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GROWTH VOLATILITY AND GOVERNMENT EXPENDITURE IN LOW AND MIDDLE INCOME COUNTRIES: A DYNAMIC PANEL ANALYSIS

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Abstract

We examine the relation between the government consumption expenditure and output growth volatility in 57 low and middle income countries by using both static and dynamic panel methods. It seems that the results of these methods largely differ from each other. Contrary to some previous results reported in the literature, we present a strong evidence for a negative relation between government expenditure and volatility in low and middle income countries. We also conclude that the volatilities of government consumption, trade openness and investment are significant in explaining the growth volatility. To have a more stable economy, policy makers in these countries should pay more attention to some issues. In this context, we think that a change in the tax and expenditure system in order to make automatic stabilizers work better would be helpful. Additionally, it is important to have a sound fiscal and monetary position to effectively carry out countercyclical policies when needed. Moreover, adopting and implementing clear and flexible rule-based economic policies should be considered. Finally, improving the institutional structure and policy making capacity must be an ultimate aim to reduce the economic volatility.

Keywords: growth volatility, government expenditures, low and middle income countries, dynamic panel methods.

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1. Introduction

Since a stable economy with predictable future provides a better business environment for economic growth, investment and decision making, ensuring macroeconomic stability is one of the most important targets for policy makers. On the other hand, higher output volatility may lead to a significant cost in terms of social welfare. In this regard, several studies, such as Ramey and Ramey (1995), Fatas (2002), Hnatkovska and Loayza (2003), Badinger (2010), suggest that volatility exerts a negative effect on growth. Therefore, *ceteris paribus*, it is important to have a stable or less volatile economy.

There is an increase in the number of studies examining the output volatility especially after the 1990s, possibly motivated by the so called Great Moderation. Many studies, such as Kim and Nelson (1999), McConnell and Perez-Quiros (2000), Stock and Watson (2002), Prasad *et al.* (2007), and Debrun, Pisani-Ferry and Sapir (2008), show that the output volatility declined in the 1980s and 1990s in comparison to previous decades. This decline has led to a new avenue for research which focuses on the main sources or determinants of the volatility. Many factors are put forward to explain the volatility including openness, financial development, macroeconomic policy, government size, and institutional structure.

Moreover, as suggested in some studies such as Kose, Prasad and Terrones (2005), Hakura (2007), Perry (2009), the output volatility has been higher in developing countries implying that there is a possibility or more space to gain by reducing output volatility in these countries. This additional gain from having a less volatile output would be more vital for developing or emerging economies that often suffer from the lack of resource, investment and predictable economic activity. Policy makers in these countries need to find out the possible determinants of the volatility in order to implement some measures to have a more stable economy. Therefore, it would be particularly helpful to examine the output volatility in developing and emerging countries.

We examine the output growth volatility and the government consumption expenditure in 57 low and middle income countries by means of both static and dynamic panel estimation methods. This paper contributes to the existing literature by presenting a strong evidence for a negative relation between government expenditure and growth volatility in these countries and also employing the dynamic panel methods in this context. We also find that there exists a robust and significant impact of volatility of investment, government consumption, and trade openness on the output growth volatility.

The remaining of the paper is organized as follows. We summarize the literature in section 2, explain the model, data, and methodology in section 3, present and discuss the estimation results in section 4 and finally conclude in section 5.

2. Literature review

A large literature has aimed to reveal the driving factors of volatility for a long time. At the onset, we would like to point out that it is common in the literature to

focus on some determinants of the volatility, largely ignoring other possible determinants. In this context, trade openness, capital flows and international financial integration, the conduct of monetary policy, financial development or deepening, fiscal variables, institutional features have been examined. Although our main motivation is to empirically examine the relationship between the government size and volatility, we also briefly review some other key determinants.

Some arguments about a negative relationship between the government size and volatility are explained and discussed in many studies, such as Gali (1994), Fatas and Mihov (2001), Andres, Domenech and Fatas (2008), Debrun, Pisani-Ferry and Sapir (2008), Mohanty and Zampolli (2009), Debrun and Kapoor (2010). One of the arguments, which in the literature is named as composition effect, assumes that the public sector is more stable in general. Another argument is based on the idea that the government size would reflect the extent or the effectiveness of automatic stabilizers in the economy. According to these two arguments, a large government share in the economy might contribute to reduce the output volatility or variability.

In a seminal study, Gali (1994), developing a model in which fiscal policy has a stabilizing effect on the output volatility, reports a negative and robust relationship between the government size and output volatility for OECD countries. This finding has been confirmed by many following studies, like Fatas and Mihov (2001), Andres, Domenech and Fatas (2008), Mohanty and Zampolli (2009) for OECD countries. Martinez-Mongay and Sekkat (2005) also conclude that the relationship is not linear. Debrun, Pisani-Ferry and Sapir (2008) find a negative relation between the government size and volatility but also detect that this relation has changed over time. Koskela and Viren (2004) and Viren (2005), for a large sample of countries, conclude that there is no robust evidence for a negative relationship in general. Thornton (2010) presents a strong evidence for a positive relationship for 21 Emerging Market Economies. Debrun and Kapoor (2010) report that the negative relation is significant especially for OECD countries and conclude that automatic stabilizers are important. Turan (2016) doesn't find any robust relation between the government size and volatility for Turkey. In a different strand of the literature, Fatas and Mihov (2003) for 91 countries, Hakura (2007) for 81 countries, and Badinger (2009) for OECD countries conclude that the discretionary fiscal policy can have a positive effect on volatility.

Because of the close connection between openness and volatility, many studies include trade openness as a control variable. In theory, it is not clear whether openness leads to less or more output volatility (Easterly, Islam and Stiglitz, 2001). On the one hand, trade openness can enable countries to alleviate the effects of domestic shocks on the economy. On the other hand, it is possible that trade openness can cause an increase in the volatility by exposing the country to external shocks. Kose, Prasad and Terrones (2005) suggest that the effect of trade and financial openness on volatility depends on some factors as the sources of shocks. Although Raddatz (2007) argues that the external shocks play only a minor role in explaining the output volatility in developing countries, Mackowiak (2007) indicates the importance of external shocks for emerging markets. Razin and Rose (1994), for 130 countries, do not find any strong

evidence for a relation between openness and volatility. Easterly, Islam and Stiglitz (2001), and Giovanni and Levchenko (2008), using data for a large number of countries, find a positive relation between trade openness and output volatility. Calderon, Loayza and Schmidt-Hebbel (2005) present some evidence that the trade openness tends to increase the output volatility in only middle income countries. Bejan (2006), using data for 111 countries, reports a positive relation between trade openness and volatility in general and also highlights the importance of making a distinction between developed and developing countries. Cavallo (2007), for 21 OECD and 56 non-OECD countries, concludes that there exists a negative relation between trade openness and volatility. Haddad *et al.* (2012), utilizing data for 77 developing and developed countries, argue that the nature of the relationship between trade openness and volatility depends on the diversification of a country's export base.

Financial openness, like trade openness, can help to smooth consumption and investment but also make the country more vulnerable to external shocks, sudden stops or capital outflows. As for financial openness, Easterly, Islam and Stiglitz (2001) do not find a significant role for private capital flows with regard to volatility. Likewise Buch, Doepke and Pierdzioch (2005) examine the relationship between financial openness and volatility for OECD countries and conclude that no robust relationship between these variables exists. Calderon, Loayza and Schmidt-Hebbel (2005), using data for 76 countries, do not find a strong evidence that financial openness leads to a greater output volatility. Bekaert, Harvey and Lundblad (2006), for a large sample of countries, suggest that financial liberalization is associated with lower consumption growth volatility and do not observe any significant increase in the volatility for liberalized emerging countries. Prasad *et al.* (2007), examining 67 industrial and developing countries, find that international financial integration does not help developing countries to reduce the macroeconomic volatility. On the contrary, they argue that some countries experience higher consumption volatility as a result of the financial globalization. More recently Hwang, Park and Shin (2013), for 21 advanced and 81 developing countries, report that the capital market openness leads to an increase in the output volatility in developing countries.

According to the monetarist approach the problems with the conduct of monetary policy can induce some fluctuations in the economic activity. Thus a well-implemented or high quality monetary policy can contribute to a reduction in volatility. Taylor (2000) suggests that the main reason behind the decline in the US output volatility is the better conduct of monetary policy after 1980s. Blanchard and Simon (2001) find that there is a close association between inflation and output volatility for the US. Debrun, Pisani-Ferry and Sapir (2008) suggest that the quality of monetary policy has a stabilizing effect on volatility for OECD countries. Debrun and Kapoor (2010) conclude that the central bank independence has a relation with lower volatility in only some specifications by utilizing data for OECD and developing countries.

As suggested in some studies, like Debrun, Pisani-Ferry and Sapir (2008), financial development or deepening may be important in explaining the economic volatility. In essence, financial development allows households and firms to smooth economic ac-

tivities over time by facilitating the access to credit. It is expected that a better and more effective credit allocation mechanism could lead to a lower volatility. Easterly, Islam and Stiglitz (2001) find that financial variables have a stabilizing effect and also suggest that private credit above some level can have a positive effect on volatility implying a non-linear relation. Debrun and Kapoor (2010) also report a stabilizing and statistically significant impact of financial development on the output volatility. In a recent paper, Wang, Wen and Xu (2013) developing a model in which financial development has a negative relation with volatility, conclude that there is a negative relationship between the financial development and volatility in a large sample of countries.

Although the importance of institutions for economic analysis and outcomes has been recognized for a long time, it has increasingly drawn more attention in recent years. In a comprehensive and influential study, Acemoglu *et al.* (2003) highlight the role of institutions in explaining volatility. Unlike many studies in the literature, they conclude that when the institutional structure has been taken into consideration, macroeconomic variables, including government size, have a small impact on volatility. Acemoglu *et al.* (2003) suggest that the institutional problems, not distortionary macroeconomic policies, are the underlying reason of observed economic volatility. Loayza *et al.* (2007) also mention the role of institutions for supporting policies that can reduce the volatility. However, the importance of institutions does not necessarily mean that macroeconomic policies are not effective or useless. On the other hand, we should note that good institutions and public administration are crucial to make and implement any policy decision in an effective way.

To sum up, in this wide and expanding literature, some factors that come into prominence are financial development, government size, trade openness, inflation, financial openness or capital flows and institutions. Government size has a stabilizing effect on volatility only in developed countries although this effect has weakened over time. However, government size does not seem to be related to lower output volatility in developing countries. It seems that we can conclude that the financial development, to some extent, and a good monetary policy have a stabilizing effect on output volatility. The effect of trade openness on volatility is not clear, while we can say that financial openness does not appear to have a robust stabilizing effect.

3. Model, data, and empirical methodology

In order to identify the determinants of output volatility, we use the following model first:

$$VolGR=f(AvGE, AvX) \quad (1)$$

where Vol and Av stand for the standard deviation and average of related variables, estimated over non-overlapping five-year periods, respectively. In other words, following the literature we use the standard deviation as a proxy for volatility in this study. The dependent variable is the standard deviation of real GDP growth rate (GR). GE represents the government consumption expenditure. It would be better

to use the general government expenditures, including especially transfer payments, rather than consumption expenditures, but, unfortunately, these series are not long enough to perform robust econometric analysis. Although our main interest is to find whether there exists a negative relation between the government expenditure and output growth volatility in low and middle income countries, we control some variables, shown by X, including the trade openness (TO), domestic credit provided by the financial sector (CR), investment (IV), financial account balance (FA), inflation rate (IN), and average growth rate (GR).

The trade openness (TO), measured as the sum of export and import, is widely used in the literature in examining the link between the government expenditure and volatility. We use the domestic credit provided by the financial sector (CR) as a proxy for financial development. Similarly, the inflation rate (IR) is expected to capture the conduct of monetary policy. The role of investment (IN), measured as the gross fixed capital formation, in economic fluctuations has been widely known and recognized among economists, since at least the emergence of Keynesian theory, if not earlier. The potential importance of capital flows is obvious in examining the volatility for low and middle income countries. However, due to data limitations, we use the financial account balance (FA) rather than the private capital flows. Finally, we also include the growth rate (GR) as an independent variable. Except for the inflation rate and the growth rate, all independent variables are percent of nominal GDP.

It is clear that Model 1 relates the average values of independent variables to the dependent variable. However, it is possible that the volatilities of the independent variables, opposed to average values, would be the main drivers of the growth volatility. For example, Gali (1994) uses the government size in level and also its standard deviation. In a similar way, Easterly, Islam and Stiglitz (2001) employ some variables in levels and their standard deviations as well in order to identify the determinants of the volatility. In another important study, Blanchard and Simon (2001) examine the link between the output volatility and inflation but also the output volatility and inflation volatility. Therefore, we employ the following model which includes the volatilities instead of average values of independent variables:

$$VolGR=h\ (VolGE, VolX) \tag{2}$$

Since Models 1 and 2 include only average values and volatilities of independent variables, respectively, these models might be subject to omitted variable bias. Because both the average values and volatilities of related variables would affect the growth volatility at the same time, in order to obtain more robust results, we also build up the following model which includes both average values and volatilities in the same specification:

$$VolGR=k(AvGE, VolGE, AvX, VolX) \tag{3}$$

The models are estimated by using unbalanced panel data for 57 low and middle income countries over the period 1965-2014. We have derived the series by using data

from World Development Indicators (WDI) of the World Bank (2016) with the exception of financial account balance provided from Balance of Payment Statistics (BPS) of International Monetary Fund (2016). The description of the variables is summarized in Table 1.

Table 1: Data description

Variable	Description
VolCR	Standard deviation of domestic credit provided by the financial sector (as a percent of GDP) over non-overlapping five-year periods
VolGE	Standard deviation of government consumption expenditures (as a percent of GDP) over non-overlapping five-year periods
VolGR	Standard deviation of growth rate over non-overlapping five-year periods
VolFA	Standard deviation of financial account balance (as a percent of GDP) over non-overlapping five-year periods
VolIN	Standard deviation of inflation rate over non-overlapping five-year periods
VolIV	Standard deviation of investment (Gross Fixed Capital Formation, as a percent of GDP) over non-overlapping five-year periods
VolTO	Standard deviation of trade openness (the sum of exports and imports as a percent of GDP) over non-overlapping five-year periods
AvCR	Average of domestic credit provided by the financial sector (as a percent of GDP) over non-overlapping five-year periods
AvGE	Average of government consumption expenditures, as a percent of GDP, over non-overlapping five-year periods
AvGR	Average growth rate of GDP over non-overlapping five-year periods
AvFA	Average of financial account balance (as a percent of GDP) non-overlapping five-year periods
AvIN	Average of inflation rate over non-overlapping five-year periods
AvIV	Average of investment rate (Gross Fixed Capital Formation, as a percent of GDP) over non-overlapping five- year periods
AvTO	Average of trade openness (the sum of export and import, as a percent of GDP) over non-overlapping five-year periods

As for the methodology, we perform panel data analysis which provides the opportunity of simultaneously dealing with cross sectional units (i=1, …, N) and time dimension (t=1, …, T) in the framework of equation 4 as below:

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 controls_{it} + \varepsilon_{it} \quad (4)$$

Here, y_{it} stands for the dependent variable which is the standard deviation of real GDP growth rate as specified in Models 1, 2, and 3. On the other hand, x_{it} indicates our main explanatory variable, namely government consumption expenditure, which has 2 different specifications with regard to the models presented above. Also, we utilize number of control variables denoted by *controls* which are listed above in the course of defining the models. As the first step of the methodology, we apply 2 alternative static panel model specifications, that are fixed effect (FE) and random effect (RE) models. Fixed effect model eliminates time-invariant differences between countries to control for unobserved heterogeneity. On the other hand, in the random effect model, unlike the fixed effect model, it is assumed that the variations across countries are random and not correlated with the regressors. As Greene (2008) emphasizes,

the crucial distinction between fixed and random effects is whether the unobserved country specific effects embody elements which are correlated with the regressor of the models. In this regard, we select the appropriate one for modelling by means of Hausman test which has the null hypothesis of no correlation between the explanatory variables and error terms. The rejection of the null hypothesis gives support for the fixed effect model.

Considering the deficiencies of static panel data analysis, we also employ dynamic panel data approach which eliminates both the cases of unobservable factors correlated with the dependent variable and regressors, and the dependent variable affecting the explanatory variables. The GMM panel estimator should strictly be employed when the time dimension is relatively short according to cross section units (N◎T) since small T is more likely to imply the endogeneity of the dependent variable. Thus, to control the potential endogeneity occured as a consequence of correlation between independent variable and error term and eliminate the unobserved individual effects which could potentially lead to biased and inconsistent parameter estimates, we follow the literature dealing with growth issues by applying general method of moments (GMM) approach. As an extension of GMM methodology, Arellano and Bond (1991) propose to eliminate individual fixed effects by differencing. The difference GMM (DGMM) of Arellano and Bond (1991) is given below in equation 5:

$$\Delta y_{it} = \alpha_0 \Delta y_{it-1} + \alpha_1 \Delta x_{it} + \alpha_2 controls_{it} + \Delta \varepsilon_{it} \quad (5)$$

In addition, the extended version of the GMM estimators, that is system GMM (SGMM) suggested by Blundell and Bond (1998), is derived from the estimation of a system of two simultaneous equations which are in levels and in first differences. We also report the results of system GMM with regard to its several priorities to difference GMM of Arellano and Bond (1991). Firstly, the weak instrument problem for difference GMM estimators in the existence of random-walk variables makes the sys-GMM estimation more preferable. Secondly, system GMM estimators are more consistent in the case of continious instrumental variables, and there is a dramatic reduction in the finite sample bias due to the utilization of extra moment conditions. In addition, system GMM is more appropriate when dealing with unbalanced panel due to the magnifying gaps in difference GMM estimation (Blundell and Bond, 1998; Blundell and Bond, 2000; Bond, 2002; Coban and Topcu, 2013).

Finally, as suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998), we examine the consistency of GMM estimators by means of specification tests which analyze the serial correlation properties of error terms and validity of instruments. For this purpose, we first utilize Arellano-Bond test of autocorrelation in the first differenced errors at order 2. Then, we apply Sargan test of overidentifying restrictions which examines the suitability of the used tools. Rejection of both null hypothesis of autocorrelation and Sargan tests avoids the problem of model misspecification.

4. Estimation results and discussion

The results of Model 1 are presented in Table 2. It seems that our static and dynamic panel estimates largely differ from each other. FE and RE estimates suggest that the average inflation rate has a positive and statistically significant impact on the volatility. As expected, it seems that an increase in the inflation rate causes a rise in the volatility. This positive effect, consistent with theoretical explanations in the literature, like Taylor (2000), and Blanchard and Simon (2001), can be interpreted as the significance of monetary policy regarding the volatility. Moreover, FE estimates indicate that the average trade openness has a significant negative effect as well. This stabilizing effect of the trade openness is consistent with the results of studies that find a negative relationship between the openness and volatility. On the other hand, RE results suggest the negative effect of the domestic credit provided by the financial sector, which is in line with theoretical predictions. Since Hausman test suggests that

Table 2: Estimates of Model 1

Dep. Var.: Standard deviation of GDP growth rate

Independent Variable	Fixed effects	Random effects	Difference GMM	System GMM
Dep. Var (lag 1).			.1994983	.1998828*
			(.1355705)	(.1092468)
Dep. var. (lag 2)			.3553339***	.3335132***
			(.0694438)	(.0697471)
AvGE	.0067945	-.0020952	-.1624799**	-0.1175369
	(.0477119)	(.0282371)	(.0710944)	(.0739361)
AvTO	-.0244089**	.0004407	-.0072194	-.009699
	(.0093608)	(.0037015)	(.012799)	(.01362)
AvCR	.0067143	-.0084609**	.0157124	.0038019
	(.0095658)	(.0037309)	(.0186922)	(.0185027)
AvIN	.0009506**	.0007506*	.0008638***	.0007742***
	(.0004165)	(.0004463)	(.0003106)	(.0002945)
AvIV	.0237124	-.0004842	.0872882	.0779726
	(.0350736)	(.0263895)	(.0562972)	(.0523309)
AvFA	.0219231	-.0020485	.0361085	.0299957
	(.0274868)	(.0212475)	(.0383059)	(.0361456)
AvGR	-.0450378	-.0638132	.0178718	.0351246
	(.0751633)	(.07114)	(.1274899)	(.131645)
Constant	4.207555***	3.76625***	1.117775	1.416072
	(1.0015)	(.6149842)	(1.342125)	(1.331898)
Hausman test (p value)	0.1177			
AR(2) test (p value)			0.9497	0.8534
Sargan test (p value)			0.2343	0.3438
# of instruments			43	51
# of countries	57	57	57	57
# of observations	338	338	228	286

Note: Robust standard errors in parenthesis.
***, **, * show significance at the 1, 5 and 10 percent-level, respectively.

RE estimates are more appropriate, we conclude that the average inflation rate and domestic credit are important variables in the linear model estimates.

DGMM and SGMM results also confirm the positive and significant effect of the inflation rate on the volatility. It seems that all the estimation methods we have carried out suggest the importance of inflation rate or monetary policy for the volatility. Furthermore, DGMM results also suggest a negative and significant effect of the government consumption expenditure on the volatility, implying that the negative link between the government expenditure and volatility is not limited to developed or OECD countries, but also valid for low and middle income countries. This finding differs from that of some studies, such as Koskela and Viren (2004), Viren (2005), and Thornton (2010), which do not report any strong negative relation between the government expenditure or size and volatility in developing countries.

We expect the volatilities of all explanatory variables to have a positive effect on the output growth volatility. This means that an increase in the volatilities of independent variables will lead to a rise in the growth volatility. As presented in Table 3, both FE and RE estimates indicate that only the volatilities of government consumption

Table 3: Estimates of Model 2

Dep. Var.: Standard deviation of GDP growth rate

Independent Variable	Fixed effects	Random effects	Difference GMM	System GMM
Dep. Var (lag 1).			.2228947**	.1547229*
			(.1107851)	(.0901652)
Dep. var. (lag 2)			.2127338***	.1652929***
			(.0614471)	(.0577277)
VolGE	.4039169**	.1479726*	.4899145*	.3205567
	(.156596)	(.083472)	(.252566)	(.2041339)
VolTO	.0305934	.0290605	.1453791***	.1327352**
	(.0378738)	(.0340255)	(.0557663)	(.052643)
VolCR	.0611833*	.0569601	.0221016	.0356674
	(.0364354)	(.0399723)	(.070427)	(.0664914)
VolIN	.000434**	.0002815	.0002773	.0001493
	(.0002125)	(.0002939)	(.0002161)	(.0002652)
VolIV	.2774306***	.249239***	.3253866***	.2936525***
	(.0825278)	(.0709975)	(.0984151)	(.1011942)
VolFA	-.005144	.0226831	.0228585	.0109893
	(.0332411)	(.0238102)	(.0380723)	(.0374715)
Constant	1.367091***	1.720418***	-1.023721***	-.2723523
	(.3377025)	(.2863895)	(.6688433)	(.5548085)
Hausman test (p value)	0.0498			
AR(2) test (p value)			0.7010	0.5412
Sargan test (p value)			0.5604	0.3411
# of instruments			42	50
# of countries	57	57	57	57
# of observations	338	338	228	286

Note: Robust standard errors in parenthesis.
***, **, * show significance at the 1, 5 and 10 percent-level, respectively.

and investment have a significant and positive effect. It is not surprising to find that an increase in the government consumption or investment volatility would change the output growth volatility. FE results also indicate that the volatility of inflation rate and domestic credit have also a significant impact on the output growth volatility. Based on Hausman test, FE estimates should be used when interpreting the results for Model 2. Therefore, we conclude that the volatilities of government consumption, investment, inflation rate and domestic credit are important variables in explaining the output growth volatility in the static estimates.

On the other hand, dynamic panel estimates suggest that an increase in the volatilities of trade openness and investment leads to a statistically significant rise in the output growth volatility. Difference GMM estimates also suggest that the volatility of government consumption has a significant effect, which is consistent with the linear models. However, unlike fixed and random effect results, we do not find any significant impact of the volatility in the domestic credit and inflation rate on the output growth volatility in dynamic panel estimates. It seems that the effects of volatilities of government consumption and investment are robust across different estimation methods.

Table 4 presents the estimates of Model 3. Our results from RE and FE estimates are similar. We find that the average trade openness and financial account balance with volatilities of domestic credit and investment have a significant effect on the growth volatility. It seems that trade openness helps lowering the output growth volatility. We should note that an increase in the financial account balance leads to a rise in the volatility. DGMM and SGMM estimates indicate that the volatilities of government consumption, trade openness and investment are significant whereas, unlike static estimation results, the trade openness, financial account balance and volatility of domestic credit are not. We also find that the government consumption has a negative effect. We should note that the volatility of investment is the only variable that has a significant effect in both static and dynamic estimations. Interestingly, the average and volatility of inflation rate do not have a significant effect any longer in both static and dynamic panel models when we control the volatility of our explanatory variables. Our results show the importance of employing both average values and volatilities of related variables in examining the output growth volatility.

Finally, in almost all GMM specifications, we find that the lagged values of dependent variables are statistically significant. Sargan test results suggest that we fail to reject the null hypothesis that is the overidentifying restrictions are valid. AR (2) test results do not indicate any autocorrelation problems. The number of instruments in our estimates is equal or smaller than the group numbers. We would like to point out that, although it increases the number of instruments, adding time dummies do not affect our results in general. We tend to consider our GMM estimates more robust and reliable compared to linear panel estimates, as explained in detail above.

Table 4: Estimates of Model 3

Dep. Var.: Standard deviation of GDP growth rate

Independent Variable	Fixed effects	Random effects	Difference GMM	System GMM
Dep. Var (lag 1).			.223922*	.1809208**
			(.1169738)	(.0917869)
Dep. var. (lag 2)			.2262404***	.1910138***
			(.0590159)	(.0594079)
VolGE	.4148653**	.1377352	.700791***	.5224672**
	(.1434995)	(.0848304)	(.2489754)	(.2191579)
AvGE	-.0341147	-.0128243	-.2505982**	-.2026729**
	(.0557234)	(.0296331)	(.1062197)	(.1018256)
VolTO	.0461673	.0508482	.1638211***	.1609707***
	(.0400022)	(.0387505)	(.0548859)	(.0540672)
AvTO	-.0232214***	-.0075822**	-.0138692	-.0146213
	(.0078714)	(.0036383)	(.0160558)	(.0163099)
VolCR	.0628366*	.0812547**	0.0329431	.0489875
	(.0363535)	(.036271)	(.0722881)	(.0689972)
AvCR	.0011435	-.0063898	.0087359	.0025162
	(.0074309)	(.0040033)	(.0140225)	(.0151577)
VolIN	.0000727	.0001016	-.0004489	.0002886
	(.001117)	(.0011073)	(.0012461)	(.0010823)
AvIN	.0005533	.000117	.0015795	.0001168
	(.0024273)	(.0023872)	(.0025633)	(.0022374)
VolIV	.3890987***	.3847435***	.3530262***	.3448141***
	(.0821217)	(.0651276)	(.1073716)	(.1170857)
AvIV	-.0415011	-.0550368**	.0090883	.0111509
	(.0341485)	(.0242306)	(.0518686)	(.0497251)
VolFA	-.009714	-.0011936	.012554	.005154
	(.0305694)	(.025259)	(.0462483)	(.051749)
AvFA	.0556634**	.0349925*	.0543841	.0606203
	(.0228764)	(.0187066)	(.0358019)	(.0383324)
AvGR	.0013165	-.0163562	.1132672	.1165098
	(.0649864)	(.0577155)	(.107331)	(.1089929)
Constant	4.092449***	3.574349***	1.780206	1.920246
	(.9620232)	(.5000269)	(1.42462)	(1.541035)
Hausman test (p value)		0.1023		
AR(2) test (p value)			0.5923	0.5354
Sargan test (p value)			0.8281	0.7168
# of instruments			49	57
# of countries	57	57	57	57
# of observations	338	338	228	286

Note: Robust standard errors in parenthesis.
***, **, * show significance at the 1, 5 and 10 percent-level, respectively.

5. Conclusion

Our study examines the relationship between the government expenditure and output growth volatility in 57 low and middle income countries by using static and dynamic panel estimation methods. Based on our dynamic panel estimates, which are more robust and reliable, we conclude that the average and volatility of government consumption and volatilities of trade openness and investment are significant in explaining the volatility in low and middle income countries. These significant variables have the correct or expected signs. More briefly, average government consumption has a negative impact on the growth volatility while the volatilities have the positive effect.

We should note that our empirical results clearly highlight four important points. First, there exists a strong negative relation between the government expenditure and volatility for low and middle income countries. This finding strikingly differs from that of some studies in the literature, which do not report any significant stabilizing impact of government expenditures on the volatility in developing countries. Second, all estimates indicate that the volatility of investment has a robust effect on the growth volatility. Third, it is important to include both averages and volatilities of related variables in the same specification in examining the volatility. Fourth, our empirical results also show the importance of using dynamic panel methods in this context.

To have a more stable economy, our results suggest that policy makers in low and middle income countries should pay more attention to some policies. First, in our opinion, it would be a good policy to make automatic stabilizers work better by changing the tax and expenditure systems while keeping the government size at the optimal level. Second, these countries should have a sound and prudent fiscal and monetary position, like low budget deficits and inflation rate, to effectively carry out the discretionary countercyclical policies when needed. Third, implementing some well-structured, clear and business friendly economic policies, based on a long term perspective and strong economic rationale, should be a priority to prevent the occurring of sudden and large fluctuations in the expectations of investors and economic agents. Moreover, adopting a flexible rule-based monetary and fiscal policy might be helpful to reduce volatility and eventually support growth by establishing credibility and providing confidence. Such a policy would be especially more successful at keeping the government expenditures and investment more stable. Fourth, the effective protection of property rights and maintaining the rule of law would be decisive in smoothing particularly investment fluctuations. In a broader sense, a vast literature convincingly shows the role or importance of institutions or institutional structure for the success of economic policies. There is no doubt that institutions matter for economic outcomes, ranging from, for example, fiscal or monetary policy to economic growth. Therefore, improving institutional structure, public administration and policy making capacity should be an ultimate aim even though it is not an easy task. Otherwise, if institutions or institutional weakness are the main reason for economic

volatility, as suggested in Acemoglu *et al.* (2003), unless this problem is effectively addressed, it would be difficult to ensure a significant and long lasting reduction in the volatility. Fifth, as highlighted in Loayza *et al.* (2007) it is important to develop a strategy, like self-insurance or hedging, to handle external shocks.

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