IDB Invest

Development through the Private Sector Series
April 2019

TN No. 17

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Methodological Innovations and Inclusion of Private Sector Indicators

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Cover page design: David Peña Blanco

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Abstract

This paper extends the development gaps diagnostic tool proposed by Borensztein et al. (2014), which attempts to determine the relative extent of development deficits in different economic and social areas for the IDB borrowing countries, providing guidance regarding investment priorities. The framework presented here expands the set of indicators, from 52 in the original study to 161, so that the potential contributions of the private sector to address development gaps are better integrated with those of the public sector. We group these indicators in various sectors and along various dimensions within each sector to facilitate the analysis of the results. Keeping the definition of development gap of an indicator as the distance between its observed and predicted value, given the expected development level of a country, we also extend the econometric framework by using panel data estimation and applying limited dependent variable methods where the indicators are defined over a restricted range.

JEL Classification: O10; O160; O54; O57; O180; O140; O130

Keywords: Development gaps, panel data, Latin America and the Caribbean

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1. Introduction

Financing and supporting the contribution of the private sector to development in Latin America and the Caribbean in an effective way poses challenges at various stages of the decision process. Firstly, it requires to develop a strategy that identifies the extent to which the private sector can contribute to development in different sectors or activities and formulate priorities. From the perspective of a multilateral development institution, the objective is to help countries get closer to their economic, social and welfare objectives, and this makes it necessary to assess the contribution of the private sector activity to those objectives. Secondly, it is necessary to evaluate the impact of a specific project within the sector or area of intervention and its chances of success in enhancing development. And finally, those potential returns should be weighted by the risks that will be assumed, including those arising from the private sector participation, where risk taking is a necessary component of entrepreneurship and innovation.

Within that demanding program, the objective of this paper is relatively modest. It sits at the beginning of the decision tree process outlined above. It seeks to obtain a snapshot of the current state of development achievement and the gaps or deficits that the economy is showing as it pursues its path of growth and betterment, and identify those areas where the country is lagging when measured by standard yardsticks. While not providing an automatic decision rule, the analysis can strengthen the selectivity of decisions by IDB Invest by suggesting the sectors and investments where a deeper analysis seems to be the most promising.

Operationally, the diagnostic tool developed in this study can help strengthen the contribution of IDB Invest to the Country Development Challenges analysis that is produced in the context of the preparation of the periodic country strategies by the IDB Group. It can also help the analysis in other contexts. For example, it can also provide a snapshot of the level of achievement of different countries in one given sector, say Telecommunications. By drilling down to the indicator level, this tool can help understand in more detail the strengths and weaknesses of one country along a certain dimension,

such as for example financial inclusion. Moreover, the development gaps analysis can provide an overview of the state of development of those sectors that are part of the Key Segments of IDB Invest Business Plan.

The paper builds on the Development Gaps diagnostic tool that was developed with the more general development problem in mind (Borensztein et al, 2014). The Development Gaps approach attempts to determine the relative extent of development deficits in different economic and social areas, and thus provide guidance regarding investment priorities. The scarcity of financial and human resources makes it impossible to tackle all these development gaps at the same time and demands setting priorities. Therefore, an estimate of the relative size of different development gaps was considered a useful tool for both governments and Multilateral Development Banks (MDBs) as the first step towards the formulation of a development plan.

The Development Gaps methodology evaluates the degree of achievement relative to an accepted norm in the different development areas from "10,000 feet above." That is, it takes indicators commonly used to measure the degree of development achieved by a country and compares them to an expected value which is derived from a cross-country econometric analysis. Although this should be considered only a first step in uncovering the overall pattern of development gaps, it helps to identify the most glaring deficits which should be apparent even at this level of generality. More detailed sector studies may reveal, for example, that the apparent underperformance shown by certain indicators respond to idiosyncrasies that are not the result of poor achievement. More detailed studies should also shed light on the sector development gaps that may exist within the country, such as regional inequalities.

Other approaches that seek to answer similar questions include the Priorities for Productivity and Income (PPI), which groups countries in various clusters according to their GDP per capita. This approach, which is applied to support IADB studies on Country Development Challenges, point out the sectors that appear to be critical to increase the probability of a country rising to a higher income group. [2] Also utilized in IDB analysis is

[2] See Izquierdo et al. (2016).

the Growth Diagnostics Methodology (GDM), which seeks to identify the most binding constraints to investment and economic growth.[3] The 2018 IADB Macroeconomic Report (Cavallo and Powell, 2018) presents and discusses results from these three methodologies.

From the perspective of this study, one advantage of the Development Gaps diagnostic tool over the other approaches is that it considers a larger set of indicators that can be easily expanded to incorporate additional variables as new data sets become available or the business focus shifts. This provides flexibility to analyze the country's position with regards to sectors where the participation of the private sector is more feasible or is expected to have a large development impact, as indicators can be added and subtracted to create a new set that is more meaningful for the private sector.

This study differs, however, from the previous version of the Development Gaps diagnostic tool in that it adds indicators and dimensions of analysis where the private sector is likely to be a natural contributor to the country's development, without disregarding development outcomes and mechanisms where the public sector plays a key role (e.g. institutional quality). For instance, it incorporates more explicitly data that reflect decisions made at the firm level. Furthermore, financial development and inclusion are more deeply examined than in Borensztein et. al. (2014) as these may be crucial for the ability of private enterprises to grow and succeed and for achieving desirable development outcomes such as improving access to financial services to firms and populations that experience the largest credit constraints.

At the same time, this study expands the number of indicators of development more generally, as it utilizes newly available data and sources. It studies 161 indicators drawn from a wide variety of sources. The sources include the indicators of financial development compiled by the IMF (Svirydzenka, 2016), World Economic Forum Executive Surveys, World Enterprise Surveys conducted by the IDB and World Bank, commercial databases with corporate and market information such as Thomson-Reuters and Bankscope, FAOSTAT data on agriculture, the Environmental Performance Index

[3] See Hausmann, Rodrik and Velasco (2008).

compiled by Yale University and the Earth Institute at Columbia University, and several other.

The paper computes development gap measures for each indicator for each individual country along 15 key sectors. The fifteen sectors span physical and social infrastructure, corporate development in various industries, financial development and inclusion, and cross-cutting issues such as climate change and gender. The individual indicators are aggregated into an overall score for each sector, with sub-scores for different dimensions of development in that particular area. For example, the Telecommunications sector comprises three dimensions: Access, Quality and Digital Adoption. Access includes variables such as the number of mobile lines per capita in the country, Quality includes indicators such as the number of 4G lines, and Digital Adoption uses indicators such as the percentage of households that made digital payments.

This study also introduces various extensions of the original Development Gaps methodology. The main innovations are two: the use of panel data in the estimation, and the application of limited dependent variable techniques in cases where the indicators are defined over the range of values of 0 to 1. The panel data estimation takes advantage of the fact that most of the variables included in the data base have historical information available (on average 12 years for each country-indicator). The panel data regression with country fixed effects reduces the risk of omitted variable bias and provides more precise estimates. Moreover, the results permit to observe the evolution of the gaps over time. In the case of limited range indicators, a fractional regression is implemented, which avoids biases in the estimation.

The remainder of the paper is organized as follows. Section 2 discusses the selection of indicators and sectors that are relevant to identifying opportunities for private sector investment with large development impact. Section 3 describes the methodology of the Development Gaps diagnostic tool. Section 4 presents some illustrative results and Section 5 concludes.

2. Indicators of Private Sector Development Gaps

The analysis focuses on those indicators that are better suited to provide an assessment of the status of development in areas where the private sector has high potential to contribute. The 161 indicators are grouped in fifteen sectors corresponding to five development areas: Infrastructure, Corporate sectors, Financial Development, Institutions and Transversal topics. Infrastructure comprises Transport, Energy, Water, Sanitation, Health, and Education; Corporate sectors comprises Agroindustry, Manufacture, Tourism, and Telecommunications; Financial Development comprises Financial Institutions and Capital Markets, and SMEs and Financial Inclusion while Transversal Topics comprises Climate Change and Environment, and Gender.

These areas broadly map into the key segments identified in the IDB Invest business plan. (IIC, 2017). In addition, the Institutions sector captures the quality of the regulatory environment and political institutions that shape the development of the private sector including the institutional framework for Public Private Partnerships. Each of these sectors have a subset of relevant dimensions in which the indicators are grouped. Figure 1 shows the sectors and their corresponding dimensions. Sectors are grouped by colors in the five development areas. Appendix 1 presents all the variables included in this framework with their sources, organized by their respective dimensions and sectors. The following section presents a brief overview of the empirical evidence on the relationship between the sector outcomes we analyze and income per capita, the main explanatory variable of our estimations.[4]

[4] The evidence documented in the corresponding IDB's sector framework is described when appropriate.

Figure 1: Sectors and Dimensions

Transport

There are several channels through which transport infrastructure investment fosters economic development. Transport investment leads to a reduction in firms' input costs and thus increases factor productivity. Also, lower production and distribution costs induced by transport improvements can result in scale effects and foster competition levels, which in turn result in higher overall productivity due to a natural selection process in favor of more productive firms (Graham et al., 2013; Melitz and Ottaviano, 2008). Moreover, agglomeration economies occur when economic agents benefit from being close to each other. In this regard, transport affects the realization of agglomeration externalities by changing the way people and firms have access to economic activity, producing even more gains in productivity and growth (Graham, 2007). The main variables we include to measure transport investment in roads are the percentage of roads that are paved, and the road density. We also assess the productivity of the transport system through measures of the burden of custom procedures, and shipping

and logistic performance indexes. Finally, we incorporate other relevant dimensions of the transport sector such as sustainability (through CO2 emissions from transport), security (measured by the persons killed in traffic accidents), and quality (using assessments of the quality of railroad, ports, and railroads, taken from the World Economic Forum's Executive Opinion Survey and from the Logistic Performance Index).

Energy

The analysis of the energy sector takes into consideration access (in both rural and urban areas); quality (distribution and transmission losses as a percentage of production, as well as the business cost of service disruption) and sustainability (non-conventional renewable energy sources as a percentage of GDP). At the macroeconomic level, there is a positive association between access to energy services and income per capita, with the poorest regions of the world experiencing the largest access deficits (State of Electricity Access Report, 2017). At a microeconomic level, studies suggest that access to modern energy services—either in the form of advanced combustion cook-stoves using biomass, or through a switch to the use of LPG—can substantially reduce the long-term costs to the household from diseases associated with high levels of indoor air-pollution; electrification also results in higher household income, with the magnitude varying considerably among countries. Despite wide availability of energy services in the urban areas at a global level, rural access still remains a concern around the world, partly associated with high line losses. Finally, we have included an indicator of renewable energy sources given that scientists believe that significant climate change is unavoidable without a drastic reduction in the emissions of greenhouse gases from the combustion of fossil fuels and the development of low carbon energy sources (Covert, Greenstone and Knittel, 2016).

Water and Sanitation[5]

Water and sanitation have high impacts on health, education and labor outcomes, on the productive sector (especially those highly dependent on water, such as agriculture and

[5] For convenience, we present the relevant evidence of Water and Sanitation together here, but they suppose separate sectors in the framework shown in Figure 1.

industry), and on the environment. It is estimated for the LAC region that for each dollar invested, the socio-economic profitability would be US$2.40 for water infrastructure and US$7.30 for sanitation (Hutton et al., 2008). The lack of water and sanitation access and quality is the main cause for diseases in the world, especially in children (UNICEF, 2006). Hence, and not surprisingly, there is a robust body of evidence showing a close relation of water and infrastructure access and quality on educational and labor outcomes, such as educational attendance rates, cognitive development and learning skills, lower labor absenteeism due to sicknesses, and allocation of time to more productive activities due to the saved time when there is no need to carry water. Untreated wastewater is one of the main threats for public health by contamination of the water bodies used for water supply, production of food and recreation, because they transmit diseases such as cholera, gastroenteritis and hepatitis (OECD, 2013). Untreated wastewater also poses a threat to the industry, agriculture, tourism, and more importantly, to the environment and ecosystems. Likewise, water pollution affects coral reefs and mangroves, thus reducing the ability to protect coastal zones from impacts related to extreme events, which are exacerbated by climate change (Bates et al., 2008).

Health

The relationship between mortality decline during the 20th century and national income levels is well established (Powles & Comim, 2018). Reliable and affordable health infrastructure services represent one of the most important vehicles for income growth and poverty alleviation through faster productivity gains and improved service delivery (Inter-American Development Bank, 2016 and International Monetary Fund, 2004). At the microeconomic level, high prevalence of communicable diseases is one of the main factors related to absenteeism and lower worker productivity, particularly in the developing world (World Economic Forum, 2018). Taking into account this empirical evidence, our analysis assesses public health infrastructure gaps along dimensions of access, affordability, business impact and quality. Access and quality indicators are part of the World Health Organization's Core Health Indicators, and include immunization coverage, number of hospital beds and physicians per 1,000 people, life expectancy, maternal deaths, and mortality rate. The average of the perception of the business impact

of malaria, tuberculosis and HIV on firm performance, as measured in the Executive Opinion Survey of the World Economic Forum, was also included (World Economic Forum, 2018).

Education

The quality of education is a key factor in countries' economic development (Hanushek and Woessmann, 2012; Barro, 2001). The analysis includes measures of Access (both through enrollment from pre-primary to tertiary education and from measurements of gender parity), Quality (measured by PISA scores, the perceived quality of the educational system and the use of Internet in schools), and Skills match (measured by how much of an obstacle does finding qualified workforce means for companies). While the gap in basic education enrollment achievement is closing between high and low-income countries, international assessments of literacy and numeracy suggest that the average student in low-income countries performs worse than 95 percent of the students in high-income countries (World Development Report, 2018). Different studies report that employers in the region are unable to find trained employees that meet the new demands of the labor market (Manpower Group, 2015; Bassi et al., 2012). Finally, while computers have become a regular part of classroom instruction in developed countries, many developing economies still have relatively low rates of computer and Internet access (Bulman and Fairlie, 2016).

Agro-industry

We incorporate measures of agricultural productivity (measured by value added per worker, investment levels and capital stock, research spending, credit access and share of raw material exports on total agricultural exports), and sustainability (as indicated by emissions per unit of agricultural output and water withdrawals from agriculture). There is a strong positive relationship between agricultural productivity and income per capita (Gollin et al, 2014; Adamopoulos et al, 2018), whereby countries in the top 10 percent of the world income distribution produce 50.1 times as much agricultural output per agricultural worker as countries in the bottom 10 percent. Greenhouse gas emissions are driving large, unprecedented changes in the atmosphere and global climate system

(Christensen et al., 2013), and the agricultural sector is the world's second largest emitter, after the energy sector. On the other hand, in LAC, 73% of the water extraction is used for agriculture purposes, 18% for domestic use and the remaining 9% for industrial use (Water Center, 2013). Ensuring water is used optimally is crucial, especially considering that Water has ranked in the top five risks for seven consecutive years in the 2018 World Economic Forum's Global Risk Report.

Manufacturing

The analysis of manufacturing focuses on measures of complexity, innovation, diversification and sustainability. It comprises indicators of economic complexity, the share of high-technology exports in total exports, R&D spending, product diversification and concentration indexes and greenhouse gas emissions from manufacture. The measure of economic complexity is taken from Hidalgo and Hausmann (2009), who interpret trade data as a bipartite network in which countries are connected to the products they export, and quantify the complexity a country's economy by characterizing the structure of this network. Hidalgo and Hausmann (2009) further show that measures of complexity obtained in their work (which is used in this study), are correlated with a country's level of income. More recently, it has been highlighted that the complexity and diversity of products a country exports are a good proxy of the knowledge and knowhow available in an economy (Hidalgo, 2015). Innovation input indicators, such as R&D spending, are included to reflect the amount of investment in technological progress and innovation (World Bank, 2017).

Tourism

Tourism may be an important economic development engine. On a meta-analysis of 63 studies on the impact of tourism on economic growth in different regions of the world, Pablo-Romero et al. (2013) find that 41 of them confirm the existence of a causal relationship from tourism to economic growth and another 12 studies identify a bi-directional relationship. The evidence for LAC is also clear. Using panel data for 21 LAC countries in the period 1985-1998, Eugenio-Martín et al. (2004) find that tourism fosters economic growth, particularly for medium and low-income countries (especially the

Caribbean). Fayissa et al. (2009) find that an increase in 10% in tourism activity increases 0,4% the overall per-capita GDP. Infrastructure is one of the main drivers of tourism growth (Eugenio-Martín et al., 2004), and naturally, the airport infrastructure and the hotel supply. Moreover, several studies highlight the relevance of tourist marketing as a key factor explaining visitors' arrivals (Nicolau et al., 2004; Naudé & Saayman, 2005; Lim, 2006; Song et al., 2010). Regarding its impact on the environment, a well-planned and managed tourism contributes to the conservation of biodiversity and environmental protection, reason why we include sustainability as one of the relevant dimensions. Moreover, there is evidence that natural tourism could be key to generate the needed resources both to protect and conserve biodiversity as well as to put it in value (Balmford et al., 2009; Buckley, 2011; Gunter et al., 2017). Finally, the number of international arrivals and the average spending per tourist are key components of the competitiveness of the tourism sector.

Telecommunications, Media and Information Technology (TMT)

The analysis of gaps in TMT includes indicators reflecting the countries performance in terms of Access (subscriptions of broadband and mobile services and use of Internet), Digital Adoption (the use of mobile phone and Internet for accessing bank account and processing payments) and Quality (given by the availability of secure internet servers and the coverage of 2G, 3G and 4G). The degree of availability of digital technologies to people, businesses and governments correlates positively with income per capita across countries (World Development Report, 2016). In fact, by lowering the cost of information storage and transmission, digital technologies reduce intermediation and the uncertainty and transaction costs associated with economic interactions. Ketterer (2017) illustrates this, by showing potential applications of blockchain technology in the financial sector. Moreover, the recent combination and convergence of digital technologies such as a machine learning, mobile devices, sensors, blockchain, artificial intelligence and the Internet of Things has spearheaded innovations that are having powerful impacts across industries other than the ICT industry itself, leading to the notion of a new industrial revolution embodied in the digitalization of the whole economy and the prospective digital transformation of all industries.

Financial Institutions & Capital Markets

We adopt the IMF (2016a)'s Index of Financial Development framework (with minor changes), which measures the level of development in terms of their depth, access, and efficiency. The index evaluates financial institutions and financial markets separately. Financial institutions comprise banks, insurance companies, mutual funds, and pension funds; financial markets comprise stock and bond markets. In this framework, financial development is defined as a combination of depth (size and liquidity of markets), access (ability of individuals and companies to access financial services), and efficiency (ability of institutions to provide financial services at low cost and with sustainable revenues, and the level of activity of capital markets). Financial development displays a positive correlation with growth (Popov, 2017), which is also supported by empirical studies based on aggregate-, industry- and firm-level data. Nevertheless, some studies suggest that there are non-linearities in the relation between finance and growth (IMF, 2017). Latin American and Caribbean economies, however, have not reached the turning point where marginal growth dividends from additional financial development become negative (IMF, 2016b).

SMEs & Financial Inclusion

The econometric analysis of financial inclusion includes variables measured along three dimensions: Fintech penetration, access to credit and banking by SMEs, and disparity in the use and access to financial services by households. Variables describing access to financial services by SMEs were included to reflect the financing gap in access to formal credit observed in the economies in the region. According to the World Bank (2018), approximately 70% of all micro, small and medium-sized enterprises (MSMEs) in emerging markets lack access to credit, an essential driver of enterprise growth and job creation. The inclusion of Fintech penetration indicators reflects the growing evidence on the contribution of digital financial services to financial inclusion (Demirguc-Kunt, et al. (2018) and World Bank (2016)). Lastly, indicators are included to capture inequalities in households' access and use of financial services by gender, income, and urban-rural status, which have been found to be still pervasive across the globe (Demirguc-Kunt, et al. (2018)).

Institutions

The indicators included in this analysis include variables of Governance, Public-Private Partnerships (PPP) environment, Security, and Business Environment. There is empirical evidence documenting the impact of the institutional environment on both firm entry (Klapper et al., 2004, and Klapper and Love, 2010) and firm growth (Batra and Stone, 2008, and Woodruff, 2003). Additionally, especially in developing countries, bank and corporate ratings depend on both the government's creditworthiness and on the general business environment, making debt contracting more expensive in countries with poor business environment ratings (Majnoni et al., 1999, and Nguyen and Knyphausen-Aufseß, 2014). Governance indicators on corruption, government effectiveness, and regulatory quality matter for firm performance, as measured by employment, investment and sales growth (Batra and Stone, 2008). For the computation of the development gap, measures of the quality of PPP institutions are taken from the World Bank's Procuring Infrastructure Public-Private Partnership Report and reflect all stages of the PPP project cycle. For example, while many countries implement good practices for the procurement phase of the project, the stages of project appraisal and contract management are often plagued with shortcomings, resulting in poor quality projects and higher contractual risks (World Bank, 2018). Security indicators reflect perceptions on the impact of crime on the cost of doing business and a series of indicators on political stability, homicides, and police services. Not only does security affect the business environment through the destruction of human and physical capital, but also through disruptions in consumption, investment, production and trade (Institute for Economics and Peace (IEP), 2016). In 2015 alone, the worldwide economic impact of violence was estimated to be US$13.6 trillion (IEP, 2016).

Climate Change & Environment

The estimation of climate change and environment gaps is based on the Environmental Performance Index (EPI) calculated by the Yale Center for Environmental Law & Policy. The EPI shows a positive correlation with country wealth, as measured by per capita GDP (Yale University, 2018). The EPI ranks 180 countries along 24 performance indicators in two dimensions of sustainable development: environmental health and ecosystem

vitality[6]. Examples of the indicators of the environmental health dimension are drinking water, sanitation, air quality, and PM2.5 exposure and exceedance. The ecosystem vitality dimension looks at metrics of biodiversity and habitat, climate and energy, forests, fisheries, agriculture, air pollution and water resources. A breakdown of the index shows that, while LAC countries benefit from having a relatively abundant natural capital, they present relatively low environmental governance levels and growing environmental deterioration.

Gender

The gender analysis includes measures along five dimensions: education, health, fintech adoption, financial access (at the household and firm levels), and firm leadership by women. These categories intend to capture disparities across two broad dimensions: human capital (health and education), and economic empowerment. Educational attainment is important insofar as gender disparities in access to education translate into earning gaps and lower rates of labor force participation (Wodon and de la Brière, 2018). The health measure used is maternal mortality, which reflects the efficacy of reproductive and maternal health policies (Inter-American Development Bank, 2015). Measures of economic empowerment are taken from the Global Findex Database and the World Enterprise Survey. Female participation in firm ownership and management is important to achieve gender equality and empowerment of women (World Bank Group, 2017). The inclusion of fintech access indicators intends to capture the observed positive impact of these technologies on women economic participation (Suri & Jack, 2016). The promotion of fintech penetration is particularly relevant among developing countries, where women are 20 percent less likely than men to have an account at a formal institution (Demirguc-Kunt et al, 2018). In most cases, we measure gender disparities by calculating ratios between the female mean of the variable at the country/year level divided by the male average.

[6] Appendix 2 shows the variables included in the Environment Performance Index and their weights.

3. Methodology

The general approach of the development gaps diagnostic tool is to compare the level of achievement measured by an economic or social indicator with a calculated “norm” appropriate for the country. The indicators are selected among the most commonly used yardsticks of development in each area, for example, domestic credit as a proportion to GDP as an indicator of development achievement in financial development. The norm is the level of achievement that could be expected in a given country considering its level of wealth. Simply put, indicators of economic development show stronger values for wealthier countries, such as higher rates of domestic credit to GDP, to continue using the example above. In this light, the development gaps tool calculates a normal value for domestic credit to GDP for country with the level of income of say, Trinidad and Tobago. This norm is generally calculated from a cross country regression of the development indicator on the level of per capita income measured in purchasing power parity terms. While many advanced economies achieve levels of domestic credit to GDP close to 100 percent (or even above that level), the calculated norm for Trinidad and Tobago is in fact about 75 percent. Rather than comparing to the level prevailing in advanced economies, the value of the development gap for this indicator for Trinidad and Tobago will be a function of the difference between its own domestic credit to GDP value and its predicted norm, 75 percent.

Raw or unadjusted gaps present a problem, however, as they are not comparable across indicators, even within the same sector. Continuing to use the case of financial development, consider for example an unadjusted gap of 30 percent in the rate of domestic credit to GDP with an unadjusted gap of 10 Automatic Teller-Machines (per 100,000 inhabitants). How can one compare those two values? The development gaps tool solves this problem by standardizing the gap values using the expected value and variance of the indicator to make all the indicators comparable on the same scale. This is achieved by using z-scores of the unadjusted gaps, which is a measure commonly used in statistics. This also permits to aggregate indicators within a sector (or even the whole economy) to compute, for example, the composite development gap in the education

sector. For ease of presentation, the adjusted gap is rescaled to an index ranging between -100 and 100, where negative values of the index imply that the country falls short of its norm for that indicator while positive values mean that the country exceeds the norm.

More precisely, the calculation of the development gaps follows three steps:

Step 1: Calculation of the norm and the gap

As in Borensztein et al. (2014), we run a regression for each development indicator on the logarithm of per capita GDP measured in real-PPP terms, using all the available countries for that specific indicator.[7] In the original methodology:

$$y_i = \alpha + \beta * \mathrm{pcGDP_i} + \mu_i$$

Where y_i represents one specific indicator for the country i and $\mathrm{pcGDP_i}$ its per-capita income level for that same year. This regression uses all the possible countries and for the last year available.

The residuals (observed minus predicted values) from this regression become the unadjusted measure of the development gap corresponding to this indicator for each country:

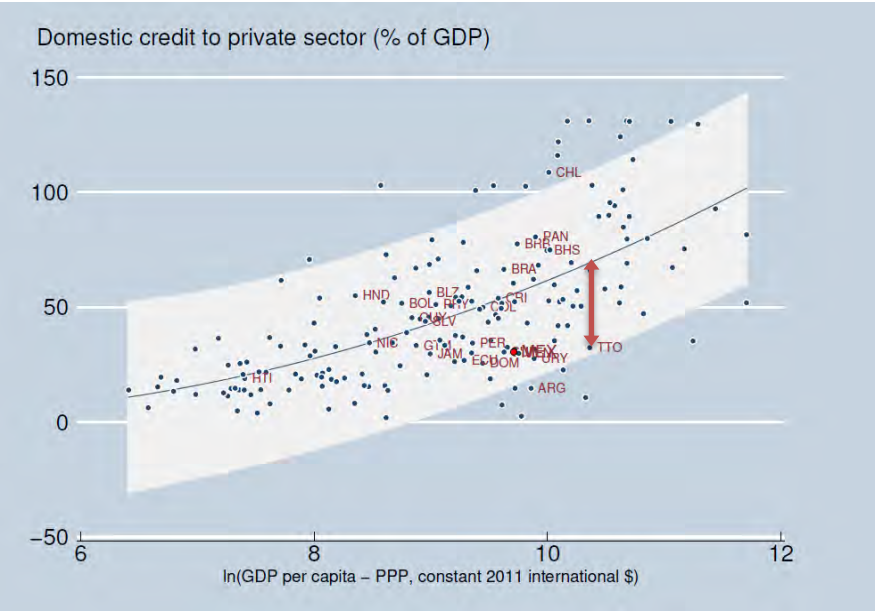
$$\hat{\mu}_i = y_i - \hat{y}_i$$

Figure 2 illustrates the methodology for the case of domestic credit as a proportion of GDP, which is one indicator within the Financial Development area. The solid line in Figure 2 shows the prediction line for the domestic credit as a percentage of GDP from regression of this indicator on per capita GDP in PPP terms (expressed in natural logs and including a quadratic term)[8]. For example, we can see that in the case of Trinidad and Tobago the observed value for this indicator is smaller than its expected level given

[7] Most of the times, the coverage of the GDP data is better than the one for the development indicator under analysis, so the availability of the latter determines the sample size for each estimated regression.
[8] Appendix 3 shows the prediction line and observed results for countries, for a selected group of indicators for each of the sectors included in the framework presented in Section 2.

Trinidad and Tobago's per capita income. Thus, we obtain a negative gap for this indicator and this country. This gap suggests that more support would be required in this area just to lead this country to an acceptable standard given its income level.[9]

Figure 2



Taking advantage of the longer sample availability for most of the indicators when compared to Borensztein et al (2014), we extended their approach to a panel data estimation. We included all the historical yearly-data available and run fixed effects estimates exploiting the panel data structure. Thus, the model to be estimated is:

$$y_{it} = \beta * \mathrm{GDPpc_{it}} + b_t + a_i + \epsilon_{it}$$

Where b_t is a time fixed effect, a_i is a country fixed effect that captures all time-constant factors that affect y_{it} and ϵ_{it} is a time-varying error term for the country i in year t. The development gap in this case is given by the composite error:

$$\widehat{\mu_{it}} = \widehat{a_i} + \widehat{\epsilon_{it}}$$

[9] Note that whenever the relationship of the variable with development (per capita income) is negative, a value above the prediction is a negative gap.

A fixed effects panel data estimate offers at least three advantages with respect to the cross-section estimates. The first and more evident is to be able to estimate the evolution of the gaps over time, adding this important dimension to the analysis.[10] Second, by controlling for all time-invariant observable and un-observable variables, fixed effects models reduce the risk of omitted variable bias. And third, the larger sample sizes increase the efficiency of our estimators.[11]

A second innovation to the original methodology has to do with incorrect negative gaps associated with indicators limited to the range [0,1], usually because they indicate the fraction of the population that share a certain attribute.[12] An example of such an indicator is the percentage of rural population that has access to electricity. Figure 3 illustrates why estimating this variable with a linear model could be problematic. Observations that fall close to the edges would have an incorrect predicted gap. For example, countries that reached 100% of access have a negative predicted gap, when the gap should be zero or positive. Including a quadratic term only partially fixes that problem. Following Wooldridge (2008), we estimate these gaps using a fractional regression that fits a probit model on continuous zero-to-one data (see Figure 4).

For the rest of the indicators (which are not limited to the range [0,1]), we apply the specification that best fits the data to get the most accurate development gaps in terms of deviation from the predicted norm by per capita GDP. In this regard, we use the Box-Cox test to assess whether the relationship between the indicator and the logarithm of per capita GDP is non-linear[13]. Additionally, and as a second step, we test the inclusion of a quadratic term of per capita GDP, based on adjusted R-squares.

A small number of indicators are available only since recently, and they have only one year of data[14]. In these cases, we run a cross-section regression, using the same criteria

[10] See applications and results that exploits the time dimension of the development gaps in Section 4.
[11] On average, the sample size using cross section regressions is 148 countries while this average increases to 1,625 country-year observations when we run fixed effects estimates, using the panel data. Histograms of those two distributions can be found in Appendix 4.
[12] About a third of the indicators included in our framework are fractions in the range [0,1].
[13] For the Box-Cox test, we use all the available data for each indicator's regression, as in a "pooled" estimate.
[14] Ten out of the 161 indicators fall in this category.

to run a fractional regression, or the Box-Cox and the inclusion of the quadratic term tests commented before.

Figure 3

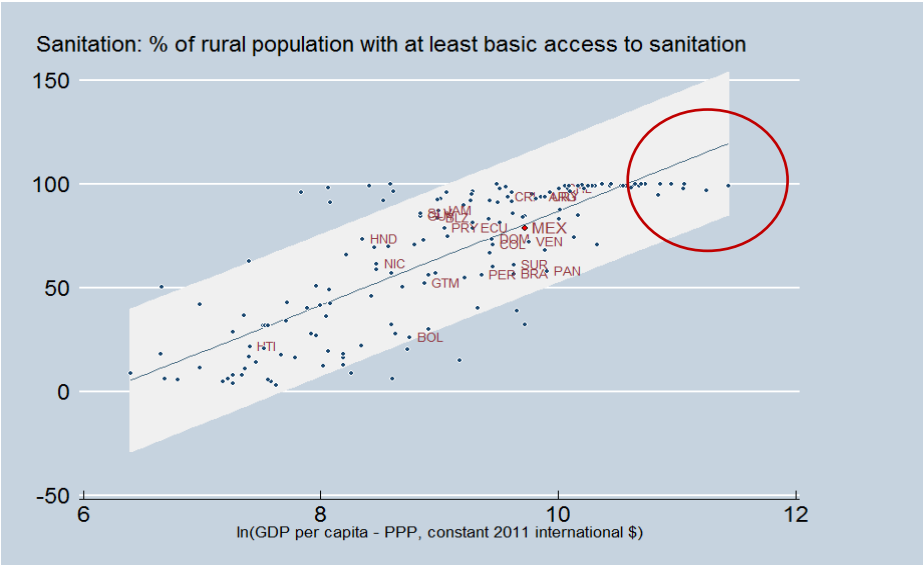
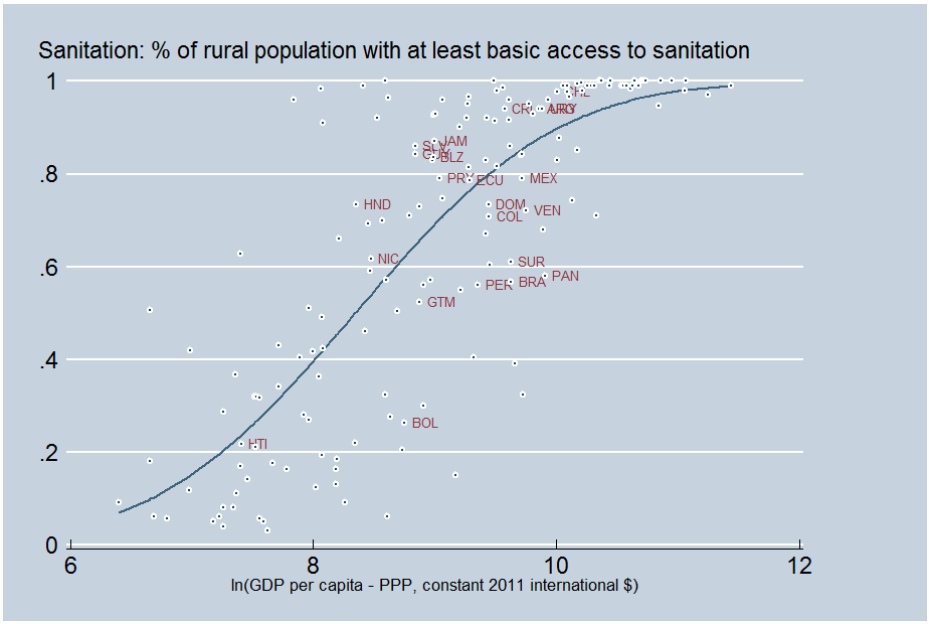


Figure 4



Step 2: Standardization of the gap

Given the heterogeneity of our indicators, before we aggregate the gaps into a composite measure, we need to standardize the gaps measurement. The standardization formula is:

$$STDGAP = \frac{GAP - \mu(GAP)}{\sigma(GAP)}$$

Where *STDGAP* is the standardized gap for a specific variable, *GAP* is the gap (or residual) obtained from the regression ($\widehat{\mu_i}$ for the case of the cross section estimates and $\widehat{\mu_{it}}$ for the panel data estimates), and *μ*(*GAP)* and *σ(GAP)* are the mean and standard deviation of the gap across countries, respectively. These standardized gaps are then multiplied by 50 for presentational purposes, such that, approximately 95% of the observations fall in the (-100, 100) range[15]. Note that outliers that exceed a z-score of 2.5 for both tails of the distribution for each of the original indicators[16] are eliminated for the estimations on per-capita GDP, but then recovered for the prediction and gaps estimates.

Step 3: Aggregation

The aggregation of the gaps within a sector into a composite gap by sector in done by using simple averages, first of all the individual indicators' gaps over a dimension within a sector, and then by averaging those dimension averages by sector. For instance, in the Energy sector we average the indicators' gaps within the dimensions Access, Quality and Sustainability, and then take the simple average of those three results (averages) to come up with the Energy sector gap of the specific country under analysis. This intermediate level of concepts, such as access and quality, allows us to assign the same weight to the dimensions in the final sector gaps. Often, there are more indicators available (which are relevant to include) associated to a specific area of development (dimension) for a sector,

[15] That is, considering all indicators follow a normal distribution. As we can see from Appendix 8, considering the estimated gaps for the latest year available, 1.9% end up being truncated (and therefore 98.1% fall in the range -100,100).
[16] Which in total accounts for 1.24% of the sample in a normal distribution.

so by “locking” these dimensions we assure that they are all equally represented in the final sector gap estimates.

4. Applications and Results

This section illustrates several applications of the Development Gaps approach to the work of IDB Invest. First, we take a snapshot of four regions of Latin America and the Caribbean in an array that corresponds to the four IDB’s regional departments, which provides a very broad picture of the current situation of the aggregate sectors for the region as a whole. Second, we examine the evolution of the gaps over time, using a few sectors and countries to illustrate this application of the methodology. Finally, we present an application not related to country strategy exercises, where we analyze in detail the achievements and deficits of the region with respect to financial development and inclusion.

Table 1 presents descriptive statistics of the variables, along with the period covered and sample size of each estimate. As it is expected, not all the countries under analysis have information for all the indicators. In this context, Appendix 6 shows the number of missing values for the 26 Latin American IDB’s borrowing countries and the 161 variables in this framework, considering the last available year’s estimates. On the other hand, and for that same set of estimates, Appendix 8 shows how many indicators were truncated to the boundaries (-100,100).

Finally, Appendix 9 presents a comparison of the estimated gaps estimated by the new methodologies applied in this paper relative to the original study of development gaps. In particular, the appendix highlights the difference between the gaps estimated using a cross section estimate for the last year available (as in the methodology presented in Borensztein et al, 2014) and those obtained using the panel data methods suggested in Section 3 (which after estimating using the whole sample, takes the estimated gap for the last year available).

Table 1[17]: Summary Statistics, a. Infrastructure

Variable definition	Period	N	Countries	Avg. years	min LAC	max LAC	CAN	CCB	CID	CSC
Transport										
Registered air carrier departures worldwide (over GDP, const. 2010 MM US)	1970-2017	4,016	175	22.9	0.1	87.4	1.0	1.7	13.4	0.3
Road density Km/GDP (constant 2010 MM US$)	2008-2013	581	115	5.1	0.3	2.1	0.7	1.1	0.8	0.8
Liner shipping connectivity index (maximum value in 2004 = 100)	2004-2016	1,732	143	12.1	4.5	53.4	32.7	13.3	20.2	36.9
Burden of customs procedure, WEF (1-7=extremely efficient)	2007-2017	1,516	152	10.0	2.2	5.0	3.4	3.7	3.4	3.8
Logistics performance index: Quality of transport-related infrastructure	2006-2017	906	166	5.5	1.9	3.2	2.4	2.3	2.5	2.8
Paved roads %, IRF	2008-2013	460	97	4.7	13.0	44.6	13.0	38.9	31.6	18.1
Quality of airports, WEF survey	2007-2017	1,500	150	10.0	2.6	6.0	4.0	4.6	4.1	4.1
Quality port infrastructure, WEF survey	2007-2017	1,502	150	10.0	2.6	6.2	3.7	4.3	4.0	4.0
Quality of railroad infrastructure, WEF survey	2009-2017	997	128	7.8	1.2	4.5	1.7	1.8	3.6	2.0
Quality of roads, WEF survey	2007-2017	1,503	150	10.0	2.1	5.2	3.5	4.0	3.7	3.5
Mortality caused by road traffic injury (per 100,000 people)	2000-2015	708	181	3.9	5.5	41.7	23.6	12.3	17.2	17.8
CO2 emissions from transport (% GDP, const. 2010 MM US$)	1971-2014	3,138	136	23.1	7.0	30.7	16.1	17.9	13.1	11.3
Energy										
Access to electricity, rural (% of rural population)	1990-2016	4,485	190	23.6	56.6	100.0	89.3	91.2	87.1	99.2
Access to electricity, urban (% of urban population)	1990-2016	4,671	195	24.0	65.4	100.0	99.9	97.8	95.6	100.0
Electric power transmission and distribution losses (% of output)	1971-2014	984	132	7.5	2.3	60.1	16.0	12.6	20.8	10.6
Average duration of power outages (hours)	2006-2017	261	134	1.9	0.4	1.7	0.8	2.1	1.0	1.3
Number of electrical outages in a typical month	2006-2017	256	131	2.0	0.5	1.7	0.8	3.6	1.3	1.1
Percentage of firms that experienced an electrical outage	2006-2017	266	136	2.0	35.1	83.0	50.9	67.7	54.4	68.2
Value lost due to electrical outages (% of sales for affected firms)	2006-2017	266	136	2.0	0.3	2.5	1.5	1.6	1.4	1.2
GDP per unit of energy use (constant 2011 PPP $ per kg of oil equiv.)	1990-2015	3,457	166	20.8	11.1	11.4	13.3	7.5	11.4	11.1
Renewable energy consumption, excluding hydro (% of GDP)	1971-2015	3,235	138	23.4	12.9	28.9	5.8	6.6	12.9	28.9
Water										
Percentage rural pop with at least basic access	2000-2015	2,559	165	15.5	40.0	100.0	80.6	89.7	82.0	95.8
Percentage urban pop with at least basic access	2000-2015	2,646	171	15.5	81.0	100.0	98.6	98.3	96.7	99.6
Percentage of firms that experienced a water outage	2006-2017	178	113	1.6	8.2	21.3	13.9	16.1	11.6	14.4
DALY rate for Unsafe Drinking Water	2000-2016	682	181	3.8	14.7	1,506.1	120.6	174.8	359.8	79.3
Percentage of rural pop using improved water, accessible on premises	2000-2015	925	157	5.9	5.0	100.0	73.2	80.3	72.5	93.0
Percentage of urban pop using improved water, accessible on premises	2000-2015	2,615	169	15.5	9.0	100.0	95.4	96.7	88.5	98.8
Percentage of wastewater treated	1995-2016	382	165	2.3	0.0	87.5	13.5	4.7	11.6	23.1
Level of water stress: freshwater withdrawal, % of available freshwater	2014-2015	172	172	1.0	25.9	25.9	1.8	18.8	25.9	3.6
Sanitation										
Percentage of rural pop with at least basic access	2000-2015	2,551	164	15.6	22.0	99.0	61.8	77.7	69.2	85.4
Percentage of urban pop with at least basic access	2000-2015	2,607	169	15.4	37.0	100.0	84.2	87.0	83.2	96.0
DALY rate for Unsafe sanitation	2000-2016	679	181	3.8	3.6	1,266.3	79.6	86.3	275.3	53.6
Percentage of rural pop using improved sanitation, sewer connections	2000-2015	2,399	154	15.6	0.0	31.0	12.0	2.3	6.4	8.6
Percentage of urban pop using improved sanitation, sewer connections	2000-2015	2,441	158	15.4	1.0	98.0	72.4	12.7	41.4	61.6
Health										
Immunization, DPT, HepB3 and measles(% of children ages 12-23 months)	1994-2016	2,974	178	16.7	56.3	99.0	89.8	94.8	87.1	93.0
Hospital beds (per 1,000 people)	1960-2012	1,828	188	9.7	0.7	6.2	1.4	3.5	1.0	3.2
Physicians (per 1,000 people)	1960-2016	2,397	188	12.8	0.5	0.5	1.8	0.5	2.2	2.9
Out-of-pocket expenditure (% of current health expenditure)	2000-2015	2,897	187	15.5	10.1	55.8	32.9	30.8	36.5	26.2
Business impact of malaria, HIV and tuberculosis, 1-7 (best), WEF survey	2007-2017	956	150	6.4	4.2	6.6	5.4	5.7	5.5	6.1
Life expectancy at birth, total (years)	1960-2016	4,798	192	25.0	63.3	79.8	73.9	72.7	73.8	76.4
Lifetime risk of maternal death (%)	1990-2015	4,356	180	24.2	0.0	1.1	0.3	0.2	0.3	0.1
Mortality rate, under-5 (per 1,000 live births)	1960-2016	4,831	188	25.7	8.3	67.0	20.9	18.2	23.4	12.7
Education										
School enrollment, gender parity index (primary & secondary)	1970-2017	3,126	189	16.5	1.02	1.02	1.02	1.04	1.00	0.99
High degree gender gap (female/male)	2005-2017	924	131	7.1	0.8	1.6	1.0	0.6	1.0	1.2
School enrollment, preprimary (% gross)	1970-2017	3,292	187	17.6	71.6	71.6	71.6	70.7	56.4	84.9
School enrollment, primary (% net)	1970-2017	2,794	184	15.2	91.3	91.3	91.3	90.8	89.5	92.9
School enrollment, secondary (% net)	1970-2017	1,965	168	11.7	88.2	88.2	88.2	83.8	65.1	87.1
School enrollment, tertiary (% gross)	1970-2016	2,883	184	15.7	24.3	90.3	58.7	26.9	39.2	90.3
To what extent is Internet used in schools?, WEF survey	2007-2017	1,503	150	10.0	2.6	5.6	3.8	4.3	3.6	4.2
PISA, mean performance on the mathematics scale	2000-2015	331	76	4.4	327.7	422.7	388.1	417.2	378.7	406.7
PISA, mean performance on the reading scale	2000-2015	332	75	4.4	357.7	458.6	411.2	427.3	402.8	431.9
PISA, mean performance on the science scale	2000-2015	333	74	4.5	331.6	447.0	406.2	424.6	389.0	428.8
Education system meet the needs of a competitive economy?, WEF survey	2007-2017	1,496	150	10.0	2.2	4.5	3.0	4.2	2.9	2.8
Math and science education quality, WEF survey	2007-2017	1,498	150	10.0	2.4	4.8	3.1	4.4	3.0	2.9
How do you assess quality of business schools?, WEF survey	2007-2017	1,497	150	10.0	3.2	5.3	4.1	4.9	4.1	4.3
Percentage of firms stating inadequate education is a major labor dificulty	2006-2017	265	137	1.9	17.2	39.7	23.0	42.2	27.4	35.3

[17] The sample size (N), countries and average years refer to those used for estimating each indicator's regression. LAC refers to the IDB's 26 borrowing countries. The last four rows are averages for the four IDB regions: Andean Group (CAN), Caribbean (CCB), Central America (CID) and Southern Cone (CSC). All the values, except for the sample sizes, countries and average years, refer to the latest year available. A histogram of the years used in the econometric estimates can be found in Appendix 5.

Table 1 (continued): Summary Statistics, b. Corporates

Variable definition	Period	N	Countries	Avg. years	min LAC	max LAC	CAN	CCB	CID	CSC
Agribusiness										
Agriculture total FDI inflows (% of Agri GDP)	1991-2016	4,030	181	22.3	0.1	5.0	0.4	2.1	0.7	0.5
Gross capital formation (over agri GDP)	1990-2015	4,244	187	22.7	0.0	0.3	0.1	0.1	0.1	0.2
Net capital stock (over agri GDP)	1990-2015	4,144	184	22.5	0.3	10.4	1.0	3.1	1.6	1.8
Agricultural raw materials exports (% of merchandise exports)	1962-2017	1,236	175	7.1	0.2	17.0	2.3	5.1	1.0	5.3
Research spending over agricultural GDP	2000-2012	728	84	8.7	0.1	7.1	0.6	3.5	0.5	0.1
Agriculture value added per worker (constant 2010 M US$)	1991-2017	4,018	172	23.4	0.9	321.3	3.7	24.0	4.4	75.8
Credit to agriculture over total credit (over GDP agri/total GDP)	1991-2016	1,746	115	15.2	10.3	216.5	106.2	33.2	86.8	121.8
Agricultural total emissions (CO_2 eq. over agric. GDP, in const. 2010 MM US$)	1961-2016	4,128	178	23.2	0.4	9.3	3.7	1.9	2.6	4.3
Freshwater withdrawals, agric. (% agric. GDP, in constant 2010 MM US$)	1970-2015	375	148	2.5	1.7	1.7	0.9	0.1	1.7	0.6
Manufacture										
ATLAS index of economic complexity	1995-2016	2,612	121	21.6	-1.2	1.0	-0.9	-0.2	-0.2	-0.1
Exports product concentration index	1995-2016	3,728	180	20.7	0.12	0.61	0.37	0.40	0.24	0.24
Number of export products, SITC 3-digit level (261 max.)	1995-2016	3,728	180	20.7	53.0	251.0	203.8	115.3	193.2	213.8
High-technology exports (% of manufactured exports)	1988-2016	296	155	1.9	0.2	24.3	6.7	10.1	8.4	9.2
Patents per one million people	1963-2016	2,375	136	17.5	16.2	162.3	32.0	73.8	62.1	128.0
Research and development expenditure (% of GDP)	1996-2015	1,574	135	11.7	0.1	0.6	0.2	0.1	0.3	0.3
CO_2 per kWh of manuf./construction (% manuf. GDP, const. 2010 MM US$)	1971-2014	2,682	129	20.8	1.2	126.9	27.2	65.2	16.7	9.9
Tourism										
Average spending per int'l tourist (US$)	2013-2015	277	142	2.0	314.3	1,968.7	980.9	906.0	978.2	654.1
Cultural, entertainment and natural digital demand	2014-2015	262	140	1.9	4.2	76.0	19.3	14.7	27.4	31.7
International tourism, arrivals per 100,000 pop.	1995-2016	3781	188	20.1	1,903.8	378,803.0	7,593.4	130,427.0	44,647.2	30,994.8
Airport density, airports/million pop.	2015-2017	265	140	1.9	0.2	17.4	1.3	10.0	1.9	0.7
Number of operating airlines, per 100,000 sq. km of land area	2014-2015	267	142	1.9	0.7	3,255.8	4.0	1,259.0	44.8	3.5
Number of hotel rooms per 100 population	2013-2015	263	139	1.9	0.2	2.2	0.5	1.2	0.5	0.4
Quality of tourism infrastructure, 1-7	2016-2016	133	133	1.0	2.5	5.8	3.8	5.0	4.9	4.2
Available seat kilometres, international	2014-2015	265	141	1.9	22.7	1,570.7	219.6	86.4	294.0	524.9
Number of international association meetings	2013-2015	258	139	1.9	4.7	304.3	64.0	6.4	44.9	141.1
Effectiveness of marketing and branding to attract tourists, 1-7	2015-2017	272	144	1.9	1.6	5.6	3.9	4.7	4.6	3.9
Sustainability of travel and tourism industry development, 1-7	2014-2016	269	142	1.9	2.2	5.5	3.7	4.2	4.4	4.1
Telecommunications										
Fixed broadband subscriptions (per 100 people)	1998-2016	2,569	192	13.4	0.0	32.4	7.9	17.1	6.3	15.2
Individuals using the Internet (% of population)	1990-2016	4,224	194	21.8	12.2	80.0	51.5	59.8	41.6	63.1
Mobile cellular subscriptions (per 100 people)	1960-2016	4,633	193	24.0	60.0	171.5	100.4	116.8	106.4	130.6
Used mobile phone/Internet to access account (% with a fin. Inst. account)	2017-2017	136	136	1.0	6.0	40.2	17.3	16.1	14.8	21.5
Paid utility bills: using a mobile phone (% paying utility bills, age 1	2014-2017	273	149	1.8	2.3	17.5	4.9	6.8	6.0	6.5
Made or received digital payments (% age 15+)	2014-2017	281	150	1.9	23.6	68.8	42.3	64.1	35.2	53.5
Secure Internet servers (per 1 million people)	2010-2017	1,478	194	7.6	4.6	8,025.5	253.6	482.6	1,196.9	2,380.4
Proportion of population covered by 2G	2000-2015	364	127	2.9	70.1	100.0	99.2	99.2	92.1	95.4
Proportion of population covered by 3G	2000-2015	1,598	185	8.6	0.0	100.0	79.9	76.8	82.1	85.9
Proportion of population covered by 4G	2014-2015	311	163	1.9	0.0	95.0	49.7	42.0	27.3	62.5

Table 1 (continued): Descriptive Statistics, c. Financial Development

Variable definition	Period	N	Countries	Avg. years	min LAC	max LAC	CAN	CCB	CID	CSC
Financial Institutions & Capital Markets										
Automated teller machines (ATMs) (per 100,000 adults)	2004-2017	2,093	182	11.5	18.0	108.3	75.4	31.9	46.7	84.5
Commercial bank branches per 100,000 adults	2004-2017	2,302	185	12.4	7.7	33.5	11.6	8.4	19.5	14.7
Percentage firms with a checking/savings account	2006-2017	238	136	1.8	82.2	98.9	93.5	99.1	82.3	95.9
Percentage firms stated access to finance as a major constraint	2006-2017	253	137	1.8	8.1	23.1	15.3	27.0	13.0	17.3
Percentage of firms using banks to finance investments	2006-2017	265	137	1.9	31.8	57.1	45.8	35.4	37.6	39.4
Percentage of firms with a bank loan/line of credit	2006-2017	266	137	1.9	42.4	77.8	61.8	44.7	42.4	52.3
Perentage of firms using banks to finance working capital	2006-2017	239	137	1.7	29.6	66.5	49.3	50.2	30.0	37.1
Bank deposits to GDP (%)	1960-2016	4,251	177	24.0	18.8	75.0	39.1	58.6	42.0	42.1
Domestic credit to private sector (% of GDP)	1960-2017	4,103	179	22.9	16.1	112.5	45.6	41.0	50.2	53.6
Life and non life insurance premium volume to GDP (%)	1990-2016	3,238	160	20.2	0.9	4.6	1.7	4.1	1.6	2.7
Mutual fund assets to GDP (%)	1981-2016	1,087	85	12.8	0.1	54.7	3.9	28.1	6.4	19.2
Pension fund assets to GDP (%)	1990-2016	1,197	96	12.5	0.8	69.6	28.0	14.0	15.6	35.1
Bank net interest margin (%)	1996-2016	3,413	186	18.3	1.9	10.4	6.7	4.9	6.0	7.3
Bank noninterest income to total income (%)	1996-2014	3,129	186	16.8	11.0	61.5	29.6	26.3	28.8	36.8
Bank overhead costs to total assets (%)	1996-2016	3,457	187	18.5	0.4	7.8	4.9	3.0	4.3	4.8
Bank return on assets (%, after tax)	1996-2016	3,281	187	17.5	-1.0	3.4	1.7	1.3	1.6	1.7
Bank return on equity (%, after tax)	1996-2016	3,326	186	17.9	-15.2	34.3	15.4	6.9	14.9	16.4
Bank lending-deposit spread	1980-2016	3,286	165	19.9	1.6	39.4	8.4	8.2	7.7	14.4
Collateral asked for loan (as % of loan)	2006-2017	259	137	1.9	165.4	241.9	186.0	189.2	190.1	217.1
N of issuers - domestic securities, fin. inst. (over million pop.)	1990-2016	1,581	108	14.6	0.0	0.9	0.0	0.1	0.1	0.4
N of issuers - domestic securities, non-fin. inst. (over million pop.)	1990-2016	1,425	103	13.8	0.0	1.5	0.0	0.0	0.1	0.6
Gross domestic securities, financial institutions (over GDP, MM US$)	1990-2016	1,557	107	14.6	0.0	0.0	0.0	0.0	0.0	0.0
Gross domestic securities, non-financial institutions (over GDP, MM US$)	1990-2016	1,403	100	14.0	0.0	0.0	0.0	0.0	0.0	0.0
Outstanding international private debt securities to GDP (%)	1980-2016	1,772	94	18.9	0.4	44.8	7.0	22.3	5.6	7.4
Stock market capitalization to GDP (%)	1975-2017	2,364	118	20.0	13.0	93.3	40.5	59.0	28.2	49.9
Stock market total value traded to GDP (%)	1975-2017	1,901	99	19.2	1.0	31.3	3.7	0.5	9.5	15.3
Stock market turnover ratio (%)	1977-2017	2,374	114	20.8	6.9	72.1	9.4	1.4	28.5	31.6
SMEs & Financial Inclusion										
Used mobile phone/Internet to access account (% with a fin. Inst. account)	2017-2017	136	136	1.0	6.0	40.2	17.3	16.1	14.8	21.5
Paid utility bills: using a mobile phone (% paying utility bills, age 15+)	2014-2017	273	149	1.8	2.3	17.5	4.9	6.8	6.0	6.5
Made or received digital payments (% age 15+)	2014-2017	281	150	1.9	23.6	68.8	42.3	64.1	35.2	53.5
Bank account ownership, (female/male)	2011-2017	411	152	2.7	0.6	1.1	0.8	0.8	0.8	0.9
Borrowed from a fin. institution, (female/male)	2011-2017	410	155	2.6	0.5	1.3	0.7	0.6	0.9	0.8
Made/received digit. payments, (fem./male)	2014-2017	273	147	1.9	0.6	1.1	0.8	0.8	0.8	1.0
Account at a formal financial institution (% age 15+)	2011-2017	423	155	2.7	28.2	80.8	52.5	80.8	41.8	57.3
Borrowed from a financial institution (% age 15+)	2011-2017	423	155	2.7	5.7	22.7	13.0	18.9	11.5	12.2
Account at a formal fin. inst. (40% poorest/60% richiest)	2011-2017	414	154	2.7	0.3	0.9	0.6	0.9	0.6	0.7
Borrowed from a financial institution (40% poorest/60% richiest)	2014-2017	275	149	1.8	0.1	0.5	0.2	0.5	0.2	0.2
SMEs with a checking/savings account	2006-2017	238	136	1.8	81.4	99.1	93.0	99.0	81.4	95.4
Percentage of SMEs with a bank loan/line of credit	2006-2017	266	137	1.9	39.2	75.4	59.4	43.5	39.2	49.6
Account at a formal fin. inst. (rural/urban)	2011-2017	400	153	2.6	0.7	1.2	0.9	0.9	0.9	1.0
Borrowed from a financial institution (rural/urban)	2011-2017	405	152	2.7	0.5	1.3	1.1	0.5	1.0	0.9

Table 1 (continued): Descriptive Statistics, d. Transversal Topics and Institutions

Variable definition	Period	N	Countries	Avg. years	min LAC	max LAC	CAN	CCB	CID	CSC
Climate Change & Environment										
Environmental Performance Index (0-100)	2017-2017	174	174	1.0	33.7	67.9	60.9	56.5	55.9	59.2
Gender										
School enrollment, gender parity index (primary & secondary)	1970-2017	3,126	189	16.5	1.02	1.02	1.02	1.04	1.00	0.99
High degree gender gap (female/male)	2005-2017	924	131	7.1	0.81	1.61	0.99	0.63	1.05	1.23
Made/received digit. payments, (fem./male)	2014-2017	273	147	1.9	0.58	1.13	0.75	0.76	0.76	0.96
Used phone/Internet to access account, (female/male)	2017-2017	138	138	1.0	0.33	0.96	0.60	0.82	0.61	0.78
Collateral asked for loan (as % of loan), (female CEO/male CEO)	2009-2017	173	117	1.5	0.49	1.28	1.03	1.06	0.52	0.59
Percentage of firms w/ a checking/savings account, (female CEO/male CEO)	2009-2017	185	126	1.5	0.71	1.04	0.92	0.98	0.97	0.99
Percentage of firms with a bank loan/line of credit, (female CEO/male CEO)	2009-2017	182	125	1.5	0.65	1.06	0.78	1.10	0.96	0.91
% of firms stated access to finance as major constraint, (female CEO/male CEO)	2009-2017	186	127	1.5	0.37	0.98	0.80	1.18	0.86	0.48
Lifetime risk of maternal death (%)	1990-2015	4,356	180	24.2	0.03	1.11	0.27	0.24	0.29	0.13
Bank account ownership, (female/male)	2011-2017	411	152	2.7	0.65	1.09	0.83	0.83	0.81	0.95
Borrowed from a fin. institution, (female/male)	2011-2017	410	155	2.6	0.47	1.28	0.75	0.56	0.90	0.85
Percent of firms with a female top manager	2009-2017	217	217	1.0	8.0	26.3	22.0	22.7	18.5	12.7
Institutions										
Doing Bussiness, distance to frontier score	2015-2017	550	185	3.0	30.9	72.3	55.5	57.3	60.4	61.4
Control of Corruption	1996-2016	3,328	192	17.3	-1.4	1.3	-0.7	0.2	-0.6	0.2
Government Effectiveness	1996-2016	3,315	192	17.3	-2.1	1.1	-0.5	0.3	-0.5	0.2
Regulatory quality for private sector development	1996-2016	3,314	192	17.3	-2.0	1.4	-0.6	0.0	-0.2	0.2
Rule of Law	1996-2016	3,358	193	17.4	-2.2	1.1	-1.0	0.0	-0.6	0.1
Voice and Accountability	1996-2016	3,361	193	17.4	-1.1	1.2	-0.2	0.7	0.1	0.6
PPP Contract Manager	2017-2017	130	130	1.0	31.0	90.0	64.3	37.5	63.8	77.6
Preparation of PPPs	2017-2017	132	132	1.0	20.0	90.0	74.3	45.5	46.2	61.4
Procurement of PPPs	2017-2017	129	129	1.0	35.0	82.0	60.0	50.0	67.8	72.2
PPP Unsolicited Proposals	2017-2017	89	89	1.0	13.0	100.0	83.3	48.0	58.3	75.0
Bussiness cost of crime, WEF survey	2007-2017	1,495	150	10.0	1.5	4.9	2.9	2.7	3.2	3.6
Intentional homicides (per 100,000 people)	1995-2015	2,228	191	11.7	6.5	108.6	30.3	23.0	42.4	12.7
Reliability police services, WEF survey	2007-2017	1,503	150	10.0	1.8	5.9	2.9	3.3	3.2	3.9
Political Stability and Absence of Violence/Terrorism	1996-2016	3,295	193	17.1	-1.0	1.1	-0.5	0.4	-0.1	0.3

Regional Snapshot

The analysis was applied to the four IDB regions: Andean (CAN), Caribbean (CCB), Central America, Mexico, Panama, Haiti and the Dominican Republic (CID), and Southern Cone (CSC).[18] All the estimates were done using the panel data, but the results showed below use the development gap estimates for the latest available year. Regional gaps are derived from the simple average of the countries in that region[19].

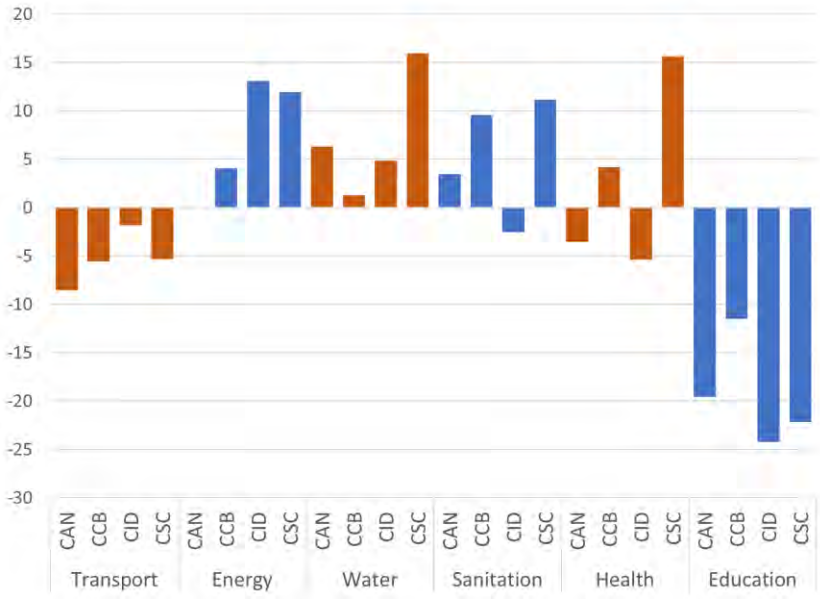
Figure 5 displays the results for the infrastructure sectors. In the physical infrastructure area, the region seems to be lagging somewhat in Transportation but shows stronger performance in Energy and Water and Sanitation. In Transportation, the quality of roads and railroads, logistics performance and the burden of customs procedures are the areas

[18] CAN comprises Bolivia, Colombia, Ecuador, and Peru; CCB comprises The Bahamas, Barbados, Guyana, Jamaica, Suriname, and Trinidad and Tobago; CID comprises Belize, Costa Rica, El Salvador, Guatemala, Haiti, Honduras, Nicaragua, Mexico, Panama and the Dominican Republic and CSC comprises Argentina, Brazil, Chile, Paraguay and Uruguay.

[19] To be able to correctly aggregate development gaps within geographic areas and to compare those results between regions, we impute values for the gaps with missing information. For this, we arrange all available countries in groups of 5 to 8 based in the World Bank income classification and in per capita income, and then we assign the average of the country's group for each specific variable (when the value is missing - see Appendix 7 for the specific country income-groups).

where most regions are lagging relative to expected values. As regards to social infrastructure, Education stands out with fairly large deficits in every region. A closer inspection of the individual indicators reveals that, while LAC has achieved satisfactory levels of access to education, education quality, measured mainly by PISA test scores and business surveys, displays poor performance.

Figure 5: Development Gaps at a Regional Level for **Infrastructure**



Regarding corporate development, the broad picture that emerges from Figure 6 is that the corporate sectors are not performing at a high level of competitiveness. In Agribusiness, the indicators along the dimension of Sustainability bring down the overall index for the regions that show large gaps (CAN and CSC). Deficit gaps predominate in Manufacturing and Tourism but with large differences across regions, and also across countries within each region. Moreover, there are regions that are performing weakly in some industries but show an adequate level of development in others. Telecommunications shows positive gaps for Access but lagging in Digital Adoption in all regions, with positive results for Quality in all regions except for CCB.

All regions appear to be lagging in their Financial Development, although the banking sector in the Caribbean region is more advanced than what its income per capita level

would anticipate. The gaps are significant both in terms of the depth and efficiency of banks and other financial institutions, and securities and other financial markets, and in terms of financial inclusion, namely access to financial services and credit for households and small and medium enterprises (Figure 7). The picture is more mixed in terms of cross-cutting issues such as climate change, gender inclusion and institutions. The Environment Performance Index shows mixed results, with CCB posting the largest gap. Gender equality, which is measured along dimensions such as education and health, entrepreneurship and access to finance, shows deficits for all regions except CCB, albeit relatively moderate. Finally, the institutional quality of CAN and CID shows small deficits, while CSC is the only region that presents a significative positive gap (Figure 8).

Figure 6: Development Gaps at a Regional Level for **Corporates**

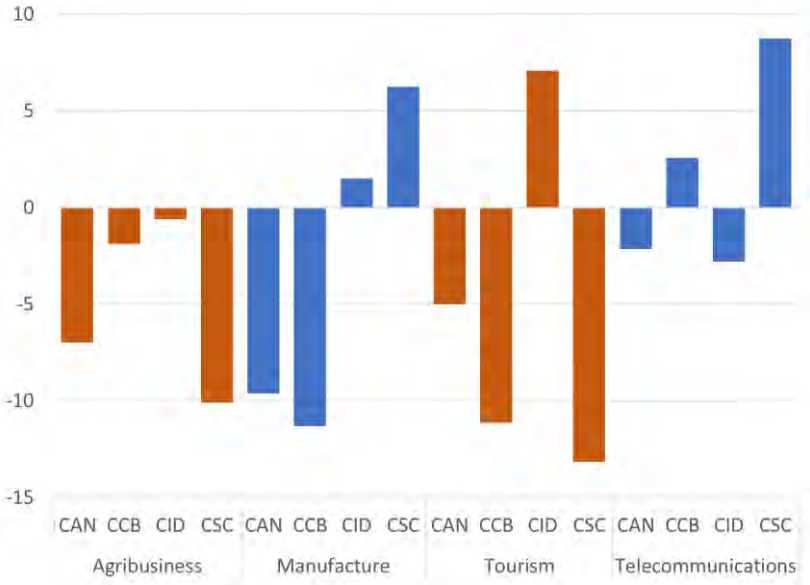


Figure 7: Development Gaps at a Regional Level for **Financial Development**

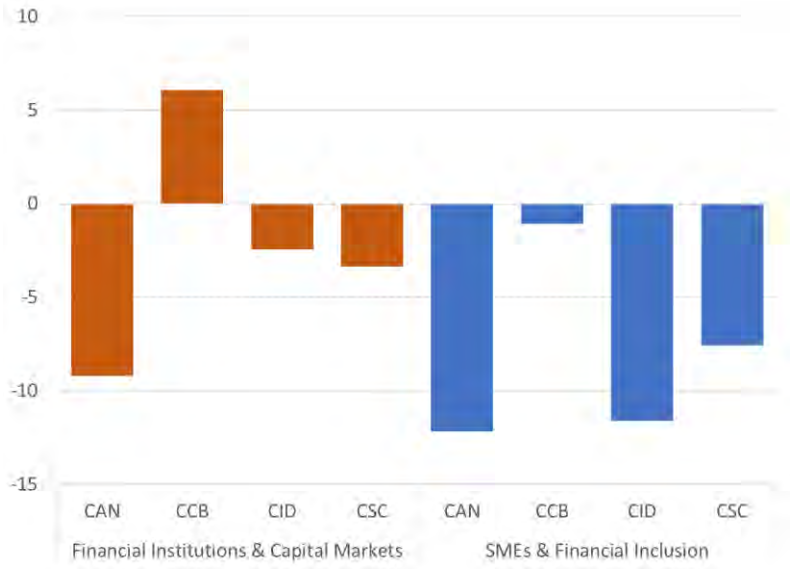
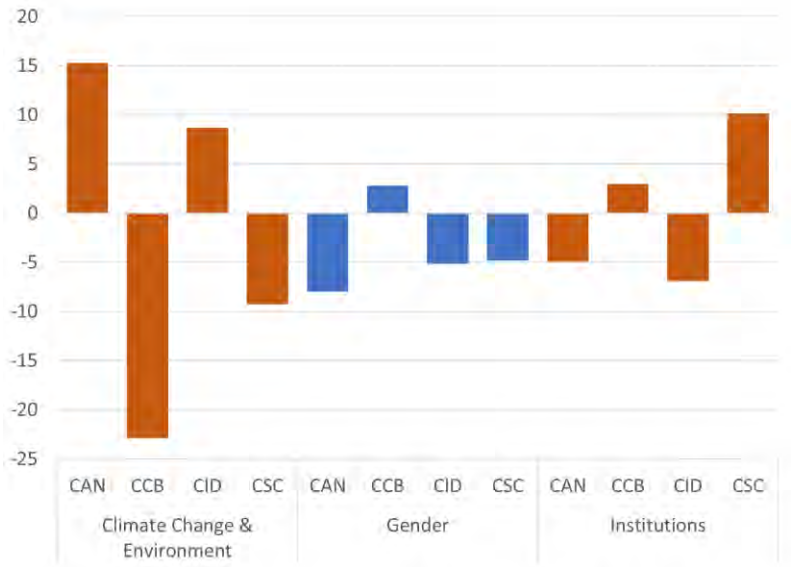


Figure 8: Development Gaps at a Regional Level for **Transversal Topics and Institutions**



Evolution over Time

The panel data estimation permits to analyze the evolution of the development gaps over time. Using as an example the case of the Mobile Subscriptions indicator for the case of Mexico, Figure 9a shows that the number of subscribers has grown steeply in Mexico

since 2000. However, when that growth is placed in the context of the global progress in the access to telecommunications, it can be seen that Mexico has been losing ground rather sharply since 2009. The widening gap means that the value of this indicator is falling increasingly short of its expected value taking into account Mexico's level of income per capita and the achievements of other countries. Figure 9b decomposes the gap in a fixed effect and a variable gap. The fixed effect can be interpreted as reflecting unchanging factors such as geography as well as other structural characteristics that have not changed much such as market structure and institutions like the rule of law. These factors have a negative effect on Mexico's achievement and have been augmented in recent year by time-varying conditions.

Figure 9 a.

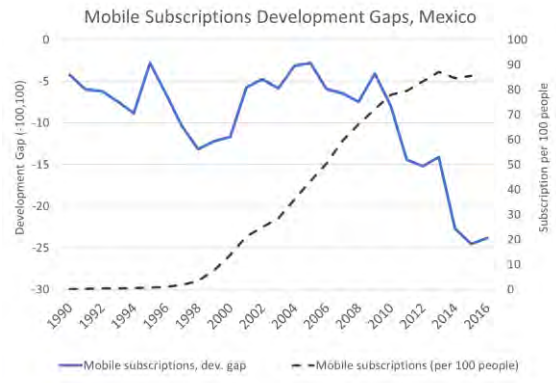
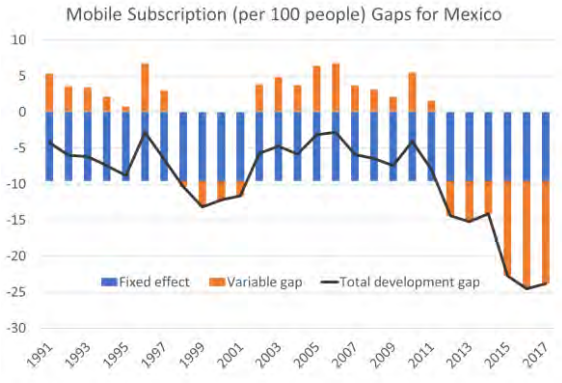


Figure 9 b.



Financial Inclusion

This section highlights three of the main findings of the application of the Development Gaps approach to the analysis of performance and deficits of financial inclusion in Latin America and the Caribbean: (i) Financial inclusion is positively correlated with income per capita, and the relationship between the two variables is robust; (ii) most of LAC economies display negative gaps regarding access to financial services; and (iii) there are large disparities between lower and higher income individuals within countries regarding access to financial instruments.

The econometric analysis of financial inclusion variables along the dimensions of access and equality suggests that there is a positive relationship between these variables and income per capita.[20] Moreover, this relationship is robust: the coefficients of GDP per capita (and GDP per capita squared, when applicable) are all statistically significant at the 1 percent level.[21]

A second stylized fact regarding financial inclusion in Latin America and the Caribbean is that most of the region exhibits negative development gaps on access to accounts in formal financial institutions. Evidence of this fact is the regression line that represents the prediction of the expected access to formal accounts at each income per capita, which lies above the observed percentages of the population older than 15 with access to accounts (see Figure 10). Relatedly, LAC economies systematically report lower savings at an individual level than other nations in the world. Individuals who save, also, are a significantly smaller percentage of those with accounts (Figure 11).

Figure 10: Percentage of the population older than 15 with access to accounts in formal financial institutions

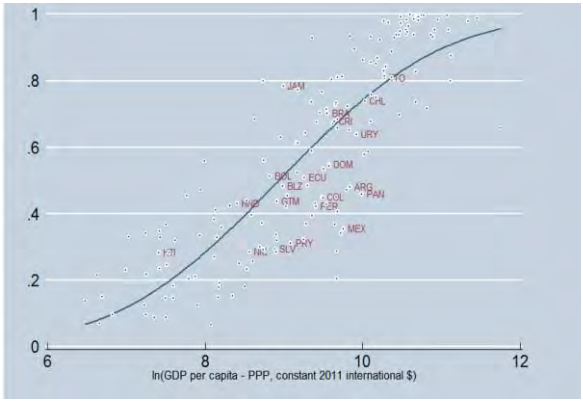
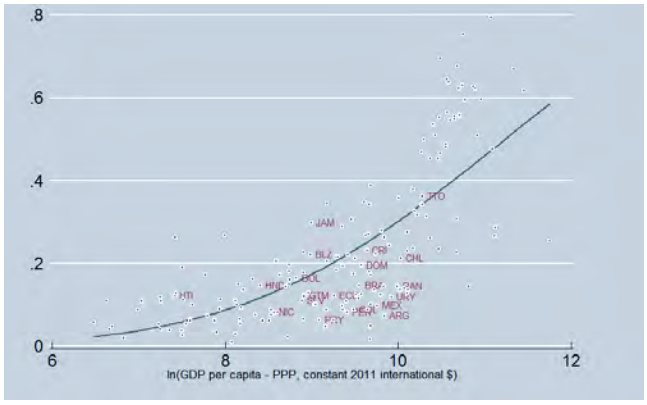


Figure 11: Percentage of the population older than 15 that saved in formal financial institutions



There is a growing body of evidence, both at a macroeconomic and at a microeconomic level, that digital technologies constitute an efficient avenue for achieving larger financial access, allowing previously unbanked populations to save and lend money.[22] However,

[20] This statement does not imply causation: larger income per capita at a country level may help reduce credit constraints and/or increase access to savings accounts. It could also be possible that third factors contribute to both larger access to financial services and increased GDP per capita.
[21] Detailed results available upon request.
[22] At the macro level, savings have the potential to boost economic growth via investments (Commission on Growth and Development (2008), Cavallo and Serebrisky (ed.) (2016)). At the micro level, savings allow individuals to deal with shocks such as unemployment

despite advances made in Latin American and the Caribbean economies to improve access to Internet (Figure 12)[23], the adoption of digital payments lags consistently behind other nations (Figure 13). Heterogeneity in the adoption of digital technologies is evident from the analysis, and the LAC region is more heterogeneous in the adoption of digital technologies to make payments than in the usage of Internet (which can be seen from the observations more closely clustered in Figure 12 than in Figure 13). Country analyses could be useful to better understand what binding constraints, beyond Internet use, could be preventing a larger percentage of the population from making digital transactions.[24]

Figure 12: Percentage of the population using Internet

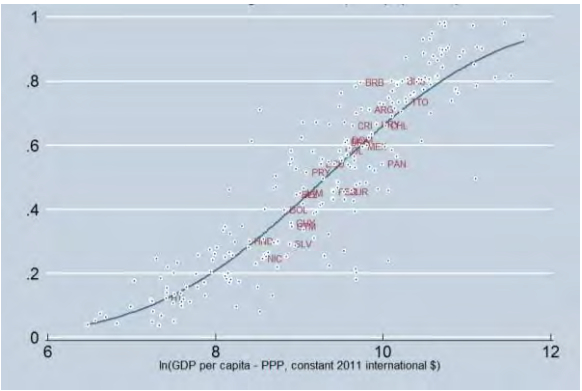
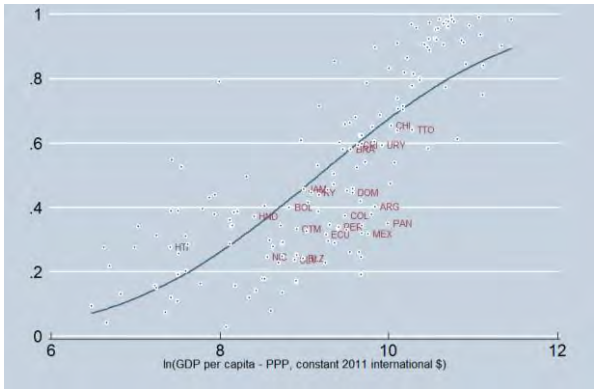


Figure 13: Percentage of the population older than 15 that made or receive digital payment



The third stylized fact related to the deficits in financial inclusion of Latin America and the Caribbean region as a whole is that most of these economies present deficits related to income equality in access to financial services within countries. Figure displays the relative access to credit card ownership of credit cards of the poorest 40% of the population in each analyzed nation versus the 60% richest. In Figure 4, observations

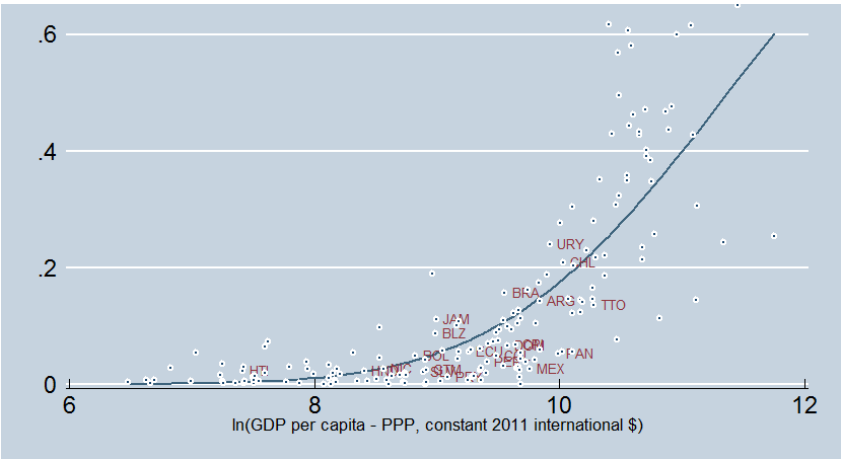
or illness, to invest in human capital, and to smooth consumption, among others, hence the importance of promoting access to digital savings and payment technologies (Bille, et. al (2018), Cavallo and Serebrisky (ed.) (2016), Demirguc-Kunt, et al. (2018), Dupas, P., A. Keats, and J. Robinson (2017), Dupas & Robinson (2012), Karlan, et al. (2016), Mbiti, I., and D. Weil (2011), and World Bank (2016)).

[23] D'almeida F. & D. Margot (2018).

[24] Field studies in Sub-Saharan Africa found that beyond internet infrastructure, the socio-cultural context is an important factor explaining Digital Financial Services (DFS) uptake. Key socio-cultural factors such as risk perceptions, mobility (of people and money), historical roots of monetary transactions, and technological appropriation, among others, could support or inhibit the use and trust towards DFS (Bille, et al. 2018). Other factors behind the use of digital payments are reliable physical, regulatory, and financial infrastructures, and the existence of financial services tailored to the needs of first time users and populations with low literacy and numeracy skills (Demirguc-Kunt, et al. 2018).

closer to 1 represent more equality between the poorer and richer populations. Poorer individuals have less access to credit cards than the richer population in all LAC economies; the analysis further suggests that there are wide inequalities, with most of the region displaying less than 20 poorer individuals per 100 richer individuals having access to credit cards, and this ratio is low when compared with other countries of similar per capita income, as most LAC countries lie below the regression line. The estimations therefore signal that there is ample space to reduce inequalities in access to financial instruments for the population with lower income across the region.

Figure 14: Credit Card Ownership of the 40% poorest population relative to the 60% richest



5. Conclusions

This paper extended the “development gaps” diagnostic tool to evaluate the degree of achievement of Latin American countries in terms of the contribution of the private sector to the development level along various economic and social dimensions. Drawing from a wide variety of sources, we expanded the set of indicators included in the analysis to 161 from 52 in the original study. We grouped these indicators in various sectors and along various dimensions within each sector to facilitate the analysis of the results. We extended the econometric framework by using panel data estimation and applying limited dependent variable methods where the indicators were defined over a restricted range.

At the level of the four regions of the Bank, the results show that all regions still need to close significant development gaps, and that while some common patterns are evident, there are also some important regional differences. In infrastructure, there are widespread gaps in Transportation and Education, which are fairly large in the latter case. While access to services displays acceptable levels, the quality or reliability dimension displays larger deficits. The corporate sectors show some fairly sizable competitiveness gaps, despite some important differences across sectors and regions. Cross-cutting issues like climate change, gender inclusion and institutions show generally mixed results. A detailed analysis of financial inclusion shows that most of LAC economies display negative gaps regarding access to financial services, and that there are large disparities between lower and higher income individuals within countries regarding access to financial instruments.

We think that these results illustrate how this approach can contribute to the analysis of the state of development, and can be helpful to formulate priorities and strategies to mobilize private sector investment to maximize the well-being of the population in Latin American and Caribbean countries.

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Appendix 1: Description of variables and sources

a. Infrastructure

Dimension	Variable name	Source
Transport		
Connectivity	Registered air carrier departures worldwide (over GDP, const. 2010 MM US)	International Civil Aviation Organization
Connectivity	Road density Km/GDP (constant 2010 MM US$)	Institute of Road Federation
Connectivity	Liner shipping connectivity index (maximum value in 2004 = 100)	United Nations Conference on Trade and Development.
Quality	Burden of customs procedure, WEF (1-7=extremely efficient)	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Quality	Logistics performance index: Quality of transport-related infrastructure	World Bank and Turku School of Economics, Logistic Performance Index Surveys
Quality	Paved roads %, IRF	IRF Geneva, World Road Statistics WRS
Quality	Quality of airports, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Quality	Quality port infrastructure, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Quality	Quality of railroad infrastructure, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Quality	Quality of roads, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Safetyness	Mortality caused by road traffic injury (per 100,000 people)	World Health Organization, Global Status Report on Road Safety
Sustainability	CO2 emissions from transport (% GDP, const. 2010 MM US$)	IEA Statistics © OECD/IEA 2014
Energy		
Access	Access to electricity, rural (% of rural population)	World Bank, Sustainable Energy for All (SE4ALL) database
Access	Access to electricity, urban (% of urban population)	World Bank, Sustainable Energy for All (SE4ALL) database
Quality	Electric power transmission and distribution losses (% of output)	IEA Statistics © OECD/IEA 2014
Quality	Average duration of power outages (hours)	World Enterprise Survey, PROTEQIN, LACES, World Bank
Quality	Number of electrical outages in a typical month	World Enterprise Survey, PROTEQIN, LACES, World Bank
Quality	Percentage of firms that experienced an electrical outage	World Enterprise Survey, PROTEQIN, LACES, World Bank
Quality	Value lost due to electrical outages (% of sales for affected firms)	World Enterprise Survey, PROTEQIN, LACES, World Bank
Sustainability	GDP per unit of energy use (constant 2011 PPP $ per kg of oil equiv.)	IEA Statistics © OECD/IEA 2014
Sustainability	Renewable energy consumption, excluding hydro (% of GDP)	IEA Statistics © OECD/IEA 2014
Water		
Access	Percentage rural pop with at least basic access	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Access	Percentage urban pop with at least basic access	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Impact on Business	Percentage of firms that experienced a water outage	World Enterprise Survey, PROTEQIN, LACES, World Bank
Impact on Health	DALY rate for Unsafe Drinking Water	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Quality	Percentage of rural pop using improved water, accessible on premises	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Quality	Percentage of urban pop using improved water, accessible on premises	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Sustainability	Percentage of wastewater treated	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Sustainability	Level of water stress: freshwater withdrawal, % of available freshwater	Food and Agriculture Organization, AQUASTAT data
Sanitation		
Access	Percentage of rural pop with at least basic access	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Access	Percentage of urban pop with at least basic access	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Impact on Health	DALY rate for Unsafe sanitation	Environmental Performance Index, Yale University
Quality	Percentage of rural pop using improved sanitation, sewer connections	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Quality	Percentage of urban pop using improved sanitation, sewer connections	WHO/UNICEF JMP for Water Supply, Sanitation and Hygiene (washdata.org)
Health		
Access	Immunization, DPT, HepB3 and measles(% of children ages 12-23 months)	World Economic Forum, Global Competitiveness Report and data files
Access	Hospital beds (per 1,000 people)	Data are from the World Health Organization, supplemented by country data
Access	Physicians (per 1,000 people)	World Health Organization's Global Health Workforce Statistics, OECD
Affordability	Out-of-pocket expenditure (% of current health expenditure)	World Health Organization Global Health Expenditure database
Business Impact	Business impact of malaria, HIV and tuberculosis, 1-7 (best), WEF survey	World Economic Forum, Global Competitiveness Report and data files
Quality	Life expectancy at birth, total (years)	Derived from life expectancy at birth from UNCTD, Eurostat, Censuses, among other
Quality	Lifetime risk of maternal death (%)	World Economic Forum, Global Competitiveness Report and data files
Quality	Mortality rate, under-5 (per 1,000 live births)	Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation
Education		
Access	School enrollment, gender parity index (primary & secondary)	UNESCO Institute for Statistics
Access	High degree gender gap (female/male)	ILO
Access	School enrollment, preprimary (% gross)	UNESCO Institute for Statistics
Access	School enrollment, primary (% net)	UNESCO Institute for Statistics
Access	School enrollment, secondary (% net)	UNESCO Institute for Statistics
Access	School enrollment, tertiary (% gross)	UNESCO Institute for Statistics
Quality	To what extent is Internet used in schools?, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Quality	PISA, mean performance on the mathematics scale	OECD Programme for International Student Assessment (PISA)
Quality	PISA, mean performance on the reading scale	OECD Programme for International Student Assessment (PISA)
Quality	PISA, mean performance on the science scale	OECD Programme for International Student Assessment (PISA)
Quality	Education system meet the needs of a competitive economy?, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Quality	Math and science education quality, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Skills match	How do you assess quality of business schools?, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Skills match	Percentage of firms stating inadequate education is a major labor dificulty	World Enterprise Survey, PROTEQIN, LACES, World Bank

b. Corporates

Dimension	Variable name	Source
Agribusiness		
Productivity	Agriculture total FDI inflows (% of Agri GDP)	FAOSTAT
Productivity	Gross capital formation (over agri GDP)	FAOSTAT
Productivity	Net capital stock (over agri GDP)	FAOSTAT
Productivity	Agricultural raw materials exports (% of merchandise exports)	World Bank estimates from Comtrade database maintained by United Nations Stats
Productivity	Research spending over agricultural GDP	FAOSTAT
Productivity	Agriculture value added per worker (constant 2010 M US$)	World Bank national accounts data, OECD National Accounts, ILOSTAT database
Productivity	Credit to agriculture over total credit (over GDP agri/total GDP)	FAOSTAT
Sustainability	Agricultural total emissions (CO2 eq. over agric. GDP, in const. 2010 MM US$)	FAOSTAT
Sustainability	Freshwater withdrawals, agric. (% agric. GDP, in constant 2010 MM US$)	Food and Agriculture Organization, AQUASTAT data
Manufacture		
Complexity	ATLAS index of economic complexity	Center for International Development, Harvard University
Diversification	Exports product concentration index	UNCTAD
Diversification	Number of export products, SITC 3-digit level (261 max.)	UNCTAD
Innovation	High-technology exports (% of manufactured exports)	United Nations, Comtrade database through the WITS platform
Innovation	Patents per one million people	World Intellectual Property Organization (WIPO)
Innovation	Research and development expenditure (% of GDP)	UNESCO Institute for Statistics
Sustainability	CO2 per kWh of manuf./construction (% manuf. GDP, const. 2010 MM US$)	IEA Statistics © OECD/IEA 2014
Tourism		
Competitiveness	Average spending per int'l tourist (US$)	The World Tourism Organization based on official national sources
Competitiveness	Cultural, entertainment and natural digital demand	World Economic Forum, Global Competitiveness Report and data files
Competitiveness	International tourism, arrivals per 100,000 pop.	World Tourism Organization, Yearbook of Tourism Statistics
Infrastructure	Airport density, airports/million pop.	World Economic Forum, The Travel and Tourism Competitiveness Report
Infrastructure	Number of operating airlines, per 100,000 sq. km of land area	World Economic Forum, The Travel and Tourism Competitiveness Report
Infrastructure	Number of hotel rooms per 100 population	World Economic Forum, The Travel and Tourism Competitiveness Report
Infrastructure	Quality of tourism infrastructure, 1-7	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Infrastructure	Available seat kilometres, international	International Air Transport Association, SRS Analyser
Market attractiveness	Number of international association meetings	The International Congress and Convention Association (ICCA)
Market attractiveness	Effectiveness of marketing and branding to attract tourists, 1-7	World Economic Forum, The Travel and Tourism Competitiveness Report
Sustainability	Sustainability of travel and tourism industry development, 1-7	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Telecommunications		
Access	Fixed broadband subscriptions (per 100 people)	International Telecom. Union, World Telecom./ICT Development Report and database
Access	Individuals using the Internet (% of population)	International Telecom. Union, World Telecom./ICT Development Report and database
Access	Mobile cellular subscriptions (per 100 people)	International Telecom. Union, World Telecom./ICT Development Report and database
Digital adoption	Used mobile phone/Internet to access account (% with a fin. Inst. account)	Global Findex database
Digital adoption	Paid utility bills: using a mobile phone (% paying utility bills, age 1	Global Findex database
Digital adoption	Made or received digital payments (% age 15+)	Global Findex database
Quality	Secure Internet servers (per 1 million people)	Netcraft (http://www.netcraft.com/) and World Bank population estimates
Quality	Proportion of population covered by 2G	International Telecommunication Union
Quality	Proportion of population covered by 3G	International Telecommunication Union
Quality	Proportion of population covered by 4G	International Telecommunication Union

c. Financial Development

Dimension	Variable name	Source
Financial Institutions & Capital Markets		
FI Access	Automated teller machines (ATMs) (per 100,000 adults)	International Monetary Fund, Financial Access Survey
FI Access	Commercial bank branches per 100,000 adults	International Monetary Fund, Financial Access Survey
FI Access	Percentage firms with a checking/savings account	World Enterprise Survey, PROTEQIN, LACES, World Bank
FI Access	Percentage firms stated access to finance as a major constraint	World Enterprise Survey, PROTEQIN, LACES, World Bank
FI Access	Percentage of firms using banks to finance investments	World Enterprise Survey, PROTEQIN, LACES, World Bank
FI Access	Percentage of firms with a bank loan/line of credit	World Enterprise Survey, PROTEQIN, LACES, World Bank
FI Access	Perentage of firms using banks to finance working capital	World Enterprise Survey, PROTEQIN, LACES, World Bank
FI Depth	Bank deposits to GDP (%)	International Financial Statistics (IFS), International Monetary Fund (IMF)
FI Depth	Domestic credit to private sector (% of GDP)	IMF, International Financial Statistics, and World Bank and OECD GDP estimates
FI Depth	Life and non life insurance premium volume to GDP (%)	Sigma Reports, Swiss Re
FI Depth	Mutual fund assets to GDP (%)	World Bank - Non banking financial database
FI Depth	Pension fund assets to GDP (%)	Nonbanking financial database, World Bank
FI Efficiency	Bank net interest margin (%)	Bankscope, Bureau van Dijk (BvD)
FI Efficiency	Bank noninterest income to total income (%)	Bankscope, Bureau van Dijk (BvD)
FI Efficiency	Bank overhead costs to total assets (%)	Bankscope, Bureau van Dijk (BvD)
FI Efficiency	Bank return on assets (%, after tax)	Bankscope, Bureau van Dijk (BvD)
FI Efficiency	Bank return on equity (%, after tax)	Bankscope, Bureau van Dijk (BvD)
FI Efficiency	Bank lending-deposit spread	International Financial Statistics (IFS), International Monetary Fund (IMF)
FI Efficiency	Collateral asked for loan (as % of loan)	World Enterprise Survey, PROTEQIN, LACES, World Bank
FM Access	N of issuers - domestic securities, fin. inst. (over million pop.)	Thomson One
FM Access	N of issuers - domestic securities, non-fin. inst. (over million pop.)	Thomson One
FM Depth	Gross domestic securities, financial institutions (over GDP, MM US$)	Thomson One
FM Depth	Gross domestic securities, non-financial institutions (over GDP, MM US$)	Thomson One
FM Depth	Outstanding international private debt securities to GDP (%)	Bank for International Settlements (BIS)
FM Depth	Stock market capitalization to GDP (%)	World Federation of Exchanges; Global Stock Markets Factbook, Standard & Poor's
FM Depth	Stock market total value traded to GDP (%)	World Federation of Exchanges database
FM Efficiency	Stock market turnover ratio (%)	World Federation of Exchanges; Global Stock Markets Factbook, Standard & Poor's
SMEs & Financial Inclusion		
Fintech	Used mobile phone/Internet to access account (% with a fin. Inst. account)	Global Findex database
Fintech	Paid utility bills: using a mobile phone (% paying utility bills, age 15+)	Global Findex database
Fintech	Made or received digital payments (% age 15+)	Global Findex database
Gender Ratio	Bank account ownership, (female/male)	Global Findex database
Gender Ratio	Borrowed from a fin. institution, (female/male)	Global Findex database
Gender Ratio	Made/received digit. payments, (fem./male)	Global Findex database
Households	Account at a formal financial institution (% age 15+)	Global Findex database
Households	Borrowed from a financial institution (% age 15+)	Global Findex database
Income Ratio	Account at a formal fin. inst. (40% poorest/60% richiest)	Global Findex database
Income Ratio	Borrowed from a financial institution (40% poorest/60% richiest)	Global Findex database
SMEs	SMEs with a checking/savings account	Bankscope, Bureau van Dijk (BvD)
SMEs	Percentage of SMEs with a bank loan/line of credit	Bankscope, Bureau van Dijk (BvD)
Urban-Rural Ratio	Account at a formal fin. inst. (rural/urban)	Global Findex database
Urban-Rural Ratio	Borrowed from a financial institution (rural/urban)	Global Findex database

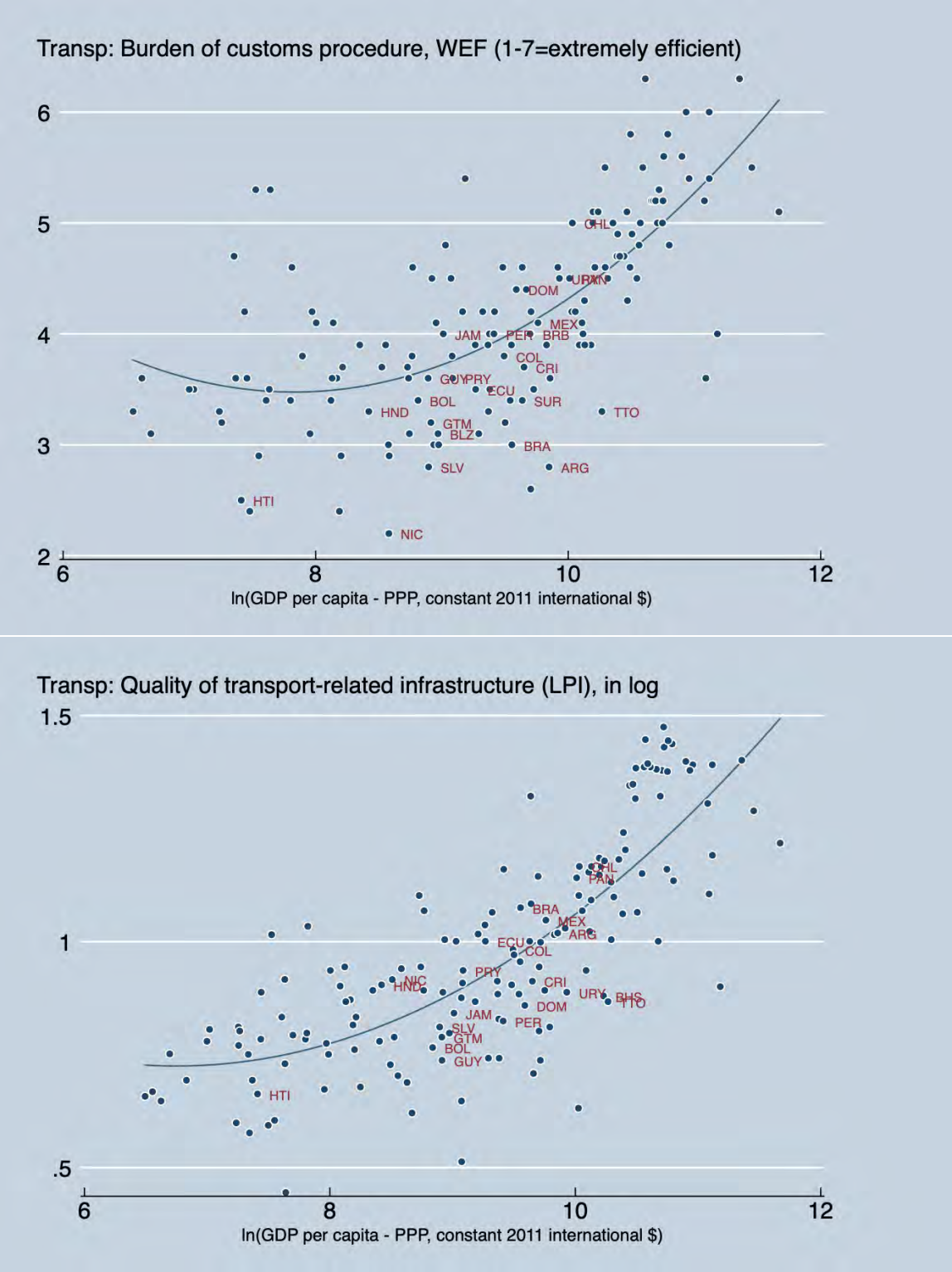
d. Transversal Topics and Institutions

Dimension	Variable name	Source
Climate Change & Environment		
Climate Change	Environmental Performance Index (0-100)	Yale CELP and CIESIN at Columbia University's Earth Institute
Gender		
Education	School enrollment, gender parity index (primary & secondary)	UNESCO Institute for Statistics
Education	High degree gender gap (female/male)	ILO
Fintech Adoption Ratio	Made/received digit. payments, (fem./male)	Global Findex database
Fintech Adoption Ratio	Used phone/Internet to access account, (female/male)	Global Findex database
Firms Financial Access Ratio	Collateral asked for loan (as % of loan), (female CEO/male CEO)	World Enterprise Survey, PROTEQIN, LACES, World Bank
Firms Financial Access Ratio	Percentage of firms w/ a checking/savings account, (female CEO/male CEO)	World Enterprise Survey, PROTEQIN, LACES, World Bank
Firms Financial Access Ratio	Percentage of firms with a bank loan/line of credit, (female CEO/male CEO)	World Enterprise Survey, PROTEQIN, LACES, World Bank
Firms Financial Access Ratio	% of firms stated access to finance as major constraint, (female CEO/male CEO)	World Enterprise Survey, PROTEQIN, LACES, World Bank
Health	Lifetime risk of maternal death (%)	WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division
Households Financial Access Ratio	Bank account ownership, (female/male)	Global Findex database
Households Financial Access Ratio	Borrowed from a fin. institution, (female/male)	Global Findex database
Percentage of Firms Led by Women	Percent of firms with a female top manager	World Enterprise Survey, PROTEQIN, LACES, World Bank
Institutions		
Business Environment	Doing Bussiness, distance to frontier score	Doing Business
Governance	Control of Corruption	Worldwide Governance Indicators, World Bank
Governance	Government Effectiveness	Worldwide Governance Indicators, World Bank
Governance	Regulatory quality for private sector development	Worldwide Governance Indicators, World Bank
Governance	Rule of Law	Worldwide Governance Indicators, World Bank
Governance	Voice and Accountability	Worldwide Governance Indicators, World Bank
PPP Environment	PPP Contract Manager	Procuring Infrastructure Public-Private Partnerships World Bank
PPP Environment	Preparation of PPPs	Procuring Infrastructure Public-Private Partnerships World Bank
PPP Environment	Procurement of PPPs	Procuring Infrastructure Public-Private Partnerships World Bank
PPP Environment	PPP Unsolicited Proposals	Procuring Infrastructure Public-Private Partnerships World Bank
Security	Bussiness cost of crime, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Security	Intentional homicides (per 100,000 people)	UN Office on Drugs and Crime's International Homicide Statistics database
Security	Reliability police services, WEF survey	World Economic Forum, Global Competitiveness Report, Executive Opinion Survey
Security	Political Stability and Absence of Violence/Terrorism	Worldwide Governance Indicators, World Bank

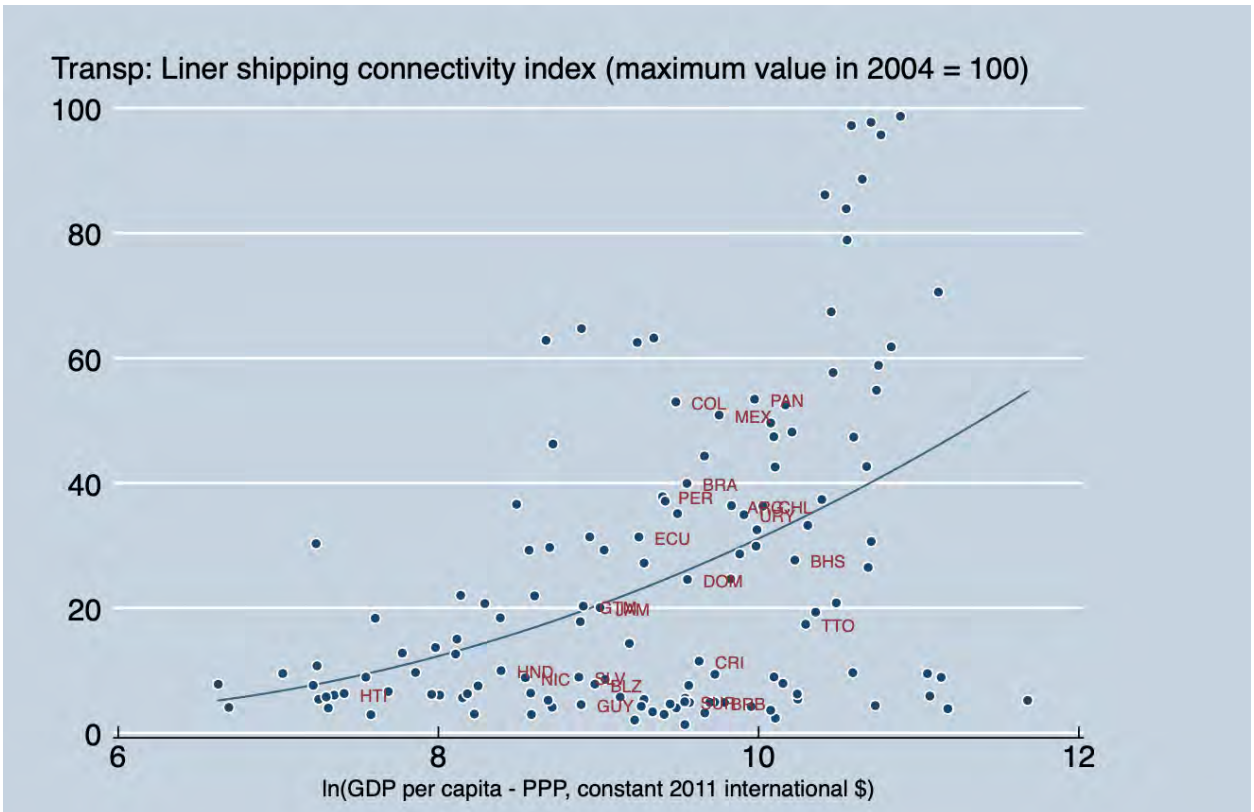
Appendix 2: Environment Performance Index (EPI) Framework

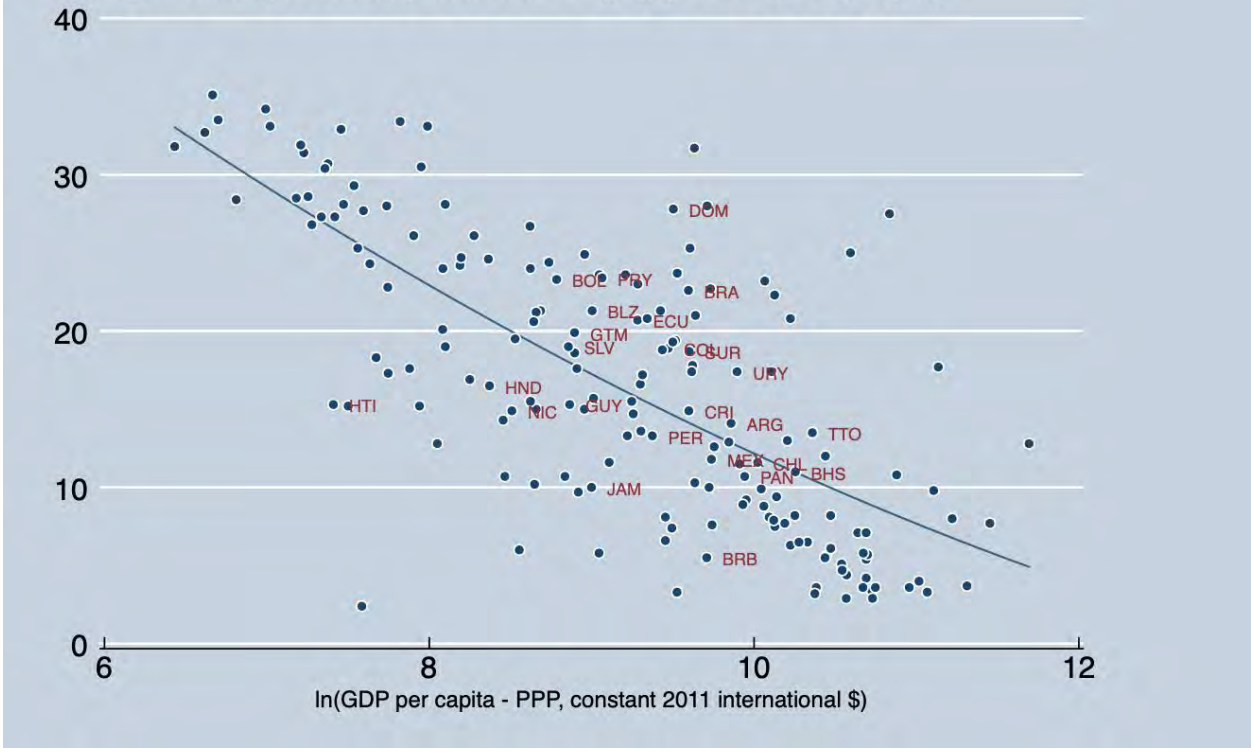
	Policy Objective		Issue Category		Indicator	
	Title	Weight	Title	Weight	Title	Weight
EPI	Environmental Health	40%	Air Quality	65%	Household Solid Fuels	40%
					$PM_{2.5}$ Exposure	30%
					$PM_{2.5}$ Exceedance	30%
			Water & Sanitation	30%	Drinking Water	50%
					Sanitation	50%
			Heavy Metals	5%	Lead Exposure	100%
	Ecosystem Vitality	60%	Biodiversity & Habitat	25%	Marine Protected Areas	20%
					Biome Protection (National)	20%
					Biome Protection (Global)	20%
					Species Protection Index	20%
					Representativeness Index	10%
					Species Habitat Index	10%
			Forests	10%	Tree Cover Loss	100%
			Fisheries	10%	Fish Stock Status	50%
					Regional Marine Trophic Index	50%
			Climate & Energy	30%	CO_2 Emissions – Total	50%
					CO_2 Emissions – Power	20%
					Methane Emissions	20%
					N_2O Emissions	5%
					Black Carbon Emissions	5%
			Air Pollution	10%	SO_2 Emissions	50%
					NO_X Emissions	50%
			Water Resources	10%	Wastewater Treatment	100%
			Agriculture	5%	Sustainable Nitrogen Management	100%

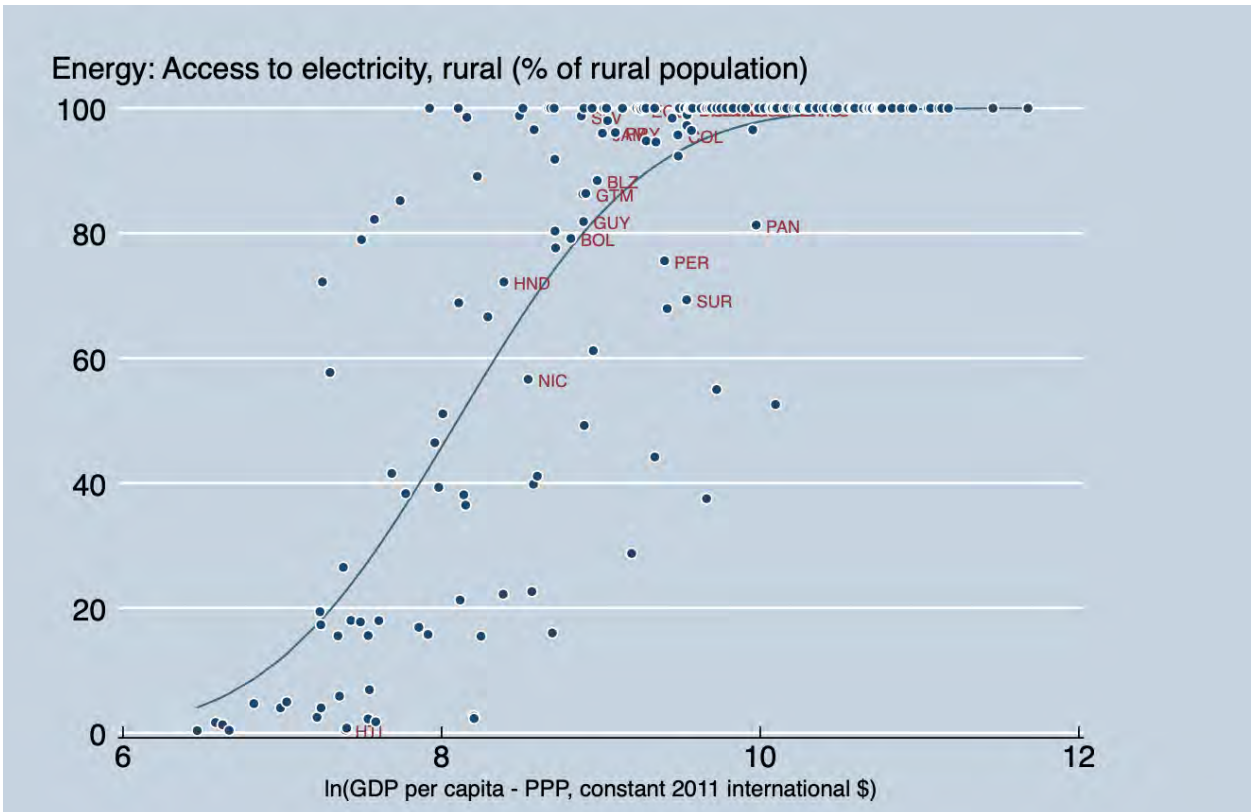
Appendix 3: Selection of indicators' graphical relationship with per-capita GDP[25]

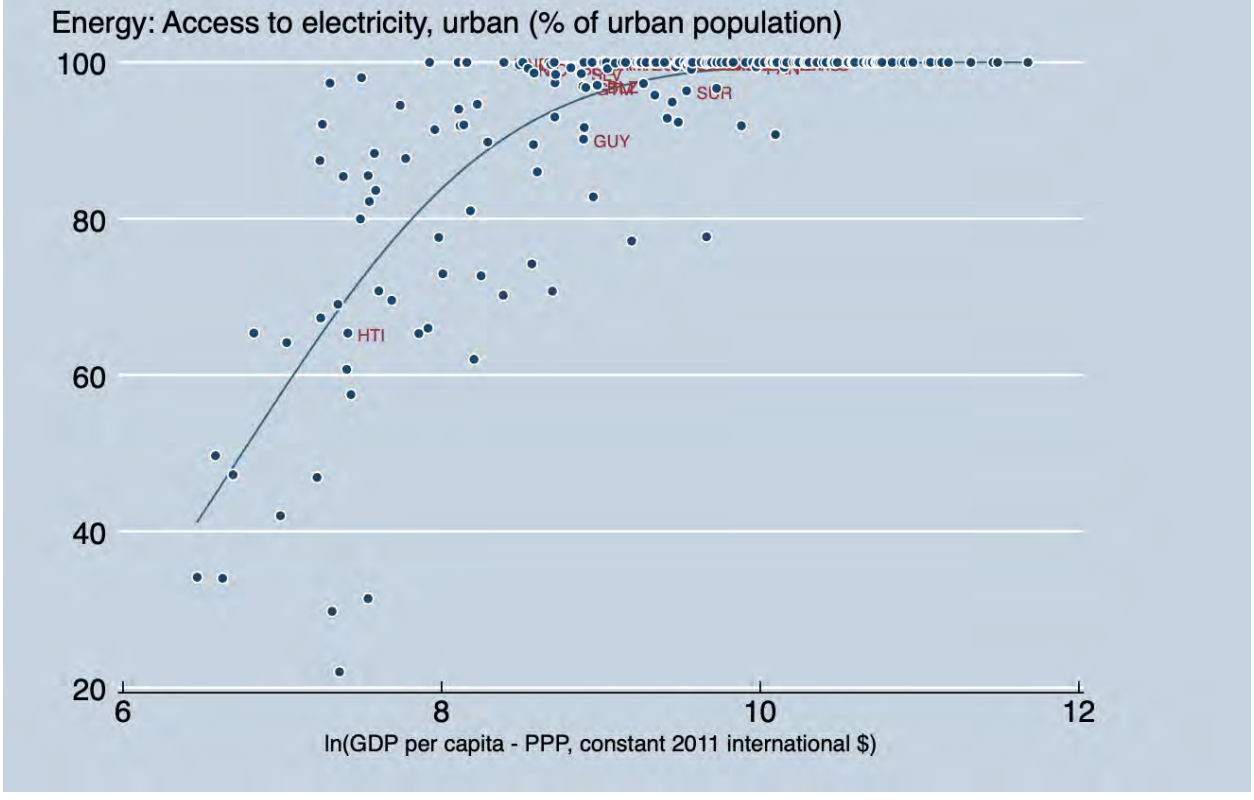


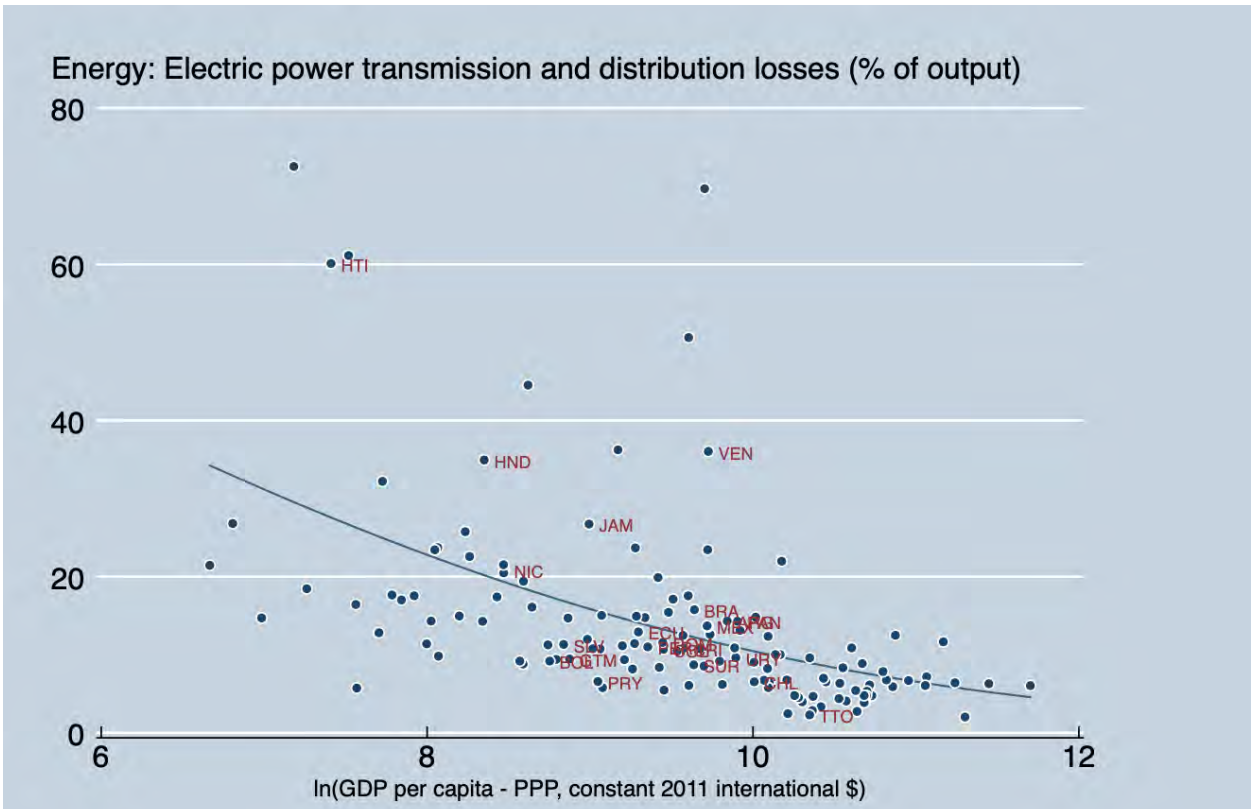
[25] Note that these graphs are referential in the sense that the prediction lines were estimated using only the last year available.

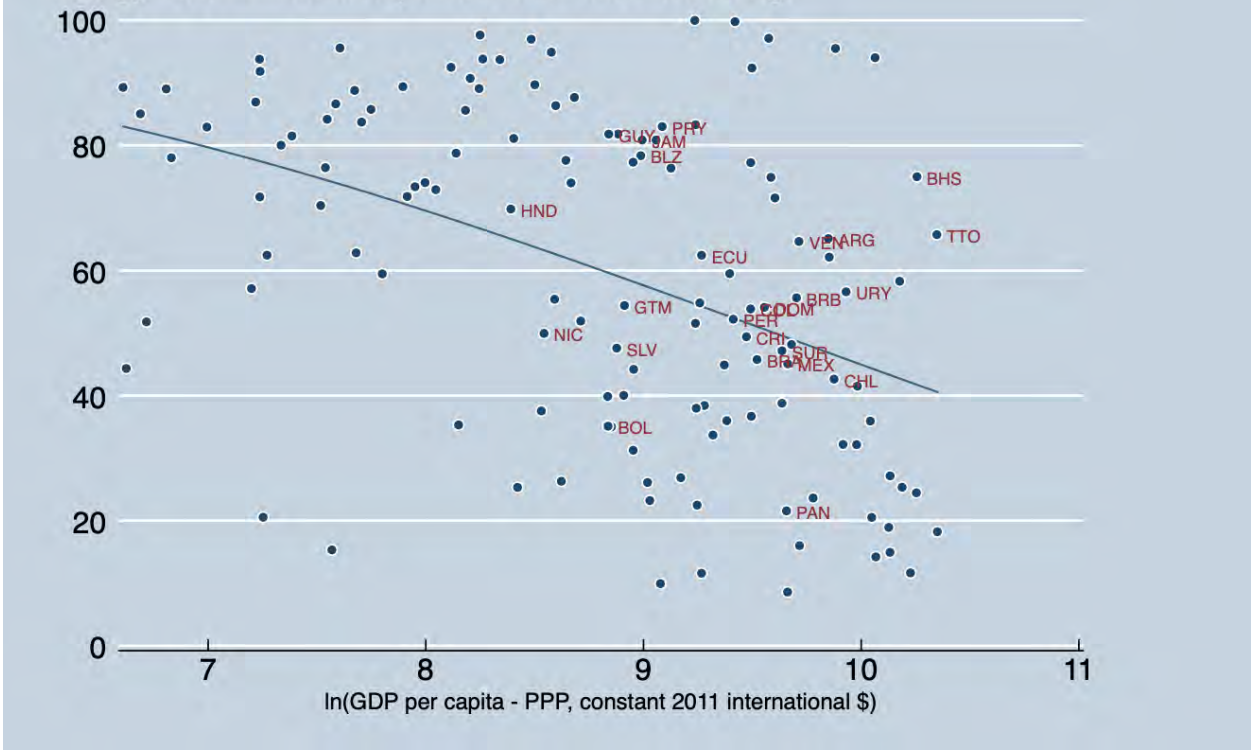

Transp: Liner shipping connectivity index (maximum value in 2004 = 100)
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
COL
PAN
MEX
BRA
PER
ARG
CHL
URY
ECU
BHS
DOM
JAM
TTO
CRI
HND
NIC
SLV
BLZ
HTI
GUY
BRB

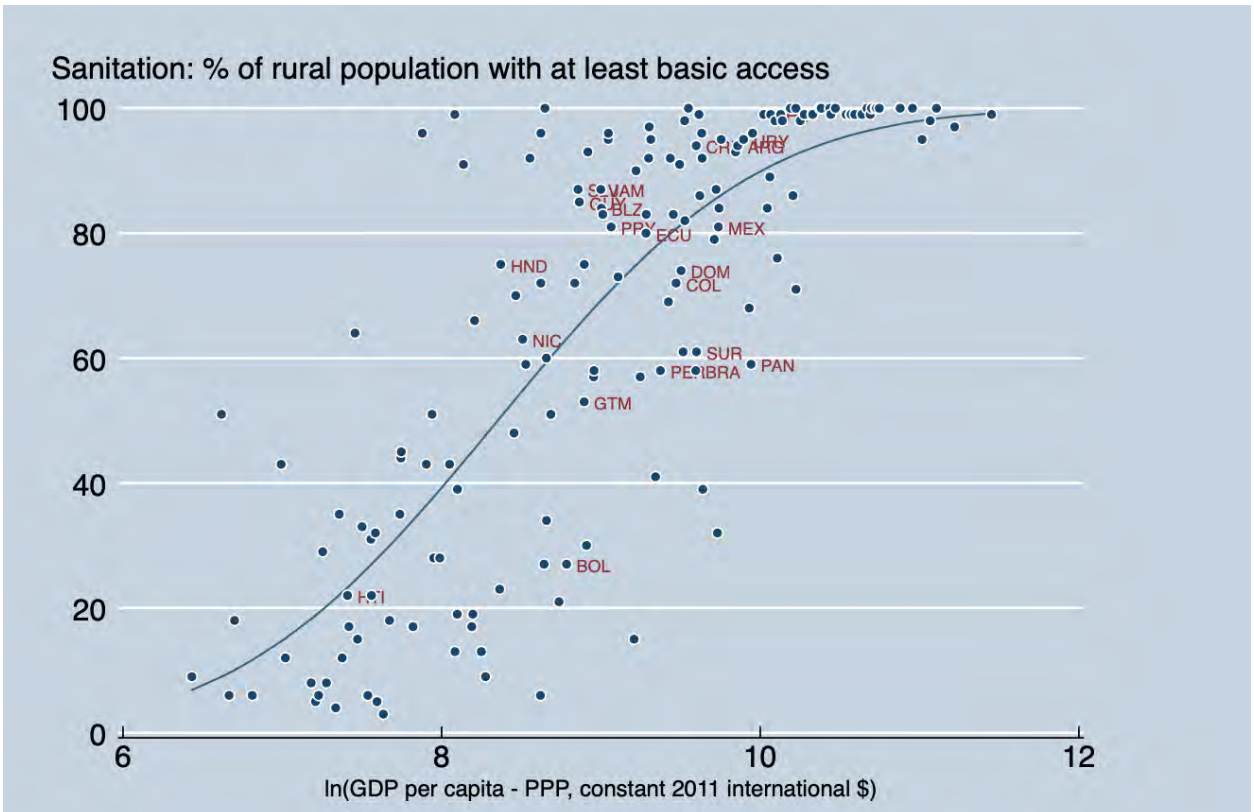

Transp: Mortality caused by road traffic injury (per 100,000 people)
40
30
20
10
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
DOM
BOL
PRY
BRA
BLZ
ECU
GTM
SLV
COL
SUR
URY
HND
HTI
NIC
GUY
CRI
ARG
TTO
PER
MEX
CHL
PAN
BHS
JAM
BRB

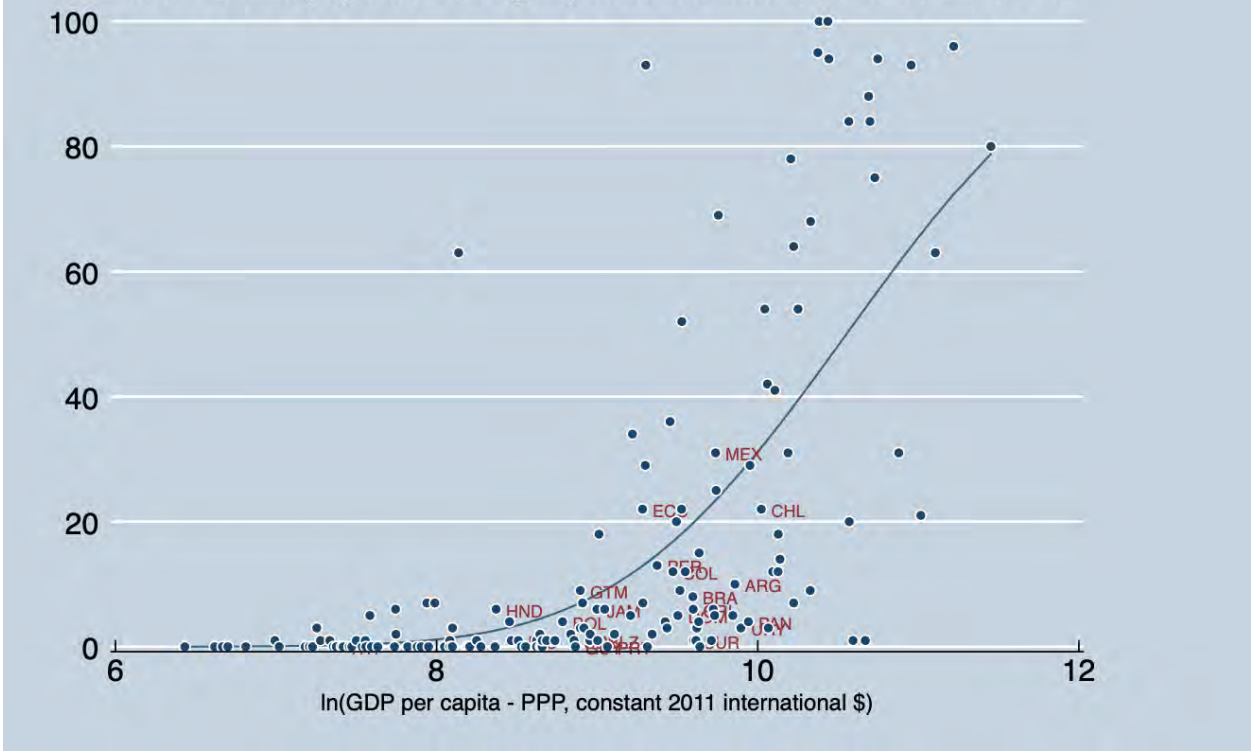

Energy: Access to electricity, rural (% of rural population)
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BLZ
GTM
GUY
BOL
PAN
PER
HND
SUR
NIC
HTI

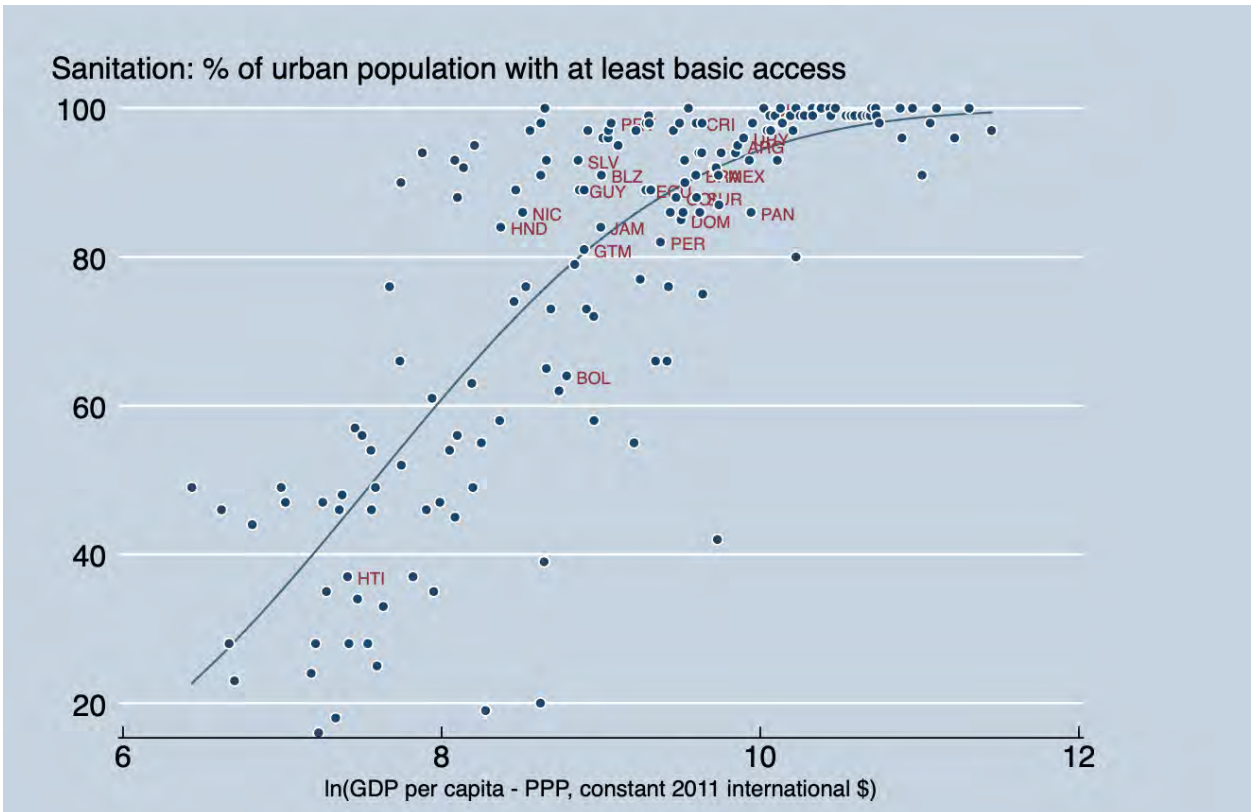

Energy: Access to electricity, urban (% of urban population)
100
80
60
40
20
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
SUR
GUY
HTI

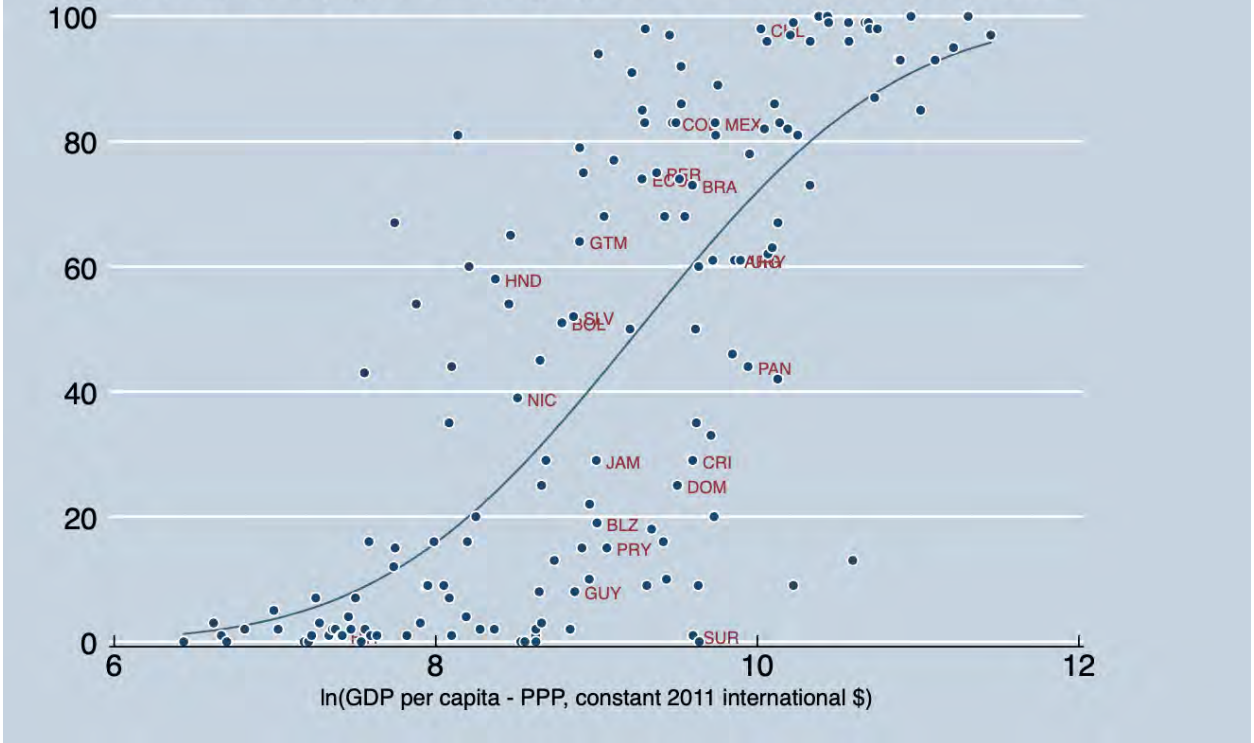

Energy: Electric power transmission and distribution losses (% of output)
80
60
40
20
0
6
8
10
12
HTI
HND
VEN
JAM
NIC
BRA
ECU
SLV
GTM
PRY
SUR
URY
CHL
TTO
ln(GDP per capita - PPP, constant 2011 international $)

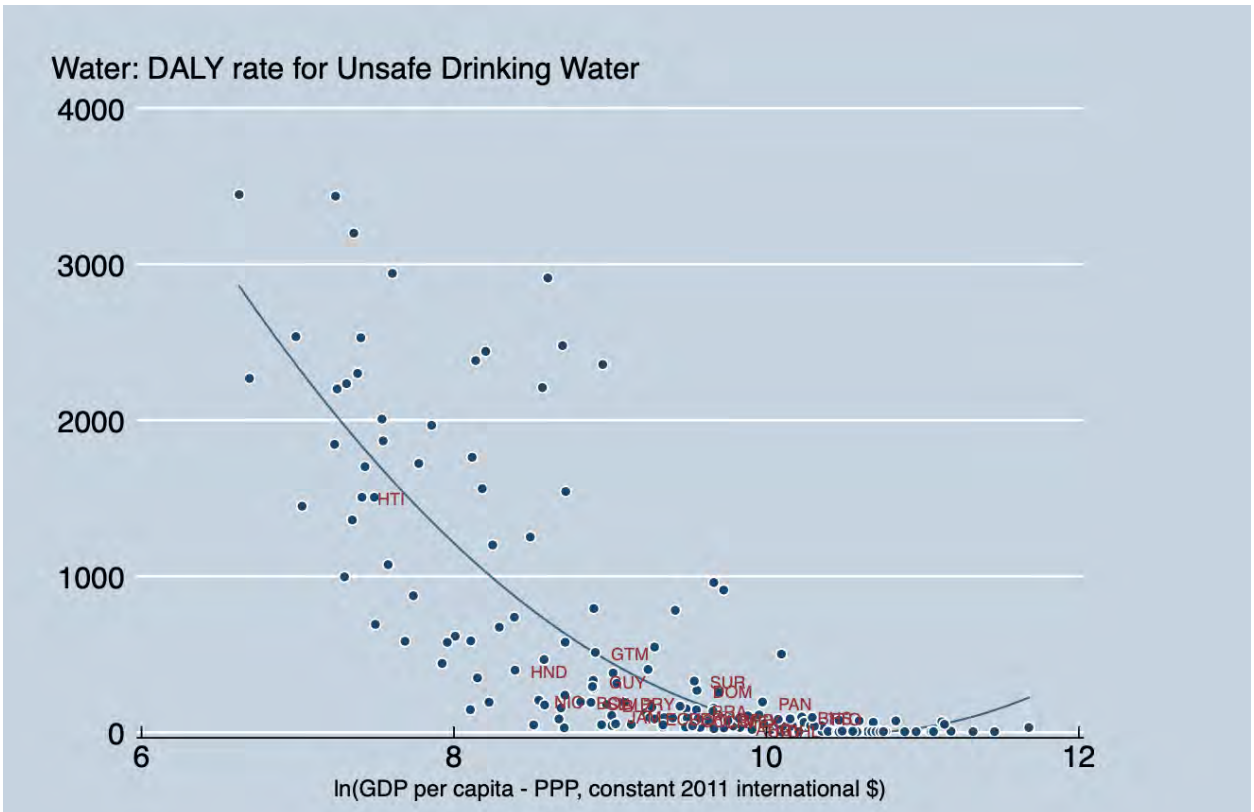

Energy: % of firms that experienced an electrical outage
100
80
60
40
20
0
7
8
9
10
11
GUY
JAM
PRY
BLZ
HND
BHS
TTO
ARG
ECU
BRB
URY
GTM
DOM
PER
NIC
SLV
CRI
SUR
MEX
CHL
BOL
PAN
ln(GDP per capita - PPP, constant 2011 international $)

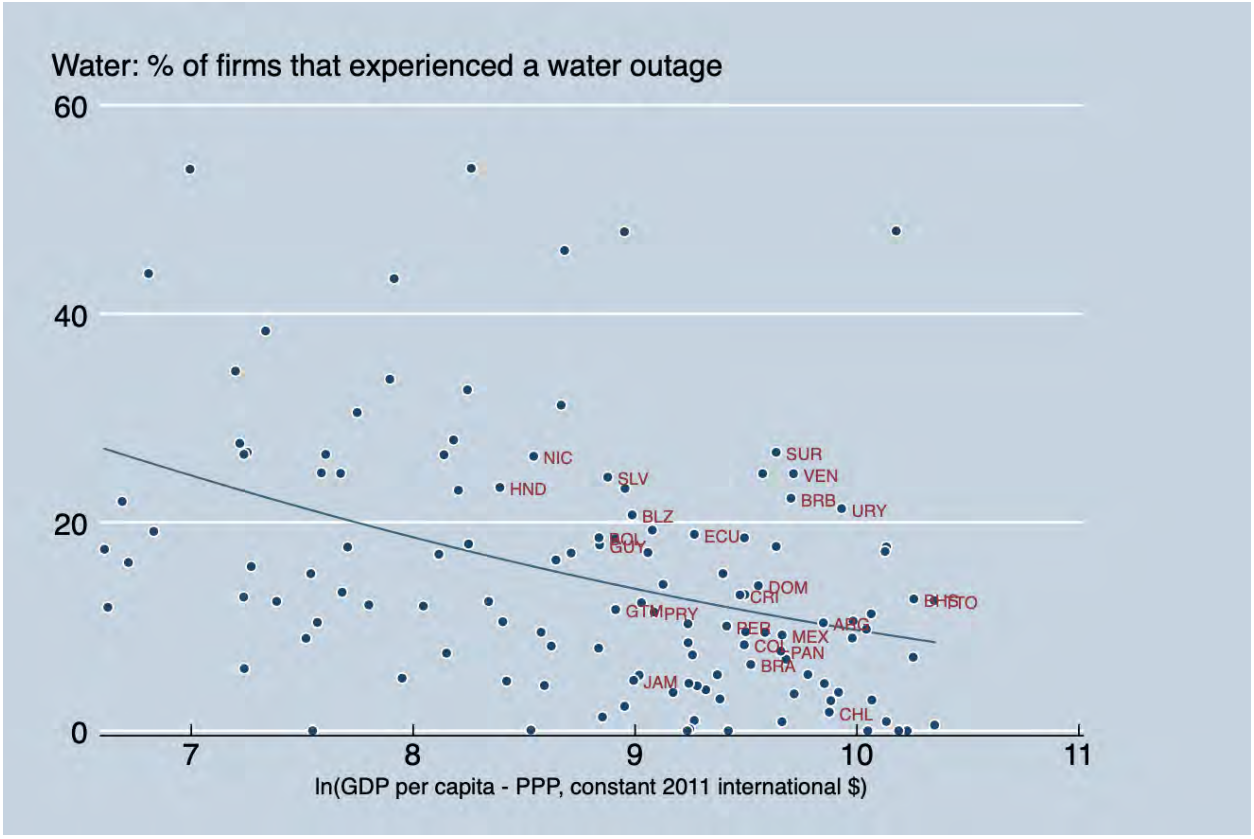

Sanitation: % of rural population with at least basic access
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
HND
NIC
GTM
BOL
HTI
DOM
COL
MEX
ECU
PAN
SUR
BRA

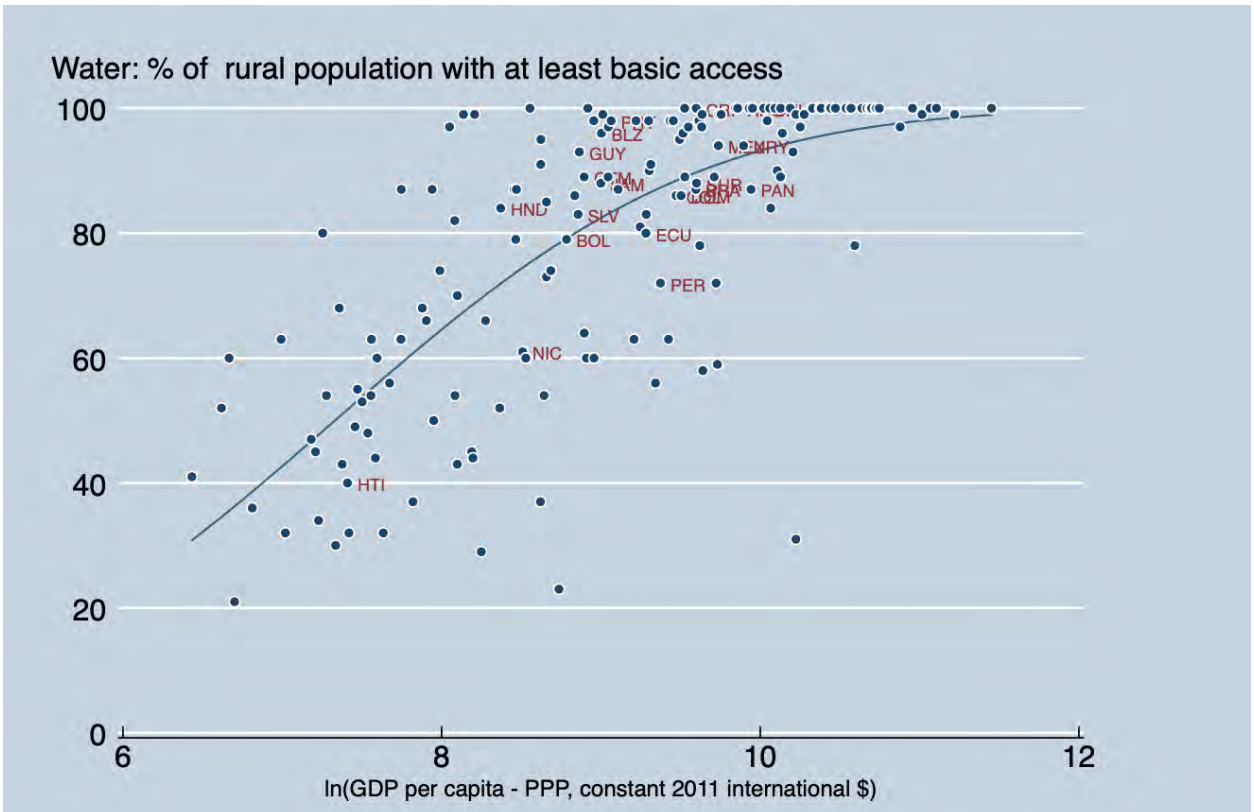

Sanitation: % rural population using improved sanitation, sewer connections
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
MEX
CHL
ARG
GTM
HND
BRA

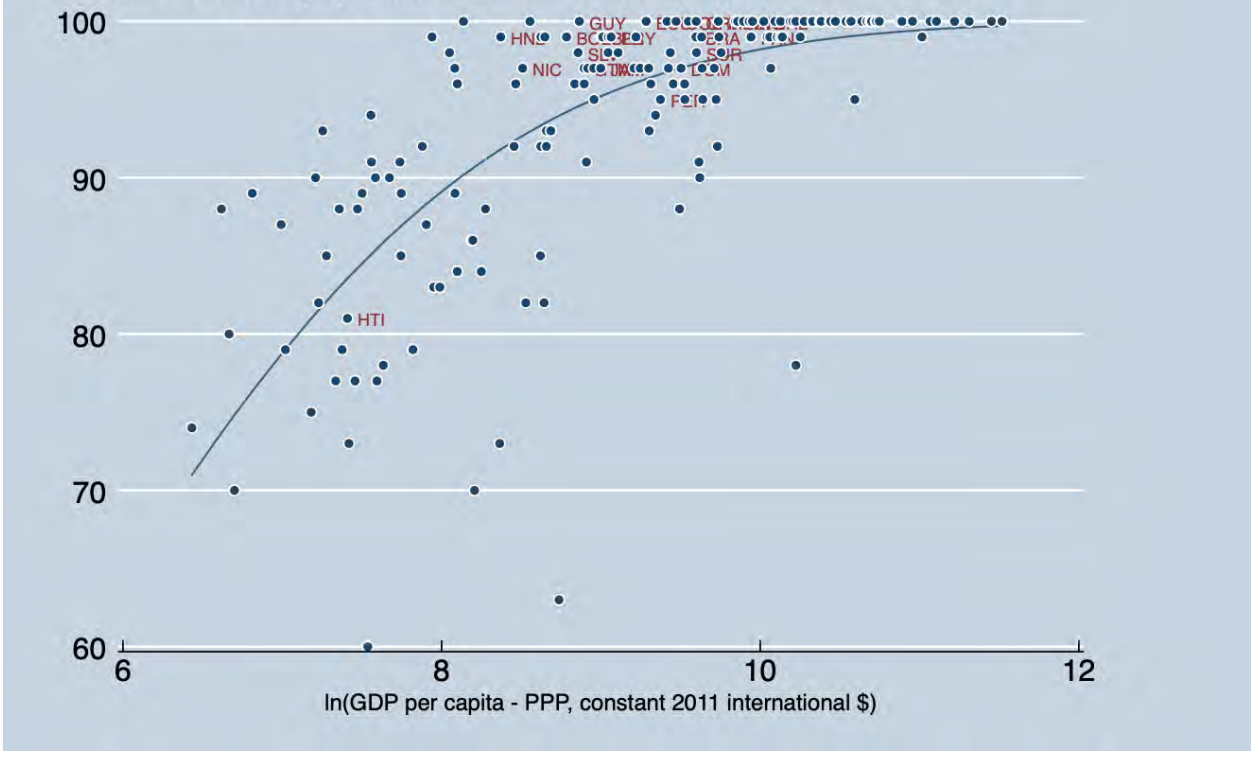

Sanitation: % of urban population with at least basic access
100
80
60
40
20
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CRI
SLV
BLZ
GUY
NIC
HND
JAM
DOM
PAN
PER
GTM
BOL
HTI

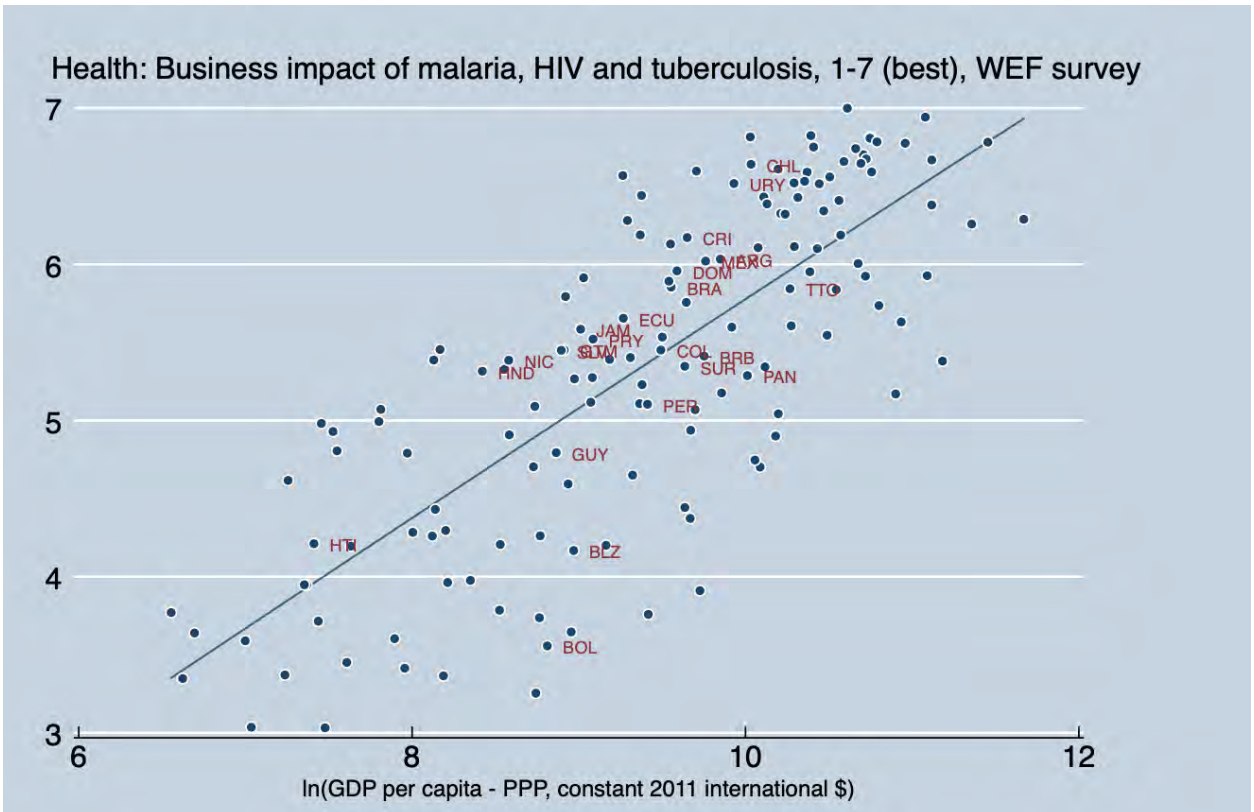

Sanitation: % urban population using improved sanitation, sewer connections
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
MEX
BRA
GTM
HND
PAN
NIC
JAM
CRI
DOM
BLZ
PRY
GUY
SUR

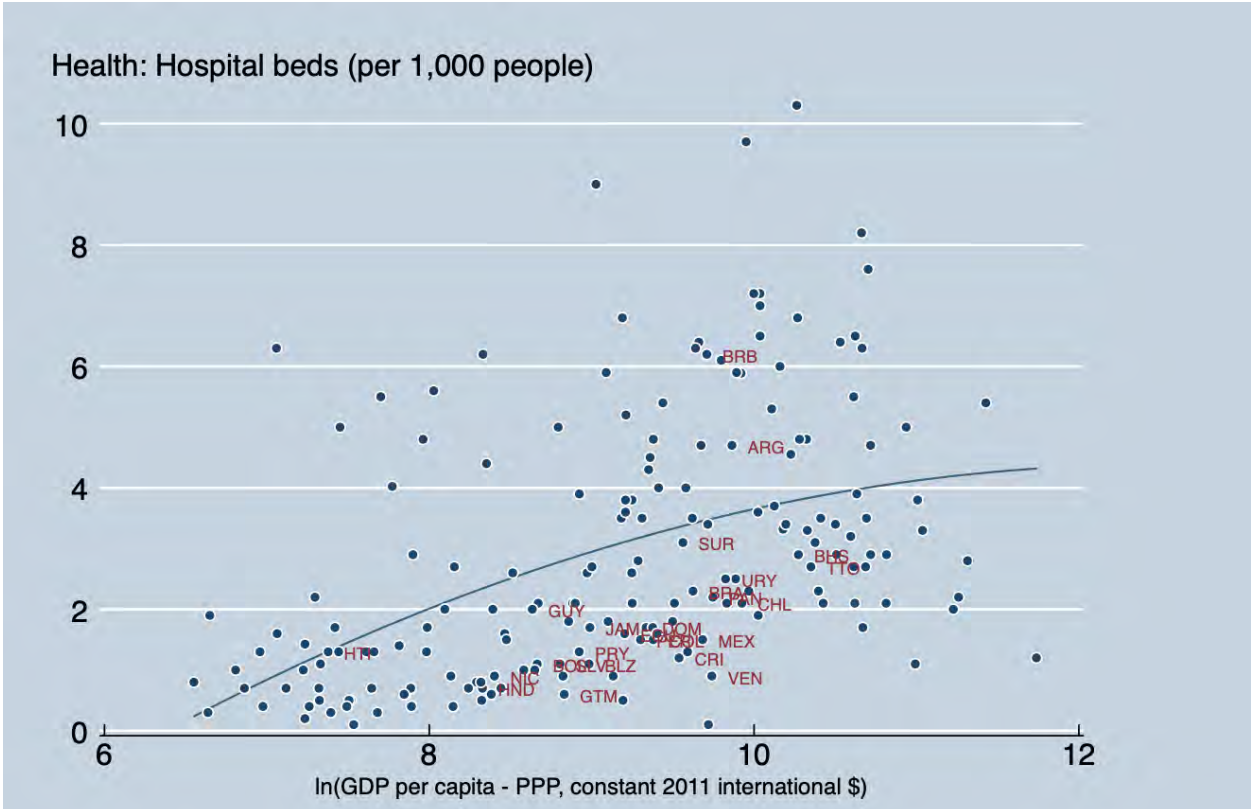

Water: DALY rate for Unsafe Drinking Water
4000
3000
2000
1000
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
HTI
GTM
HND
GUY
SUR
DOM
PAN

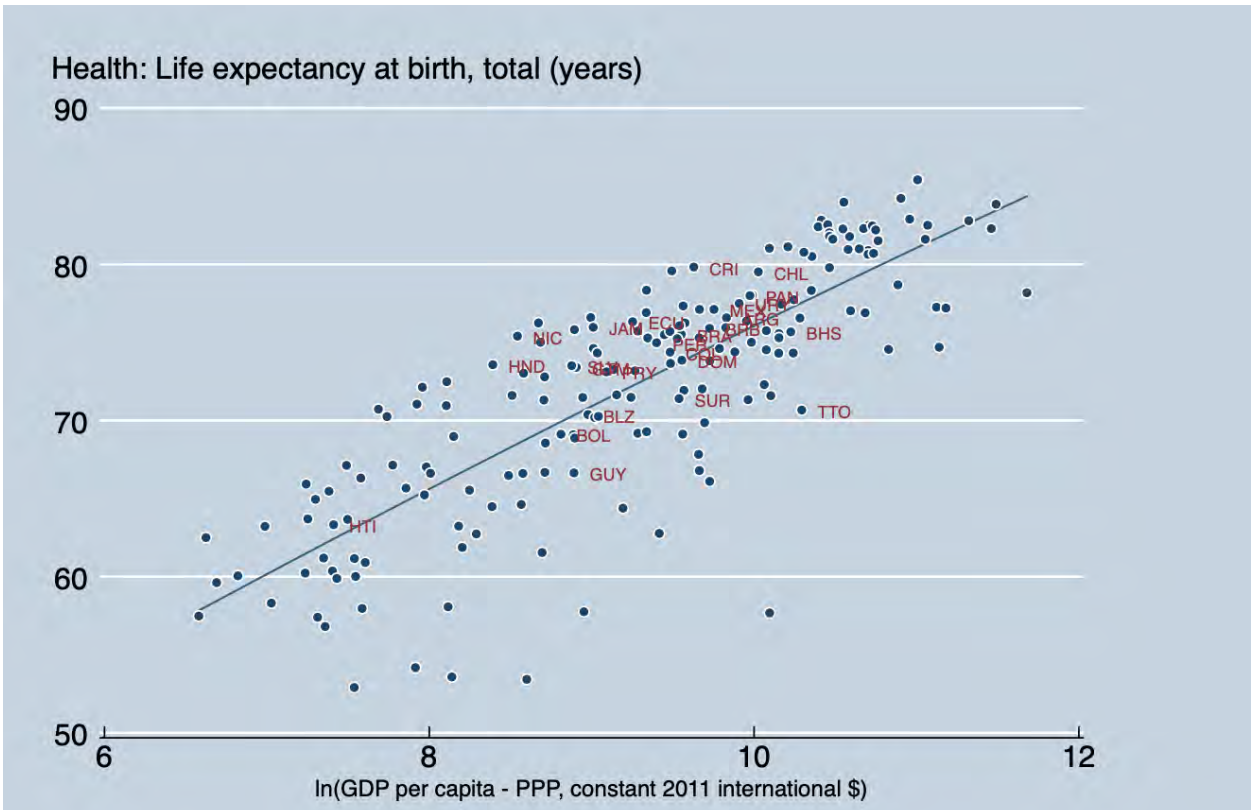

Water: % of firms that experienced a water outage
60
40
20
0
7
8
9
10
11
ln(GDP per capita - PPP, constant 2011 international $)
NIC
HND
SLV
SUR
VEN
BRB
URY
BLZ
ECU
GUY
DOM
CRI
GTM
PRY
MEX
PAN
BRA
JAM
CHL

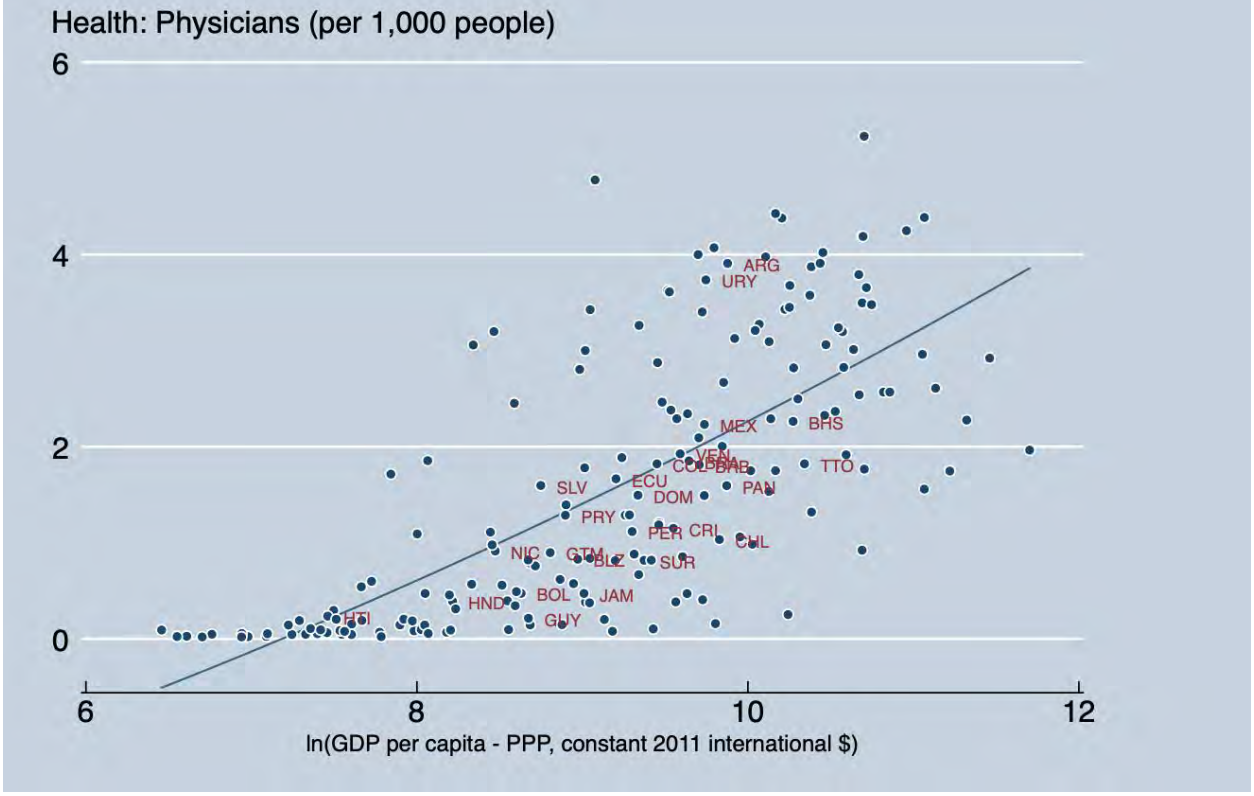

Water: % of rural population with at least basic access
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BLZ
GUY
PAN
HND
SLV
BOL
ECU
PER
NIC
HTI

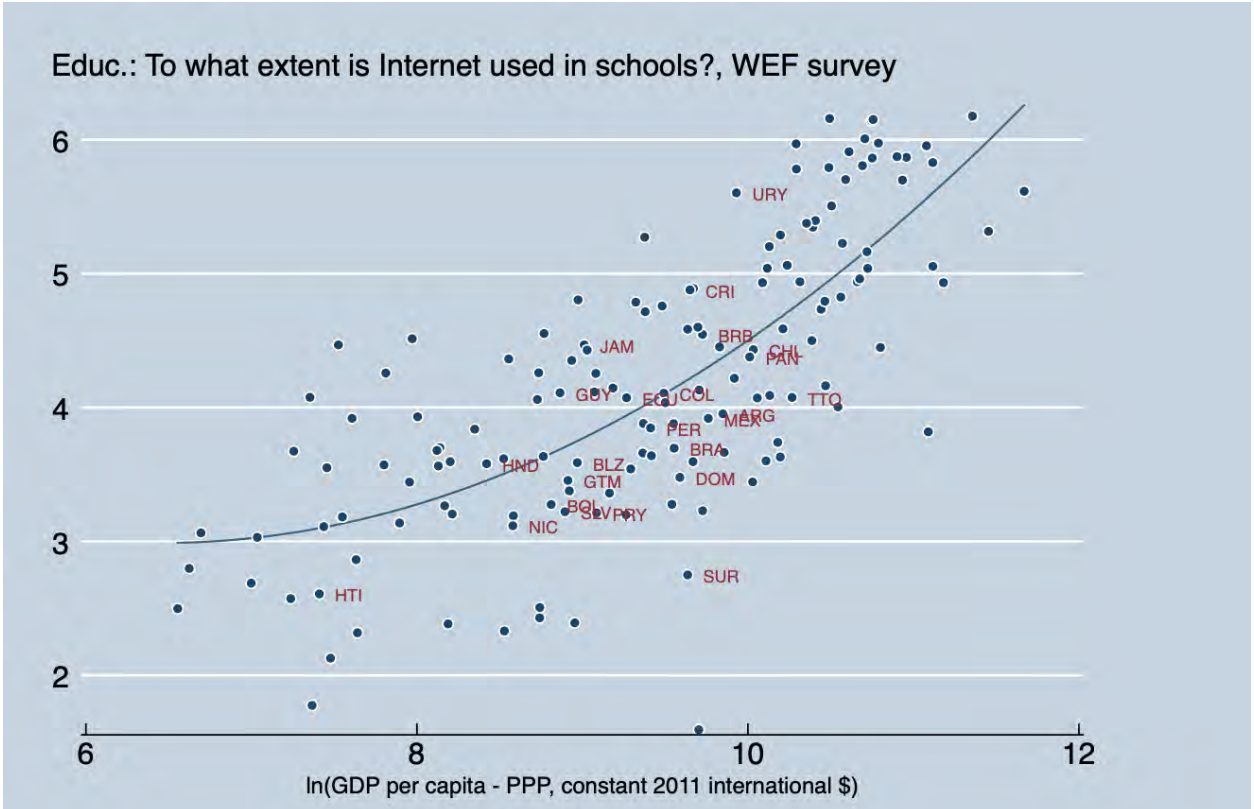

Water: % of urban population with at least basic access
100
90
80
70
60
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
GUY
NIC
HTI

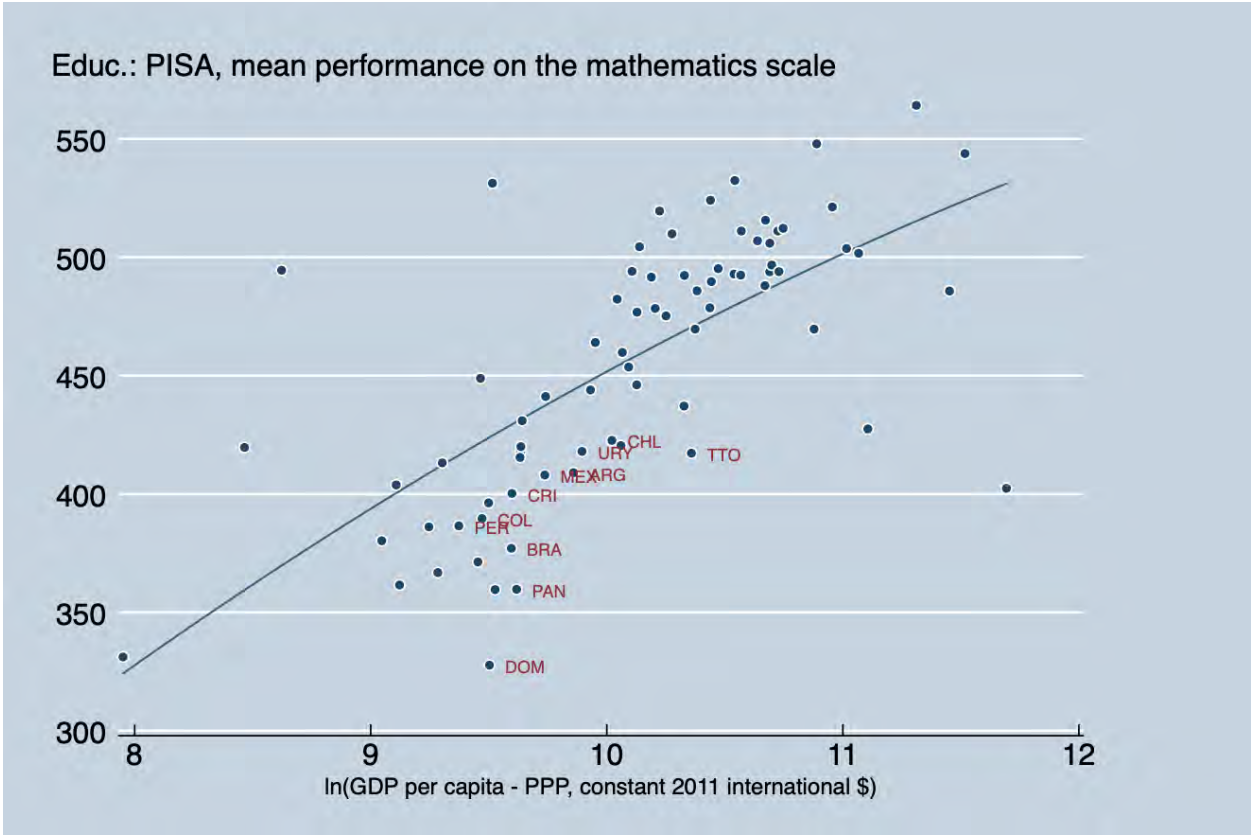

Health: Business impact of malaria, HIV and tuberculosis, 1-7 (best), WEF survey
7
6
5
4
3
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CHL
URY
CRI
MEX
DOM
BRA
TTO
ECU
JAM
PRY
COL
BRB
SUR
PAN
NIC
HND
PER
GUY
HTI
BLZ
BOL

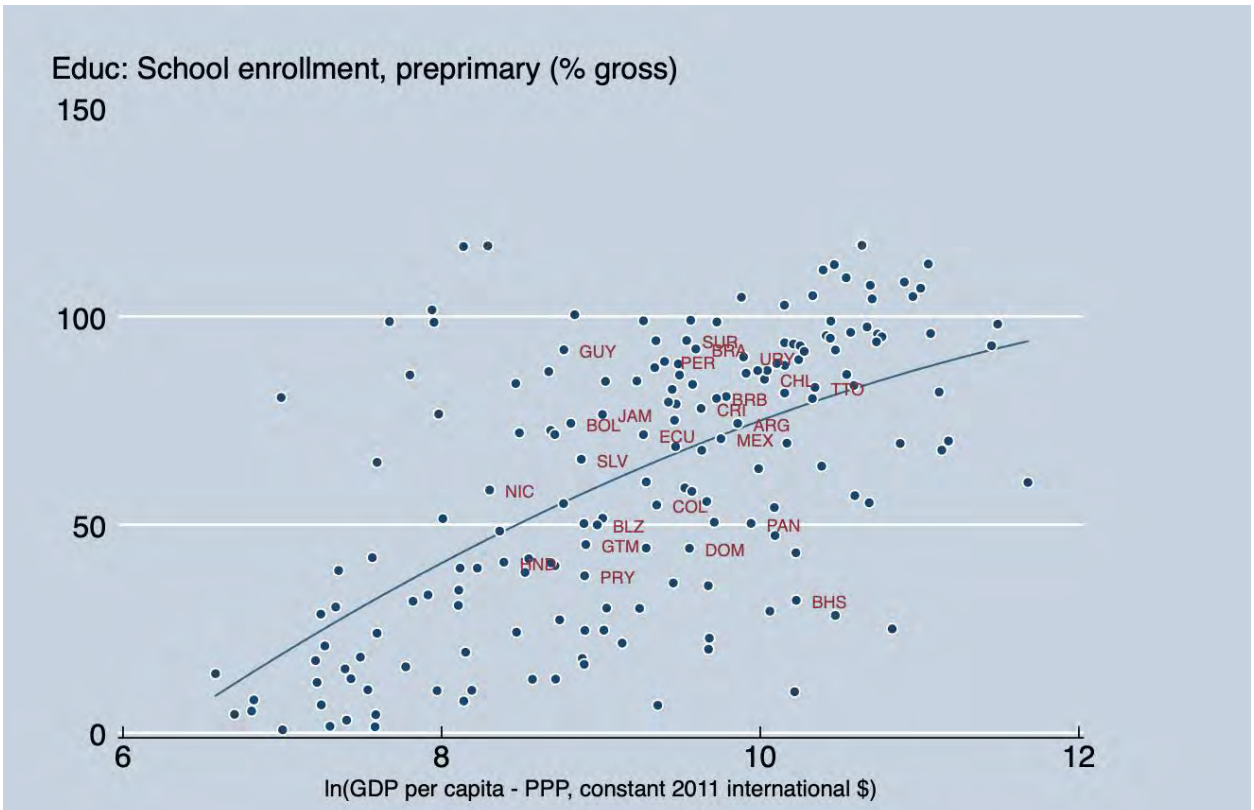

Health: Hospital beds (per 1,000 people)
10
8
6
4
2
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BRB
ARG
SUR
BHS
TTO
URY
CHL
MEX
CRI
VEN
GUY
HTI
PRY
BLZ
NIC
HND
GTM

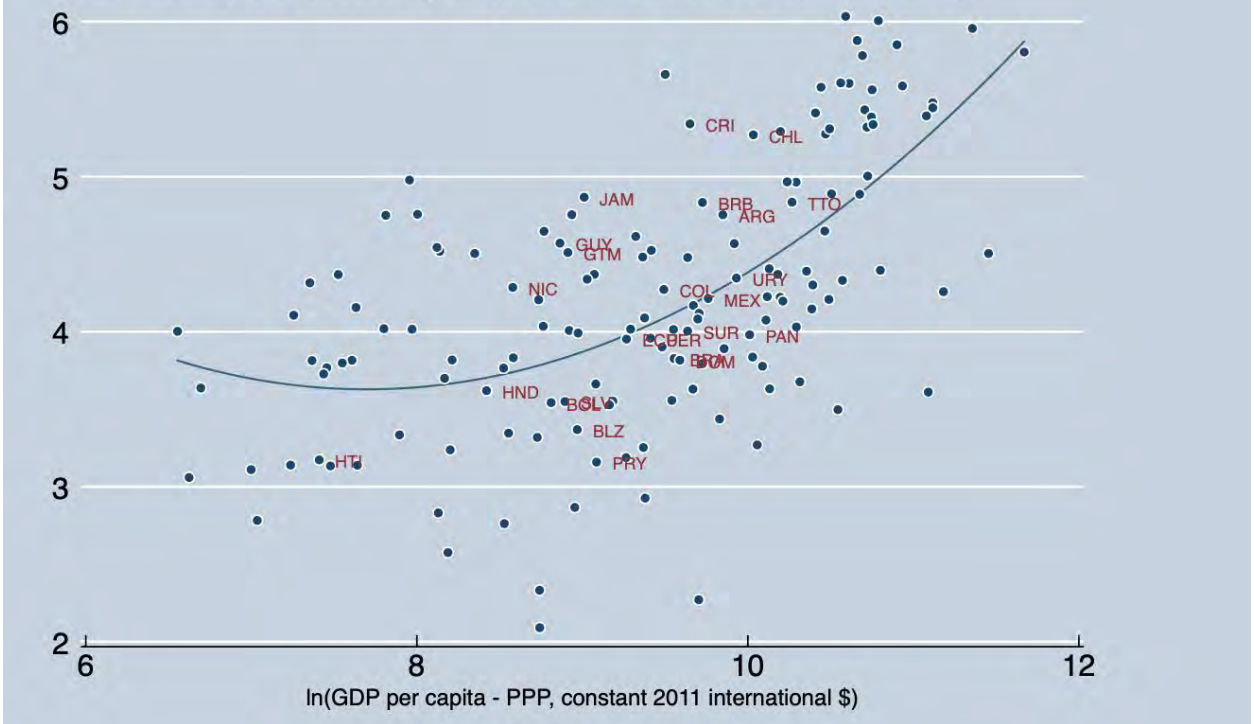

Health: Life expectancy at birth, total (years)
90
80
70
60
50
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CRI
CHL
PAN
MEX
ARG
BHS
ECU
JAM
NIC
HND
PRY
DOM
SUR
TTO
BLZ
BOL
GUY
HTI

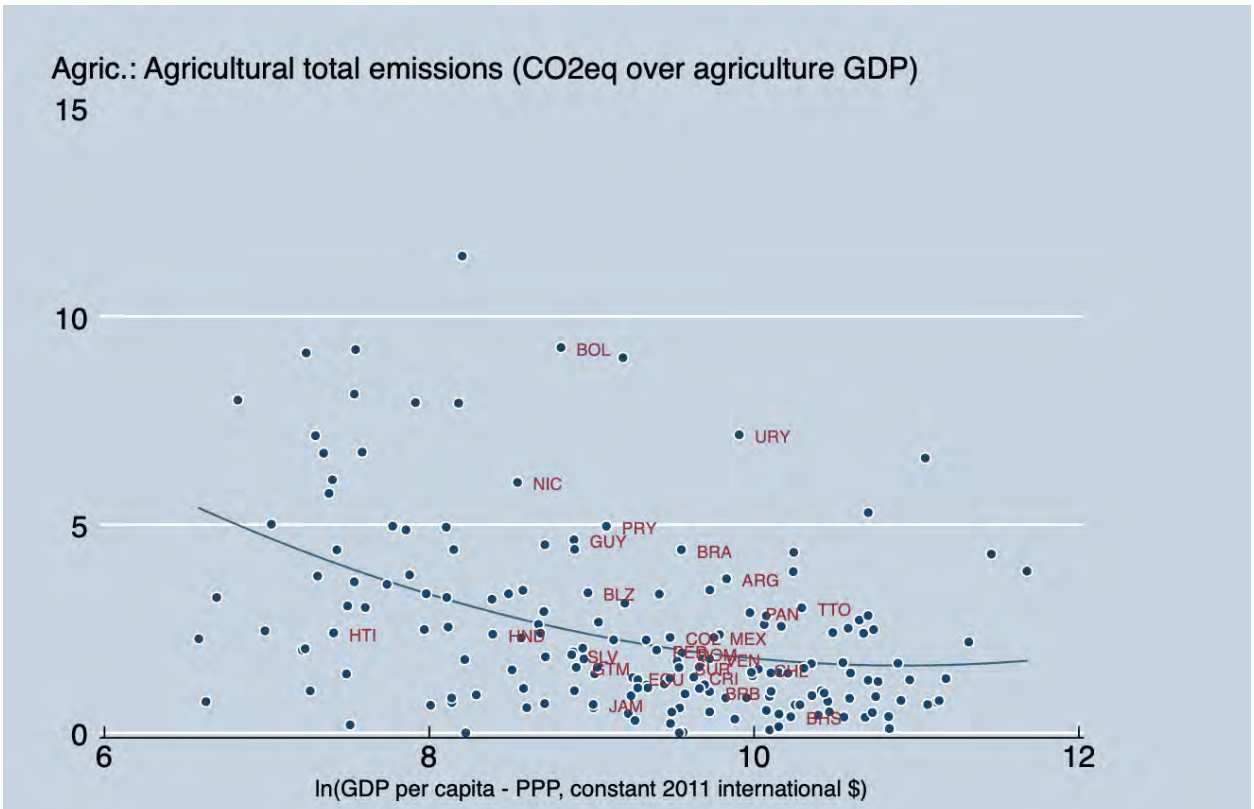

Health: Physicians (per 1,000 people)
6
4
2
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
ARG
URY
MEX
BHS
TTO
PAN
ECU
SLV
DOM
PRY
PER
CRI
CHL
NIC
GTM
BLZ
SUR
HND
BOL
JAM
GUY
HTI

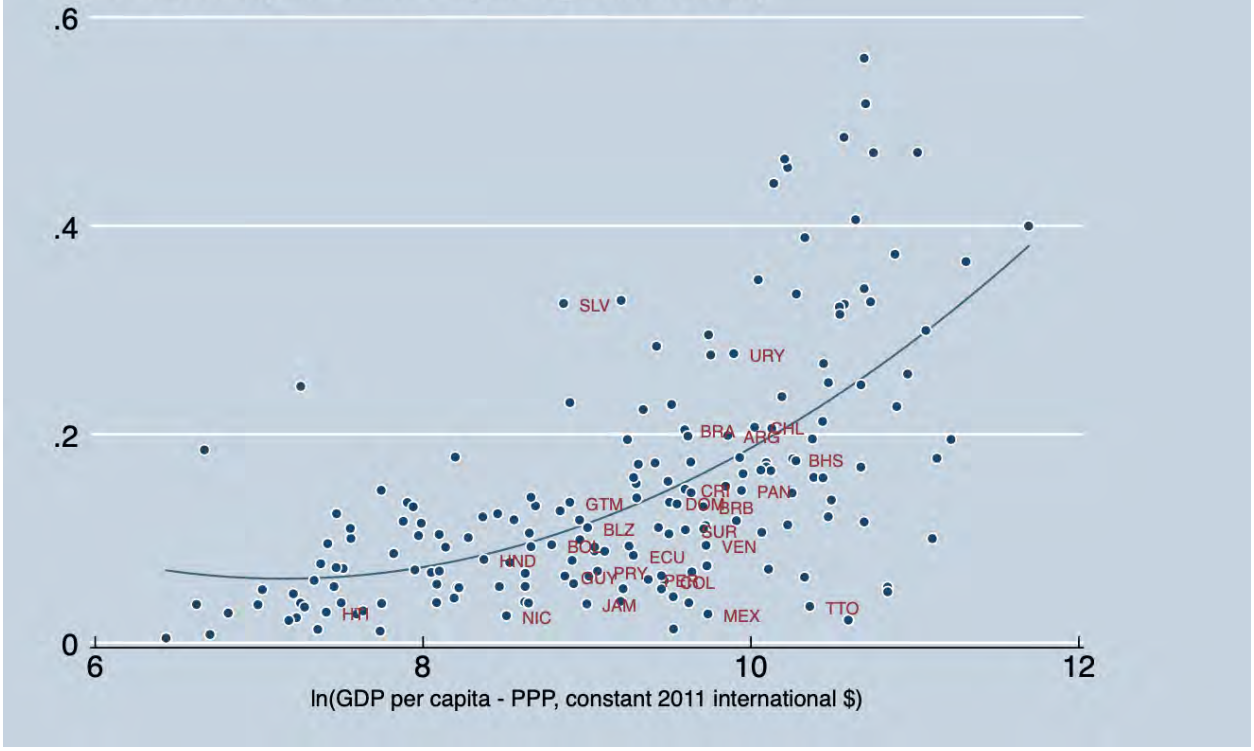

Educ.: To what extent is Internet used in schools?, WEF survey
6
5
4
3
2
URY
CRI
BRB
JAM
CHL
PAN
GUY
ECU
COL
TTO
ARG
MEX
PER
BRA
HND
BLZ
GTM
DOM
BOL
SLV
PRY
NIC
SUR
HTI
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)

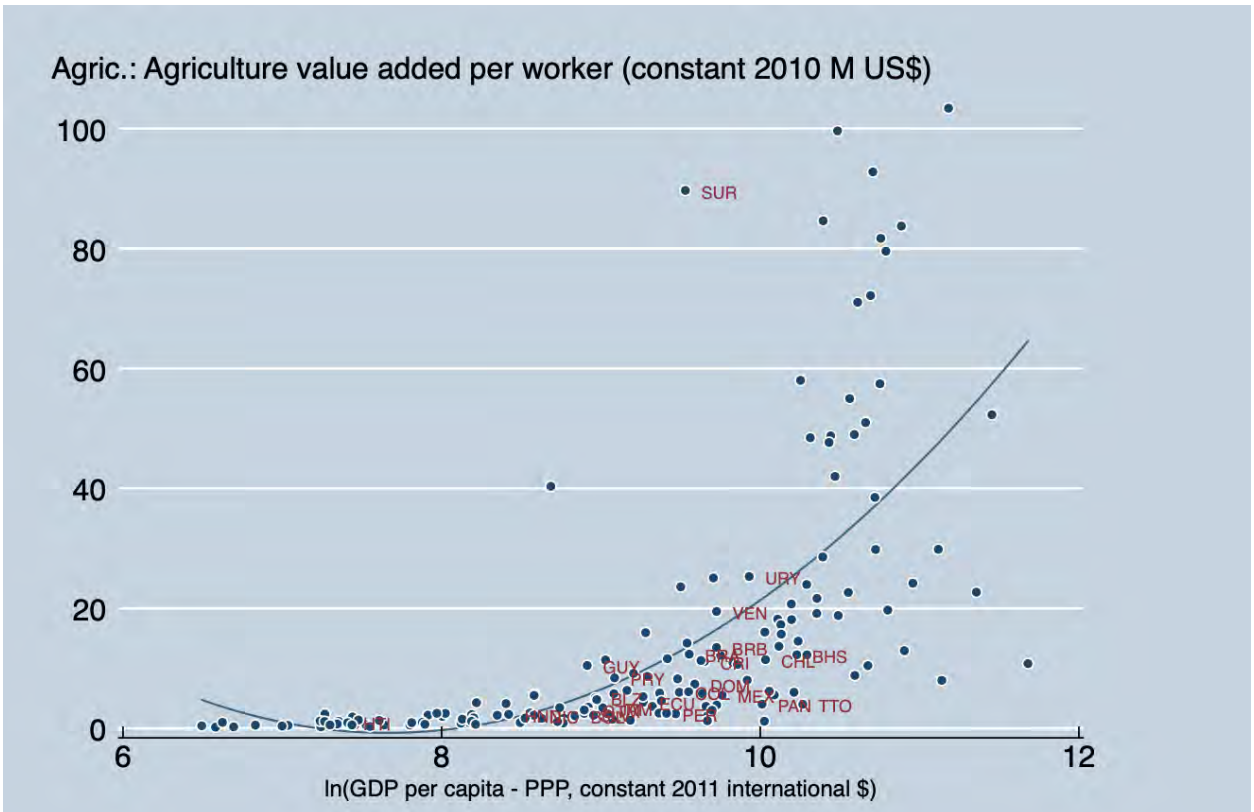

Educ.: PISA, mean performance on the mathematics scale
550
500
450
400
350
300
CHL
URY
TTO
MEX
ARG
CRI
COL
PER
BRA
PAN
DOM
8
9
10
11
12
ln(GDP per capita - PPP, constant 2011 international $)

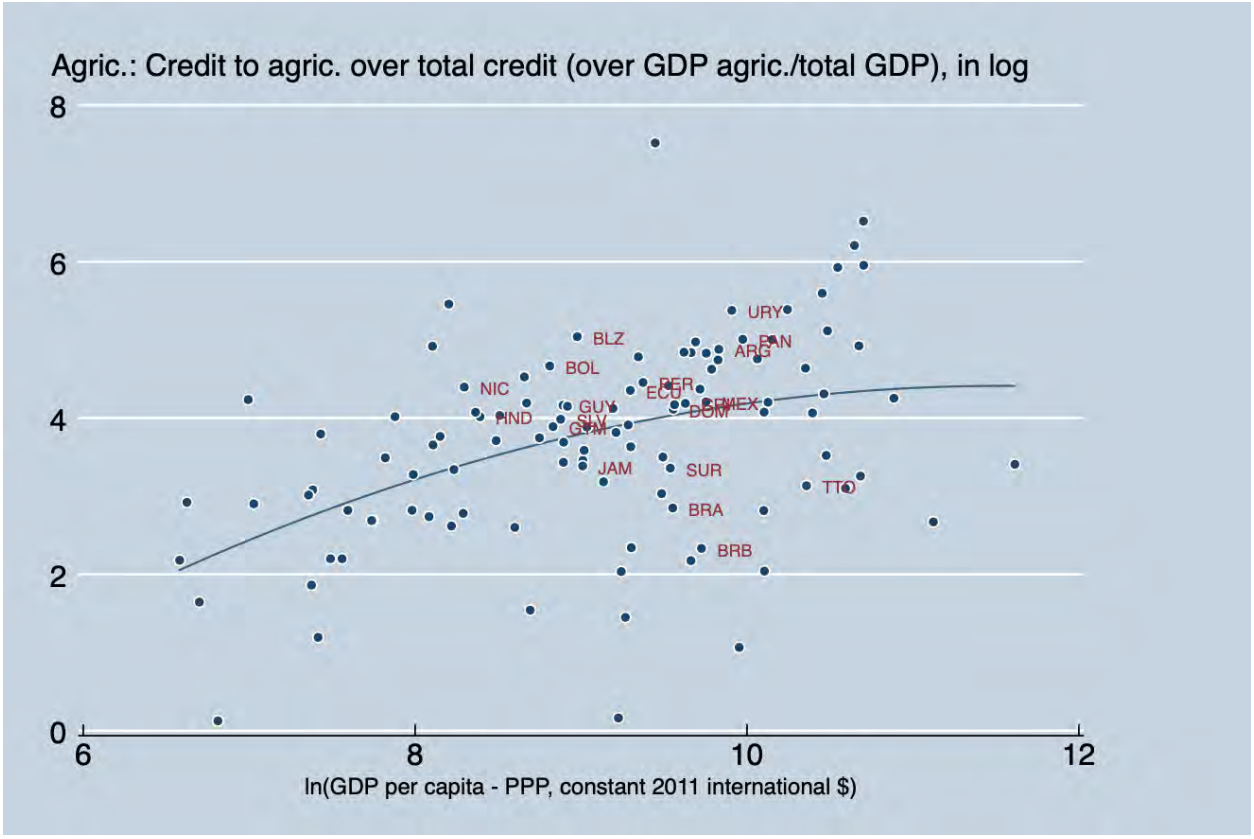

Educ: School enrollment, preprimary (% gross)
150
100
50
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
GUY
SUR
BRA
PER
URY
CHL
TTO
BRB
CRI
JAM
BOL
ARG
ECU
MEX
SLV
NIC
COL
BLZ
PAN
GTM
DOM
HND
PRY
BHS

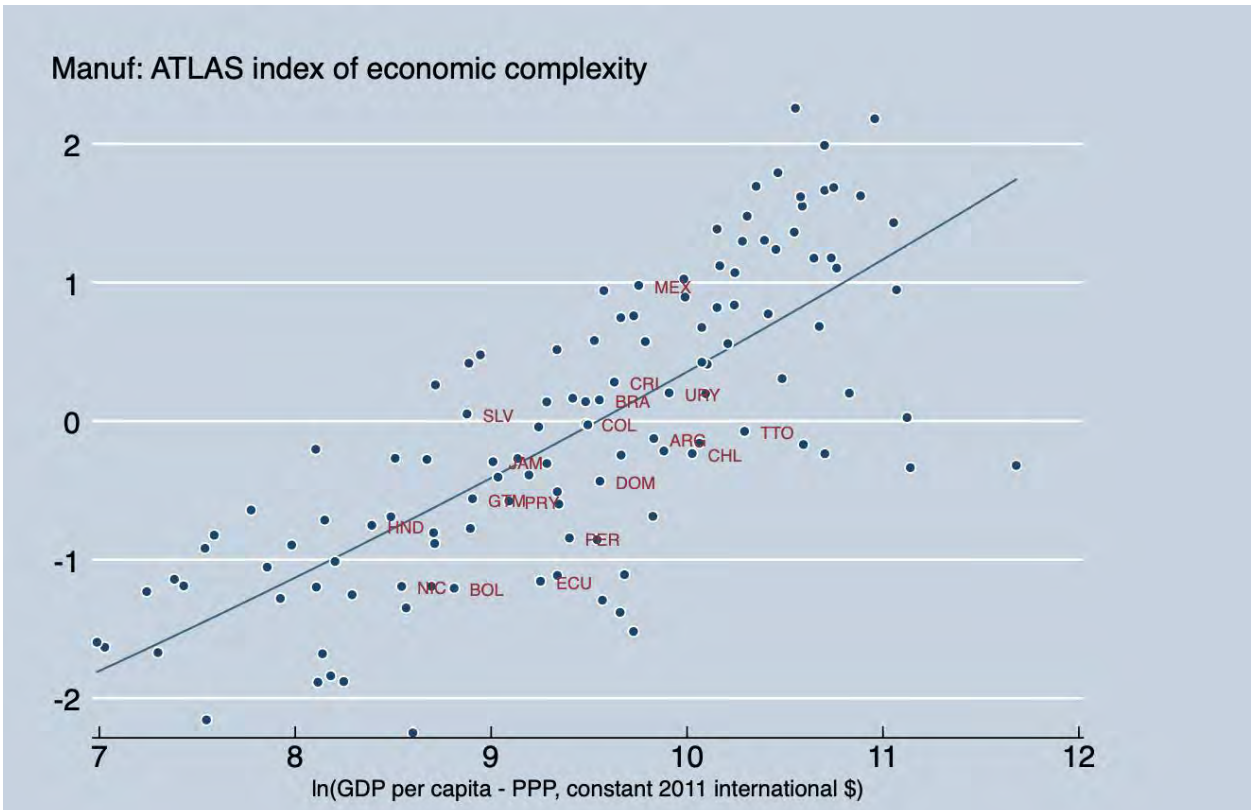

Educ.: How do you assess quality of business schools?, WEF survey
6
5
4
3
2
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CRI
CHL
JAM
BRB
ARG
TTO
GUY
GTM
NIC
URY
COL
MEX
SUR
PAN
HND
BLZ
HTI
PRY

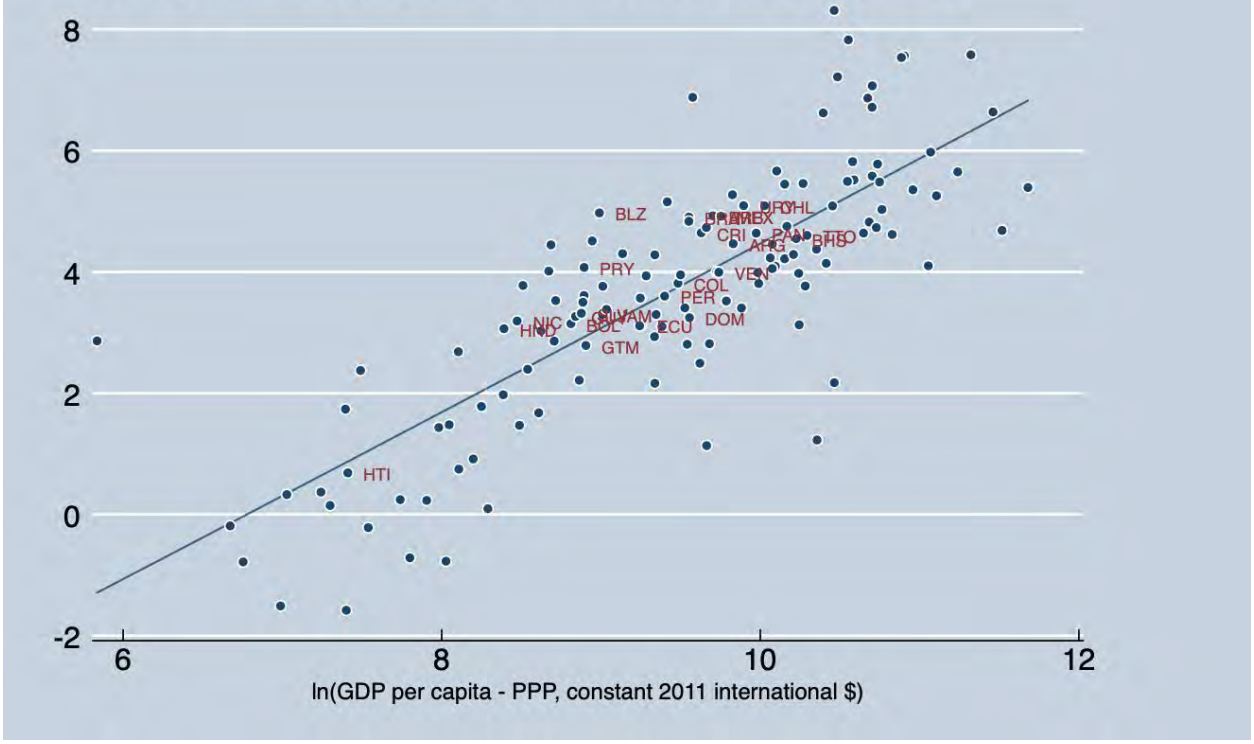

Agric.: Agricultural total emissions (CO2eq over agriculture GDP)
15
10
5
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BOL
URY
NIC
PRY
GUY
BRA
ARG
BLZ
PAN
TTO
HTI
HND
SLV
GTM
ECU
CRI
MEX
VEN
CHL
BRB
JAM
BHS

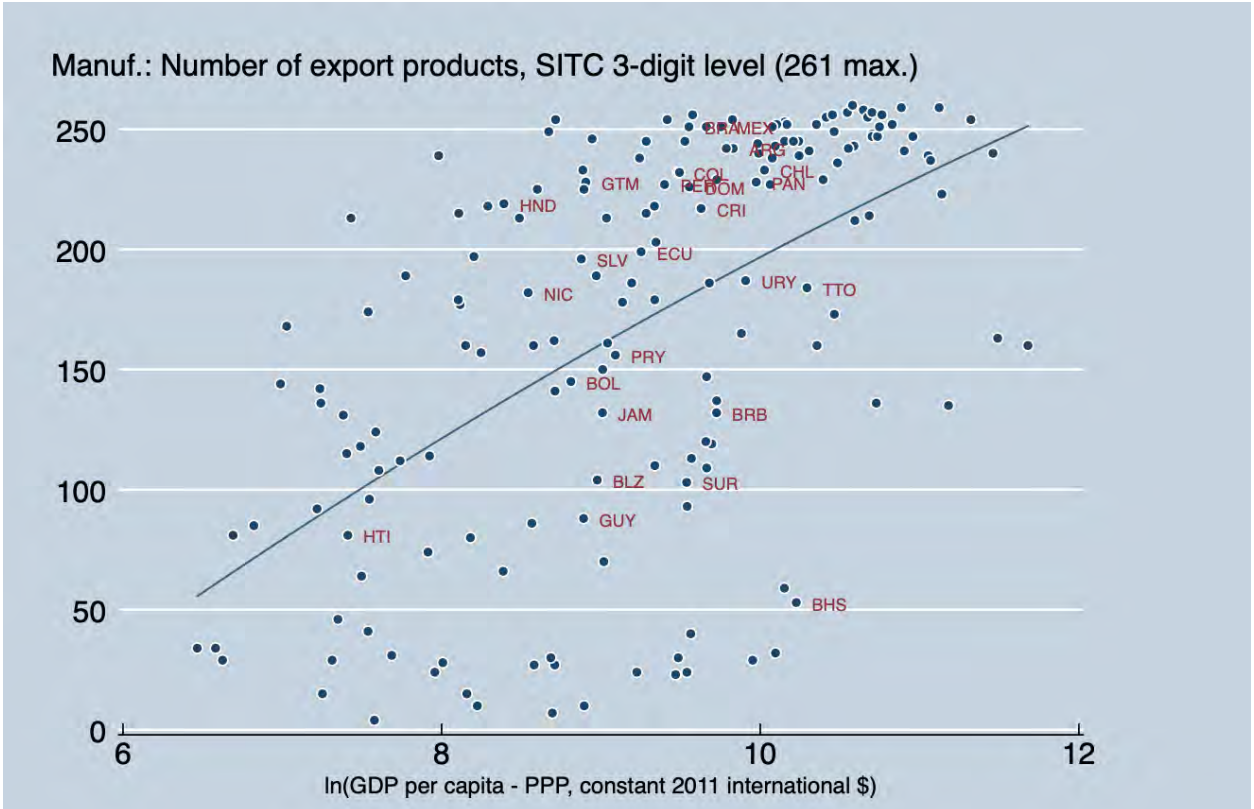

Agric.: Gross capital formation (over agriculture GDP)
.6
.4
.2
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
SLV
URY
BRA
ARG
CHL
BHS
CRI
PAN
GTM
DOM
BRB
BLZ
SUR
BOL
HND
ECU
VEN
GUY
PRY
HTI
NIC
JAM
MEX
TTO

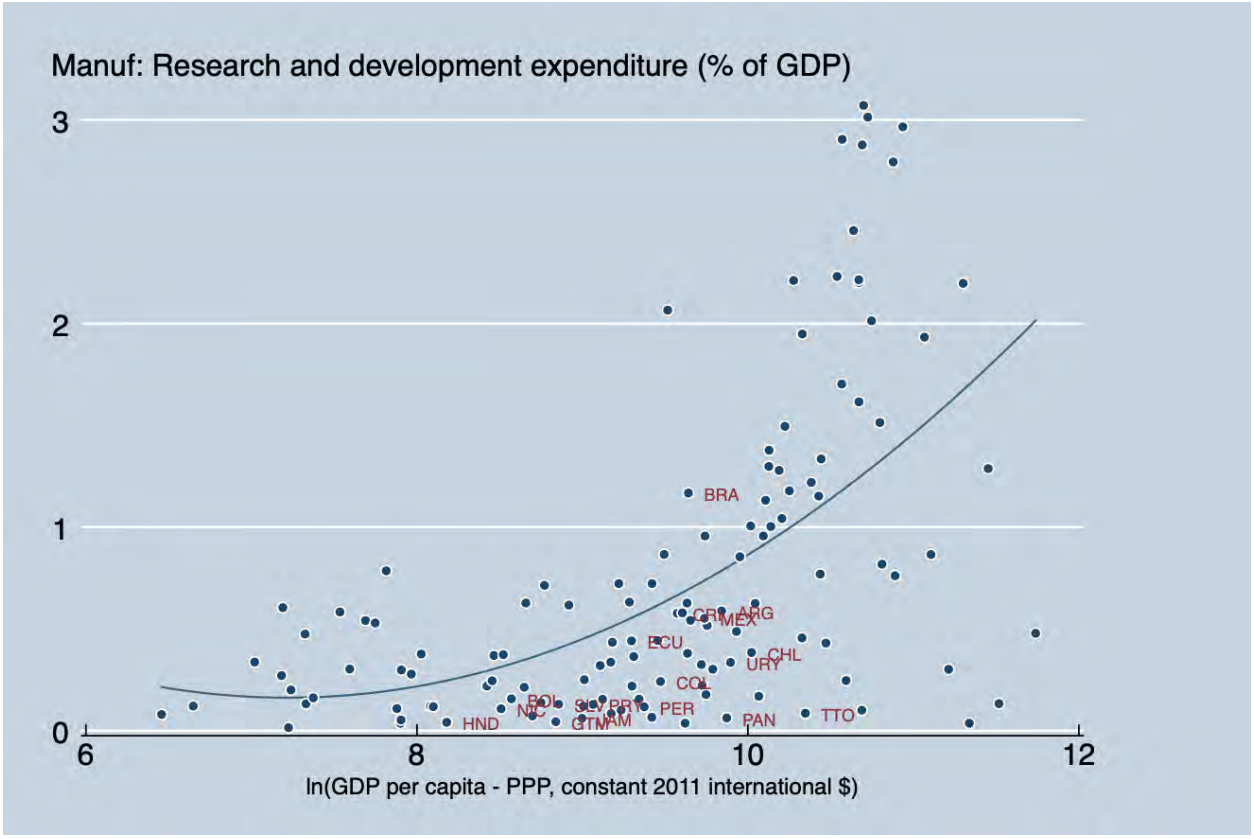

Agric.: Agriculture value added per worker (constant 2010 M US$)
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
SUR
URY
VEN
BRB
CHL
BHS
GUY
PRY
DOM
MEX
PAN
TTO

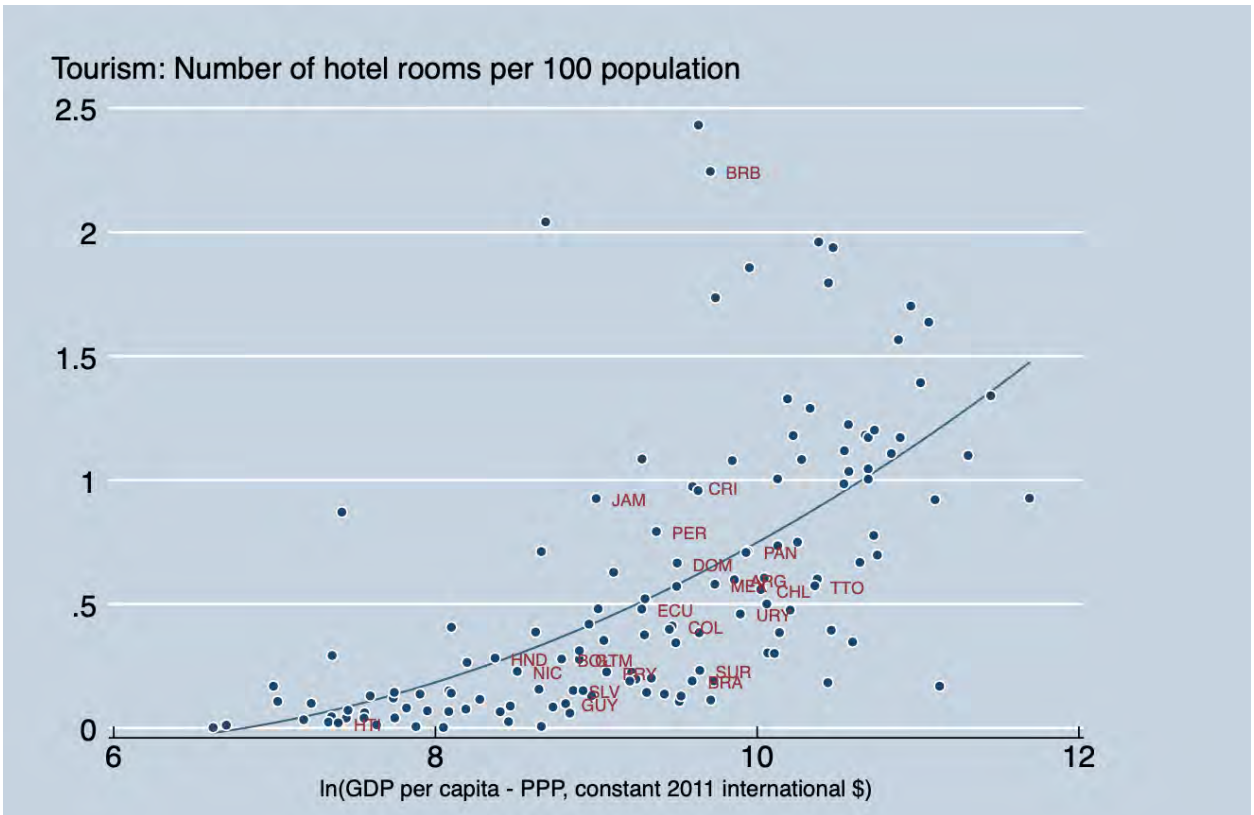

Agric.: Credit to agric. over total credit (over GDP agric./total GDP), in log
8
6
4
2
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
URY
BLZ
ARG
BOL
NIC
PER
ECU
GUY
DOM
MEX
JAM
SUR
TTO
BRA
BRB

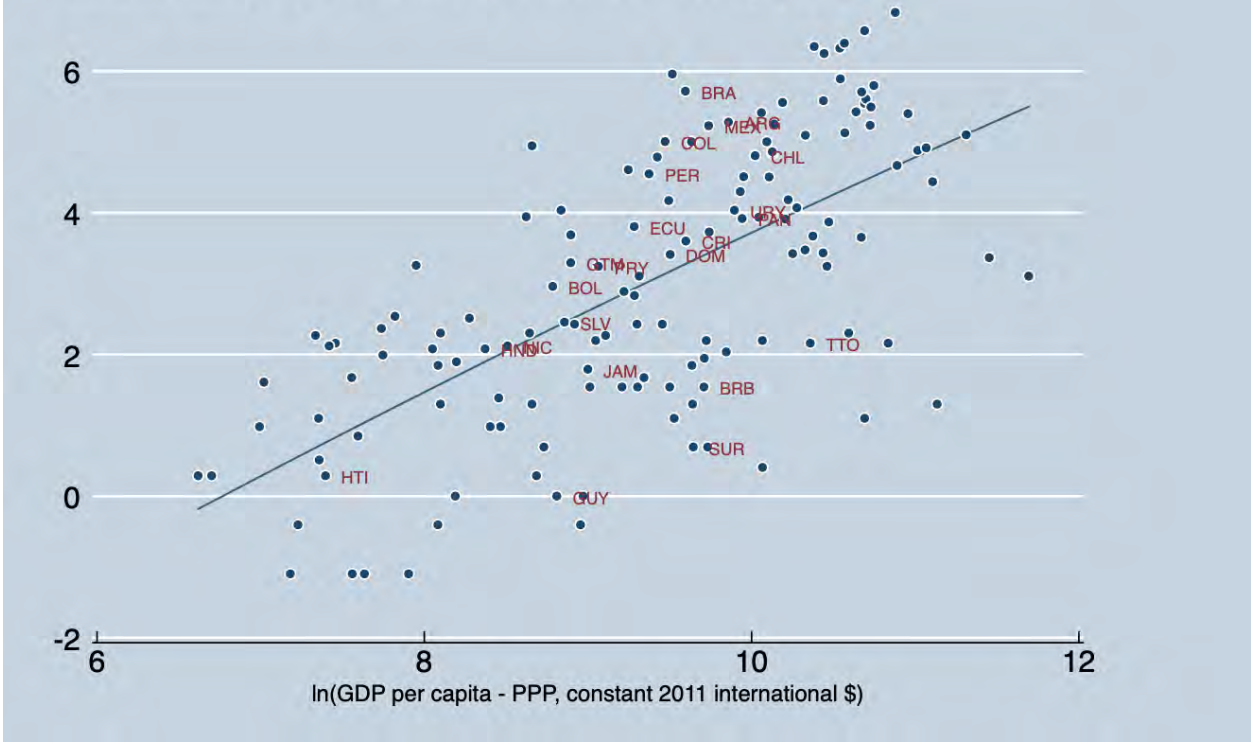

Manuf: ATLAS index of economic complexity
2
1
0
-1
-2
7
8
9
10
11
12
ln(GDP per capita - PPP, constant 2011 international $)
MEX
CRI
BRA
URY
SLV
COL
TTO
ARG
CHL
JAM
DOM
GTM
PRY
HND
PER
NIC
BOL
ECU

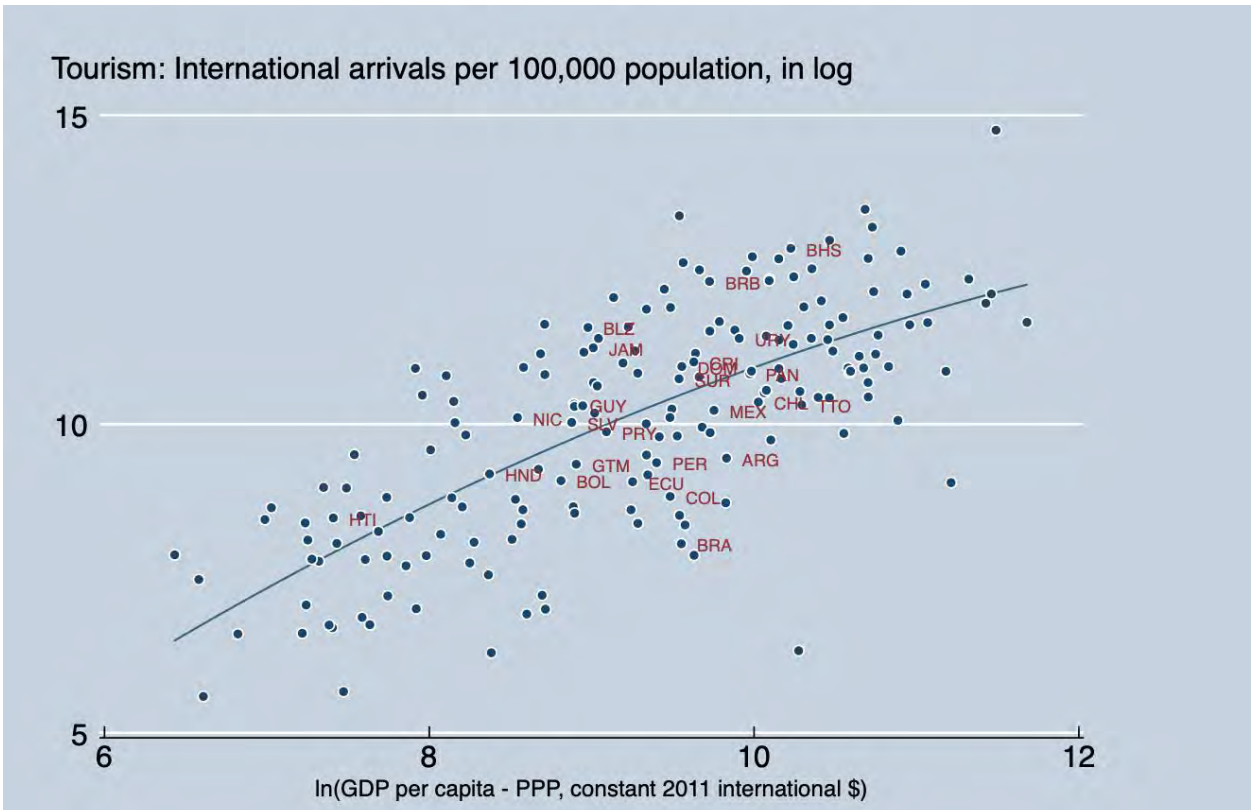

Manuf: High-technology exports (% of manufactured exports), in log
8
6
4
2
0
-2
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BLZ
CRI
PRY
COL
PER
DOM
NIC
HND
BOL
ECU
GTM
HTI

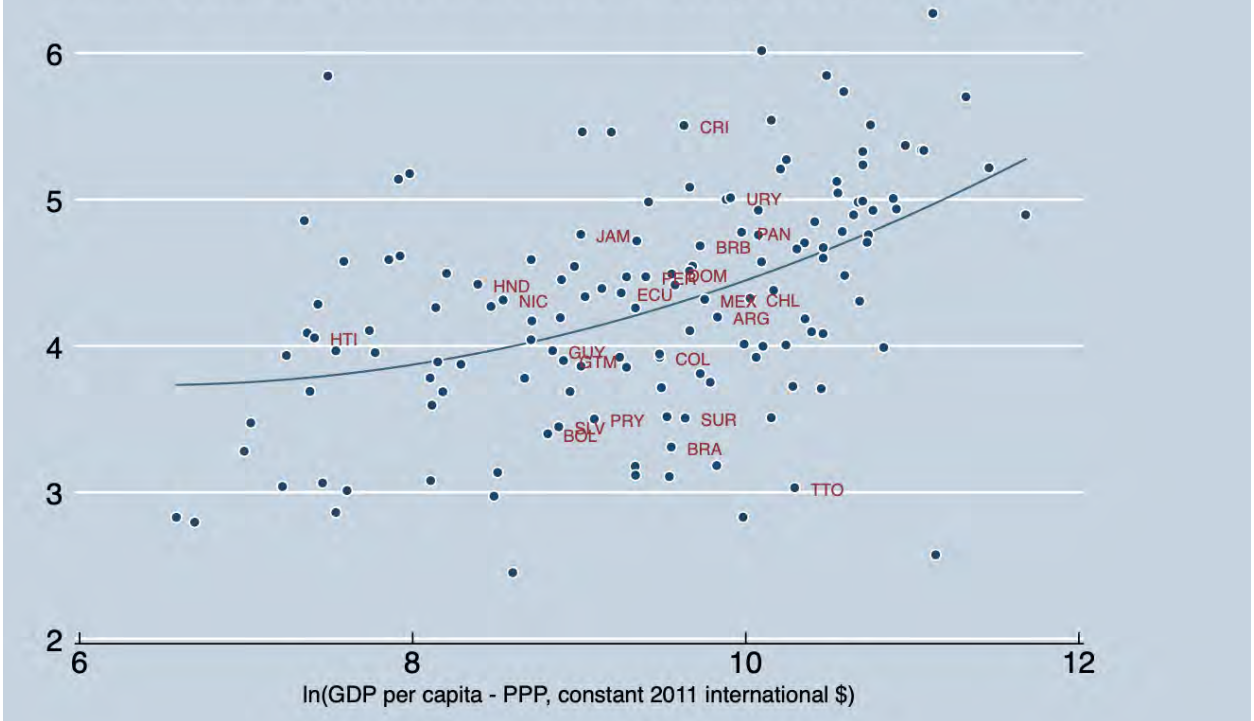

Manuf.: Number of export products, SITC 3-digit level (261 max.)
250
200
150
100
50
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
GTM
HND
CRI
SLV
ECU
NIC
URY
TTO
PRY
BOL
JAM
BRB
BLZ
SUR
GUY
HTI
BHS
CHL
PAN

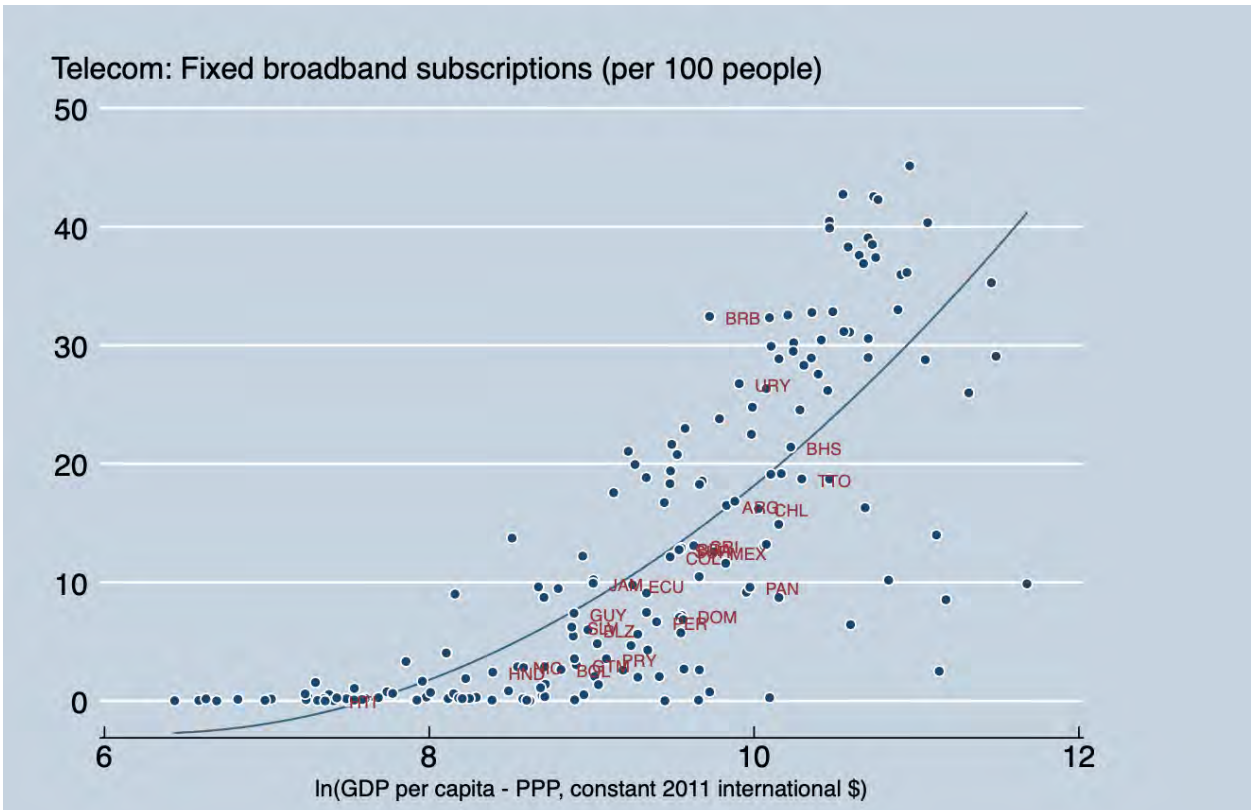

Manuf: Research and development expenditure (% of GDP)
3
2
1
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BRA
ARG
MEX
ECU
CHL
URY
COL
PER
PAN
TTO
HND

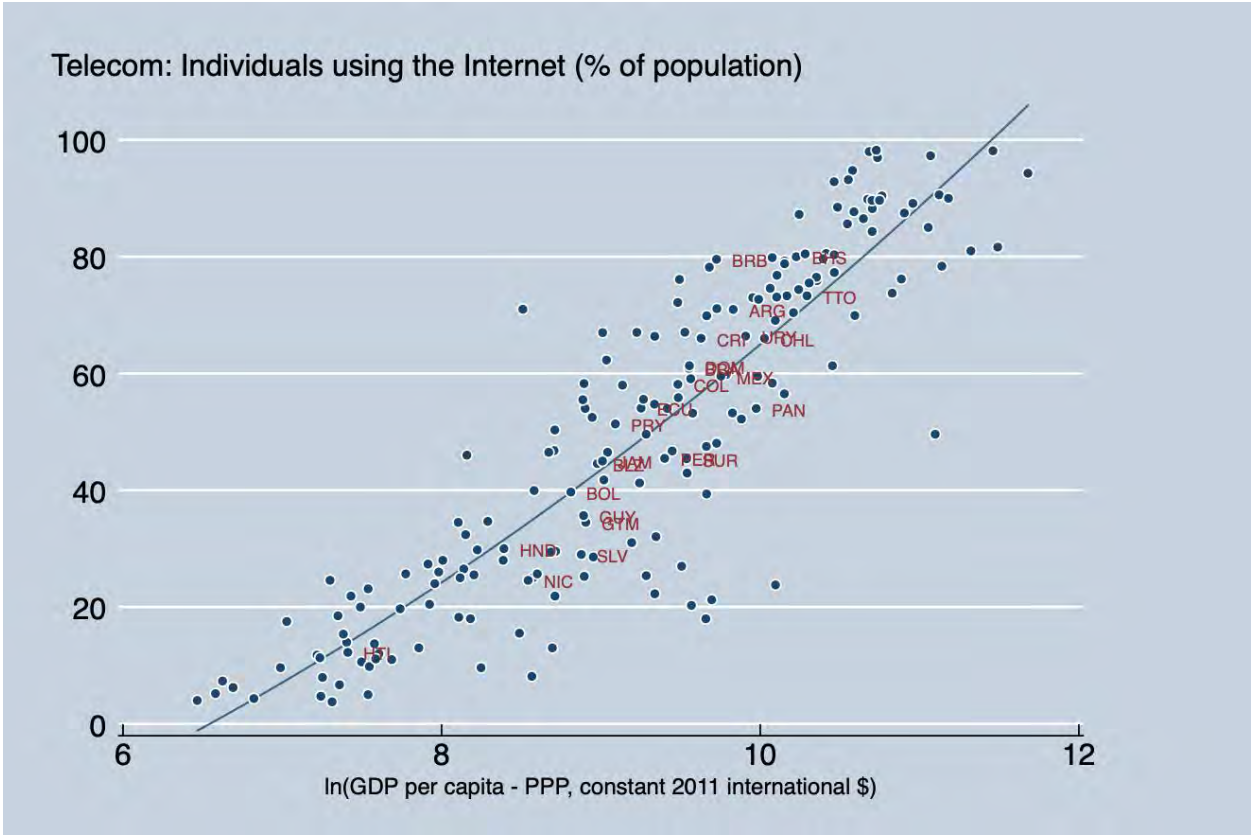

Tourism: Number of hotel rooms per 100 population
2.5
2
1.5
1
.5
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BRB
CRI
JAM
PER
DOM
PAN
MEX
ARG
CHL
TTO
ECU
URY
COL
HND
NIC
PRY
SUR
BRA
SLV
GUY
HTI

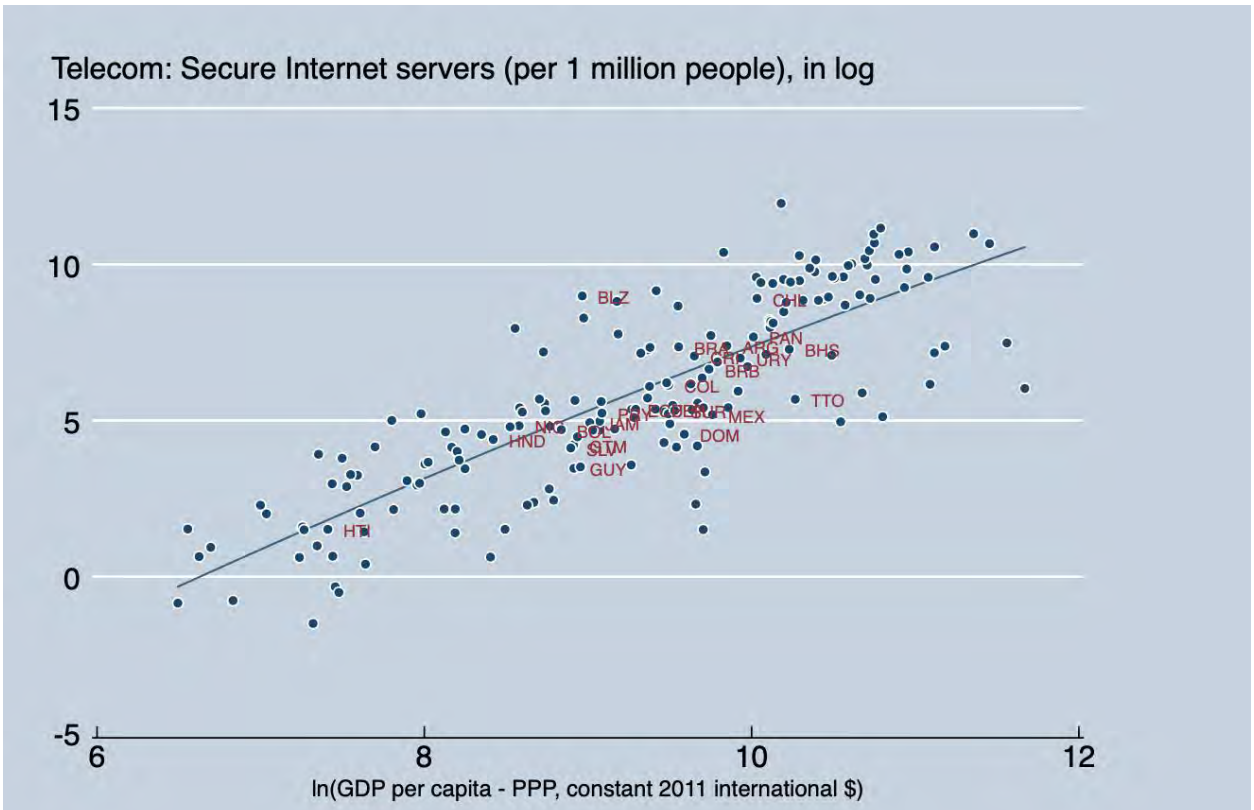

Tourism: Number of international association meetings, in log
6
4
2
0
-2
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BRA
MEX
ARG
COL
CHL
PER
URY
PAN
ECU
CRI
DOM
GTM
PRY
BOL
SLV
HND
NIC
TTO
JAM
BRB
SUR
HTI
GUY

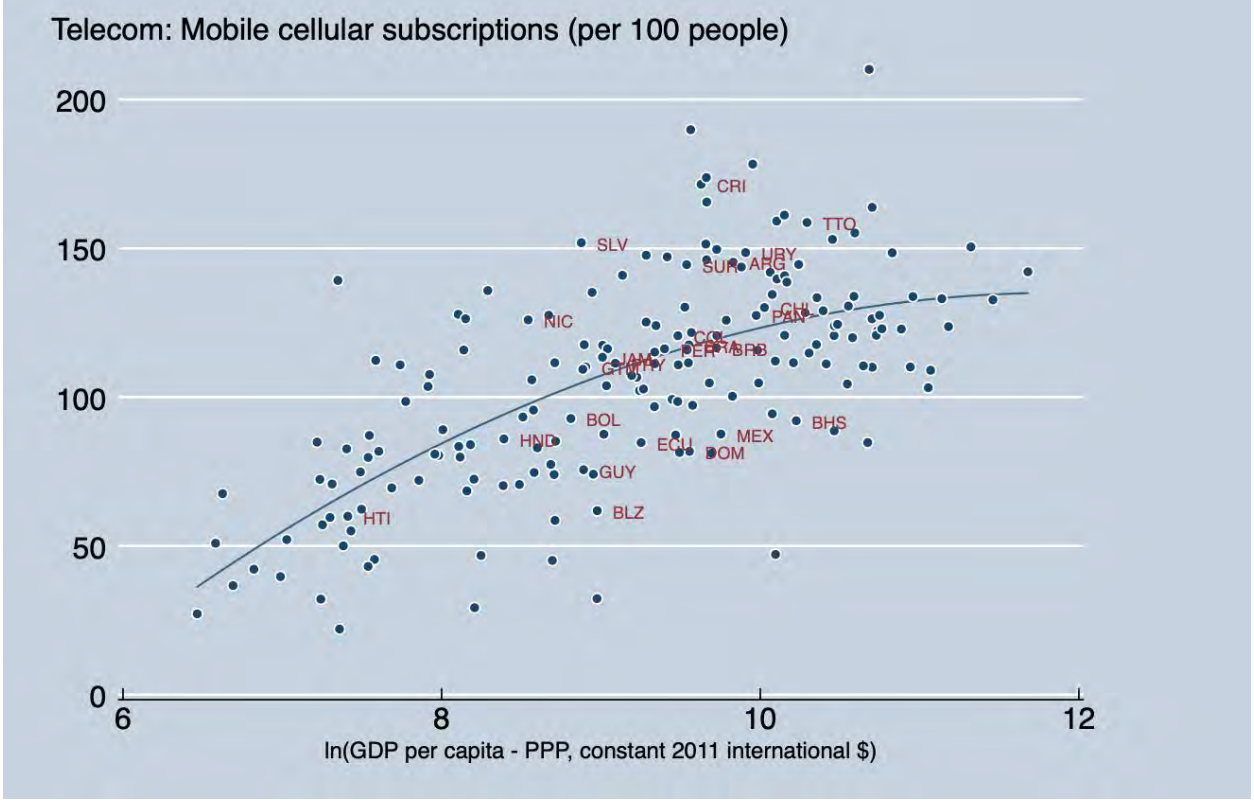

Tourism: International arrivals per 100,000 population, in log
15
10
5
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BHS
BRB
BLZ
JAM
URY
DOM
SUR
PAN
GUY
NIC
SLV
MEX
CHL
TTO
PRY
ARG
HND
GTM
PER
BOL
ECU
COL
HTI
BRA

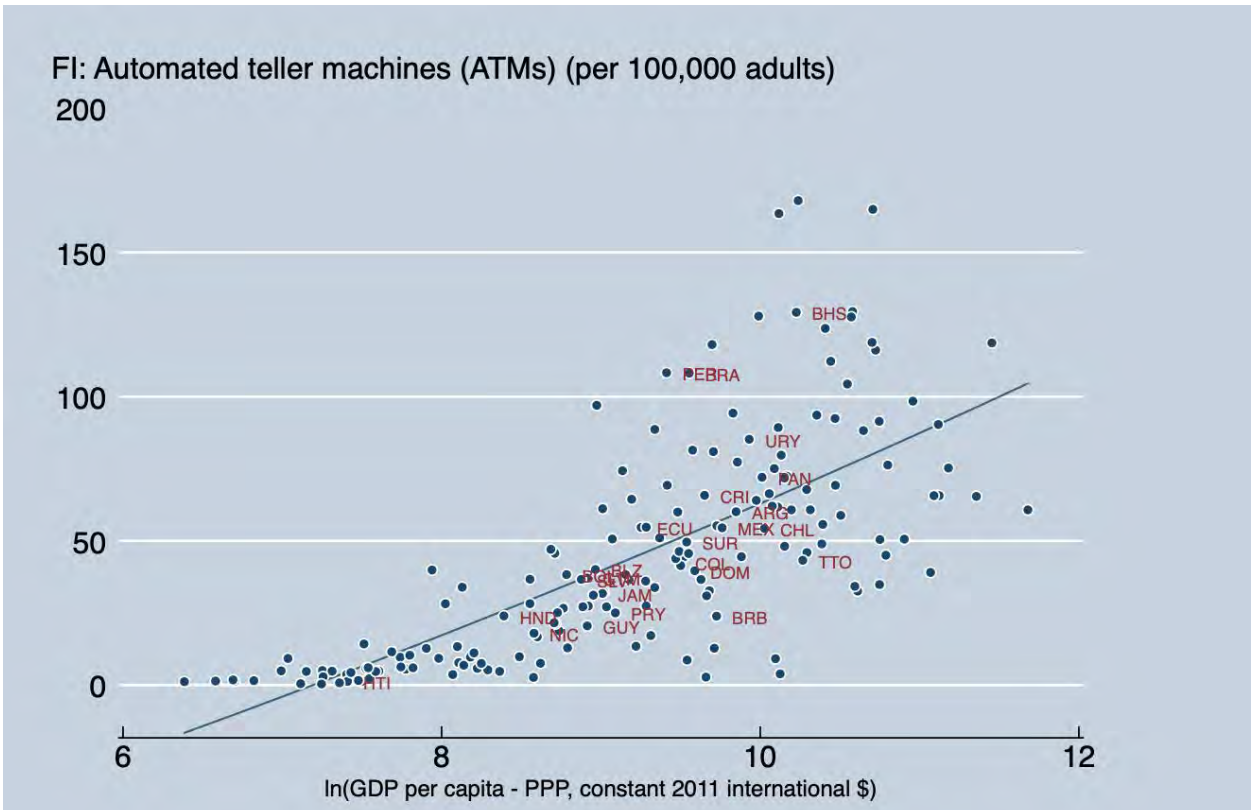

Tourism: Sustainability of travel and tourism industry development, WEF Survey
6
5
4
3
2
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CRI
URY
JAM
PAN
BRB
DOM
HND
NIC
ECU
MEX
CHL
ARG
HTI
GUY
GTM
COL
PRY
SUR
SLV
BOL
BRA
TTO

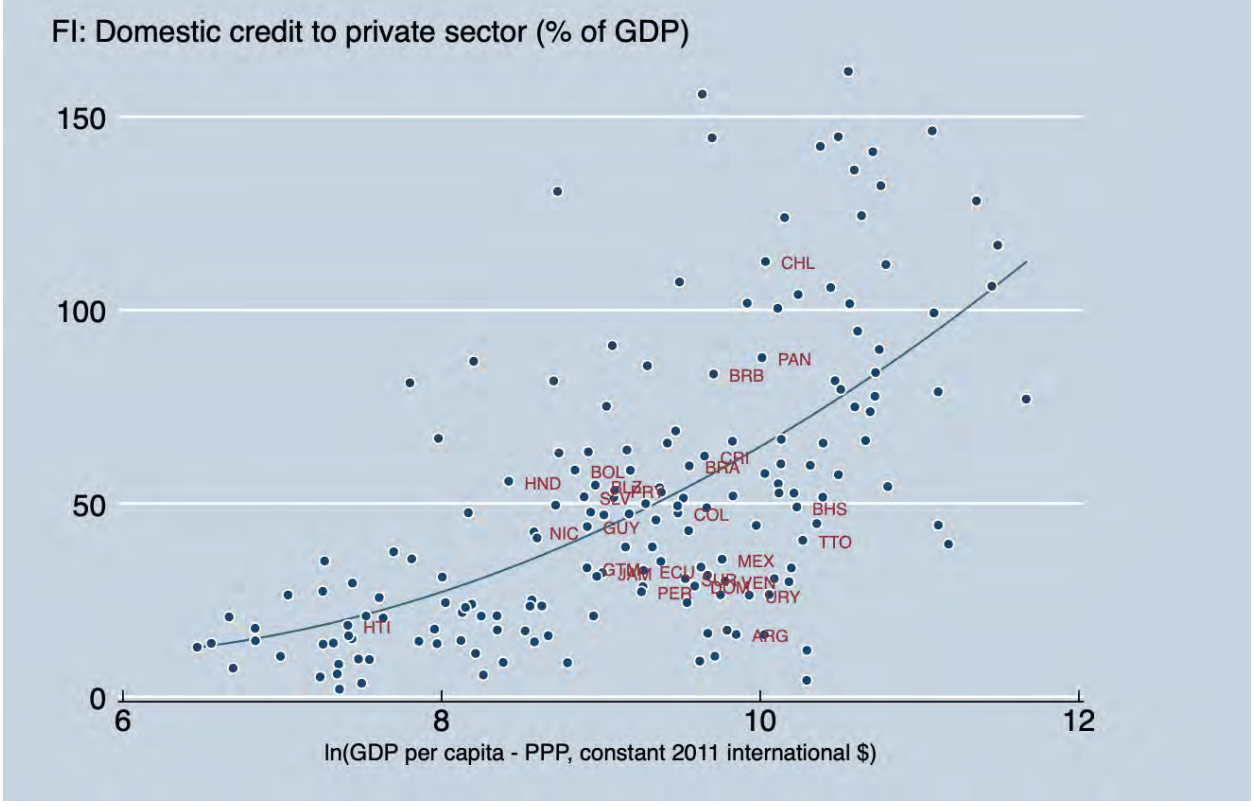

Telecom: Fixed broadband subscriptions (per 100 people)
50
40
30
20
10
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BRB
URY
BHS
TTO
ARG
CHL
MEX
COL
ECU
PAN
JAM
GUY
BLZ
DOM
PRY
HND
NIC
BOL
HTI

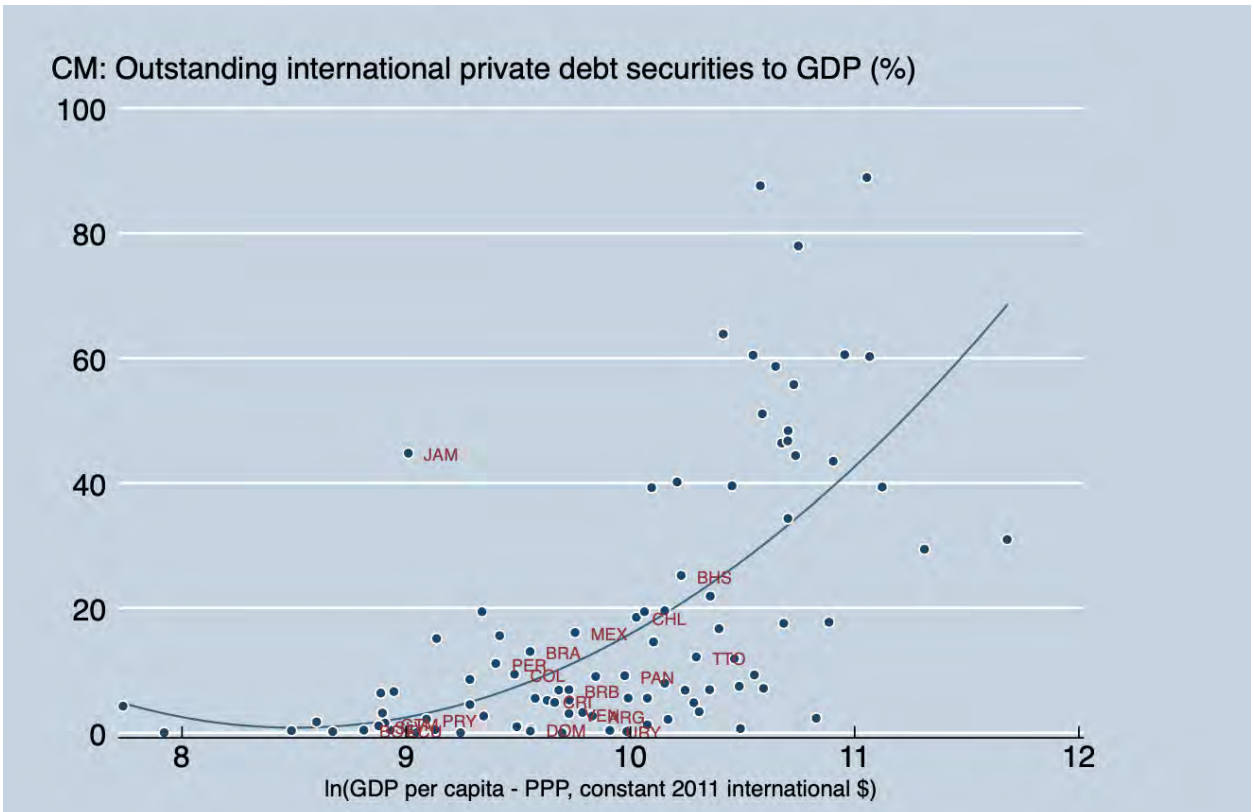

Telecom: Individuals using the Internet (% of population)
100
80
60
40
20
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BRB
BHS
TTO
ARG
CRI
URY
CHL
MEX
COL
ECU
PAN
PRY
PER
BOL
GUY
SLV
HND
NIC
HTI

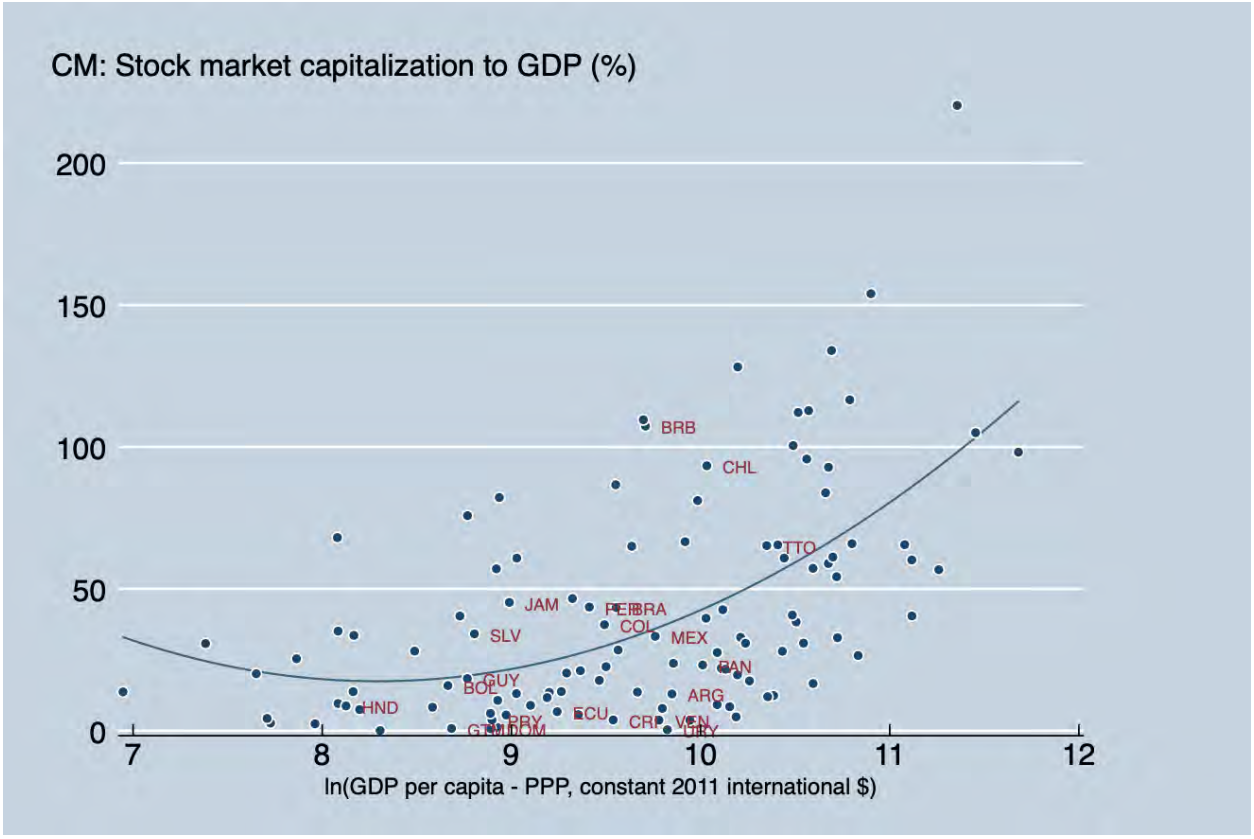

Telecom: Secure Internet servers (per 1 million people), in log
15
10
5
0
-5
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BLZ
CHL
PAN
BHS
URY
BRB
COL
TTO
MEX
DOM
HND
GUY
HTI

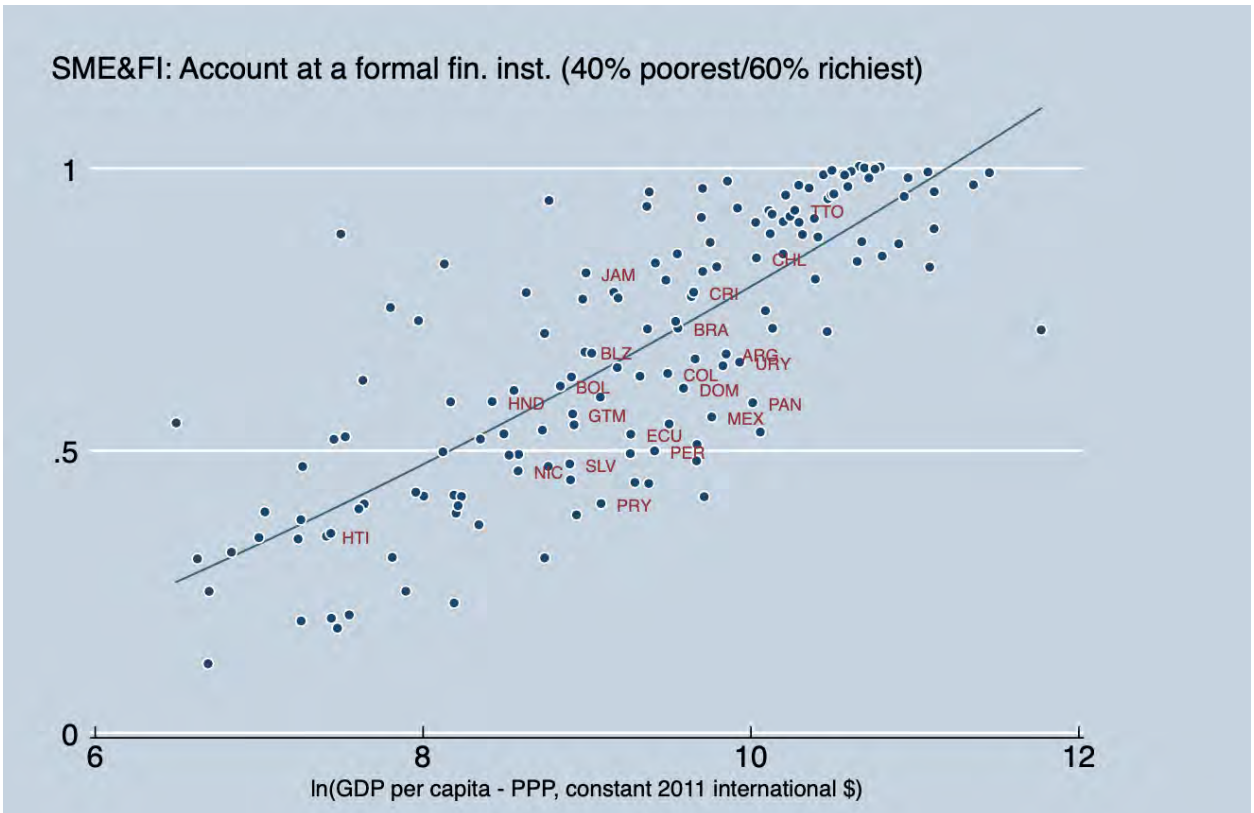

Telecom: Mobile cellular subscriptions (per 100 people)
200
150
100
50
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CRI
TTO
SLV
URY
SUR
ARG
CHL
PAN
NIC
BRB
BOL
BHS
HND
ECU
MEX
DOM
GUY
BLZ
HTI

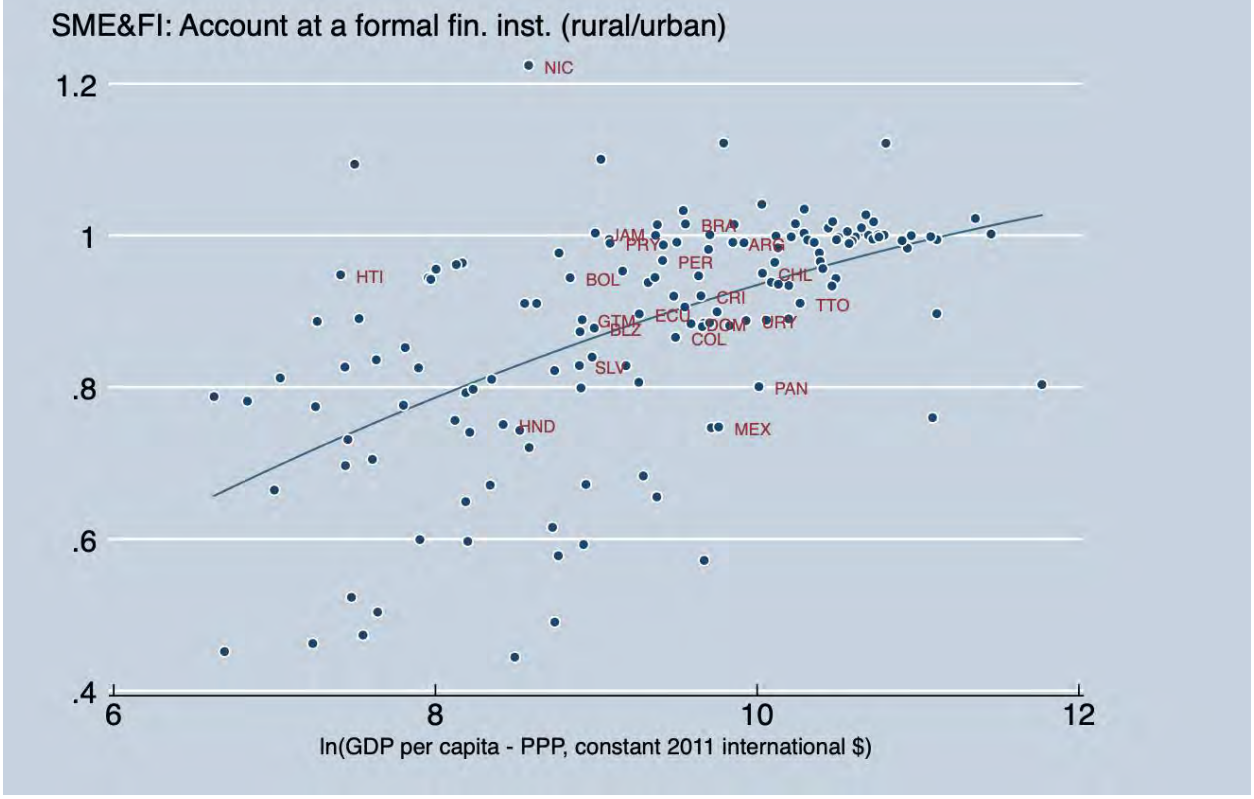

FI: Automated teller machines (ATMs) (per 100,000 adults)
200
150
100
50
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BHS
PEBRA
URY
PAN
CRI
ARG
ECU
MEX
CHL
SUR
COL
TTO
DOM
JAM
PRY
BRB
HND
GUY
NIC
HTI

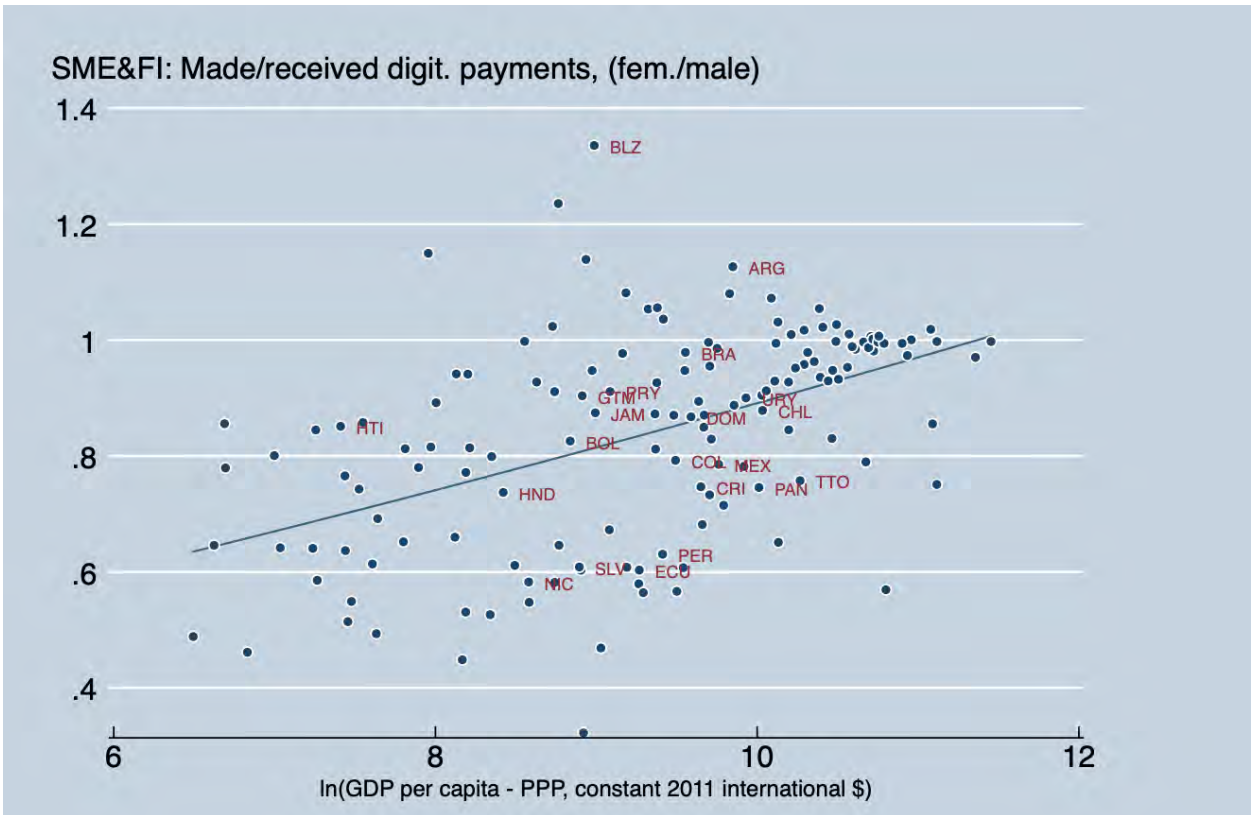

FI: Domestic credit to private sector (% of GDP)
150
100
50
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CHL
PAN
BRB
CRI
BRA
HND
BOL
COL
BHS
TTO
NIC
GUY
MEX
ECU
PER
URY
HTI
ARG

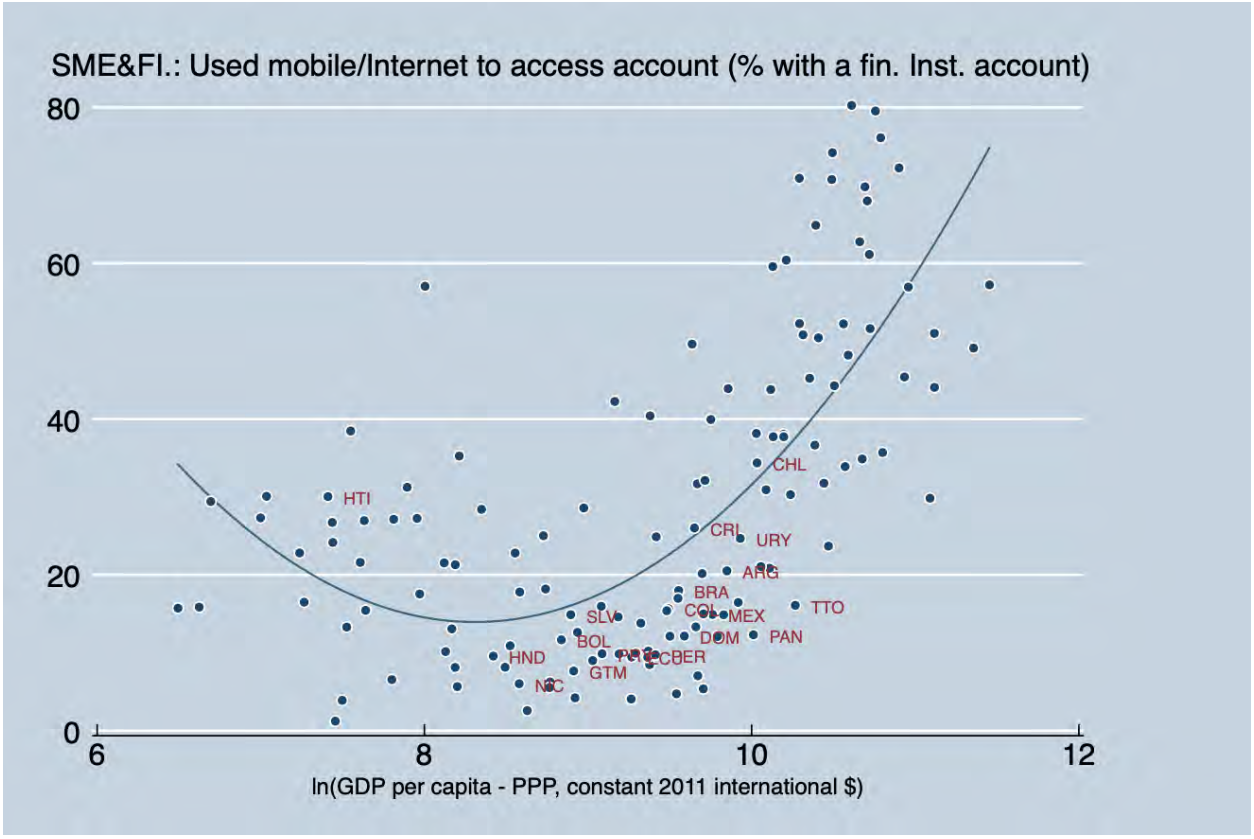

CM: Outstanding international private debt securities to GDP (%)
100
80
60
40
20
0
8
9
10
11
12
ln(GDP per capita - PPP, constant 2011 international $)
JAM
BHS
CHL
MEX
BRA
PER
COL
TTO
PAN
BRB
CRI
PRY
DOM
URY

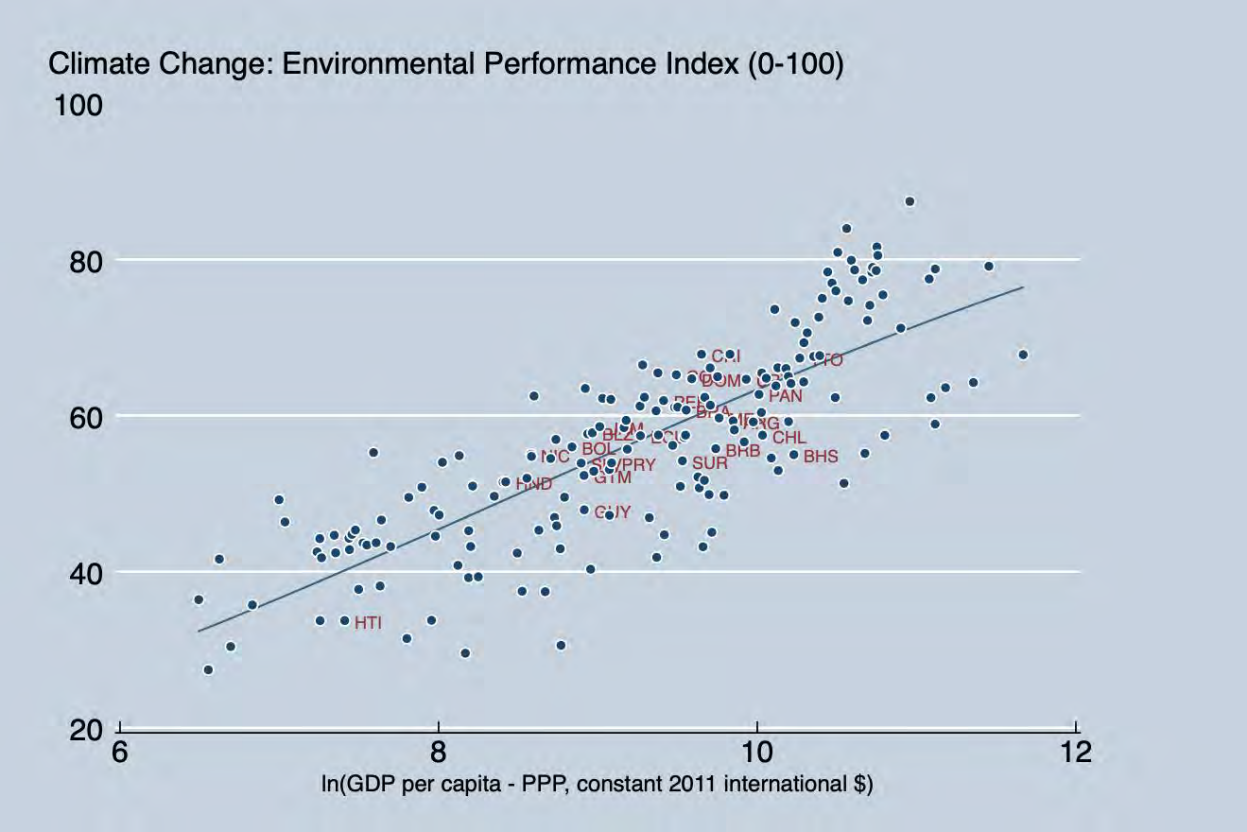

CM: Stock market capitalization to GDP (%)
200
150
100
50
0
7
8
9
10
11
12
ln(GDP per capita - PPP, constant 2011 international $)
BRB
CHL
TTO
JAM
BRA
COL
SLV
MEX
PAN
GUY
BOL
HND
ARG
ECU
CRI
URY

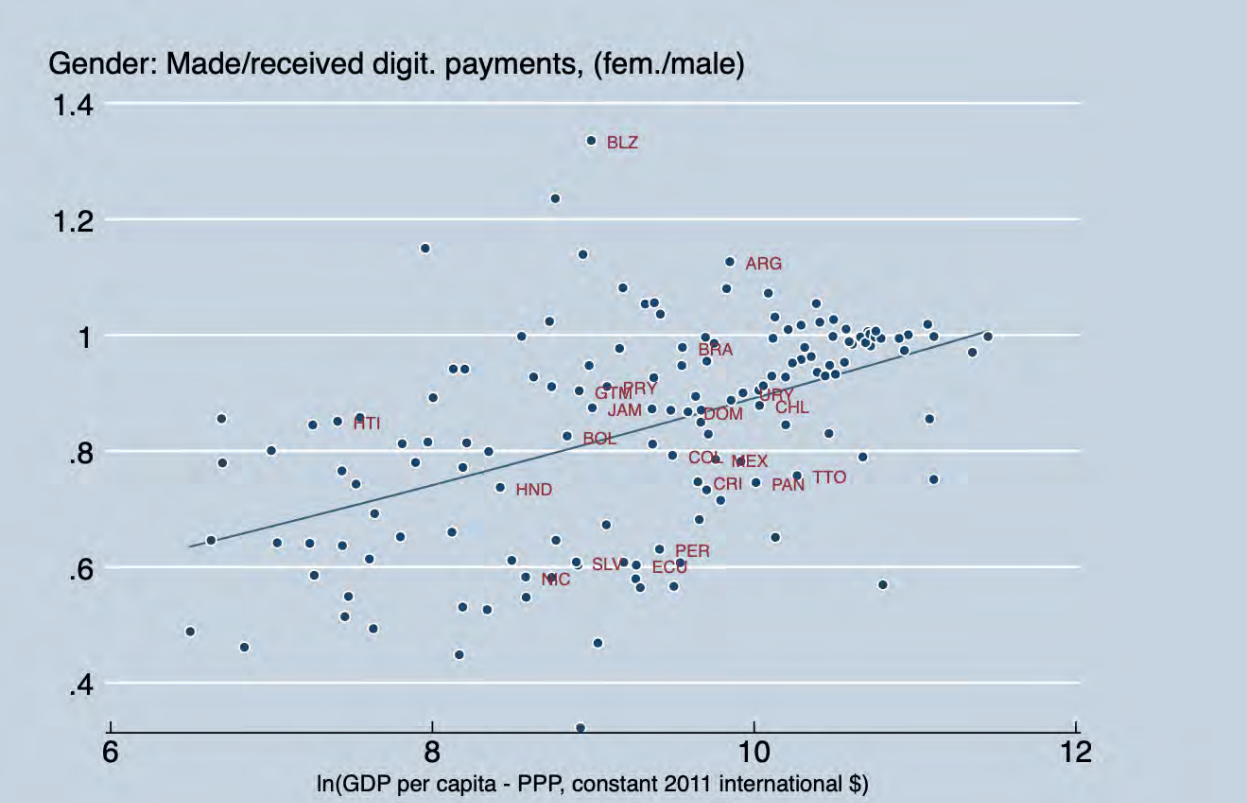

SME&FI: Account at a formal fin. inst. (40% poorest/60% richiest)
1
.5
0
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
TTO
CHL
JAM
CRI
BRA
BLZ
ARG
URY
COL
DOM
BOL
HND
PAN
GTM
MEX
ECU
PER
NIC
SLV
PRY
HTI

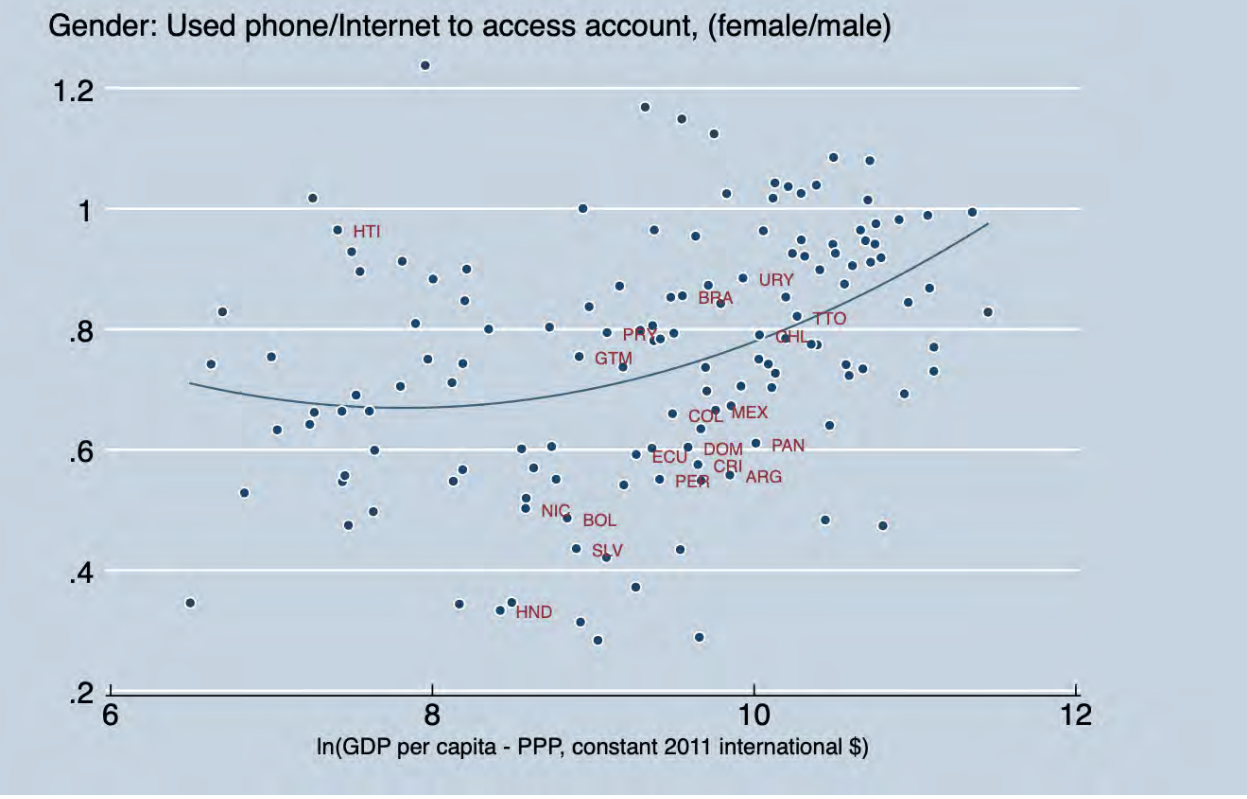

SME&FI: Account at a formal fin. inst. (rural/urban)
1.2
1
.8
.6
.4
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
NIC
BRA
JAM
PRY
ARG
PER
HTI
BOL
CHL
CRI
TTO
ECU
GTM
DOM
URY
BLZ
COL
SLV
PAN
HND
MEX

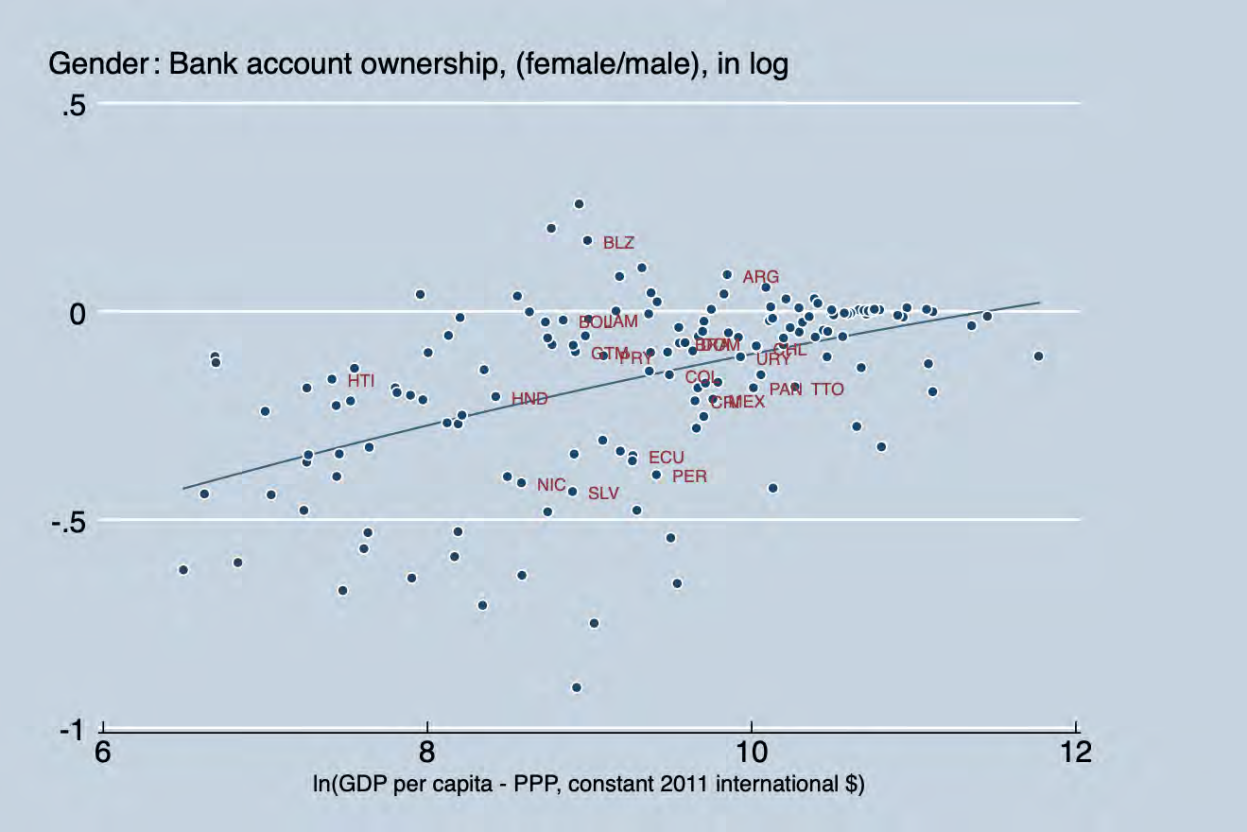

SME&FI: Made/received digit. payments, (fem./male)
1.4
1.2
1
.8
.6
.4
BLZ
ARG
BRA
GTM
JAM
DOM
CHL
HTI
BOL
COL
MEX
HND
CRI
PAN
TTO
PER
SLV
ECU
NIC
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)

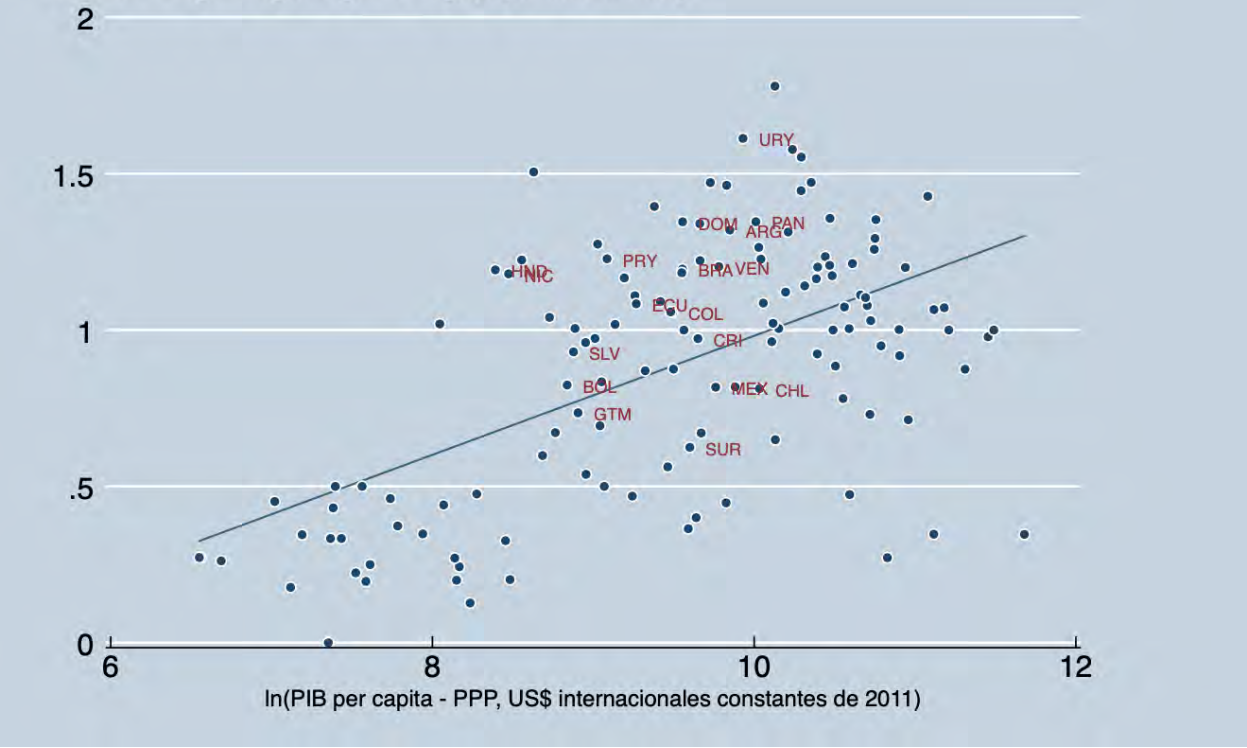

SME&FI.: Used mobile/Internet to access account (% with a fin. Inst. account)
80
60
40
20
0
CHL
HTI
CRI
URY
ARG
BRA
COL
MEX
TTO
SLV
BOL
DOM
PAN
HND
GTM
NIC
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)

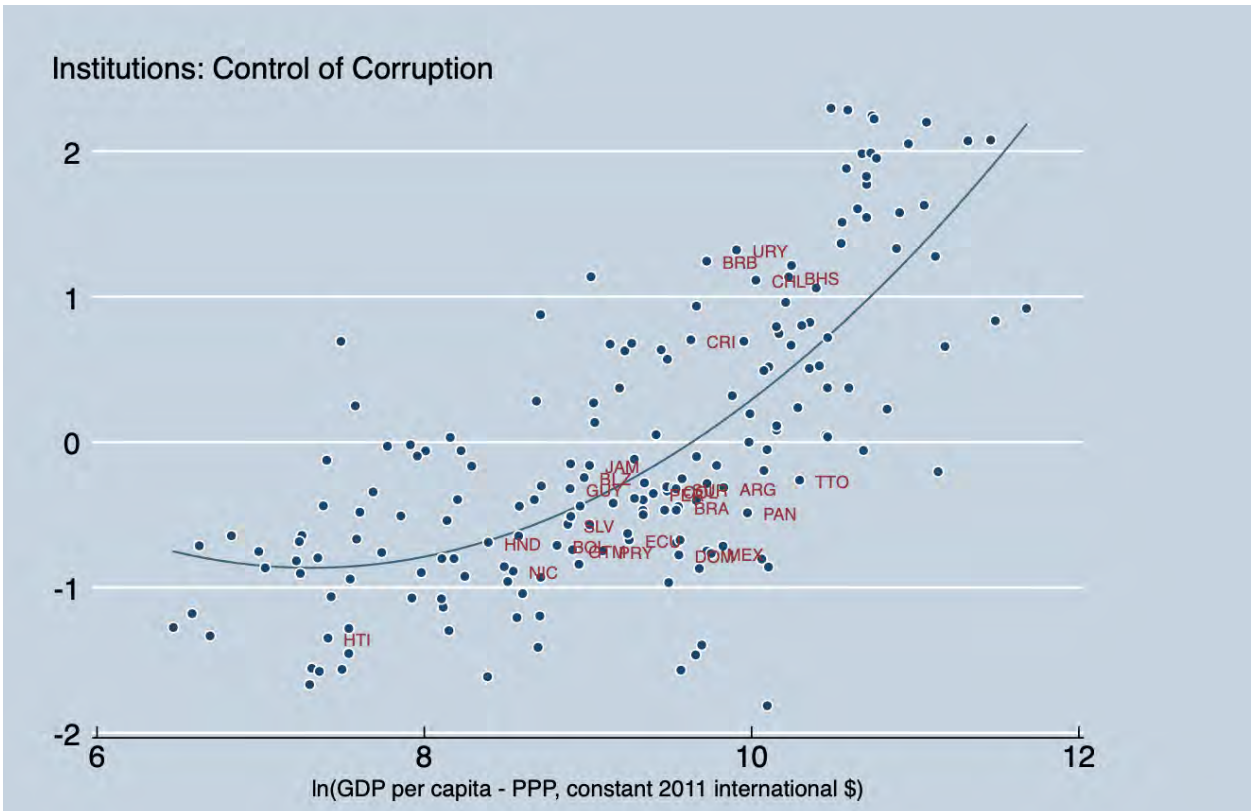

Climate Change: Environmental Performance Index (0-100)
100
80
60
40
20
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
PAN
CHL
BHS
BHB
SUR
BOL
GTM
HTI

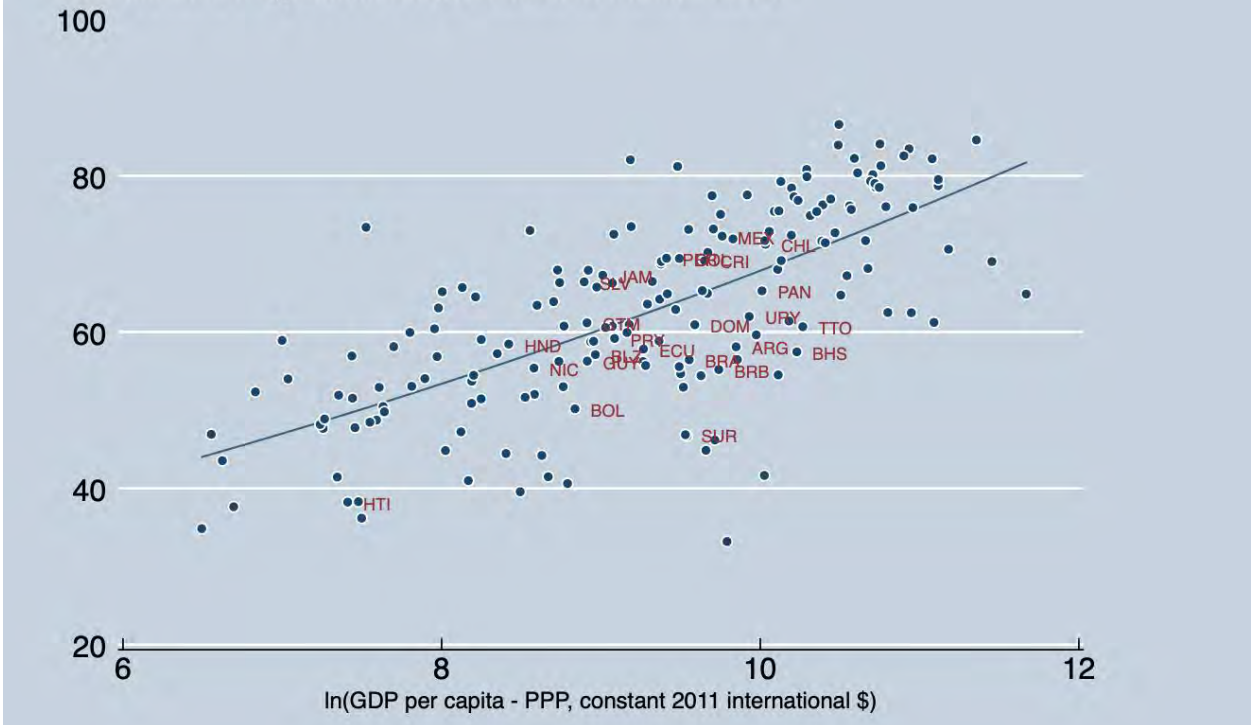

Gender: Made/received digit. payments, (fem./male)
1.4
1.2
1
.8
.6
.4
BLZ
ARG
BRA
URY
GTM
JAM
DOM
CHL
HTI
BOL
COL
MEX
CRI
PAN
TTO
HND
PER
SLV
ECU
NIC
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)

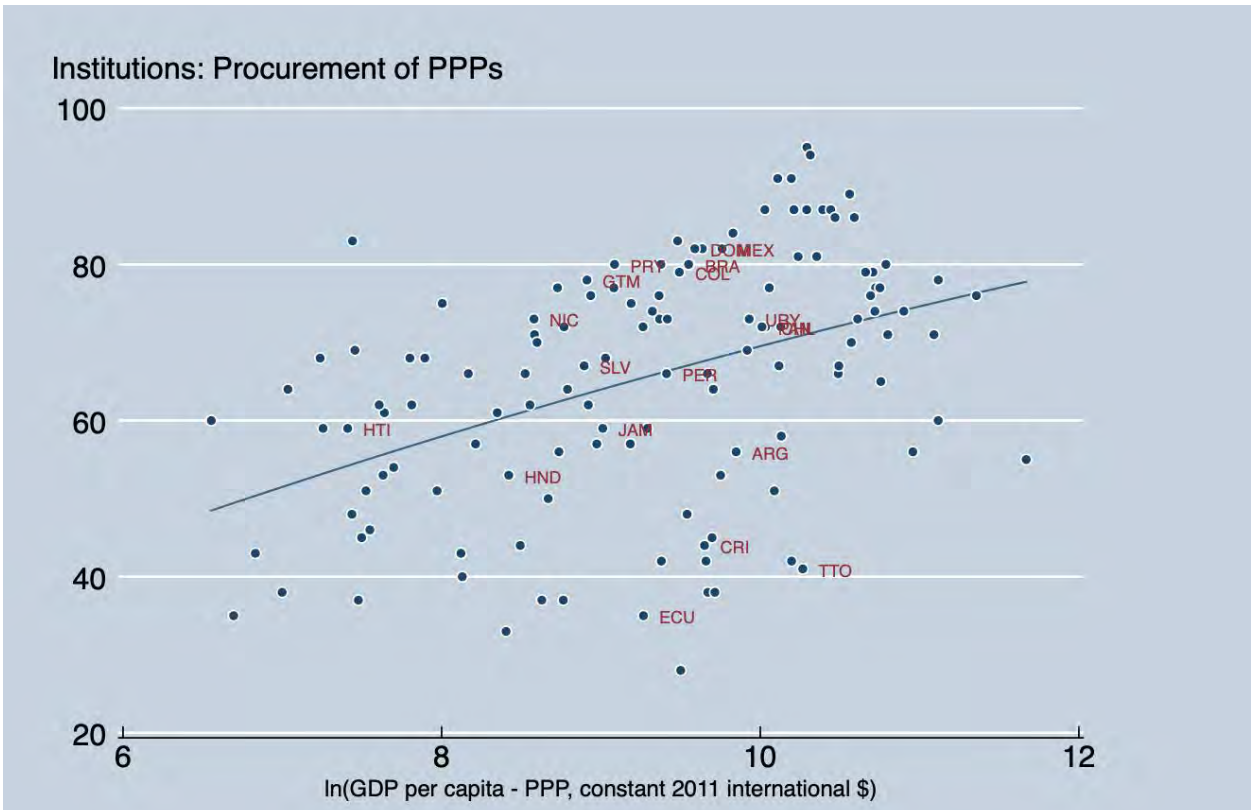

Gender: Used phone/Internet to access account, (female/male)
1.2
1
.8
.6
.4
.2
HTI
URY
BRA
TTO
PRY
CHL
GTM
COL
MEX
DOM
PAN
ECU
CRI
ARG
PER
NIC
BOL
SLV
HND
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)

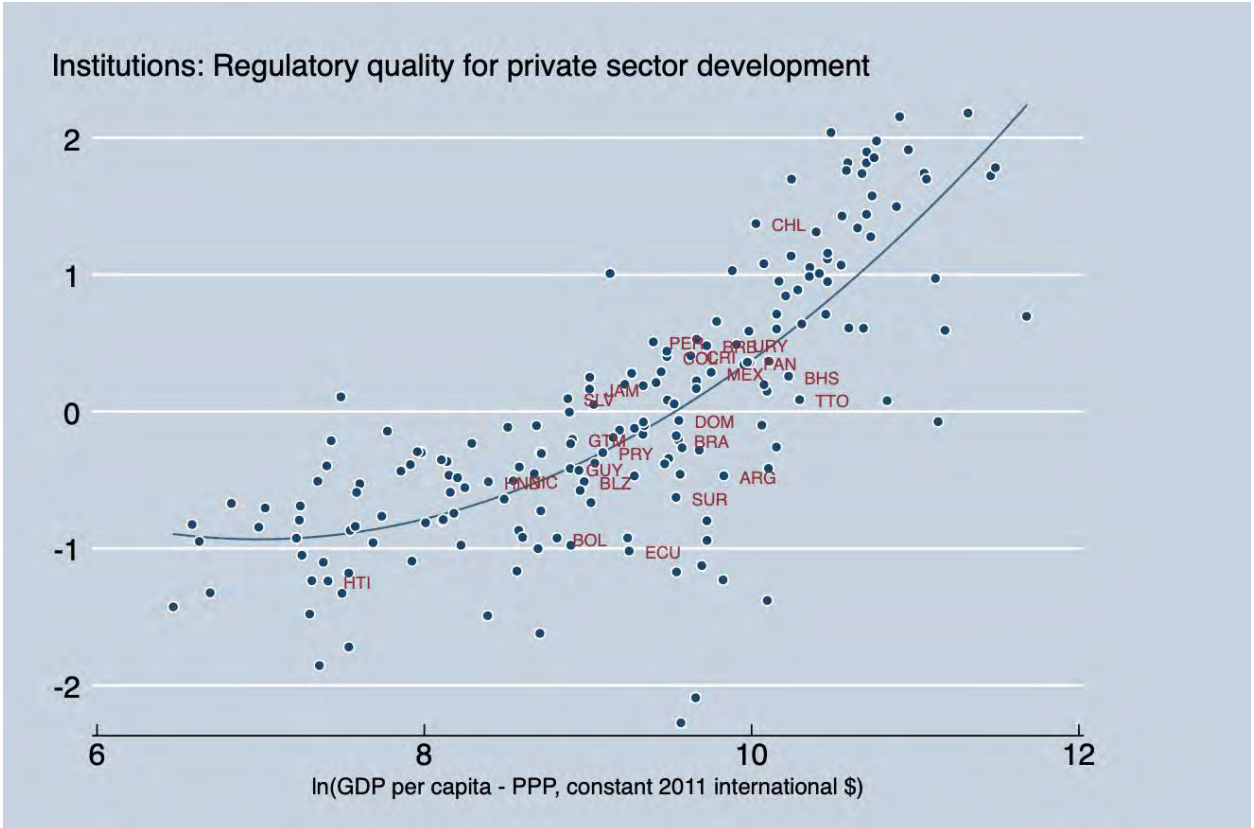

Gender: Bank account ownership, (female/male), in log
.5
0
-.5
-1
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
BLZ
ARG
BOL
GTM
PRY
DOM
CHL
URY
HTI
COL
PAN
TTO
HND
CRI
MEX
ECU
PER
NIC
SLV


Gender: High degree gender gap (female/male)
2
1.5
1
.5
0
6
8
10
12
ln(PIB per capita - PPP, US$ internacionales constantes de 2011)
URY
DOM
PAN
ARG
PRY
HND
NIC
BRA
VEN
ECU
COL
CRI
SLV
BOL
MEX
CHL
GTM
SUR


Institutions: Control of Corruption
2
1
0
-1
-2
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
URY
BRB
CHL
BHS
CRI
JAM
BLZ
GUY
ARG
TTO
BRA
PAN
SLV
HND
ECU
PRY
DOM
MEX
NIC
HTI

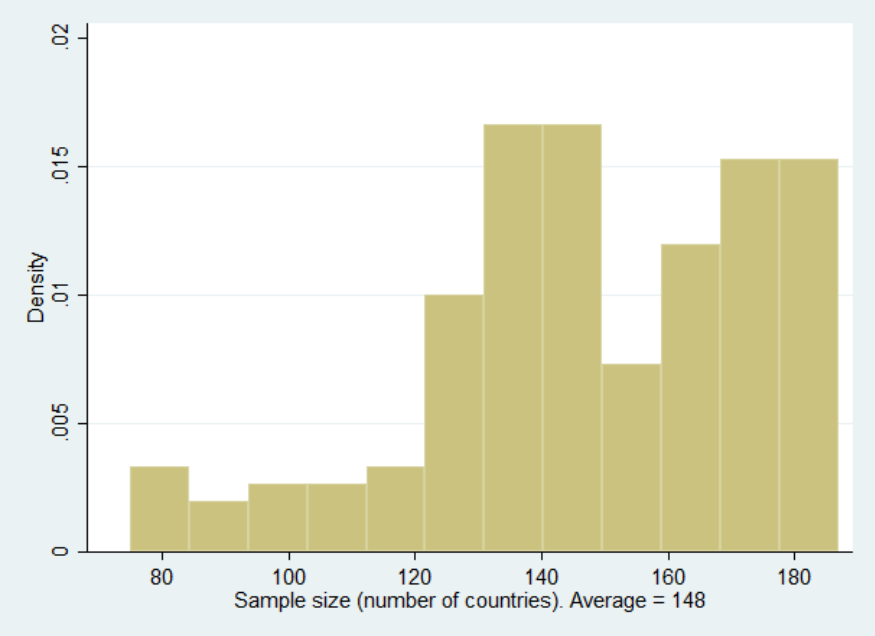

Institutions: Doing Bussiness, distance to frontier score
100
80
60
40
20
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
MEX
CHL
CRI
JAM
SLV
PAN
URY
TTO
DOM
GTM
PRY
HND
ECU
ARG
BHS
BRA
BRB
NIC
GUY
BOL
SUR
HTI


Institutions: Procurement of PPPs
100
80
60
40
20
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
DOM
MEX
PRY
BRA
GTM
COL
NIC
URY
SLV
PER
HTI
JAM
ARG
HND
CRI
TTO
ECU

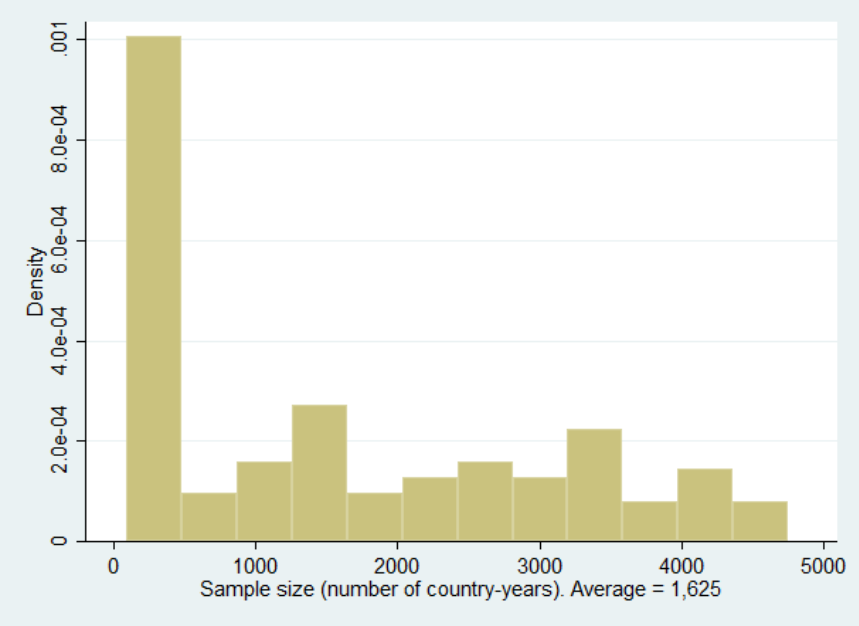

Institutions: Regulatory quality for private sector development
2
1
0
-1
-2
6
8
10
12
ln(GDP per capita - PPP, constant 2011 international $)
CHL
PER
URY
CRI
PAN
MEX
BHS
JAM
SLV
TTO
DOM
GTM
BRA
PRY
GUY
ARG
BLZ
SUR
BOL
ECU
HTI

Appendix 4: Sample sizes, cross section versus panel data (density histograms)

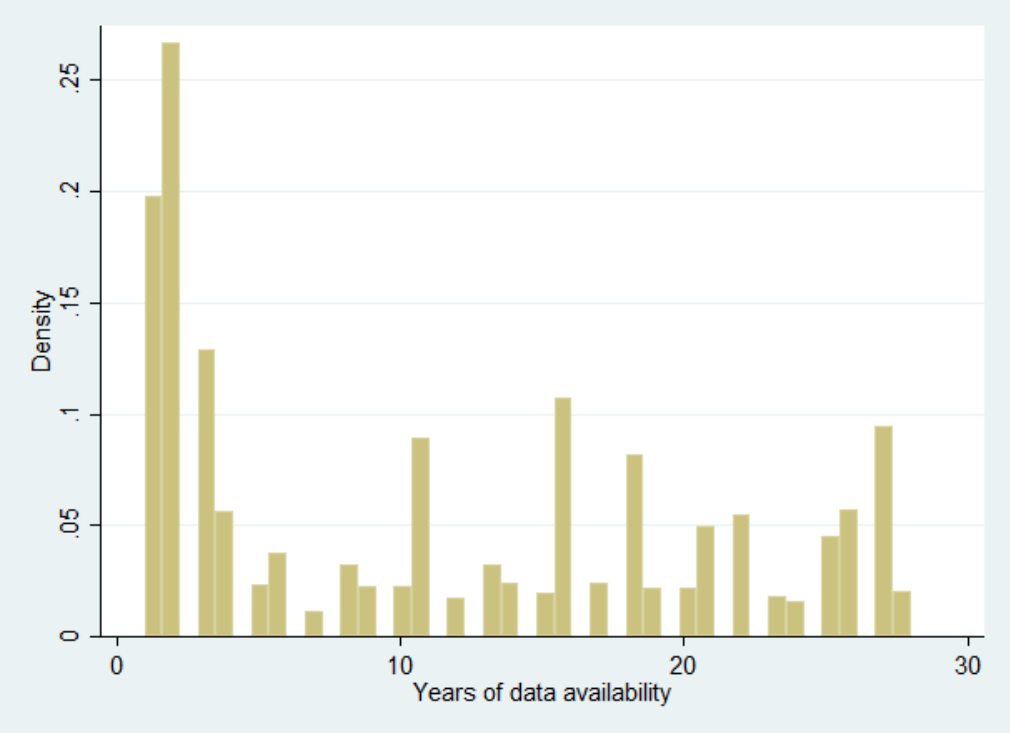
a. Sample size, cross section (using the latest year available)



b. Sample size, panel data (all available years for each estimate)



Appendix 5: Number of available years for all indicators (density histogram)



Appendix 6: Missing values[26]

Country Name	Missing values	Percent of total missings in LAC	Percent of own countries' development gaps
Venezuela, RB	114	22.5	70.8
Bahamas, The	75	14.8	46.6
Haiti	48	9.5	29.8
Barbados	47	9.3	29.2
Guyana	43	8.5	26.7
Suriname	43	8.5	26.7
Belize	40	7.9	24.8
Trinidad and Tobago	14	2.8	8.7
Bolivia	11	2.2	6.8
Nicaragua	11	2.2	6.8
Jamaica	10	2.0	6.2
Honduras	9	1.8	5.6
Guatemala	7	1.4	4.3
Dominican Republic	6	1.2	3.7
Ecuador	6	1.2	3.7
El Salvador	6	1.2	3.7
Paraguay	5	1.0	3.1
Peru	3	0.6	1.9
Colombia	2	0.4	1.2
Panama	2	0.4	1.2
Uruguay	2	0.4	1.2
Chile	1	0.2	0.6
Costa Rica	1	0.2	0.6
Argentina	0	0.0	0.0
Brazil	0	0.0	0.0
Mexico	0	0.0	0.0
Total	**506**	**100**	**12.1***

(*): Average

[26] Note that for the case of Venezuela, currently there is only per-capita GDP information until 2014. Therefore, Venezuelan indicators that only have data for 2015 onwards would not have an estimated gap, given that the method only takes information of indicators and per-capita GDP for the same year (for each country).

Appendix 7: Income clusters for missing values' imputations (for regional comparison exercise)[27]

Country	Country Code	Per-capita GDP (1)	Year for (1)	World Bank Classfication	Cluster
Chile	**CHL**	**22,767**	**2017**	**High income: OECD**	**1**
Greece	GRC	24,574	2017	High income: OECD	1
Poland	POL	27,216	2017	High income: OECD	1
Portugal	PRT	27,937	2017	High income: OECD	1
Estonia	EST	29,481	2017	High income: OECD	1
Slovak Republic	SVK	30,155	2017	High income: OECD	1
Slovenia	SVN	31,401	2017	High income: OECD	1
Czech Republic	CZE	32,606	2017	High income: OECD	1
Israel	ISR	33,132	2017	High income: OECD	2
Spain	ESP	34,272	2017	High income: OECD	2
Italy	ITA	35,220	2017	High income: OECD	2
Korea, Rep.	KOR	35,938	2017	High income: OECD	2
New Zealand	NZL	36,086	2017	High income: OECD	2
France	FRA	38,606	2017	High income: OECD	2
Japan	JPN	39,002	2017	High income: OECD	2
United Kingdom	GBR	39,753	2017	High income: OECD	2
Finland	FIN	40,586	2017	High income: OECD	3
Belgium	BEL	42,659	2017	High income: OECD	3
Canada	CAN	44,018	2017	High income: OECD	3
Australia	AUS	44,649	2017	High income: OECD	3
Germany	DEU	45,229	2017	High income: OECD	3
Austria	AUT	45,437	2017	High income: OECD	3
Iceland	ISL	46,483	2017	High income: OECD	3
Denmark	DNK	46,683	2017	High income: OECD	3
Sweden	SWE	46,949	2017	High income: OECD	4
Netherlands	NLD	48,473	2017	High income: OECD	4
United States	USA	54,225	2017	High income: OECD	4
Switzerland	CHE	57,410	2017	High income: OECD	4
Norway	NOR	64,800	2017	High income: OECD	4
Ireland	IRL	67,335	2017	High income: OECD	4
Luxembourg	LUX	94,278	2017	High income: OECD	4
Barbados	**BRB**	**16,978**	**2017**	**High income: nonOECD**	**5**
Uruguay	**URY**	**20,551**	**2017**	**High income: nonOECD**	**5**
Antigua and Barbuda	ATG	21,491	2017	High income: nonOECD	5
Equatorial Guinea	GNQ	22,605	2017	High income: nonOECD	5
Croatia	HRV	22,670	2017	High income: nonOECD	5
St. Kitts and Nevis	KNA	24,654	2017	High income: nonOECD	5
Russian Federation	RUS	24,766	2017	High income: nonOECD	5
Latvia	LVA	25,064	2017	High income: nonOECD	5
Bahamas, The	**BHS**	**27,718**	**2017**	**High income: nonOECD**	**6**
Trinidad and Tobago	**TTO**	**28,763**	**2017**	**High income: nonOECD**	**6**
Lithuania	LTU	29,524	2017	High income: nonOECD	6
Cyprus	CYP	32,415	2017	High income: nonOECD	6
Puerto Rico	PRI	35,045	2016	High income: nonOECD	6
Aruba	ABW	35,974	2011	High income: nonOECD	6
Sint Maarten (Dutch part)	SXM	36,327	2011	High income: nonOECD	6
Malta	MLT	36,513	2017	High income: nonOECD	7
Oman	OMN	37,961	2017	High income: nonOECD	7
Bahrain	BHR	43,291	2017	High income: nonOECD	7
Saudi Arabia	SAU	49,045	2017	High income: nonOECD	7
Cayman Islands	CYM	49,903	2011	High income: nonOECD	7
Bermuda	BMU	50,669	2013	High income: nonOECD	7
Hong Kong SAR, China	HKG	56,055	2017	High income: nonOECD	7
San Marino	SMR	56,862	2017	High income: nonOECD	8
Kuwait	KWT	65,531	2017	High income: nonOECD	8
United Arab Emirates	ARE	67,294	2017	High income: nonOECD	8
Brunei Darussalam	BRN	71,809	2017	High income: nonOECD	8
Singapore	SGP	85,535	2017	High income: nonOECD	8
Macao SAR, China	MAC	104,862	2017	High income: nonOECD	8
Qatar	QAT	116,936	2017	High income: nonOECD	8

[27] Per capita GDP corresponds to the same variable we used in our main gaps estimates (measured in real-PPP terms). The World Bank income classification corresponds to its 2017 version (most of the indicators are up to 2017).

Appendix 7 (continued): Income clusters for missing values' imputations (for regional comparison exercise)

Country	Country Code	Per-capita GDP (1)	Year for (1)	World Bank Classfication	Cluster
Central African Republic	CAF	661	2017	Low income	9
Burundi	BDI	702	2017	Low income	9
Liberia	LBR	753	2017	Low income	9
Congo, Dem. Rep.	COD	808	2017	Low income	9
Niger	NER	926	2017	Low income	9
Malawi	MWI	1,095	2017	Low income	9
Mozambique	MOZ	1,136	2017	Low income	9
Sierra Leone	SLE	1,390	2017	Low income	9
Comoros	COM	1,414	2017	Low income	9
Madagascar	MDG	1,416	2017	Low income	9
Togo	TGO	1,430	2017	Low income	9
Eritrea	ERI	1,510	2011	Low income	10
Guinea-Bissau	GNB	1,549	2017	Low income	10
Gambia, The	GMB	1,562	2017	Low income	10
Haiti	**HTI**	**1,653**	**2017**	**Low income**	**10**
Uganda	UGA	1,698	2017	Low income	10
Burkina Faso	BFA	1,703	2017	Low income	10
Ethiopia	ETH	1,730	2017	Low income	10
Chad	TCD	1,768	2017	Low income	10
Afghanistan	AFG	1,804	2017	Low income	10
Rwanda	RWA	1,854	2017	Low income	10
Zimbabwe	ZWE	1,900	2017	Low income	10
Mali	MLI	2,014	2017	Low income	11
Benin	BEN	2,064	2017	Low income	11
Guinea	GIN	2,081	2017	Low income	11
Nepal	NPL	2,443	2017	Low income	11
Tanzania	TZA	2,683	2017	Low income	11
Tajikistan	TJK	2,897	2017	Low income	11
Kenya	KEN	2,993	2017	Low income	11
Bangladesh	BGD	3,524	2017	Low income	11
Cambodia	KHM	3,645	2017	Low income	11
Myanmar	MMR	5,592	2017	Low income	11
Yemen, Rep.	YEM	1,479	2016	Lower middle income	12
South Sudan	SSD	1,570	2016	Lower middle income	12
Kiribati	KIR	1,981	2017	Lower middle income	12
Solomon Islands	SLB	2,206	2017	Lower middle income	12
Senegal	SEN	2,471	2017	Lower middle income	12
Djibouti	DJI	2,705	2011	Lower middle income	12
Lesotho	LSO	2,851	2017	Lower middle income	12
Vanuatu	VUT	2,922	2017	Lower middle income	12
Sao Tome and Principe	STP	3,053	2017	Lower middle income	12
Cameroon	CMR	3,365	2017	Lower middle income	13
Kyrgyz Republic	KGZ	3,393	2017	Lower middle income	13
Mauritania	MRT	3,598	2017	Lower middle income	13
Cote d'Ivoire	CIV	3,601	2017	Lower middle income	13
Zambia	ZMB	3,689	2017	Lower middle income	13
Papua New Guinea	PNG	3,823	2017	Lower middle income	13
Ghana	GHA	4,228	2017	Lower middle income	13
Sudan	SDN	4,467	2017	Lower middle income	13
Honduras	**HND**	**4,542**	**2017**	**Lower middle income**	**13**
Congo, Rep.	COG	4,881	2017	Lower middle income	14
Pakistan	PAK	5,035	2017	Lower middle income	14
Moldova	MDA	5,190	2017	Lower middle income	14
Nicaragua	**NIC**	**5,321**	**2017**	**Lower middle income**	**14**
Nigeria	NGA	5,338	2017	Lower middle income	14
Samoa	WSM	6,022	2017	Lower middle income	14
Vietnam	VNM	6,172	2017	Lower middle income	14
Cabo Verde	CPV	6,223	2017	Lower middle income	14
Uzbekistan	UZB	6,253	2017	Lower middle income	14
Lao PDR	LAO	6,397	2017	Lower middle income	15
India	IND	6,427	2017	Lower middle income	15
Timor-Leste	TLS	6,570	2017	Lower middle income	15
Bolivia	**BOL**	**6,886**	**2017**	**Lower middle income**	**15**
El Salvador	**SLV**	**7,292**	**2017**	**Lower middle income**	**15**
Guatemala	**GTM**	**7,424**	**2017**	**Lower middle income**	**15**
Guyana	**GUY**	**7,435**	**2017**	**Lower middle income**	**15**
Morocco	MAR	7,485	2017	Lower middle income	15
Philippines	PHL	7,599	2017	Lower middle income	15

Appendix 7 (continued): Income clusters for missing values' imputations (for regional comparison exercise)

Country	Country Code	Per-capita GDP (1)	Year for (1)	World Bank Classfication	Cluster
Swaziland	SWZ	7,739	2017	Lower middle income	16
Ukraine	UKR	7,894	2017	Lower middle income	16
Bhutan	BTN	8,709	2017	Lower middle income	16
Armenia	ARM	8,788	2017	Lower middle income	16
Paraguay	**PRY**	**8,827**	**2017**	**Lower middle income**	**16**
Georgia	GEO	9,745	2017	Lower middle income	16
Kosovo	XKX	9,796	2017		16
Egypt, Arab Rep.	EGY	10,550	2017	Lower middle income	16
Indonesia	IDN	11,189	2017	Lower middle income	16
Sri Lanka	LKA	11,669	2017	Lower middle income	16
Tuvalu	TUV	3,575	2017	Upper middle income	17
Marshall Islands	MHL	3,819	2017	Upper middle income	17
Tonga	TON	5,426	2017	Upper middle income	17
Angola	AGO	5,820	2017	Upper middle income	17
Belize	**BLZ**	**7,824**	**2017**	**Upper middle income**	**17**
Jamaica	**JAM**	**8,194**	**2017**	**Upper middle income**	**17**
Jordan	JOR	8,337	2017	Upper middle income	17
Fiji	FJI	8,703	2017	Upper middle income	17
Mongolia	MNG	11,841	2017	Lower middle income	17
Namibia	NAM	9,542	2017	Upper middle income	18
Dominica	DMA	9,673	2017	Upper middle income	18
Ecuador	**ECU**	**10,582**	**2017**	**Upper middle income**	**18**
St. Vincent and the Grenadines	VCT	10,727	2017	Upper middle income	18
Tunisia	TUN	10,849	2017	Upper middle income	18
Bosnia and Herzegovina	BIH	11,714	2017	Upper middle income	18
Albania	ALB	11,803	2017	Upper middle income	18
Peru	**PER**	**12,237**	**2017**	**Upper middle income**	**18**
South Africa	ZAF	12,295	2017	Upper middle income	18
Nauru	NRU	12,896	2017		19
St. Lucia	LCA	12,952	2017	Upper middle income	19
Macedonia, FYR	MKD	13,111	2017	Upper middle income	19
Palau	PLW	13,240	2017	Upper middle income	19
Colombia	**COL**	**13,255**	**2017**	**Upper middle income**	**19**
Lebanon	LBN	13,368	2017	Upper middle income	19
Grenada	GRD	13,594	2017	Upper middle income	19
Suriname	**SUR**	**13,767**	**2017**	**Upper middle income**	**19**
Algeria	DZA	13,914	2017	Upper middle income	19
Serbia	SRB	14,049	2017	Upper middle income	19
Brazil	**BRA**	**14,104**	**2017**	**Upper middle income**	**20**
Dominican Republic	**DOM**	**14,601**	**2017**	**Upper middle income**	**20**
Maldives	MDV	15,184	2017	Upper middle income	20
China	CHN	15,309	2017	Upper middle income	20
Costa Rica	**CRI**	**15,525**	**2017**	**Upper middle income**	**20**
Iraq	IRQ	15,664	2017	Upper middle income	20
Botswana	BWA	15,807	2017	Upper middle income	20
Azerbaijan	AZE	15,847	2017	Upper middle income	20
Thailand	THA	16,278	2017	Upper middle income	20
Turkmenistan	TKM	16,389	2017	Upper middle income	21
Montenegro	MNE	16,409	2017	Upper middle income	21
Gabon	GAB	16,562	2017	Upper middle income	21
Venezuela, RB	**VEN**	**16,745**	**2014**	**Upper middle income**	**21**
Belarus	BLR	17,168	2017	Upper middle income	21
Mexico	**MEX**	**17,337**	**2017**	**Upper middle income**	**21**
Libya	LBY	17,882	2017	Upper middle income	21
Bulgaria	BGR	18,563	2017	Upper middle income	21
Argentina	**ARG**	**18,934**	**2017**	**Upper middle income**	**21**
Iran, Islamic Rep.	IRN	19,083	2017	Upper middle income	22
Mauritius	MUS	20,293	2017	Upper middle income	22
Panama	**PAN**	**22,267**	**2017**	**Upper middle income**	**22**
Romania	ROU	23,313	2017	Upper middle income	22
Kazakhstan	KAZ	24,056	2017	Upper middle income	22
Turkey	TUR	25,129	2017	Upper middle income	22
Seychelles	SYC	26,382	2017	Upper middle income	22
Hungary	HUN	26,778	2017	Upper middle income	22
Malaysia	MYS	26,808	2017	Upper middle income	22

Appendix 8: Truncated gaps

Country Name	Truncated gaps	Percent of total truncated gaps in LAC	Percent of own countries' dev. Gaps
Trinidad and Tobago	9	11.5	5.6
Belize	7	9.0	4.3
Dominican Republic	6	7.7	3.7
El Salvador	6	7.7	3.7
Haiti	5	6.4	3.1
Panama	5	6.4	3.1
Argentina	4	5.1	2.5
Barbados	4	5.1	2.5
Chile	4	5.1	2.5
Peru	4	5.1	2.5
Suriname	4	5.1	2.5
Brazil	3	3.9	1.9
Honduras	3	3.9	1.9
Bolivia	2	2.6	1.2
Costa Rica	2	2.6	1.2
Guyana	2	2.6	1.2
Mexico	2	2.6	1.2
Nicaragua	2	2.6	1.2
Uruguay	2	2.6	1.2
Jamaica	1	1.3	0.6
Venezuela, RB	1	1.3	0.6
Bahamas, The	0	0.0	0.0
Colombia	0	0.0	0.0
Ecuador	0	0.0	0.0
Guatemala	0	0.0	0.0
Total	**78**	**100**	**1.9***

(*) Average

Appendix 9: Comparing cross-section and panel data results

Sector	Development Gaps (-100,100)					
	Panel data + fractional regs (1)	Cross-section + fractional regs (2)	Cross-section, no fractional regs (3)	(1)-(2)	(2)-(3)	(1)-(3)
Gender	-7.8	1.2	1.1	-9.1	0.1	-9.0
SMEs & Financial Inclusion	-9.1	-3.4	-1.0	-5.7	-2.4	-8.1
Education	-18.2	-10.9	-11.4	-7.3	0.5	-6.8
Climate Change & Environment	-0.3	-0.3	5.1	0.0	-5.4	-5.4
Transport	-12.5	-7.3	-7.3	-5.2	0.0	-5.2
Sanitation	1.6	0.3	6.2	1.3	-5.9	-4.6
Tourism	-0.2	3.8	3.8	-4.0	0.0	-4.0
Manufacture	-4.9	-1.4	-2.7	-3.4	1.3	-2.1
Institutions	-9.1	-7.7	-7.7	-1.4	0.0	-1.4
Financial Institutions & Capital Markets	-0.7	-0.6	-0.5	-0.1	-0.1	-0.2
Health	-1.7	-3.2	-2.3	1.5	-1.0	0.6
Agribusiness	1.0	-0.2	-0.3	1.2	0.1	1.3
Water	8.8	5.6	6.1	3.2	-0.5	2.7
Energy	3.5	-1.6	-0.3	5.1	-1.3	3.8
Telecommunications	2.1	-9.6	-6.7	11.7	-2.9	8.8

Notes: Column 1 uses all the years available for each regression, but then only uses the estimated gap for the latest year available, while columns 2 and 3 run a cross-section regression using only the latest year available. "Fractional regs" refers to the inclusion of the methods presented in Section 3 for the case of indicators that are continuous variables between 0 and 1. Sectors are ordered by the difference between (1) and (3), from smaller to larger. To make the comparison more accurate, the gaps used here were not truncated between -100 and 100.