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Determinants of Economic Growth in the Pre-Crisis Period[4]

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***Abstract**: This paper analyses the determinants of economic growth in the post WWII to the pre-crisis period (1953-2007) using the dynamic generalized methods of moments (GMM) panel approach to determine effects of the real and the monetary determinants. Our results obtained from the panel of 61 countries suggest that economic growth varies between periods, as well as with level of economic development. Real determinants of GDP growth (real per capita GDP level, private consumption, investments, government expenditure, exports, and imports) affect the economic growth in all countries, while the monetary determinants (inflation, interest rate, and foreign direct investment) play more important role in the developed countries.*

***Keywords**: economic growth, determinants of growth, GMM model*

Determinante ekonomskog rasta u pre-kriznom periodu

***Apstrakt**: U ovom radu analizirane su determinante ekonomskog rasta nakon Drugog svetskog rata do ekonomske krize (1953-2007). U analizi je korišćen dinamički opšti metoda momenta (GMM) panel za određivanje efekata realnih i monetarnih determinanti. Rezultati dobijeni od panela 61 zemlje ukazuju na to da se ekonomski rast razlikuje između perioda, kao i da zavisi od nivoa ekonomskog razvoja. Realne determinante rasta BDP-a (realni nivo BDP po*

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glavi stanovnika, privatna potrošnja, investicije, državna potrošnja, izvoz i uvoz) utiču na ekonomski rast u svim zemljama, dok monetarne determinante (inflacija, kamatna stopa i strane direktne investicije) imaju važniju ulogu u razvijenim zemljama.

***Ključne reči**: ekonomski rast, determinante rasta, GMM model*

1. Introduction

Up to the industrial revolution, the world economy had a constant level of growth. With the expansion of trade and capital movements, the world is experiencing higher levels of growth up to WWII. However, intensive and diverse growth levels are more noticeable after WWII. This period of diverse growth coincides with Breton-Woods Monetary Arrangement (1946-1973) and continues even in the period after the collapse of Monetary Arrangement.

This variation in economic development within different time periods and between countries allows for investigation of economic growth and its determinants. In this research, we look into the real and monetary determinants of economic growth by using data from 61 countries in the period from 1953 to 2007. Although post-2007 data were available, we did not use them to eliminate the effects of global financial and economic crises.

The following section describes data and their sources, and provides descriptive statistics. Section 3 presents our econometric approach, and the most important results are outlined in Section 4. Section 5 provides conclusion.

2. Data

Data are defined in Table 1, which also provides abbreviations used in the following tables. Source of all data was IMF's IFS. We used a subsample of data where we eliminated outliers where economic growth is higher than 14 percent or is lower than minus 14 percent, where inflation is above 500 percent, where depreciation of exchange rate is more than 1,000 percent or where consumption, government expenditure, investments, import, or export are higher than GDP.

In the analysis, we included 61 countries, with all available data series: Albania, Argentina, Australia, Austria, Belarus, Belgium, Botswana, Brazil, Bulgaria, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo, Croatia, Czech Republic, Denmark, Egypt, Estonia, France, Gabon, Germany, Hungary, India, Indonesia, Israel, Italy, Japan,

Madagascar, Malaysia, Macedonia, Mexico, Morocco, The Netherlands, New Zealand, Norway, Kenya, Korea, Kuwait, Libya, Philippines, Poland, Romania, Russia, Saudi Arabia, Slovak Republic, Slovenia, South Africa, Sri Lanka, Switzerland, Syria, Thailand, Turkey, Ukraine, United States, United Kingdom, Venezuela, and Zimbabwe.

Table 1: Definitions of variables

Abbreviations	Definition
rGDPpc	Real per capita Gross Domestic Product deflated by CPI
Initial rGDPpc	Initial rGDPpc
Consumption	Share of Private Consumption in GDP
Government	Share of Government Expenditures in GDP
Investment	Share of Investments in GDP
Exports	Share of Exports in GDP
Import	Share of Imports in GDP
Inflation	Percentage change of CPI
FDI	Share of Foreign Direct Investments in GDP
National interest rate	Nominal national interest rate reduced by inflation rate
REER	Real Effective Exchange Rate is Percentage difference of real exchange rate variation of its equilibrium level (100). Value above 0 shows depreciation, while value under 0 shows appreciation of real exchange rate.
Openness	Share of sum of exports and imports in Gross Domestic Product

Source: Author's

Table 2 shows descriptive statistics and reveals the average growth of 2.7%. Consumption is on average 62% of GDP, while Government expenditures are on average 16%. On average, economies can be defined as closed, as imports and exports are below 15% of GDP. This period is also characterized by negative difference between real exchange rate and real effective exchange rate in equilibrium, i.e. most national currencies are overvalued. Foreign Directed Investments are 1.5% of GDP, as they are appearing mostly in the last two decades.

Correlation reveals that consumption and inflation are negatively correlated, while investments, imports and FDI are positively correlated with economic growth. All other variables have expected signs, except real exchange rate, which is expected to be negatively correlated to growth.

Table 2. Descriptive analysis, the world economy in the period 1953-2007.

Panel A: Descriptive statics

stats	growth	consumption	government	investment	inflation	exports	imports	fdi	natinterest	REER	openness
mean	2,709	61,606	16,098	21,776	12,436	23,959	24,217	1,557	1,086	-15,605	48,337
max	11,593	89,445	69,370	41,663	372,827	97,966	80,794	39,385	321,167	759,006	178,760
min	-11,416	19,752	3,786	4,952	-3,108	0,213	0,239	-32,116	-289,360	-99,998	0,453
sd	3,282	11,103	6,383	5,815	31,833	15,917	14,301	3,909	23,926	84,405	28,251
N	483	483	483	483	483	483	483	397	450	483	483

Panel B: Korelation

	growth	consumption	government	investment	inflation	exports	imports	fdi	natinterest	reer	openness
growth	1,000										
consumption	-0,110	1,000									
	(0,016)										
government	-0,048	-0,351	1,000								
	(0,296)	(0,000)									
investment	0,391	-0,467	-0,037	1,000							
	(0,000)	(0,000)	(0,420)								
inflation	-0,099	0,148	-0,051	-0,070	1,000						
	(0,030)	(0,001)	(0,268)	(0,123)							
exports	0,066	-0,616	0,222	0,237	-0,097	1,000					
	(0,149)	(0,000)	(0,000)	(0,000)	(0,034)						
imports	0,206	-0,209	0,244	0,272	-0,070	0,746	1,000				
	(0,000)	(0,000)	(0,000)	(0,000)	(0,123)	(0,000)					
fdi	0,088	-0,015	-0,028	0,043	-0,064	0,291	0,389	1,000			
	(0,080)	(0,774)	(0,575)	(0,397)	(0,200)	(0,000)	(0,000)				
natinterest	0,049	-0,019	-0,016	0,050	-0,071	-0,016	-0,027	0,026	1,000		
	(0,298)	(0,681)	(0,737)	(0,294)	(0,133)	(0,741)	(0,570)	(0,618)			
reer	0,051	-0,031	-0,063	0,098	0,061	-0,081	-0,117	-0,024	0,059	1,000	
	(0,265)	(0,497)	(0,168)	(0,031)	(0,178)	(0,077)	(0,010)	(0,631)	(0,212)		
openness	0,141	-0,455	0,252	0,270	-0,092	0,941	0,925	0,363	-0,022	-0,104	1,000
	(0,002)	(0,000)	(0,000)	(0,000)	(0,044)	(0,000)	(0,000)	(0,000)	(0,646)	(0,022)	

3. Methodology

The most widely used growth equation in literature estimates the existence of convergence of GDP (*Yt-1*), the effects of public consumption (*G*), inflation (π), and openness of the economy (*X+M*):

$$Y = Y_{t-1} + G + \pi + (X + M) \quad (1)$$

We also enrich the model by looking at the additional components of aggregate demand: consumption and investments. We also employ control variables that are important indicators of economic wellbeing on the macro level: the rate of inflation, FDI, rate of interest and exchange rate. This approach is in line with Schumpeter (1957). Following Krugman and Obstfeld (2003) model, we can present the extended version of equation 1 with the expected signs:

$$Y = Y_i + G + \pi + C + I + X - M + \mathrm{FDI} + R + \mathrm{RER} \quad (2)$$

where *Y* is real per capita GDP, *Yi* is initial rGDPpc, *G* is public (government) expenditure, π is inflation, *C* is consumption, *I* is private investment, *X* is the total sum of exports and *M* is the total sum of imports, *FDI* is foreign direct investment, *R* is real national interest rate, and *REER* is misalignment real exchange rate from the real equilibrium exchange rate.

To achieve long term and continuous growth, countries need a right balance of the mentioned determinants of GDP. However, there are many more determinants of growth that we did not include, some of which are even unobservable. In the following paragraph, we explain how and why we derived equation (3) in the fashion we did, so that it eliminates potential endogeneity.

Levine (1999) points to argument made by Rajan and Zingales (1998) where some variables may be endogenous economic growth. For example, Rajan and Zingales (1998) point out that in particular "financial markets may anticipate economic growth and develop in anticipation of greater economic activity." Therefore, instead of being root cause of it, financial and monetary development may be a leading indicator of real sector development. Following Levine et al. (2000) and Beck et al. (2000), we also employ generalized-method-of-moments (GMM) techniques in the dynamic panel setting to correct the data for the endogeneity. To find out more about this method, you can consult Blundell and Bond (1998), Arellano and Bover (1995), and Arellano and Bond (1991). Furthermore, a similar introduction to the subject can be found in Bond (2002).

Let y_{it} be the log of real GDP per capita at time *t* in country *i*. We want to estimate this equation:

$$y_{i,t} - y_{i,t-1} = (\alpha - 1)y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (3)$$

where $y_{i,t} - y_{i,t-1}$ presents the in real GDP per capita growth rate, $X_{i,t}$ contains explanatory variables, η_i corrects for unobserved effects that are country-specific, and ε_{it} is a pure Gaussian error term, i.e. white noise. We can also rewrite the equation (3) as the following:

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (4)$$

and obtain the first differences of the entire equation in order to eliminate the effect of country-specific level, as it can be in correlation with the lagged dependent variable:

$$y_{i,t} - y_{i,t-1} = \alpha\left(y_{i,t-1} - y_{i,t-2}\right) + \beta'\left(X_{i,t} - X_{i,t-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right) \quad (5)$$

Following the derivation of equation (5), the lagged difference in real GDP per capita can be correlated with error terms. This, along with the endogeneity of *X*, would require the use of instruments. We can use the difference estimator (also GMM), that uses the lagged level values of the explanatory variables as its instrument under two conditions. First one is that the error term does not show serial correlation. The second one is that the lagged level values of explanatory variables are at least weakly exogenously provided (i.e., they are not correlated with the error term). If that holds, we can derive these moment conditions and to calculate the difference estimator by using these two equations:

$$E\left[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})\right] = 0 \quad for \quad s \geq 2; t = 3, \ldots., T, \quad (6)$$

$$E\left[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})\right] = 0 \quad for \quad s \geq 2; t = 3, \ldots., T, \quad (7)$$

The GMM difference estimator is further expanded with the estimator in level values to produce so called system estimator. Including level values in equation also allows for using information about differences on cross-country level, and that is not possible when we only employ the difference estimator.

The level equations employ the lagged difference of the *X* as instrument under two general conditions. First condition is that the error term is not correlated serially with itself. Second condition is that there may be correlation between the level values of the explanatory variables and the specific error term from one period, but there is no serial correlation between the differences in the *X* and the error term. These two conditions are used to obtain the next two properties on stationarity:

$$E\left[y_{i,t+p}\eta_i\right] = E\left[y_{i,t+q}\eta_i\right] \;\; and \;\; E\left[X_{i,t+p}\eta_i\right] = E\left[X_{i,t+q}\eta_i\right] \tag{8}$$

for all *q* and *p*.

We will use two additional moment conditions in order to obtain the regression in level values:

$$E\left[(y_{i,t-s} - y_{i,t-s-1})(\eta_i + \epsilon_{i,t})\right] = 0 \;\; for \;\; s = 1 \tag{9}$$

$$E\left[(X_{i,t-s} - X_{i,t-s-1})(\eta_i + \epsilon_{i,t})\right] = 0 \;\; for \;\; s = 1. \tag{10}$$

Therefore, we obtain the GMM system estimator employing the moment conditions from equations (6), (7), (9), and (10).

Following Beck and Levine (2004), we also employ alternatively developed procedure by Calderon et al. (1999, 2002) in order to control for the potential over-fitting. The *X* is obtained by reducing the dimensionality of all instrument lags.

4. Empirical results

We begin econometric analysis by estimating basic growth equation:

$$y = c + \alpha y_{-1} + \beta G + \gamma\pi + \tau C + \eta I + \phi X + \mu M \tag{11}$$

where *y* is the dependent variable which represents growth rate, while the independent variables are located at the right side of equation: *y-1* initial real per capita GDP, *G* – public (government) expenditure, *π* – inflation rate, *C* – consumption, *I* – investment, *X* – exports and *M* – imports. We begin by estimating equation 1 in column 1, and then continue by adding only one determinant at the time in the columns 2 to 5. Column 6 presents estimation where we include all growth determinants as in equation (11).

Estimation results of equation (11) are presented in column 6 in Table 3 and surprisingly show no convergence. GDP growth is positively influenced by investments, consumption, and exports. On the other hand, public consumption, inflation, and imports show negative effect on GDP growth. Sargan specification test as well as AR(2) prove the validity of results in all specifications.

Table 3. Estimated equations of the coefficients of the basic growth determinants in the world economy in the period 1953-2007, GMM panel model

	(1)	(2)	(3)	(4)	(5)	(6)
Initial GDP[a]	0.240	0.708	-0.093	0.416	0.363	0.159
	(0.735)	(0.075)	(0.870)	(0.581)	(0.664)	(0.692)
Government[a]	-7.685	-3.553	-5.443	-7.737	-7.663	-4.422
	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)
Inflation[b]	-2.364	-2.467	-2.388	-2.330	-2.557	-3.272
	(0.079)	(0.025)	(0.0 43)	(0.096)	(0.070)	(0.012)
Consumption[a]	2.033	1.852	2.095			
	(0.016)	(0.000)	(0.005)			
Investment[a]		3.770				4.796
		(0.005)				(0.099)
Exports[a]			2.655			4.433
			(0.057)			(0.000)
Imports[a]				2.082		5.279
				(0.015)		(0.000)
Constant					3.756	-4.417
					(0.000)	(0.002)
Sargan	0.338	0.167	0.628	0.290	0.508	0.293
AR(2)	0.302	0.357	0.305	0.327	0.263	0.456
Observation	483	483	483	483	483	483
Countries	61	61	61	61	61	61

Note: p-values are given in the brackets
[a] *In regression equation this variables is shown as ln(variable/100)*
[b] *In regression equation this variables is shown as ln(1+variable/100)*

Table 4, where we added monetary determinants of growth, again shows absence of convergence. This confirms our findings from previous results, and it is also in line with convergence literature such as Maddison (1982), Barro (1996), De Long (1988), Grier and Tullock (1989), Kolodko (2000).

Results suggest that the government expenditure and the inflation have negative effect on the economic growth in all specifications. This is in line with Barro's (1996) growth analyses where the government expenditure and the inflation retard growth. The expansion of the government expenditure is also associated with the increase in inflation, and they are expected to jointly have a negative influence on the macroeconomic soundness.

Private consumption, as suggested by the aggregate demand theories, contributes to higher growth levels. The domestic investment shows the positive influence on the growth, while the FDI, surprisingly, decreases the levels of growth. Real effective interest rate, as expected, decreases growth levels while divergence from real exchange rates increases growth. Sargan

specification tests as well as AR(2) again prove the validity of results in all specifications.

Table 4. Estimated equations of the coefficients of the expanded growth determinants in the world economy in the period 1953-2007, GMM panel model

	(1)	(2)	(3)	(4)	(5)
Initial GDP[a]	0.159	0.304	0.622	0.204	0.113
	(0.692)	(0.334)	(0.171)	(0.672)	(0.715)
Government[a]	-4.422	-6.950	-5.675	-4.699	-6.590
	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)
Inflation[b]	-3.272	-3.210	-3.890	-5.404	-3.081
	(0.012)	(0.000)	(0.026)	(0.006)	(0.024)
Consumption[a]	4.796	6.686	5.938	6.537	9.044
	(0.099)	(0.005)	(0.088)	(0.081)	(0.000)
Investment[a]	4.433	4.116	5.058	4.693	4.367
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)
Exports[a]	5.279	5.482	5.369	3.745	6.494
	(0.000)	(0.000)	(0.010)	(0.025)	(0.000)
Imports[a]	-4.41	-2.306	-4.077	-2.891	-2.186
	(0.002)	(0.071)	(0.032)	(0.091)	(0.088)
FDI[b]		-17.976			-6.508
		(0.000)			(0.006)
Nationinterest[b]			-4.676		-1.880
			(0.000)		(0.017)
REER[b]				0.792	0.318
				(0.079)	(0.005)
Constant	5.426	4.864	4.899	7.420	8.681
	(0.080)	(0.208)	(0.305)	(0.067)	(0.005)
Sargan	0.293	0.235	0.203	0.421	0.208
AR(2)	0.456	0.349	0.478	0.466	0.215
Observation	483	483	483	483	483
Countries	61	61	61	61	61

Note: p-values are given in the brackets
[a] *In regression equation this variables is shown as ln(variable/100)*
[b] *In regression equation this variables is shown as ln(1+variable/100)*

Let us again consider 10% increase in growth determinants and look at the quantitative effects on the growth rate. Government expenditure would lead to 2.6% lower growth while inflation lowers it by 0.3%. Similar increase in consumption would increase growth by 0.9%, investment would increase growth by 0.4%, while exports would increase growth by 0.6%. Imports would lower growth by 0.2%, and FDI would lower it by 0.6%. 10% increase in real

effective interest rate would lower growth by 0.2%, while similar increase in divergence from real exchange rate would increase growth by 0.03%.

5. Conclusion

Results of the dynamic generalized method of moment panel regression (GMM panel) were used to estimate various set of growth equations looking at the real and the monetary determinants of growth. All specifications show absence of convergence and suggest that government expenditures lower rates of growth. This can be explained by increasingly higher share of non-productive expenditure in overall government expenditure.

Private consumption, on the other hand, confirms the aggregate demand theories and shows positive effects on growth. Openness to trade shows overall positive effects on growth, but if we look separately at imports and exports we see that exports increase growth while imports decrease growth, as expected.

Inflation shows negative effect on growth in all specifications, as expected, as it is a good proxy for soundness of macroeconomic policies. Unlike previous results, the depreciation of real effective exchange rate shows positive effect on growth, but magnitude of the influence much smaller than inflation. Foreign direct investment surprisingly shows negative effects on growth, and real interest rate also lowers growth.

These results suggest that sound macroeconomic policies are key in achieving long term economic prospect. Although we excluded post-crisis period our sample is diverse enough that robustness of results is expected to hold even during crises.

References

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies,* 58(2), 277. doi:10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics,* 68(1), 29-51. doi:10.1016/0304-4076(94)01642-d

Barro, R. (1996). *Determinants of Economic Growth: A Cross-Country Empirical Study*. Cambridge, MA: National Bureau of Economic Research. doi:10.3386/w5698

Beck, T., Levine, R., & et al., (2000). Finance and the Sources of Growth. *Journal of Financial Economics,* 58(1-2); 261-300.

Beck, T., & Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. *Journal of Banking & Finance,* 28(3), 423-442. doi:10.1016/s0378-4266(02)00408-9

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics,* 87(1), 115-143. doi:10.1016/s0304-4076(98)00009-8

Bond, S.R. (2002). Dynamic panel data models: a guide to micro data methods and practice. *Portuguese Economic Journal,* 1(2), 141-162. doi:10.1007/s10258-002-0009-9

Calderon, C.A., Chong, A., & Loayza, N.V. (2002). Determinants of Current Account Deficits in Developing Countries. *Contributions in Macroeconomics,* 2(1), doi:10.2202/1534-6005.1021

deLong B., (1988). Productivity Growth, Convergence, and Welfare: Comment. *American Economic Review,* Vol. 78, No. 5. pp. 1138-1154.

Grier, K.B., & Tullock, G. (1989). An empirical analysis of cross-national economic growth, 1951–1980. *Journal of Monetary Economics,* 24(2), 259-276. doi:10.1016/0304-3932(89)90006-8

Kolodko, G.W. (2000). Globalization and Catching-Up: From Recession to Growth in Transition Economies. *IMF Working Papers,* 00(100), 1. doi:10.5089/9781451852394.001

Krugman, P., & Obstfeld, M. (2003). *International Economics: Theory and Policy*. Addison Wesley. sixth edition.

Levine, R. (1999). Law, Finance, and Economic Growth. *Journal of Financial Intermediation,* 8(1-2), 8-35. doi:10.1006/jfin.1998.0255

Levine, R., Loayza, N., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics,* 46(1), 31-77. doi:10.1016/s0304-3932(00)00017-9

Rajan, R.G., & Zingales, L. (1998). Financial Dependence and Growth. *American Economic Review,* 88(3); 559-586.

Schumpeter, J.A. (1947). Theoretical Problems of Economic Growth. *The Journal of Economic History,* 7(S1), 1-9. doi:10.1017/s0022050700065189