrik's (1998) argument that more open economies may find it desirable to have bigger governments seems highly relevant. Cross-sectional evidence shows that the positive relationship between government size and trade openness holds for our sample (Figure 5, top panel). Over time, however, the link weakens considerably after the mid-1990s (compare top right and bottom left panels in Figure 5) as changes in trade openness are negatively related to changes in government size (Figure 5, bottom right panel). Although the latter result is evidently driven by two outliers (Belgium, denoted by a dot, and Ireland, denoted by a triangle), the contrast between time-series and cross-sectional evidence remains striking.

The negative time-series correlation between government size and trade openness (or even the absence thereof) thus suggests that Rodrik's point should be qualified by accounting for the existence of potential "collateral benefits" to trade openness in terms of stabilisation. Specifically, if stronger trade linkages are accompanied by heightened financial integration and a smoother functioning of global and domestic financial intermediation, both the need for fiscal stabilisation and the costs of producing it could have changed. On the one hand, an open capital account expands opportunities for smoothing economy-wide consumption and increases pressures for adopting market-friendly reforms, especially in the financial sector (Kose et al., 2006). Greater financial openness coupled with a strengthening of domestic financial market institutions may therefore reduce the need for fiscal stabilisation. On the other hand, global competition puts pressure on tax bases, and places a premium on less distortive tax systems and less regulated markets, which increases the marginal cost of "producing" fiscal stabilisation. These arguments seem particularly relevant for the euro area where financial integration has been proceeding at a rapid pace (see Decressin, Faruqee and Fonteyne, 2007).

4.2. The Great Moderation: Beyond the US

We now move to addressing the evolution of volatility and its relationship to the two broad characteristics of countries assessed as relevant by the literature: openness and government size.

4.2.1. Volatility over Four Decades

We first look at the evolution of output volatility in our sample of countries since the early 1960s. Our preferred measure is the standard deviation of quarterly GDP growth rates over eleven quarters, which allows us to compare results obtained with country characteristics over the same periods.

The decline in output volatility pointed out in US studies is a general trend which started in the 1980s in the US but took place somewhat later in other countries (Figure 6). One interesting observation is that this decline was significantly more pronounced in the more volatile economies, so that the variance diminished dramatically from the 1960s to the 2000s; and, second, that the US, which was among the volatile economies in the 1970s, has been since the late 1980s been among the least volatile one.

A second observation is that more open economies also experienced a decline in volatility, but seem to remain more vulnerable to shocks and global downturns (Figure 7). In spite of an increased ability to smooth out fluctuations through accessing world capital markets, they have recently exhibited above-average inflation. If anything, the relationship between openness and volatility seems to have strengthened.

4.2.2. Where has volatility declined?

To find out which characteristic matters, we now consider a matrix that splits countries into four categories combining openness and government size criteria (cut-off levels for each criterion are the median) and we also consider two sub-periods, 1961-1997 (the Fatas-Mihov sample) and 1995-2006.

The top and medium panels of Figure 8 indicate that for the whole period as well as in the first sub-period, volatility is greater in countries with smaller governments and that more open economies tend to be more volatile than closed economies despite having larger governments. This reproduces the standard stylised facts pointed out in the literature.

The bottom panel displays the evidence for the last decade 1995-2006. It appears that volatility has decreased much more in relatively closed countries with smaller governments than anywhere else, and that more open economies remain more volatile, especially if their governments are small. So the relationship between volatility and government size only holds for open economies while that between openness and volatility holds across the board.

This leads us to test the implications for a bivariate expression of the Fatas-Mihov-Gali relationship. When re-estimated over the 1995-2006 period, it breaks down entirely (Figure 9). We also test for a relationship with government size measured either by Social Security or non-Social Security spending. In both cases we find that the relationship held good in the 1961-97 period but has disappeared in more recent times.

The factor behind this breakdown is that the reduction in volatility has been on average weaker in countries with larger governments. This is evidenced in Figure 10, which plots the relationship between government size and the decline in volatility.

The reasons why countries with larger governments have failed to fully benefit from the Great Moderation are unclear and call for a more detailed analysis with a view to identifying which factors do not apply to the countries with big governments (through interaction terms, see Section 5). Is it that the benefits of financial deepening have been higher in small-government countries, because markets have substituted what was previously a (lack of) government-induced stabilisation? Is it because shocks have been small over the last decade, which has made automatic stabilisers temporarily less relevant? Or could it be that countries with larger governments (many of them in the euro area) have simply not experienced improved monetary policy management, for instance because of inappropriate exchange rate regimes? Finally, it may be the case that governments contribute little to stabilisation after all because the operation of automatic stabilisers has been offset by discretionary actions.

4.3. What Stabilises Private Consumption?

As discussed above, consumers able to optimally adjust their savings could maintain a stable consumption profile regardless of transitory income fluctuations. In the extreme case of perfect and complete markets, income disturbances would be irrelevant for welfare as individuals would have unrestricted access to credit and could trade a wide array of contingent claims. It is therefore important to find out what lies behind the volatility of aggregate private consumption, and whether this has changed over time, while volatility in income was steadily declining. Particular attention is paid to the behaviour of fiscal variables (income taxes and transfers) and savings. In doing so, we use the period budget identity of a representative consumer (i) to decompose the variance of real household consumption (C_i) into its key components, namely personal primary income (Y_i), direct taxes (T_i), social security transfers (B_i), and households' savings (S_i):

$$C_i = Y_i - T_i + B_i - S_i + \varepsilon_i , \tag{1}$$

where ε_i is a residual that includes items not taken into account in the primary income such as interest payments (income) on outstanding liabilities (assets). The variance of C_i can therefore be decomposed as follows:

$$Var(C) = Var(Y) + Var(T) + Var(B) + Var(S) + 2\left[Cov(Y,T) + Cov(Y,B) + Cov(Y,S) + Z\right],$$

where Z stands for all other covariance terms.

We compute this decomposition for the US and major European countries, distinguishing between pre- and post-1984 periods.[9] Figure 11 first summarises the results for the US. It shows that the decline in the variance of income accounts for the largest fraction of the reduced variance of consumption. A lower variance of savings and a lower (initially positive) covariance between savings and consumption also contribute to reducing consumption fluctuations, but to a significantly lesser degree. Changes in covariances contribute to increasing volatility because of a significantly lower (negative) correlation between income and transfers. There is no meaningful change in the income-tax correlation. Our analysis of US data thus suggests that (1) consumption volatility has declined in line with income volatility; (2) automatic stabilisers have not contributed to this decline, quite to the contrary: the insurance role of transfers seems to have declined; and (3) financial development has played a role—albeit a minor one.

We do the same exercise for the four largest euro area economies, namely France, Germany, Italy, and Spain. We find that all four experienced a very large decline in the variance of consumption. In Germany, Spain and to a lesser extent France, lower income volatility accounts for the largest fraction of this decline. With the exception of Spain, the decline in the variance of savings is also substantial, and in all four countries there is a reduction in the (initially positive) covariance between savings and income. Household saving behaviour seems to be more consistent with buffering income shocks and correspondingly less prone to precautionary saving in bad times. Finally, changes in taxes and transfers seem to have played no meaningful role in the reduction of consumption volatility.

[9] The 1984 cut-off date is standard in the US literature on the great moderation. This is why we adopted here, even though it may not be the ideal cut-off for all EU countries.

These observations are consistent with the view that the change in government size is unlikely to have contributed to lower consumption volatility, and that the latter has instead been driven by the overall reduction in output volatility and more countercyclical saving behaviour (to which financial development may have contributed).

5. A Fresh Look at the Link between Government Size and Volatility

As discussed above, there are two main reasons as to why large governments are expected to contribute more to output stability than small ones. The first is that the magnitude of automatic stabilisers depends primarily on the size of the government sector (Galì, 1994, Girouard and André, 2005); the second results from a composition effect of domestic expenditure. Specifically, if the response of public spending to the business cycle is muted, it mechanically contributes to the stability of aggregate demand (Darby and Mélitz, 2007).

The stylised facts presented in the previous sections fail to provide overwhelming support for the general argument. Looking at time series, it seems clear that volatility is unrelated to government size, while, from a cross country perspective, the well-documented negative relationship between government size and volatility seems to have broken down in the mid-1990s as the general decline in output volatility among OECD countries was less pronounced in those countries with relatively larger governments.

Econometric techniques are now needed to examine more rigorously the conditional correlations among these variables and to establish causality. A natural way to proceed is to merge arguments about the link between government size and volatility with those about the Great Moderation to obtain a more complete picture of the key determinants of

output volatility. Indeed, interesting correlations may emerge both from time-series and cross-sectional dimensions of the data, calling for a panel data analysis. Our panel includes annual data averaged over 10 years.[10] In our view, that time span strikes a good balance between the need to have sufficient observations and the desirability to minimise purely cyclical effects—such as mechanical increases (decreases) in expenditure to GDP ratios during unexpected downturns (upturns).

5.1. Specification and Econometric Issues

As theory provides limited guidance, if any, on the specification of a growth-volatility model, we focus on a parsimonious set of explanatory variables identified as relevant in the literature. Indeed, our objective is not to uncover a new powerful explanation of recent trends through an exhaustive search process, but to take a hard look at conventional wisdom in the face of these new trends, and suggest policy implications.

Our starting point is the standard analysis of Fatás and Mihov (2001), which we extend in three directions. First, we reduce concerns about the small size of the sample (20 OECD countries[11]) by exploiting the time dimension through panel-data analysis. Second, the panel approach allows us to test for two central hypotheses of the Great Moderation debate, namely improvements in the conduct of monetary policy, and greater financial development. While a more credible anchoring of inflationary expectations is expected to

[10] In earlier decades, we have in some cases less than 10 yearly observations available. To avoid losing too many degrees of freedom, we included averages for decades in which we had at least 5 consecutive annual data points. We are therefore working with a maximum of 91 data points (out of a possible 100).

[11] The countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States of America.

facilitate countercyclical actions by monetary authorities, expanded access to credit should result in a smoother aggregate consumption path because more individuals can self-insure against adverse income shocks. These two hypotheses are essential in our investigation because financial markets and monetary policy are two primary substitutes for fiscal stabilisation. Specifically, we conjecture that in comparison to an economy with dysfunctional monetary and financial institutions, a financially developed economy with credible monetary authorities would likely (i) have a smaller government, and (ii), for a given size of government, contribute less to fiscal stabilisation.[12] We approach the second issue by introducing interaction variables in the model. Interaction terms will also inform us about possible causes of the apparent breakdown in the relationship between government size and volatility in the 1990s, and in particular whether this is related to greater monetary policy credibility and improved access to financial intermediation during that period. The third difference with Fatás and Mihov (2001) follows from Buti et al. (2003), who suggested that the relationship between government size and volatility could be non-linear. We therefore allow for non-constant "returns" of government size in terms of output stability.

The unrestricted form of the estimated equation is as follows:

$$Y_{i,t} = \alpha_0 + \sum_{t=2}^{5} \alpha_t P_t + \theta_1 G_{i,t} + \theta_2 G_{i,t}^2 + \sum_{j=1}^{J} \beta_j X_{j,i,t} + \sum_{j=1}^{J} \gamma_j G_{i,t} X_{j,i,t} + \varepsilon_{i,t}, \qquad (2)$$

with $i = 1,...,20$, and $t = 1,...,5$;

where the dependent variable *Y* denotes real GDP volatility, *G* symbolises government size, *X* is a vector of other explanatory variables, P_t's are period fixed-effects, and $\varepsilon_{i,t}$ is

[12] This could be because the composition of expenditure and revenues entails smaller stabilizers (e.g. less unemployment benefits, greater reliance on indirect taxation), or because discretionary policy may conflict more often with macroeconomic stabilization.

an error term. Estimates of γ_j's and θ_2 provide direct tests of the interactions and non-linearities discussed above. We also performed so-called "spline" regressions, using the term $\theta_2 D_{i,t}\left(G_{i,t} - G^*\right)$ instead of $\theta_2 G_{i,t}^2$, where $D_{i,t}$ is a binary variable equal to 1 when *G* exceeds a given threshold G^* and equal to 0 otherwise. By allowing for a kink in the relationship between *Y* and *G*, the "spline" term can be useful in pinning down threshold effects provided that there exists a G^* for which the overall fit of the model is materially better than for alternative thresholds.

Following Fatàs and Mihov (2001), our preferred measures of government size and output volatility are the logarithm of the general government's expenditure-to-GDP ratio, and the standard deviation of real GDP growth, respectively. While the expenditure ratio is a proxy for the magnitude of automatic stabilisers, the measure of volatility raises two issues. The first is that it captures variations in potential growth (over time and across countries) which, as such, should not trigger a stabilising response from macroeconomic policies. However, all the results discussed below are robust to the use of an alternative volatility measure not subject to the same problem—the standard deviation of first-differenced output gaps—and to the introduction of average real GDP growth as a control variable (see Table A1 in the Appendix). The second concern is that the focus on GDP volatility (as opposed to private consumption volatility) is questionable because the estimated stabilising effect of government size would also reflect composition effects in addition to private consumption smoothing. While we do not dispute that private consumption volatility is closer to generally accepted welfare metrics, we have documented above the high positive correlation between these two measures. Moreover, we believe that the eventual composition effect (or the absence thereof) is an integral part of the stabilisation debate and should be preserved. One reason is that government

spending could also be a source of shocks that would only be imperfectly reflected in private consumption. The opposite argument holds: government expenditure (e.g. public investment) could be used to enact discretionary stabilisation packages without immediate effect on private consumption but with an undeniably *stabilising* impact on the overall economy.

All equations are estimated with Ordinary Least Squares (OLS), adjusting standard errors for the presence of heteroskedasticity. As we introduce only two key determinants of the Great Moderation, our estimates may suffer from bias due to the *omission of variables* explaining variations in output volatility over time. To alleviate this concern, the panel regressions include time fixed-effects, a choice largely supported by the corresponding specification tests. Time fixed-effects also ensure that our estimates are driven by cross-country variations under the assumption that the same model applies to each period. The focus on the cross-sectional dimension of the sample is in line with the existing literature. To reduce concerns about omitted cross-country determinants of output volatility, we test the robustness of our results to the introduction of plausible control variables (see Table A2 in the Appendix).[13]

As discussed in section 3, another source of concern in the absence of strong theoretical priors is that estimates derived from a single-equation approach may be biased by *reverse causation*, that is the possibility that volatility itself affects the delivery of insurance against macroeconomic risk, including through automatic stabilisers, monetary policy and financial intermediation. In particular, more open economies tend to opt for larger

[13] Regressions including country-fixed effects (for which estimates reflect time variations under the assumption that all countries follow the same model) did not yield any meaningful result.

governments *because* of their intrinsically greater exposure to external shocks and a correspondingly greater appetite for fiscal stabilisation (Rodrik, 1998). If sufficiently large, such reverse causality would create a downward bias in the OLS estimates of θ_1, and possibly also in the β_j's and the γ_j's corresponding to Great Moderation variables. We therefore explicitly tested for possible endogeneity problems and took that into account in our estimation to correct for any bias (see Table A3 in Appendix). In general, we found no evidence of a statistically significant bias related to reverse causality running from volatility to government size. This is in contrast to Fatàs and Mihov (2001) and can be explained by the fact that the time-series dimension of our sample is likely to attenuate that particular reverse causation problem—more related to a cross-country argument (i.e. the link between openness and volatility). Only the measure of monetary policy quality (QMP) used in our regressions—the exponential deviation of inflation from a two percent target, as in IMF (2007)—fails the exogeneity test at the 10 percent level of significance.[14] Because our results appeared robust to using an index of central bank independence instead of QMP (see Tables A4 to A6 in the Appendix), we kept the latter in our regression for the sake of comparability with existing analyses.

5.2. Results

The first step in our empirical analysis is to assess the extent to which the time dimension of our sample is affecting the strong negative cross-sectional relationship between government size and output volatility documented in Galì (1994) and Fatás and Mihov (2001). Table 1 displays estimates obtained with a parsimonious version of equation (2)

[14] Such a measure is subject to a reverse causality problem to the extent that real volatility translates into inflation volatility.

explaining volatility by the size of government and the degree of openness to trade[15]. For the sake of comparison with previous studies, we report both cross-country and panel regressions for different time spans of the sample. First, although trade openness tends to increase volatility, the effect is in general not statistically significant, and quantitatively sensitive to time. Second, the negative relationship between government size and volatility weakens dramatically when the sample includes the post-1990 periods. In fact, when the sample is truncated to include only the 1991-2007 period, the relationship turns positive, although it remains statistically non-significant. Similar results hold when our alternative measure of output volatility is used, and when additional control variables (GDP per capita at PPP and average real growth) are introduced (Appendix Tables A1 and A2). This first exercise suggests that the Galì (1994) and Fatás-Mihov (2001) results may be specific to the small sample used in their study (20 observations and time averages heavily influenced by pre-1990 observations). In subsequent regressions, we focus on results obtained for the full panel (that includes all available data points over 1961-2007).

Although the inclusion of time fixed-effects should prevent any statistical bias related to the omission of determinants of output volatility over time, it is useful to check the extent to which progress in the quality of monetary policy and financial development (FD)—two potential substitutes for fiscal stabilisation—plays a significant role in reducing volatility when the size of government is taken into account (Table 2).[16] Both variables seem to

[15] Openness to trade is measured as the sum of imports and exports divided by twice the GDP.

[16] As previously indicated, the quality of monetary policy is measured as the exponential deviation of actual inflation from a 2 percent inflation target (see IMF, September 2007 *World Economic Outlook*). This captures the idea that a credible inflation anchor helps monetary policymakers to stabilize the economy. The financial development variable is the total credit by deposit money banks to the private sector in percent of GDP.

individually contribute to lower volatility over and above the contribution of automatic stabilisers[17] (columns 1 and 2). Interestingly, the estimated effect of government size appears to weaken when QMP is present, while it seems unaffected by the introduction of FD. This may point to a greater substitutability between monetary and fiscal stabilisation than between the latter and expanded opportunities for individuals to smooth consumption through financial intermediation. However, when both QMP and FD are simultaneously included, their respective effects are not fully robust to time dummies, especially for FD (columns 3 and 4), which becomes statistically insignificant. This suggests that other related developments (omitted here) may have played a role in the decline of output volatility.

Allowing for the impact of government size to vary over time—one coefficient for the period 1961-90 and another for the period 1991-2007—confirms the apparent break in the stabilising role of government size after 1990 (column 5), while leaving the estimated role of FD and QMP largely unchanged. This indicates that the structural break cannot be (entirely) due to the emergence of substitutes to fiscal stabilisation. Yet the weak role played by FD and QMP when fiscal stabilisation is taken into account contrasts with the conventional Great Moderation literature, where these two variables seem to matter more. The last step in our investigation is therefore to test more directly for the possibility that, for a given size of government, the impact of fiscal stabilisation is contingent on the presence of alternative ways for economic agents to insure against macroeconomic risk. It is also important to consider the hypothesis of decreasing returns in terms of fiscal

[17] The relevant comparison in Table 1 is column 7.

stabilisation with larger governments as one possible reason for the structural break of the 1990s, when the size of governments culminated in most OECD countries.[18]

Table 3 explores the role of two interaction terms—between FD and government size, and between the latter and QMP—, and one non-linearity—the squared of government size.[19] To help in reading the results (the reader should bear in mind that the logarithm of government size is always negative), the middle panel of Table 3 displays the marginal effects of our variables of interest on volatility, with bold numbers identifying effects for which all the estimated coefficients involved in the calculation are statistically different from zero.

A number of novel insights emerge from these results. First, government size plays a statistically significant stabilisation role across a wide range of specifications, regardless of the combination of interaction terms, non-linearities and control variables. This underscores the importance of studying the stabilisation function of fiscal policy in relation to the existence of alternative policy instruments (monetary policy) and of ways for individuals to self-insure against aggregate shocks (financial intermediation). This also helps qualify the tempting, and probably simplistic, conclusion that automatic stabilisers abruptly stopped contributing to stabilisation in the mid-1990s.

[18] Table A3 in the Appendix confirms these results using Instrumental-Variables (IV) techniques. As excluded instruments (i.e. variables that are highly correlated with government size but orthogonal to error term), we use the rate of urbanization, the dependency ratio, and political indicators, including the average degree of fragmentation of coalition governments (known to increase the size of government due to more pervasive common pool problems), and the existence of majoritarian electoral rule (known to be associated with smaller government for the opposite reason as fragmentation). Exogeneity tests suggest that reverse causality is not a statistical issue in our sample. However, it is interesting to observe that, as in Fatás and Mihov (2001), the estimated coefficients for government size are higher (in absolute value), and that trade openness has a stronger and often weakly significant effect, in line with Rodrik (1998).

[19] The squared was preferred to spline coefficients because we could not identify a plausible threshold of government size (between 35 and 55 percent of GDP) that yielded a significantly better fit of the estimated model.

Second, financial development and, even more so, the quality of monetary policy make a greater contribution to the reduction of volatility when the government (automatic fiscal stabilisation) is smaller. In the case of monetary policy, this result lends further support to our conjecture that better monetary stabilisation partly relieves fiscal policymakers of the "stabilisation burden", allowing them to pursue other objectives not necessarily consistent with macroeconomic stabilisation. In the case of financial development, our estimates could indicate that the "demand" for self-insurance (and the corresponding contribution of FD to stability) is likely to be greater if automatic fiscal stabilisation is limited. Overall, this supports the view that greater FD and QMP over time have mostly contributed to increased stability in countries that had small governments to start with, which is fully consistent with our stylised facts. The same result also supports the idea that wherever government provides considerable automatic stabilisation, economic agents may not embrace self-insurance through the financial sector (see smaller contribution of FD) as much as elsewhere. This could point to a "revealed preference" for fiscal stabilisation against the alternative. One reason for such preference could be that private lending decisions may turn out to be inconsistent with self-insurance for consumers with limited collateral.

Finally, we find support for the conjecture by Buti et al. (2003) of decreasing returns in fiscal stabilisation. This non-linearity in the relationship between government size and output volatility points to the fact that larger governments are increasingly inefficient at providing stabilisation (at the extremes, when government spending equals either zero or the entire GDP, the contribution to stabilisation is nil). That said, the relationship is hard

to estimate precisely,[20] and it was not possible to convincingly pin down a specific size threshold beyond which any further expansion of government expenditure would become harmful for stability. However, as shown in Figure 13 (using the results in column 3 of Table 3), an increase in government size by one percent of GDP is unlikely to yield a reduction in output growth volatility exceeding 0.1 percentage point once the overall size of public expenditure approaches 40 percent of GDP.

One last issue investigated in the size-volatility literature is whether the composition of government revenue and expenditure materially affects the magnitude of automatic stabilisers for a given size. The most straightforward way to answer this question is to re-estimate one of our equations (in this case, the parsimonious specification of Table 1) using a variety of revenue and expenditure categories (or more precisely the logarithms of their ratio to GDP) as the relevant measures of government size. The estimates for θ_1 are displayed in Table 4.

In line with Fatás and Mihov (2001), we do not find consistent and robust evidence of significant composition effects, as all expenditure and revenue categories have the same sign regardless of the time span. It is nevertheless worth noting that government consumption and social security transfers are the only categories retaining a significant stabilising effect when using the entire time span 1961-2007. Also, the contribution of indirect taxes generally seems statistically weaker than that of direct taxes, reflecting the lower elasticity of the former to the business cycle (Girouard and André, 2005). This would suggest that the scope for enhancing automatic fiscal stabilisation through a

[20] Figure 13 illustrates the extent of the uncertainty arising from errors in the estimated coefficients, using the variance-covariance matrix of coefficients to calculate the impact of a 1 standard-deviation difference. Notice that the correlation of errors is almost equal to 1.

deliberate re-shuffling of the structure of government expenditure or revenue may be rather limited. Moreover, it is unclear whether such reshuffling (e.g. a shift of favour direct taxation) would be advisable in terms of the other objectives of public finances (e.g. efficiency).

6. Conclusions

In the euro area, the loss of monetary policy as an instrument to offset country-specific disturbances naturally places the onus on fiscal policy. While there is little doubt that the anti-inflationary credibility of the ECB leaves ample room for an effective monetary stabilisation of common demand shocks, only national fiscal authorities can provide public insurance against country-specific disturbances. A natural question in regard to our analysis is whether participation in the euro area calls for enhanced automatic stabilisation through bigger government. The evidence discussed in the previous section points to a negative answer for several reasons.

First, government expenditure is already large in the euro area, exceeding 45 percent of GDP on average, a range in which any further increase in size does not appear to yield any meaningful benefit in terms of automatic stabilisation. Second, while automatic stabilisers can be enhanced through changes in the composition of expenditure and revenue (for instance by increasing social security transfers and shifting the tax burden towards direct taxation), it is unclear whether the gains in terms of stabilisation would not be offset by efficiency losses. Finally, the apparent substitution between monetary and fiscal stabilisation, and between the latter and market-based self-insurance/stabilisation, suggests two alternatives to bigger governments. The first is that further financial development could alleviate the need for fiscal stabilisation. The second is that governments may be shifting objectives, opting for more stabilisation-friendly policies when alternatives do not appear to be available. Widespread evidence of pro-cyclicality in discretionary fiscal policies in the euro area suggests that there is room for more fiscal stabilisation without necessarily increasing the overall size of the public sector. In comparison, countries with relatively lean public sectors like Japan and the United States

have a consistent record of enacting discretionary fiscal packages explicitly aimed at stabilising the economy (albeit with variable degrees of success). The challenge is to make sure that such actions are timely—which requires short information, decision and implementation lags—and that they are symmetric over the cycle —i.e. any stimulus should be reversed during the upturn. Reforms of fiscal institutions aimed at enhancing such discretionary stabilisation — instead of focusing exclusively on fiscal discipline — are conceivable, and emerge as a fruitful area for further research.

Finally, the econometric evidence pointing to a degree of substitution between fiscal stabilisation and other contributions to stability (monetary policy and financial development) arguably reflects fairly recent developments that may owe much to the circumstances of the 1990s and the early 2000s and ultimately turn out to be exceptional by historical standards. In particular, it is unclear how much extra stability could arise from further improvements in monetary policy design. Also, the extent to which financial development can play an effective stabilisation role through self-insurance remains debatable in light of the procyclical nature of lending standards. The latter tends to be loose in good times when the expected future value of collateral and income gains reduce credit risk, and tighter in bad times for the opposite reasons. The implication is that the prospect for further stability gains outside improved fiscal policies may well be fairly limited and that it may probably be too early to forsake automatic fiscal stabilisation.

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Figure 1: Historical Volatility of US GDP and Consumption

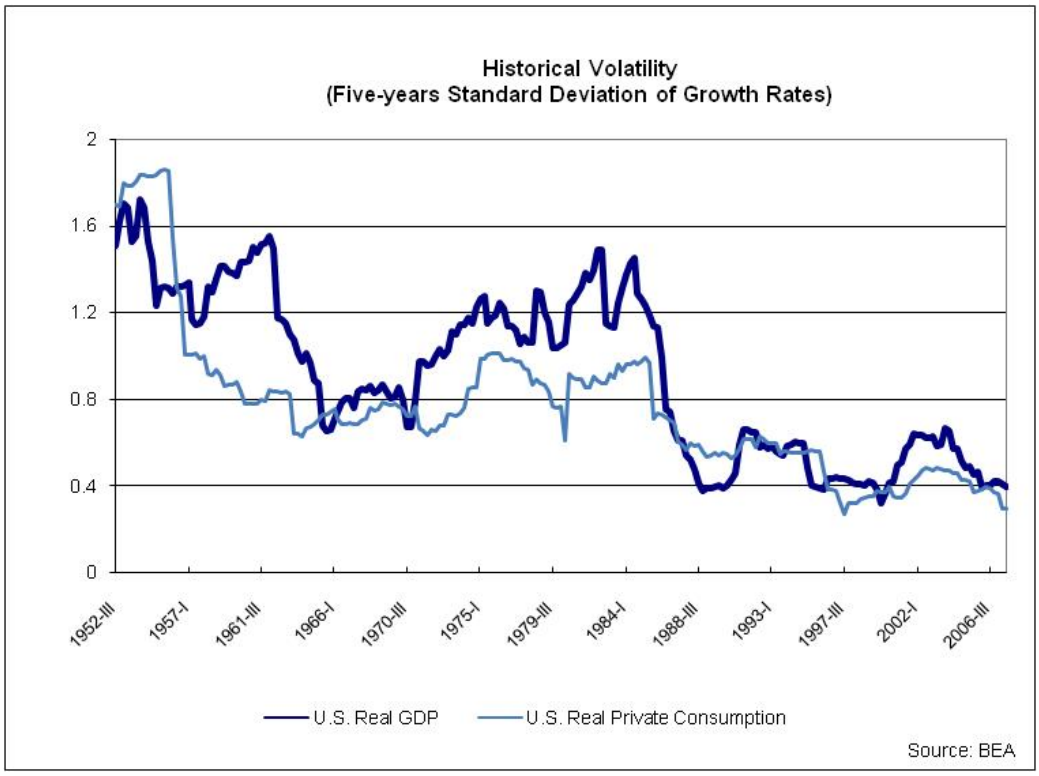


Figure 2: The Taylor Curve and the Inflation – Output Volatility Trade-off

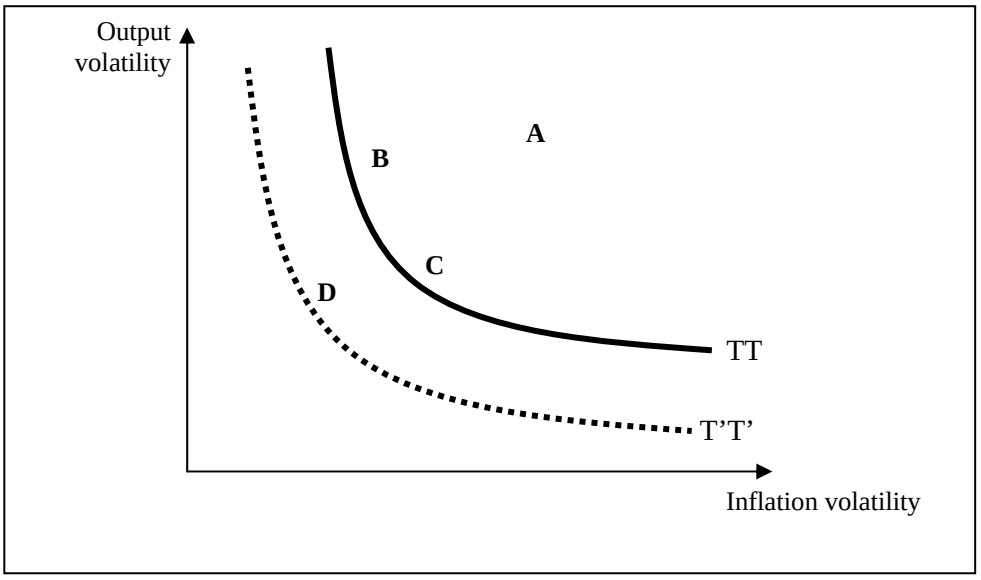


Figure 3: Total Expenditure to GDP ratio (1963-2006)

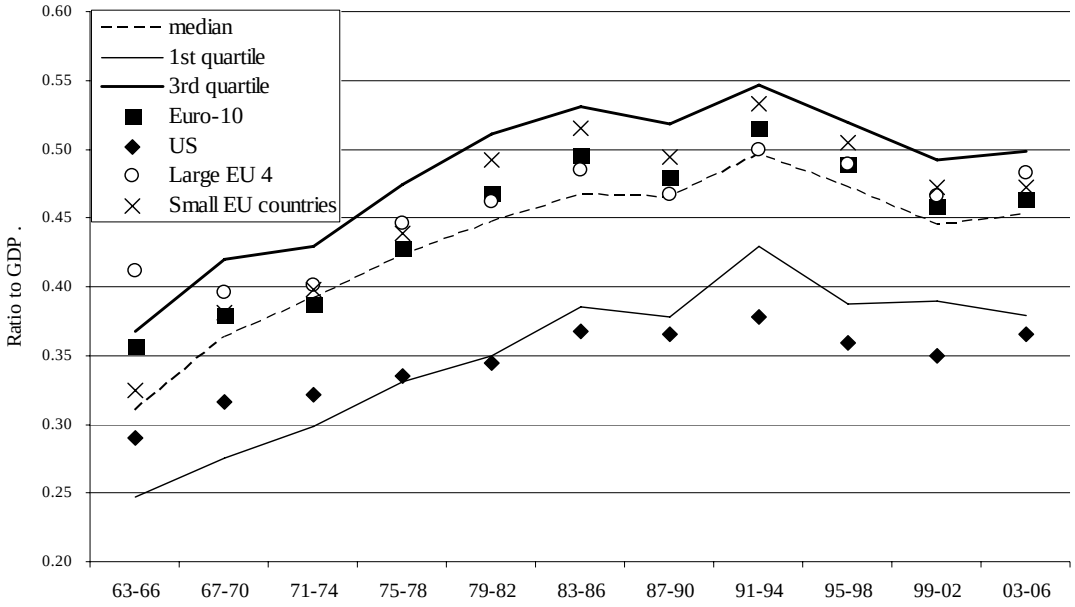
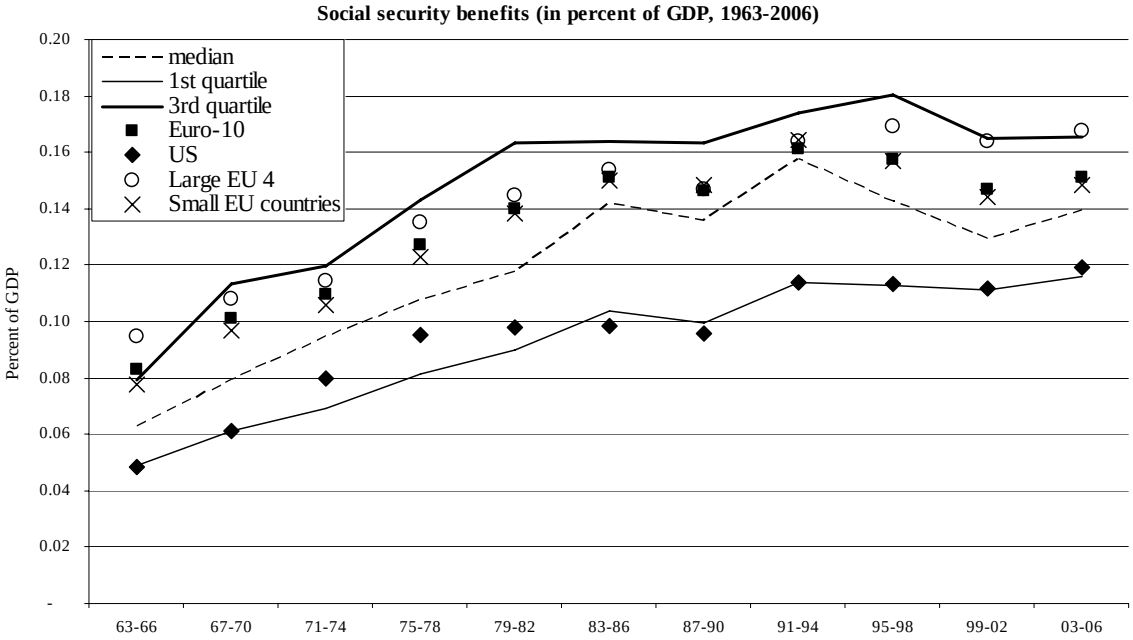


Figure 4: Social-Security vs. Non-Social-Security Expenditure (ratio to GDP 1963-2006)



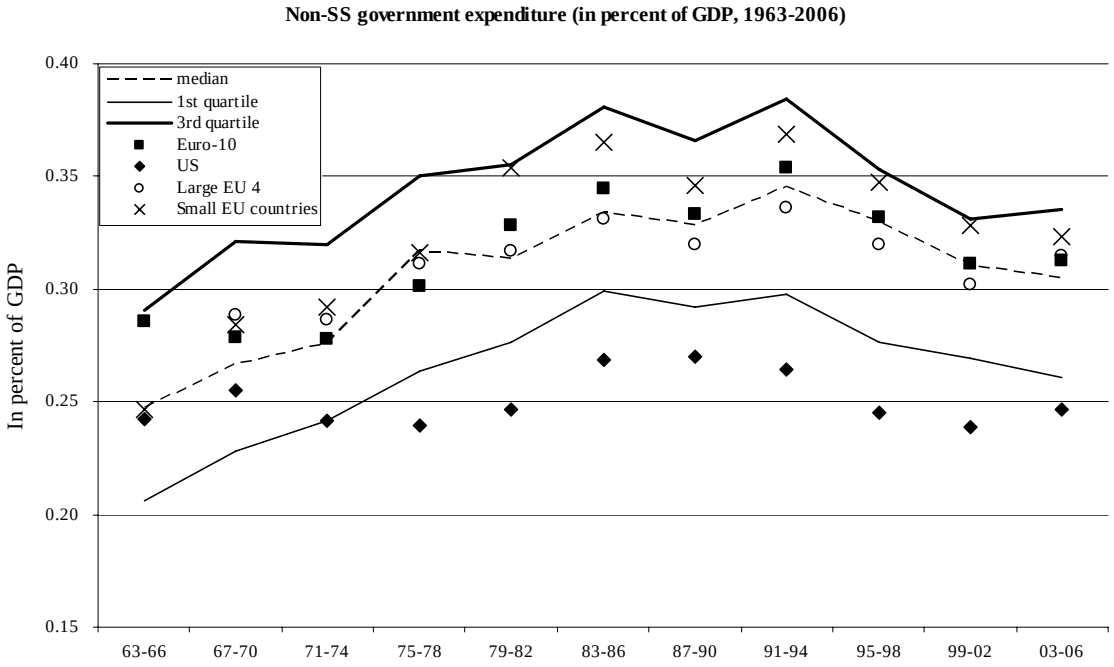


Figure 5: Openness to Trade and Government Size

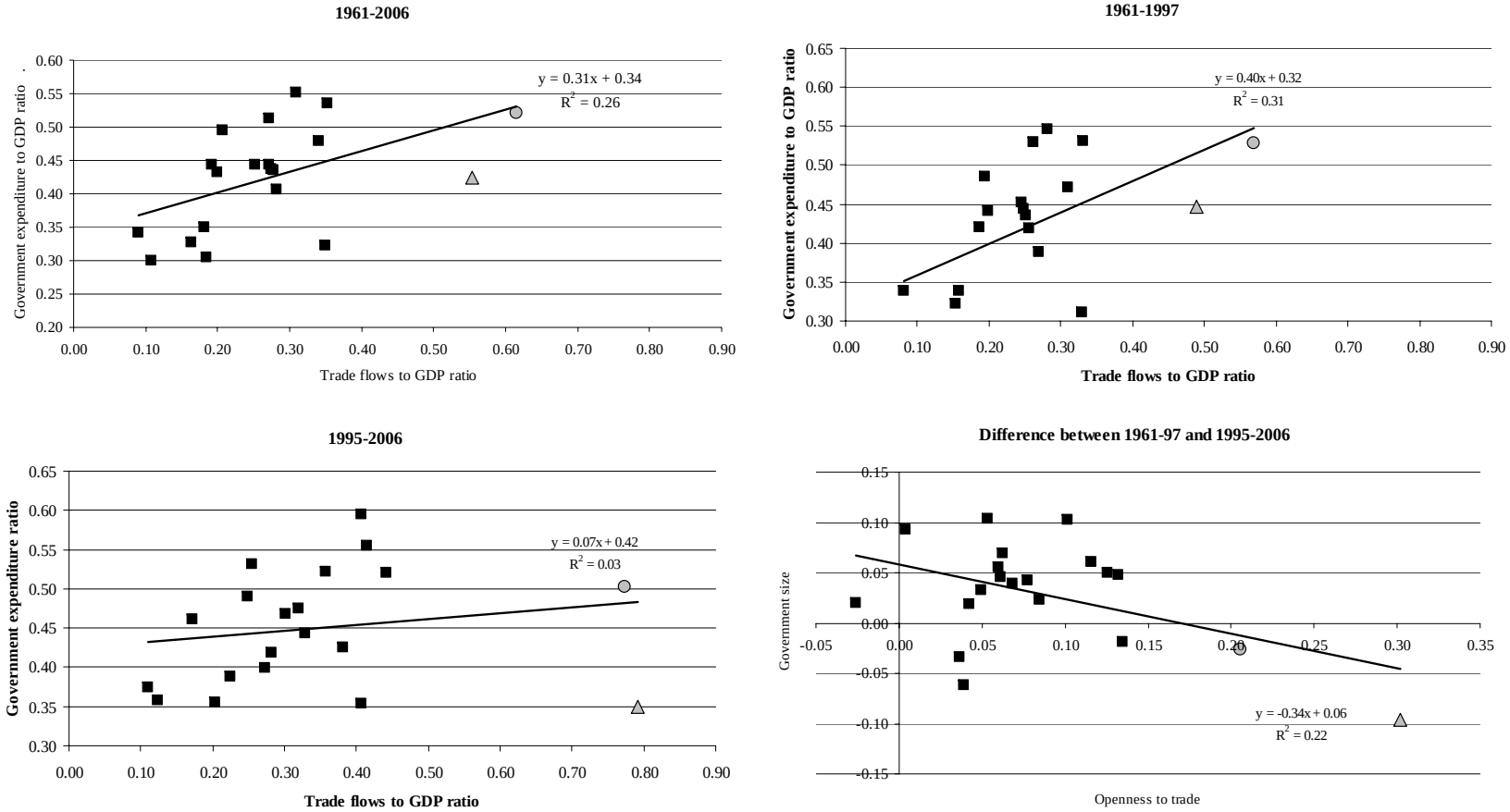


Figure 6: The Great Moderation (1963-2006)

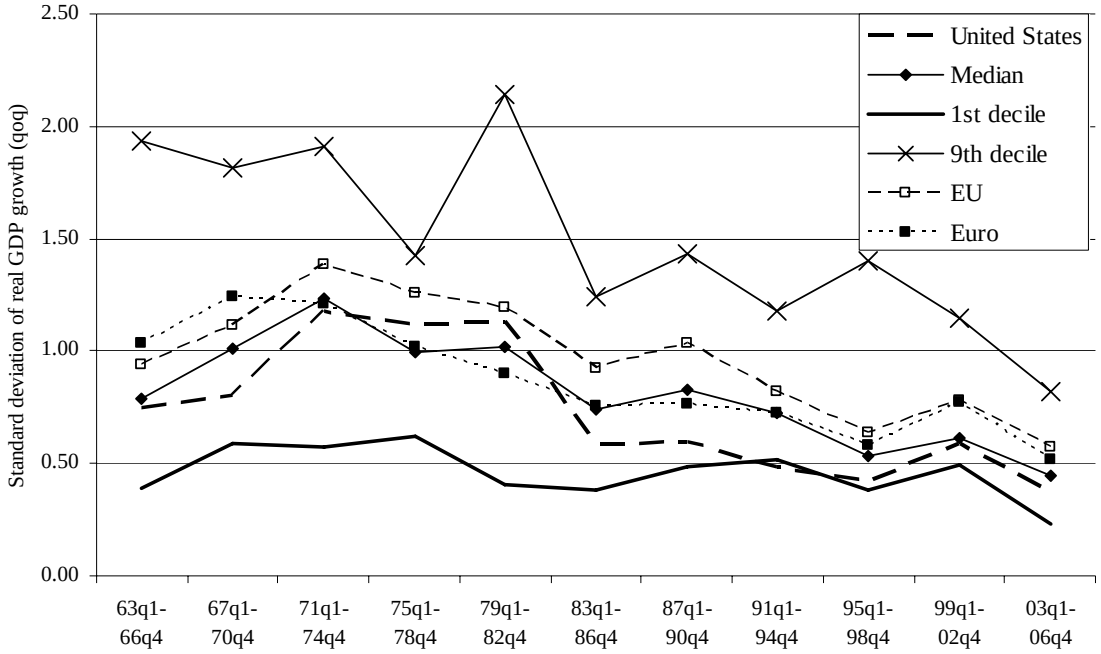


Figure 7: The Great Moderation: More Open Economies (1963-2006)

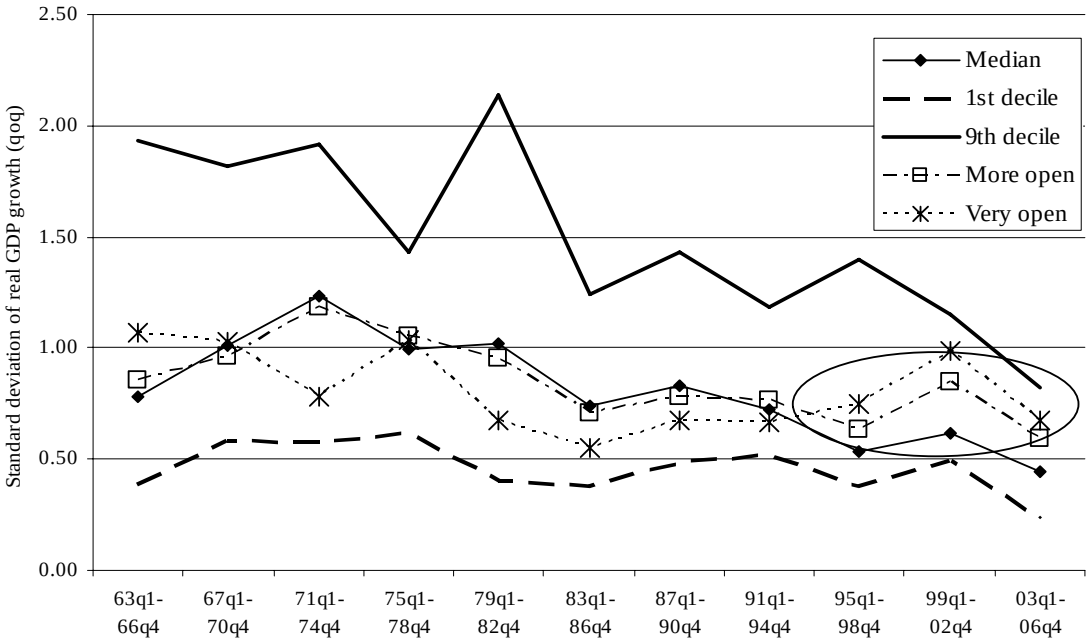


Figure 8: Volatility by Country Groupings: Openness and Government Size

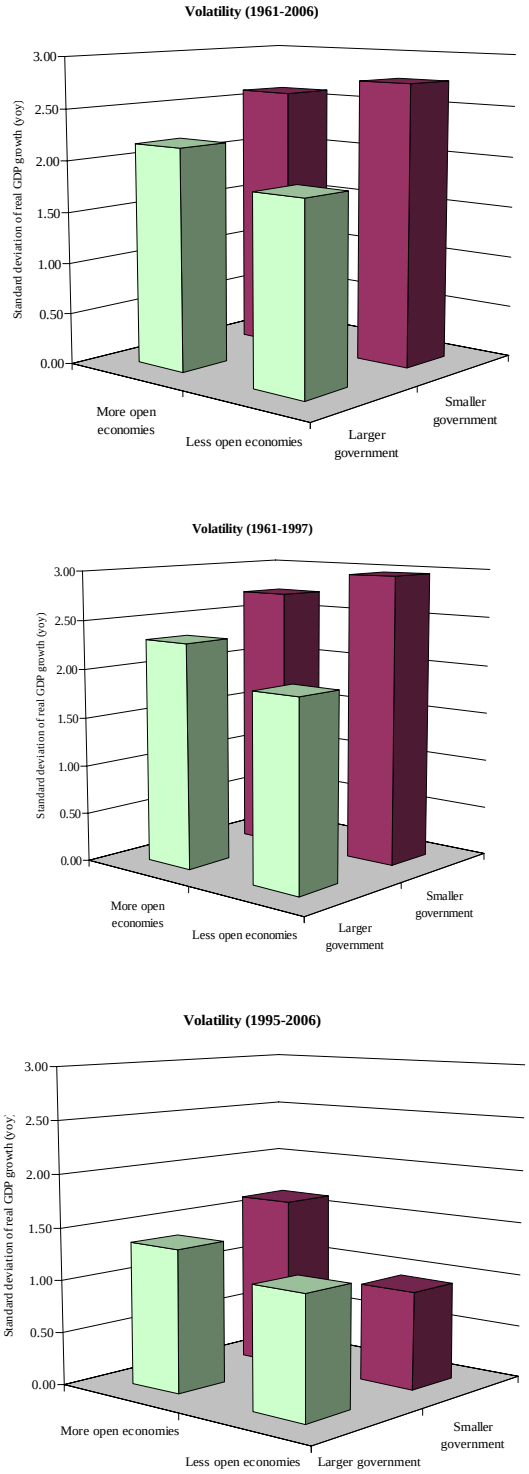


Figure 9: The Changing Relationship between Volatility and Government Size

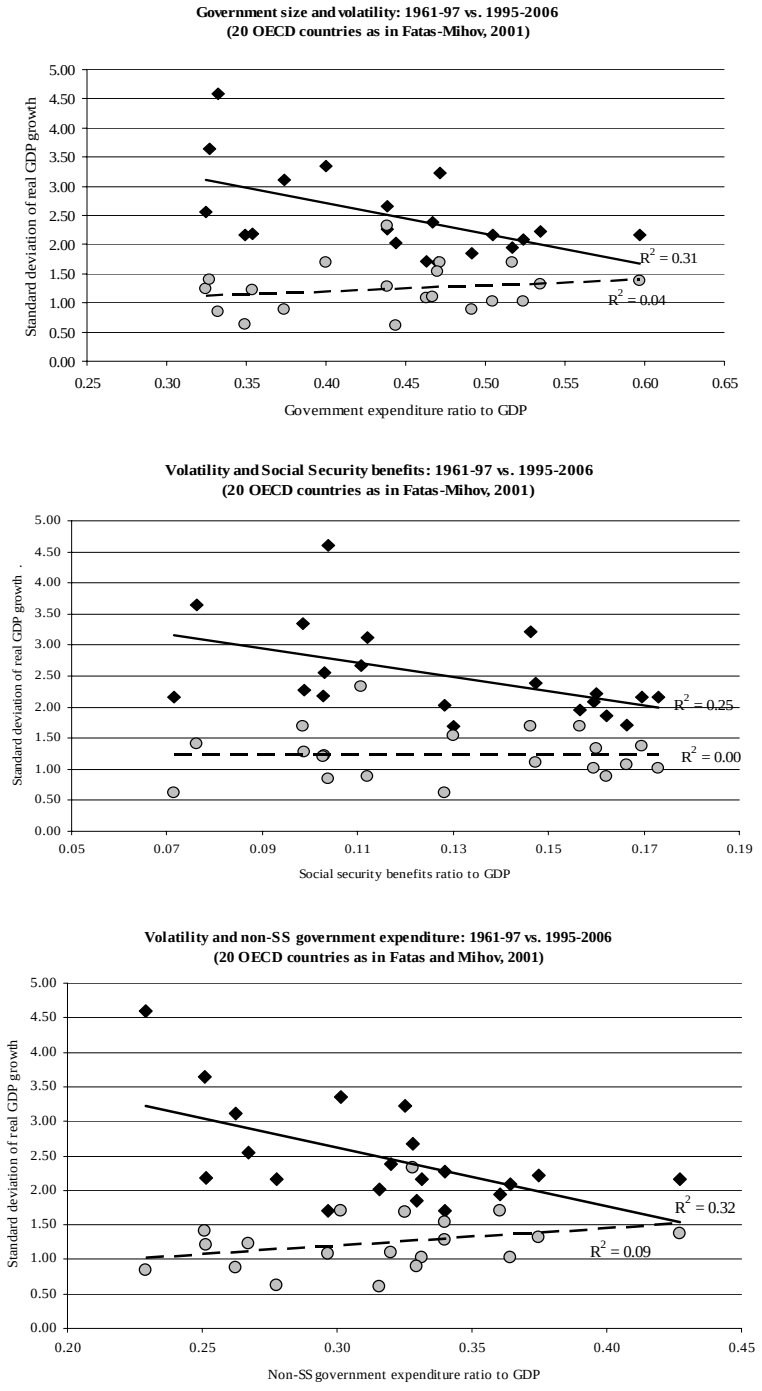


Figure 10: **Government Size and Change in Output Volatility**

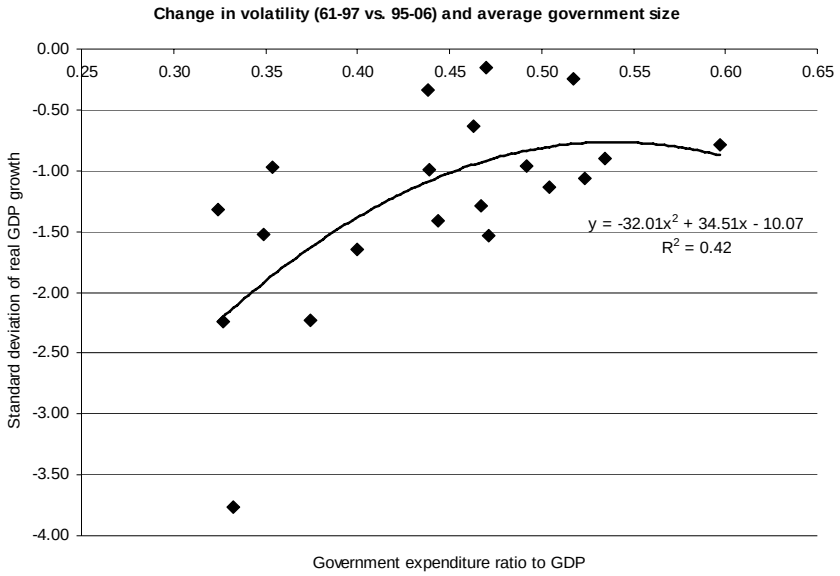
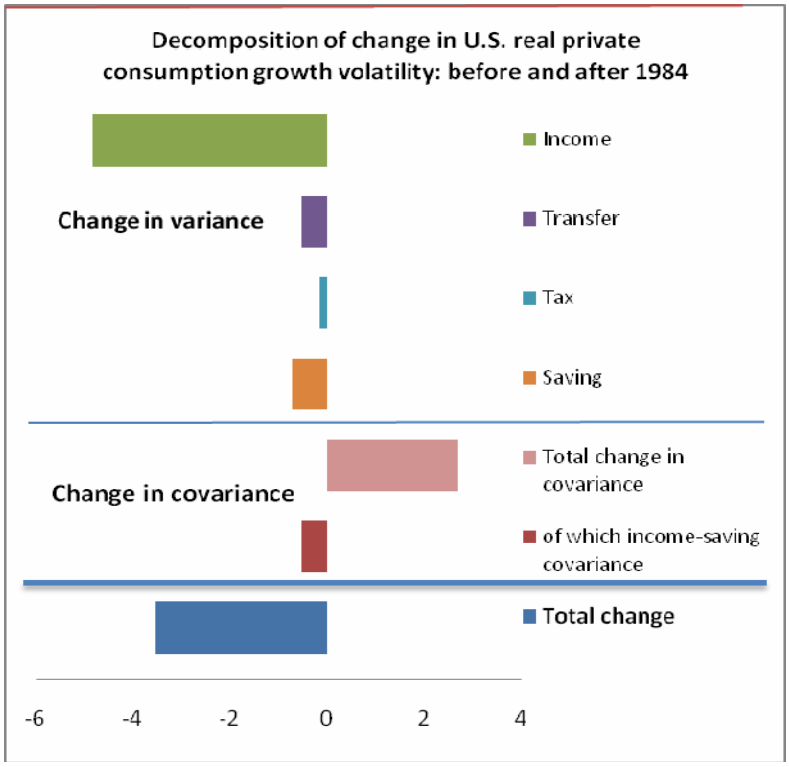
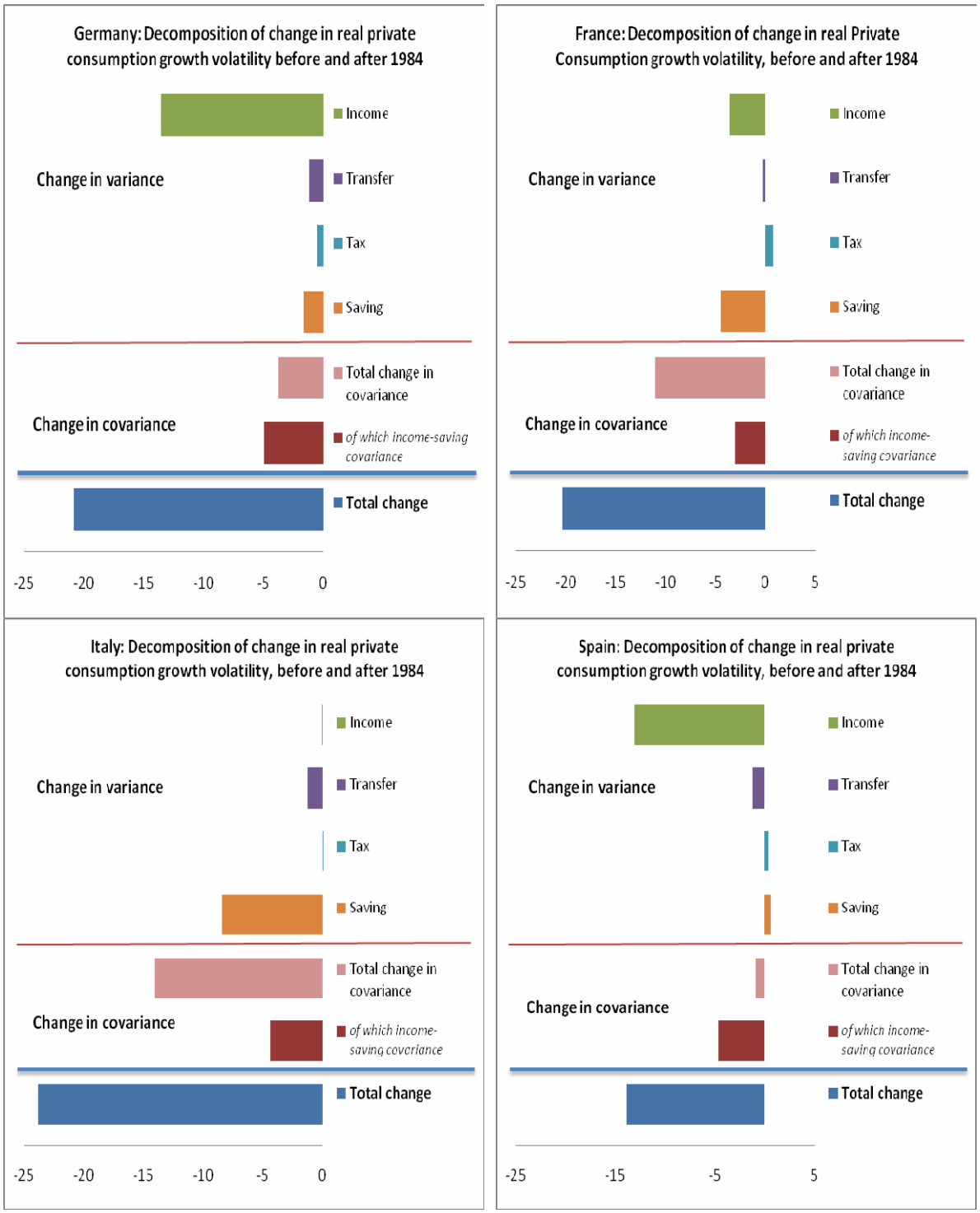


Figure 11: Variance Decomposition of US Household Consumption, pre- and post-1984



Sources: OECD and authors' calculations.

Figure 12: Variance Decomposition of Household Consumption in Selected euro area Countries, pre- and post-1984



Sources: OECD and authors' calculations.

Figure 13: Government Size and Estimated Impact on Volatility of an Increase in Government Expenditure by 1 percentage point of GDP

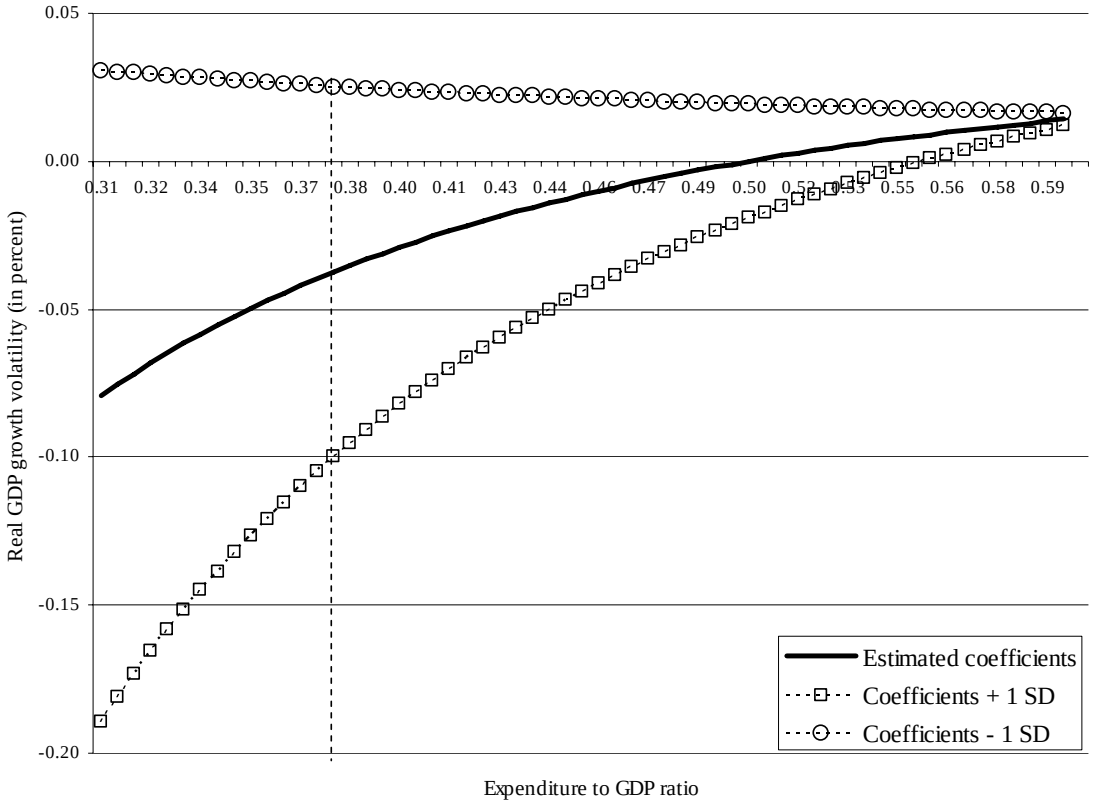


Table 1. Government Size and Volatility: Basic Results

Dependent variable: standard deviation of real GDP growth

	Cross-section OLS				Pooled OLS			
	1	2	3	4	5	6	7	8
	1961-2000	1961-90	1961-2007	1991-2007	1961-2000	1961-90	1961-2007	1991-2007
Openness	0.76	1.98	0.40	0.60	1.35 *	2.20 ***	0.84	0.54
	(0.66)	(1.49)	(0.48)	(0.87)	(1.67)	(2.79)	(1.56)	(0.79)
Government size	**-1.34 ***	**-2.23 *****	**-0.90**	**0.42**	**-1.78 *****	**-2.68 *****	**-1.32 ** **	**0.61**
	(-1.72)	**(-2.88)**	**(-1.37)**	**(0.58)**	**(-2.60)**	**(4.35)**	**(-2.37)**	**(0.81)**
Constant	0.61	-0.47	0.90	1.57 **	-0.36	-1.59 *	0.30	1.36
	(0.63)	(-0.46)	(1.16)	(2.25)	(-0.39)	(1.98)	(0.41)	(1.64)
N. obs.	20	19	20	20	71	51	91	40
Time fixed-effects (p-value)	…	…	…	…	0.09	0.00	0.00	0.00
R-squared	0.16	0.36	0.11	0.08	0.24	0.43	0.38	0.31

Note: Robust t-statistics are reported in parentheses. Panel regressions include time effects. The p-value of the time-effects test is associated with the null hypothesis (F-test) that all period effects are jointly equal to zero.

Table 2. Government Size and the "Great Moderation" (Pooled OLS, 1961-2007)

Dependent variable: standard deviation of real GDP growth					
	1	2	3	4	5
Openness	0.81	0.77	0.25	0.77	0.95 *
	(1.52)	(1.46)	(0.41)	(1.46)	(1.77)
Government size (all sample)	**-1.06 ***	**-1.40 ****	**-0.83**	**-1.15 ***	**…**
	(-1.92)	**(-2.48)**	**(-1.58)**	**(-1.94)**	
Government size (1961-90)	**…**	**…**	**…**	**…**	**-1.98 *****
					(-3.43)
Government size (1991-2007)	**…**	**…**	**…**	**…**	**0.45**
					(0.60)
Quality of monetary policy 1/	-1.36 ***	…	-1.79 ***	-1.12 *	-0.95 *
	(-2.51)		(-3.13)	(-1.88)	(-1.67)
Financial development 2/	…	-0.40 **	-0.41 ***	-0.27	-0.17
		(-1.94)	(-2.65)	(-1.21)	(-0.83)
Constant	1.91 **	0.37	2.92 ***	1.68 *	0.47
	(2.05)	(0.53)	(4.03)	(1.71)	(0.51)
N. obs.	91	90	90	90	90
Time fixed-effects:					
p-value	0.00	0.00	…	0.00	0.00
Included	yes	yes	no	yes	yes
R-squared	0.41	0.40	0.30	0.42	0.49

Note: Robust t-statistics are reported in parentheses. Panel regressions include time effects. The p-value of the time-effects test is associated with the null hypothesis (F-test) that all period effects are jointly equal to zero.

1/ IMF measure (exponential deviation from a 2 percent inflation target, see September 2007 World Economic Outlook).

2/ Financial development is measured as the total credit by deposit money banks to the private sector in percentage of GDP.

Table 3. Government Size and Volatility: Interactions and Non-linearities (Pooled OLS, 1961-2007)

Dependent variable: standard deviation of real GDP growth										
	1	2	3	4	5	6	7	8	9	10
Openness	0.74	0.73	0.70	0.90 *	0.20	0.73	0.48	0.13	0.62	0.71
	(1.45)	(1.34)	(1.25)	(1.78)	(0.34)	(1.40)	(1.02)	(0.21)	(1.12)	(1.41)
Government size (GS)	**-2.74 *****	**-5.04 ** **	**3.34**	**…**	**-2.77 *****	**-2.47 *****	**-2.10 *****	**2.16**	**1.94**	**…**
	(-3.26)	**(-2.23)**	**(1.42)**		**(-3.94)**	**(-3.50)**	**(-2.70)**	**(0.86)**	**(0.82)**	
Financial development (FD)	1.42 *	…	…	…	…	…	…	…	…	…
	(1.83)									
Quality of monetary policy (QMP)	…	3.35	…	…	…	…	…	…	…	…
		(1.32)								
GDP per capita (at PPP)	…	…	…	…	…	…	-0.01	…	…	…
							(-0.59)			
Average real growth	…	…	…	…	…	…	0.09	…	…	…
							(1.19)			
Non-linear terms:										
Interaction GS*FD	**1.92 ** **	**…**	**…**	**…**	**0.50 *****	**0.38**	**0.29**	**0.35 ** **	**0.25**	**0.31**
	(2.35)				**(2.85)**	**(1.49)**	**(1.09)**	**(2.41)**	**(1.17)**	**(1.43)**
Interaction GS*QMP	**…**	**4.60 * **	**…**	**…**	**1.83 *****	**1.21 * **	**1.31 ** **	**2.01 *****	**1.35 ** **	**1.41 ** **
		(1.74)			**(3.12)**	**(1.83)**	**(2.01)**	**(3.76)**	**(2.19)**	**(2.17)**
Squared GS	**…**	**…**	**2.37 ** **	**0.76 *****	**…**	**…**	**…**	**2.55 ** **	**2.25 * **	**1.35 *****
			(2.03)	**(2.90)**				**(2.09)**	**(1.92)**	**(4.18)**
Constant	-0.99	-2.10	2.35 *	0.73 *	1.02	0.51	0.68	3.34 ***	2.57 *	1.66 ***
	(-1.06)	(-0.95)	(1.85)	(1.66)	(1.08)	(0.68)	(0.84)	(2.54)	(1.87)	(2.86)
	Marginal effect on volatility of an increase in… 1/									
Financial development if										
government expenditure is 35 percent of GDP	**-0.60**	…	…	…	**-0.52**	-0.40	-0.30	**-0.37**	-0.26	-0.33
government expenditure is 50 percent of GDP	**0.09**	…	…	…	**-0.35**	-0.26	-0.20	**-0.24**	-0.17	-0.21
Quality of monetary policy if										
government expenditure is 35 percent of GDP	…	-1.48	…	…	**-1.92**	**-1.27**	**-1.38**	**-2.11**	**-1.42**	**-1.48**
government expenditure is 50 percent of GDP	…	0.16	…	…	**-1.27**	**-0.84**	**-0.91**	**-1.39**	**-0.94**	**-0.98**
Size of government if										
expenditure is 35 percent of GDP	**-1.30**	**-1.03**	-1.65	**-1.60**	**-0.80**	-1.13	-0.74	-1.18	-1.42	**-1.37**
expenditure is 50 percent of GDP	**-1.30**	**-1.03**	0.05	**-1.05**	**-0.80**	-1.13	-0.74	0.64	0.18	**-0.41**
N. obs.	90	90	91	91	90	90	90	90	90	90
Time fixed-effects:										
p-value	0.00	0.00	0.00	0.00	…	0.00	0.00	…	0.00	0.00
Included	yes	yes	yes	yes	no	yes	yes	no	yes	yes
R-squared	0.44	0.45	0.43	0.41	0.33	0.44	0.46	0.38	0.49	0.48

Note: Robust t-statistics are reported in parentheses. The F-test is associated with the null hypothesis that all time effects are jointly equal to zero.
1/ Numbers show the value of the estimated derivative function of volatility with respect to the relevant explanatory variable. Bold numbers denote cases where all estimated coefficients used in the calculations are statistically different from zero. The marginal impact of government size is measured at sample mean of FD and QMP.

Table 4. Output Volatility and Alternative Measures of Government Size (pooled OLS)

Dependent variable: standard deviation of real GDP growth				
	1	2	3	4
	1961-90	1961-2000	1961-2007	1991-2007
Total expenditure	**-2.68 *** **	**-1.78 *** **	**-1.32 ** **	0.61
	(4.35)	**(-2.60)**	**(-2.37)**	(0.81)
Government consumption	**-2.03 *** **	**-1.34 ** **	**-0.98 ** **	0.53
	(-4.09)	**(-2.40)**	**(-2.17)**	(0.79)
Government wage consumption	**-1.26 ** **	-0.65	-0.42	0.46
	(-2.64)	(-1.34)	(-1.12)	(0.70)
Direct taxes	**-0.62 ** **	**-0.49 ** **	-0.36	0.48
	(-2.53)	**(-2.07)**	(-1.58)	(1.64)
Indirect taxes	**-0.67 * **	-0.27	-0.22	0.46
	(-1.89)	(-0.80)	(-0.81)	(1.29)
Social security transfers paid	**-0.76 ** **	**-0.63 * **	**-0.46 * **	0.26
	(-2.32)	**(-1.80)**	**(-1.67)**	(0.54)

Note: Robust t-statistics are reported in parentheses. All regressions include time fixed-effects. The baseline specification is that in Table 1. Other coefficients and statistics are not reported but are available upon request.

Appendix: Robustness checks

Table A1. Government Size and Volatility: Basic Results with Output Gap Volatility

Dependent variable: standard deviation of output gap changes								
	Cross-section OLS				Pooled OLS			
	1	2	3	4	5	6	7	
	1961-2000	1961-90	1961-2007	1991-2007	1961-2000	1961-90	1961-2007	19
Openness	0.42	1.51	0.17	0.41	0.82	1.63 **	0.62 *	
	(0.43)	(1.23)	(0.24)	(0.85)	(1.64)	(2.29)	(1.87)	
Government size	**-1.10**	**-1.89 ** **	**-0.69**	**0.44**	**-1.46 *** **	**-2.22 *** **	**-1.14 ** **	
	(-1.67)	**(-2.65)**	**(-1.22)**	**(0.86)**	**(-2.66)**	**(2.68)**	**(-2.54)**	
Constant	0.67	-0.26	0.95	1.47 ***	-0.02	-1.08	0.40	
	(0.82)	(-0.28)	(1.42)	(3.01)	(-0.02)	(-1.39)	(0.70)	
N. obs.	20	19	20	20	71	51	91	
Time fixed-effects (p-value)	…	…	…	…	0.12	0.03	0.00	
R-squared	0.17	0.33	0.10	0.11	0.30	0.39	0.39	

Note: Robust t-statistics are reported in parentheses. Panel regressions include time effects. The p-value of the time-effects tes
is associated with the null hypothesis (F-test) that all period effects are jointly equal to zero.

Table A2. Government Size and Volatility: Additional Controls

Dependent variable: standard deviation of real GDP growth								
	Cross-section OLS				Pooled OLS			
	1	2	3	4	5	6	7	8
	1961-2000	1961-90	1961-2007	1991-2007	1961-2000	1961-90	1961-2007	1991-200
Openness	0.24	2.01 *	0.23	-0.02	0.58	1.57 *	0.53	0.23
	(0.26)	(1.85)	(0.32)	(-0.03)	(0.72)	(1.75)	(1.16)	(0.46)
Government size	**-0.94**	**-3.87 *** **	**-0.46**	**1.02**	**-1.11**	**-2.45 *** **	**-0.92**	**0.90**
	(-1.37)	**(-4.29)**	**(-0.73)**	**(1.31)**	**(-1.45)**	**(-2.98)**	**(-1.61)**	**(1.25)**
GDP per capita (at PPP)	-2.01 ***	-1.61 ***	-1.20 *	-0.11	1.21 ***	-0.92 *	-0.96 ***	-0.52
	(-3.02)	(-3.05)	(-2.05)	(-0.14)	(-2.75)	(-1.88)	(-2.66)	(-0.92)
Average real growth	-0.21	-0.70 ***	0.00	0.22 *	0.04	-0.10	0.04	0.13
	(1.18)	(-3.93)	(0.02)	(1.82)	0.42)	(-0.87)	(0.55)	(1.32)
Constant	7.53 ***	4.89 ***	4.73	2.06	3.21 *	1.56	2.85	3.15
	(3.04)	(2.37)	(2.10)	(0.85)	(1.70)	(0.77)	(2.18) **	(1.64)
N. obs.	20	19	20	20	71	51	91	40
Time fixed-effects (p-value)	…	…	…	…	0.00	0.00	0.00	0.00
R-squared	0.53	0.72	0.46	0.25	0.33	0.48	0.43	0.35

Note: Robust t-statistics are reported in parentheses. Panel regressions include time effects. The p-value of the time-effects test
is associated with the null hypothesis (F-test) that all period effects are jointly equal to zero.

Table A3. Government Size and Volatility: Instrumental Variables (Pooled TSLS, period fixed effects, 1961-2007)

First-stage regression (dependent variable: log of government expenditure to GDP ratio)

	1	2	3	4	5	6
Openness	…	0.39 ***	0.39 ***	0.39 ***	0.39 ***	0.36 ***
		(2.97)	(2.84)	(2.86)	(2.90)	(2.65)
Rate of urbanization	0.00 **	0.00 **	0.00	0.00	0.00 *	0.00
	(1.91)	(1.83)	(1.54)	(0.78)	(1.76)	(0.47)
Dependency ratio	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***
	(4.97)	(6.10)	(6.03)	(6.07)	(5.76)	(5.29)
Government fragmentation	0.35 ***	0.19 **	0.19 **	0.17 **	0.19 **	0.17 **
	(4.46)	(2.11)	(1.97)	(1.99)	(2.17)	(2.07)
Majoritarian electoral rule (dummy)	-0.58 **	-0.45 **	-0.46 **	-0.48 **	-0.46 **	-0.50 **
	(-2.57)	(-2.20)	(-2.14)	(-2.53)	(-2.22)	(-2.07)
GDP per capita at PPP	…	…	-0.02	…	…	…
			(-0.15)			
Quality of monetary policy	…	…	…	0.31 ***	…	0.38 ***
				(2.80)		(3.30)
Financial development	…	…	…	…	-0.03	-0.08
					(-0.70)	(-1.60)
Constant	-1.40 ***	-1.59 **	-1.57 ***	-1.80 ***	-1.55 ***	1.36
	(-7.18)	(1.98)	(-4.05)	(-10.62)	(-7.42)	(1.64)
R-squared	0.57	0.63	0.63	0.66	0.63	0.67
Partial R-squared of excluded instruments	0.50	0.45	0.43	0.44	0.43	0.40
Hansen J-test (p-value)	0.17	0.14	0.29	0.28	0.16	0.22
Weak identification test	19.58 **	15.27 *	14.51 *	14.36 *	13.59 *	12.17 *
Dependent variable: standard deviation of real GDP growth rate						
Openness	…	1.06 *	0.80	0.97 *	1.06 *	0.93 *
		(1.80)	(1.62)	(1.75)	(1.83)	(1.71)
Government size	**-1.22 ** **	**-1.61 ** **	**-1.19 ** **	**-1.18 * **	**-1.84 *** **	**-1.27 * **
	(-2.35)	**(2.44)**	**(-2.01)**	**(-1.82)**	**(2.54)**	**(-1.65)**
GDP per capita (at PPP)	…	…	-1.04 ***	…	…	…
			(-2.66)			
Quality of monetary policy	…	…	…	-1.31 **	…	-1.13 *
				(-2.32)		(-1.66)
Financial development	…	…	…	…	-0.38 *	-0.21
					(-1.72)	(-0.83)
Constant	0.04	-0.70	3.21 **	1.00	-0.47	0.98
	(0.08)	(-0.95)	(3.21)	(0.94)	(-0.67)	(0.87)
N. obs.	78	78	78	78	78	78
R-squared	0.35	0.36	0.42	0.41	0.37	0.41
Exogeneity tests:						
- Government size (p-value of Hausman test)	**0.27**	**0.27**	**0.52**	**0.35**	**0.21**	**0.40**
- Quality of monetary policy (p-value of C statistic)	…	…	…	0.07*	…	0.11 1/
- Financial development (p-value of C statistic)	…	…	…	…	0.74	

Note: Robust t-statistics are reported in parentheses.
1/ Joint test.

Table A4. Government Size and the "Great Moderation" (Pooled OLS, 1961-2007)

Dependent variable: standard deviation of real GDP growth					
	1	2	3	4	5
Openness	0.84	0.77	0.38	0.79	0.97 *
	(1.64)	(1.46)	(0.68)	(1.54)	(1.85)
Government size (all sample)	**-1.16 ****	**-1.40 ****	**-0.84 ***	**-1.26 ****	**…**
	(-2.26)	**(-2.48)**	**(-1.74)**	**(-2.35)**	
Government size (1961-90)	**…**	**…**	**…**	**…**	**-2.07 *****
					(-3.91)
Government size (1991-2007)	**…**	**…**	**…**	**…**	**0.35**
					(0.48)
Central bank independence	-0.78 **	…	-1.25 ***	-0.67 *	-0.56 *
	(-2.21)		(-3.62)	(-1.79)	(-1.74)
Financial development 1/	…	-0.40 **	-0.41 ***	-0.32	-0.22
		(-1.94)	(-2.88)	(-1.59)	(-1.12)
Constant	0.81	0.37	1.98 ***	0.79	-0.28
	(1.14)	(0.53)	(3.51)	(1.14)	(-0.28)
N. obs.	91	90	90	90	90
Time fixed-effects:					
p-value	0.00	0.00	…	0.00	0.00
Included	yes	yes	no	yes	yes
R-squared	0.41	0.40	0.30	0.42	0.49

Note: Robust t-statistics are reported in parentheses. Panel regressions include time effects. The p-value of the time-effects test is associated with the null hypothesis (F-test) that all period effects are jointly equal to zero.

1/ Financial development is measured as the total credit by deposit money banks to the private sector in percentage of GDP.

Table A5. Government Size and Volatility: Instrumental Variables (Pooled TSLS, period fixed effects, 1961-2007)

First-stage regression (dependent variable: log of government expenditure to GDP ratio)

	1	2	3	4	5	6
Openness	…	0.39 ***	0.39 ***	0.38 ***	0.39 ***	0.37 ***
		(2.97)	(2.84)	(2.78)	(2.90)	(2.68)
Rate of urbanization	0.00 **	0.00 **	0.00	0.00 *	0.00 *	0.00
	(1.91)	(1.83)	(1.54)	(1.75)	(1.76)	(1.64)
Dependency ratio	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***	0.04 ***
	(4.97)	(6.10)	(6.03)	(5.82)	(5.76)	(5.28)
Government fragmentation	0.35 ***	0.19 **	0.19 **	0.19 **	0.19 **	0.19 **
	(4.46)	(2.11)	(1.97)	(2.16)	(2.17)	(2.25)
Majoritarian electoral rule (dummy)	-0.58 **	-0.45 **	-0.46 **	-0.53 **	-0.46 **	-0.55 ***
	(-2.57)	(-2.20)	(-2.14)	(-2.57)	(-2.22)	(-2.66)
GDP per capita at PPP	…	…	-0.02	…	…	…
			(-0.15)			
Central bank independence	…	…	…	0.12	…	0.14
				(1.48)		(1.64)
Financial development	…	…	…	…	-0.03	-0.05
					(-0.70)	(-1.03)
Constant	-1.40 ***	-1.59 **	-1.57 ***	-1.63 ***	-1.55 ***	1.36
	(-7.18)	(1.98)	(-4.05)	(-9.05)	(-7.42)	(1.64)
R-squared	0.57	0.63	0.63	0.64	0.63	0.65
Partial R-squared of excluded instruments	0.50	0.45	0.43	0.46	0.43	0.44
Hansen J-test (p-value)	0.17	0.14	0.29	0.18	0.16	0.20
Weak identification test	19.58 **	15.27 *	14.51 *	15.17 *	13.59 *	13.20 *
Dependent variable: standard deviation of real GDP growth rate						
Openness	…	1.06 *	0.80	1.13 **	1.06 *	1.11 **
		(1.80)	(1.62)	(2.07)	(1.83)	(2.06)
Government size	**-1.22 ** **	**-1.61 ** **	**-1.19 ** **	**-1.54 ** **	**-1.84 *** **	**-1.71 ** **
	(-2.35)	**(2.44)**	**(-2.01)**	**(-2.45)**	**(2.54)**	**(-2.44)**
GDP per capita (at PPP)	…	…	-1.04 ***	…	…	…
			(-2.66)			
Central bank independence	…	…	…	-0.76 **	…	-0.66 *
				(-2.04)		(-1.63)
Financial development	…	…	…	…	-0.38 *	-0.31
					(-1.72)	(-1.34)
Constant	0.04	-0.70	3.21 **	-0.06	-0.47	0.07
	(0.08)	(-0.95)	(3.21)	(-0.07)	(-0.67)	(0.09)
N. obs.	78	78	78	78	78	78
R-squared	0.35	0.36	0.42	0.39	0.37	0.40
Exogeneity tests:						
- Government size (p-value of Hausman test)	**0.27**	**0.27**	**0.52**	**0.21**	**0.21**	**0.19**
- Central bank independence (p-value of C statistic)	…	…	…	0.19	…	0.27 1/
- Financial development (p-value of C statistic)	…	…	…	…	0.74	

Note: Robust t-statistics are reported in parentheses.
1/ Joint test.

Table A6. Government Size and Volatility: Interactions and Non-linearities (Pooled OLS, 1961-2007)

Dependent variable: standard deviation of real GDP growth								
	1	2	3	4	5	6	7	8
Openness	0.74	0.72	0.70	0.90 *	0.75	0.63	0.67	0.74
	(1.45)	(1.37)	(1.25)	(1.78)	(1.50)	(1.38)	(1.25)	(1.54)
Government size (GS)	**-2.74 *****	**-2.79 *****	**3.34**	**…**	**-1.91 *****	**-1.64 ****	**1.54**	**…**
	(-3.26)	**(-3.66)**	**(1.42)**		**(-3.37)**	**(-2.46)**	**(0.65)**	
Financial development (FD)	1.42 *	…	…	…	…	…	…	…
	(1.83)							
Central bank independence (CBI)	…	2.73 **	…	…	…	…	…	…
		(2.17)						
GDP per capita (at PPP)	…	…	…	…	…	-0.02	…	…
						(-1.12)		
Average real growth	…	…	…	…	…	0.03	…	…
						(0.64)		
Non-linear terms:								
Interaction GS*FD	**1.92 ****	**…**	**…**	**…**	**0.39 ***	**0.32**	**0.34 ***	**0.38 ***
	(2.35)				**(1.78)**	**(1.29)**	**(1.66)**	**(1.82)**
Interaction GS*CBI	**…**	**3.83 *****	**…**	**…**	**0.88 ****	**0.81 ***	**0.71 ***	**0.79 ****
		(2.84)			**(2.14)**	**(1.86)**	**(1.71)**	**(1.97)**
Squared GS	**…**	**…**	**2.37 ****	**0.76 *****	**…**	**…**	**1.72**	**1.00 *****
			(2.03)	**(2.90)**			**(1.51)**	**(4.02)**
Constant	-0.99	-0.73	2.35 *	0.73 *	0.25	0.58	1.72	1.01 **
	(-1.06)	(-0.82)	(1.85)	(1.66)	(0.38)	(0.75)	(1.35)	(2.48)
	Marginal effect on volatility of an increase in… 1/							
Financial development if								
government expenditure is 35 percent of GDP	**-0.60**	…	…	…	**-0.41**	-0.34	**-0.36**	**-0.40**
government expenditure is 50 percent of GDP	**0.09**	…	…	…	**-0.27**	-0.22	**-0.24**	**-0.26**
Central bank independence if								
government expenditure is 35 percent of GDP	…	**-1.29**	…	…	**-0.93**	**-0.85**	**-0.75**	**-0.83**
government expenditure is 50 percent of GDP	…	**0.08**	…	…	**-0.61**	**-0.56**	**-0.49**	**-0.55**
Size of government if								
expenditure is 35 percent of GDP	**-1.30**	**-0.70**	-1.65	**-1.60**	**-1.13**	-0.96	-1.43	**-1.38**
expenditure is 50 percent of GDP	**-1.30**	**-0.70**	0.05	**-1.05**	**-1.13**	-0.96	-0.20	**-0.67**
N. obs.	90	90	91	91	90	90	90	90
Time fixed-effects:								
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Included	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.44	0.46	0.43	0.41	0.45	0.46	0.49	0.48

Note: Robust t-statistics are reported in parentheses. The F-test is associated with the null hypothesis that all time effects are jointly equal to zero.
1/ Numbers show the value of the estimated derivative function of volatility with respect to the relevant explanatory variable. Bold numbers denote cases where all estimated coefficients used in the calculations are statistically different from zero. The marginal impact of government size is measured at sample mean of FD and CBI.