

FACTS ABOUT DETERMINANTS OF ECONOMIC GROWTH

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During 1961-2001 some economies has raised their GDP for more than 10 times, and others have decreased their per capita GDP to a half from their initial level in 1961. Using the general framework developed by Barro on a panel date for more than 150 countries with observations computed 5 years, 10 years, 20 years, 40 years period, and annually, during 1961-2000, we found that economic growth is positively correlated with a higher level of health and education, and an increase in: savings, openness of the economy, development of the financial system, capital formation, FDI, and real interest rate. Therewith economic growth is negatively correlated with a higher level of GDP per capita, and an increase in: government consumption, inflation rate, budget deficit, fertility and population growth, unemployment, and current account deficit.

Keywords: determinants of economic growth, economic growth, macroeconomic stability

Determinants of Economic Growth: A Short Summary of the Literature

An important literature has been written on the determinants of economic growth in the last 20 years. Their analyses have recorded a real success explaining the differences in per capita growth accounted by countries over long periods of time.

Barro (1991)(8), the initiator and developer of this theory, uses as main explanatory variables: the initial level of real per capita GDP, the school enrolment, the political instability, the deviation regarding the parity of power purchasing, the life expectancy at birth and fertility rate. Using a panel consisting in over 100 countries, Barro (1997)(7) found that the hypothesis of conditional convergence is valid. The lower is the starting level of real per capita GDP, relative to the long-run or steady state-position, the faster is the growth rate. Economies that have less capital per worker (relative to their long-run capital per worker) tend to have higher rates of return and higher growth rates. The convergence is conditional because it depends on the other determinants of the economic growth. This means for certain levels of the education attainment, health and other variables that reflect national characteristics, policies, and institutions, growth rate rises when the initial level of real per capita GDP is low relative to its long term level. Therewith, for a given starting level of real per capita GDP, the growth rate is enhanced by higher initial schooling and life expectancy, lower fertility, lower government consumption, better maintenance of the rule of law, lower inflation, and improvements in the terms of trade.

The empiric evidences in the literature suggest that economic growth is positively related to:

- the starting level of average years of school attainment at the secondary and higher level - Barro (1991, 1996, 1998, 1999, 2001, 2003), Levine and Renelt (1992), Benhabib and Spiegel (1994), Doppelhofer, Miller, and Sala-i-Martin (2000)
- TFP (total factor productivity) - Sarel (1998), Crafts (1999), Easterly and Levine (2001), Iwata, Khan, and Muraio (2002)
- technological progress and technological diffusion - Romer (1986, 1987, and 1990), Lucas (1988), Rebelo (1991), Grossman and Helpman (1991), Gordon (2002)
- investments in research and development - Grossman and Helpman (1991), Aghion and Hewitt (1992), Coe and Helpman (1993), Barro and Sala-i-Martin (1995)
- improvements in the stock of capital - Romer (1986), Lucas (1988), Rebelo (1991)

- labor and capital productivity - Bergoeing, Kehoe, Kehoe, and Soto (2002)
- saving rate - Levine and Renelt (1992), Howitt and Aghion (1998), Bernanke and Gurkaynak (2001), Aghion, Comin, and Howitt (2006)
- initial level of life expectancy at birth - Barro (1996, 2003), Doppelhofer, Miller, and Sala-i-Martin (2000)
- investment rates - Barro (1989, 2003), DeLong and Summers (1991), Mankiw, Romer, and Weil (1992), Levine and Renelt (1992), Mankiw, Phelps, and Romer (1995), Hugo (1999), Bernanke and Gurkaynak (2001)
- institutional framework - Knack and Keefer (1994), Dhonte, Bhattacharya, and Yousef (2000)
- macroeconomic stability - Fischer (1993), Easterly and Levine (1997)
- better maintenance of the rule of law - Barro (1996, 2003)
- investments in infrastructure - Barro (1989), Canning and Fay (1993), Easterly and Levine (1997)
- maintenance of the property rights - Barro (1989)
- development of the financial and banking system - King and Levine (1993), Levine and Zervos (1996), Rajan and Zingales (1998), Demirgüç-Kunt and Maksimovic (1999), Beck, Levine, and Loayza (1999)
- foreign direct investments - Borensztein, De Gregorio, and Lee (1995).
- Economic growth rates are negatively related to:
 - the initial level of real per capita GDP - Barro (1991, 1996, 2003) Mankiw, Romer, and Weil (1992), Levine and Renelt (1992), Doppelhofer, Miller, and Sala-i-Martin (2000)
 - taxation level - Barro (1989)
 - government consumption - Barro (1991, 1996, 2003)
 - market distortions - Barro (1989, 1991, 2003), Fischer (1993), Easterly and Levine (1997)
 - political instability - Barro (1989, 1991), Mankiw, Phelps, and Romer (1995)
 - high inflation and inflation fluctuation - De Gregorio (1992, 1993), Barro (1995, 1996, 2003), Easterly and Bruno (1995), Sarel (1996), Easterly and Levine (1997)
 - fertility rate - Barro (1996, 2003)
 - budget deficit - Fischer (1993), Easterly and Rebelo (1993), Mankiw and Ball (1995).

General Framework for the Growth Determinants Analysis

The general framework for the determinants of the economic growth, developed by Barro (1997)(7), follows the extension of the neoclassical model, which relates real GDP per capita growth rate (annual %) with two kinds of variables: initial variables and the control or environmental variables. As initial levels of the state variables, we shall be using the stock of physical capital as a logarithm of the initial level of real per capita GDP (PPP current international \$ or constant 1995 US\$), and the initial level of human capital, in the form of education, expressed by the secondary and tertiary school enrolment (% gross), and in the form of state of health, expressed by the logarithm of life expectancy at birth, total (years). As control variables, which characterize the governmental policies and the economic agents' decisions, we use in all our regressions the following indicators: general government final consumption expenditure (% of GDP), gross capital formation (% of GDP), fertility rate (total births per woman), population growth (annual %), inflation rates (consumer prices, annual %), budget deficit (overall budget balance, including grants - % of GDP), market capitalization of listed companies (% of GDP), domestic credit provided by banking sector (% of GDP), gross domestic savings (% of GDP), unemployment (total, % of total labor force), current account balance (% of GDP), foreign direct investment (net inflows, % of GDP), openness of the economy (as sum of exports and imports of goods and services, % of GDP), real interest rate (%), money and quasi money (M2) as % of GDP, and real effective exchange rate (index, 1995 = 100). The availability of data for the initial level of physical and human capital is unsure, especially for the countries situated under the development process, and the way in which an indicator is measured can be different from one country to another. In these conditions, we shall considerate, as Barro did (1995, 1997), that for certain values of the education and health, an increased initial level of GDP per capita reflects a greater stock of physical capital per person (or a larger quantity of natural resources).

We write therefore, as a function, for a country, the growth rate of GDP per capita, for the period t of time as like Barro 1997 (7):

$$[1] Dy = F(y^*; h^*; \dots),$$

where y^* and h^* represent the initial conditions, respectively y^* is the initial level of GDP per capita, and h^* the initial level of human capital (expresses by the secondary school enrolment, the life expectancy at birth, etc.). The omitted variables, denoted by "...", comprise an array of control and environmental influences. These variables would include preferences for saving and fertility, the government policies with respect to spending, and so on.

In the empirical implementation we use the initial level of per capita GDP from the growth equation from above, under the form $\log(y^*)$. The negative coefficient of this variable represents the convergence rate. For h^* we shall be using the initial level of the secondary or tertiary school enrolment rate and the logarithm of life expectancy at birth as an initial level.

Data and Methodology

We are using 23 indicators for 167 countries, from World Development Indicators 2002 and World Development Indicators 2007, World Bank. In order to exploit the temporal dimension of the data and to analyze the long term relation between the determinants and the economic growth we shall use panel data with annual, 5 and 10 years, 20 years, and 40 years observations. Thereby, the observations for control variables are computed as average (mean) values of the indicators on 5 years, 10 years, and 20 years periods, during 1961 - 2000. The variables which are representing the initial conditions are computed as observations from the beginning of each period. Economic growth is computed as the annual growth rate of real GDP as a mean for each period of the available data.

In regressions we shall use the maximum number of countries and periods shown by the available information.

The basic regression is:

$$[2] \Delta = \alpha + \beta X + \gamma Y + \varepsilon,$$

where the dependent variable Δ is the real growth of the GDP per capita, X is the matrix of the variables which express the initial conditions and Y is the matrix of the control variables.

In order to study the relation between determinants and the economic growth we shall use the following type of equations:

$$[3] y_{it} = \alpha_{it} + x'_{it} \beta_i + \varepsilon_{it},$$

where $i = 1, 2, \dots, N$ represent the country and $t = 1, 2, \dots, T$, the time period. We use Pooled Least Squares and Feasible GLS (general list square) as econometric methods.

Due to the variable variances of the residuals between countries, we shall use a feasible GLS that assuming the presence of cross-section heteroskedasticity. In order to allow variances within a cross-section to differ across time we shall use White Heteroskedasticity Covariance, which estimate covariances that are robust to general heteroskedasticity. We test the variable variances of the residuals with Bartlett, Levene, and Brown-Forsythe tests.

In the literature Easterly (2000), Kraay and Monokroussos (2000) applied Pooled OLS analyses on panel data, Fischer (1993) and Barro (2003) used three-stage least squares, Levine and Schmukler (2003), Claessens, Klingebiel, Schmukler (2003) worked with FGLS.

In order to use as much as possible data, due to the fact that there are some observations missing at some countries, we worked with unbalanced data in Eviews 4.1.

Results

In over 30 regressions (like the one from the table 1) on economic growth, using the general framework described above we found the following:

- initial level of GDP per capita is very significant and robust in all the regression and all types of computed observations (annual, 5 and 10 years, 20 years, and 40 years periods) and it's negatively correlated with the economic growth, which confirms the conditional convergence predicted by the Solow – Swan neoclassic economic growth models. Therefore, the convergence for the analyzed countries varies depending on other determinants that are in regressions between -0.9% and -1.8% for the GDP PPP at the purchasing power parity, as can be seen below, in table 1 and 2.
- the initial level of health, expressed by the logarithm of life expectancy at birth is very significant and positively correlated with growth in all the regressions, being a robust determinant of economic growth;
- initial level of the education, expressed especially by the secondary school enrollment and by tertiary has a positive value in regressions and is significant;
- saving is important and has a significant and positive coefficient in different regressions, but its value depend on the others variables used in regressions;
- government consumption is negatively correlated with economic growth, having a significant values, lesser in regressions with observations computed in 20 and 40 years periods;
- inflation is significant and robust, negatively correlated with growth in regressions. It has a low coefficient, which means it has a strong impact only at high levels. In a regression with growth using 40 years average observations it has the biggest R^2 from of 0.185501 and a robust negative coefficient (-0.005113) which mean is very important determinant over long periods of time.
- budget deficit has a strong negative impact on economic growth with a big coefficient, as can be seen in the tables 1 and 2;
- the openness of the economy enter significant, in many growth regression, generally with a positive coefficient;
- fertility and population growth have a negative impact upon economic growth because, as Barro (1996) said, the resources will be directed to increase the natality and create capital for new workers than to enhance output production and per worker capital;
- development of the financial and banking system plays a very important role in an efficient allocations of resources in the economy and is positively correlated with growth through M2 monetary aggregate, domestic credit provided by banking sector, and especially through market capitalization of listed companies in GDP.
- gross capital formation is positively correlated with growth, having a coefficient of 0.127;
- foreign direct investments are positively correlated with growth, because investors chose those economies with favorable business environments and encourage technological transfer;
- unemployment is significant negative correlated with growth in many regressions;
- real interest rate is positively correlated with growth with a coefficient of 0.030353;
- current account balance has also generally a positive coefficient in relation with growth;
- real effective exchange rate is positively correlated with growth in some regressions but its coefficient is very close to 0.

Dependent Variable: GDPCGR?

Method: GLS (Cross Section Weights)

Sample: 4 8

Included observations: 5

Number of cross-sections used: 94

Total panel (unbalanced) observations: 302

One-step weighting matrix

White Heteroskedasticity-Consistent Standard Errors & Covariance

Cross sections without valid observations dropped

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-20.47142	2.268677	-9.023504	0
LNGDPP?	-0.924206	0.095567	-9.670808	0
LNLIFEE?	7.360633	0.684115	10.75934	0
SCHOSE?	0.009036	0.002087	4.329817	0
G?	-0.054177	0.007347	-7.373924	0
INFL?	-0.001929	0.000455	-4.2355	0
BD?	-0.103043	0.011448	-9.001083	0
(EXPO?+IMP?)	0.005681	0.000659	8.618753	0
UNEM?	-0.051539	0.010257	-5.024746	0
Weighted Statistics				
R-squared	0.83167	Mean dependent var		4.345779
Adjusted R-squared	0.827073	S.D. dependent var		6.988164
S.E. of regression	2.905989	Sum squared resid		2474.318
F-statistic	180.953	Durbin-Watson stat		2.035221
Prob(F-statistic)	0			
Unweighted Statistics				
R-squared	0.16552	Mean dependent var		1.858468
Adjusted R-squared	0.142736	S.D. dependent var		3.240077
S.E. of regression	2.999941	Sum squared resid		2636.897
Durbin-Watson stat	1.634752			

TABLE 1 - REGRESSION ON DETERMINANTS OF THE ECONOMIC GROWTH

These are estimation outputs in Eviews 4.1. Notations: GDPCGR? is GDP per capita growth rate (5 years average), C is the common intercept, LNGDPP? is logarithm of the initial level of real per capita GDP PPP (the first of in each 5 years period), LNLIFEE? is logarithm of life expectancy at birth (the first of in each 5 years period or the value from the previous year if the observations is missing for the first year), SCHOSE? is secondary school enrolment (computed as LNLIFEE?), G? is government consumption, INFL? is inflation rate, BD? is budget deficit, (EXPO?+IMP?) is the openness of the economy, and UNEM? is unemployment rate. The periods are 1961-1965, 1966-1970, 1971-1975, 1976-1980, 1981-1985, 1986-1990, 1991-1995, and 1996-2000. We reject absolutely the hypotheses of equality of variances between series for the residuals using the following tests: Bartlett (df: 93, value: 212.0552, probability: 0.0000), Levene (df: (93, 208), value: 8.984600, probability: 0.0000), and Brown-Forsythe (df: (93, 208), value: 4.716500, probability: 0.0000).

In the analyses of economic growth on different ways of computing the observations the most appropriate one is on 5 years periods. For one year and 10 years periods the residuals of the regressions are, in general, with a positive serial correlation and a Durbin-Watson statistic under the normal accepted value of 1.8.

Conclusion

Economic growth rates vary dramatically across countries over long period of time creating big differences in the standard of living per capita of its residents. Although the annual growth of per capita GDP in the world wide economies was about 2.0% during 1961-2005, which correspond to an increase of 2.4 times for per capita GDP, some economies has raised their GDP for more than 10 times, having average growth rates of more than 5.5%, and others have decreased their per capita GDP to a half from their initial level in 1961 with average growth rates lesser than -1.5%. The difference between Botswana one the most growing economy and Niger one of the slowest growing economies during 1961 and 2005 was more than 20 times.

The determinants of growth have an important role in explaining these differences. Empiric evidence confirms the conditional convergence and relates economic growth with tow type of variables: initial variables and the control or environmental variables. Using the general framework developed by Barro (1991, 1997, 2003) on a panel date for more than 150 countries with observations computed 5 years, 10 years, 20 years, 40 years period, and annually, during 1961-2000, we found that economic growth is positively correlated with a higher level of human capital through health, accounted by life expectancy at birth, and education in the form of secondary and tertiary school enrollment, and an increase in savings, in openness of the economy, an improvement in the development of the financial and banking system, a raise of gross capital formation, and foreign direct investments, an increase of the real interest rate. We also found economic growth is negatively correlated with a higher level of physical capital accounted by the level of GDP per capita, with government consumption, inflation rate, budget deficit, fertility and population growth, unemployment, and current account deficit. This finding confirm the relations between growth and its determinants from the previous literature on observations computed 10 years, 20 years, 40 years period and annually.

In the analyses of economic growth on different ways of computing the observations the most appropriate one is on 5 years time period because is diminishing the influences of short term fluctuation and encompass the dynamics of growth and its determinants.

References

1. Acemoglu D., "Introduction to Modern Economic Growth", Cambridge, MA: Massachusetts Institute of Technology, 2007
2. Aghion P. and Durlauf S., "Handbook of Economic Growth", North-Holland, 2005
3. Aghion P., Comin D., and Howitt P., "When Does Domestic Saving Matter for Economic Growth," National Bureau of Economic Research Working Papers 12275, 2006
4. Barro R. J. and Sala-i-Martin X., "Economic Growth", New York: McGraw-Hill, 1995
5. Barro R. J., "Determinants of Economic Growth in a Panel of Countries", *Annals of Economics and Finance* 4, 231-274, 2003
6. Barro R. J., "A Cross-Country Study of Growth, Saving, and Government", National Bureau of Economic Research Working Paper nr. 2855, 1989
7. Barro R. J., "Determinants of Economic Growth: A Cross-Country Empirical Study", Cambridge MA, MIT Press, 1997
8. Barro R. J., "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics* 106, 2, 407-443, 1991
9. Easterly W. and Levine R., "Africa's Growth Tragedy: Policies and Ethnic Divisions," *Quarterly Journal of Economics* November, 1997
10. Easterly W. and Rebelo S., "Fiscal Policy and Economic Growth: an Empirical Investigation", *Journal of Monetary Economics* 32, December, 417-458, 1993
11. Fischer S., "The Role of Macroeconomic Factors in Growth", *Journal of Monetary Economics*, XXXII, 485-511, 1993
12. Grossman G. and Helpman E., "Endogenous Innovation in the Theory of Growth", *The Journal of Economic Perspectives*, Vol. 8, nr. 1, 1994
13. Jones C. I., "Sources of U.S. Economic Growth in a World of Ideas", *American Economic Review*, Vol. 92 (1), 2002

14. Krugman P., "The Myth of Asia's Miracle", *Foreign Affairs*, Vol. 4 November-December, 1994
15. Levine R. and Renelt D., "A Sensitivity Analysis of Cross-Country Growth Regressions", *American Economic Review*, 82, 942-963, 1992
16. Levine R. and Zervos S., "Stock Markets, Banks, and Economic Growth", *American Economic Review*, 88, 537-58, 1998
17. Lucas R. E., "On the Mechanics of Economic Development", *Journal of Monetary Economics* 22, 3-42, 1988
18. Mankiw G., Phelps E., and Romer P., "Growth of Nations," National Bureau of Economic Research, *Brooking Papers on Economic Activity*, No. 1, 1995
19. Mankiw N. G., Romer D., and Weil D., "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics* 107, 401-437, 1992
20. Porter M. E., Schwab K., and Sala-i-Martin X., "The Global Competitiveness Report 2007-2008", Palgrave Macmillan, 2007
21. Porter M., "The Competitive Advantage of Nations", New York: Free Press, 1990
22. Rebelo S., "Long-Run Policy Analysis and Long-Run Growth", *The Journal of Political Economy*, Vol. 99, nr. 3, 1991
23. Romer P. M., "Increasing Returns and Long-Run Growth", *Journal of Political Economy*, Vol. 94, No. 5, 1986
24. Romer P. M., "Economic Growth", *The Concise Encyclopedia of Economics*, David R. Henderson, ed. Liberty Fund, 2007
25. Sala-i-Martin X., Doppelhofer G., and Miller R. I., "Determinants of Long-Term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach", *American Economic Review*, American Economic Association, vol. 94(4), 2004
26. Sarel M., "Growth in East Asia. What We Can and What We Cannot Infer," *International Monetary Fund Working Paper* 95/98, 1998
27. Solow R. M., "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics* 70, 65-94, 1956
28. Young A. A., "Increasing Returns and Economic Progress", *Economic Journal*, Vol. 38, 527-42, 1928
29. Young A., "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience", *The Quarterly Journal of Economics*, Vol. 110, No. 3, 1995
30. *** World Bank, "2002 World Development Indicators", 2002
31. *** World Bank, "2007 World Development Indicators", 2007