DRIVERS OF GROWTH IN FAST EMERGING ECONOMIES: A DYNAMIC INSTRUMENTAL QUANTILE APPROACH TO REAL OUTPUT AND ITS RATES OF GROWTH IN BRICS AND MINT COUNTRIES, 2001-2011

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Abstract
We analyze the evolution of fast emerging economies of the BRICS (Brazil, Russia, India, China & South Africa) and MINT (Mexico, Indonesia, Nigeria & Turkey) countries, by assessing growth determinants throughout the conditional distributions of the growth rate and real GDP output for the period 2001-2011. An instrumenal variable (IV) quantile regression approach is complemented with Two-Stage-Least Squares and IV Least Absolute Deviations. We find that the highest rates of growth of real GDP per head, among the nine countries of this study, corresponded to China, India, Nigeria, Indonesia and Turkey, but the highest increases in real GDP per capita corresponded, in descending order, to Turkey China, Brazil, South Africa and India. This study analyzes the impacts of several indicators on the increase of the rate of growth of real GDP and on the logarithm of the real GDP. We analyze several limitations of the methodology, related with the selection of the explained and the explanatory variables, the effect of missing variables, and the particular problems of some indicatorsOur results show that Net Foreign Direct Investment, Natural Resources, and Political Stability have a positive and significant impact on the rate of growth of real GDP or on real GDP.

JEL Classification: C52; F21; F23; O40; O50
Keywords: Economic Growth; Emerging countries; Quantile regression

1. Introduction

The growing relevance of China in the world and the recent global financial crisis has led to an evolving stream of literature on post-Washington Consensus (WC) models. These include: a combination of the WC and the Beijing Model (BM) in a development consensus (Asongu, 2016a, 2016b); new development strategies based on a combination of the WC and other development models that have successfully advanced developing countries (Fosu, 2013a); the false economics of preconditions (Monga, 2014); the need for more self-reliance (Fofack, 2014); the New Structural Economics which sustains the need for a synthesis between liberalism and structuralism (Stiglitz et al., 2013ab; Stiglitz & Lin, 2013; Norman & Stiglitz, 2012; Lin & Monga, 2011); the Liberal Institutional Pluralism[1] and the Moyo (2013)

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[1] The post-WC paradigm focuses on, inter alia: institutions for good public commodity delivery, diversity in institutions, and governance conditions for economic growth. More insights into this shift can be found in Fofack (2014, pp. 5-9), Acemoglu et al. (2005), Rodrik (2008), Brett (2009) and Asongu and Ssozi (2016).

conjecture. Consistent with the Moyo conjecture, economic rights should be given priority at the early phase of industrialisation. Hence, the BM should take priority over the WC as a short-term development model[2]. This paradigm shift has motivated many developing countries to adopt strategies that steer clear of the WC.

One of such moves is a decision by leaders of the BRICS (Brazil, Russia, India, China & South Africa) countries to establish a New Development Bank (NDB) at the recent July 15th 2014 BRICS summit in Brazil, which has led to a plethora of questions in policy and academic circles, inter alia: '*What is the purpose of this BRICS bank? Why have these countries created it now? And, what implications does it have for the global development-finance landscape?*'(Desai & Vreeland, 2014). While these concerns have already been substantially engaged (Khanna, 2014; Griffith-Jones, 2014), what is quite apparent is that the BRICS would need to maintain a respectable economic growth rate to sustain the ambitions of the Contingency Reserve Arrangement (CRA) and NDB. This brings us to a key question of determinants of economic growth in these fast emerging economies. Accordingly, understanding drivers of growth in these countries holds several lessons for other developing countries.

But before we engage the concern of understanding these drivers, it is important to briefly discuss the NDB and CRA. According to the narrative, the former or BRICS bank has a 50 USD billion initial capital. The bank's constitution is on equal-basis in terms of voting share because of an equal contribution of 10 USD billion from each of the five signatories. The capital-base would be allocated to finance sustainable development and infrastructure projects in low- & middle-income nations as well as in the BRICS countries. The CRA of 100 USD billion is meant to provide more liquidity leverage to member nations in case they are faced with balance sheet issues. Contrary to the bank's capital that is contributed equally among member states, the CRA is funded: 41% by China, 18% from Brazil, Russia and India and 5% from South Africa.

Consistent with the underlying literature on fast growing developing countries (Akpan et al., 2014; Asongu & Nwachukwu, 2015; Asongu & Kodila-Tedika, 2015), there are many benefits fast economic growth procures, among others: finance, employment and other positive externalities from a potentially increasing foreign direct investment (FDI) that is associated with appealing trends in managerial expertise, corporate governance and transfer of know-how.

According to the United Nations Conference on Trade and Development (UNCTAD, 2013), the BRICS and MINT (Mexico, Indonesia, Nigeria & Turkey) have been representing about 20% of global GDP and more than half of global FDI inflows over the past years (e.g 2011 & 2012). As presented in Table 1, in section 2, during the period 2001-2012, growth among the BRICS and MINT nations represented about 19% of world GDP, accounted for more than 51% of the population in the world and reflected about 30% of its FDI (World Bank, 2013).

[2] Moyo has defined the BM as '*de-emphasised democracy, state capitalism and priority in economic rights'* and the WC as '*liberal democracy, private capitalism and priority in political rights*'.

In spite of the growing instrumentality of the nine fast developing countries in the global econnomy, to the best of our knowledge, very few studies have focused on the BRICS and MINT. Most studies have been based on determinants of FDI into these countries. These include, papers exclusively focused on the BRICS (Vijayakumar et al., 2010; Jadhav & Katti, 2012; Jadhav, 2012) and four studies oriented towards the BRICS and MINT (Akpan et al., 2014; Asongu & Nwachukwu, 2015; Asongu & Kodila-Tedika, 2015; Asongu, 2016c).

Some studies have assessed drivers of growth in the underlying countries, while other studies have analyzed those drivers in samples that also include a more general international approach. The dependent variable in many studies is the rate of growth of real GDP, while other studies select the value of real GDP or the value of real GDP per capita. The selection of the explained variable is important to select the units of measurement of the explanatory variables, as seen in Guisan(2015), in order to avoid mixing of rates of growth, shares on GDP, total current values, total real values and per capita values that may lead to unclear results.

Sheng-jun (2011) has investigated education as a driver of growth in the BRIC nations to conclude that whereas Russia and Brazil invest relatively more in education compared to China and India, growth is stronger in the latter set of countries. Basu et al. (2013) on their part have concluded that the potential growth of the BRICS nations substantially depends on the capacity of its population to develop skills, especially in the working age. Agrawal (2013) has assessed the relationship between FDI and economic growth in the BRICS to conclude that there is a long-term relationship running from FDI to ecoomic growth. Goel and Korhonen (2011) had earlier addressed three questions in the BRIC, notably: "*(a) How do medium term growth determinants differ from short term determinants? (b) What are differences between growth effects of aggregate versus disaggregated exports? And (c) Does lower institutional quality hinder growth?*" Their findings indicate that, whereas nations of the BRIC have better growth, there are substantial within-group disparities. China and Russia for the most part show relatively higher growth, India sometimes reflected positive growth while Brazil failed to outpeform the other three countries. These disparities in growth naturally caution empirics on growth determinants to pay specific attention to high-growth and higher-growth nations.

Human capital has an important role in development as education and research have several direct and indirect positive effects, not only on the increase or real production per head, but also in socio-economic welfare (quality of government, women empowerment, and other variables), as it has been shown in interesting studies of international development as Guisan and Neira(2006), Guisan(2009), Tchamyou (2017, 2018) and other studies.

Usually some positive impacts of education on development are to increase the capacity to invest (both from domestic savings and from foreign origin), and to increase industrial production per head, with positive effects on other economic sectors, as seen in the macro-econometric approach of supply and demand presented in Guisan(2015) and in other studies. Besides human capital contributes, very often, to

increase quality of government and other related variables that usually foster socio-economic development, as seen in Guisan(2009) and other studies.

The present line of inquiry complements the above literature in at least three ways.

First, the determinants of growth are assessed throughout the conditional distributions of growth. The intuition for this empirical technique is that growth among fast emerging economies may still be contingent on initial growth levels, such that growth determinants are different across high- and higher-growth countries. A Quantile regression (QR) estimation technique is employed to accommodate this objective.

Second, MINT countries are added to the BRICS, consistent with recent literaure on fast emerging countries (Apkan et al., 2014).

Third, the concern of endogeneity is addresed by instrumenting the determinants with their first-differences and first-lags. Hence, the instrumentation process is dynamic. Moreover, it extends Asongu and Kodila-Tedika (2015) who have assessed determinants of FDI in the MINT and BRICS using QR and instrumenting only with first lags.

The remainder of the study is structured as follows. Section 2 presents the data and methodology. The empirical analysis and results are covered in Section 3. Section 4 concludes with implications.

2. Data and Methodology

2.1 Data

We assess a panel of 9 BRICS and MINT countries with data from Apkan et al. (2014) for the period 2001-2011. The original sources are the World Bank's World Development Indicators and World Governance Indicators databases. The adopted periodicity is also consistent with a recent stream of literature on FDI determinants in the BRICS and MINT (Asongu & Nwachukwu, 2015; Asongu & Kodila-Tedika, 2015). Two dependent variables are used for robustness purposes, notably: GDP growth and real GDP output.

Tables A1 and A2 in the Annexure relate the increases of GDP per head with manufacturing and other industrial activities in BRICS and MINT countries for the period 2000-2010. According to those tables, the highest rates of growth of GDP per head corresponded to China, India, Nigeria, Indonesia and Turkey, but the highest increases per year corresponded, in descending order, to Turkey, China, Brazil, South Africa and India. It is important to notice that faster growth does not always imply higher growth of the variable (in units), because the rate of growth depends not only of the increase but also of the initial value. Thus, for the same increase the rate is higher when initial values are lower.

The highest levels of industrial and non-industrial production per head in year 2010, in Table A2, correspond to Turkey, Russia and Mexico, with real value-added per capita of industry over 4000 Dollars, and real value-added of non-ndustrial sectors over 8000 Dollars at 2005 prices and Purchasing Power Parities.

Determinants of growth employed in the study which are classified in Table 2 below are broadly consistent with the UNCTAD (2002) and Akpan et al. (2014). The retained determinants include: *Gross FDI*, *Net FDI inflows*, *natural resources*, *infrastructure*,

private credit, *inflation*, *political stability* and *trade openness*. With the exception of high inflation that has the potential for decreasing growth, the expected signs from other determinants are positive. Accordingly, low and stable inflation is conducive for a positive economic outlook (Asongu, 2013a).

Table 1: Stylized facts on BRICS and MINT, years 2011 and 2012

	GDP (constant 2005 US$, billions)	**GDP per capita (constant 2005 US$)**	**GDP growth (annual %)**	**GDP per capita growth (annual %)**	**FDI net inflows (BoP, current US$, billions)***	**Population growth (annual %)**	**Population, total, millions**	**Natural resources, Share of GDP***	**Human Development Index (HDI)**
Brazil	1136.56	5721	0.87	0.00	71.54	0.87	198.66	5.72	0.73
China	4522.14	3348	7.80	7.28	280.07	0.49	1350.70	9.09	0.70
India	1368.76	1107	3.24	1.94	32.19	1.26	1236.69	7.36	0.55
Indonesia	427.47	1732	6.23	4.91	19.24	1.25	246.86	10.00	0.63
Mexico	997.10	8251	3.92	2.65	21.50	1.24	120.85	9.02	0.78
Nigeria	177.67	1052	6.55	3.62	8.84	2.79	168.83	35.77	0.47
Russia	980.91	6834	3.44	3.03	55.08	0.40	143.53	22.03	0.79
South Africa	307.31	6003	2.55	1.34	5.89	1.18	51.19	10.64	0.63
Turkey	628.43	8493	2.24	0.94	16.05	1.28	74.00	0.84	0.72

Source of data: UNDP (2013), World Bank (2013) and Akpan et al. (2014). Data correspond to year 2012, but those marked with * are data o f year 2011.

FDI as a determinant is in line with Agrawal et al. (2014). The inclusion of both Gross FDI and Net FDI has a twofold motivation: (a) on the one hand, it is in accordance with the underlying FDI literature discussed in the introduction and; (b) on the other hand, it is meant to increase subtlety for more policy outcomes. Inflation measured as the annual Consumer Price Index and trade openness (annual imports plus exports as a % of GDP) are in accordance with Barro (2003).

Private domestic or bank credit as a growth determinant is consistent with recent economic growth literature (Asongu, 2015; Nyasha & Odhiambo, 2017) while natural resources (or share of natural resources on GDP) and political stability (in estimate) are in line with Tridico (2007) and Fosu (2013b). The choice of infrastructure is justified by the fact that, infrastructural development has been established to 'unidirectionally' cause real output growth in China (Sahoo et al., 2010). The use of mobile phones (per 100 people) to proxy for infrastructure is in line with Asiedu (2002) and Sekkat and Veganzones-Varoudakis (2007).

Table 2: Classification of Growth determinants

Determining Variables	**Examples**
Policy variables	Tax policy, trade policy, privatization policy, macroeconomic policy
Business variables	Investment incentives
Market-related economic determinants	Market size, market growth, market structure
Resource-related economic determinants	Raw materials, labor cost, technology
Efficiency-related economic determinants	Transport and communication costs, labor productivity

Source: UNCTAD (2002) and Akpan et al. (2014)

The summary statisitcs of the variables used in the study is presented in Table 3 below.

Table 3: Summary Statistics of 9 countries for the period 2001-2011: 99 observations

	Mean	S.D	Min	Max	Units
Net Foreign Direct Investment Inflows (NFDI)	28.979	46.359	-2.977	280.07	Current
Foreign Direct Investment (Gross FDI)	2.402	1.348	-1.855	6.136	Share GDP
Real GDP Growth (GDPg, annual %)	5.351	3.789	-7.820	14.200	Rate of growth
Log of Real GDP (constant of 2005 US billions)	6.346	0.886	4.260	8.341	Real (Log)
Infrastructure (Number of mobile phones per 100 people)	52.433	39.220	0.210	179.31	Per heads
Bank Credit (Private domestic credit on GDP)	85.019	63.492	4.909	201.58	Share
Natural resources (on GDP)	9.003	8.110	0.294	38.410	Share GDP
Inflation (Consumer Price Index, annual %)	8.580	7.519	-0.765	54.400	Rate of growth
Trade Openness (Import + Exports on GDP)	0.514	0.128	0.225	0.856	Share GDP
Political Stability (Estimate)	-0.826	0.613	-2.193	0.286	Kaufrmann units

Notes : S.D: Standard Deviation. Min: Minimum. Max: Maximum. Units of measurement: Current value of NFDI is in Bn USD. Shares of GDP are expressed in percentages of GDP. Rates of growth are the % of annual increase. Kaufmann units are the scales used by Kaufmann et al. for quality of Government, between -2.5 (the worst cases) and 2.5 (the best positions).

Several of these variables may have a positive impact on industrial development per capita and other variables of interest for economic and social development. For example, FDI may be useful if it contributes to increase the degree of development and/ or the quality of life of citizens (infrastructures related with sanitation, for example, with positive effects on health). Regarding the units of measurement, we must notice that the mixing of variables at current and constant prices, or the ratios between two variables with rates of real growth or per capita values, should be analyzed carefully in order to avoid misleading conclusions, as pointed out in the selected readings of Applied Econometrics methodology written by Guisan (2015).

2.2 Methodology

In accordance with the literature on conditional drivers, in order to investigate if intiial levels of growth matter in the determinants of growth, we employ a quantile regression (QR) approcah, which consists of assessing determinants of economic growth throughout the distributions of eonomic growth (Keonker & Hallock, 2001; Billger & Goel, 2009; Asongu, 2013b).

Previous studies on the determinants of growth have reported parameter estimates at the conditional mean of economic growth. Some examples discussed in the introduction include: (a) Sheng-jun (2011, p. 190-193) that is based on averages and (b) Goel and Korhonen (2011) which is focused on Two-Stage Least Squares (2SLS).

Whereas mean impacts are important, the adopted QR approach is in line with the motivation of the present exposition. That is to say, it asssess how intial growth levels matter in the determinants of economic growth. For instance, while Ordinary Least Squares (OLS) suppose that growth and the error terms are normally distributed, the QR strategy is not founded on the assumption of error terms that are normally distributed. Therefore, the strategy helps us to assess the drivers with particular emphasis on the good and best candidates among the fast growing emerging countries. In this light, parameters estimated are shown at several points of the conditional distributions of growth (Koenker & Bassett, 1978). This technique therefore incorporates the conclusions of Goel and Korhonen (2011) from the BRICS literature discussed in the introduction, notably: the need to distinguish existing growth levels.

The QR technique is increasingly being employed in recent development literaure, inter alia: corruption (Okada & Samreth, 2012; Billger & Goel, 2009), health (Asongu, 2014) and finance (Tchamyou & Asongu, 2017) studies. A common shortcoming to the underlying applications is the concern of endogeneity. We address it by instrumenting the determinants in a twofold or dynamic manner. Accordingly, we instrument the determinants with their first lags and first differences. The fitted values obtained from the first-stage regressions are used in the second-stage QR specifications. Below are the two first-stage instrumentation processes.

$$x_{i,t} = \alpha + \delta_j \left(x_{i,t-1} \right) + \varepsilon_{i,t} \quad (1)$$

$$x_{i,t} = \alpha + \delta_j \left(x_{it} - x_{it-1} \right) + \varepsilon_{i,t} \quad (2)$$

Where: $x_{i,t}$ is a growth determinant for country i at period t; α is a constant and $\varepsilon_{i,t}$ the error term. The instrumentation is based on first lags and first differences in Eq. (1) and Eq. (2) respectively. In the two equations, the estimation processes are based on Heteroscedasticity and Autocorrelation Consistent (HAC) standard errors.

The second stage of the QR is presented in Eq. (3) below, where the θ th quantile estimator of economic growth is derived by optimizing the following problem. We present Eq. (3) below without subscripts for the purpose of simplicity.

$$\min_{\beta \in R^k} \left[\sum_{i \in \{i: y_i \geq x_{i'}\beta\}} \theta \left| y_i - x_{i'}\beta \right| + \sum_{i \in \{i: y_i < x_{i'}\beta\}} (1-\theta) \left| y_i - x_{i'}\beta \right| \right] \quad (3)$$

Where $\theta \in (0,1)$. Contrary to OLS that is based on minimizing the sum of squared residuals, the QR procedure consists of minimising the weighted sum of absolute deviations. For instance, the 75th or 90th quantiles (with θ=0.75 or 0.90 respectively) by weighing the residuals approximately. The conditional quantile of economic growth or y_i given x_i is:

$$Q_y(\theta / x_i) = x_{i'}\beta_\theta \quad (4)$$

where unique slope parameters are estimated for each θth specific quantile. Consistent with Asongu and Kodila-Tedika (2015), this formulation is analogous to $E(y/x) = x_{i'}\beta$ in the OLS slope where parameters are examined only at the mean of the conditional distribution of economic growth. In Eq. (4), while the dependent variable y_i is an economic growth (*GDP growth* or *real GDP*) indicator, x_i contains: a constant term, *Gross FDI*, *Net FDI*, *infrastructure*, *trade openness*, *inflation*, *private credit*, *natural resources* and *political stability*.

For the purpose of robustness, we also report the results for Least Absolute Deviations (LAD) using the Gretl Software which should theoretically correspond to results of the 50th quartile based on the Stata software. It should be noted that contrary to mainstream QR findings that are complemented with OLS findings; in this study we have complemented QR estimates with 2SLS since the corresponding OLS follows an instrumental variable procedure. Specifications in Eq. (4) are tailored to control for overparameterisation and multicollinearity issues. For this purpose, the correlation matrix in Table 4 enables the study to control for any potential concerns of high degrees of substitution among the instrumented independent variables.

Table 4: Correlation matrix on the loadings

Panel A: Instrumentation with first lags										
IVInfra	IVInfla	IVCredit	IVTrade	IVPolS	IVNres	IVFDI	IVNFDI	GDPg	RGDP	
1.000	-0.081	0.234	0.203	0.303	0.273	0.152	0.178	-0.320	0.177	IVInfra
	1.000	0.010	-0.081	-0.268	0.077	-0.165	-0.278	-0.070	-0.344	IVInfla
		1.000	-0.140	0.551	-0.490	-0.024	0.162	0.071	0.139	IVCredit
			1.000	-0.344	0.336	0.246	0.219	0.145	-0.168	IVTrade
				1.000	-0.240	0.162	0.241	-0.215	0.454	IVPolS
					1.000	0.052	0.051	-0.084	0.064	IVNres
						1.000	0.472	-0.037	0.223	IVFDI
							1.000	0.240	0.711	IVNFDI
								1.000	0.222	GDPg
									1.000	RGDP
Panel B: Instrumentation with first difference										
IVInfra	IVInfla	IVCredit	IVTrade	IVPolS	IVNres	IVFDI	IVNFDI	GDPg	RGDP	
1.000	-0.122	-0.049	0.024	0.041	-0.008	0.173	0.066	0.019	0.077	IVInfra
	1.000	-0.238	0.017	-0.058	-0.283	-0.063	-0.212	-0.074	-0.132	IVInfla
		1.000	0.100	-0.021	0.342	-0.023	0.155	0.052	-0.068	IVCredit
			1.000	-0.007	0.362	0.184	0.221	0.207	-0.059	IVTrade
				1.000	-0.147	0.134	-0.089	0.037	-0.069	IVPolS
					1.000	0.211	0.308	0.207	-0.059	IVNres
						1.000	0.453	0.257	-0.004	IVFDI
							1.000	0.453	0.333	IVNFDI
								1.000	0.222	GDPg
									1.000	RGDP

IV: Instrumented Variable. Infra: Infrastructure. Infla: Inflation. Credit: Domestic Credit. PolS: Political Stability. Nres: Natural resources.

While Panel A of the correlation matrix is based on first-lag instrumentation, the corresponding matrix in Panel B presents them in first difference. From a preliminary examination of the correlation coefficients, there does not appear to be 'high degree of substitution' concerns among the instrumented variables. Hence, we are confident that the estimated variables would produce signs that are not biased due to highly correlated independent variables entering into conflict.

3. Empirical results

In Table 5, we present findings which entail estimations from 2SLS, LAD and QR.

Table 5: Panel A: Determinants of Growth Rate of GDP. Sample 90 obs.

	Panel A1: Instrumentation with first lags						
	2SLS	**LAD**	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**
Constant	**3.895****	2.603	2.458	0.725	2.603	**5.637*****	4.979
	(0.042)	(0.333)	(0.773)	(0.788)	(0.361)	**(0.003)**	(0.337)
FDI	-0.582	-0.302	-0.825	-0.385	-0.302	**-0.882****	-0.511
	(0.332)	(0.688)	(0.808)	(0.631)	(0.692)	**(0.023)**	(0.497)
NFDI	**0.027*****	0.023	0.027	**0.019****	**0.023***	**0.060*****	**0.047*****
	(0.000)	(0.160)	(0.312)	**(0.033)**	**(0.051)**	**(0.000)**	**(0.000)**
Nresources	0.040	0.077	0.007	-0.005	0.077	0.078	0.020
	(0.398)	(0.433)	(0.972)	(0.936)	(0.339)	(0.188)	(0.894)
Infrastructure	-0.037	-0.018	-0.073	-0.010	-0.018	**-0.02*****	-0.028
	(0.001)	(0.268)	(0.199)	(0.431)	(0.195)	**(0.002)**	(0.238)
Inflation	-0.088	-0.088	-0.306	0.003	-0.088	**-0.107****	0.005
	(0.144)	(0.489)	(0.139)	(0.968)	(0.333)	**(0.032)**	(0.954)
Credit	**0.019****	**0.024****	0.027	0.013	**0.024****	**0.024*****	0.017
	(0.029)	**(0.011)**	(0.410)	(0.256)	**(0.030)**	**(0.001)**	(0.186)
Trade	2.386	-0.146	6.308	3.113	0.146	-2.043	1.788
	(0.446)	(0.971)	(0.602)	(0.498)	(0.976)	(0.538)	(0.849)
Political Stability	**-2.154****	**-3.03*****	-1.224	-2.153	**-3.032****	**-4.05*****	**-3.163****
	(0.025)	**(0.005)**	(0.727)	(0.106)	**(0.013)**	**(0.000)**	**(0.015)**
R^2	0.250	---	0.254	0.156	0.189	0.260	0.318
Fisher	**4.717*****	---	---	---	---	---	---
Log-likelihood	-227.345	-222.069	---	---	---	---	---

	Panel A2: Instrumentation with first difference						
	2SLS	**LAD**	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**
Constant	27.810	81.832	-77.882	35.509	81.832	52.007	83.691
	(0.559)	(0.384)	(0.717)	(0.457)	(0.239)	(0.621)	(0.467)
FDI	0.169	-0.357	-0.256	1.077	0.357	0.583	**-4.00*****
	(0.765)	(0.773)	(0.892)	(0.109)	(0.680)	(0.637)	**(0.007)**
NFDI	**0.051*****	**0.068***	**0.039****	**0.032****	**0.068*****	**0.054*****	**0.050***
	(0.000)	**(0.087)**	**(0.038)**	**(0.035)**	**(0.000)**	**(0.002)**	**(0.082)**
Nresources	**1.660***	-0.281	3.567	**2.206****	-0.281	-0.025	-0.754
	(0.066)	(0.882)	(0.139)	**(0.031)**	(0.835)	(0.989)	(0.512)
Infrastructure	-0.002	0.008	0.022	0.014	0.008	-0.026	-0.033
	(0.875)	(0.728)	(0.768)	(0.335)	(0.684)	(0.490)	(0.244)
Inflation	0.127	-0.046	0.363	0.223	-0.046	-0.370	-0.012
	(0.551)	(0.884)	(0.364)	(0.123)	(0.857)	(0.404)	(0.968)
Credit	-0.455	-0.961	0.266	-0.885	-0.961	-0.432	-0.636
	(0.379)	(0.380)	(0.917)	(0.127)	(0.248)	(0.728)	(0.627)
Trade	7.520	14.396	**56.17*****	**40.85*****	14.396	-5.175	-0.073
	(0.466)	(0.577)	**(0.002)**	**(0.000)**	(0.257)	(0.829)	(0.996)
Political Stability	**6.267****	0.2828	11.559	4.790	0.282	-0.028	3.133
	(0.049)	(0.968)	(0.279)	(0.307)	(0.967)	(0.997)	(0.612)
R^2	0.164	---	0.387	0.231	0.120	0.109	0.144
Fisher	3.198	---	---	---	---	---	---
Log-likelihood	-232.20	-229.423	---	---	---	---	---

Table 5. Panel B: Determinants of Real GDP Output (log)

	Panel B1: Instrumentation with first lags						
	2SLS	**LAD**	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**
Constant	**7.894*** **	**7.44*** **	**8.38*** **	**7.972*** **	**7.443*** **	**7.55*** **	**7.666*** **
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
FDI	-0.154	-0.173	0.121	-0.159	**-0.17*** **	**-0.15*** **	**0.374*** **
	(0.240)	(0.197)	(0.450)	(0.141)	**(0.004)**	**(0.004)**	**(0.000)**
NFDI	**0.014*** **	**0.014*** **	**0.010*** **	**0.014*** **	**0.014*** **	**0.01*** **	**0.025*** **
	(0.000)	**(0.003)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Nresources	0.017	0.024	**0.045*** **	**0.034*** **	**0.024*** **	0.002	0.006
	(0.225)	(0.150)	**(0.001)**	**(0.000)**	**(0.000)**	(0.794)	(0.476)
Infrastructure	0.0004	0.0004	0.0005	0.0005	0.0004	-0.0008	-0.001
	(0.847)	(0.865)	(0.786)	(0.737)	(0.707)	(0.499)	(0.341)
Inflation	-0.022	-0.010	**-0.11*** **	**-0.05*** **	-0.010	-0.016	-0.013
	(0.225)	(0.742)	**(0.000)**	**(0.000)**	(0.139)	(0.187)	(0.103)
Credit	-0.001	0.001	**-0.003***	**-0.003*** **	0.001	**-0.001***	-0.0008
	(0.647)	(0.664)	**(0.061)**	**(0.004)**	(0.230)	**(0.094)**	(0.559)
Trade	**-2.28** **	**-2.04** **	**-2.79*** **	**-2.49*** **	**-2.0*** **	**-1.18*** **	**0.683***
	(0.029)	**(0.020)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.006)**	**(0.062)**
Political Stability	0.365	0.289	**0.448** **	**0.414*** **	**0.289*** **	-0.005	0.067
	(0.146)	(0.236)	**(0.038)**	**(0.004)**	**(0.003)**	(0.958)	(0.418)
R^2	0.675	---	0.554	0.505	0.463	0.476	0.617
Fisher	**24.14*** **	---	---	---	---	---	---
Log-likelihood	-61.106	-63.745	---	---	---	---	---
Observations	90	90	90	90	90	90	90

		Panel B2: Instrumentation with first difference						
		2SLS	**LAD**	**Q.10**	**Q.25**	**Q.50**	**Q.75**	**Q.90**
	Constant	**31.88** **	35.357	13.083	0.006	35.357	**42.184** **	53.588
		(0.015)	(0.144)	(0.315)	(1.000)	(0.137)	**(0.012)**	(0.399)
	FDI	-0.447	**-0.981***	-0.430	-0.151	**-0.981** **	**-1.05*** **	**-1.666*** **
		(0.152)	**(0.085)**	(0.109)	(0.813)	**(0.010)**	**(0.000)**	**(0.002)**
	NFDI	**0.013*** **	**0.015***	**0.019*** **	**0.014*** **	**0.015*** **	**0.020*** **	**0.020***
		(0.000)	**(0.060)**	**(0.000)**	**(0.001)**	**(0.004)**	**(0.000)**	**(0.062)**
	Nresources	**-0.175***	-0.240	-0.088	0.080	-0.240	-0.174	-0.115
		(0.093)	(0.544)	(0.863)	(0.879)	(0.587)	(0.550)	(0.906)
	Infrastructure	0.003	0.003	**0.013***	0.007	0.003	-0.001	-0.006
		(0.582)	(0.491)	**(0.074)**	(0.465)	(0.553)	(0.596)	(0.437)
	Inflation	**-0.058***	-0.068	0.078	0.068	-0.068	**-0.124** **	0.021
		(0.064)	(0.371)	(0.484)	(0.602)	(0.442)	**(0.013)**	(0.871)
	Credit	**-0.257***	-0.277	-0.034	0.074	-0.277	**-0.362** **	-0.483
		(0.068)	(0.326)	(0.819)	(0.843)	(0.329)	**(0.066)**	(0.498)
	Trade	-2.442	-3.038	-1.644	-3.300	-3.038	-1.175	-0.884
		(0.119)	(0.792)	(0.889)	(0.711)	(0.501)	(0.652)	(0.994)
	Political Stability	-0.359	-1.195	**5.017*** **	0.846	-1.195	-1.092	-0.145
		(0.791)	(0.573)	**(0.003)**	(0.756)	(0.593)	(0.426)	(0.967)
	R^2	0.107	---	0.186	0.101	0.138	0.171	0.305
	Fisher	**2.333** **	---	---	---	---	---	---
	Log-likelihood	-106.636	-106.306	---	---	---	---	---
	Observations	90	90	90	90	90	90	90

***; **;*: significance levels of 1%, 5% and 10% respectively. GDP: Gross Domestic Product. Nresources: Natural Resources. Lower quantiles (e.g., Q 0.1) signify nations where Growth is least. 2SLS: Two-Stage Least Squares. LAD: Least Absolute Deviations. FDI: Gross Foreign Direct Investment. NFDI: Net Foreign Direct Investment Inflows. R^2 is Adjusted for OLS and Pseudo for QR (Quantile Regression).

The 2SLS findings reflect baseline results on mean effects that we compare with those of LAD and various quantiles in the conditional distributions of economic growth.

Whereas the findings of Panel A are based on the economic growth rate, the dependent variable for Panel B is real GDP output. The Left-Hand-Side (LHS) and Right-Hand-Side (RHS) of either panels are based on first-lag and first-difference instrumentation processes respectively.

Accordingly, Panel A1 (A2) are GDP growth determinants based on first lag (difference) instrumentation while Panel B1 (B2) are real GDP output determinants based on first lag (difference) instrumentation. All estimaions are robust in standard errors. In the interpretation of estimated coefficients, it is important to note that lower quantiles of conditional distributions in economic growth denote countries with lower initial growth levels.

Comparisons of the results of different methods of the estimations

The following findings are observable in Table 5. First, the baseline 2SLS results when compared with the corresponding QR estimates are significantly different in terms of significance and magnitude. This difference in findings justifies the need to complement 2SLS with QR estimates. Second, the instrumental variable (IV) LAD results are consistent with the 50^{th} quartile across specifications and panels. This implies that the IV LAD results obtained from the Gretl software are in line with those of the 50^{th} quartile from the Stata software.

Second, Gross FDI shows a negative effect on economic growth, with the effect most apparent in top quantiles of the growth distribution. The interpretation is consistent across specifications and panels. It is interesting to note that the corresponding 2SLS estimates are negatively insignificant for the most part.

Third, the effect of Net FDI is positively significant, consistently for both 2SLS and QR estimates. Moreover, the magnitude of significance is higher in top quantiles of the growth distributions. This interpretation is broadly consistent across panels and specifications.

Fourth, on the effect of natural resources, but for a slim exception (2SLS in Panel B1) it is broadly positive in the bottom quantiles of the growth rate distributions (25^{th} quartile in Panel A2 and 10^{th} decile to 50^{th} quartile in Panel B1). It is also interesting to note that the decreasing tendency in 'positive effect magnitude' in Panel B1 means the positive impact of natural resources is more apparent in countries with initial high growth levels, but dissipates in higher growth countries. It is important to take into account the limitations of this indicator as seen in the Annexure.

Fifth, the impact of infrastructure is not very apparent because of overwhelming insignificant estimates. This finding is surprising, given that infrastructure is proxied by mobile phone penetration. Accordingly, mobile telephony has been documented to be substantially driving growth in developing countries (Sridhar & Sridhar, 2007, p. 37; Afutu-Kotey et al., 2017; Bongomin et al., 2018 ; Gosavi, 2017; Hubani & Wiese, 2017; Isszhaku & Wiese, 2017; Minkoua Nzie et al., 2017; Muthinja & Chipeta, 2017). It is also important to take into account the limitations of this indicator as seen in the Annexure.

Sixth, the effect of inflation is sparsely significant, notably negative in the: 75th quartile of Panel A1, 10th decile and 25th quartile of Panel B1 and 2SLS, and 75th quartile of Panel B2. The negative sign is consistent with the expectations of economic theory.

Seventh, whereas the incidence of bank credit shows a positive impact for GDP growth, it shows a negative effect on real GDP output. In Panel A1, the positive effect is apparent in 2SLS, 50th and 75th quartiles, while the estimates are insignificant in Panel A2. On the other hand, in Panel B, bank credit has a negative effect in the: 10th decile, 25th and 75th quartiles of Panel B1 and 2SLS and 75th quartile of Panel B2. These results may be related with the problem of units of measurement for this variable.

Eighth, the effect of trade openness has some significant variations. For GDP estimations in Panel A, while it is not consistently significant in Panel A1, it is highly significant in the 10th decile and 25th quartiles of Panel A2. On the other hand, for real GDP output regressions, the estimations are consistently negative but for the 90th decile which is positive in Panel B1, whereas it is not consistently significant in Panel B2. These results may also be related with the problem of units of measurement of this variable.

Ninth, while the incidence of political stability shows a negative impact on GDP growth, it is positive on real GDP output. The negative (positive) effect is apparent only in top (bottom) quantiles of GDP growth (real GDP output). This variable has shown a positive effect on real GDP per capita, in several studies cited in the bibliography, but not necessarily on the rate of GDP growth or in the real value of GDP.

Tenth, the goodness of fit is low in all the cases; in spite of the number of indicators included, what may be due in several cases to the problem of mixing rates, shares, current and constant values.

Comments on the significant results of table 5.

Before we comment on the results of Table 5, it is important to bear in mind that GDP growth rates, for the same level of increase of income in Dollars at constant prices, are higher in low income countries, because the initial values are lower. Besides, some variables that may not show important effects on the rate of growth or do not explain the changes in the real value of GDP may have important positive effects on the evolution of real GDP per capita.

Regarding the results of Table 5, for the rate of growth and the log of real GDP, we must be aware that higher rates of growth do not necessarily imply higher units of growth nor higher increases of real GDP per capita. Many variables, like infrastructures, quality of government and investment per capita, have positive effects on the increase and the level of real GDP per capita, even when they do not show a positive effect on the rate of growth of GDP.

For that reason we find that the usual methodology to try to measure the impacts of several indicators on the rate of growth, or in the real value of GDP, may have unclear results, and bad adjustments, for several reasons, like the mixing of variables in different units (rates, per capita, shares or others), the limitations of some indicators and the choice of the dependent variable.

These are the main results from Table 5:

1) First, we have observed that the 2SLS results are significantly different from the IV QR results. This implies that while mean effects may be important, median effects are also very relevant for policy implications. Hence, in the investigation of drivers of growth in emerging countries, it is important to account for initial levels of growth because blanket policy implications may not be effective unless they are contingent on existing growth levels and tailored differently across other high- and higher-growth nations.

2) Second, we have also found that Gross FDI shows a negative effect on economic growth, with the effect most apparent in top quantiles of the growth distributions, likely due to the problem with the units of measure. A possible inference for this finding is that, in high-growth countries the outflow component of FDI in Gross FDI significantly decreases growth in terms of real GDP output and GDP growth rate. Hence, we may naturally expect Net FDI inflows to exert positive effects on growth dynamics.

3) Third, the effect of Net FDI is positively significant across specifications and panels, with the magnitude of positive significance greater in higher growth countries. This finding is consistent with the results on effects from Gross FDI. Two points are noteworthy here. On the one hand, FDI now exerts a positive effect on high-growth countries because of potentially negative effects of FDI outflows. On the other hand, FDI generally has a more significant impact in terms of magnitude in higher-growth countries. This inference is logically consistent with both the negative effects of FDI outflows and positive impacts of Net FDI inflows on growth dynamics. This brings us to the conclusion that, as much as countries with higher initial levels of growth benefit more from inward FDI relative to their low-growth counterparts; they are also susceptible to experiencing more deterioration in growth owing to outward FDI.

4) Fourth, we have noticed that the impact of natural resources shows a positive decreasing magnitude. This broadly implies the positive effect of natural resources is more apparent in BRICS and MINT nations at the bottom quantiles of the growth distributions. As a policy implication, sampled countries need to improve on their management of natural resources with increasing economic growth, in order to reverse the decreasing positive trend of growth externalities from national resources.

5) Fifth, the impact of infrastructure proxied by mobile penetration is not very apparent. This finding is contrary to mainstream literature documenting a positive effect of mobile phone penetration on economic growth (Sridhar & Sridhar, 2007). A possible explanation for this unexpected result could be the low usage of mobile phone for mobile banking activities in the MINT and BRICS nations (Mohseni-Cheraghlou, 2013). Global averages for ‘mobile phone penetration’ (per 100 people), ‘mobile phone used to pay bills’ (% of adults) and ‘mobile phone used to send/receive money’ (% of adults) are respectively: 90.90, 3. 51 & 4.71. Corresponding rates in sampled countries are: Brazil (123.2; 1.3; 0), Russia (179.3; 1.7; 1.5); India (72; 2.2; 0.6); China (73.2; 1.3; 0.6); South Africa (126.8; 4.4; 5.4); Mexico (82.4; 3.9; 1.5); Indonesia (97.7; 0.2; 0.6); Nigeria (58.6; 1.4; 9.9) and Turkey (88.7; 4.3; 2.2). Hence, the comparatively low

employment of mobile phone for mobile banking purposes could explain its unexpected insignificant relationship with growth dynamics[3].

6) Sixth, whereas the incidence of bank credit shows a positive effect for GDP growth, it shows a negative effect on real GDP output. Understanding why the underlying effects are conflicting is an interesting future research direction.

7) Seventh, table 5 shows that whereas the effect of political stability shows a negative on GDP growth, it has a positive impact on real GDP output. Moreover, the negative (positive) effect is apparent only in top (bottom) quantiles of GDP growth (real GDP output).

4. Conclusions

The analysis of the evolution of BRICS and MINT countries for the period 2001-2011 shows that these countries have experienced important increases both of real Gross Domestic Product (GDP) and real GDP per head.

The highest rates of growth of real GDP per head corresponded to China, India, Nigeria, Indonesia and Turkey, but the highest increases, of real GDP per capita (per year, in Dollars at constant prices) corresponded, in descending order, to Turkey (542), China (415), Brazil (214), South Africa (200) and India (136). The lowest increases of real GDP per capita corresponded to Indonesia (117), Russia (102), Nigeria (70) and Mexico (37). Although the increase of Nigeria is small, it implies a high percentage due to the low starting values of this country.

This study has analyzed the impacts of several indicators on the increase of the rate of growth of real GDP and on the logarithm of the real GDP. The main conclusions in this regard are the following:

1) We have found several limitations regarding the usual methodology, what may be conducted to unclear results of the models.
2) Some of the limitations have to do with missing explanatory variables, and with the units of measurement of each indicator. Other limitations are given for particular problems of some indicators.
3) Finally, the effects of the explanatory variables are different according to the explained variable of the model: results differ if we try to explain the rate of growth of GDP or the value of real GDP.

Regarding the results in Table 5, we have found positive and significant impact of NFDI in the four panels, and of other two variables in Panel A2: Natural resources and Political stability.

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[3] The interested reader can find more insights into the statistics on the following link : http://blogs.worldbank.org/allaboutfinance/mobile-banking-who-driver-s-seat

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Annex

Table A1 presents the evolution of real value-added per capita of Manufacturing and Non-Manufacturing activities, as well of real Gross Domestic Product per capita of BRICS and MINT countries for the period 2000-2010. Graph A1 shows the average annual increase of real production per head for the period 2000-2010.

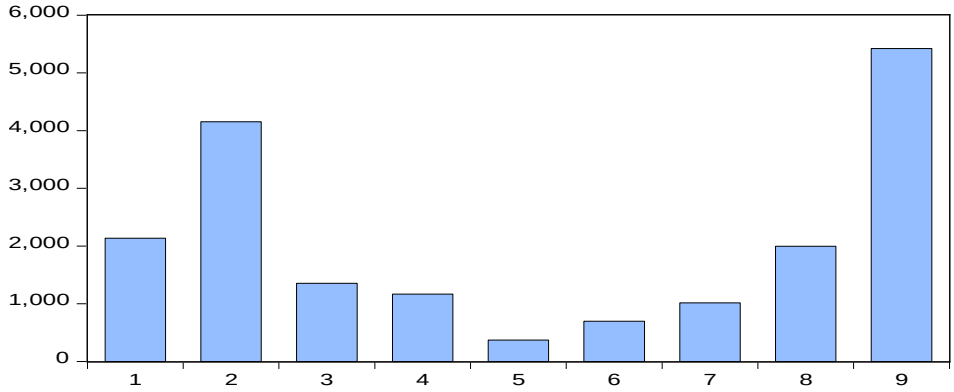
Table A1. Production per capita, annual increase and rate of growth (5), 2000-2010.

Country name	QMH 2000	QMH 2010	GDPH 2000	GDPH 2010	QNMH 2000	QNMH 2010	Increase Per year	Rate ph Compound
Brazil	1347	1307	7921	**10056**	6574	8749	214	2.42
China	852	**2181**	2664	6816	1812	4635	415	9.85
India	258	430	1718	3073	1460	2643	136	5.99
Indonesia	760	931	2714	3880	1954	2949	117	3.64
Mexico	2414	**2239**	12071	**12441**	9657	10202	37	0.30
Nigeria	58	151	1456	2152	1398	2002	70	3.98
Russia	3425	**3322**	23108	24124	19683	20803	102	0.43
South Africa	1421	1137	7480	9477	6059	8340	200	2.39
Turkey	3085	**4435**	17959	23382	14875	18948	542	2.67

Notes: QMH and QNMH are, respectively, manufacturing and non-manufacturing real value-added per head, while GDPH is the sum of both variables. Data of QMH, GDPH, QNMH in US Dollars at 2005 Purchasing Power Parities (PPPs). The last columns are the average increase per year and the annual percentage of growth (calculated with compound rate). Source: Guisan and Aguayo(2015), Guisan and Exposito(2015) and Guisan (2017 a b), elaborated from World Bank indicators.

In table A1, we may notice that the order of the countries is not the same if we use the highest increases or the highest rates of growth, because for a same increase a lower initial value implies faster growth (higher rate of growth). The highest rates of growth of ph corresponded to China, India, Nigeria, Indonesia and Turkey, but the highest increases, of real GDP per capita, per year corresponded, in descending order, to Turkey, China, Brazil, South Africa and India.

Graph A1. Increase of real GDP per capita for the period 2000-2010



Source: Elaborated with data of GDPH from table A1. Countries: 1. Brazil, 2. China, 3. India, 4. Indonesia, 5. Mexico, 6. Nigeria, 7. Russia, 8. South Africa, 9. Turkey

Table A2 presents the percentage of real value-added of industry on Gross Domestic product and the real value-added of industry per head accordingly to WDI statistics (including not only manufacturing but also energy, mining and building), for

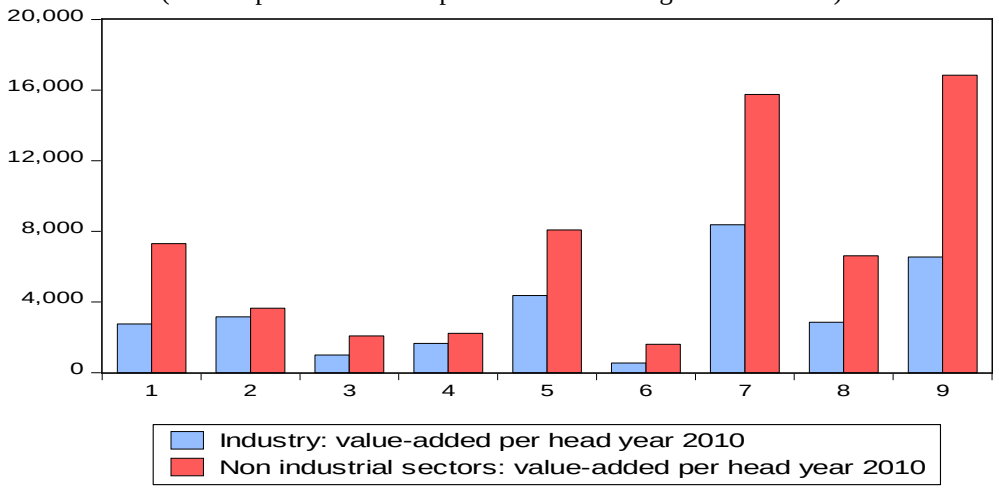
year 2010. This table also presents the evolution of population for the period 2000-2010, as well as the values of investment and savings per capita in year 2010. Graph A2 shows the real-value per head of industrial and non industrial sectors in year 2010.

Table A2. Industry and non Industrial production per head, Investment and Savings per head (USD at 2005 PPPs) in year 2010 and evolution of Population (millions) for 2000-2010.

Country name	%Industry 2010	Gdph Industry 2010	Gdp Non Industry 2010	POP 2000	POP 2010	IH 10	SH 10	Dif 10
Brazil	27.38	2753	7303	173.9	194.9	1936	1663	-273
China	46.40	3163	3653	1262.6	1338.3	3257	3608	351
India	32.42	996	2077	1015.9	1224.6	1068	1036	-33
Indonesia	42.78	1660	2220	206.3	239.9	1260	1240	-21
Mexico	35.09	4366	8075	98.0	113.4	3106	3042	-64
Nigeria	25.32	545	1607	117.6	158.4	465	777	313
Russia	34.70	8370	15754	146.3	141.8	3240	3921	682
South Africa	30.16	2858	6619	44.0	50.0	1825	1559	-266
Turkey	27.98	6543	16839	67.4	72.8	2501	1708	-793

Notes:. Population (million people). Investment per head (IH) and Savings per head (SH). GDP in Industry and Non Industry per capita in year 2010 (at 2005 prices and PPPs). Dif=SH-IH is the difference between savings per head and investment per head in year 2010. Source: First column and Population from World Bank indicators. The second column was calculated applying the percentages of the first column of this table to real GDP per head of table A1. The third column is the difference between GDP per head and industrial GDP per head. IH, SH and Dif elaborated by Guisan(2014) from World Bank statistics.

Graph A2. Real value-added per capita of Industry and Non-Industrial sectors in table A2.
(Dollars per head at 2005 prices and Purchasing Power Parities)



Source: Elaborated with data from table A2: Gdph in industry and Gdph in non industrial sectors. Countries: 1. Brazil, 2. China, 3. India, 4. Indonesia, 5. Mexico, 6. Nigeria, 7. Russia, 8. South Africa, 9. Turkey

In table A2 the highest levels of investment per capita (IH) in year 2010 corresponded, in descending order, to China, Russia, Mexico, Turkey and Brazil. Savings per head are higher than investment per head in China, Nigeria and Russia, and lower in the other six countries.

The highest levels of industrial and non industrial production per head in year 2010, in table A2, correspond to Turkey, Russia and Mexico, with GDPh of industry over 4000 Dollars, and GDPh of Non Industrial sectors over 8000.

Comments on some indicators:

Natural resources:Data of the Worldbank on Natural resource: Are based on the sources and methods described in World Bank(2011).

"Statistical Concept and Methodology: *The estimates of natural resources rents are calculated as the difference between the price of a commodity and the average cost of producing it. This is done by estimating the world price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs (including a normal return on capital). These unit rents are then multiplied by the physical quantities countries extract or harvest to determine the rents for each commodity as a share of gross domestic product (GDP)."License* : CC BY-4.0. "*Long Definition*: *Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents."*

Regarding this indicator we find that the values of their share on GDP is usually very low in many countries, because it does not include many natural resources, besides in some cases the annual data have too strong variations.

Infrastructures: The indicator of number of mobile telephones seems not be enough to represent the differences of infrastructures in different countries and years.

Worldwide Government Indicators: It includes interesting variables related with the quality of government and voices of citizens, but the indicators seems to be more adequate for studies where the explanatory variables is real GDP per capita, instead of studies explaining the rate of growth of the total real value of GDP.

Missing variables

For the model of real Output, it is important to include the effect of total human capital and total social capital. It is difficult to find of total social capital, and for that reason it may be advisable to choose the real output per capita as the explanatory variable and relate its values with the average years of schooling of adult population, and the indicators of social capital used in this study from Kaufman et al. These variables have shown important positive effects on several studies cited in the bibliography.