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Dissertation Paper

The impact of the trade and financial openness on the economic growth in the countries from the Eastern Europe

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Abstract

The impact of trade and financial openness can be measured by the sensitivity of the first moment of the economic growth. Taking into account the domestic conditions, this paper provides an empirical evaluation of the impact of globalization on the economic growth in the Eastern Europe. The data set includes a sample of 9 countries from the Eastern Europe, which are member states of the EU. This paper investigates the possibility of a non-monotonic relationship between the trade/financial openness and the economic growth. The analysis of non-linearity is done by allowing the effects of trade/financial integration to vary with the general level of economic development.

The econometric models used in the analysis are the dynamic panel data models: the "Difference" GMM (Arellano-Bond (1991)) and the "System" GMM (Arellano-Bover(1995)/Blundell-Bond(1998)). These models are designed for a dynamic persistent panel data with few time periods and many individuals, with endogenous regressors, with fixed effect, with heteroskedasticity and auto-correlation within cross-sections.

The main conclusions of this paper are that trade openness has a significant positive impact on the economic growth while the impact of the financial integration is a negative one. This analysis reveals a strong non-linearity of the impact of trade openness on the economic growth. The non-linearity of the financial openness impact on the economic growth couldn't be deduced.

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1. Introduction

The analysis of the relationship between globalization and macroeconomic performance represents a main interest of the growing empirical literature. The central aspect of globalization is the world trend towards a larger financial and trade openness. This trend is observed in the case of both developing and industrial economies. The recent wave of globalization started in the mid of the 1980s, with a rising cross-border financial flow.

There is an intense debate between policy makers and academics about the impact of the financial and trade integration on the economic growth. The general economic theory suggests that the financial globalization has a significant potential benefit and can induce a more efficient allocation of resources, provide possibilities for risk diversification, strengthen macroeconomic policies and promote the development of the country.

The neo-classical framework suggests that the worldwide financial globalization should lead to a flow of capital from the rich countries to the poor countries, because the expected return in the capital from the poor countries is higher. This flow of capital toward the poor countries is expected to lead to an increase in investments, to the "import" of the managerial skills and other forms of organizational expertise, to foster the development of the home financial markets and impose discipline on the macroeconomic policies.

The policy makers from the developed countries have been integrating the domestic economies into the world markets in order to reap the potential benefits of the globalization. Following the same logic, the less developed countries should proceed in this way too. Nevertheless this issue is very controversial. Globalization can intensify the external exposure, measured by the sensitivity of the economic growth to the openness of the national economy. In the process of integration, the poor countries may be more vulnerable due to their specialization in production, to the non-diversified sources of income, to the weak institutions and the unstable macroeconomic policies. Thus, a premature opening of the domestic economy towards the international markets without having some basic supporting conditions can affect the country and make her more vulnerable to the external shocks.

Unfortunately, the existing literature does not provide a systematic and consistent empirical analysis of the relationship between financial and trade openness and economic growth.

The source of debate, related to the impact of globalization, is a mixed set of observed results from the empirical literature. One of the possible explanations may be the difficulty of quantifying the grade of the financial and trade liberalization and the difficulties to measure the liberalizations in a consistent way among different countries.

Other sources of divergences are represented by the fact that the studies include different countries and periods in their samples and use diverse econometric techniques.

The countries from the Eastern Europe began to integrate their economies into the world markets of goods and services as well in the world financial market from the end of the 1980s. The enlargement of the European Union brought additional incentives for the Eastern European countries to further integrate their national economies in both the european and global markets. Although all the countries from my sample are now members of the EU, it doesn't mean that the process of their integration is at the end.

There is little empirical analysis on the effect of trade and financial integration of the Eastern Europe countries on the economic growth of the domestic economies. The objective of this paper is to shed some light on the impact of the trade and financial integration of the Eastern Europe on the growth rate of GDP per capita.

2. De Jure vs. De Facto measures of financial and trade openness.

The analysis of financial and trade openness is based on two classes of indicators of the openness. The first one refers to the legal[1] measures which reflect the restrictions or barriers imposed on the international trade volumes and flows/stocks of capital. The second group of indicators refers to the de facto measures of openness. They reflect the actual trade volumes, the capital flows between countries and the capital stocks of foreigners in the domestic economy or vice versa.

1 Legal (De Jure) measures of financial openness are mainly based on the information of capital control in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions.

The former set of indicators reveals the official policy of the authorities from the home country regarding trade or financial integration. This class of measures reflects exogenous policy conditions. The latter set of indicators displays the actual level of trade and financial integration of the domestic economy and it is heavily influenced by the country's specific features such as: size, production specialization, geographical conditions, etc. In this set of measures the indicators have a high degree of correlation between them. This fact makes them endogenous to the first moments of the economic growth. The de facto measures reflect the actual level of financial and trade integration of the domestic country in the world markets of goods, services and capital.

The empirical studies which use measures of the de facto trade and financial integration tend to give more robust and significant results.

3. Literature review.

There is a growing empirical literature which is trying to shed light on the effect of financial and trade openness on the economic growth. Most of the empirical analyses is unable to find a robust evidence in the support of the growth benefits of the globalization – the trade and financial ones. In the same time some of the researches have found a threshold, mainly related to the economic level of development. Only after the country has met the threshold conditions, can it reap the benefits of trade and financial integration.

Some of the researches – Rodrik (1998), Bhagwati (1998), Stiglitz (2002) – see in the further financial globalization a primary obstacle to the stability of the world financial markets. Thus, they are calling for the control of capital flows and argue for the introduction of the barriers on the international trade, such as the "Tobin taxes". Other authors consider that the financial integration helps the poor countries to develop, while bringing more stability among the industrial countries – Fischer (1998), Summers (2002).

Even if the empirical literature is developing and highlights the positive robust effect of the financial and trade openness on the economic growth, there are many unanswered questions about how a country can reap these positive effects and how it should proceed in the progress toward a higher degree of liberalization in both the trade and financial aspect.

3.1 The financial openness and growth.

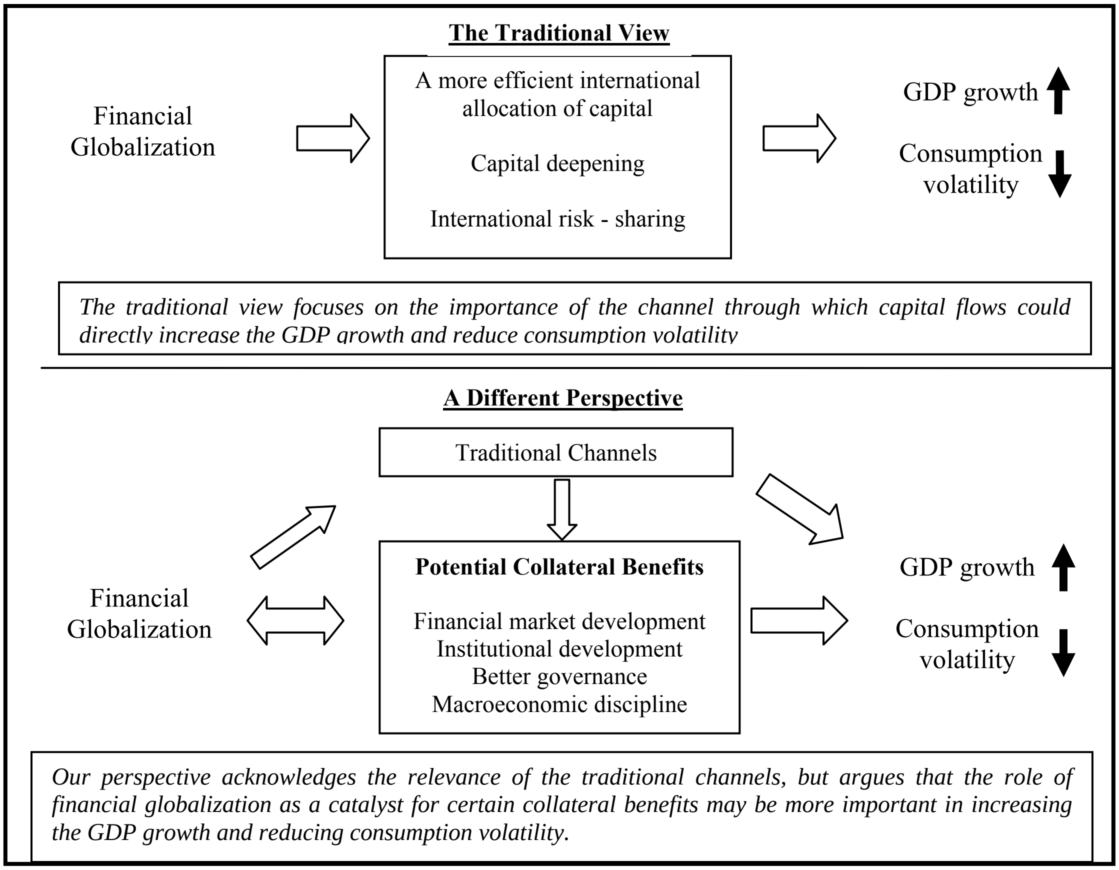
The impact of financial integration on the economic growth became of interest for the researchers mainly beginning with the 1990s of the XX century. The Asian financial crisis from 1997-1998 revealed the international contamination of the macroeconomic instability from one country to another and the deregulation of the international capital flows. One of the lessons of that crisis is that in the presence of weak financial and fiscal institutions, the capital account liberalization can be followed by a balance-of-payment crises. Nevertheless, there is little evidence from the empirical works that the financial integration is responsible for the world financial crisis.

Kose, Prasad, Rogoff and Wei (2006) suggest in their paper that the financial globalization brings benefits not only through the traditional channel but also through a set of "collateral benefits" (see figure below).

The studies related to the impact of the financial globalization on growth use very different measures, data samples, year span and models. Quinn Dennis (1997) has found a significant positive effect of financial openness on the economic growth. Edison, Klein, Ricci and Sloek (2002) discovered a positive and statistically significant growth effect of financial integration too. Another conclusion made by them is that the countries from the East Asia have a more pronounced positive effect of the capital account liberalization than the rest of the world.

The other authors have not found a robust evidence of neither positive nor negative effects of the financial openness on growth. Grilli and Milesi-Ferretti (1995) have found the fact that capital controls and capital flow restrictions are associated with a higher rate of inflation and also a higher rate of seigniorage in the total taxes. In the same time they haven't found any robust correlation between the capital account restrictions and the economic growth. Razin and Rubinstein (2004) have analyzed the impact of the financial liberalization through the perspective of exchange rate regimes. Their conclusion is that the countries with different exchange rate regimes experienced different growth rates. The other empirical analyses which are part of this group are: Kraay (1998), Rodrik (1998), O'Donnell (2001), Edison, Levine (2002).

Figure 1: Two views regarding the Impact of Financial Globalization on Developing Countries[2].



Kose (2005) haven't found a robust positive effect of the financial openness on the growth rate but he showed that an interaction between the financial integration and the growth volatility will turn the negative effect of the volatility into a positive one.

Some of the researches have supposed a non-monotonic effect of the financial openness on the growth rate of GDP per capita, so they have tested the significance of the interactions term between the financial integration measures and other variables, as for example GDP per capita in level – Calderon, Loayza and Scmidt-Hebbel (2005). The main conclusion is that the external financial openness has a tendency to reduce the growth in the countries that are not industrialized – Klein and Olivei (2000), have a low income level – Edwards (2001) and have a high black market premium – Arteta (2001), while the effect on the countries with opposite features is inverse. Klein (2003) has

[2] See M. Ayhan Kose, Eswar Prasad, Kenneth Rogoff, and Shang-Jin Wei (2006), "Financial Globalization: A Reappraisal", IMF Working Paper, Research Department, page 5.

checked if the interaction term of the financial openness with the government quality and with the GDP per capita has a significant influence on the GDP growth rate. His conclusion was that a high financial integration only raises the growth rate in the middle-income countries.

Hence, the latest studies have robust results that confirm that the relationship between the financial integration and the growth rate is non-monotonic. At lower levels of development of the domestic economy, the financial openness lowers the growth rate while in the developed economies the financial integration induces an increase in the growth rate. The main reason for the negative impact of the financial globalization on the low income countries is that the financial integration in these countries is combined with a low-quality government, poor public institutions and an ineffective supervision of the financial institutions.

3.2 The trade openness and growth.

There is a large amount of empirical literature regarding the effect of the trade liberalization on the economic growth. As in the case of the financial openness, the empirical studies on the effects of the trade openness differ significantly in regards of analyzed variables, trade openness measures, control variables, data samples and econometric models.

Some of the studies made in the ‘90s have found a significant positive effect of the trade liberalization on the economic growth: Dollar (1992), Ben-David (1993), Sachs and Warner (1995) Edwards (1998) Frankel and Romer (1999). Some of these researches have been criticized for possible biases in the estimated coefficients because of the endogeneity of the explanatory variables, the inclusion of the irrelevant control variables or inadequate data samples and econometric techniques.

Rodrik (2004) emphasized that the trade openness is not robust to the inclusion of the institutional quality indicators. In the same year Bolaki and Freund (2004) got to the conclusion that trade openness doesn’t have a positive effect on the growth rate and doesn’t influence the level of GDP per capita in the case of highly regulated economies. Rigobon and Rodrik (2005) got to the conclusion that trade openness has a negative effect on the income levels per capita. He used the quality of the institutions and the geography as control variables.

In contrast, other recent studies reported a robust and significant effect of the trade openness on the growth rate such as: Wacziarg (2001), Irvin and Tervio (2002), Alcala and Ciccone (2004), Kose (2005). There is an interesting conclusion obtained by Dollar, Kraay (2002), Wacziarg and Welch (2003) which is represented by the fact that trade openness has a no robust effect on the growth rate in the cross-section estimation techniques but has a robust one in the case when the panel data models are used.

Alesina (2005) has introduced in the analysis an interaction term between the trade openness and the country's size and found out that trade openness has a large effect in the small countries but these effects become zero as the country's size increases.

Calderon, Loayza and Schmidt-Hebbel (2005) analyzed the effect of the trade and financial openness depending on the level of development of the economy. They used GDP per capita as a proxy of the level of development. They have found that the effect of the trade and financial openness on the economic growth is concave.

Chang, Kaltani, and Loayza (2005) have found that the economic growth effect of trade liberalization is positive and robust but only in the case that the trade openness is going together with economic reforms.

Aksoy (2006) used the within-country estimation and got to the conclusion that trade liberalization induces a significant growth of GDP per capita in the developing countries. Another conclusion of this author is that trade openness doesn't change significantly the level of industrialization of an economy.

Therefore, the recent studies reached the conclusion that trade openness has a positive effect on the economic growth.

4. Model specifications

The investigation of economic growth and the factors that influence it has been the interest of the researches for a long period of time. The empirical researches of the first and the second moment of the economic growth have some problems with the estimation of the growth regressions. One of the main difficulties is that the right-hand-side variables (regressors) are endogenous and measured with error. Another difficulty is represented by the omitted variables. For example, one variable that should be included in the growth estimation model is the initial level of efficiency which is unobservable. This means that the least squares estimator is biased, because the omitted variable is correlated with at least one of the regressors, for example with the initial level of GDP per capita. The other cause of biases is that there are some indicators which present difficulty in measurement, for example: the political stability, the quality of macroeconomic policy, the financial depth, etc.

Ideally the researches would like to use a model that allows the endogeneity of the regressors, the measurement error and omitted variables. In order to address these problems researches increasingly use a more sophisticated cross-section and time series methods. One of the most known methods is the dynamic model of the first–differenced equation estimated by the Generalized Method of Moments approach, developed by Arellano – Bond (1991). Nevertheless, this model has a serious problem in estimating the persistent time series and more attention is paid to an alternative approach for the panel data - “System” GMM.

Both the “Difference” GMM and “System” GMM estimators represent the broader historical trend in econometric practice toward estimators that make fewer assumptions about the data generating process and use more complex techniques in order to isolate useful information included in the available data sets.

4.1 Instrumental variables and Efficient GMM.

The basic assumption in the OLS estimation approach is that the regressors on the right-hand-side of the equation are orthogonal to the errors. The Two Stage Least Squares (2SLS) model distinguishes between regressors and instruments while allowing the two categories to overlap[3]. The 2SLS is implemented through the OLS model in two steps. In order to give an example we will take into consideration the following regression:

$$y = x^{'}\beta + \varepsilon \text{ with the assumptions: } E[z\varepsilon] = 0 \text{ and } E[\varepsilon|z] = 0$$

[3] The method of instrumental variables (IV) provides solution when some of the regressors are endogenous. IV has to satisfy two primary conditions:

- $Cov(z_1,\varepsilon) = 0$ and
- $Cov(z_1,x_1) \neq 0$

Where x_1 is endogenous regressor , z_1 is instrument for x_1 and ε is idiosyncratic error. (see Wooldridge, J. M., 2001, “Econometric Analysis of Cross Section and Panel Data” The MIT Press, pages 83-84) where β is a column of coefficients, y and ε are the dependent variable and respectively the idiosyncratic error, x is a column of the k regressors and z is column of j instruments. x and z can have some common elements ,with the condition that j ≥ k. X, Y and Z are the matrices of N observations for x, y and z and define E = Y – Xβ. In case of a given estimator $\hat{\beta}$ (estimated, for example with the OLS regression), the empirical errors are: $\hat{E} = \left[\hat{e}_1 \ldots \hat{e}_N\right] = Y - X\hat{\beta}$. In this moment there are no assumptions about the matrix of variance – covariance of the errors: $E\left[EE^{'}\middle|Z\right] \equiv \Omega$.

In the estimation process, the model with its instruments, that theoretically are orthogonal to the error term $E[z\varepsilon] = 0$, is trying to force the corresponding vector of the empirical results $E_N[z\varepsilon] = \frac{1}{N} Z^{'}\hat{E}$ to zero. During this process the model creates a system with more equations than variables, if the instruments outnumber the parameters. In this case it is said that the model is over-identified. Since it is impossible to satisfy all the moments at once, the problem is to satisfy them as well as possible, that in the common sense means to minimize the vector $E_N[z\varepsilon]$.

In the Generalized Method of Moments one defines that magnitude through a generalized metric based on a positive semi-definite quadratic form of matrix - A. Then the system which needs to be minimized looks like:

$$\left\|E_N[z\varepsilon]\right\|_A = \left\|\frac{1}{N} Z^{'}\hat{E}\right\|_A = N\left(\frac{1}{N} Z^{'}\hat{E}\right)^{'} A\left(\frac{1}{N} Z^{'}\hat{E}\right) = \frac{1}{N}\hat{E}^{'} ZAZ^{'}\hat{E}$$

In order to derive the implied GMM estimator ($\hat{\beta}_A$) the minimization problem has to be solved: $\hat{\beta}_A = \arg\min_{\hat{\beta}} \left\|Z^{'}\hat{E}\right\|_A$ whose solution is determined by $\frac{d}{d\hat{\beta}}\left\|Z^{'}\hat{E}\right\|_A = 0$.

It is known that $\frac{d(Ab)}{db} = A$ and $\frac{d(b^{'}Ab)}{db} = 2b^{'}A$, where b is a column vector and A is a symmetric matrix.

The minimization problem can be resolved by:

$$0=\frac{d}{d\hat{\beta}}\left\|Z^{'}\hat{E}\right\|_{A}=\frac{d}{d\hat{E}}\left\|Z^{'}\hat{E}\right\|_{A}\frac{d\hat{E}}{d\hat{\beta}}=\frac{d}{d\hat{E}}\left(\frac{1}{N}\hat{E}^{'}\left(ZAZ^{'}\right)\hat{E}\right)\frac{d\left(Y-x\hat{\beta}\right)}{d\hat{\beta}}=\frac{2}{N}\hat{E}\,ZAZ^{'}(-X)$$

The factor 2/N is dropped and the estimator of β is:

$$0=\hat{E}^{'}\,ZAZ^{'}X=(Y-X\,\hat{\beta}_{A})^{'}ZAZ^{'}X=Y^{'}ZAZ^{'}X-\hat{\beta}_{A}\,X^{'}ZAZ^{'}X\Rightarrow\hat{\beta}_{A}\,X^{'}ZAZ^{'}X=Y^{'}ZAZ^{'}X$$

and the final result of β estimator is:

$$\hat{\beta}=(X^{'}ZAZ^{'}X)^{-1}X^{'}ZAZ^{'}Y^{'}$$

This is the GMM estimator introduced by Hansen A. (1982) who demonstrated that the GMM estimator is consistent, meaning that it converges in probability to β as the sample size goes to the infinity. But this estimator has a problem in the sense that it is not generally unbiased. The bias of the estimator is:

$$\begin{aligned}\hat{\beta}_{A}-\beta&=\left(X^{'}ZAZ^{'}X\right)^{-1}X^{'}ZAZ^{'}\left(X\beta+E\right)-\beta\\&=\left(X^{'}ZAZ^{'}X\right)^{-1}X^{'}ZAZ^{'}X\beta+\left(X^{'}ZAZ^{'}X\right)^{-1}X^{'}ZAZ^{'}E-\beta\\&=\left(X^{'}ZAZ^{'}X\right)^{-1}X^{'}ZAZ^{'}E\end{aligned}$$

It can be observed that each choice of A implies a different linear consistent estimator of β. The logical question is which A should researches choose? In order to get an efficient GMM estimator A must represent weight moments in inverse proportion to their variances and co-variances matrix of moments (Ω), which means:

$$A_{EGMM}=Var\left[Z^{'}E\right]^{-1}=\left(Z^{'}Var\left[E|Z\right]Z\right)^{-1}=\left(Z^{'}\Omega Z\right)^{-1}$$ [4]

Substituting this choice of A into the formula for efficient GMM, we have:

$$\hat{\beta}_{EGMM}\left(X^{'}Z\left(Z^{'}\Omega Z\right)^{-1}Z^{'}X\right)^{-1}X^{'}Z\left(Z^{'}\Omega Z\right)^{-1}Z^{'}Y$$

Till now the efficient GMM is not feasible because Ω is unknown.

[4] EGMM is the abbreviation from “efficient GMM”.

4.2 Feasible GMM

To get a feasible GMM estimation of the expression, $Z'\Omega Z$ is needed. In the case that it is assumed that errors are homoskedastic, the EGMM is the same with 2SLS estimator and it looks like:

$\hat{\beta}_{2SLS} = \left(X'Z(Z'Z)^{-1}Z'X\right)^{-1} X'Z(Z'Z)^{-1}Z'Y$; where Ω is the form of σ^2I.

If more complex patterns of variance in the error are suspected, we should use other types of estimators for the standard errors. The $\hat{\Omega}$ matrix can be estimated based on the formula that itself is not asymptotically convergent to the Ω, but which has the advantage that $\frac{1}{N}Z'\hat{\Omega}Z$ is a consistent estimator of $\frac{1}{N}Z'\Omega Z$.

If we believe that there is heteroskedasticity in the errors between cross sections, then, using the consistent estimates of the residuals $\hat{E}$, $\hat{\Omega}$ can be defined as:

$$\hat{\Omega} = \begin{bmatrix} \hat{e}_1^{\,2} & 0 & . & 0 \\ 0 & \hat{e}_2^{\,2} & . & 0 \\ . & . & . & . \\ 0 & 0 & 0 & \hat{e}_N^{\,2} \end{bmatrix}$$

Similarly, if we suppose that there are arbitrary patterns of covariance within individuals with a “clustered” $\hat{\Omega}$, then the block diagonal matrix has the form:

$$\hat{\Omega}_i = \hat{E}_i \hat{E}_i' = \begin{bmatrix} \hat{e}_{i,1}^{\,2} & \hat{e}_{i,1}\hat{e}_{i,2} & . & \hat{e}_{i,1}\hat{e}_{i,T} \\ \hat{e}_{i,2}\hat{e}_{i,1} & \hat{e}_{i,2}^{\,2} & . & \hat{e}_{i,2}\hat{e}_{i,T} \\ . & . & . & . \\ \hat{e}_{i,T}\hat{e}_{i,1} & \hat{e}_{i,T}\hat{e}_{i,2} & . & \hat{e}_{i,T}^{\,2} \end{bmatrix}$$

where $\hat{E}_i$ is the vector of residuals for cross section i, and T is a number of observations per cross section.

In the equation above, $\hat{e}$ is derived from an initial consistent estimator of β. The usual practice to derive the initial consistent estimators of β is to choose A = $(Z'HZ)^{-1}$, where H is an estimator of Ω based on a minimal arbitrary assumption about the error, for example homoskedasticity.

Hence, to obtain an efficient and feasible GMM estimator, the initial GMM regressor is performed, where Ω is replaced by an arbitrarily chosen H (one step GMM), to obtain the residuals from this estimation. Then these residuals are used to construct a proxy for the matrix of variance-covariance, which is noted $\hat{\Omega}_{\beta_1}$. After that we return to the GMM estimation and set $A = \left(Z' \hat{\Omega}_{\beta_1} Z \right)^{-1}$. This two-step estimator ($\hat{\beta}_2$) is asymptotically efficient and robust to whatever patterns of heteroskedasticity and cross-correlation of the errors. In conclusion, it can be written:

$$\hat{\beta}_1 = \left(X'Z(Z'HZ)^{-1} Z'X \right)^{-1} X'Z(Z'HZ)^{-1} Z'Y$$

$$\hat{\beta}_2 = \hat{\beta}_{EFGMM} = \left(X'Z \left(Z' \hat{\Omega}_{\beta_1} Z \right)^{-1} Z'X \right)^{-1} X'Z \left(Z' \hat{\Omega}_{\beta_1} Z \right)^{-1} Z'Y$$

Therefore, researchers often report one step results for small samples because of the downward bias in the calculated standard errors in the two-step approach. Windmeijer (2005) demonstrated that the two-step GMM is a good estimator for the infeasible GMM estimator where the true value of the parameters is used to deduce the Ω matrix.

In the case of small samples, the two-step GMM estimator is biased due to the fact that the asymptotic standard errors, which are calculated using the $\hat{\beta}_1$ estimator from the first step, don’t take into account the variation of the small samples.

4.3 The Dynamic Panel data models: The “Difference” and “System” GMM

In this empirical analysis we use the dynamic panel data models developed by Arellano – Bond (1991) - “Difference” GMM, and Arellano – Bover (1995)/Blundell – Bond (1998) - “System” GMM, which are becoming increasingly popular.

These models are extremely useful in the following situations:

1) There are few time periods and many individuals.

2) There is a linear functional relationship between the dependent variable and its regressors.

3) The single left side variable (dependent variable) is dynamic so its current realizations depend on its own past realizations.

4) The regressors are correlated with the past and possible current realizations of the error, meaning that the independent variables are not strictly exogenous.

5) There is heteroskedasticity and autocorrelation within individuals, but not across them - the idiosyncratic errors are uncorrelated across individuals.

6) There may be an arbitrarily distributed fixed effect for each set of cross sections. This argues against cross section regressions, which are unable to take into account a fixed effect and in the favor of panel data models.

7) Some regressors may be predetermined but not strictly exogenous.

8) The available set of instrumental variables is called the "internal" set of instruments – based on lags of instrumented variables and lags of differences of the instrumented variables[5].

The Arellano – Bond model transforms all the regressors by using the first difference and then uses the Generalized Method of Moments developed by Hansen (1982). A similar estimator was originally developed by Holtz-Eakin, Newey and Rosen (1988). They demonstrated that it is inappropriate to apply standard techniques for estimating vector autoregressions for short panel data set with ten – twelve years of observations for each unit and with possible individual heteroskedasticity. The authors Casseli, Esquivel and Lefort (1996) are one of the researches who used the Generalized Method of Moments to estimate a cross-country gross regression, in order to eliminate the problem related to the correlated individual effects and the endogeneity of the explanatory variables.

The basic idea of the Arellano – Bond approach is to write the regression equation as a dynamic one, in the sense that the lagged dependent variable will appear on the right-hand-side of the equation. The first step of the "Difference" GMM is to difference the equation within each cross section in order to remove the time invariant country specific

[5] It is worth noting that the model permits to use external instruments too.

effect and then to instrument the right-hand-side variables in the first differenced equation using the levels of the series lagged two periods or more.

This model has some advantages such as: estimates are not biased by any omitted variables that are constant over the time, there is no more the problem rose by unobserved indicators and the instrumental variables permit to estimate parameters consistently even in the presence of a measurement error and endogeniety of regressors.

But even the “Difference” GMM method may have a serious drawback. It is known that a large finite sample biases can occur when instrumental variables are weak. When time series are persistent and the number of the time series observations is small, the first differenced GMM estimator performs poorly. The reason is that the lagged levels of variables are weak instruments for the first differenced equation.

Generally the growth of the output is highly persistent. In order to avoid modeling cyclical dynamic and because of the absence of the long data, most of the models use a small number of time periods.

Better results can be achieved using the “System” GMM estimator developed by the authors Arellano, Bover, Blundell and Bond. The Arellano – Bover / Blundell – Bond model improves the Arellano – Bond estimator by making an additional assumption, that the first differences of the instrumented variables are uncorrelated with the fixed effect. This approach permits to introduce more instruments and can noticeably improve the efficiency of the model. This model is known as the “System” GMM and uses two equations – the original one (in levels) and a transformed one (in differences).

The “System” GMM estimator can also be biased in some circumstances. Kazuhiko Hayakawa (2005) has demonstrated that the biasness of the System GMM is a weighted sum of biasness in an opposite direction of the first differencing and the level estimators. It was demonstrated through the Monte-Carlo simulations, that the “System” GMM has the smallest biasness, when the variances of the fixed individual effect and of the idiosyncratic error have the same magnitude and when the coefficient of autocorrelation – α is around 0.3 or 0.4.

We will now considered the AR(1) model with unobserved individual specific effect and without any additional regressors:

$$y_{i,t} = \alpha y_{i,t-1} + \eta_i + \varepsilon_{i,t}; where |\alpha| <= 1$$

where i = 1, …, N and t = 2, …, T and $\eta_i + \varepsilon_{i,t} = u_{i,t}$ has a standard error component structure:

$$E|\eta_i| = E|\varepsilon_{i,t}| = E|\varepsilon_{i,t}\eta_i| = 0 \text{, for i = 1,…,N and t = 1,…T.}$$

The other assumption is that the errors $\varepsilon_{i,t}$ are serially uncorrelated, thus:

$$E[\varepsilon_{i,t}\varepsilon_{i,s}] = 0 \text{, for i = 1,…,N and } t \neq s.$$

All these assumptions imply the following m = 0.5(T-1)(T-2) moment restrictions:

$$E[y_{i,t-s}\Delta\varepsilon_{i,t}] = 0 \text{ , for t = 3,…T and } s \geq 2.$$

If the matrix of instruments – Z – is introduced, the moment restrictions can be written as $E[Z_i{}'\Delta\varepsilon_i] = 0$, where Z_i is (T-2) * m matrix given by:

$$Z_i = \begin{bmatrix} y_{i,1} & 0 & 0 & \dots & 0 & \dots & 0 \\ 0 & y_{i,1} & y_{i,2} & \dots & 0 & \dots & 0 \\ . & . & . & . & . & . & . \\ 0 & 0 & 0 & \dots & y_{i,1} & \dots & y_{i,T-2} \end{bmatrix}$$

and $\Delta\varepsilon_i$ is the (T-2) vector $(\Delta\varepsilon_{i,3}, \Delta\varepsilon_{i,4}, \dots, \Delta\varepsilon_{i,t})'$

These moment restrictions implied by the standard linear “Difference” GMM estimator imply using lagged levels, dated t – 2 and earlier, as instruments for equation in first difference.

The efficiency of the instruments in Arellano – Bond model depends greatly on the level of correlation between lagged levels of initial series and the first differences of the series of panel data. If the lagged levels of the series are weakly correlated with the subsequent first differences, then the available instruments for the difference equation are weak, thus the estimated coefficients tend to be biased. In an autoregressive model this happens when the autoregressive parameter (α) tends to unity or when the variance of the individual effect $–\eta_{i,t}$ – increases relative to the variance of the error – $\varepsilon_{i,t}$.

Blundell and Bond (1998) show that the “Difference” GMM estimator can be a subject to a large downward bias, especially when the number of time periods available is small[6]. In the empirical analysis an approach used to detect, whether coefficients estimated using the "Difference" GMM method are biased, is to compare the first-difference GMM results with alternative estimates of the coefficients[7]. The first model we should compare results with, is the simple OLS estimator. In the econometric literature it is emphasized that the OLS estimates coefficients are upward biased for the autoregressive process in the presence of the individual specific effect (Hsiao, 1986[8]). In the same time Nickell (1981) demonstrated that the Within Groups approach will estimate coefficients seriously downward biased in case of panel data with fixed cross-section effect. Therefore, if the Difference GMM estimators are close to the OLS or Within – Group estimators then the coefficients estimated by the first difference GMM model are biased upward or downward.

Blundell and Bond (1998) suggest to be cautious before relying on the estimators of the "Difference" GMM, especially in the case of heavily autoregressive data series like GDP per capita.

One of the possible solutions to improve the model is to include explanatory variables, other than the lagged dependent variable, as for example the inclusion of the current and lagged values of the regressors in the set of instruments.

In the willingness to obtain one estimator with superior sample proprieties for the autoregressive model with persistent panel data, Blundell and Bond (1998) consider the additional assumption that:

$$E\left[\eta_i \Delta y_{i,2}\right] = 0 \text{ for i = 1,…, N}$$

This condition holds true if the $y_{i,t}$ series are stationary and yields an additional set of assumptions to the linear moment conditions from the "Difference" GMM:

$$E\left(\varepsilon_{i,t} \Delta y_{i,t-1}\right) = 0 \text{, for i = 1,…,N and t = 3,…,T.}$$

This procedure allows the use of the lagged first differences of the series as the instruments for equations in level, suggestion made by Arellano and Bover (1995).

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[6] For example, when T = 4, N = 100 and the true value of $\alpha = 0.9$, the mean of the distribution of the Difference GMM is 0.23, with a standard deviation of 0.83. See Blundell, Bond 1998.
[7] For example: Bond, S., Hoeffler, A. and Temple. J. (2001), "GMM Estimation of Empirical Growth Models".
[8] Hsiao, C. (1986) "Analysis of Panel Data". Cambridge: Cambridge University Press.

Now we can construct the GMM estimator which exploits the both sets of moment restrictions: $E\left[y_{i,t-s}\Delta\varepsilon_{i,t}\right]=0$ and $E\left(\varepsilon_{i,t}\Delta y_{i,t-1}\right)=0$.

The matrix of the instruments is:

$$Z_i^{+}=\begin{bmatrix} Z_i & 0 & 0 & ... & 0 \\ 0 & \Delta y_{i,2} & 0 & ... & 0 \\ 0 & 0 & \Delta y_{i,3} & ... & 0 \\ . & . & . & ... & 0 \\ 0 & 0 & 0 & ... & \Delta y_{i,T-1} \end{bmatrix}$$

where Z_i is the matrix of instrumental variables form the first difference equation. Therefore, the complete set of conditions can be written as:

$$E\left(Z_i^{+}\varepsilon_i^{+}\right)=0 \text{, where } \varepsilon_i^{+}=\left(\Delta\varepsilon_{i,3},...,\Delta\varepsilon_{i,T},\varepsilon_{i,3},...,\varepsilon_{i,T}\right).$$

The "System" GMM combines the standard set of equations in first differences with suitably lagged levels as instruments and additional equations in level with suitably lagged first differences as instruments.

Although the initial model, which needs to be estimated, implies the correlation between $y_{i,t}$ and the individual specific effect – η_i, the final set of assumptions requires that the first differences of the dependent variable - $\Delta y_{i,t}$ are not correlated with η_i, permitting lagged first differences to be used as instruments for equation in level.

The validity of these additional instruments can be tested using the Sargan test of over-identifying restrictions or the Hausman comparison between the "Difference" GMM and "System" GMM results. Blundell, Bond and Windmeijer (2000) bring some additional improvement to the "System" GMM model.

Another method-of-moment type estimator that may also perform better than the first difference GMM is the symmetrically normalized first-difference GMM estimator proposed by Alonso-Borrego and Arellano (1999).

Temporary error measurement

One of the assumptions made till now is that y_{it} or any other regressor can be exactly measured, but this case is rare in the empirical studies. How can the "Difference" and "System" GMM handle transitory measurement error? First of all it must be pointed out that permanent additive measurement errors are absorbed into the time invariant individual effect, thus this type of permanent measurement error is controlled.

Suppose that instead of observing the true value of the $y_{i,t}$ series we will observe $\overset{\approx}{y}_{i,t} = y_{i,t} + m_{i,t}$, for i = 1,…,N and t = 1,…,T with the assumption that the measurement errors are serially uncorrelated: $E\left[m_{i,t} m_{i,s}\right] = 0$ for i = 1,…,N and t ≠ s. In the same time it is supposed that the measurement error is uncorrelated with any realization of the disturbance except the current disturbance $\varepsilon_{i,t}$: $E\left[m_{i,t} \varepsilon_{i,s}\right] = 0$ for i = 1,…,N and t ≠ s.

Therefore, the empirical model using the available data is:

$$\overset{\approx}{y}_{i,t} = \alpha \overset{\approx}{y}_{i,t} + \eta_i + v_{i,t} \quad \text{where } |\alpha| < 1$$

$$v_{i,t} = \varepsilon_{i,t} + m_{i,t} - \alpha m_{i,t-1},$$

with i = 1,…,N and t = 2,…,T. The first difference equation is:

$$\Delta \overset{\approx}{y}_{i,t} = \alpha \Delta \overset{\approx}{y}_{i,t} + \Delta v_{i,t} \quad \text{where } |\alpha| < 1$$

$$\Delta v_{i,t} = \Delta \varepsilon_{i,t} + \Delta m_{i,t} - \alpha \Delta m_{i,t-1}$$

with i = 1,…,N and t = 3,…,T.

In the level equation from above the error term $v_{i,t}$ is serially correlated, thus the second lag of the observed series $\overset{\approx}{y}_{i,t-2}$ is a no more valid instrument for the first differenced equation. If we don't introduce further assumptions, this implies that no instruments are available for the differenced equation in period t = 3. Thus, at least four time series observations on miss-measured series are required in order to identify the parameters of the interest. In the case we have T ≥ 4, the following moment conditions are available.

$$E\left[\overset{\approx}{y}_{i,t-s} \Delta v_{i,t}\right] = 0, \text{ where t = 4,…,T and s } \geq 3.$$

This implies using the lagged levels of observed data in t-3 and earlier as instrumental variables for the equation in the first difference.

Assuming that $E\left[\eta_i \Delta y_{i,2} = 0\right]$, for i = 1,…,N, additional moment conditions for the level equation would be available in the absence of the measurement error. The serial correlation in $v_{i,t}$ implies that $\Delta \overset{\approx}{y}_{i,t-1}$ is no longer a valid instrument for the equations in level. Nevertheless, knowing that measurement error $m_{i,t}$ induces no correlation between observed first differences $\Delta \overset{\approx}{y}_{i,t}$ and the individual effect η_i, it is observable that:

$$E[\eta_i \Delta m_{i,t} = 0], \text{ for i = 1,…,N and t = 2,…, T.}$$

Thus the following moment conditions are available:

$$E\left(\Delta \overset{\approx}{y}_{i,t-2}(\eta_i + v_{i,t})\right) = 0 \text{ for i = 1,…,N and t = 4,…,T.}$$

It can be concluded that suitably lagged first-differences of the observed series can still be used as instruments for the level equations in the presence of the serial uncorrelated measurement error.

Endogenous regressors.

We will now consider an equation with additional variables on the right-hand-side of the equation:

$$y_{i,t} = \alpha y_{i,t-1} + \beta x_{i,t}' + \eta_i + \varepsilon_{i,t} \qquad |\alpha| < 1$$

for i = 1,…,N and t = 2,…,T, and where $x_{i,t}$ is correlated with η_i in the sense that $E(x_{i,t}\varepsilon_{i,s}) \neq 0$ for i = 1,…,N and s ≤ t. The above expression allows contemporaneous correlation between the current shock $\varepsilon_{i,t}$ and $x_{i,t}$ and feedbacks from the past shocks $\varepsilon_{i,t-s}$ onto the current value of $x_{i,t}$. The error's components satisfy the assumptions:

$$E[\eta_i] = E[\varepsilon_{i,t}] = E[\eta_i \varepsilon_{i,t}] = 0$$

The above equation can be rewritten as:

$$\Delta y_{i,t} = (\alpha - 1) y_{i,t-1} + \beta x_{i,t} + \eta_i + \varepsilon_{i,t}$$

In order to eliminate the individual constant effect η_i, the first difference of the level equation must be done. In this case another additional moment conditions appear:

$$E[x_{i,t-s} \Delta \varepsilon_{i,t}] = 0, \quad \text{with t = 3,…,T and s} \geq 2$$

Therefore the lagged values of endogenous variables $x_{i,t}$ dated t-2 can be used as instruments for the first differenced equation.

Similarly to the assumption $E[\eta_i \Delta y_{i,2}] = 0$ for i = 1,…,N it is assumed that $E[\eta_i \Delta x_{i,t}] = 0$, where i = 1,…,N and t = 2, …,T. In this case the following set of conditions is introduced:

$$E(\Delta x_{i,t-1}\varepsilon_{i,t}) = 0 \text{ for i = 1,…,N and t = 3, …,T}$$

The measurement error in the observed $x_{i,t}$ series has no effect on the estimation of the model. Since we are already allowing for simultaneous correlation between $x_{i,t}$ and the disturbance, the lagged values of the observed right and left hand-side series ($x_{i,t}$ and $y_{i,t}$) dated t-2 and earlier continue to be valid instruments for the first differenced equation.

In conclusion, if the model contains variables which are measured with error this will require t-2 values of the variables in level to be omitted from the set of the instruments used for the equation in the first differences. At the same time, the lagged t-1 first-differences of the variables have to be omitted from the set of the instruments for the equations in levels.

4.4 Tests of Specification

Sargan test

The first test used in the dynamic panel data model is a Sargan test which tests the joint validity of the moment conditions. The Sargan statistic of the over-identification is:

$$s = \hat{\varepsilon}' Z \left(\sum_{i=1}^{N} Z_i' \hat{\varepsilon}_i \hat{\varepsilon}_i' Z_i \right)^{-1} Z_i' \hat{\varepsilon}$$

where $\hat{\varepsilon} \equiv \left(\hat{\varepsilon}_1',...,\hat{\varepsilon}_N' \right)$ are estimated residuals from the two-stage GMM estimator. The null hypothesis of Sargan test is that $E[Z_i'\varepsilon_i] = 0$. Under the null assumption, the asymptotic distribution of the test is χ^2_{j-k}, where j is a number of instruments and k is a number of regressors from the equation[9].

Arellano-Bond autocorrelation test.

The second specification test I use in my analysis is the Arellano-Bond test. This checks the second order auto-correlation of the residuals in the first difference. If the

[9] j-k is called the degrees of over-identification.

matrix of errors is E then E^{-l} represents the l lag of the E with zero, when $t \leq l$. The Arellano-Bond auto-correlation test is based on the following statistics:

$$ab = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \hat{E}_i^{-l} \hat{E}_i$$

which has an asymptotically normal distribution and null hypothesis of no serial correlation of order l.

In conclusion, the considerable strength of the "Difference" and "System" GMM is that they permit to obtain consistent estimators of the parameters of interest, even in the presence of the endogenous right-hand-side variables and the measurement errors in the both dependent and right-hand-side variables.

Different assumptions about the presence of the measurement error and the endogeneity of the right-hand-side variables have a major impact on the validity of the specific instruments. These assumptions can be tested in the GMM framework with the Sargan test of over-identifying restrictions.

5. Empirical Analysis

5.1 Preliminary analysis.

The empirical analysis is focused on the economic growth, trade and financial openness of the countries from the Eastern Europe. In all cases the dependent variable is the annual GDP per capita growth rate.

The first purpose of our study is to investigate if there is a relationship between trade and financial openness and economic growth. Another intention is to investigate if the impact of trade and financial globalization is non-linear and depends on the level of development of the national economy. This is done through the examination of the effect of the trade and financial openness depending on the level of GDP per capita which represents the proxy of the country's development level.

We work with a pooled dataset of cross-country and time-series observations. My panel data set consists of 9 countries from the Eastern Europe: Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, and Slovenia. All these countries are new member states of the European Union. Romania and Bulgaria joined the EU on the first January 2007 while the rest of the countries joined the EU on the first May 2004. The time series dimension is 10 years, from 1996 till 2005. The sources of data are: AMECO[10] and IFS[11] databases. The table below presents the full definition and sources of all the variables used in our analysis.

Table 1: Definitions of the variables.

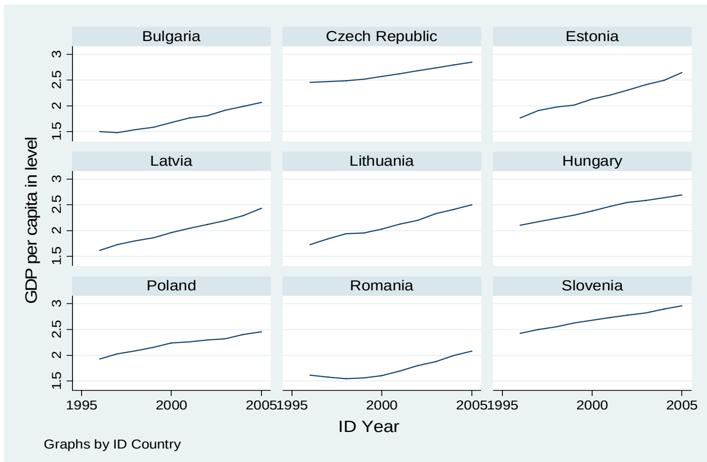
Variable	Definition and construction of the variable	Source of the data	Abbreviation
GDP per capita	Log of the ratio of the total GDP to total population.	AMECO database	GDP_PC_Level
GDP per capita growth rate	Log differences of the GDP per capita.	My calculations using data from the AMECO database	GDP_PC_Gr
Financial depth	Log of the ratio of the domestic credit claims to GDP	My calculations with data from the IFS.	Fin_Depth
CPI	Consumer Price Index at the end of the year (2000 = 100)	IFS statistics for each country.	
Lack of price stability.	Log of the expression (1+ log of the differences of the CPI)	My calculations with data from IFS.	Price_stab
Trade Openness	Log of the ratio export + imports to GDP. All figures are current market prices.	My calculations with data from the AMECO database	TO
Financial Openness	Log of the ratio of the absolute value of Direct investment abroad + Direct investments in national economy to GDP.	My calculations using data from the IFS statistics.	FO
Government Burden	Log of the ratio of the government consumption expenditures to GDP	My calculations using dataset from the IFS.	Gov_Burden
Term of Trade	Term of trade of goods and services index.	The AMECO database	
Term of Trade changes	Log differences of ToT	My calculations using dataset from the AMECO database.	ToT
Foreign growth	Log differences of the GDP per capita of the EU 15 countries.	My calculations using dataset from the AMECO database.	EU_15_GDP_Gr
Transfers	The ratio of the net current transfers from the rest of the world to GDP.	My calculations using dataset from the AMECO database.	transf
Interaction between TO and country's development level 1	The logarithm of TO multiplied with the logarithm of GDP per capita in level	My calculations using the data from above.	TO_GDP_PC_Level
Interaction between TO and the country's development level 2	The logarithm of TO multiplied with squared logarithm of GDP per capita in level	My calculations using data from above.	TO_GDP_PC_Level_2
Interaction between FO and country's development level 1	The logarithm of FO multiplied with logarithm of GDP per capita in level	My calculations using data from above.	FO_GDP_PC_Level
Interaction between FO and country's development level 2	The logarithm of FO multiplied with squared logarithm of GDP per capita in level	My calculations using data from above.	FO_GDP_PC_Level_2

[10] AMECO is annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs (DG – ECFIN)

[11] International Financial Statistics (IFS) is a database of The Statistics Department of the International Monetary Fund

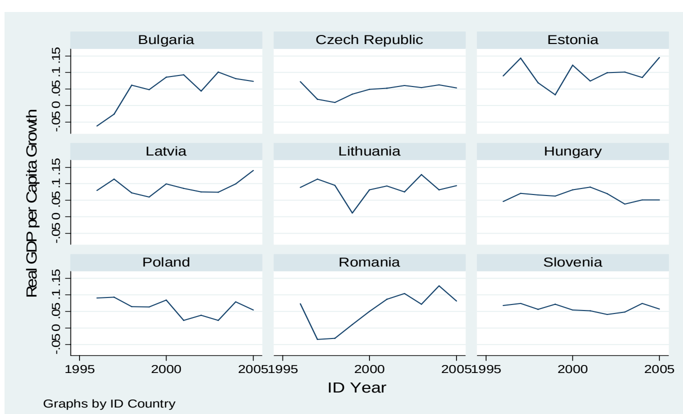
First of all, we should look at the evolution of the GDP per capita growth rate and of the countries' development level represented by the logarithm of the GDP per capita in level in the analyzed period.

Graph 1: The evolution of the GDP per capita in level.



It can be observed that the GDP per capita has been growing in all the countries through the whole period excepting Romania, where the economic growth has begun in 1999. The most developed countries from our sample are the Czech Republic and Slovenia with the highest GDP per capita level. The average GDP per capita level is 13.699 EUR (1996 – 2005) in the Czech Republic and 14.853 EUR in the case of Slovenia. The countries which became EU members on 1st January 2007 (Bulgaria and Romania) have almost the same level of the GDP per capita, while remaining the poorest countries from our sample.

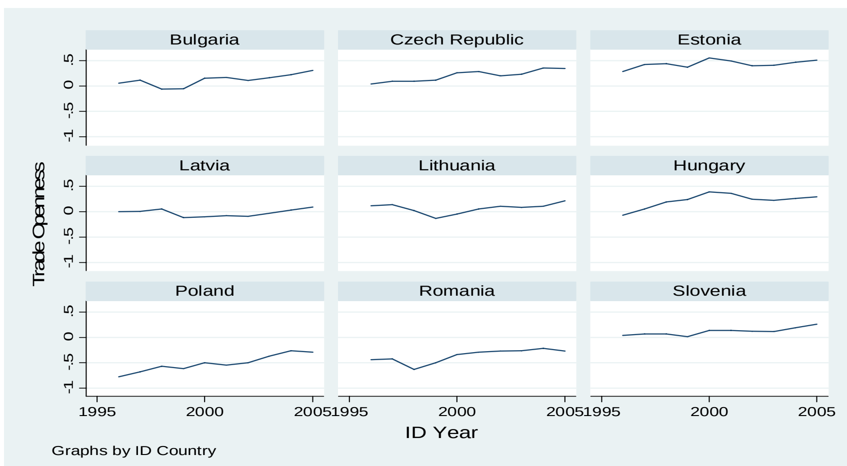
Graph 2: The Evolution of the GDP per capita growth rate.



The pattern of the growth rate of GDP per capita differs significantly among the states from our sample. The Balkan states, Bulgaria and Romania, especially Romania, have known an important increase of the growth rate since 1998 – 1999. The more developed countries, like Slovenia, Czech Republic and Hungary have nearly the same growth rate during the whole time span. The negative impact of the financial crisis from 1997-1998 is evident from the graph, especially in the case of Romania, hardly escaped from default. The both Balkan countries started to have a positive trend of the GDP per capita after 1999. In the same time they have the most volatile growth rate.

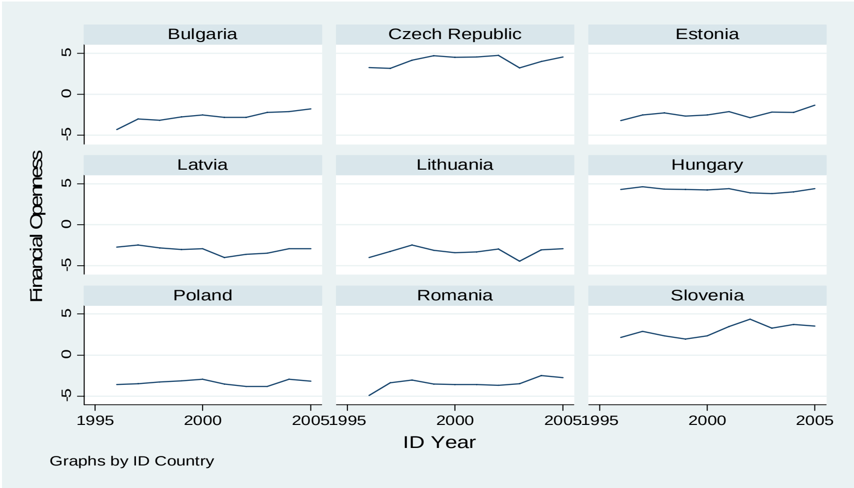
The overview of the trade and financial openness is presented below.

Graph 3: The evolution of the trade openness in the Eastern Europe.



As we can notice in the graph from above, the Trade Openness (TO) has increased in all the countries from our sample between 1996 – 2005. Some countries like the Czech Republic, Estonia, Slovenia and Hungary are more integrated in the world's markets of goods and services. There is a big difference between the two Balkan states: Bulgaria is more involved in the trade globalization while Romania remains less integrated in the world's market of goods and services. In the case of Romania there has been an upward trend beginning with 1999. The biggest country in Eastern Europe – Poland remains marginally integrated in the world's market of goods and services if it is compared with the other countries from this region like Hungary or Czech Republic.

Graph 4: The evolution of the financial openness in the Eastern Europe.



In the case of the Financial Openness (FO) there are big differences between the countries in the region. Thus, there are three countries (Czech Republic, Slovenia and Hungary) which are much more integrated in the world's financial market than the rest of the six countries from our sample. The evolution of the FO in the analyzed time span differs from country to country. Thus, the biggest states from the region, Poland and Romania, had nearly a constant level of FO between 1998 – 2003 but it has increased beginning with 2003, mainly due to the Foreign Direct Investments in these countries. Between the two Balkan states, Bulgaria has a higher level of financial openness than Romania.

If we compare the financial integration with the trade openness, the financial openness has not an evident upward trend in all the nine countries at the end of the XXth century and the beginning of the XXIst century. The financial integration has started to increase in the majority of the countries from the sample only at the beginning of 2002 or 2003.

In our analysis we use the estimation method which is suited for panel data, deals with dynamic regression specifications, controls for unobserved time- and country-specific effect, accounts for some endogeneity and measurement error in the regressors.

The base models I use are the two Dynamic Generalized Methods of Moments:

- The first one is the Arellano-Bond model (1991), which was named by researchers the "Difference" GMM.

- The second one is the model developed by Arellano and Bover (1995) which was further developed by Blundell and Bond in 1999. Researches call it the "System" GMM[12].

We will use for estimation and tests the Stata 9.1 and Eviews 5 softwares.

The general regression to be estimated is:

$$y_{i,t} = \beta' X_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t}$$

where the subscript i represents the country and t represents years. y is the GDP per capita growth rate which is the dependent variable. X is the set of time- and country-explanatory variables which includes a lagged dependent variable, proxies of trade and financial openness, control variables and interaction terms. μ_t is an unobserved time specific effect, η_i is an unobserved country specific effect and $\varepsilon_{i,t}$ is the idiosyncratic error.

We will deal with the unobserved time specific effect by including the period's specific dummy variables as instruments into the regression for all the estimators. To deal with the unobserved country specific effect is not that simple given the possibility that the model is dynamic and contains endogenous explanatory variables. Therefore, the unobserved country specific effect is controlled by differencing and instrumentation. Thus we will relax the assumption of a strong exogeneity of the regressors by allowing them to be correlated with the current and previous realizations of the error term. The other two assumptions are that the changes in the explanatory variables are uncorrelated with the unobserved country's specific effect and the future realizations of the error term are not correlated with the current realization of the explanatory variables.

Arellano-Bond (1991), Arellano-Bover (1995) and Blundell-Bover (1998) show that this set of assumptions generates moment conditions which allow the estimation of the parameters of interest. The instruments corresponding to these moment conditions are appropriately lagged values of both levels and differences of the explanatory and lagged

[12] For System GMM estimator I use Stata "xtabond2" command written by David Roodman. See Roodman, D. (2006), "How to do xtabond2: An introduction to "Difference" and "System" GMM in Stata", Center for Global Development, working paper 103.

dependent variable. Since the moment conditions over-identify the regression model in a typical way, they also allow for a specification testing through the Sargan test.

When Blundell and Bond proposed the “System” GMM estimator in 1998, they imposed restrictions on the initial condition – $y_{i,t}$ in sense that they considered only a stationary model with an auto-regressive coefficient $\alpha < 1$[13]. We have checked the stationarity of the GDP per capita growth rate. For this we have used Levin, Lin & Chu and Im, Pesaran & Shin statistics. All the statistics reject null hypothesis of the presence of the individual and common unit root (see Appendix A). In the same time we have checked the stationarity of all the other variables.

It is known that the estimator can be seriously biased if the instrumental variables are weak. This happens especially when the dependent variable is highly persistent and the number of time series’ observation is small. The GDP per capita growth rate is stationary as we showed above and we will now check its persistency. From the correlograms in the Appendix A it can be deduced that both the time series of GDP per capita growth rate and the first difference of the GDP per capita growth rate are auto-correlated. In both cases the hypothesis zero of the Ljung-Box Q-statistics for auto-correlation term of order 1 is rejected with a 5% level of confidence[14]. Thus, we can infer that the growth rate is persistent.

It is highlighted in the literature that the “System” GMM, which uses both the “Difference” and the “Level” GMM, is less biased than the “Difference” GMM even if the “System” GMM uses more instruments than the rest of the estimators. Despite of this, there are two conditions for the “System” GMM to be less biased than the “Difference” GMM model. The first condition is that the variances of the individual effect and the error term should be nearly at the same magnitude. The “System” GMM estimators are biased if the variance of the individual effect is much larger or smaller than the variance of the error. The second condition refers to the coefficient of the lagged dependent variable – α. Hayakawa (2005) deduced, using Monte-Carlo simulations, that the small

[13] Binder, Hsiao and Pesaran (2000) have extended Blundell – Bond (1998) model in case $y_{i,t}$ has a unit root.
[14] Hypothesis zero of Q statistics for lag l of Ljung-Box test is that there is no autocorrelation up to order l.

sample bias is less significant if α < 0.5 and the bias is around zero if α is about 0.3 or 0.4[15].

In order to check the α coefficient, I have estimated the regression:

$$\mathrm{GDP\_PC\_Gr}_{\mathrm{i,t}} = \alpha \mathrm{GDP\_PC\_Gr}_{\mathrm{i,t-1}} + \eta_i + \varepsilon_{i,t}$$

using the OLS and the "Difference" GMM methods (Appendix B). The coefficient – α – is 0.32 in the case of OLS estimator and 0.3 in the case of "Difference" GMM estimator. The coefficient for the autoregressive term of the GDP per capita growth rate is near the value of 0.3, thus, based on the conclusions emphasized by Hayakawa, we expect that the bias of the "System" GMM will be less than the bias of the "Difference" and "Level" GMM regressions taken separately.

5.2 The Economic growth regressions.

It is a standard in the literature that the dependent variable is the GDP per capita growth rate. We have introduced in the model the control variables: GDP per capita in level as a proxy of the country's level of development, the ratio of the domestic credits to the GDP as a proxy of financial depth, the inflation rate to account for monetary discipline, the rate of the government consumption expenditures to the GDP as a proxy of the government's weight in economy. The economic literature also emphasizes the importance of the remittances of the citizens from the Eastern Europe who work abroad and the impact of these remittances on the economic growth. Thus, in order to evaluate the impact of the remittances on the economic growth I have included as an additional control variable the log ratio between transfers from abroad into the domestic economy and the GDP.

The most important regressors for our analysis are the financial and trade openness.

I will compare my results with the results of the authors: Calderon, C., Loayza, N and Schmidt-Hebbel, K. (CLS) from their paper "Does Openness Imply Greater Exposure" (2005). This comparison is relevant because the authors highlighted above have used the same econometric technique and nearly the same set of control variables.

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[15] See Kazuhiko Hayakawa (2005), "Small Sample Bias Properties of the System GMM Estimator in Dynamic Panel Data Models", Hitotsubashi University, Research Unit for Statistical Analysis in Social Sciences, Paper No. 82, page 9

5.2.1 The linear effects of the trade and financial openness.

In order to measure the effect of the commercial and financial integration on the economic growth we estimate the regression:

$$\begin{aligned}\mathrm{GDP\_PC\_Gr}_{\mathrm{i,t}} = \alpha\mathrm{GDP\_PC\_Gr}_{\mathrm{i,t\text{-}1}} + \beta_1\mathrm{GDP\_PC\_Level}_{\ \mathrm{i,t}} + \beta_2\mathrm{Fin\_Depth}_{\mathrm{i,t}} + \\ + \beta_3\mathrm{Price\_stab}_{\mathrm{i,t}} + \beta_4\mathrm{Gov\_Burden}_{\mathrm{i,t}} + \beta_5\mathrm{transf}_{\mathrm{i,t}} + \beta_6 TO_{i,t} + \beta_7 FO_{i,t} + \\ + \beta_8 ToT_{i,t} + \beta_9\mathrm{EU\_15\_GDP\_Gr}_{\mathrm{i,t}} + \eta_i + \varepsilon_{i,t}\end{aligned}$$

All the variables in the above equation are in logarithm.

The one- and two-step estimators are asymptotically equivalent for the "Difference" and "System" GMM models in the case that the heteroskedasticity is present in the errors. Thus, the two step estimators are more efficient than the one-step. But the Monte-Carlo simulations revealed that the efficiency gains of the two-step GMM are small and another disadvantage of the two-step GMM is that the estimators converge to their asymptotic distributions in a relatively slow way. Thus in the case of a finite sample, the standard errors associated with the two-step GMM estimators are seriously biased and unreliable for any conclusions. Based on this I use the one-step "Difference" and "System" GMM estimators which are more reliable in the case of finite samples and are also robust to heteroskedasticity[16].

Initially I will try to estimate the equation from above using the "Difference" GMM model. The additional assumptions to the standard ones are: all reported statistics take into account the fact that our panel data is small[17], we have 10 additional instruments which represent dummy variables for 10 years.

The estimated coefficients using the "Difference" GMM model together with the Sargan and Arellano-Bond auto-correlation tests are:

[16] See Bond, S., Hoeffler, A. and Temple, J. (2001) "GMM estimation of Empirical Growth Models".

[17] A small sample correction to the covariance matrix means that the resulted statistics are t tests for each coefficient instead of z tests statistics and an F statistics instead of the Wald χ^2 test for overall fit.

Figure 2: The "Difference" GMM estimator of the linear effects of trade and financial openness.

```
Arellano-Bond dynamic panel-data estimation     Number of obs      =        72
Group variable (i): ID                          Number of groups   =         9

                                                F(10, 61)          =     10.83

Time variable (t): Year                         Obs per group: min =         8
                                                               avg =         8
                                                               max =         8

One-step results
------------------------------------------------------------------------------
D.GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
  GDP_PC_Gr |
        LD. |  -.2077454    .083181    -2.50   0.015    -.3740761   -.0414148
GDP_PC_Level|
        D1. |   .4420358   .0781347     5.66   0.000     .2857958    .5982758
  Fin_Depth |
        D1. |  -.0717311   .0155315    -4.62   0.000    -.1027882   -.0406741
 Price_stab |
        D1. |   -.097949   .0230645    -4.25   0.000    -.1440693   -.0518287
 Gov_Burden |
        D1. |   .0297999   .0321357     0.93   0.357    -.0344594    .0940592
     transf |
        D1. |  -.0036191   .0039551    -0.92   0.364    -.0115277    .0042895
         TO |
        D1. |   .1595385   .0347954     4.59   0.000     .0899607    .2291162
         FO |
        D1. |  -.0014518   .0048608    -0.30   0.766    -.0111716    .0082679
        ToT |
        D1. |   -.042302   .0803635    -0.53   0.601    -.2029988    .1183947
EU_15_GDP_Gr|
        D1. |   .0391543   .1705439     0.23   0.819    -.3018693     .380178
      _cons |  -.0280559   .0049545    -5.66   0.000    -.0379631   -.0181487
------------------------------------------------------------------------------
Sargan test of over-identifying restrictions:
        chi2(44) =     48.38          Prob > chi2 = 0.3006

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
        H0: no autocorrelation   z =  -0.98   Pr > z = 0.3275
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
        H0: no autocorrelation   z =  -0.73   Pr > z = 0.4628
```

As we can notice, the hypothesis zero from the Arellano-Bond test for auto-correlation of the residuals of order 2 is accepted. There isn't an autocorrelation of second order in the errors. The hypothesis which is being tested with the Sargan test is that the instrumental variables are uncorrelated to the set of residuals, and therefore they are acceptable, "healthy" instruments. In our case the instrumental variables are accepted as being "healthy" with the P value of the Sargan test of 30.06%. In fact the Sargan test checks the viability of the moment conditions in the "Difference" GMM model.

Nevertheless, there are some problems with a part of the estimated coefficients. For example, the coefficients of the government's burden, transfers, FO, and foreign growth rate are zero from the statistical point of view. We will try to use a more advanced method which can better estimate the coefficients. We are especially interested in the coefficient of the financial integration's indicator, which cannot be estimated through the "Difference" GMM estimator. One of the possible solutions is to find some additional instruments from outside of the model in order to get statistical significant coefficients. But this is quite difficult and more data series are needed. The additional data series have to satisfy the conditions imposed to the instrumental variables, such as: the instrumental variable has to be correlated with the explanatory variable and in the same time, the correlation between the instrumental variable and the idiosyncratic error has to be zero.

The “Difference” GMM has some disadvantages, which are discussed in the previous chapter and which can be resolved with the “System” GMM model. The assumptions used in the case of the “System” GMM are the same as those from the “Difference” GMM discussed above. The estimators of the “System” GMM are:

Figure 3: The “System” GMM estimator of the linear effects of trade and financial openness.

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: ID                              Number of obs      =        81
Time variable : Year                            Number of groups   =         9
Number of instruments = 153                     Obs per group: min =         9
F(10, 70)     =      9.36                                      avg =      9.00
Prob > F      =     0.000                                      max =         9
------------------------------------------------------------------------------
   GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDP_PC_Gr |
         L1. |   .1041783   .0913611     1.14   0.258    -.0780357    .2863923
GDP_PC_Level |   .0320869   .0176889     1.81   0.074    -.0031926    .0673664
   Fin_Depth |  -.0164222   .0098312    -1.67   0.099    -.0360298    .0031854
  Price_stab |  -.0908557   .0226117    -4.02   0.000    -.1359534    -.045758
  Gov_Burden |  -.0298075   .0137649    -2.17   0.034    -.0572608   -.0023542
      transf |   .0044734   .0041773     1.07   0.288     -.003858    .0128048
          TO |    .054121   .0109413     4.95   0.000     .0322994    .0759427
          FO |   -.005598   .0015452    -3.62   0.001    -.0086799   -.0025162
         ToT |  -.1249649   .1058385    -1.18   0.242    -.3360532    .0861233
EU_15_GDP_Gr |   .2814838   .1924305     1.46   0.148    -.1023066    .6652742
       _cons |  -.0680658   .0604123    -1.13   0.264    -.1885543    .0524228
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.56  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -0.22  Pr > z =  0.823

Sargan test of overid. restrictions: chi2(142)   =  92.34  Prob > chi2 =  1.000
```

The “System” GMM has much better results than the “Difference” GMM model. In this case the Sargan test has the P value of 1. In the same time the Arellano-Bond tests for auto-correlation of the second order are accepted with a P value of 82.3%.

In order to check the result obtained from the “System” GMM approach we have estimated the same equation with some additional estimators. These estimators are:

- Within Group estimator.
- Generalized Least Squares (GLS) with a correlated disturbance.

The results of all these estimators are presented in Appendix A, and are summarized in the table bellow:

Table 2: The results of the estimators of the linear effects of trade and financial openness.

Model	Within Groups		GLS		Diff GMM		Syst GMM	
GDP_PC_Gr	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
GDP_PC_Gr L1	0.0513	0.110	0.1143	0.098	-0.2077**	0.083	0.1042	0.091
GDP_PC_Level	0.0070	0.045	0.0305*	0.016	0.4420**	0.078	0.0321*	0.018
Fin_Depth	-0.0096	0.019	-0.0191**	0.009	-0.0717**	0.016	-0.0164*	0.010
Price_stab	-0.1008**	0.035	-0.0896**	0.022	-0.0979**	0.023	-0.0909**	0.023
Gov_Burden	-0.0272	0.047	-0.0331**	0.011	0.0298	0.032	-0.0298**	0.014
transf	0.0009	0.005	0.0017	0.003	-0.0036	0.004	0.0045	0.004
TO	0.1175**	0.048	0.0538**	0.013	0.1595**	0.035	0.0541**	0.011
FO	0.0003	0.007	-0.0060**	0.002	-0.0015	0.005	-0.0056**	0.002
ToT	-0.0812	0.129	-0.0782	0.101	-0.0423	0.080	-0.1250	0.106
EU_15_GDP_Gr	0.2656	0.264	0.1884	0.172	0.0392	0.171	0.2815	0.192
cons	-0.0099	0.120	-0.0830	0.053	-0.0281**	0.005	-0.0681	0.060
Arellano-Bond test of AR(1)	-		-		0.3275		0	
Arellano-Bond test of AR(2)	-		-		0.4628		0.823	
Sargan test	-		-		0.3006		1	

* (**) denotes statistical significance at the 10 (5) percent level.

The best results are given by the “System” GMM model with significant coefficients of interest. In order to check the results of the “System” GMM we have estimated the coefficients using the Feasible Generalized Least Squares estimator, which takes into account the heteroskedasticity of the errors and the correlation of the errors within each cross section. It is evident that the coefficients of the GLS estimator are significant and close to the coefficients deduced from the “System” GMM estimator. This fact demonstrates us the presence of the heteroskedasticity and autocorrelation in the set of the data. The Within group estimator with fixed effect is unable to estimate the coefficients. Most of the coefficients estimated with the Within-Group estimators are insignificant from the statistical point of view. This demonstrates that the simple panel data models which takes into account only a fixed cross-section effect gets a weak result in the case of a dynamic model with measurement errors in data sets and endogenous regressors.

First of all we will analyze the coefficients of the control variables based on the "System" GMM estimators and compare them with the results obtained by Calderon, Loayza and Schimidt-Hebbel (CLS)[18].

The elasticity of the GDP per capita in level is positive (0.32) meaning that, in average, the growth rate is higher for the countries with a higher level of development in the analyzed sample. CLS obtained the coefficient with another sign which is -0.177. In their case a higher level of GDP per capita means a lower rate of growth. The possible explication may be the debatable issue between the economists, which is if poorer countries tend to have a higher growth rate. As a result, there should be a threshold after which the higher the level of development in a country is, the lower the average rate of growth will be. In our sample we have the former communist countries from the Eastern Europe which converge to the average level of development from the Western Europe. It seems that these countries are before that threshold after which the higher the level of income is, the lower the growth rate will be. Thus, for the countries from the Eastern Europe a higher initial level of output per capita with 10% means in average a higher growth rate with 3.21%.

The coefficient of the financial depth is significant for $\alpha = 10\%$ and has an elasticity of -.0164, while CLS have obtained a coefficient equal to 0.631. One of the explanations for this negative coefficient is that we have taken the ratio of the domestic credit to GDP as a proxy of the financial development. A better proxy may be the ratio between the private domestic credits to GDP or the ratio of the M2/M3 money aggregator to the GDP. The Eastern Europe has been in transition since the beginning of the 1990s

[18] See Calderon, C., Loayza, N. and Schmidt-Hebbel, K. (2005), "Does Openness Imply Greater Exposure?" World Bank Policy Research Paper No. 3733 page 30.

so the economies from this region are in a continuous change. In most of the countries from our sample, the biggest part of the domestic credit has been going toward consumption. This increase in demand was covered by the increase of the imports with a negative effect on the current account. In this case a higher rate of the domestic credits to GDP means fewer products made in the economy, a higher deficit level of the trade balance and a lower level of the GDP growth rate. It is worth noting that the negative impact of the financial depth is very small and we believe that a further development of the financial sector will have a positive impact on the growth rate, especially when more and more credits will be driven toward the real economy and the enterprises' investments.

The price stability has a positive effect on the growth rate with a coefficient of -.091 which is smaller than the coefficient obtained by CLS: -2.275. The conclusion is that the impact of inflation in the countries from our sample is smaller than the average impact of inflation on growth in the countries from the sample used by CLS in their analysis. In some of the countries from the Eastern Europe the inflation rate is relatively small so the policymakers can marginally seize this opportunity. In the same time they have to continue with the supervision of inflation closely because of the significant negative impact of its increase on the growth rate.

The elasticity of the government's burden has a negative sign and its value is: -0.0398. It is comparable as sign with the results obtained by CLS (-1.488). These results denote that in the both analyzed cases, when the sample contains 76 countries from all over the world or only 9 countries from Eastern Europe, the government is not a good administrator and that more governmental expenditure leads to the decrease of the GDP growth rate.

As we have mentioned before in this paper we have included the logarithm of the ratio of net transfers from abroad to GDP as a control variable. With this inclusion we have proposed to check if the transfers have a significant impact on the growth rate. As it can be observed, the impact of this variable is insignificant because the value of the coefficient is zero from the statistical point of view.

The trade openness is one of the main indicators of interest for us. The coefficient of the TO is positive and is equal to 0.0541. Thus, in the case of the Eastern Europe a higher degree of integration into the world's market of goods and services leads to an increase of the growth rate of GDP per capita, which means a higher level of development of the domestic economy. The elasticity of the commercial openness obtained for the Eastern Europe is smaller that one obtained by CLS (0.403).

While the trade openness has a positive impact on the growth rate, the FO has a negative one: -0.0056. This result disagrees with the result obtained by CLS, who got the coefficient of financial openness equal to 0.051. In the empirical literature some authors argue that the impact of the financial integration on a country depends on the country's development level as a whole but also on the one of the financial sector. Thus, they affirm that there is a threshold of a country's development level after which the higher the level of financial integration is, the higher the rate of financial growth will be. It seems that the countries from this sample haven't reached that threshold. If it is really the case we will analyze in this paper later.

CLS highlighted in their study the significance of the impacts of the foreign shocks (growth rate of ToT and Foreign growth) on the growth rate in the domestic economy. In CLS's analysis the impacts of the growth rate of the country's trading partners and the growth rate of Term of Trade on the level of development of the home country are positive and equal to: 1.536 and 0.038 respectively. In our analysis on the countries from the Eastern Europe the impacts of both indicators are insignificant, which suggests a lack of influence of these variables on the economic growth.

5.2.2 The non-linear growth effect of the trade openness.

There is a view that the growth effect of openness may not be homogenous across countries. Indeed, motivated by the work of Kein and Olivei (2000) in the case of financial and trade openness, researches began to consider the possibility that the growth effect of opening the economy may depend on the country's characteristics, as for example the level of income or the institutional quality[19]. In our analysis we have a different look at this possibility by allowing the effect of each openness measure (TO and FO) to vary with the level of GDP per capita, which serves as a proxy for the overall development level of a country. We will do this in the same way as CLS, by interacting each openness measure with the linear and quadratic GDP per capita in level.

Firstly we will consider the interaction of the TO and the level of GDP per capita. The regression which needs to be estimated is:

$$\begin{aligned}\mathrm{GDP\_PC\_Gr}_{\mathrm{i,t}} = {} & \alpha\mathrm{GDP\_PC\_Gr}_{\mathrm{i,t-1}} + \beta_1\mathrm{GDP\_PC\_Level}_{\mathrm{i,t}} + \beta_2\mathrm{Fin\_Depth}_{\mathrm{i,t}} + \beta_3\mathrm{Price\_stab}_{\mathrm{i,t}} + \\ & + \beta_4\mathrm{Gov\_Burden}_{\mathrm{i,t}} + \beta_5\mathrm{transf}_{\mathrm{i,t}} + \beta_6 TO_{i,t} + \beta_7 FO_{i,t} + \beta_8 ToT_{i,t} + \\ & \beta_9\mathrm{EU\_15\_GDP\_Gr}_{\mathrm{i,t}} + \beta_{10} TO_{i,t} * \mathrm{GDP\_PC\_Gr}_{\mathrm{i,t}} + \\ & + \beta_{11} TO_{i,t} * \mathrm{GDP\_PC\_Gr}_{\mathrm{i,t}}^{2} + \eta_i + \varepsilon_{i,t}\end{aligned}$$

Like in the previous regression we will first use the model of "Difference" GMM. The set of assumptions is the same as in the "Difference" GMM model from the first regression we have estimated. The coefficients estimated using the "Difference GMM" approach are:

Figure 4: The "Difference" GMM estimator of the non-linear effects of trade openness on the economic growth.

[19] See Edwards (2001) and Klein (2003)

```
Arellano-Bond dynamic panel-data estimation     Number of obs      =        72
Group variable (i): ID                          Number of groups   =         9

                                                F(12, 59)          =     11.49

Time variable (t): Year                         Obs per group: min =         8
                                                               avg =         8
                                                               max =         8

One-step results
------------------------------------------------------------------------------
 D.GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDP_PC_Gr |
         LD. |  -.3089569   .0849199    -3.64   0.001    -.4788812   -.1390325
GDP_PC_Level |
         D1. |   .4306313   .0752613     5.72   0.000     .2800337    .5812289
   Fin_Depth |
         D1. |  -.0586202    .016944    -3.46   0.001     -.092525   -.0247154
  Price_stab |
         D1. |  -.1265034   .0246363    -5.13   0.000    -.1758006   -.0772063
  Gov_Burden |
         D1. |   .0172212   .0314109     0.55   0.586    -.0456318    .0800742
      transf |
         D1. |  -.0028038   .0041363    -0.68   0.501    -.0110805     .005473
          TO |
         D1. |   .8615306   .4156967     2.07   0.043     .0297235    1.693338
          FO |
         D1. |  -.0012265   .0046645    -0.26   0.794    -.0105602    .0081072
         ToT |
         D1. |  -.0736593   .0763337    -0.96   0.339    -.2264026    .0790841
EU_15_GDP_Gr |
         D1. |  -.0390995   .1636576    -0.24   0.812    -.3665776    .2883786
TO_GDP_PC_~l |
         D1. |  -.5990949   .3793155    -1.58   0.120    -1.358103    .1599136
TO_GDP_PC_~2 |
         D1. |   .1288536   .0867277     1.49   0.143    -.0446881    .3023954
       _cons |  -.0298546   .0047256    -6.32   0.000    -.0393105   -.0203987
------------------------------------------------------------------------------
Sargan test of over-identifying restrictions:
         chi2(44) =    56.33          Prob > chi2 = 0.1006

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
         H0: no autocorrelation    z =   -0.45   Pr > z = 0.6552
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
         H0: no autocorrelation    z =   -1.17   Pr > z = 0.2400
```

As it can be noticed, the "Difference" GMM estimator has the same type of problem as the previous regression with some coefficients which are zero from the statistical point of view. In the same time, the coefficients of interest in the present case: TO_GDP_PC_level and TO_GDP_PC_level_2 are insignificant too.

The Sargan test of over-identifying restriction is slightly more than 10%. This result highlights the fact that the instruments used are not good and the results are biased.

In order to resolve the problems appeared in the "Difference" GMM model we will use the "System" GMM approach.

The estimators of the "System" GMM model is:

Figure 5: The "System" GMM estimator of the non-linear effects of trade openness on the economic growth.

```
Dynamic panel-data estimation, one-step system GMM

Group variable: ID                              Number of obs      =        81
Time variable : Year                            Number of groups   =         9
Number of instruments = 153                     Obs per group: min =         9
F(12, 68)     =      8.20                                      avg =      9.00
Prob > F      =     0.000                                      max =         9

------------------------------------------------------------------------------
   GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDP_PC_Gr |
         L1. |   .0748521   .0927137     0.81   0.422    -.1101552    .2598594
GDP_PC_Level |   .0166018   .0189507     0.88   0.384    -.0212137    .0544174
   Fin_Depth |  -.0119973   .0100739    -1.19   0.238    -.0320994    .0081049
  Price_stab |  -.0968378    .023027    -4.21   0.000    -.1427874   -.0508882
  Gov_Burden |   -.033602   .0140547    -2.39   0.020    -.0616477   -.0055564
      transf |   .0073455   .0046581     1.58   0.119    -.0019495    .0166406
          TO |   .9232751   .3706846     2.49   0.015     .1835854    1.662965
          FO |  -.0056194   .0015529    -3.62   0.001    -.0087182   -.0025206
         ToT |  -.0683409   .1092658    -0.63   0.534    -.2863774    .1496956
EU_15_GDP_Gr |   .3223708   .1949511     1.65   0.103    -.0666479    .7113896
TO_GDP_PC_~1 |  -.8424974   .3570283    -2.36   0.021    -1.554936   -.1300586
TO_GDP_PC_~2 |   .2005421   .0852644     2.35   0.022     .0303997    .3706845
       _cons |  -.0248439   .0641889    -0.39   0.700    -.1529309    .1032432
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.23  Pr > z =  0.001
Arellano-Bond test for AR(2) in first differences: z =  -0.32  Pr > z =  0.750

Sargan test of overid. restrictions: chi2(140)  =  85.95  Prob > chi2  =  1.000
Warning: Sargan/Hansen tests are weak when instruments are many.
```

The "System" GMM provides better results from the statistical point of view. The Sargan test is 1, which emphasizes the fact that the set of instruments is accepted as being a "healthy" one. The Arellano-Bond test of auto-correlation of the second order is accepted with a P value of 75.0%, this result emphasizing that the errors of the equation in the level are not auto-correlated. Table from bellow summurizes the results obtained from diffecrnt estimators[20].

Table 3: The results of the estimators of the non-linear growth effects of the trade openness.

Model	Within Groups		GLS		Diff GMM		Syst GMM	
GDP_PC_Gr	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
GDP_PC_Gr L1	-0.0646	0.112	0.1215	0.096	-0.3090**	0.085	0.0749	0.093
GDP_PC_Level	-0.0573	0.050	0.0211	0.019	0.4306**	0.075	0.0166	0.019
Fin_Depth	0.0150	0.020	-0.0195*	0.010	-0.0586**	0.017	-0.0120	0.010
Price_stab	-0.1400**	0.036	-0.0937**	0.023	-0.1265**	0.025	-0.0968**	0.023
Gov_Burden	-0.0616	0.047	-0.0352**	0.012	0.0172	0.031	-0.0336**	0.014
transf	0.0001	0.006	0.0042	0.004	-0.0028	0.004	0.0073	0.005
TO	1.6944**	0.546	0.6505*	0.353	0.8615**	0.416	0.9233**	0.371
FO	-0.0001	0.007	-0.0054**	0.002	-0.0012	0.005	-0.0056**	0.002
ToT	-0.0688	0.124	-0.0541	0.109	-0.0737	0.076	-0.0683	0.109
EU_15_GDP_Gr	0.1900	0.253	0.2132	0.189	-0.0391	0.164	0.3224	0.195
TO_GDP_PC_Level	-1.4252**	0.503	-0.5540*	0.335	-0.5991	0.379	-0.8425**	0.357
TO_GDP_PC_Level_2	0.3177**	0.117	0.1264	0.079	0.1289	0.087	0.2005**	0.085
cons	0.1113	0.129	-0.0563	0.061	-0.0299	0.005	-0.0248	0.064
Arellano-Bond test of AR(1)	-		-		0.6552		0.001	
Arellano-Bond test of AR(2)	-		-		0.24		0.75	
Sargan test	-		-		0.1006		1	

* (**) denotes statistical significance at the 10 (5) percent level.

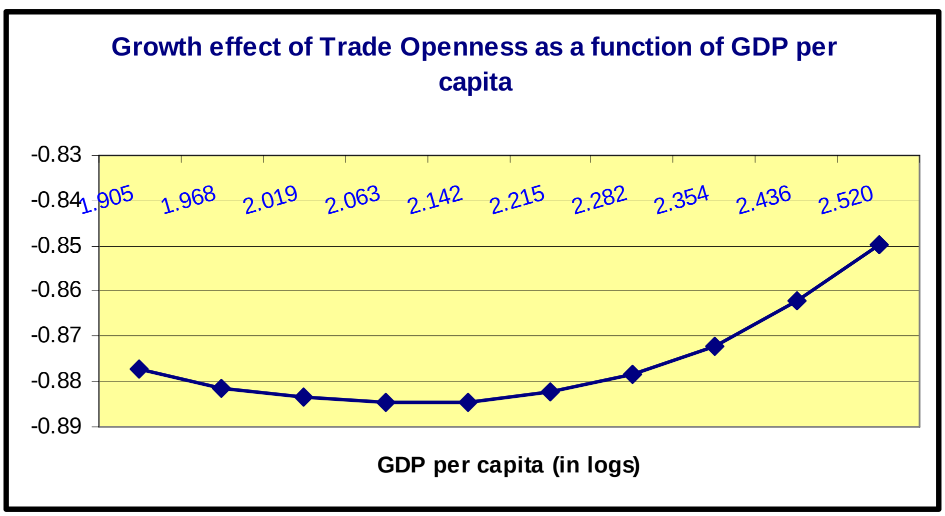
[20] See Appendix D with Within Group and GLS results.

In addition to the coefficients which were insignificant in the first regression (transfers, ToT and GDP per capita growth rate in EU 15) now appeared other insignificant coefficients, such as: GDP in level and financial depth. The justification of this fact is that the new set of data contains additional information which explains the endogenous variable. Thus, the significance of the variables with a lower level of information gets closer to zero from the statistical point of view.

The other coefficients are significant and consistent with the coefficients from the first regression. The coefficient of the FO is the same (-0.0056) in the former and the latest equation.

The figure below illustrates the effect of the trade openness as a function of the level of GDP per capita. The coefficients used to estimate this effect are those from the latest equation: the coefficient of the interaction between the TO and the level of GDP per capita in logs (-0.843) and the coefficient of interaction between TO and the squared level of GDP per capita in logs (0.201).

Graph 5: The Growth effect of TO as a function of GDP per capita



It is observable that the impact of trade liberalization is convex with a quite small coefficient of convexity. Thus, the impact of the TO depends on the level of the country's development: a more developed economy with a higher level of GDP per capita has much more advantages from the integration in the world's market of goods and services after it passes the threshold. An economy begins to reap benefits from trade liberalization only after it passes its specific threshold of development.

The overall average of GDP per capita in log is 2.19 in our sample, which means that, in average, the countries from the Eastern Europe have passed the threshold and they will get benefits from the further trade integration.

From the point of view of the policy makers it is expected that they will further stimulate the trade integration of the countries as their level of development will get higher.

5.2.3 The non-linear growth effect of the financial openness.

In order to estimate the possible non-linear effect of financial openness on the GDP per capita growth rate, we will consider the interaction of the FO and level of GDP per capita.

The regression which needs to be estimated is:

$$\begin{aligned}\mathrm{GDP\_PC\_Gr_{i,t}} = {} & \alpha\mathrm{GDP\_PC\_Gr_{i,t-1}} + \beta_1\mathrm{GDP\_PC\_Level}_{\mathrm{i,t}} + \beta_2\mathrm{Fin\_Depth_{i,t}} + \beta_3\mathrm{Price\_stab_{i,t}} + \\ & + \beta_4\mathrm{Gov\_Burden_{i,t}} + \beta_5\mathrm{transf_{i,t}} + \beta_6 TO_{i,t} + \beta_7 FO_{i,t} + \beta_8 ToT_{i,t} + \\ & + \beta_9\mathrm{EU\_15\_GDP\_Gr_{i,t}} + \beta_{10} FO_{i,t} * \mathrm{GDP\_PC\_Gr_{i,t}} + \\ & + \beta_{11} FO_{i,t} * \mathrm{GDP\_PC\_Gr_{i,t}}^2 + \eta_i + \varepsilon_{i,t}\end{aligned}$$

In the first equation, which estimates the linear effect of trade and financial openness on the economic growth, the coefficient of the financial integration is pretty small. The elasticity of the financial openness is only -0.0056, which means that in case the financial integration will grow with 10%, the growth rate of the GDP per capita will slow down by only 0.056%. This suggests us, that even if coefficient of FO is significant from statistical point of view, it is unimportant in absolute value. In these circumstances we expect that the coefficients of the interaction terms between FO and GDP per capita will be either very small or insignificant from statistical point of view.

Like in the previous regression, we will first use the model of “Difference” GMM. The set of assumptions is the same as in the “Difference” GMM model from the first regression we have estimated. The estimators of the model are:

Figure 6: The "Difference" GMM estimator of the non-linear effects of financial openness on the economic growth.

```
Arellano-Bond dynamic panel-data estimation     Number of obs      =        72
Group variable (i): ID                          Number of groups   =         9

                                                F(12, 59)          =     10.44

Time variable (t): Year                         Obs per group: min =         8
                                                               avg =         8
                                                               max =         8

One-step results
```

D.GDP_PC_Gr	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDP_PC_Gr LD.	-.2475854	.0871692	-2.84	0.006	-.4220106	-.0731602
GDP_PC_Level D1.	.4044788	.0841648	4.81	0.000	.2360654	.5728922
Fin_Depth D1.	-.0729411	.0155214	-4.70	0.000	-.1039994	-.0418828
Price_stab D1.	-.1026994	.0229486	-4.48	0.000	-.1486194	-.0567795
Gov_Burden D1.	.0080424	.0332964	0.24	0.810	-.0585835	.0746684
transf D1.	-.0050555	.0040377	-1.25	0.215	-.013135	.0030241
TO D1.	.1551952	.0336523	4.61	0.000	.0878571	.2225333
FO D1.	.0810012	.059888	1.35	0.181	-.0388345	.2008369
ToT D1.	-.0497765	.0801893	-0.62	0.537	-.2102349	.1106818
EU_15_GDP_Gr D1.	.021812	.1676548	0.13	0.897	-.3136645	.3572885
FO_GDP_PC_~l D1.	-.0620231	.0517838	-1.20	0.236	-.1656422	.0415961
FO_GDP_PC_~2 D1.	.011426	.0111317	1.03	0.309	-.0108485	.0337004
_cons	-.0274814	.0056055	-4.90	0.000	-.038698	-.0162648

```
Sargan test of over-identifying restrictions:
         chi2(44) =    59.39          Prob > chi2 = 0.0606

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
         H0: no autocorrelation    z =  -0.68   Pr > z = 0.4961
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
         H0: no autocorrelation    z =  -0.74   Pr > z = 0.4582
```

The Sargan test of over-identifying restriction has slightly above 5%. This suggests the fact that the instruments for the first-differenced equation are weak.

In the same time some of the coefficients are not significantly different from zero from the statistical point of view. The coefficients of interest in the present case are: the FO_GDP_PC_level and FO_GDP_PC_level_2 which are not significantly different from zero.

We will try to get better results with the help of the "System" GMM approach.

Figure 7: The "System" GMM estimator of the non-linear effects of financial openness on the economic growth.

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: ID                              Number of obs      =        81
Time variable : Year                            Number of groups   =         9
Number of instruments = 153                     Obs per group: min =         9
F(12, 68)     =      8.25                                      avg =      9.00
Prob > F      =     0.000                                      max =         9
------------------------------------------------------------------------------
  GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
  GDP_PC_Gr |
        L1. |   .0588993   .0956799     0.62   0.540    -.1320269    .2498256
GDP_PC_Level|   .0115327   .0248107     0.46   0.644    -.0379763    .0610417
  Fin_Depth |   -.022374   .0108233    -2.07   0.043    -.0439715   -.0007764
 Price_stab |  -.0747343   .0249824    -2.99   0.004    -.1245859   -.0248826
 Gov_Burden |  -.0284066   .0147736    -1.92   0.059    -.0578869    .0010736
     transf |   .0028228   .0042642     0.66   0.510    -.0056863     .011332
         TO |   .0537799   .0108211     4.97   0.000     .0321867     .075373
         FO |   .0692117     .06736     1.03   0.308    -.0652031    .2036266
        ToT |  -.1062909    .106722    -1.00   0.323    -.3192513    .1066695
EU_15_GDP_Gr|   .2357997   .1957818     1.20   0.233    -.1548769    .6264762
FO_GDP_PC_~l|   -.058477   .0574994    -1.02   0.313    -.1732151    .0562612
FO_GDP_PC_~2|   .0114067   .0123082     0.93   0.357     -.013154    .0359674
      _cons |  -.0230744    .068475    -0.34   0.737     -.159714    .1135653
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -3.11  Pr > z =  0.002
Arellano-Bond test for AR(2) in first differences: z =  -0.18  Pr > z =  0.858
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(140)   =  93.45  Prob > chi2 =  0.999
```

If we compare the Sargan test and the Arellano-Bond test for AR(2), the "System" GMM approach gets better results. But the coefficients of interest FO_GDP_PC_Level and FO_GDP_PC_Level_2 are insignificantly different from zero.

Table 4: The results of the estimators of the non-linear growth effects of the finamcial openness[21].

Model	Within Groups		GLS		Diff GMM		Syst GMM	
GDP_PC_Gr	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
GDP_PC_Gr L1	-0.0133	0.116	0.0407	0.103	-0.2476**	0.087	0.0589	0.096
GDP_PC_Level	-0.0046	0.052	-0.0041	0.021	0.4045**	0.084	0.0115	0.025
Fin_Depth	-0.0272	0.021	-0.0346**	0.011	-0.0729**	0.016	-0.0224**	0.011
Price_stab	-0.0781**	0.036	-0.0601**	0.024	-0.1027**	0.023	-0.0747**	0.025
Gov_Burden	-0.0265	0.052	-0.0303**	0.010	0.0080	0.033	-0.0284*	0.015
transf	-0.0028	0.006	0.0008	0.003	-0.0051	0.004	0.0028	0.004
TO	0.1046**	0.048	0.0552**	0.013	0.1552**	0.034	0.0538**	0.011
FO	0.1057	0.091	0.1518**	0.061	0.0810	0.060	0.0692	0.067
ToT	-0.0629	0.129	-0.0210	0.106	-0.0498	0.080	-0.1063	0.107
EU_15_GDP_Gr	0.2566	0.260	0.1557	0.176	0.0218	0.168	0.2358	0.196
FO_GDP_PC_Level	-0.0782	0.078	-0.1260**	0.051	-0.0620	0.052	-0.0585	0.057
FO_GDP_PC_Level_2	0.0141	0.017	0.0252**	0.011	0.0114	0.011	0.0114	0.012
cons	-0.0014	0.120	-0.0051	0.060	-0.0275*	0.006	-0.0231	0.068
Arellano-Bond test of AR(1)	-		-		0.4961		0.002	
Arellano-Bond test of AR(2)	-		-		0.4582		0.858	
Sargan test	-		-		0.0606		0.999	

* (**) denotes statistical significance at the 10 (5) percent level.

[21] See Appendix E with Within Group and GLS results.

As we observe, neither the “Difference” GMM nor the “System” GMM approach get significant coefficients of the interaction terms between the financial integration and the GDP per capita in level. The GLS method gives the estimators of these coefficients significantly different from zero but we would not rely on these estimators because the GLS method doesn’t take into account the cross-country fixed effect and the fact that the regressors are endogenous.

As we expected before the analysis, the interaction terms between FO and GDP per capita are insignificant from the statistical point of view.

Albeit the impact of the financial integration is currently a negative one and doesn’t depend on the level of development, it is expected that policy makers will further stimulate the financial integration of the country in the hope that the economy will reach a certain level of development, after which the country will begin to benefit from the financial integration.

We consider that the analysis of the impact of the financial globalization on the economic growth has to be correlated with the analysis of the influence of the financial depth on the growth rate. As we have noticed in the analysis of the first regression, both indicators have a negative impact on the growth rate. We believe that a further development of the domestic financial market in interaction with a further financial integration of the economy will bring considerable benefits to the economy and will influence the growth rate of the domestic economy in a positive way.

6.Conclusions

This paper has proposed to analyze the impact of the financial and trade openness on the economic growth in the countries from the Eastern Europe.

We used a panel data set which contains 9 countries[22] from this region and 10 years of observation. We have carefully studied the existent econometrical model which can deal with problems like: the endogeneity of regressors measured with errors, omitted variables, and the persistency of the dependent variable. Therefore, we have used two of the most complex econometric techniques in the panel data analysis: the “Difference” and

[22] These countries are: Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, and Slovenia

"System" Generalized Method of Moments which can deal with all the issues highlighted above. In the same time we have estimated regressions using alternative methods, such as the Within Group and GLS estimators which can deal only with a part of the problems from above. The best result was given by the "System" GMM estimator, which is in accordance with the results obtained by other authors who used a comparison between the "System" GMM and alternative approaches in their empirical analysis[23].

Related to the trade integration, our study revealed a significant positive effect of trade openness on the economic growth. We have analyzed the view that the growth effect of the trade openness is not linear and varies with the level of development of the country[24]. Our results sustain this view, the growth effect of the trade openness in the countries from Eastern Europe being non-monotonic and convex. Thus, there is a threshold of the development after which the national economy begins to reap the positive effects from the openness of the national markets of goods and services. Our further analysis has revealed that the most of the countries from Eastern Europe passed this threshold and have already begun to benefit from the trade liberalization.

Related to the financial integration the impact of financial openness is negative but it is very small so its impact on the growth rate in negligible, being close to zero. Our further analysis revealed that the growth effect of the financial openness is monotonic and doesn't depend on the country's level of development.

The study also includes the analysis of the impact of the control variables on the growth rate. The main conclusion is that the factors such as, growth rate in EU 15 and changes in the ToT, don't have an impact on the path of the growth rate in the countries from the Eastern Europe.

There is no evidence that transfers influence the growth rate. Another fact which can be noticed is that a higher financial depth leads to a lower growth rate. This conclusion should be treated with concern because different proxies of the financial depth may lead to different results.

The main problem in analyzing the growth impact of trade and financial openness in the countries from Eastern Europe refers to the availability of the data. The relevant

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[23] See Bond, S., A. Hoeffler, and J. Temple (2001).
[24] See Calderón, C., N. L.Klaus, and Schmidt-Hebbel (2005).

data series related to these countries are quite short, being available only for the last 15 years.

The result of our analysis should be taken with some prudence. The estimated elasticities have to be analyzed with concern. It is difficult to interpret them as true long run coefficients which represent the growth effect of different indicators, because the time series data set is very short. Furthermore, we can affirm that the growth impact of the trade and financial integration is likely to continue to change as a consequence of the structural changes in the economies from the Eastern Europe. In order to broaden the analysis, the further studies of the growth impact of trade and financial integration should take into account other variables too, such as the education rate, the ratio of money aggregates M2/M3 to the GDP and the ration of the private domestic credits to the GDP.

7. BIBLIOGRAPHY

1) **Arellano, M. and O. Bover (1995), „Another look at the instrumental variable estimation of error-components models", Journal of Econometrics 68, 29-51**

2) **Arellano, M. and S. Bond (1991), „Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", The Review of Economic Studies, Vol. 58, No. 2., pp. 277-297.**

3) **Beck, T., R. Levine, and N. Loayza (2000), „Finance and the sources of growth", Journal of Financial Economics 58 ,261-300**

4) **Bekaert, G., C. R. Harvey, and C. Lundblad (2006), „Growth volatility and financial liberalization", Journal of International Money and Finance 25 370-403**

5) **Blundell, R. and S. Bond (1998a), "GMM estimation with persistent panel data: an application to production functions", The Institute for Fiscal Studies - Working Paper Series No. W99/4**

6) **(1998b), "Initial conditions and moment restrictions in dynamic panel data models", Journal of Econometrics 87 (1998) 115-143**

7) **Bond, S., C. Nauges, and F. Windmeijer (2002), „Unit Roots and Identification in Autoregressive Panel Data Models: A Comparison of Alternative Tests", Institute for Fiscal Studies**

8) **Bond, S., A. Hoeffler, and J. Temple (2001), „GMM Estimation of Empirical Growth Models", The University of Oxford and the University of Bristol**

9) **Braun, M. and C. Raddatz (2007), „Trade liberalization, capital account liberalization and the real effects of financial development", Journal of International Money and Finance 26 ,730-761**

10) **Calderón, C., N. L.Klaus, and Schmidt-Hebbel (2005), „Does Openness Imply Greater Exposure?", The World Bank**

11) **Chanda, A. (2005), „The influence of capital controls on long run growth: Where and how much?", Journal of Development Economics 77, 441– 466**

12) **Denizer, C. , M.F. Iyigun, and A.L. Owen (2000), "Finance and Macroeconomic Volatility", Policy Research Working Paper - The World Bank**

13) **Edison, H.J., M. W. Klein, L. Ricci, and T. Sloek (2002), "Capital Account Liberalization and Economic Performance: Survey and Synthesis", NBER Working Paper No. 9100**

14) **Hayakawa, K. (2005), „Small Sample Bias Properties of the System GMM Estimator in Dynamic Panel Data Models", Discussion Paper Series No.82 – Institute of Economic Research Hitotsubashi University**

15) **King, R.G. and R. Levine (1993), „Finance and Growth: Schumpeter Might be Right", The Quarterly Journal of Economics, Vol. 108, No. 3., pp. 717-737.**

16) **Klein, M.W. (2003), "Capital Account Openness and the Varieties of Growth Experience", Fletcher School, Tufts University and NBER.**

17) **Kose, M.A., E. Prasad, K. Rogoff, and S.J Wei (2006), „Financial Globalization: A Reappraisal", IMF Working Paper**

18) **Kose, M.A., E. Prasad, and M.E. Terrones (2003), „Financial Integration and Macroeconomic Volatility", IMF Working Paper**

19) **Neaime, S. (2005), „Financial Market Integration and Macroeconomic Volatility in the MENA Region: An Empirical Investigation", Review of Middle East Economics and Finance Vol. 3, No. 3, 231–255.**

20) **Nickell, S. (1981), „Biases in Dynamic Models with Fixed Effects", Econometrica, Vol. 49, No. 6., pp. 1417-1426.**

21) **Ramey, G. and V. A. Ramey (1995), „Cross-Country Evidence on the Link Between Volatility and Growth", The American Economic Review, Vol. 85, No. 5., pp. 1138-1151.**

22) Razin, A. And Y.Rubinstein (2004), „Growth Effects of the Exchange-Rate Regime and the Capital-Account Openness in A Crisis-Prone World Market: A Nuanced View", NBER Working Paper No. 10555

23) Rincón, H. (2007), „Financial Globalization, Economic Growth, and Macroeconomic Volatility", Boradorres de Economia, No 430.

24) Roodman, D. (2006), „How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata", Center for Global Development

25) Salinas, G. And A. Aksoy (2006), „Growth before and after trade liberalization", World Bank - Policy Research Working Paper 4062

26) Summers, L.H. (2000), „International Financial Crises: Causes, Prevention, and Cures", The American Economic Review, Vol. 90, No. 2, Papers and Proceedings of the One Hundred Twelfth Annual Meeting of the American Economic Association, pp. 1-16.

27) Yanikkaya, H. (2003), „Trade openness and economic growth: a cross-country empirical investigation", Journal of Development Economics 72 ,57– 89

28) Vinh, X. and K. J. Daly (2007), „The determinants of international financial integration", Global Finance Journal, School of Economics, University of New South Wales, Australia

29) Windmeijer, F., „A Finite Sample Correction For The Variance of Linear Two-Step GMM Estimators", The institute For Fiscal Studies

30) Wooldridge, Jeffrey M. (2002). „Introductory Econometrics: A Modern Approach", second edition, South-Western College Publishing.

31) Wooldridge, Jeffrey M. (2001). Econometric Analysis of Cross Section and Panel Data, Cambridge, MA: The MIT Press.

Appendix A: The correlogram and unit root test of the GDP per capita growth rate.

The correlogram of the GDP per capita growth rate and the first "Difference" of the GDP per capita growth rate.

Correlogram of GDP_PC_GR

Date: 06/26/07 Time: 14:08
Sample: 1996 2005
Included observations: 90

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.409	0.409	15.600	0.000
		2	0.160	-0.009	18.016	0.000
		3	0.112	0.059	19.206	0.000
		4	-0.043	-0.131	19.385	0.001
		5	0.009	0.082	19.393	0.002

Correlogram of D(GDP_PC_GR)

Date: 06/26/07 Time: 14:09
Sample: 1996 2005
Included observations: 81

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.272	-0.272	6.1997	0.013
		2	-0.102	-0.190	7.0869	0.029
		3	0.134	0.055	8.6373	0.035
		4	-0.216	-0.199	12.729	0.013
		5	0.118	0.029	13.951	0.016

Unit root test of the GDP per capita growth rate.

Levin, Lin & Chu Unit Root Test on GDP_PC_GR

Null Hypothesis: Unit root (common unit root process)
Date: 06/26/07 Time: 14:51
Sample: 1996 2005
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic selection of lags based on SIC: 0 to 1
Newey-West bandwidth selection using Bartlett kernel
Total number of observations: 78
Cross-sections included: 9

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-5.94064	0.0000

** Probabilities are computed assuming asympotic normality

Intermediate results on GDP_PC_GR

Cross section	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
1	-0.96136	0.0003	0.0012	1	1	1.0	8
2	-0.54683	4.E-05	0.0005	1	1	2.0	8
3	-1.32906	0.0011	0.0004	0	1	7.0	9
4	-1.92270	0.0004	0.0002	1	1	8.0	8
5	-1.10113	0.0009	0.0002	0	1	7.0	9
6	-0.63885	0.0002	0.0001	0	1	8.0	9
7	-0.81092	0.0006	0.0004	0	1	2.0	9
8	-0.41754	0.0020	0.0024	0	1	1.0	9
9	-0.88377	0.0001	5.E-05	0	1	5.0	9

	Coefficient	t-Stat	SE Reg	mu*	sig*	Obs
Pooled	-0.78715	-9.025	1.073	-0.554	0.919	78

Im, Pesaran and Shin Unit Root Test on GDP_PC_GR

Null Hypothesis: Unit root (individual unit root process)
Date: 06/26/07 Time: 14:52
Sample: 1996 2005
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic selection of lags based on SIC: 0 to 1
Total number of observations: 78
Cross-sections included: 9

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-2.83853	0.0023

** Probabilities are computed assuming asympotic normality

Intermediate ADF test results

Cross section	t-Stat	Prob.	E(t)	E(Var)	Lag	Max Lag	Obs
1	-4.9059	0.0068	-1.516	1.812	1	1	8
2	-2.9312	0.0838	-1.516	1.812	1	1	8
3	-3.1827	0.0558	-1.515	1.385	0	1	9
4	-2.1924	0.2211	-1.516	1.812	1	1	8
5	-2.9177	0.0811	-1.515	1.385	0	1	9
6	-1.8972	0.3187	-1.515	1.385	0	1	9
7	-2.3749	0.1723	-1.515	1.385	0	1	9
8	-1.3423	0.5605	-1.515	1.385	0	1	9
9	-2.4162	0.1631	-1.515	1.385	0	1	9
Average	-2.6845		-1.515	1.527			

Appendix B: Estimators of the autoregression coefficient of the growth rate.

Regression 1: OLS with FE

Dependent Variable: GDP_PC_GR
Method: Panel Least Squares
Date: 06/26/07 Time: 13:07
Sample (adjusted): 1997 2005
Cross-sections included: 9
Total panel (balanced) observations: 81

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.047322	0.007710	6.137398	0.0000
GDP_PC_GR(-1)	0.319170	0.105264	3.032094	0.0034

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.336302	Mean dependent var	0.068322
Adjusted R-squared	0.252171	S.D. dependent var	0.035270
S.E. of regression	0.030500	Akaike info criterion	-4.027027
Sum squared resid	0.066048	Schwarz criterion	-3.731416
Log likelihood	173.0946	F-statistic	3.997366
Durbin-Watson stat	1.935082	Prob(F-statistic)	0.000364

Regression 2: "Difference" GMM (estimated in Eviews)

Dependent Variable: GDP_PC_GR
Method: Panel Generalized Method of Moments
Transformation: First Differences
Date: 06/26/07 Time: 13:17
Sample (adjusted): 1998 2005
Cross-sections included: 9
Total panel (balanced) observations: 72
Difference specification instrument weighting matrix
Instrument list: @DYN(GDP_PC_GR,-2) @LEV(@SYSPER)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_PC_GR(-1)	0.298483	0.106215	2.810185	0.0066
@LEV(@ISPERIOD("1998"))	-0.012248	0.011217	-1.091891	0.2790
@LEV(@ISPERIOD("1999"))	-0.003907	0.013008	-0.300333	0.7649
@LEV(@ISPERIOD("2000"))	0.036991	0.012973	2.851395	0.0059
@LEV(@ISPERIOD("2001"))	-0.016800	0.013466	-1.247550	0.2168
@LEV(@ISPERIOD("2002"))	-0.002841	0.012967	-0.219060	0.8273
@LEV(@ISPERIOD("2003"))	0.004965	0.012959	0.383142	0.7029
@LEV(@ISPERIOD("2004"))	0.010345	0.012955	0.798529	0.4276
@LEV(@ISPERIOD("2005"))	-0.002392	0.013006	-0.183942	0.8546

Effects Specification

Cross-section fixed (first differences)
Period fixed (dummy variables)

R-squared	-0.101966	Mean dependent var	0.002575
Adjusted R-squared	-0.241898	S.D. dependent var	0.034860
S.E. of regression	0.038848	Sum squared resid	0.095078
J-statistic	33.68036	Instrument rank	45.00000

Regression 3: "Difference" GMM (estimated in Stata)

```
Arellano-Bond dynamic panel-data estimation     Number of obs      =        72
Group variable (i): ID                          Number of groups   =         9

                                                F(1, 70)           =      6.97

Time variable (t): Year                         Obs per group: min =         8
                                                               avg =         8
                                                               max =         8

One-step results
------------------------------------------------------------------------------
D.GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
  GDP_PC_Gr |
        LD. |   .3081823   .1167289     2.64   0.010     .0753738    .5409909
      _cons |   .0029505   .0012854     2.30   0.025     .0003869    .0055142
------------------------------------------------------------------------------
Sargan test of over-identifying restrictions:
        chi2(35) =    37.37          Prob > chi2 = 0.3609

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
        H0: no autocorrelation   z =  -3.81   Pr > z = 0.0001
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
        H0: no autocorrelation   z =   0.03   Pr > z = 0.9732
```

Appendix C: The estimators of the linear effects of trade and financial openness

Regression 4: The Within Group estimator of the linear effects of trade and financial openness.

```
Fixed-effects (within) regression               Number of obs      =        81
Group variable (i): ID                          Number of groups   =         9

R-sq:  within  = 0.4095                         Obs per group: min =         9
       between = 0.1674                                        avg =       9.0
       overall = 0.1986                                        max =         9

                                                F(10,62)           =      4.30
corr(u_i, Xb)  = -0.7636                        Prob > F           =    0.0001

------------------------------------------------------------------------------
   GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDP_PC_Gr |
         L1. |   .0513252   .1103323     0.47   0.643    -.1692259    .2718763
GDP_PC_Level |   .0070012   .0452872     0.15   0.878    -.0835267    .0975291
   Fin_Depth |   -.009645   .0190215    -0.51   0.614    -.0476685    .0283786
  Price_stab |  -.1007901   .0349091    -2.89   0.005    -.1705725   -.0310077
  Gov_Burden |  -.0271797   .0474351    -0.57   0.569    -.1220012    .0676418
      transf |   .0008553   .0053683     0.16   0.874    -.0098757    .0115864
          TO |   .1175301   .0481026     2.44   0.017     .0213744    .2136858
          FO |   .0003246   .0068596     0.05   0.962    -.0133875    .0140367
         ToT |  -.0812062   .1291375    -0.63   0.532    -.3393484     .176936
EU_15_GDP_Gr |   .2655558   .2635847     1.01   0.318    -.2613424    .7924541
       _cons |  -.0099277   .1200802    -0.08   0.934    -.2499647    .2301092
-------------+----------------------------------------------------------------
     sigma_u |  .03448656
     sigma_e |  .02665501
         rho |  .62602118   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(8, 62) =     0.94             Prob > F = 0.4879
```

Regression 5: The FGLS estimator of the linear effects of trade and financial openness.

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   panel-specific AR(1)

Estimated covariances      =         9          Number of obs      =        81
Estimated autocorrelations =         9          Number of groups   =         9
Estimated coefficients     =        11          Time periods       =         9
                                                Wald chi2(10)      =     91.25
Log likelihood             =  193.4721          Prob > chi2        =    0.0000

------------------------------------------------------------------------------
   GDP_PC_Gr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDP_PC_Gr |
         L1. |    .114326   .0976253     1.17   0.242    -.0770162    .3056682
GDP_PC_Level |   .0304843   .0157806     1.93   0.053    -.0004451    .0614137
   Fin_Depth |   -.019084   .0094396    -2.02   0.043    -.0375852   -.0005828
  Price_stab |  -.0896426   .0222595    -4.03   0.000    -.1332704   -.0460148
  Gov_Burden |  -.0331141   .0114896    -2.88   0.004    -.0556334   -.0105948
      transf |   .0016568   .0031494     0.53   0.599    -.0045159    .0078295
          TO |   .0538172   .0129262     4.16   0.000     .0284823    .0791521
          FO |    -.00604   .0015263    -3.96   0.000    -.0090315   -.0030485
         ToT |  -.0781831   .1011113    -0.77   0.439    -.2763576    .1199915
EU_15_GDP_Gr |   .1884326   .1723526     1.09   0.274    -.1493723    .5262376
       _cons |   -.082991   .0534046    -1.55   0.120    -.1876622    .0216801
------------------------------------------------------------------------------
```

Appendix D: The estimators of the non-linear growth effects of the trade openness

Regression 6: Within Group estimator.

```
Fixed-effects (within) regression               Number of obs      =        81
Group variable (i): ID                          Number of groups   =         9

R-sq:  within  = 0.4846                         Obs per group: min =         9
       between = 0.1606                                        avg =       9.0
       overall = 0.2123                                        max =         9

                                                F(12,60)           =      4.70
corr(u_i, Xb)  = -0.7909                        Prob > F           =    0.0000
```

GDP_PC_Gr	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDP_PC_Gr L1.	-.064638	.1120224	-0.58	0.566	-.2887162	.1594402
GDP_PC_Level	-.0572913	.0502839	-1.14	0.259	-.157874	.0432913
Fin_Depth	.0150083	.0199423	0.75	0.455	-.0248822	.0548988
Price_stab	-.1400434	.0358239	-3.91	0.000	-.2117019	-.0683849
Gov_Burden	-.061615	.0465361	-1.32	0.191	-.1547012	.0314711
transf	.0001176	.0061226	0.02	0.985	-.0121294	.0123647
TO	1.694445	.5459377	3.10	0.003	.6024075	2.786484
FO	-.0001114	.0066492	-0.02	0.987	-.0134118	.0131889
ToT	-.0688146	.1238431	-0.56	0.581	-.3165378	.1789085
EU_15_GDP_Gr	.1900405	.2529671	0.75	0.455	-.3159691	.6960502
TO_GDP_PC_~1	-1.425203	.5034526	-2.83	0.006	-2.432258	-.4181476
TO_GDP_PC_~2	.3176784	.1170431	2.71	0.009	.0835573	.5517996
_cons	.1112616	.1293939	0.86	0.393	-.1475647	.3700879
sigma_u	.03848168					
sigma_e	.02531545					
rho	.69794577	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(8, 60) =     1.55              Prob > F = 0.1590
```

Regression 7: Cross-sectional time-series FGLS regression.

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   panel-specific AR(1)

Estimated covariances      =         9          Number of obs      =        81
Estimated autocorrelations =         9          Number of groups   =         9
Estimated coefficients     =        13          Time periods       =         9
                                                Wald chi2(12)      =    103.55
Log likelihood             =  191.1665          Prob > chi2        =    0.0000
```

GDP_PC_Gr	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
GDP_PC_Gr L1.	.1214599	.096468	1.26	0.208	-.0676139	.3105336
GDP_PC_Level	.0211436	.0187729	1.13	0.260	-.0156506	.0579378
Fin_Depth	-.0195111	.010011	-1.95	0.051	-.0391323	.0001101
Price_stab	-.0936746	.0230398	-4.07	0.000	-.1388317	-.0485175
Gov_Burden	-.0351853	.0117005	-3.01	0.003	-.0581179	-.0122527
transf	.0042031	.0036719	1.14	0.252	-.0029938	.0114
TO	.6504671	.3534411	1.84	0.066	-.0422648	1.343199
FO	-.0054202	.001576	-3.44	0.001	-.0085091	-.0023312
ToT	-.0541126	.1091638	-0.50	0.620	-.2680698	.1598446
EU_15_GDP_Gr	.2132292	.1888749	1.13	0.259	-.1569589	.5834172
TO_GDP_PC_~1	-.5540324	.335467	-1.65	0.099	-1.211536	.103471
TO_GDP_PC_~2	.1263633	.0786326	1.61	0.108	-.0277538	.2804804
_cons	-.0562956	.0609558	-0.92	0.356	-.1757667	.0631755

Appendix E: The estimators of the non-linear growth effects of the financial openness

Regression 8: Within Group estimator.

```
Fixed-effects (within) regression               Number of obs      =        81
Group variable (i): ID                          Number of groups   =         9

R-sq:  within  = 0.4469                         Obs per group: min =         9
       between = 0.2440                                        avg =       9.0
       overall = 0.2650                                        max =         9

                                                F(12,60)           =      4.04
corr(u_i, Xb)  = -0.7185                        Prob > F           =    0.0001

------------------------------------------------------------------------------
   GDP_PC_Gr |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDP_PC_Gr |
         L1. |  -.0133346   .1156758    -0.12   0.909    -.2447207    .2180515
GDP_PC_Level |  -.0045999   .0515283    -0.09   0.929    -.1076719     .098472
   Fin_Depth |  -.0271782   .0207242    -1.31   0.195    -.0686328    .0142764
  Price_stab |  -.0781489   .0361384    -2.16   0.035    -.1504364   -.0058613
  Gov_Burden |  -.0265442   .0518816    -0.51   0.611    -.1303229    .0772344
      transf |  -.0028042   .0055874    -0.50   0.618    -.0139806    .0083722
          TO |   .1046226   .0478917     2.18   0.033     .0088249    .2004204
          FO |   .1057049    .091321     1.16   0.252    -.0769642    .2883741
         ToT |  -.0628522   .1285653    -0.49   0.627     -.320021    .1943167
EU_15_GDP_Gr |   .2566259   .2596751     0.99   0.327    -.2628016    .7760534
FO_GDP_PC_~1 |  -.0781828   .0782086    -1.00   0.321    -.2346232    .0782577
FO_GDP_PC_~2 |   .0140573   .0165737     0.85   0.400    -.0190949    .0472096
       _cons |  -.0014192   .1196618    -0.01   0.991    -.2407786    .2379401
-------------+----------------------------------------------------------------
     sigma_u |  .03025505
     sigma_e |  .02622389
         rho |  .57101282   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(8, 60) =     1.28             Prob > F = 0.2686
```

Regression 9: Cross-sectional time-series FGLS regression.

```
Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   panel-specific AR(1)

Estimated covariances      =         9          Number of obs      =        81
Estimated autocorrelations =         9          Number of groups   =         9
Estimated coefficients     =        13          Time periods       =         9
                                                Wald chi2(12)      =    103.37
Log likelihood             =  194.9069          Prob > chi2        =    0.0000

------------------------------------------------------------------------------
   GDP_PC_Gr |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDP_PC_Gr |
         L1. |   .0407066   .1033375     0.39   0.694    -.1618312    .2432443
GDP_PC_Level |  -.0041122   .0209085    -0.20   0.844    -.0450921    .0368678
   Fin_Depth |  -.0346359   .0108678    -3.19   0.001    -.0559365   -.0133353
  Price_stab |  -.0601211   .0238833    -2.52   0.012    -.1069316   -.0133106
  Gov_Burden |  -.0303188   .0101793    -2.98   0.003    -.0502698   -.0103678
      transf |   .0007671   .0029883     0.26   0.797    -.0050898     .006624
          TO |   .0552164   .0129793     4.25   0.000     .0297774    .0806554
          FO |   .1517778   .0611689     2.48   0.013     .0318889    .2716667
         ToT |  -.0210336   .1055152    -0.20   0.842    -.2278395    .1857723
EU_15_GDP_Gr |   .1557431   .1764062     0.88   0.377    -.1900068    .5014929
FO_GDP_PC_~1 |   -.125952   .0512855    -2.46   0.014    -.2264697   -.0254343
FO_GDP_PC_~2 |   .0251516   .0107982     2.33   0.020     .0039876    .0463157
       _cons |  -.0051227   .0597086    -0.09   0.932    -.1221493    .1119039
------------------------------------------------------------------------------
```