Public expenditure and growth volatility: do "globalization" and institutions matter?

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Abstract

We revisit the empirical relationship between output volatility and government expenditure in a model where output volatility and expenditure are jointly determined. The key regressors in our model are trade and financial integration indicators, institutional variables, including central bank independence, and a measure of *de facto* exchange rate flexibility. Our findings on the role of public expenditures, exchange rate regime choice and central bank independence consistently signal that government discretion has destabilising effects on growth volatility. We confirm that government size increases with trade integration, but this has adverse effects because public spending is positively related to growth volatility. Institutions that increase policymakers accountability limit the level of public expenditure and volatility. In this regard our results support the view that strengthening institutions is a key to improve the efficiency of policies

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1 Introduction

The emerging consensus on the large costs of wide economic fluctuations[1] has propelled a lively debate on the sources of output growth volatility and the possible smoothing role of policies and institutions. Rodrik (1998) argues that there may be a degree of complementarity between trade openness and government size as more open economies are subject to greater external risk. This argument implies that public expenditure should increase when output is more volatile, resurrecting the old keynesian theme on the stabilising role of government intervention (Gali, 1994).

We contribute to this literature by revisiting the empirical relationship between output volatility and government expenditure.

Our modeling approach rests on two key considerations. First, output volatility and expenditure are jointly determined. Second, both variables might respond to structural factors such as institutions and the degree of trade and financial openness of the economy. In line with these considerations, we estimate a two-equations system where variables describing cross-country differences in terms of politico-institutional arrangements and external openness are included in the list of regressors.

The literature has identified three key determinants of government expenditure: institutions and government failures (i.e. constitutional arrangements, policy-myopia and political instability), economic fundamentals (i.e. the stage of economic development, demographic forces, country size), globalization (i.e. trade and financial openness).[2] With regard to the sources of output volatility, conventional wisdom emphasises the role of country exposure to shocks and of the associated economic policy responses. These, in turn, are affected by structural factors such as economic fundamentals and institutions.[3] Our modeling approach brings together these two strands of literature. Our estimates are based on a large sample of countries over a 30 years period, ranging from 1970 to 2000.

We obtain a number of results. First, economic volatility calls for higher government expenditure, but this in turn appears to increase output volatility.

[1] Following Ramey and Ramey (1995), various papers have identified a strong and persistent negative effect of output volatility on output growth (see inter alia Fatas (2002) and Hnatkovska and Loayza (2005). Aghion et al. (2005) show that this effect gets stronger the lower the degree of financial development of the economy. Kose et al. (2006) find that trade and financial integration significantly reduce the strength of the relationship. Chatterjee and Shukayev (2006) however suggest that the relationship might be sensitive to changes in the specification of growth regressions.

[2] Persson and Tabellini (2003, 2004) and Persson et al. (2006) provide comprehensive discussions of the determinants of fiscal policy outcomes.

[3] See Bejan (2004) for a survey of the empirical evidence in this field.

We argue that this latter effect operates though the volatility of government expenditure: higher expenditure is also more volatile, and a more volatile expenditure raises the volatility of output if expenditure is procyclical. Our evidence complements the results of Fatas and Mihov (2003).

Second, trade openness increases economic volatility and hence expenditure, as argued by Rodrik (1998). However, this is not the end of the story. In fact trade openness has a direct effect on expenditure over and above its impact on volatility. Our interpretation is that this direct effect represents government response to trade-induced in relative incomes, calling for redistributive policies.

Third, the other main dimension of globalisation, namely financial openness, generates complex effects. On the one hand it increases volatility, in line with theoretical arguments on the effects of international risk sharing on specialisation (Kalemli-Ozcan et al., 2003) and boom-bust cycles (Aghion et al., 1999). On the other it has a direct disciplining effect on government expenditure: more financially open economies are associated with lower spending. Therefore the overall impact of financial openness on government expenditure and output volatility is ambiguous.

Fourth, we find that political institutions affect output volatility through their impact on government expenditure: in fact, similarly to Persson and Tabellini (2004), expenditure tends to be higher in parliamentary systems and in worse polities. We will provide a common interpretative framework for these two effects.

Fifth, there is an additional institutional effect: greater central bank independence lowers economic volatility. In contrast with the well known neutrality result obtained by Alesina and Summers (1993), this is consistent with our finding that government expenditure raises growth volatility. If government discretion has destabilising effects, restricting its ability to affect central bank decisions should reduce output fluctuations.

The remainder of the paper is organised as follows. Section 2 provides a brief review of the literature. Section 3 introduces the econometric model. Results from the baseline specifications are discussed in Section 4. Section 5 presents some extensions. Section 6 concludes. A complete description of the variables can be found in the Appendix.

2 Literature review

In this section we briefly discuss the key contributions of the literature to the issues analysed in the paper.

Public expenditure and openness. The original argument put forward by Rodrik (1998) links this effect to the increased exposure to risk that glob-

alisation brings about and therefore to the increased demand for insurance. However, in addition to risk-insurance, other channels link openness to spending. For instance, openness to trade could sharpen inequalities across sectors of the economy and/or between workers with different skills (Kletzer, 2002). These growing inequalities might then translate into stronger redistributive demands and increased public spending.[4] Our explicit modeling of the joint effect of globalisation on volatility and fiscal policy allows us to shed light on this issue and improve the understanding of the transmission channels.

Fiscal policy and output volatility. Gali (1994) documents a negative serial correlation between government size and output volatility. This result is confirmed and apparently reinforced in Fatas and Mihov (2001), who show that even after controlling for endogeneity, the negative correlation is still present and, in some cases, becomes more significant. Andres et al. (2004) provide a rigourous theoretical underpinning for this result. In their framework, the working of automatic stabilizers should imply a negative correlation between public spending and volatility. However, a growing amount of evidence points to a pro-cyclical fiscal policy pattern (see Lane (2003), Kaminsky et al. (2004) Alesina and Tabellini (2006)). If the discretionary component of expenditure is pro-cyclical, then the sign of the correlation between expenditure and volatility becomes ambiguous. This issue has been investigated in Fatas and Mihov (2003) who show a strong effect of volatility by the discretionary component of fiscal policy. Yet there are substantial differences between our approach and theirs, as they analyse a single equation model, where the determinants of fiscal policy are largely unexplained.

Political institutions and public expenditure. Persson et al. (2000) formally study how different regimes (parliamentary vs. presidential) affect the size and scope of government, concluding that parliamentary regimes should be associated with higher taxes and overall spending. In parliamentary regimes accountability towards voters is weaker and politicians are more likely to collude, this in turn results in higher rents and higher taxation.[5] Persson and Tabellini (2003, 2004) provide evidence that government expenditure in percent of GDP is lower in presidential regimes and in countries with a majoritarian rule. Institutions might affect volatility through their influence on government expenditure. Acemoglu et al. (2003) explicitly test the volatility effect of the quality of institutions, as measured by the extent of constitutional limits on the exercise of arbitrary power by the executive. They conclude that poor institutions lead to economic instability and to bad macroeconomic policies

[4]Kim (2007) shows that much of the openness-spending nexus should be attributed to channels other than insurance against increased volatility.

[5]Austen-Smith (2000) and Persson et al. (2006) obtain similar results using different theoretical appraches.

via a variety of mediating channels. Henisz (2004), using a measure of checks and balances, obtains that worse institutions increase fiscal policy volatility by allowing policymakers to suddenly revert the existing course of policy action. Policy volatility might thus be the link between institutions and output volatility. Our paper contributes to this strand of research by providing explicit estimates of the direct and indirect (via government expenditure) impact of institutions on volatility.

Central bank independence output volatility and public expenditure. Early models of monetary policy delegation postulated a positive correlation between central bank independence and output volatility (Rogoff, 1985). Alesina and Summers (1993) produced a celebrated neutrality result, subsequently rationalized by a voluminous theoretical research. Alesina and Gatti (1995) pointed out that delegation schemes entailed a trade-off, in terms of output volatility, between the distortionary responses of conservative central bankers and the beneficial effects of monetary policy independence from political cycles.

3 Econometric modeling

3.1 Model set-up and estimation

We estimate the following two-equations model:

$$\sigma_{ct} = \mathrm{A}_1 X_{ct} + \alpha_2 g_{ct} + \varepsilon_{ct} \tag{1}$$

$$g_{ct} = \mathrm{B}_1 W_{ct} + \beta_2 \sigma_{ct} + \upsilon_{ct} \tag{2}$$

where σ is a measure of economic volatility, g is government expenditure, subscripts c and t respectively denote a generic country and time, X and W are two sets of regressors (each including a constant term), A and B are the associated vectors of parameters, ε and υ are error terms. Some of the regressors might appear on the r.h.s. of both equations; that is, X and $W$are allowed to have some elements in common.[6]

We consider a general structure of residuals, allowing for heteroskedasticity, contemporaneous correlation of the residuals across equations and non-zero correlation between some of the regressors and the error term in each equation. Under these assumptions, the Generalized Method of Moments (GMM) provides robust estimation of the parameters of the model, without requiring

[6]The order and rank conditions for identification of the system limit the number of regressors that can appear in both equations.

information of the exact distribution of the disturbances. In fact, many standard estimators (i.e. OLS, SUR, 2SLS, 3SLS) can be derived as special cases of the GMM estimator (see Wooldridge, 2002).

In applying the GMM procedure, we use White's heteroskedasticty consistent covariance matrix. For each set of estimates we run the diagnostic test of overidentifying restrictions to check the validity of our choice of instruments (see also Section 3.4). The dataset used for estimation is a panel covering a large sample of countries and spanning over a 30 years spell, from 1970 to 2000. Data are averaged over a period of five-years as we are not interested in short term effects. Tables 3 and 4 provide the list of countries included in the analysis and some descriptive statistics of the variables.

3.2 Specification of the volatility equation

In line with the literature, our measure of economic volatility (*econovol*) is the standard deviation of aggregate output growth over a five-year period.[7] On the r.h.s. of the volatility equation (1) there is the other endogenous variable of the system, total government expenditure in percent of GDP (*govexp*). Following Gali (1994) the expected sign on government size should be negative.

The key regressors in our analysis fall into two broad categories: open economy and institutional factors.

Exposure to external shocks should be an important source of volatility. Rodrik (1998) stresses the importance of trade openness. By contrast, financial openness should have a stabilising effect by favouring risk diversification. However, high volatility of international capital movements could be a source of risk *per se*.[8] We account for these effects by including the imports plus exports to GDP ratio (*tradeopen*), and an index of international capital flows liberalisation (*finopen*).[9] In addition we consider an index based on the *de facto* classification of exchange rate regimes proposed by Reinhart and Rogoff (2004). This variable (*excharr*) takes higher values (from 1 to 5) the more flexible the regime is. The effect of *excharr* on growth volatility is a priori ambiguous. On the one hand, countries that peg their currency to an external anchor loose the possibility of using monetary policy for domestic stabilisation purposes. If the economy is prevalently hit by asymmetric real shocks, this should increase volatility. On the other hand, flexible exchange rate arrangements leave room for a discretionary conduct of macroeconomic policies that

[7] Using the standard deviation of per-capita income growth does not alter the results (available upon request).

[8] See for instance the discussion in Easterly et al. (2000), Buch et al. (2002), Bekaert et al. (2006), Kose et al. (2003, 2006).

[9] The index is taken from Chinn and Ito (2006). See the appendix for further details.

is often associated with more, rather than less, volatility. The prediction on the sign of the estimated coefficient is thus uncertain ex-ante.

Turning to institutional factors we provide an explicit treatment of institutional variables that shape policymakers' incentives. For the case of fiscal policy, the effect of institutions is most likely observed indirectly through public spending. This implies that after including *govexp* in the volatility regression, institutions should have no residual direct effect. However, if institutions affect other dimensions of the policy space, then the inclusion of fiscal spending would not exhaust the effect of institutions on volatility. Persson and Tabellini (2003, 2004) have become a key reference in the empirical treatment and analysis of the economic effects of institutional arrangements. Following their contributions, we will focus on three dimensions of a country's institutional setting: the quality of the polity (*polity*), the type of political system (*system*), and the electoral rule (*rule*). The first is an index ranging from -10 to +10, with higher values denoting better polities. The second is a thricotomous variable taking value 0 for presidential and authoritarian, 1 for assembly-elected and 2 for parliamentary systems. The third is a binary dummy taking value 1 for plurality (as opposed to proportional) electoral rule.

To complete the analysis of institutional aspects we include a measure of *de facto* central bank independence. We use the turnover rate of central bank governor (*cbturn*):[10] higher values indicate lower independence. The expected sign on this variable is ambiguous depending on whether central bank independence isolates monetary policy from political instability or generates distorted responses to shocks as in Rogoff (1985). To the best of our knowledge, this is the first attempt to estimate the effect of de facto independence on volatility within a structural model of two endogenous equations.[11]

Finally we consider other controls already used in the empirical literature: the level of per-capita GDP (*GDP p.c.*) proxying for the stage of economic development (Acemoglu and Zillibotti, 1997), the ratio of domestic credit to the private sector to GDP (*findepth*), to account for the depth of domestic financial markets.

3.3 Specification of the expenditure equation

The dependent variable of equation (2) is government expenditure to GDP ratio, *govexp*. We employ total expenditure, rather than government consumption, because policymakers are likely to use transfers and subsidies as

[10] See Ghosh et al. (2002)

[11] Cecchetti et al. (2006) use a similar measure in a single equation model. They obtain that central bank independence is never statistically significant in the output volatility regression.

insurance tools.[12]

Output volatility now appears as a regressor. If government expenditure provides individual risk insurance and business cycle stabilisation, then output volatility in equation (2) should display an estimated positive coefficient.

Rodrik (1998) argues that trade exposure is a major source of risk, calling for larger government expenditure. Note that if this effect works through the increased volatility of output, then the contemporaneous inclusion of *econovol* on the r.h.s of equation (2) should make the coefficient on *tradeopen* not significant. Extending Rodrik's argument to financial factors, financial openness should affect spending through its effect on growth volatility. However, governments may consolidate their fiscal stance to stabilise capital flows. In other words, financial openness could discipline governments. In this case we should observe a direct negative effect of *finopen* on government spending.

Extending the mainstream empirical literature, we include the variable *excharr*. There are various theoretical arguments implying that exchange rate arrangements might be an important determinant of spending. Countries pegging their currency to an external anchor cannot use monetary policy for domestic stabilisation purposes and therefore rely more heavily on fiscal policy. This argument can be reversed: policymakers might overspend under a flexible exchange rate regime because the latter leaves room for discretionary policies. To the contrary, the sustainability of a peg may require a tighter fiscal stance. In the end, different effects of opposite sign are likely to be at work and the role of *excharr* remains theoretically ambiguous.

The interpretation of political variables follows Persson et al. (2006). Proportional systems are more likely to generate coalition governments and political fragmentation, thus reducing the overall accountability of decision-makers towards the electorate. This increases politicians' incentive to appropriate the common pool of resources, leading to an inefficient policy equilibrium characterised by high spending. The dummy *rule* captures the type of electoral rule, with the prediction of a negative coefficient. A similar argument applies to political systems. Parliamentary systems tend to have a larger incidence of coalition governments. The accountability of each single coalition member falls in fragmented governments, thus leading to overspending equilibria. Finally, we control for the quality of the polity through the variable *polity*. We expect a negative correlation between polity and *govexp*, as worse polities weaken checks and balances, reducing politicians' accountability to voters.

Turning to the other controls, our specification is in line with recent studies in the field (i.e. Persson and Tabellini, 2003). The level of per-capita income,

[12] Andres et al. (2004) show the importance of different components of government spending in generating a stabilizing effect on output volatility.

GDP p.c., accounts for Wagner's Law. This is the hypothesis that countries at more advanced stages of development can afford proportionally greater spending (because, for instance, they tend to have comparably more efficient tax collection systems). The log of population size (*pop*) controls for possible scale effects. Alesina and Wacziarg (1998) suggest that when the costs of partially or completely non-rival public goods can be shared over larger populations, per-capita expenditure on these goods is lower and hence spending ratios should negatively correlate with population size. To account for the greater spending of ageing societies, we also add the share of population above 65 (*oldpop*).

3.4 Our choice of instruments

The need to employ instruments comes from the fact that regressors other than the endogenous dependent variables could be correlated with the error terms in the two equations. For instance, this is indeed likely to be the case for the log of per-capita income. Both theoretical and empirical models of growth emphasise the effects of government expenditure on the average growth rate, and hence on per-capita income (Barro, 1990; Barro and Sala-I-Martin, 1995). Similarly, there is now a voluminous literature on the interactions between output volatility and output growth.[13] Another likely candidate for endogeneity is the exchange rate regime, as the evidence reported by Carmignani et al. (2006) suggests. Finally, the turnover of the central banker, being potentially determined by the economic performance of the country, is also treated as endogenous.

Finding good instruments is always a paramount task. We adopt a pragmatic approach. We do not consider lagged values of endogenous variables as they often prove to be only weakly exogenous (Lundberg and Squire, 2003). We instrument the level of development with a variable measuring country's distance from equator (see La Porta et al., 1999). To achieve a greater number of overidentifying restrictions, we integrate this set of instruments with two indicators of the degree of competitiveness and openness of the executive recruitment process, which are measures of institutional quality that we think unlikely to be endogenous.[14] Finally, in the specifications that include the central bank turnover, we further extend the group of instruments with the addition of (i) two institutional variables capturing the likely effect of political turnover on de facto central bank turnover and (ii) a country-fixed effect in the form of an indicator of government interference in the economy that is not

[13] See the references quoted in the introduction.

[14] These indicators are the variables *xopen* and *xcomp* in the Database of Political Institutions.

time varying.[15] All equations include time and regional dummies.

We are then left with two questions. First, is our choice of instruments good? Second, are there any other endogenous variables in the system? We rely on a few tests to answer these two questions. We run an F-test on the regression of endogenous variables on instruments and we always reject the null hypothesis that the estimated coefficients are jointly insignificant. Then, we always run the Sargan test and never reject the null that our overidentfying restrictions are correct. Finally, we apply the Hausmann test to check for the endogeneity of other regressors, always rejecting the endogeneity hypothesis. While we reckon that none of these tests is the ultimate proof of instruments validity, we take it as a good battery of diagnostics that support our choices.

4 Results: baseline specifications

4.1 Base model

In order to facilitate comparison with the rest of the literature we now present a baseline version of the model that does not include *cbturn* in the growth volatility equation. Results are reported in column I of table 1.[16]

The first striking result concerns the simultaneous interaction between public expenditure and growth volatility. The latter in equation (2) has a positive effect on government expenditure. At first sight, this should confirm the view that fiscal policy is a shock absorber. However, in equation (1) we find that spending increases volatility. It seems that economic volatility feedbacks on itself through spending. As we discuss later, the transmission mechanism from public spending to growth volatility might operate through the volatility of government expenditure.

The effects of globalisation are complex. Trade openness increases economic volatility and hence expenditure. This confirms the cornerstone of Rodrik's argument: economies that are more open to trade face greater risk and hence require greater insurance. In addition to that, we find a direct effect of trade openness on public spending. This might be due to the unequal distribution of costs and benefits of trade integration across sectors and socio-economic groups, that increase pressure for redistribution through public spending (see

[15] The two institutional indicators are the frequency of political change (from the Database of Political Institutions) and the strength of constraints on the executive (from Henisz, 2000). The country-fixed effect is the variable *wagepri* from Economic Freedom of the World.

[16] Throughout the rest of this section and the next-one we always report at the bottom of the table the value of the Sargan test statistic of overidentifying restrictions. All equations include time dummies, not reported in the tables.

for instance Kletzer (2002) for the US economy). We also find a clear volatility-increasing effect of financial openness. Various channels could instead explain the positive coefficient on *finopen* in equation (1). Financially open economies are more vulnerable to the risk of speculative attacks and hence more likely to experience financial crises that cause sharp output fluctuations. Moreover, the volatility of capital flows tends to induce boom-bust cycles (Aghion et al., 1999). Another possible explanation is that increased risk sharing opportunities lead to more specialized productive structures, thus exposing the country to the risk of idiosyncratic shocks (Kalemli-Ozcan et al., 2003). In equation (2) we find that financial openness has a negative direct effect on spending. Since integration into global financial links rewards good macroeconomic policy management, financial openness seems to discipline policymakers. However, this effect is to some extent offset by the positive feedback operating through economic volatility.

More flexible exchange rate regimes are associated with lower government spending and with greater output growth volatility. Taking into account the apparent procyclical behaviour of fiscal and monetary policies, the negative direct effect of *excharr* on *govex* suggests that exchange rate regime choice and fiscal interventism are substitutes. For instance countries pegging their currency to an external anchor cannot use discretionary monetary policy and therefore rely more heavily on fiscal policy.

The estimated coefficients on the political variables in equation (2) are in line with the theoretical expectations, with a positive sign for *system* and a negative sign for *polity* and *rule* (the latter not statistically significant), whereas we cannot detect any direct effect of these variables in (1).[17] Column II in 1 shows that removing institutional variables from (1) does not affect other results. From now on we use this more parsimonious specification. Overall, the evidence depicts an intuitively appealing picture of the role of institutions. Institutions matter in so far as they affect the accountability of politicians to voters. Proportional systems are characterised by a prevalence of fragmented ruling coalitions, governments are typically short-lived, but changes in government do not often lead to changes in the composition of the ruling coalition. Worse polities envisage weaker checks and balances of power. Both fragmentation and weaker checks and balances reduce the accountability of decision-makers to voters. The resulting policy equilibrium will be then characterised by overspending. On the contrary, greater accountability to voters is likely to induce less spending. Given the adverse effect of public expenditure in equation (4), institutions that discipline public spending also dampen growth

[17]Entering political variables one at the time, or in pairs of two, would not change the results.

volatility.

Turning to the remaining controls, with respect to equation (2) we find support for Wagner's law and for a positive effect of ageing on public expenditure, whereas the coefficient on *pop* is not significant. In equation (1) we cannot find a significant impact of financial depth on output volatility. In fact, different theoretical arguments can be put forward to explain the role of financial depth. On the one hand, if deeper financial systems imply better smoothing of shocks, then financial development should reduce volatility. On the other hand, domestic credit to private sector as a share of GDP tends to rise in the advent of credit booms, which are a source of volatility. In this respect, our chosen measure of financial depth should sharpen output growth fluctuations. Easterly et al. (2000) suggest that effects of opposite sign lead to a non-linear relationship between financial development and volatility. The estimated coefficient in a linear specification would therefore result instable and generally not significant. Further research on this relationship is certainly needed.

4.2 Refinements

Columns III and IV of Table 1 present two refinements of the volatility equation. First of all, following Rodrik (1998), we interact our measure of trade openness with the period standard deviation of terms of trade (*tradeopen*voltot*) to obtain an overall measure of "external risk". It can be argued that the extent to which openness to international trade affects domestic output growth volatility depends on the volatility of terms of trade. Column III reports the estimates of a model where *tradeopen*voltot* replaces*tradeopen* in the baseline model.[18] *tradeopen*voltot* has a positive and significant effect in both equations, just like *tradeopen*. Relative to the other estimates in column I, the only significant change concerns the volatility effect of financial depth, which is now marginally significant.

The second refinement concerns the exclusion of those variables whose estimated coefficients happen to be largely insignificant in the previous specifications. This is indeed a test of robustness to spurious correlations eventually emerging from the inclusion of noise variables in the model. We therefore drop population size and the rule dummy from the expenditure equation, and the political variables and financial depth from the volatility equation.[19] As re-

[18]We also tried to add the volatility of terms of trade to the baseline specification without interacting it with trade openness. The large standard errors that we obtained are however indicative of some multicollinearity problem and that is why in the rest of the paper we prefer using the interactive term.

[19]In fact, financial depth is significant at the 10% level of confidence in the specification of column III. However, when left in the parsimonious specification of column IV, its coefficient

ported in column IV, results concerning the remaining variables are unaffected.

5 Extensions

We take the refined baseline specification in column IV of Table 1 as the starting point to explore some extensions and, at the same time, further check the robustness of results. This new evidence is reported in Table 2.

5.1 Volatility of expenditure and volatility of output

The finding that government expenditure increases the volatility of output suggests that automatic stabilisers are weak and/or more than offset by discretionary procylical spending. We further investigate this relationship by proposing two variations of the basic model. First, in Column I of Table 2 we explore whether OECD countries behave differently from the rest of the sample. As a matter of fact, previous evidence (i.e. Gali, 1994) indicates that in OECD economies fiscal policy works as an automatic stabiliser. We therefore add an interactive term defined as the product of *govexp* times an OECD dummy.

The estimated coefficient on *govexp* remains positive and significant. The one on the interactive term is negative, but not statistically different from zero. This means that the effect of fiscal spending on volatility in OECD countries is not substantially different from the sample average, albeit it could be slightly less strong. In this sense, our results are more in line with Koskela and Viren (2003).

In the second variation of the model, we further investigate the transmission mechanism linking expenditure and output volatility. Our candidate is the volatility of government expenditure. Countries that heavily rely on discretionary fiscal instruments are likely to experience both higher spending levels and greater spending volatility. In turn, the volatility of spending is a source of output volatility to the extent that fiscal policy takes a pro-cyclical stance. To shed light on this conjecture we add the volatility of government expenditure (*volgovexp*), to the set of regressors in the output volatility equation.[20]

turns largely insignificant. In general, its inclusion does not alter the results on the other variable and its estimated coefficient remains not different from zero.

[20]The variable *volgovexp* is treated as endogenous and instrumented by politico-institutional indicators that capture the fiscal policy response to government changes. These include the frequency of *de-facto* cabinet changes, the strength of constraints that limit policy changes when the government changes, and a dummy variable that picks the ideological orientation of the incumbent. The reason to include this latter is that the ideological orientation of the government determines the more or less active role of fiscal policy and hence

The results in Column II of Table 2 are clearly indicative of a multicollinearity problem between the level and the volatility of spending (and possibly between government volatility and per-capita GDP). On the basis of our conjecture, this was expected.[21] To address the multicollinearity issue, we drop *govexp* from the r.h.s. of the output volatility equation. This is equivalent to imposing the restriction $\alpha_2 = 0$ in equation (1). Results are displayed in Column III. In line with our proposed conjecture, the volatility of government expenditure now has a positive and statistically significant coefficient. Therefore, it seems that expenditure levels affect output volatility through the volatility of expenditure. This result is complementary to the cross-country evidence of Fatas and Mihov (2003).[22]

5.2 Central bank independence and output volatility

An important extension of our base model concerns the role of central bank independence in determining volatility. The de facto measure of independence *cbturn* is added to the output volatility equation. To the best of our knowledge, this is the first attempt to estimate the effect of de facto independence on volatility within a structural model of two endogenous equations.[23] Results are given in Column IV of Table 2. To interpret the estimated coefficient recall that higher values of *cbturn* indicate lower central bank independence.

The positive estimated coefficient on *cbturn* means that less independent central banks cause greater output volatility. The standard view incorporated in monetary theory (i.e. Rogoff, 1985) holds that an independent central bank trades-off output volatility for inflation stabilisation, thus implying that greater independence will increase volatility. However, some earlier empirical findings (i.e. Alesina and Summers (1993); Cukierman (1992) and recently Cecchetti et al. (2006)) gave way to the hypothesis that monetary arrangements are neutral. Our result instead pushes the neutrality argument one significant step further: central bank independence not only does not increase volatility, it actually re-

the volatility of fiscal instruments.

[21] Note however that all other results are confirmed.

[22] Theories of partisan business cycles (i.e. Alesina, 1987) also imply that government changes sharpen macroeconomic fluctuations to the extent that they involve changes in policymakers ideology. We therefore also experimented with a model specification that includes the volatility of policymakers ideology on the r.h.s. of the output volatility equation. However, ideological volatility turns out to be always insignificant (whether or not it is treated as endogenous and whether or not the level of government expenditure is included in the regression). Results are available upon request.

[23] Cecchetti et al. (2006) try to use a similar measure in a single equation model. They obtain that central bank independence is never statistically significant in the output volatility regression.

duces volatility. Our intuition for this result extends the argument of Alesina and Gatti (1995). The independent central banker attaches more importance to low inflation than to output stabilisation. This in turn increases output volatility due economic shocks. However, the independent central banker also isolates monetary policy from the distortionary effect of the political cycle. In this sense, it reduces output volatility due to political shocks. The estimated negative coefficient on *cbturn* means that the second effect prevails. An interesting hypothesis to be tested in the future is that the relative strength of the political effect decreases at more advanced stages of economic and institutional development. This non-linearity would also explain why other empirical work that mainly focuses on industrial economies has not found evidence of a positive impact of *cbturn* on output volatility.

The implications of this finding are significant. If central bank independence reduces volatility, then the trade-off between inflation and stabilisation in the delegation of monetary policy disappears. Furthermore, by lowering volatility, central bank independence reduces fiscal expenditure, thus facilitating the consolidation of the fiscal stance. In this perspective, not delegating monetary policy to an independent central bank turns out to be a major policy and institutional failure.[24]

In column V we document the existence of an interactive effect between central bank independence and financial openness on volatility. Intuitively, if the vulnerability of a country to sudden changes in capital flows depends on the credibility of its macroeconomic institutions, then the importance of central bank independence in stabilising output volatility should increase with the degree of financial openness. The joint term cbturn*finopen captures this interaction. Its estimated coefficient is positive; at the same time the coefficient on *cbturn* remains positive and significant while the coefficient on *finopen* becomes insignificant. Accordingly, our interpretation is twofold. First, in line with the above intuition, central bank independence reduces volatility and this effect is reinforced the more open to international financial flows the country is. Second, in countries where central banks are largely independent, financial openness has a small effect on output volatility. On the contrary, financial openness becomes more significantly destabilising in countries where the turnover of the central banker is high. Finally, all of the other results are unchanged.[25]

[24]Results concerning *cbturn* are qualitatively unchanged if the output volatility equation includes the volatility, rather than the level, of government expenditure.

[25]We also tried to add central bank turnover directly into the spending equation. This poses problems of multicollinearity, since the institutional variables in the spending equation are also determinants of *cbturn*. As a matter of fact, all of the institutional variables become insignificant, while *cbturn* takes a negative sign. All of the other coefficients are unchanged (results are available upon request). A possible avenue of future research would explicitly

5.3 Central bank independence

An important extension of our base model concerns the role of central bank independence in determining volatility. The positive estimated coefficient on *cbturn* means that *less* independent central banks cause *greater* output volatility.[26] This implies that central bank independence isolates monetary policy from the distortionary effects of political discretion. The implications of this finding are significant. If central bank independence reduces volatility, then the trade-off between inflation and stabilisation in the delegation of monetary policy *de facto* disappears. Furthermore, by lowering volatility, central bank independence reduces fiscal expenditure, thus facilitating the consolidation of the fiscal stance. In this perspective, not delegating monetary policy to an independent central bank turns out to be a major policy and institutional failure.[27]

In in column V we document the existence of an interactive effect between central bank independence and financial openness on volatility. Intuitively, if the vulnerability of a country to sudden changes in capital flows depends on the credibility of its macroeconomic institutions, then the importance of central bank independence in stabilising output volatility should increase with the degree of financial openness. The joint term *cbturn*finopen* captures this interaction. Its estimated coefficient is positive; at the same time the coefficient on *cbturn* remains positive and significant while the coefficient on *finopen* becomes insignificant. Accordingly, our interpretation is twofold. First, central bank independence reduces volatility and this effect is reinforced the more open the economy to international financial flows. Second, in countries where central banks are largely independent, financial openness *per se* has a small effect on output volatility. [28]

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model the determinants of central bank turnover in a system of three endogenous equations, so to avoid the multicollinearity problems.

[26] Recall that higher values of *cbturn* indicate lower central bank independence

[27] Results concerning *cbturn* are qualitatively unchanged if the output volatility equation includes the volatility, rather than the level, of government expenditure.

[28] We also tried to add central bank turnover directly into the spending equation. This poses problems of multicollinearity, since the institutional variables in the spending equation are also determinants of *cbturn*. As a matter of fact, all of the institutional variables become insignificant, while *cbturn* takes a negative sign. All of the other coefficients are unchanged (results are available upon request). A possible avenue of future research would explicitly model the determinants of central bank turnover in a system of three endogenous equations, so to avoid the multicollinearity problems.

5.4 Freely falling regimes

The classification proposed by Reinhart and Rogoff (2004) includes a number of "freely falling" regimes. These are countries that are experiencing flexible exchange rate regimes combined with high inflation. We test the robustness of our findings to the exclusion of these regimes. To this purpose, we re-estimate the model with central bank turnover only on the sample of non-freely falling regimes. The new results are reported in column VI (without interaction between *cbturn* and *finopen*) and VII (with interaction between *cbturn* and *finopen*).

It turns out that little changes. In the volatility equation, the *excharr* variable looses some of its statistical significance, but the estimated coefficient still passes the zero restriction test at the 10% level of confidence. The coefficient on *findepth* is largely insignificant, but this was indeed the case also in some of the previous specifications. All of the other results are not weakened, but if possible statistically strengthened by the exclusion of freely falling regimes.

6 Conclusions

Our findings on the role of public expenditures, exchange rate regime choice and central bank independence consistently signal that government discretion has destabilising effects on growth volatility. Institutions that increase policy-makers accountability limit the adverse effects of fiscal discretion on volatility. In this regard our results support the view that strengthening institutions is a key to improve the efficiency of policies?

Our analysis also sheds light on the multifaceted effects of globalisation. Both trade and financial openness have direct and indirect effects on volatility. For financial openness these effects are of different sign. International financial integration directly increases volatility, but it also lowers spending and (indirectly) volatility. For trade openness, these effects appear to go in the same direction. Not only trade implies exposure to shocks, it also seems to raise pressures from redistributive fiscal policies. Once more, strengthening institutions is the key to preserve the benefits from trade integration.

We conclude with three directions of future research. First, the formalisation of the link between monetary policy and fluctuations must be revisited in view of our findings concerning the role of central bank independence. Second, the link between levels and volatility of government expenditure must be made explicit, allowing for feedback effects from output volatility. Third, with longer and more detailed series on fiscal variables becoming available over time, it will be interesting to look at individual components of expenditure in addition to

total government spending.

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Table 1: Baseline model

	I	II	III	IV
Output volatility				
Constant	0.048	0.082***	0.062**	0.049*
Tradeopen*voltot		0.498***	0.473***	0.378*
GDP p.c.	−0.015**	−0.022***	−0.021***	−0.018***
Excharr	0.026***	0.033***	0.034***	0.030***
Finopen	0.008***	0.009***	0.010***	0.009***
Govexp	0.138**	0.126**	0.171***	0.166***
Findepth	0.012	0.015	0.020*	
Tradeopen		0.039**		
System	−0.003			
Rule	−0.001			
Polity	0.000			
Government expenditure				
Constant	−0.107	−0.045	−0.088	−0.113
Tradeopen	0.128***	0.107**	0.131***	0.138**
Finopen	−0.026***	−0.027***	−0.026***	−0.025***
Econvol	1.795**	1.512**	1.414**	1.316*
Pop	0.002	−0.001	0.001	
Oldsh	0.958***	0.975***	0.941***	0.915***
GDP p.c.	0.037***	0.038***	0.038***	0.041***
Excharr	−0.053***	−0.058***	−0.052***	−0.047**
System	0.023***	0.019***	0.019***	0.017***
Rule	−0.01	−0.01	−0.013*	
Polity	−0.003***	−0.004***	−0.004***	−0.004***
N. obs	332	332	332	345
J-stat	0.045	0.044	0.040	0.052

Note: Estimated coefficients on the time dummies are not reported.

*,**,*** denote statistical significant at 10, 5 and 1 percent respectively.

Endogenous variables: dependent variables GDP p.., excharr, voltot

Instruments: exogenous variables, xconst, latitude, sociopolrisk, xrcomp, pop, regional dummies, time dummies.

For variables description and list of countries included see the appendix

Table 2: Extensions

	I	II	III	IV	V	VI
Output volatility						
Constant	0.031	0.009	−0.024	0.055**	−0.01	0.001
Tradeopen∗voltot	0.399**	0.401**	0.522**	0.303*	0.619***	0.696***
GDP p.c.	−0.014***	−0.006	−0.001	−0.016***	−0.013***	−0.014***
Excharr	0.027***	0.016***	0.013***	0.014***	0.022***	0.021***
Finopen	0.008***	0.003*	0.003∗	0.007***	−0.002	0.008***
Govexp	0.169***	0.045		0.178***	0.207***	0.213***
Govexp∗dOECD	−0.024					
Volgovexp		0.409	0.589**			
Cbturn				0.080***	0.125***	0.112***
Cbturn∗Finopen					0.062**	
Government expenditure						
Constant	−0.135*	−0.164**	−0.161	−0.214**	−0.162*	−0.174*
Tradeopen	0.119**	0.130***	0.130**	0.075*	0.084*	0.081*
Finopen	−0.027***	−0.024***	−0.024***	−0.030***	−0.026***	−0.026***
Econvol	1.267*	1.651***	1.353*	2.202***	1.528**	1.645***
Oldsh	0.865***	0.909***	0.907***	0.683***	0.676***	0.670***
GDP p.c.	0.048***	0.045***	0.045***	0.062***	0.056***	0.058***
Excharr	−0.056**	−0.045***	−0.041**	−0.073***	−0.069***	−0.071***
System	0.015***	0.021***	0.022***	0.018***	0.028***	0.025***
Polity	−0.004***	−0.004***	−0.004***	−0.003***	−0.004***	−0.004***
N. Obs	345	322	350	340	324	308
J-stat	0.057	0.087	0.084	0.081	0.072	0.081

Note: Estimated coefficients on the time dummies are not reported.

*,**,*** denote statistical significant at 10, 5 and 1 percent respectively.

Endogenous variables: dependent variables GDP p.., excharr, voltot

Instruments: exogenous variables, xconst, latitude, sociopolrisk, xrcomp, pop, polconv democ polcomp dright (xrreg parreg xropen wagepri in col. IV-VI), regional and time dummies

For variables description and list of countries included see the appendix

Table 3: List of countries

Algeria	Estonia	Korea	Romania
Argentina	Finland	Kyrgyz Rep.	Russia
Armenia	France	Latvia	Slovak Rep.
Australia	Gambia	Lesotho	Slovenia
Austria	Ghana	Libya	South Africa
Azerbaijan	Greece	Lithuania	Spain
Belarus	Guatemala	Malawi	Sri Lanka
Belgium	Haiti	Malaysia	Swaziland
Bolivia	Honduras	Mauritius	Syria
Brazil	Hungary	Mexico	Tanzania
Chile	Iceland	Moldova	Thailand
China	Indonesia	Morocco	Turkey
Colombia	Iran	Nepal	Uganda
Costa Rica	Ireland	Netherlands	United Kingdom
Cyprus	Israel	New Zealand	United States
Czech Rep.	Italy	Nigeria	Uruguay
Denmark	Jamaica	Pakistan	Venezuela
Dominican Rep	Jordan	Peru	Zambia
Ecuador	Kazakhstan	Philippines	Zimbabwe
Egypt	Kenya	Portugal	

Table 4: Descriptive statistics

	Mean	Median	Max.	Min.	Std. Dev.	N. Obs
Cbturn	0.24	0.20	1.40	0.00	0.26	633
Tradeopen	0.39	0.32	1.35	0.06	0.23	860
Finopen	-0.04	-0.47	2.66	-1.79	1.46	773
Econvol	0.04	0.03	1.09	0.00	0.05	979
OLDSH	0.06	0.04	0.18	0.01	0.04	958
Gdppc	8.06	8.07	10.53	5.55	1.12	693
Excharr	2.31	2.00	5.00	1.00	1.23	717
System	0.81	0.60	2.00	0.00	0.86	789
Polity	-0.43	-3.80	10.00	-10.00	7.49	866
Voltot	0.08	0.06	0.61	0.00	0.08	938
Govexp	0.28	0.27	0.54	0.10	0.11	646
Findepth	0.34	0.26	1.18	0.04	0.26	788

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Data source

Model variables	Description
Tradeopen	Trade openness: exports+imports in percent of GDP
Finopen	Financial openness: First standardised principal component of R_1, R_2, $SHARE_3$ and R_4, where: (i) R_1 takes value 1 in the absence of multiple exchange rates, (ii) R_2 takes value 1 if current account transactions are not restricted, and (iii) R_3 takes value 1 if capital account transactions are not restricted, (iv) R_4 takes value 1 in the absence of a requirement of surrender of export proceeds. SHARE_3 is then constructed for each year as the average of R_3 in that year and in the four preceding years (Chinn and Ito, 2001)
GDP p.c.	Log of per-capita real GDP
Econvol	Volatility of aggregate GDP growth: standard deviation of the annual growth rate of GDP over the five-year window
Govexp	Total government expenditure in percent of GDP
Volgovexp	Volatility of government expenditure in percent of GDP: standard deviation of the annual expenditure ot GDP ratio over a five-year window.
Oldsh	Population aged 60 and above in percent of total population
Pop	Log of total population
Findepth	Financial depth: domestic credit to private sector in percent of GDP
Excharr	Exchange rate regime: Variable taking values from 1 (extreme pegs) to 5 (freely falling), based on Reinhart and Rogoff (2004) de facto classification of exchange rate regimes.
cbturn	Central Bank Turnover... (Ghosh, 2002)
Voltot	Volatility of terms of trade: standard deviation of (log) terms of trade over the five year window.
System	Type of political system: taking values 1 (presidential), 2 (assembly elected) or 3 (parliamentary) depending on the constitutional arrangements disciplining the exercise of power.
Polity	Index of quality of polity
Rule	Dummy variable taking value 1 if country has a plurality (majoritarian) electoral rule.