

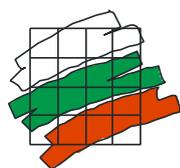
Working Paper Series

Cyclical Policy of Fiscal Policy over the Business Cycle: An Empirical Study on Developed and Developing Countries

Bogdan Bogdanov



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Cyclical Policy over the Business Cycle: An Empirical Study on Developed and Developing Countries

Bogdan Bogdanov*

Abstract

This paper presents strong empirical evidence that automatic stabilizers and countercyclical fiscal policy decrease output volatility. The conducted empirical analysis proves the economic intuition that the automatic fiscal stance is countercyclical, regardless of the size and the prosperity of the economy. Connecting our empirical results to the Endogenous Growth Theory, we develop the idea that countercyclical fiscal policy boosts long-term economic growth. We conduct the study on two samples of countries – developed and developing. We recognize the fiscal policy pattern of the developed nations to be countercyclical, whereas the one of the developing countries to be acyclical. The derived results support our hypothesis that countercyclical fiscal policy reduces output volatility as the volatility of per capita output of the developed nations appear significantly less than the one of the developing countries. We identify possible determinants of fiscal policy in good and bad times. We empirically recognize that openness to trade, terms of trade, level of corruption and financial development affect fiscal policy in both samples of countries.

Key words: Fiscal policy, automatic stabilizers, discretionary policy, output volatility, determinants

JEL Classification: C23, E32, E62

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I. Introduction

This section of the paper states the purpose of our work and introduces the main concepts that we study. Theoretical description of fiscal policy, automatic stabilizers and discretionary fiscal policy is outlined. A theoretical relationship between fiscal policy, output volatility and economic growth is presented. Our identification strategy concerning the determinants of fiscal policy and its components is constructed.

1. Purpose of the Paper

The main purpose of this paper is to examine the differences between developed and developing countries with respect to how the behavior of their fiscal policies affects output volatility and economic growth over the different phases of the business cycle, as well as to find credible determinants of the size of the public sector. This is to be done through an empirical study that first establishes reliable measures of the cyclicity of fiscal policy, its components - the automatic stabilizers and the discretionary fiscal policy, and output volatility. Then, we look for a relationship between fiscal stances, economic activity and growth in the two samples of countries we have chosen. Finally, we try to find to what extent fiscal policy and its components, in the two groups of economies, is determined by political, institutional and other macroeconomic factors.

2. Fiscal Policy

Fiscal policy refers to the way a government tries to influence an economy through changes in taxation (government revenue collection) and spending. In practice, fiscal policy affects a number of macroeconomic variables - aggregate demand, income distribution, resource allocation and economic activity as a whole. Governments actively use fiscal policies to address market failures and achieve redistributive goals. These classical functions of the role of a government - to correct externalities and ensure adequate provision of public goods and services - have a sound foundation and are conducive to higher long-run growth and social inclusion. In this sense, fiscal policy plays the role of the main tool a government can use, in order to reduce the impact of the different phases of the business cycle on the economy.

3. Automatic Stabilizers

Conventional economic theory teaches us that automatic stabilizers are associated with the cyclical properties of taxes, transfer of payments and government spending during times of fluctuations of economic growth. In other words, the automatic change of government receipts and expenditures due to the current state of the economy. No action is required by the government in order the automatic stabilizers to work. Moreover, the automatic stabilizers react instantly to changes of the economic environment, in much quicker and more timely fashion than a government would. For example, in an economy that is in

recession, levels of unemployment are increasing progressively and thus, revenues from income and consumption taxes are decreasing. Furthermore, transfers to and services for the unemployed increase. Therefore, with no explicit action by the state, when an economy enters into recession, government revenues start decreasing and government spending start increasing. The opposite is true for times of economic booms. Thus, automatic stabilizers are often associated with countercyclical behavior, behaving in the fashion of the well known cyclically balanced budget - accumulated debt from the automatic stabilizers during bad times is offset by automatic stabilizers' surpluses in good times.

4. Discretionary Fiscal Policy

It is often difficult for a government to rely on the automatic stabilizers solely. There are many countries where the effects of the business cycle over their economies cannot be handled by the stabilizing function of the automatic stabilizers. In such cases, those governments conduct discretionary fiscal policies, i.e. deliberate manipulation of taxation and spending in order to promote full employment and economic growth. Usually, governments' fiscal policy decisions tend to be inefficient to the phases of the business cycle, most of the times not matching the optimal size of the public sector needed by the economic conditions in the country. Such governments engage in deep countercyclical fiscal policies or go the opposite direction by conducting procyclical fiscal policies (the public sector expands during booms and contracts during recessions). In the cases of excessive discretionary fiscal policy, the provisions of public goods and services may promote growth in the short run, but both the inefficient provision of these goods and revenue raising mechanisms that distort the allocation of resources may impede growth in the long run. This totally contradicts with one of the main goals that a fiscal policy is to achieve - to make smooth and fast transitions over the different stages of the business cycle. Instead, extreme discretionary fiscal policies prolong the phases of the business cycle and shift the economy in a sudden manner from a time of great economic growth to one of a severe recession.

5. Fiscal Policy, Output Volatility and Economic Growth

The problem of how fiscal policy is related to economic activity and growth has been examined by many economists and still the question remains for most of it unanswered. It is hard to doubt that fiscal policy affects economic growth and output volatility in the short-run. But does this hold true for the long-run as well? This paper will try to provide an answer to that question. As suggested from Endogenous Growth Theory, the output volatility during the business cycle is related to the long-run economic growth. Then, if this theory holds true, it should be also true that fiscal policy is an important determinant of long-run economic growth via its implicit effects on output volatility. Through this complex relationship we try to identify whether automatic stabilizers or discretionary fiscal policy have any favorable effect on output volatility and economic growth.

6. Determinants of Fiscal Policy

Knowing that economic policy may affect long-run economic growth, it is of great importance to understand the driving factors of fiscal policy. That is why this work also focuses on the finding of credible determinants of fiscal policy in both samples of countries – developed and developing. We are to look for those factors in a set of political, institutional and some macroeconomic variables. The identified causes of fiscal policy will be of great significance to our interpretation of how economic growth could be stabilized and enhanced.

II. Literature Review

This section of the paper presents the related literature to the problems we are to resolve in our work. We look at the methodologies that were previously employed to establish credible measures of fiscal policy, automatic stabilizers and discretionary fiscal policy. We also present the various approaches that were developed in previous works to determine the behavior of the fiscal stances over the business cycle. In addition, this part of our paper summarizes the results obtained by other scholars when recognizing a relationship between fiscal policy and economic activity and growth. Finally, we outline driving factors of fiscal policy suggested from chosen authors of contemporary economic literature.

1. Measures and Cyclicity of Fiscal Policy

Deriving a reliable measure for the cyclicity of fiscal policy is of major importance to our further empirical analysis. In literature, the most frequently encountered problem was to identify a good public-sector variable that realistically represents the size of government. However, a number of approaches were developed to accurately overcome this obstacle. For example, Alesina and Tabellini (2005) use the growth rate of government expenditures, revenues and budget surpluses as fiscal variables and further, look for a relationship between them and respectively GDP gaps and the terms of trade. Their findings recognize that revenues and surpluses are insignificant public-sector variables, so their additional work is based on the cyclicity of government expenditures only. Alesina and Tabellini (2005) differentiate the results of cyclicity of fiscal policy into two categories – fiscal policy in developed and developing countries. Their empirical study shows that usually countercyclical fiscal policy is conducted by developed countries whereas procyclical fiscal policy is engaged in less developed, i.e. developing countries. A similar model is developed by Badinger (2008), but as an explanatory variable to the cyclicity of government expenditures he uses the growth of real GDP, solely. His work deserves attention due to the fact that he conducts the study on 88 different countries for a time span of 44 years. The scale of the project limits him to the use of government expenditures data as a measure of the activity of fiscal policy. The empirical results of Badinger (2008) confirm the found cyclical pattern of public spendings by Alesina and Tabellini (2005). Ilzetcki (2008) captures the behavior of fiscal

policy over the business cycle by running GMM regressions of the detrended log of government consumption as dependent variable and the detrended log of real GDP as an explanatory variable. He finds evidence that government consumption and output are positively related for the cases of the developing countries, but opposite to most of the literature on the subject, Ilzetcki (2008) also finds that developed countries exhibit procyclical fiscal pattern. However, his results verify that developing economies show far more procyclical fiscal stance. Parallel to that work is the one of Fatas and Mihov (2003), where the primary deficits over real GDP and the growth rate of government expenditures and revenues are set as dependent variables to the growth of real GDP. Their empirical study is focused on a sample of OECD countries and recognizes the expenditures' stance as the one that is most credible and exhibits countercyclical behavior. Although with lower levels of significance, Fatas and Mihov (2003) find that the primary deficit as a share of real GDP is countercyclical over the business cycle, whereas revenues are procyclical.

However, a number of other scholars associate the behavior of the size of the government with the cyclicity of the fiscal balance only. For instance, Gavin and Perotti (1997) conduct an empirical study on a number of industrialized and Latin countries, where they use the growth rate of the fiscal surplus as dependent variable to the terms of trade and the growth of real GDP. Their findings suggest that in developed countries, countercyclical fiscal policy is conducted, whereas Latin American economies exhibit mostly procyclical government behavior. A similar approach to measure the size of the government is used by Catao and Sutton (2002) and Manasse (2006). They use the growth of fiscal surplus as share of GDP and regress it respectively to output gap and terms of trade, and output gap and public debt. As the purpose of Catao and Sutton (2002) is not to identify any particular fiscal patterns, that of Manasse (2006) recognizes mostly procyclical fiscal behavior when using OLS estimators, and acyclical in good times and procyclical in bad times when conducting MARS regressions. Aghion and Marinescu (2007) developed an empirical model that captures the stance of the size of the government by using the gross government debt as dependent variable to the GDP gap using data for the OECD countries. By means of the econometric AR(1) MCMC method, they derive series of cyclicity of budget policy for each country. Their results imply that budget deficits are countercyclical, having their countercyclicality decreasing over time for the EMU countries and increasing for the US and the UK.

A different methodology to depict the behavior of fiscal policy is presented by the work of Kaminski, Reinhart and Vegh (2004). By plotting real GDP and real government spending, their paper offers a stylized fact that fiscal policy is mainly countercyclical or acyclical in the OECD countries over the business cycle, and on the contrary, procyclical throughout a set of developing countries.

2. Measures and Cyclicity of Automatic Stabilizers

To answer the question “To what extent do automatic stabilizers smooth the business cycle?” we first have to identify a credible measure of this component of fiscal policy. In the case of the automatic stabilizers we are not that interested in the cyclical pattern of the fiscal stance, because of the naturally predetermined countercyclical behavior that it has. Nevertheless, we are greatly fond of finding a good proxy of the automatic fiscal stance, as it appears a hard task to separate the automatic from the discretionary fiscal effects.

However, contemporary literature hasn't dealt extensively with this issue. There are very few attempts to provide theoretical analysis of automatic stabilizers in stochastic general equilibrium model. One such work is the one of Gali (1994) where in the context of a real business cycle model with flexible prices and continuous market clearing, he identifies different effects of government size. These effects are, however, small in size and of ambiguous sign. Most of the effects are related to changes in the elasticities of capital and labor as a result of lower values of the steady state levels of employment and the capital output ratio. As a whole the obtained results by Gali (1994) are ambiguous.

A purely empirical study on the subject is the one of Fatas and Mihov (1999). There they use the government size over GDP as a proxy of the measure of the automatic stabilizers where the government size is measured as the level of government spending. Further, the work of Fatas and Mihov (1999) tries to identify alternative measures of the automatic stabilizers by decomposing the government expenditures and revenues to their primary components - non-wage government spending, wage government spending, transfers of payments and government revenues from direct and indirect taxes, respectively. Their results show that only the measure of indirect taxes lacks the standard attributes of the automatic stabilizers.

Fatas and Mihov (2003) continue the work on identifying a good measure of automatic stabilizers. Here they use several measures with the purpose to capture the effect of the automatic stabilizers on the economy. Initially, they use the taxes and net transfers, as a proxy to the measure of the automatic stabilizers. Fatas and Mihov (2003) argue that those variables empirically response to a very similar fashion like the more aggregate fiscal variables which represent the real size of the government. To further understand how automatic stabilizers work, they look for a relationship between the disposable income and consumption, as the variables that predict the measure of the automatic fiscal stance, and output volatility. However, in their further analysis Fatas and Mihov (2003) try to avoid capturing any discretionary fiscal policy as bias to their results that is why they use the marginal tax rate on labor as direct measure of automatic stabilizers. Further, they take a broader view on the automatic component of fiscal policy and construct a measure that captures the responsiveness of fiscal policy to cyclical conditions and try to identify whether this measure is responsible for the correlation between the size of the government and the output volatility. Fatas and Mihov (2003) measure the responsiveness of fiscal policy as the

elasticity of fiscal variables to GDP changes. Using the primary deficit as fiscal variable, they run the specified regression for each country, extracting the coefficients and thus building the desired measure.

3. Measures and Cyclicity of Discretionary Fiscal Policy

The second component of fiscal policy is the deliberate intervention of the government via taxation and spending in the economy. Again, a major issue to be resolved in an empirical study of fiscal policy is what indicator to use as a credible measure of the discretionary fiscal policy. Similarly to the automatic stabilizers, we are not that interested in the cyclical pattern of the discretionary fiscal policy, but in a methodology to develop a trustworthy measure of the unanticipated fiscal behaviour. Fatas and Mihov (2003) use vector autoregressions (VAR) to extract the indicator of fiscal policy stance. Their baseline VAR contains logarithm of private output, logarithm of the implicit GDP deflator, ratio of primary deficit to output and T-bill rate. They regard this vector of variables as the minimal set of macroeconomic variables necessary for the construction of an indicator of fiscal policy. After estimating the reduced form of their regression equations, Fatas and Mihov (2003) orthogonalize the residuals from the fiscal policy equation to contemporaneous movements in output and prices. This orthogonalized residual is their measure of unanticipated fiscal policy shifts.

The extracted indicator of fiscal policy by Fatas and Mihov (2003) turns out to be very highly correlated with the measure they construct on Blanchard's (1993) suggestions. In his work, Blanchard (1993) argues that an indicator of discretionary fiscal policy must be relative in nature. The procedure outlined in his paper requires selecting a pre-specified benchmark and estimating elasticities of the different components of the budget with respect to a representative set of macroeconomic variables. The response of the budget deficit to current economic conditions is then constructed by using the estimated elasticities. The difference between this value and the actual budget deficit is a measure of discretionary fiscal policy. Blanchard (1993) original recommendation is to use unemployment, inflation, and interest rates in the construction of the induced changes in the budget balance. The presented equation for calculating the index of discretionary change looks like:

$$FiscalImpulse_t = \left(\frac{PrimarySurplus_t}{GNP_t} \right) \times (Unemployment_{t-1}) - \left(\frac{PrimarySurplus_{t-1}}{GNP_{t-1}} \right) \quad (1)$$

Alesina and Perotti (1996) propose a slightly modified version of the above equation. In their work, instead of dividing on gross national product from the current and the previous period, they divide on gross domestic product. Alesina and Perotti (1996) derive series of fiscal impulses for each country in their sample. Their findings suggest that episodes of strong adjustments of fiscal policy result to a bigger extend from expenditure cut fiscal policies rather than tax revenue increases.

An alternative methodology to calculate the fiscal impulse is proposed by Chouraqui, Hagemann and Sartor (1990). Their measure also known as the “Dutch measure”, defines the fiscal impulse as the difference between the current primary deficit and the primary deficit that would have prevailed if expenditure in the previous year had grown with potential GDP, and revenues had grown with actual GDP. Like the Blanchard (1993) measure, this measure takes the previous year as the benchmark year. However, here the cyclically neutral expenditure is assumed to be proportional to potential output, while the cyclically neutral taxation is assumed to be proportional to actual output. The Chouraqui, Hagemann and Sartor (1990) approach to define discretionary fiscal policy is frequently used in the estimation of the OECD organization.

A different approach to the problem of finding a measure of the discretionary component of fiscal policy is presented in the work of Badinger (2008). There he follows the standard approach and estimates cyclicity of the fiscal parameters by regressing growth of real government consumption on the growth of real GDP and correcting for serial correlation in the error term. The estimate of the structural residual of the proposed regression equation is interpreted as series of discretionary fiscal shocks. He estimates this by use of ordinary least squares and as a result he obtains a decomposition of the growth of government consumption into a cyclical and discretionary component.

4. Effects of Fiscal Policy on Growth and Output Volatility

The core of this paper is concentrated on the effects of fiscal policy and its components – the automatic stabilizers and the discretionary fiscal policy, on economic growth and output volatility. Contemporary literature has examined this issue with the great number of various fiscal measures presented in the previous sections of the paper. In the work of Aghion and Marinescu (2007) the authors analyze the dynamics of the cyclicity of budgetary policy, which they identify as a reliable proxy for the policy behavior, on a panel of OECD countries in the time span 1960-2006. Their findings suggest that countercyclical fiscal policy is positively associated with economic growth, especially if the country’s financial development is lower.

Despite the ambiguity of the theoretical model in Gali (1994), his empirical analysis suggests that there is a strong negative relationship between the identified measures of automatic stabilizers and output volatility, not considering the cyclical behavior of the studied fiscal variable. Gali’s (1994) results are verified in the work of Fatas and Mihov (1999). When examining the role of the automatic stabilizers on a panel of OECD economies in the period 1960-1997, they reach the conclusion that their proxy measures of the automatic fiscal stance is strongly negatively correlated with the volatility of the business cycles. They prove that by using not only government fiscal variables but also macroeconomic variables from the private sector. Fatas and Mihov (1999) even go further and check for reverse causality that originates in the possibility that more volatile economies have larger governments in order to insure them against additional international risk. When

accounting for the possible endogeneity of the public sector, they find that the stabilizing effect of the government size becomes even stronger and larger in absolute values.

In the continued work of Fatas and Mihov (2003) they verify the results obtained in their paper from 1999 and further look for the impact of the found discretionary fiscal stance on economic activity. Their results suggest that there is a strong, positive and persistent effect of discretionary fiscal expansions on output volatility, regardless of the cyclical behavior of the government policy. Badinger (2008) is building on the research of Fatas and Mihov (2003) by conducting an empirical study on 88 countries from different regions of the world in the time span 1960-2004. He provides comprehensive empirical evidence that discretionary fiscal policy, defined as policy unrelated to the business cycle, and cyclical fiscal policy lower output growth by increasing output volatility. The found destabilizing effects do not depend on whether the discretionary fiscal policy is pro- or countercyclical.

5. Determinants of Fiscal Policy

A great amount of high-quality literature deals with the problem of identifying the determinants of fiscal policy. Such work is the one of Aghion and Marinescu (2007) where they find that lower level of financial development, higher degree of openness to trade and absence of inflation targeting result in lower degree of countercyclicality of fiscal policy, budget deficits in particular.

Rodrik (1998) presents another comprehensive empirical evidence that openness to trade has a significant positive association with most of the fiscal variables comprising the government expenditures. An explanation offered to this phenomenon is that there exists social insurance against external risk, i.e. governments consume larger share of aggregate output in economies subject to greater amount of external risk. Once Rodrik (1998) controls for external risk, openness to trade doesn't seem to exert an independent effect on government consumption. His conclusive empirical results indicate that spending on social security and welfare is significantly more sensitive to exposure to external risk than is the total government consumption.

The work of Gavin and Perroti (1997) explains the found in their paper procyclical fiscal behavior in Latin America in the period 1968-1995 with loss of market access during macroeconomic bad times. Their findings are consistent with the fact that access to emergency credit is higher during bad times when countercyclical fiscal stance is observed, thus credit constraints in Latin America are found as major reason for the procyclicality of fiscal policy in the region. Gavin and Perroti (1997) also offer another explanation to the South American fiscal phenomenon - the voracity effects associated with political distortions.

Manasse (2006) finds that policy reaction is different depending on the state of the economy - acyclical in bad times and largely procyclical in during good times. He tries to explain this policy behavior with the presence of fiscal rules, such as limits on deficits,

borrowing or spending. Manasse (2006) finds evidence that these fiscal constraints may reduce the deficits on average and furthermore, enhance rather than weaken countercyclical fiscal policy. His work also recognizes that strong institutions reduce the deficit bias on average. Better institutions are associated with lower procyclicality in good times and higher procyclicality in bad times.

An interesting approach to the problem was the one of Alesina and Tabellini (2005). Their empirical study shows that usually countercyclical fiscal policy is conducted by developed countries whereas procyclical fiscal policy is engaged in less developed, i.e. developing countries. The reason they offer to this phenomenon is political – people don't trust corrupt government. Their empirical study tries to identify a relationship between the level of control of corruption and cyclicity of fiscal policy. Alesina and Tabellini (2005) use data for the OECD countries as well as countries from the Sub-Saharan and Latin American region. They find that countercyclical fiscal policy is conducted through most of the developed countries in OECD and on the contrary, strict procyclical fiscal policy is engaged in the developing countries from South America and Central Africa. Furthermore, they identify strong, positive and persistent relationship between the control of corruption and the cyclicity of fiscal policy. Their empirical results verify the initial assumption that people from developing countries may not trust their governments. Their explanation for this phenomenon is that voters demand tax cuts as well as increase in productive government spending when positive shocks hit the economy. According to Alesina and Tabellini (2005), for the same reason voters don't allow governments to build-up reserves and assets but rather demand government debt for which the government will have to allocate resources to pay the interest and respectively, spend everything that could be stolen. They disregard all credit constraint issues that a developing country may encounter during an economic shock, as the results that their empirical study show identify this reason for procyclicality of fiscal policy as a highly insignificant.

III. Specification of the Empirical Models

This section justifies our choice of fiscal, economic, institutional and political variables, and reveals our intuition and methodology in constructing the implemented empirical models. Initially, we motivate the employed “per capita” approach in our analysis and then we assemble reliable measures of fiscal policy, automatic stabilizers and discretionary policy. We present reasonable explanation for the composed regression equations that capture the cyclical behavior of the fiscal stances. Further, we outline the approach we use to estimate the potential output and the output gap, and we develop the procedure through which we capture the influence of fiscal policy on output volatility. Finally, we propose a regression equation that suggests a number of possible determinants of all fiscal variables that we have constructed.

1. The “per capita” Approach

In our work, we calculate all measures of the economy and the public sector in “per capita” terms. This approach is innovative and it hasn’t been used in the analyzed related literature. Our motivation behind this choice can be explained by a number of arguments:

First, the problem of identifying a good measure of the size of the government is partially overcome by the use of “per capita” fiscal variables. In the previous section, we have seen that one of the most problematic issues related to the empirical studies of fiscal policy, is how to measure correctly the size of the government. By using the ‘per capita’ standard, we capture the portion of government dedicated to each citizen, i.e. the role of the state in individual terms. This further gives us an actual and reasonable view of how government influence behaves over time.

Second, as we are not interested in the real sizes of the examined economies, by using GDP per capita we successfully obtain a measure that is also a good proxy of the standards of living in the examined sets of countries. The aggregate value of gross domestic product might be misleading to our interpretation of what is a developed or developing country. Thus, by calculating in “per capita” terms, not only we preserve all properties of the actual total output, but we are also able to clearly classify the chosen economies to developed and developing ones.

And third, we correct for demographic shocks. In our study, the population levels and growth are of great importance to the correctness of our estimations. The long time span of our empirical analysis may suffer from the endogenous nature of the population size, which in terms may result as bias in all aggregate variables simultaneously. By using “per capita” measures in our models, we actually divide everything by the size of the population for the given period and therefore, we correct for possible heteroskedasticity that might exist in our data sample.

To summarize, the “per capita” approach gives us a more realistic and comprehensive picture of the government’s role on the economy. The use of variables measured in “per capita” terms sustains the simplicity of our work, fixes for the endogenous effects of the demographic shocks, gives us a realistic proxy for the actual size of the government, and well differentiates the two samples of economies by the resulted gap in standards of living.

2. Measures and Cyclicity of Fiscal Policy

2.1. Measures of Fiscal Policy

In our work, we follow the standard methodology in the related literature and we use the growth rates of government revenues and expenditures as well as the fiscal deficits as share of total output as measures of fiscal policy. These fiscal measures are the most general ones and have been proved to serve as good proxies of the fiscal policy behavior by the works of

Fatas and Mihov (1999), Fatas and MIhov (2003), Alesina and Tabellini (2005), Badinger (2008), Gavin and Perotti (1997), Manasse (2006) and Kaminski, Reinhart and Vegh (2004).

2.2. Cyclicity of Fiscal Policy

As there could not be developed any mathematical proof or clear economic theory about the problem whether fiscal policy has an impact on economic growth or economic growth influences fiscal policy, or both affect each other simultaneously, we follow the approach designed in most of the literature concerned with cyclicity of fiscal policy and its components. Hence, the causality pattern of all empirical models that are to be used in our work assumes that cyclicity of fiscal policy is dependent on economic growth. In that sense, we construct three regression equations that are intended to give us a reasonable view of the fiscal stances over the business cycle:

$$\Delta \ln(T^{pc})_{i,t} = \alpha_i + \beta_1 \Delta \ln(GDP^{pc})_{i,t} + u_{i,t} \quad (2a)$$

$$\Delta \ln(G^{pc})_{i,t} = \alpha_i + \beta_1 \Delta \ln(GDP^{pc})_{i,t} + u_{i,t} \quad (2b)$$

$$\left(\frac{G - T}{GDP} \right)_{i,t} = \alpha_i + \beta_1 \Delta \ln(GDP^{pc})_{i,t} + u_{i,t} \quad (2c)$$

where T^{pc} stands for real government revenues per capita, G^{pc} for real government expenditures per capita, GDP^{pc} for real gross domestic product per capita, G for real total government expenditures, T for real total government revenues, GDP for real gross domestic product, i is a subscript for the country ID and t for the time. In equation (2c) our dependent variable is not calculated in per capita terms because by dividing both the nominator and the denominator by the population level, the population level eliminates itself.

The β_1 coefficients in equations (2a), (2b) and (2c) are measures of the cyclical behavior of our chosen dependent variables over the business cycle. However, there exists a disagreement how to interpret those coefficients. That is why, by following the most common approach in the contemporary economic literature, here we define what is countercyclical, procyclical and acyclical fiscal policy:

Table 1. Cyclicity of Fiscal Policy

| β_1 coefficient | Countercyclical | Procyclical |
|-----------------------|-----------------|-------------|
| Eq. (2a) | + | - |
| Eq. (2b) | - | + |
| Eq. (2c) | - | + |

Thus, we define countercyclical fiscal policy when the growth rate of GDP^{pc} is positively associated to the growth rate of T^{pc} and at the same time negatively related to the growth rate of G^{pc} and the fiscal deficits. We recognize a fiscal policy to be procyclical when the estimated β_1 coefficients exhibit the opposite to the described above relationships with

the growth rate of GDP^{pc} . Finally, we define acyclical fiscal policy when all other combinations of signs are observed or in the event when more than two of the estimated coefficients are insignificant. We do not set any expected signs for the β_1 coefficients of the constructed regression equations. However, the broad literature on the subject suggests that developed nations follow countercyclical fiscal policy, whereas in most cases developing economies are found to exhibit pro- or acyclical fiscal behavior.

Similar causality intuition and methodology are used in the works of Fatas and Mihov (2003), Alesina and Tabellini (2005), Badinger (2008), Gavin and Perotti (1997) and Manasse (2006).

3. Measures and Cyclicity of Automatic Stabilizers

3.1. Measures of Automatic Stabilizers

It is very questionable which fiscal variable correctly mirrors the behavior of the automatic stabilizers. Although the literature on the subject is very limited, the works of Fatas and Mihov (1999) and Fatas and Mihov (2003) suggest that all components of the government tax revenue, except the indirect taxes, as well as the ratio of government expenditures to output, exhibit the fundamental properties of the automatic fiscal stance. In our paper, we consider two variables that could serve the role of an automatic stabilizer in our further analysis. We choose the government tax on income, profits and capital gains as well as the suggested from Fatas and Mihov (1999) and Fatas and Mihov (2003) ratio of government expenditures to output. We consider those two fiscal measures a good proxy of the automatic stabilizers and moreover, we would eventually choose one of them, depending on their cyclical correctness and significant relationship with the growth of gross domestic product, to continue our further empirical analysis on output volatility.

3.2. Cyclicity of Automatic Stabilizers

Similarly to Section 2.2 of our paper, we use the same intuitive causality and methodology to construct the regression equations that show us the cyclical pattern of the chosen measures of automatic stabilizers:

$$\Delta \ln(TIPCG^{pc})_{i,t} = \alpha_i + \beta_1 \Delta \ln(GDP^{pc})_{i,t} + u_{i,t} \quad (3a)$$

$$\left(\frac{G}{GDP}\right)_{i,t} = \alpha_i + \beta_1 \Delta \ln(GDP^{pc})_{i,t} + u_{i,t} \quad (3b)$$

where $TIPCG^{pc}$ stands for government real tax on income, profits and capital gains per capita.

The estimated β_1 coefficients from equations (3a) and (3b) show us the behavior of the chosen proxies of automatic stabilizers over the business cycle. For our further empirical analysis, we choose the variable that performs better in the specified regression equations. In particular, we are looking for a significant and procyclical behavior of the per capita

government tax on income, profits and capital gains and a significant and countercyclical behavior of the ratio of real total government expenditures to real output. We define the cyclicality of the selected variables through the following table:

Table 2. Cyclicity of Automatic Stabilizers

| β_1 coefficient | Countercyclical | Procyclical |
|-----------------------|-----------------|-------------|
| Eq. (3a) | - | + |
| Eq. (3b) | + | - |

In the event when the estimated coefficients are insignificant, we define the variables as acyclical. For the purposes of simplicity in our additional work in this section, the chosen variable that would represent the measure and the cyclical stance of the automatic stabilizers will be referred to as *AUTO*.

4. Measures and Cyclicity of Discretionary Fiscal Policy

4.1. Measures of Discretionary Fiscal Policy

Current economic literature hasn't found a good proxy of the discretionary fiscal policy among the statistical data samples presently available. Thus, in order to estimate the discretionary impulse of fiscal policy, we employ the two most popular indexes developed to capture the discretionary fiscal behaviour.

Most works on the subject take the methodology proposed by Blanchard (1993) to calculate the discretionary fiscal impulse. However, due to our limited dataset of unemployment rate, we have decided to also adopt the function for calculating the discretionary fiscal stance developed by Chouraqui, Hagemann and Sartor (1990) and widely used by the OECD:

$$(DISCR^{OECD})_{i,t} = \frac{(G_{i,t}^{pc} - T_{i,t}^{pc}) - (G_{i,t-1}^{pc} \times (1 + \Delta \ln(\widehat{GDP}^{pc})_{i,t}) - T_{i,t-1}^{pc} \times (1 + \Delta \ln(GDP^{pc})_{i,t}))}{GDP_{i,t-1}^{pc}} \quad (4a)$$

where $DISCR^{OECD}$ stands for the derived discretionary fiscal impulse and \widehat{GDP}^{pc} for potential real gross domestic product per capita. In this equation, we take all variables in per capita terms, because we divide the nominator and the denominator on the population level from different periods, thus they don't eliminate each other. The interpretation of the derived discretionary impulse is described in the following table:

Table 3. Interpretation of $DISCR^{OECD}$ index

| | $DISCR^{OECD} < 0$ | $DISCR^{OECD} = 0$ | $DISCR^{OECD} > 0$ |
|----------------|----------------------------------|-------------------------|--------------------------------|
| Interpretation | Discretionary Fiscal Contraction | No Discretionary Action | Discretionary Fiscal Expansion |

Despite the fact that the Blanchard (1993) measure would generate a limited dataset of the discretionary fiscal impulse, we employ it. However, we use the modified by Alesina and Perotti (1996) methodology:

$$(DISCR^{Blanchard})_{i,t} = \left(\frac{G_{i,t} - T_{i,t}}{GDP_{i,t}} \right) \times (U_{i,t-1}) - \left(\frac{G_{i,t-1} - T_{i,t-1}}{GDP_{i,t-1}} \right) \quad (4b)$$

where $DISCR^{Blanchard}$ stands for the derived discretionary fiscal impulse and U for the unemployment rate. The interpretation of the derived discretionary impulse is described in the following table:

Table 4. Interpretation of $DISCR^{Blanchard}$ index

| | $DISCR^{Blanchard} < 0$ | $DISCR^{Blanchard} = 0$ | $DISCR^{Blanchard} > 0$ |
|----------------|----------------------------------|-------------------------|--------------------------------|
| Interpretation | Discretionary Fiscal Contraction | No Discretionary Action | Discretionary Fiscal Expansion |

Throughout the rest of our work we use both measures of discretionary fiscal impulse. We compare and contrast the behavior and the effects the two measures exhibit in our further empirical analysis.

4.2. Cyclicalities of Discretionary Fiscal Policy

Similarly to Section 2.2 and 3.2 of our paper, we use the same intuitive causality and methodology to construct the regression equations that will show us the cyclical pattern of the derived measures of discretionary fiscal policy. However, throughout all our estimations we consider the discretionary impulse from the previous period. Economic theory suggests that discretionary fiscal policy affects an economy slower than automatic stabilizers do. We assume that the economic environment needs one year to fully assimilate the new conditions set up by the discretionary fiscal policy decision of the government:

$$(DISCR^{Blanchard})_{i,t-1} = \alpha_i + \beta_1 \Delta \ln(GDP^{pc})_{i,t} + u_{i,t} \quad (5a)$$

$$(DISCR^{OECD})_{i,t-1} = \alpha_i + \beta_1 \Delta \ln(GDP^{pc})_{i,t} + u_{i,t} \quad (5b)$$

The estimated β_1 coefficients from equations (5a) and (5b) show us the behavior of our proxies of discretionary fiscal impulse over the business cycle. We do not set any expected signs for the β_1 coefficients of the constructed regression equations. We define the cyclicalities of the derived fiscal variables in the following table:

Table 5. Cyclicalty of Discretionary Fiscal Policy

| β_1 coefficient | Countercyclical | Procyclical |
|-----------------------|-----------------|-------------|
| Eq. (5a) | + | - |
| Eq. (5b) | + | - |

In case the estimated coefficients are insignificant, we define the variables as acyclical.

5. Effects of Fiscal Policy on Growth and Output Volatility

5.1. Potential Output and Output Gap

In order to continue our empirical analysis, we have to construct a credible measure of output volatility. An instant candidate for this variable is the standard deviation of GDP. However, this procedure would return a single value per country for the selected time span, whereas we need series of output volatility values. That is the reason we decided to use the output gap as a proxy for output volatility. The output gap is the percentage difference between potential and actual output per capita. Potential output is defined as the level of real GDP that the economy can produce, by fully employing all the factors of production, given the actual level of technology and without causing acceleration in inflation.

Our choice is well justified from a theoretical point of view as well. As one of the primary purposes of fiscal policy is to foster full employment through the provision of public goods and services, it is potential output that is the target to be achieved by the government. In the sense of the theory we are building, the deviation of the actual output from the potential one appears to be the gap that is to be eliminated through the mechanisms of fiscal policy.

However, another issue arises once we have decided to use potential output in our estimations, and it is how exactly we should calculate the potential gross domestic product. A great amount of economic literature deals with this problem. For example, Ganev (2004) summarizes that there generally exist two types of solutions to the problem – estimations of potential output via production functions and via filters. Nonetheless, as Ganev (2004) states it, there don't exist accurate labor, capital and technology measures and thus, calculating potential gross domestic product with production functions is cumbersome. On the other hand, a number of filters have been developed through the recent years, and as the empirical results of Ganev (2004) suggest, they may generate quite reasonable results for data observations of long time span. That's the reason we focus on the filter proposed by Hodrick and Prescott (1997) – the one that is most widely used in the related literature to our subject. We further refer to that filter as the HP filter.

In the work of Hodrick and Prescott (1997), they assume that the growth component of a time series variable have a smooth variation over time. They decompose the variable in mind to a cyclical component - c_t , and a growth trend component - g_t . They also

assume that in the long run the generated deviations offset each other and average to a zero. In our case, the HP filter decomposition looks like:

$$GDP_t^{pc} = g_t + c_t \quad (6a)$$

The growth component is derived by solving the minimization problem:

$$Min \left\{ \sum_{t=1}^T c_t^2 + \lambda \sum_{t=1}^{T-1} [(g_{t+1} - g_t) - (g_t - g_{t-1})]^2 \right\} \quad (6b)$$

where λ is a smoothing parameter. The larger the value of this parameter, the smoother the obtained trend. For annual data, as recommended from Ravn and Uhlig (2002), the value of 6.25 is preferred. In the above equation, the first term is the square of the cyclical component and the second one is the square of the change of the growth trend component. As a result, the HP filter returns a smooth trend – the potential real GDP per capita, as well as the difference between the observed and the filtered values – in our case the real GDP gap per capita.

5.2. Output Volatility and Fiscal Policy

Throughout this subsection we build the regression equations that look for a credible relationship between output volatility and fiscal policy – the most intriguing part and ultimate goal of our work. In our great interest here are the measures of automatic stabilizers and discretionary fiscal policy that we have previously identified as well as the generated via the HP filter – potential real output per capita. For the purpose of our empirical analysis, we transform the extracted real GDP per capita gap variable in absolute values. We do that because we are not interested whether the derived deviation is positive or negative. We don't differentiate between overheating and unutilized economy. We look for the stabilizing effects of the fiscal policy toward the optimal potential real GDP generated by the HP filter. We further divide the real output gap per capita on the real aggregate potential output. We do that in order to obtain the percentage deviation of the actual real GDP per capita from the potential real GDP per capita.

We attempt to explain the behavior of the deviation from the potential real output per capita by regressing it against the stance of the two components of fiscal policy – the automatic stabilizers and the discretionary fiscal impulse of the previous period:

$$ABSGDPGAP_{i,t}^{pc} = \alpha_i + \beta_1 AUTO_{i,t} + \beta_2 DISCR_{i,t-1}^{Blanchard} + u_{i,t} \quad (7a)$$

$$ABSGDPGAP_{i,t}^{pc} = \alpha_i + \beta_1 AUTO_{i,t} + \beta_2 DISCR_{i,t-1}^{OECD} + u_{i,t} \quad (7b)$$

where $ABSGDPGAP^{pc}$ is the absolute percentage deviation of the actual real GDP per capita from the potential real GDP per capita. The β coefficients from the estimated

regression equations are of great interest to our interpretation of the role of fiscal policy over the business cycle. We do not expect any particular results from the estimated regression equations. The obtained results are to be deeply analyzed and conclusions are about to be drawn about the effects of the automatic stabilizers and the discretionary fiscal policy on output volatility in both developed and developing nations.

6. Determinants of Fiscal Policy

As the final step of our work, we try to recognize the driving forces behind all the fiscal variables we have identified up to now. Throughout the literature review section of this paper, we observe that not only macroeconomic indicators are held responsible for the behavior of the fiscal stances, but also a few institutional and political variables are found to influence the governments' fiscal decisions. Therefore, we have picked four potential variables that to some extent can provide a credible explanation for the behavior of the fiscal stances.

As suggested from the broad literature on the subject, we employ the openness to trade and the terms of trade macroeconomic variables. We define openness to trade as the ratio of the sum of imports and exports to output, and terms of trade as the ratio of exports to imports. Moreover, as advocated by Aghion and Marinescu (2007), we include to our set the macroeconomic variables financial development, which represents the ratio of private credit to gross domestic product. In addition, we also take into account the findings of Alesina and Tabellini (2005) that the index of control of corruption is highly correlated with fiscal policy and thus, we incorporate this variable into our estimations. Furthermore, to catch a reasonable effect of those explanatory variables, we build the notions of good and bad times. As a benchmark, to differentiate between good and bad times, we take the arithmetic mean of $ABSGDPGAP^{pc}$ for both sets of countries. The observations that refer to the years where $ABSGDPGAP^{pc}$ is less than its arithmetic mean, we consider as the good times of smooth economic growth. On the other hand, the observations where $ABSGDPGAP^{pc}$ is equal or greater than its arithmetic mean, we consider as the bad times of economic extremes and shocks. Our motivation behind the use of $ABSGDPGAP^{pc}$ as benchmark for good and bad times lies in the fact that the ultimate purpose of our work is to find the factors, which help for decreasing the output volatility through the means of fiscal policy. At last, we attempt to identify the determinants of fiscal policy with the following regression equations:

$$\begin{aligned} goodZ_{i,t} = & \alpha_i + \beta_1 goodOPEN_{i,t} + \beta_2 goodToT_{i,t} + \beta_3 goodCORR_{i,t} \\ & + \beta_4 goodFinDev_{i,t} + u_{i,t} \end{aligned} \quad (8a)$$

$$\begin{aligned} badZ_{i,t} = & \alpha_i + \beta_1 badOPEN_{i,t} + \beta_2 badToT_{i,t} + \beta_3 badCORR_{i,t} \\ & + \beta_4 badFinDev_{i,t} + u_{i,t} \end{aligned} \quad (8b)$$

where eq. (8a) takes into account the observations of the good times and eq. (8b) of the bad times, Z stands for the six stances of fiscal policy we have recognized: $\Delta \log(T^{pc})$, $\Delta \log(G^{pc})$, $\left(\frac{G-T}{GDP}\right)$, $AUTO$, $DISCR^{Blanchard}$, $DISCR^{OECD}$, $OPEN$ for openness to trade, ToT for terms of trade, $CORR$ for the control of corruption index and $FinDev$ for the financial development.

The estimated β coefficients are of great interest to our understandings for the driving forces of fiscal policy. We do not set any expected signs for the β coefficients of the constructed regression equations. The derived results are to be thoroughly analyzed for both samples of countries. Empirical evidence about how institutional, political and macroeconomic factors influence fiscal policy making, is about to be found.

IV. Empirical Results

This chapter of the paper presents our empirical results and the interpretations we attach to them. First, we describe our data, country-selection and time span. Then, we build a procedure, with which we test the statistical significance of our variables and regression equations. Furthermore, we interpret the valid estimations of the cyclicity of fiscal policy, automatic stabilizers and discretionary fiscal policy, as well as the effects of fiscal policy on output volatility. At last, we scrutinize at the results that define the determinants of fiscal policy and its components. Nevertheless, the obtained results should be interpreted with caution as we claim to have identified only empirical relationships among the studied fiscal, macroeconomic and institutional variables.

1. Data

Our work is focused on an empirical analysis based on key macroeconomic, fiscal and institutional variables of seven developed and twenty three developing countries listed in Table 6 (Appendix A). Our data is annual with time span from 1972 to 2001. It is essential to point out that the nations we have picked preserve the properties of a developed or developing country for the whole time span of the empirical analysis. Through our selection of economies, we included countries that during the time span of our empirical analysis had little or no presence of communist, socialist or totalitarian government.

In Section 3 of this paper, we presented our methodology for deriving the needed dependent and explanatory variables for our regression equations. The sources of the required base variables, through which we develop our dependent and explanatory variables, are listed in Table 7 (Appendix A).

We construct two panels of time series cross sectional data – one for the developed and another for the developing nations. The procedures ran on both panels are identical as a decisive goal of our work is to compare and contrast the obtained results for both sets of economies.

2. Panel Data Analysis

Before proceeding to the interpretations of our empirical results, we are about to build the procedure with which we test the statistical significance of our results. In basic terms, we check whether the dependent variables are stationary, the regression variables are cointegrated, residuals are homoskedastic, and there doesn't exist serial correlation. The estimation method of fixed or random effects is preferred. Here, it is important to note that due to the theoretically supported design of our variables and regression equations, we do not change the dimensions and the structure of those that do not pass the testing procedure described below, because doing so will distort our interpretations and thus, result in illusory and incorrect analysis. Instead, we ignore the results obtained with the statistically invalid variables and regression equations.

First, we perform a test for unit roots on all dependent variables in our regression equations. We use Fisher's test, a panel data based test developed by Maddala and Wu (1999) that combines the p-values from N independent unit root tests. Based on the p-values of individual unit root tests, Fisher's test assumes that all series are non-stationary under the null hypothesis against the alternative that at least one series in the panel is stationary. If a dependent variable doesn't pass the described stationary test, we ignore the regression equation in which it is part of.

Using the Fisher's test, we also check whether cointegration exists on all of the remaining regression equations. We perform the test on the predicted residuals of the regressions, where the null hypothesis assumes that there is no cointegration between the regressed variables and vice versa for the alternative hypothesis. If a regression equation doesn't pass the test for cointegration, we ignore it as cointegration is assumed to be present in the further fixed and random effects estimations.

Further, we perform a test for serial correlation on the remaining regression equations using the Wooldridge test for serial correlation in panel data. The tested null hypothesis here is that there is no serial correlation in the given specification. In the cases when we reject the null hypothesis, we don't ignore the given regression equations as we can fix for the experienced serial correlation with both fixed and random effects methodologies.

Moreover, we test the regression equations for heteroskedasticity. As there doesn't exist such test procedure for panel data in the available software (STATA 9.1), we employ an approach that consists of a number of steps. First, knowing that GLS regression methodology with only heteroskedasticity produces maximum-likelihood parameter estimates, we run a GLS regression to fit the given regression equation with panel-level heteroskedasticity and then save the likelihood. After that we run the same GLS regression without heteroskedasticity and store the resulted model as well. Then we employ the likelihood-ratio test, running it with nested models (the two we have stored). In the described procedure the null hypothesis assumes homoskedasticity. In the cases when we reject the null

hypothesis, we don't ignore the given regression equations as we can fix for the heteroskedasticity with both fixed and random effects methodologies.

In an empirical work with panel data, the choice between the two alternative regressions - fixed or random effects - is fundamental. The generally accepted way of choosing between fixed and random effects is running a Hausman test. The Hausman test checks a more efficient model against a less efficient, but consistent model, to make sure that the more efficient model also gives consistent results. In our case of panel data, the more efficient model is the random effects one. Thus, we assume the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. In the cases when we reject the null hypothesis, it is better for us to use fixed effects estimations, where if serial correlation or heteroskedasticity exists, we fix with the "robust" STATA command. In the cases when we don't reject the null hypothesis, it is more efficient for us to use the random effects estimation, which on panel data regressions automatically fix for serial correlation and heteroskedasticity, if any.

Based on the described validation procedure above, we have excluded 24 out of the planned 48 regression equations. We do that in order to avoid conducting misleading estimations and spurious regressions. For the panel of the developed nations we ignore regression equations (2c), (3b), (5a), (8a) where dependent variable is - $good\left(\frac{G-T}{GDP}\right)$, $goodDISCR^{Blanchard}$, $goodDISCR^{OECD}$, and (8b) where dependent variable is - $bad\Delta\ln(G^{pc})$, $bad\left(\frac{G-T}{GDP}\right)$, $badDISCR^{Blanchard}$, $badDISCR^{OECD}$. For the panel of the developing nations we exclude regression equations (3b), (8a) where dependent variable is - $good\left(\frac{G-T}{GDP}\right)$ and $good\left(\frac{G}{GDP}\right)$, and (8b) with all dependent variables. The technical results from all regression equations that satisfy our validation procedure are listed in Appendix B.

3. Interpretation of the Empirical Results

3.1. Cyclicity of Fiscal Policy

The first stage of our empirical analysis is to find what behavior do the fiscal policies of both developed and developing countries exhibit. We run regression equations (2a) and (2b) for the panel of the developed nations. In Table 8 we outline the obtained results:

Table 8. Cyclicity of Fiscal Policy in Developed Countries

| Dependent Variable | $\Delta\ln(T^{pc})$ Eq. (2a) | $\Delta\ln(G^{pc})$ Eq. (2b) |
|-----------------------|------------------------------------|-------------------------------------|
| $\Delta\ln(GDP^{pc})$ | 0.902*** (0.134) t-stat 6.74 | -0.274** (0.135) t-stat -2.03 |
| Adj R ² | 0.20 | 0.02 |

| | | |
|-------------------|----------------|----------------|
| Estimation Method | Random Effects | Random Effects |
|-------------------|----------------|----------------|

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

The estimated coefficients and significance were expected by the results stated in the broad literature on the subject. The behavior of the government revenues per capita is strongly procyclical as 1% increase of per capita output results in 0.90% in per capita tax revenue. Furthermore, government expenditures per capita exhibit countercyclical pattern as 1 % increase of GDP per capita is mirrored by 0.27% decrease of government spending per capita. Although we cannot take into account Eq. (2c) in order to fully verify our interpretations based on the definition of countercyclical fiscal policy in Chapter III, we can conclude that indeed, fiscal policy in developed countries exhibits countercyclical stance.

We continue by regressing equations (2a), (2b) and (2c) on the panel of the developing countries. In Table 9 we outline the obtained results:

Table 9. Cyclicity of Fiscal Policy in Developing Countries

| Dependent Variable | $\Delta \ln(T^{pc})$ Eq. (2a) | $\Delta \ln(G^{pc})$ Eq. (2b) | $\left(\frac{G-T}{GDP}\right)$ Eq. (2c) |
|------------------------|-------------------------------------|------------------------------------|--|
| $\Delta \ln(GDP^{pc})$ | 1.033*** (0.076) t-stat 13.61 | 0.748*** (0.103) t-stat 7.25 | -0.093** (0.037) t-stat -2.55 |
| Adj R ² | 0.25 | 0.09 | 0.02 |
| Estimation Method | Random Effects | Random Effects | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

Based on the definition of our interpretation of the results in Chapter III, the estimated results cannot lead us to any specific conclusions. We see that government revenues per capita are strongly procyclical as 1% increase GDP per capita results in 1.03% increase in per capita government revenues. Moreover, it is clear that the government expenditures per capita are also procyclical as 1% increase in output per capita results in 0.74% increase of government spendings per capita. However, the fiscal deficits exhibit countercyclical fiscal stance as the estimations show that 1% increase in GDP per capita results in -0.09% less debt. Thus, according to our definition of acyclical fiscal policy in Chapter III, we identify the fiscal policy pattern of the developing countries as such.

However, the estimated regression equations (2b) for the panel data of the developed countries and (2c) for the panel data of the developing countries result with Adj R² of very small value. The small Adj R² could be addressed to the fact that the chosen fiscal

variables cannot fully explain the variability of the growth rate of GDP^{pc} . Moreover, as we are not looking for a set of explanatory variables of output growth, but instead, we only attempt to identify the cyclical stance of the tested fiscal variables, the small values of the Adj R² for both panels of data are tolerable for the correctness of the interpretations of the obtained results.

So, the first major discrepancy between the two sets of economies we have chosen is that they differ in their fiscal policies behavior over the business cycle. The estimations based on the panel of the developed countries suggest countercyclical fiscal policy, whereas those conducted on the data of the developing economies imply acyclical fiscal policy pattern.

3.2. Cyclicity of Automatic Stabilizers

This section of our empirical analysis deals with the validation of our choice of a proxy for the automatic stabilizers. As we ignore Eq. (3b) for both sets of countries, we are left only with the fiscal variable – taxes on income, profits and capital gains per capita, to serve the role of a proxy for the automatic fiscal stance. First, we perform Eq. (3a) on the panel data of the developed countries. In Table 10 we outline the obtained results:

Table 10. Cyclicity of Automatic Stabilizers in Developed Countries

| Dependent Variable | $\Delta \ln(TIPCG^{pc})$ Eq. (3a) |
|------------------------|--------------------------------------|
| $\Delta \ln(GDP^{pc})$ | 1.429*** (0.261) t-stat 5.47 |
| Adj R ² | 0.14 |
| Estimation Method | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

The estimated results confirm our intuition that the taxes on income, profits and capital gains per capita could be a good proxy for the automatic stabilizers. With 1% increase of GDP per capita, our proxy of the automatic fiscal stance increases with 1.43%. As the chosen variable is tax-based, it is natural for it to be procyclical with the per capita output. This procyclical behavior of the examined variable actually implies the countercyclical pattern of the automatic stabilizers.

Next, we perform the same regression equation on the panel of the developing countries. In Table 11 we outline the obtained results:

Table 11. Cyclicity of Automatic Stabilizers in Developing Countries

| Dependent Variable | $\Delta \ln(TIPCG^{pc})$ Eq. (3a) |
|------------------------|--------------------------------------|
| $\Delta \ln(GDP^{pc})$ | 1.198*** (0.135) t-stat 8.88 |
| Adj R ² | 0.13 |
| Estimation Method | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

Again, our intuition is empirically confirmed. In the case of the developing economies, the taxes on income, profits and capital gains per capita increase approximately 1.20% with every additional percent of output per capita growth.

Both estimations prove that the examined variable is a good proxy for the automatic stabilizers as it behaves almost identically in the two sets of countries and furthermore, suggests the expected countercyclical pattern of the automatic fiscal stance. For the purposes of simplicity in our additional work, the fiscal variable taxes on income, profits and capital gains that we empirically proved to represent the measure and the cyclical stance of the automatic stabilizers will be referred to as *AUTO*.

3.3. Cyclicity of Discretionary Fiscal Policy

In the next step of our empirical analysis we try to identify a cyclical pattern of the discretionary fiscal impulses that we have built – the OECD and the Blanchard discretionary policy measures. For the panel of the developed countries we ignore Eq. (5a) so, we estimate only Eq. (5b). In Table 12 we outline the obtained results:

Table 12. Cyclicity of Discretionary Fiscal Policy in Developed Countries

| Dependent Variable | $DISCR^{OECD}$ Eq. (5b) |
|------------------------|-----------------------------------|
| $\Delta \ln(GDP^{pc})$ | -0.012 (0.054) t-stat -0.23 |
| Adj R ² | 0.00 |
| Estimation Method | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

The derived results are statistically insignificant, thus we cannot draw any conclusions about the behavior of the discretionary fiscal policy in the developed nations. The β coefficient of defined explanatory variable is insignificant and $DISCR^{OECD}$ explains 0% of the variability of the growth rate of GDP^{pc} . Therefore, as specified in Section 3, we define the discretionary fiscal impulse in the developed economies to be acyclical.

Next, we conduct Eq. (5a) and (5b) on the panel of the developing countries. In Table 13 we outline the obtained results:

Table 13. Cyclicalty of Discretionary Fiscal Policy in Developing Countries

| Dependent Variable | $DISCR^{Blanchard}$ Eq. (5a) | $DISCR^{OECD}$ Eq. (5b) |
|------------------------|-----------------------------------|--------------------------------------|
| $\Delta \ln(GDP^{pc})$ | -0.052 (0.049) t-stat -1.07 | -0.090*** (0.023) t-stat -3.88 |
| Adj R2 | 0.00 | 0.03 |
| Estimation Method | Random Effects | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

The estimated results recognize only Eq. (5b) to be statistically significant. We see that the discretionary OECD measure exhibits countercyclical pattern as 1% of GDP per capita growth is mirrored by -0.09% discretionary contraction. In the case of Eq. (5a), the data of the Blanchard measure is extremely limited for the panel of the developing countries and thus, estimated strongly insignificant results can be disregarded. Nevertheless, the small values of the Adj R² and the β coefficient in the estimated regression equation (5b), imply that the effect of the tested fiscal variable is negligible to the behaviour of the growth rate of GDP^{pc} over the business cycle. Therefore, based on the obtained estimations, we cannot draw any credible conclusions about the discretionary fiscal impulse in the set of developing countries as well.

The derived results in this section failed to give us any valuable information about the behavior of the discretionary impulse in both sets of economies.

3.4. Effects of Fiscal Policy on Growth and Output Volatility

This part of our interpretation of the obtained empirical results is the most important one in our work. Here we find whether fiscal policy affects output volatility or not. First, we estimate regression equations (7a) and (7b) on the panel of the developed countries. In Table 14 we outline the obtained results:

Table 14. Effects of Fiscal Policy on Output Volatility in Developed Countries

| Dependent Variable | <i>ABSGDPGAP^{pc}</i> Eq. (7a) | <i>ABSGDPGAP^{pc}</i> Eq. (7b) |
|----------------------------------|---|---|
| <i>AUTO</i> | -0.024*** (0.007) t-stat -3.06 | -0.024*** (0.007) t-stat -3.22 |
| <i>DISCR^{Blanchard}</i> | 0.005 (0.017) t-stat 0.29 | - |
| <i>DISCR^{OECD}</i> | - | 0.051 (0.039) t-stat 1.31 |
| Adj R2 | 0.06 | 0.06 |
| Estimation Method | Random Effects | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

In both equations, the explanatory variable that represents the automatic stabilizers is found to be significant with identical negative relation to the measure of output volatility, whereas both measures of discretionary fiscal policy are recognized to be statistically insignificant. The estimations show that 1% increase of the automatic fiscal stance contributes to 0.024% less output volatility. This finding is of particular interest knowing that the fiscal stance of the automatic stabilizers is strongly countercyclical. Thus, it implies that not only the behavior of the automatic stabilizers, but also the countercyclical fiscal stance have a beneficent effect on output volatility in the sample of the developed countries.

To verify our findings concerned with the automatic stabilizers and output volatility we conduct the same regression equations on the panel of the developing economies. In Table 15 we outline the obtained results:

Table 15. Effects of Fiscal Policy on Output Volatility in Developing Countries

| Dependent Variable | <i>ABSGDPGAP^{pc}</i> Eq. (7a) | <i>ABSGDPGAP^{pc}</i> Eq. (7b) |
|----------------------------------|---|---|
| <i>AUTO</i> | -0.036*** (0.010) t-stat -0.64 | -0.015*** (0.004) t-stat -3.09 |
| <i>DISCR^{Blanchard}</i> | -0.025 (0.038) t-stat -3.28 | - |
| <i>DISCR^{OECD}</i> | - | -0.007 (0.029) |

| | | |
|--------------------|---------------|----------------|
| | | t-stat -0.25 |
| Adj R ² | 0.09 | 0.02 |
| Estimation Method | Fixed Effects | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

Interestingly, the estimated results greatly resemble the ones obtained on the panel of the developed countries. Again, our proxy of the automatic stabilizers is found to be significant and negatively related to output volatility in both regression equations, whereas the two discretionary impulses are identified as statistically insignificant. In Eq. (7a) and (7b), 1% increase of the automatic fiscal stance is mirrored by 0.036% and 0.015% less output volatility, respectively. Those findings only strengthen the previously drawn conclusions about the effect of the automatic stabilizers and the countercyclical fiscal policy on output volatility.

However, we notice that although the relationship of the automatic stabilizers to output volatility is negative, it is estimated with Adj R² and β coefficients of small nominal value. The small Adj R² could be addressed to the fact that fiscal policy cannot fully explain the variability of the per capita GDP output gap. As we are not looking for the full set of explanatory variables of output volatility, but instead, we only attempt to identify a credible relationship between fiscal policy and output volatility, the small nominal values of the Adj R² for both panels of data are tolerable for the correctness of the interpretations of the obtained results. The small values of the estimated β coefficients are also reasonable and acceptable, knowing that fiscal policy can have only limited influence on output. Therefore, we recognize the estimated results as credible and furthermore, we draw the conclusion that, regardless of the type of economy, automatic stabilizers and countercyclical fiscal policy decrease output volatility, not taking into account the scale of the exhibited effect.

Connecting our findings, that automatic stabilizers and countercyclical fiscal policy as a whole contribute to less output volatility, with Endogenous Growth Theory, which states that low levels of output volatility result in higher economic growth in the long-run, we can derive another conclusion that countercyclical fiscal policy could be a key determinant in boosting economic prosperity in the long-run. In fact, our empirical conclusions of the role of fiscal policy over the business cycle support the Keynesian view of how fiscal policy should be conducted in order to promote economic growth. Moreover, based on our findings in Section 3.1 of this chapter, we see that in fact, the conducted countercyclical fiscal policy by the developed nations could explain, to some extent, the lower levels of output volatility per capita as outlined by Table 16. On the other hand, the opposite could be true for the sample of the developing nations.

Table 16. Arithmetic Mean and 95% Confidence Interval of $ABSGDPGAP^{pc}$

| Data Panels | Developed | Developing |
|-------------------------|--------------|--------------|
| Arithmetic Mean | 0.96 | 1.84 |
| 95% Confidence Interval | (0.85, 1.07) | (1.71, 1.98) |

3.5. Determinants of Fiscal Policy

Knowing that fiscal policy, in particular countercyclical fiscal policy, does have an implication to economic growth, it is of great importance to identify some of its determinants. However, according to our methodology, we only know that the given state is whether in a good or a bad time, meaning that the actual output is whether close to or far from the potential one, but don't know if the economy is in a boom or a recession, we cannot give direction to the dependent fiscal variables, so they to exhibit countercyclical fiscal pattern. However, our findings are important due to the fact that policy makers can use the recognized determinants of fiscal policy accordingly, to enhance the desired direction of the needed fiscal policy for the given stage of the business cycle in which the economy resides.

We conduct regression equation (8a) on the panel of the developed economies, ignoring the statistically invalid regressions. In Table 17 we outline the obtained results:

Table 17. Determinants of Fiscal Policy in Developed Countries - Good Times, Eq. (8a)

| Dependent Variable | $good\Delta\ln(T^{pc})$ | $good\Delta\ln(G^{pc})$ | $goodAUTO$ |
|--------------------|-------------------------------------|-------------------------------------|-----------------------------------|
| $goodOPEN$ | -0.109** (0.051) t-stat -2.10 | -0.009 (0.020) t-stat -0.48 | 0.025 (0.041) t-stat 0.63 |
| $goodToT$ | -0.053 (0.048) t-stat -1.11 | -0.020 (0.031) t-stat -0.67 | 0.001 (0.061) t-stat 0.01 |
| $goodCORR$ | 0.000 (0.006) t-stat -0.10 | 0.007* (0.003) t-stat 1.94 | -0.006 (0.006) t-stat -0.84 |
| $goodFinDev$ | 0.000 (0.016) t-stat 0.00 | -0.028** (0.012) t-stat -2.30 | 0.021 (0.024) t-stat 0.88 |
| Adj R ² | 0.02 | 0.13 | 0.02 |
| Estimation Method | Fixed Effects | Random Effects | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

The estimations identify three determinants of fiscal policy in good times for the developed countries - openness to trade, corruption and financial development, respectively

having impact on the growth rate of the government revenues per capita and the growth rate of government expenditures per capita.

In addition, we perform regression equation (8b) on the panel of the developed countries, ignoring the statistically invalid regressions. In Table 18 we outline the obtained results:

Table 18. Determinants of Fiscal Policy in Developed Countries – Bad Times, Eq. (8b)

| Dependent Variable | <i>bad</i> $\Delta\ln(T^{pc})$ | <i>bad</i> <i>AUTO</i> |
|--------------------------|-----------------------------------|-------------------------------------|
| <i>bad</i> <i>OPEN</i> | 0.025 (0.045) t-stat 0.56 | 0.071 (0.059) t-stat 1.20 |
| <i>bad</i> <i>ToT</i> | -0.076 (0.099) t-stat -0.77 | -0.113 (0.140) t-stat -0.81 |
| <i>bad</i> <i>CORR</i> | -0.008 (0.007) t-stat -1.07 | -0.019** (0.009) t-stat -2.08 |
| <i>bad</i> <i>FinDev</i> | -0.044 (0.034) t-stat -1.31 | -0.063 (0.048) t-stat -1.32 |
| Adj R2 | 0.16 | 0.26 |
| Estimation Method | Random Effects | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

The estimated two regressions identify only one determinant of fiscal policy in good times for the developed countries – the control of corruption index, having impact on the automatic fiscal stance.

We continue by estimating regression equation (8a) on the panel of the developing countries, ignoring the statistically invalid regressions. In Table 19 we outline the obtained results:

Table 19. Determinants of Fiscal Policy in Developing Countries – Good Times, Eq. (8a)

| Dependent Variable | <i>good</i> $\Delta\ln(T^{pc})$ | <i>good</i> $\Delta\ln(G^{pc})$ | <i>good</i> <i>AUTO</i> | <i>good</i> <i>DISCR</i> ^{Blanchard} | <i>good</i> <i>DISCR</i> ^{OECD} |
|-------------------------|----------------------------------|-----------------------------------|---------------------------------|---|--|
| <i>good</i> <i>OPEN</i> | -0.044 (0.031) t-stat 1.43 | -0.021 (0.039) t-stat -0.54 | 0.046 (0.054) t-stat 0.86 | 0.237* (0.125) t-stat 1.90 | 0.004 (0.009) t-stat 0.42 |
| <i>good</i> <i>ToT</i> | -0.034 | -0.083** | 0.039 | 0.060 | -0.003 |

| | | | | | |
|-------------------|-------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | (0.032) t-stat -1.07 | (0.040) t-stat -2.05 | (0.051) t-stat 0.76 | (0.099) t-stat 0.60 | (0.010) t-stat -0.34 |
| <i>goodCORR</i> | -0.008** (0.003) t-stat -2.41 | 0.003 (0.004) t-stat 0.62 | -0.008 (0.007) t-stat -1.18 | -0.018 (0.017) t-stat -1.06 | 0.001 (0.001) t-stat 1.09 |
| <i>goodFinDev</i> | 0.015 (0.033) t-stat 0.48 | -0.061 (0.042) t-stat -1.47 | 0.007 (0.052) t-stat 0.12 | -0.045 (0.053) t-stat -0.85 | -0.009 (0.010) t-stat -0.89 |
| Adj R2 | 0.07 | 0.08 | 0.04 | 0.03 | 0.02 |
| Estimation Method | Random Effects | Random Effects | Random Effects | Fixed Effects | Random Effects |

Standard Errors in parenthesis

* - Significant at 90%

** - Significant at 95%

*** - Significant at 99%

The derived results show only two determinants of fiscal policy in good times in the sample of the developing countries – openness to trade, having impact the discretionary fiscal policy, and terms of trade, affecting the growth rate of government expenditures per capita. We do not perform estimation of Eq. (8b) on the panel of the developing countries as all of the variants of the equation appeared to be statistically invalid.

Our empirical results recognize each of the used explanatory variables to affect the fiscal policy of a given state, whether in good or bad times. However, Eq. (8a) and Eq. (8b) for both panels of data are estimated with very low Adj. R², which implies that the behaviour of dependent fiscal variables is not properly explained. Therefore, one of our conclusions based on those regression equations is that more determinants of fiscal policy should be identified in order to reach credible values of the estimated Adj. R² and thus, build confidence on the recognized statistically significant relationships.

Nevertheless, those findings are important for policy makers who are facing fiscal policy constraints, but want to engage in a certain fiscal stance. The identified determinants of fiscal policy could be used as a tool to develop or enhance countercyclical fiscal policy, which our work empirically identified to lower output volatility and thus, suggests an increase in economic growth in the long-run.

V. Conclusion

Our work empirically found that fiscal policy affects output volatility. We identified a negative relationship between automatic stabilizers and volatility of output per capita, in both developed and developing economies. The conducted empirical analysis proved the economic intuition that the automatic fiscal stance is countercyclical, regardless of the size and the prosperity of the economy. Based on those findings, we drew the conclusion that the automatic stabilizers and the countercyclical fiscal policy, as a whole, reduce the output

volatility. Connecting our empirical results to the Endogenous Growth Theory, we developed the idea that countercyclical fiscal policy boosts long-term economic growth.

We recognized the fiscal policy pattern of the developed nations to be countercyclical, whereas the one of the developing countries to be acyclical. We estimated the 95% confidence interval for the level of output volatility in both samples of countries and the derived results supported our hypothesis that countercyclical fiscal policy reduces output volatility. The volatility of per capita output of the developed nations appeared significantly less than the one of the developing countries.

Moreover, we identified possible determinants of fiscal policy in both good and bad times, where we defined as good times the years, in which the actual output is close to the potential one, and vice versa. We empirically recognized that openness to trade, terms of trade, level of corruption and financial development affect fiscal policy in both samples of developed and developing countries. We proposed the idea that restricted policy makers can use the identified determinants as tools to manipulate fiscal policy.

Although, all of the inferred estimations are robust and statistically significant, they have to be interpreted with caution. Overall, our findings suggest that more fiscal variables and models should be built, in order to credibly prove the conclusions presented in this paper. We admit that further research is needed to fully explain the role of the cyclicity of fiscal policy on output volatility and economic growth.

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Appendix A

Table 20. List of Developed and Developing Countries

| Developed Countries | Developing Countries |
|---------------------|----------------------|
| USA | Colombia |
| Japan | Costa Rica |
| Germany | Cyprus |
| UK | Dominican Republic |
| France | Ethiopia |
| Italy | Guatemala |
| Canada | India |
| | Indonesia |
| | Israel |
| | Kenya |
| | Mauritius |
| | Mexico |
| | Morocco |
| | New Zealand |
| | Pakistan |
| | Panama |
| | Singapore |
| | South Africa |
| | Sri Lanka |
| | Thailand |
| | Tunisia |
| | Turkey |
| | Uruguay |

Table 21. List of Base Variables and Their Sources.

| Base Variable | Source |
|---|---|
| Population | Penn World Table 6.2 |
| GDP Deflator | United Nations Data Online |
| Nominal Total Government Revenues (local currency) | IMF Historical Government Finance Statistics, IMF Government Finance Statistics |
| Nominal Total Government Expenditure (local currency) | IMF Historical Government Finance Statistics, IMF Government Finance Statistics |
| Nominal Gross Domestic Product (local currency) | United Nations Data Online |
| Nominal Tax on Income, Profits and Capital Gains (local currency) | IMF Historical Government Finance Statistics, IMF Government Finance Statistics |
| Unemployment Rate | IMF Data Mapper, OECD Statistics Databases, World Development Indicators Online |
| Nominal Imports (local currency) | World Development Indicators Online |
| Nominal Exports (local currency) | World Development Indicators Online |
| Nominal Private Credit (local currency) | World Development Indicators Online |
| Control of Corruption Index | Transparency International |

+ -

Appendix B

Variables

$$d\ln gdp_{pc} = \Delta \ln(GDP^{pc})$$

$$d\ln rev_{pc} = \Delta \ln(T^{pc})$$

$$d\ln exp_{pc} = \Delta \ln(G^{pc})$$

$$fbgdp = \left(\frac{G-T}{GDP}\right)$$

$$d\ln tipc_{gpc} = \Delta \ln(TIPCG^{pc})$$

$$l1discrblanchard = (DISCR^{Blanchard})_{t-1}$$

$$l1discroecd = (DISCR^{OECD})_{t-1}$$

$$absgdpgappercnt = ABSGDPGAP^{pc}$$

$$goodd\ln rev_{pc} = good\Delta \ln(T^{pc})$$

$$goodd\ln exp_{pc} = \Delta good\ln(G^{pc})$$

$$goodd\ln tipc_{gpc} = good\Delta \ln(TIPCG^{pc})$$

$$goodl1discrblanchard = good(DISCR^{Blanchard})_{t-1}$$

$$goodl1discroecd = good(DISCR^{OECD})_{t-1}$$

$$goodopen = goodOPEN$$

$$goodtot = goodToT$$

$$goodcorr = goodCORR$$

$$goodfindev = goodFinDev$$

$$badd\ln rev_{pc} = bad\Delta \ln(T^{pc})$$

$$badd\ln tipc_{gpc} = bad\Delta \ln(TIPCG^{pc})$$

$$badopen = badOPEN$$

$$badtot = badToT$$

$$badcorr = badCORR$$

$$badfindev = badFinDev$$

Regression Equations - Developed Countries

Eq. (2a)

```
. xtreg d.lnrevpc d.lngdppc, re
```

```
Random-effects GLS regression      Number of obs      =      189
Group variable (i): iid            Number of groups   =        7

R-sq:  within = 0.1868              Obs per group: min =       18
       between = 0.6429              avg =                27.0
       overall = 0.1953              max =                29

Random effects u_i ~ Gaussian      Wald chi2(1)       =      45.39
corr(u_i, X) = 0 (assumed)        Prob > chi2        =      0.0000
```

| D.lnrevpc | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|-------------|-----------|-----------------------------------|------|-------|----------------------|----------|
| -----+----- | | | | | | |
| lngdppc | | | | | | |
| D1. | .9029767 | .1340317 | 6.74 | 0.000 | .6402793 | 1.165674 |
| _cons | .0109222 | .0038473 | 2.84 | 0.005 | .0033817 | .0184627 |
| -----+----- | | | | | | |
| sigma_u | 0 | | | | | |
| sigma_e | .03551612 | | | | | |
| rho | 0 | (fraction of variance due to u_i) | | | | |

Eq. (2b)

```
. xtreg dlnexppc dlngdppc, re
```

```
Random-effects GLS regression      Number of obs      =      189
Group variable (i): iid            Number of groups   =        7

R-sq:  within = 0.0283              Obs per group: min =       18
       between = 0.4302              avg =                27.0
       overall = 0.0216              max =                29

Random effects u_i ~ Gaussian      Wald chi2(1)       =      4.13
corr(u_i, X) = 0 (assumed)        Prob > chi2        =      0.0421
```

| dlnexppc | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|-------------|-----------|-----------------------------------|-------|-------|----------------------|-----------|
| -----+----- | | | | | | |
| dlnexppc | | | | | | |
| dlnexppc | -.2744888 | .1350182 | -2.03 | 0.042 | -.5391197 | -.0098579 |
| _cons | .0329449 | .0038756 | 8.50 | 0.000 | .0253489 | .0405409 |
| -----+----- | | | | | | |
| sigma_u | 0 | | | | | |
| sigma_e | .03553705 | | | | | |
| rho | 0 | (fraction of variance due to u_i) | | | | |

Eq. (3a)

```
. xtreg dlntipcgpc d.lngdppc, re
```

```
Random-effects GLS regression           Number of obs   =       188
Group variable (i): iid                 Number of groups =         7

R-sq:  within = 0.1370                   Obs per group:  min =        18
        between = 0.2175                                     avg =       26.9
        overall = 0.1390                                     max =        29

Random effects u_i ~ Gaussian           Wald chi2(1)    =       29.88
corr(u_i, X) = 0 (assumed)              Prob > chi2     =       0.0000
```

| dlntipcgpc | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|------------|-----------|-----------------------------------|------|-------|----------------------|----------|
| <hr/> | | | | | | |
| lngdppc | | | | | | |
| D1. | 1.428696 | .2613784 | 5.47 | 0.000 | .9164039 | 1.940988 |
| _cons | .0039417 | .0086547 | 0.46 | 0.649 | -.0130212 | .0209046 |
| <hr/> | | | | | | |
| sigma_u | .01151279 | | | | | |
| sigma_e | .06809357 | | | | | |
| rho | .02779128 | (fraction of variance due to u_i) | | | | |

Eq. (5b)

```
. xtreg lldiscreoecd dlngdppc, re
```

```
Random-effects GLS regression           Number of obs   =       182
Group variable (i): iid                 Number of groups =         7

R-sq:  within = 0.0004                   Obs per group:  min =        17
        between = 0.1143                                     avg =       26.0
        overall = 0.0003                                     max =        28

Random effects u_i ~ Gaussian           Wald chi2(1)    =         0.05
corr(u_i, X) = 0 (assumed)              Prob > chi2     =       0.8215
```

| lldiscreoecd | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|--------------|-----------|-----------------------------------|-------|-------|----------------------|----------|
| <hr/> | | | | | | |
| dlngdppc | -.0122736 | .0544156 | -0.23 | 0.822 | -.1189263 | .094379 |
| _cons | -.0005896 | .0014848 | -0.40 | 0.691 | -.0034997 | .0023206 |
| <hr/> | | | | | | |
| sigma_u | 0 | | | | | |
| sigma_e | .01367587 | | | | | |
| rho | 0 | (fraction of variance due to u_i) | | | | |

Eq. (8a)

```
. xtreg gooddlnevpc goodcorr goodfindev goodopen goodtot, robust fe
```

Fixed-effects (within) regression Number of obs = 68
Group variable (i): iid Number of groups = 7

R-sq: within = 0.0915 Obs per group: min = 7
 between = 0.0273 avg = 9.7
 overall = 0.0153 max = 13

corr(u_i, Xb) = -0.8900 F(4,57) = 2.07
 Prob > F = 0.0970

| gooddlnevpc | Coef. | Robust Std. Err. | t | P> t | [95% Conf. Interval] | |
|-------------|-----------|-----------------------------------|-------|-------|----------------------|-----------|
| goodcorr | -.0006915 | .0066657 | -0.10 | 0.918 | -.0140393 | .0126562 |
| goodfindev | -.0000611 | .0168743 | -0.00 | 0.997 | -.0338514 | .0337292 |
| goodopen | -.1092816 | .0519779 | -2.10 | 0.040 | -.2133655 | -.0051978 |
| goodtot | -.053976 | .0484979 | -1.11 | 0.270 | -.1510915 | .0431395 |
| _cons | .1348561 | .0853306 | 1.58 | 0.120 | -.0360156 | .3057278 |
| sigma_u | .02658407 | | | | | |
| sigma_e | .02568375 | | | | | |
| rho | .51722012 | (fraction of variance due to u_i) | | | | |

Eq. (8a)

```
. xtreg gooddlnexppc goodcorr goodfindev goodopen goodtot, re
```

Random-effects GLS regression Number of obs = 68
Group variable (i): iid Number of groups = 7

R-sq: within = 0.1596 Obs per group: min = 7
 between = 0.1496 avg = 9.7
 overall = 0.1340 max = 13

Random effects u_i ~ Gaussian Wald chi2(4) = 9.75
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0449

| gooddlnexppc | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|--------------|-----------|-----------------------------------|-------|-------|----------------------|-----------|
| goodcorr | .0065113 | .0033583 | 1.94 | 0.053 | -.0000708 | .0130934 |
| goodfindev | -.0288108 | .0125081 | -2.30 | 0.021 | -.0533262 | -.0042953 |
| goodopen | -.0099394 | .0208069 | -0.48 | 0.633 | -.0507201 | .0308413 |
| goodtot | -.0207907 | .0312521 | -0.67 | 0.506 | -.0820437 | .0404623 |
| _cons | .0194966 | .039233 | 0.50 | 0.619 | -.0573986 | .0963919 |
| sigma_u | 0 | | | | | |
| sigma_e | .02683267 | | | | | |
| rho | 0 | (fraction of variance due to u_i) | | | | |

Eq. (8b)

```

. xtreg      baddlntipcgp badcorr badfindev badtot badopen, re

Random-effects GLS regression           Number of obs   =       37
Group variable (i): iid                 Number of groups =        6

R-sq:  within = 0.0564                   Obs per group:  min =        4
        between = 0.7371                                     avg =       6.2
        overall = 0.2573                                     max =       10

Random effects u_i ~ Gaussian           Wald chi2(4)     =       11.09
corr(u_i, X) = 0 (assumed)             Prob > chi2      =       0.0256

-----+-----
baddlntipc~c |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      badcorr |   -0.0190846   .0091967    -2.08   0.038   -0.0371099   -0.0010593
      badfindev |   -0.063973   .0484295    -1.32   0.187   -0.1588931    .0309472
      badtot |   -0.1136766   .1403825    -0.81   0.418   -0.3888212    .161468
      badopen |    .0712178   .0591759     1.20   0.229   -0.0447649    .1872005
      _cons |    .3001741   .1492245     2.01   0.044    .0076994    .5926488
-----+-----
      sigma_u |           0
      sigma_e |   .05605436
      rho |           0   (fraction of variance due to u_i)

```

Regression Equations - Developing Countries

Eq. (2a)

```
. xtreg dlnevpc dlngdppc, re
```

```
Random-effects GLS regression           Number of obs   =       554
Group variable (i): iid                 Number of groups =        23

R-sq:  within = 0.2403                   Obs per group:  min =         9
        between = 0.6047                   avg =       24.1
        overall = 0.2513                   max =        29

Random effects u_i ~ Gaussian           Wald chi2(1)    =       185.29
corr(u_i, X) = 0 (assumed)              Prob > chi2     =        0.0000
```

| | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|----------|-----------|-----------------------------------|-------|-------|----------------------|----------|
| dlnevpc | | | | | | |
| dlngdppc | 1.033266 | .0759077 | 13.61 | 0.000 | .8844894 | 1.182042 |
| _cons | .0084197 | .003717 | 2.27 | 0.024 | .0011345 | .0157049 |
| sigma_u | 0 | | | | | |
| sigma_e | .08079114 | | | | | |
| rho | 0 | (fraction of variance due to u_i) | | | | |

Eq. (2b)

```
. xtreg dlnextppc dlngdppc, re
```

```
Random-effects GLS regression           Number of obs   =       554
Group variable (i): iid                 Number of groups =        23

R-sq:  within = 0.0782                   Obs per group:  min =         9
        between = 0.4849                   avg =       24.1
        overall = 0.0870                   max =        29

Random effects u_i ~ Gaussian           Wald chi2(1)    =        52.58
corr(u_i, X) = 0 (assumed)              Prob > chi2     =        0.0000
```

| | Coef. | Std. Err. | z | P> z | [95% Conf. Interval] | |
|-----------|-----------|-----------------------------------|------|-------|----------------------|----------|
| dlnextppc | | | | | | |
| dlngdppc | .7477493 | .1031221 | 7.25 | 0.000 | .5456337 | .9498648 |
| _cons | .0092211 | .0050496 | 1.83 | 0.068 | -.000676 | .0191182 |
| sigma_u | 0 | | | | | |
| sigma_e | .10989482 | | | | | |
| rho | 0 | (fraction of variance due to u_i) | | | | |

Eq. (2c)

```
. xtreg fbgdp dlngdppc, re

Random-effects GLS regression           Number of obs   =       554
Group variable (i): iid                 Number of groups =        23

R-sq:  within = 0.0109                  Obs per group:  min =         9
        between = 0.0718                                     avg =       24.1
        overall = 0.0222                                     max =        29

Random effects u_i ~ Gaussian           Wald chi2(1)    =        6.48
corr(u_i, X) = 0 (assumed)             Prob > chi2     =       0.0109

-----+-----
      fbgdp |          Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      dlngdppc |   -0.0930149   .0365448    -2.55  0.011    -0.1646413   -0.0213884
      _cons |    .0218898   .00545     4.02  0.000     0.0112079    0.0325717
-----+-----
      sigma_u |          .0247497
      sigma_e |          .03610431
      rho |          .31968986   (fraction of variance due to u_i)
```

Eq. (3a)

```
. xtreg dlntipcgpc dlngdppc, re

Random-effects GLS regression           Number of obs   =       551
Group variable (i): iid                 Number of groups =        23

R-sq:  within = 0.1148                  Obs per group:  min =         9
        between = 0.5552                                     avg =       24.0
        overall = 0.1256                                     max =        29

Random effects u_i ~ Gaussian           Wald chi2(1)    =       78.88
corr(u_i, X) = 0 (assumed)             Prob > chi2     =       0.0000

-----+-----
      dlntipcgpc |          Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      dlngdppc |    1.198119   .1349002     8.88  0.000     0.9337197    1.462519
      _cons |    .0092056   .0065758     1.40  0.162    -0.0036828    0.022094
-----+-----
      sigma_u |          0
      sigma_e |    .14288015
      rho |          0   (fraction of variance due to u_i)
```

Eq. (5a)

```
. xtreg lldiscrblanchard dlngdppc, re

Random-effects GLS regression           Number of obs   =       185
Group variable (i): iid                 Number of groups =        15

R-sq:  within = 0.0081                   Obs per group:  min =         3
        between = 0.0318                  avg =       12.3
        overall = 0.0004                  max =        24

Random effects u_i ~ Gaussian           Wald chi2(1)    =        1.14
corr(u_i, X) = 0 (assumed)              Prob > chi2     =       0.2865

-----+-----
lldiscrbla~d |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      dlngdppc |  -0.0524182   .0491853    -1.07  0.287    -0.1488197   0.0439833
       _cons   |  -0.0133394   .0053238    -2.51  0.012    -0.0237737  -0.002905
-----+-----
      sigma_u   |      .01818021
      sigma_e   |      .02831349
       rho     |      .29193405   (fraction of variance due to u_i)
```

Eq. (5b)

```
. xtreg lldiscroecd dlngdppc, re

Random-effects GLS regression           Number of obs   =       526
Group variable (i): iid                 Number of groups =        23

R-sq:  within = 0.0293                   Obs per group:  min =         8
        between = 0.0380                  avg =       22.9
        overall = 0.0280                  max =        28

Random effects u_i ~ Gaussian           Wald chi2(1)    =       15.09
corr(u_i, X) = 0 (assumed)              Prob > chi2     =       0.0001

-----+-----
lldiscroecd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      dlngdppc | -0.0895968   .0230682    -3.88  0.000    -0.1348096  -0.0443839
       _cons   |   0.000619   .0011129     0.56  0.578    -0.0015621   0.0028002
-----+-----
      sigma_u   |           0
      sigma_e   |   0.02374424
       rho     |           0   (fraction of variance due to u_i)
```


Eq. (8a)

```

. xtreg          goodl1dis~cd goodcorr goodfindev goodopen goodtot, re

Random-effects GLS regression              Number of obs   =       109
Group variable (i): iid                   Number of groups =        18

R-sq:  within = 0.0099                    Obs per group:  min =         1
        between = 0.0056                  avg =         6.1
        overall = 0.0158                  max =         16

Random effects u_i ~ Gaussian              Wald chi2(4)     =         1.67
corr(u_i, X) = 0 (assumed)                Prob > chi2      =         0.7954

-----+-----
goodl1dis~cd |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
    goodcorr |    .0011558   .0010563     1.09   0.274    - .0009146   .0032262
   goodfindev |   -.0088516   .0100007    -0.89   0.376    - .0284526   .0107494
    goodopen |    .0040126   .009485     0.42   0.672    - .0145776   .0226029
    goodtot  |   -.0033227   .0098245    -0.34   0.735    - .0225784   .0159331
      _cons  |   -.0015552   .0104118    -0.15   0.881    - .021962    .0188516
-----+-----
    sigma_u  |           0
    sigma_e  |    .02388355
      rho    |           0   (fraction of variance due to u_i)

```