WP/17/197

IMF Working Paper

Benchmarking Social Spending Using Efficiency Frontiers

by Javier Kapsoli and Iulia Ruxandra Teodoru

INTERNATIONAL MONETARY FUND

WP/17/197

IMF Working Paper

Benchmarking Social Spending Using Efficiency Frontiers

by Javier Kapsoli and Iulia Ruxandra Teodoru

INTERNATIONAL MONETARY FUND

 WP/17/197

IMF Working Paper

Western Hemisphere Department

Benchmarking Social Spending Using Efficiency Frontiers[1]

Prepared by Javier Kapsoli and Iulia Ruxandra Teodoru

Authorized for distribution by Lorenzo Figliuoli

September 2017

Abstract

Developing and low-income economies face the challenge of increasing public spending to address sizeable infrastructure and social gaps while simultaneously restoring the fiscal discipline weakened to countervail the effect of the global recession. Increasing the efficiency of social spending could be the key policy to address the dilemma as it allows the optimization of the existing resources by reducing spending inefficiencies. This paper quantifies the efficiency gap in the health and education sectors for a large sample of developing and emerging countries and proposes measures to reduce these gaps for the specific cases of El Salvador, Guatemala, and Honduras.

JEL Classification Numbers: H51, H52, I18, I28, 054

Keywords: Health, education, efficiency, developing countries, low-income countries

Author's E-Mail Address: jkapsoli@imf.org, iteodoru@imf.org

[1] The paper has benefited from the insightful comments of Roberto García-Saltos, Lorenzo Figliuoli, and Carlos Janada.

Contents Page

I. INTRODUCTION

The global financial crisis has provided many important lessons for developing and low-income economies. For the first time, they were able to implement counter-cyclical policies, limiting the consequences of the crisis on growth and employment.[2] However, the easing was not followed by a timely withdrawal of the stimulus resulting in a decline of fiscal buffers and, in some cases, high debt levels. Given high uncertainty surrounding the global outlook, constrained fiscal space due to high debt burdens, and long-term demographic pressures, these countries face the challenge of rebuilding buffers to strengthen the counter cyclical role of fiscal policy. Although it is difficult to assess the appropriate level of buffers required to shield against potential contingencies, the experience of the global financial crisis highlights the value of building ample margins.

This problem comes together with the pressing need to close—or at least reduce—infrastructure and social gaps requiring a sizeable increase in public spending. If used appropriately while maintaining prudent fiscal policies, public spending can shore up long-run growth by increasing both physical and human capital stocks and -ultimately- productivity. In developing and low-income economies, this increase in productivity is closely linked to the expansion in the provision of health and education services.[3] Additionally, high public investment benefits competitiveness by exploiting the synergies with private investment.

Increasing the efficiency of public spending is the answer to simultaneously address the—apparently contradictory—objectives mentioned in the previous paragraphs. For example, the most efficient public investments are able to generate twice the growth impact compared to the least efficient ones, while increasing the efficiency of health and education spending can generate sizeable savings.[4]

In this paper, we focus on gauging and scoring the efficiency of social spending (health and education). The calculated efficiency measures could be used to estimate potential expenditure savings. Due to the size of social spending, these savings are significant. On average, public spending in developing and low-income economies is around 23 percent of GDP; the bulk of it is allotted to the budget of the health and education sectors. Because of it, even small changes in the efficiency of public spending could release a sizeable amount of resources which could be diverted to other spending with greater value for money. As mentioned above, addressing the inefficiency of public spending could help the authorities to effectively increase their delivery of public services while simultaneously keeping their fiscal balances under control. We also illustrate the potential use of the efficiency scores estimated in the paper for the cases of Guatemala, El Salvador, and Honduras.

[2] See IMF (2010) and Celasun and others (2015).

[3] A large body of literature suggests that knowledge and skills are critical to increase productivity which in turn translates into economic by fostering the capacity to adapt and develop new technologies. See De La Fuente (2011) for more details.

[4] See IMF (2014).

The remainder of the paper is organized as follows. Section II discusses the benchmarking methodology. Section III describes the main trends in health and education spending and compares the main outcomes in the above mentioned countries. Section IV presents the main results of the paper. The final section concludes and proposes policy recommendations to improve the efficiency of social spending in Guatemala, El Salvador, and Honduras.

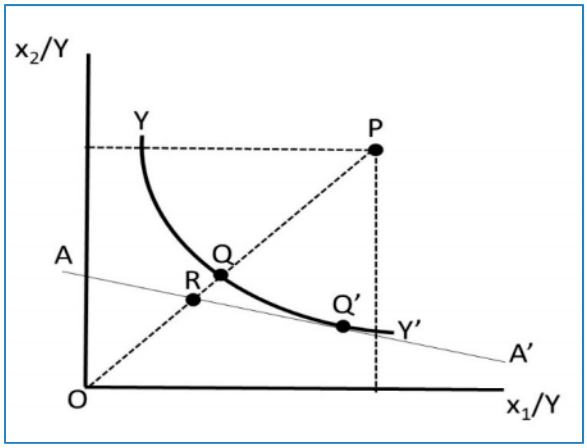
II. BENCHMARKING METHODOLOGY

Benchmarking is the systematic comparison of the performance of one unit against other peers. It involves comparing units implementing the same transformation processes consuming inputs to produce goods and services (outputs). These units could be firms, industries, etc. but for the purpose of this paper, they are countries. This comparison is done based on performance evaluations. Because of this, any benchmarking exercise is intimately related to the concept of efficiency. In the benchmarking literature, efficiency is measured by identifying the best performing units and use them to build a frontier. That frontier is called the "efficiency frontier". With the frontier, the performance of all units is assessed by measuring their distances relative to the efficiency frontier.

The modern discussion of gauging efficiency started with Farrel's (1957) seminal paper. The paper defines two types of efficiency, technical and allocative. Figure 1 illustrates both concepts by using the familiar isoquant diagram assuming a production function with two inputs x_1 and x_2. To simplify the analysis, we normalize the inputs relative to the output so that the level of production is always one. The YY' isoquant represents the optimal (minimum) combination of normalized inputs required to produce one unit of output. The point P represents a sub-optimal production bundle because it produces one unit of output, but by using more inputs relative to Q (which is part of the isoquant). As point Q represents the optimal consumption of inputs required to efficiently produce one unit of output, the ratio QP/OP would be a measure of technical inefficiency which means that distance QP could be saved if inputs were used efficiently.

The latter is a view of efficiency entirely based on the technical capacity to obtain the higher level of output with the minimum consumption of inputs. However, one can see efficiency also from a cost minimizing perspective. Let p_1 and p_2 be the prices of inputs x_1 and x_2 then the slope of line AA' would be $-p_2/p_1$ and Q' would be the optimal bundle assuming such price levels. For the production bundle P, the ratio OR/OQ would be a measure of the allocative or cost efficiency. Allocative efficiency measures the amount of resources that could be saved if, given input prices, the consumption of inputs would be used to minimize the unit's total cost. Because of the lack of comparable multi-country data on prices, this paper focuses entirely on the estimation of technical efficiency.

Figure 1. Technical and Allocative Efficiency



Technical efficiency could be estimated based on input or output oriented models. In input-oriented models, the efficiency scores are the proportional amount by which input consumption could be reduced while leaving outputs unchanged. On the other hand, efficiency scores from output-oriented models are defined as the proportional amount by which outputs could be increased while leaving inputs consumption unchanged.

There are two families of methodologies—parametric and non-parametric—to estimate technical efficiency. Each methodology has advantages and disadvantages. Parametric methods require several assumptions on the errors' distribution and the functional form underpinning the model. At the same time, parametric methods assume a stochastic relationship between inputs and outputs allowing us to separate from the efficiency estimation the part that is real inefficiency and the part which is explained by measurement errors or other noise in the data.[5] The flagship of the parametric methods is the stochastic frontier model (SFA).[6]

Non-parametric methods, on the other hand, are based on mathematical programming and, therefore, do not require any distributional assumptions or assumptions relative to functional form of the transformation relation between outputs and inputs. However, non-parametric models do not include randomness and thus, all the data by construction provides information on the inefficiency or the technological frontier. This assumption makes non-parametric models very sensitive to the presence of outliers or noise in the data. Data envelopment analysis (DEA) is—by far—the most widely method used in the benchmarking literature. DEA is a mathematical programming method that can solve the two main tasks involved in a benchmarking exercise: a) calculate the frontier based on the best performer units, and b) evaluate performances relative to such frontier. A DEA model requires the following basic assumptions: (i) free disposability, (ii) convexity, (iii) returns to scale, and (iv) additivity. Note that (iii) defines the different DEA specifications ranging from constant returns to scale (CRS) to variable returns to scale (VRS). The

[5] Parametric methods could also be classified in non-distributional and distributional methods. The first involves adjustments on simple econometric methods to comply with the restrictions that all estimated errors lie below the frontier while the second involves the specification of a full econometric model including stochastic assumptions for the behavior of the inefficiency parameter.

[6] See Kumbhakar and others, 2015, chapter 3, for more details on the SFA model.

CRS model is characterized for having only one best performer unit while the VRS allows the presence of several best performers defining a convex efficiency frontier.

As we mentioned above, the DEA model has several drawbacks. First, it is a purely deterministic method ignoring the presence of noise in the data such as measurement errors, which is very common in the case where the units under analysis are countries, and in particular emerging economies. Second, DEA estimations are biased as they estimate the efficiency frontier based on "best performer" units which do not necessarily represent the true frontier. The SFA model also has drawbacks beyond the many assumptions required to set up the model. It assumes inefficiency as one of the parameters to estimate. This assumption needs a prior on the statistical distribution of such inefficiency term. The most popular distributional assumptions are half-normal, truncated normal, and exponential. Any of them involves a zero or constant average for the inefficiency parameter, therefore, resulting in an underestimation of it (i.e., the efficiency scores are overestimated).

Simar and Wilson (1998, 2000) developed a methodology that uses bootstrapping to add a layer of randomness to the DEA model to overcome the above-mentioned drawbacks. They pointed out that—in reality—a DEA frontier is an estimation of the true frontier based on a single sample drawn from an unknown population. Because of that, the efficiency measures are sensitive to the sampling variations underpinning the estimate of the frontier. A way to assess this sensitivity is using bootstrapping. Bootstrapping is a computer-based statistical method which generates an artificial, new random dataset obtained by sampling with replacement from a given dataset. This new dataset could be used to calculate some statistics called "replicates". The procedure is repeated many times, each time generating new replicates until we have a sample of replicates. Based on this sample we can infer conclusions on the distribution of the original data under the assumption that it mimics the distribution of the bootstrapped sample.[7]

Bootstrapping allow us to correct the bias in the efficiency scores and calculates their corresponding confidence intervals. As mentioned above, as the DEA frontier is based on best performing units, it would capture only the lower bound of the true frontier. This, by definition, generates an upward bias in the estimated efficiency scores. If we assume that the distribution of the difference between the estimated and the bootstrapped efficiency scores mimics the distribution of the difference between the true and the estimated efficiency scores, we can estimate the bias, correct the efficiency scores and find their confidence intervals.

III. Social Spending Trends

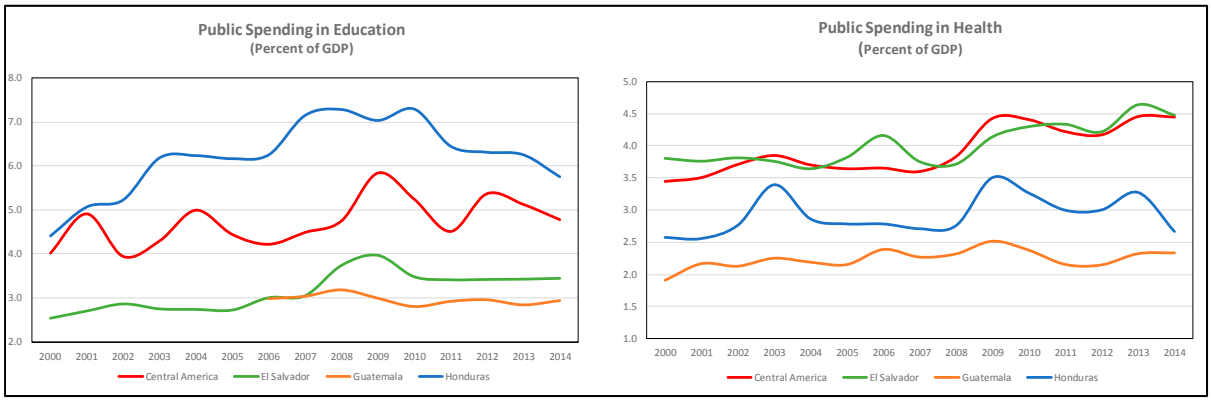
We start our empirical analysis by providing a review of the main trends of the countries that we discuss in this paper: Honduras, Guatemala and El Salvador. As we can see in Figure 2, social spending has been increasing slowly in Central America. The increase in health and education since 2000 is in both cases around 1 percent of GDP, from 3.5 to 4.5 percent of GDP in health and from 4 to 5 percent of GDP in education. This trend is consistent with the one in the whole

[7] See Bogetoft and Otto (2011), chapter 6, for details on bootstrapping and its application to DEA models.

Latin American region where the amount of public education spending is basically the same but the amount of public spending in health falls short by ½ percent of GDP.

Public spending in education in Honduras is consistently higher than the Central American and Latin American regional levels. It is also even higher than the OECD level. On the contrary, social spending in Guatemala, in both health and education, is largely below the average of the region. In El Salvador, public spending on education is also very low compared to the region. Box 1 discusses the main drivers of social spending in Honduras, El Salvador, and Guatemala.

Figure 2. Social Spending Trends



Sources: The World Bank, WHO, and UNICEF.

Box 1. Main Drivers of Social Spending

El Salvador

Public Spending in health is in line with comparator countries. Spending in health has been driven not only by the increase in nominal wages (around 65 percent of total spending), but also by an increase in positions (by 30 percent between 2007-2015), through the creation of an integral network of health services, including of Community Health Teams (ECOS) focused on primary care (García-Escribano and others 2015). Particularly worrisome is the health workers' compensation which involves an annual increase of 8 percent disregarding any fiscal sustainability consideration. Access to medical insurance is low—only 24 percent of the population overall, and only 9 percent in rural areas. However, spending is more progressive—spending per capita by the Ministry of Health on the first income decile of people who do not have medical insurance was about 43 percent of the income of beneficiaries in this decile, while it was only 1 percent of the income of beneficiaries in the highest income decile (Interamerican Development Bank 2016).

Public spending in education is slightly lower in El Salvador *vis-à-vis* comparator countries. At around 3.4 percent of GDP, it is below the Central America and Latin America averages (4.4 and 4.8 percent of GDP, respectively) or the OECD average (5.4 percent of GDP). Growth of spending in education has been driven by the increase in wages (around 68 percent of total spending) and in posts. The latter was due to the incorporation in the public payroll of around 8,300 teachers who were previously hired by private community centers.

Guatemala

Public spending in education (at around 2.9 percent of GDP) is lower *vis-à-vis* comparator countries. Spending in education is mainly comprised of teachers' salaries (which represent about 70 percent of total spending), while investment in infrastructure and instruction materials is tiny.

Public spending in health is low *vis-à-vis* comparator countries. At around 2.4 percent of GDP, it is far below the Central America and Latin America averages (at 4.4 and 3.8 percent of GDP, respectively) and the OECD average (6.7 percent of GDP). This is reflected in low access to medical insurance—only 20 percent of the population are covered. Only 8 percent of the extreme poor and 36 percent of the poor are covered by public health programs, while most who are benefiting (56 percent) are the non-poor (IADB, 2016). Other studies (ICEFI, 2015) have shown that primary health care only covers 22 percent of the population, while all care levels (primary, secondary, and tertiary) show gaps of at least 40 years in terms of infrastructure. At the same time, while spending on medicines and supplies represents as much as 40 percent of total spending, their procurement has not been transparent.

Honduras

Public spending in education is high *vis-à-vis* comparator countries. At around 6 percent of GDP, it is above the Central America and Latin America averages (4.4 and 4.8 percent of GDP, respectively) and it is even higher than the OECD average (5.4 percent of GDP). Spending in education is mainly driven by wages—around 80 percent of it allocated for paying teachers' salaries. Teachers' wages in turn have been increasing since the enactment of the "*Programa de ajuste social y calidad educativa* (PASCE)" in 2006. PASCE envisaged a 20 percent increase in base wages for the 2007-2009 period plus an indexation to the increase in the minimum wage thereafter.

Public spending in health in Honduras is in line with comparator countries. Nevertheless, this finding seems at odds with the large insurance gap (only 18 percent of the population has access to medical insurance and 5 percent in rural areas). Medical insurance coverage is 30 percent for people in the top income quintile of the population and it is almost inexistent for the lowest quintile (World Bank, 2015).

IV. EMPIRICAL RESULTS

As explained in section II, our methodology assumes underlying "technological" processes to create certain social outcomes based on certain inputs (among them public spending). This framework requires the assumption of some degree of homogeneity across countries in the world. The benchmarking literature has identified an important methodological concern regarding this assumption, namely factor prices tend to be higher in wealthier *vis-à-vis* medium or low-income countries.[8] Higher prices usually imply higher spending; therefore, rich countries could be deemed inefficient only due to this effect. Following previous researchers that have faced a similar problem, we have adjusted for this effect by excluding all industrialized economies from our sample so that developing and low-income economies would not appear relatively more efficient only due to higher factor prices presented in the industrialized world (see Gupta and Verhoeven, 2001 or Herrera and Pang, 2005).

Our input-output model specification (consistent with Herrera and Pang, 2005 or Grigoli and Kapsoli, 2013) uses health-adjusted life expectancy (HALE) as output and public spending, private spending and the educational level of adults as inputs.[9] All spending variables are expressed in 2011 PPP US dollars. The educational level of adults is measured by the average years of schooling for population older than 15 years. For education, we prepare separate estimates for primary and secondary education. We use net enrollment rates as output and public spending and the teacher-pupil ratio as inputs.[10] In the case of education, a common critique is that enrollment rates do not adequately measure educational achievements. This is true, but unfortunately any of the standardized tests (PISA, TIMMS, and PIRLS) commonly used to measure achievements has limited country coverage, particularly for lower-income countries.

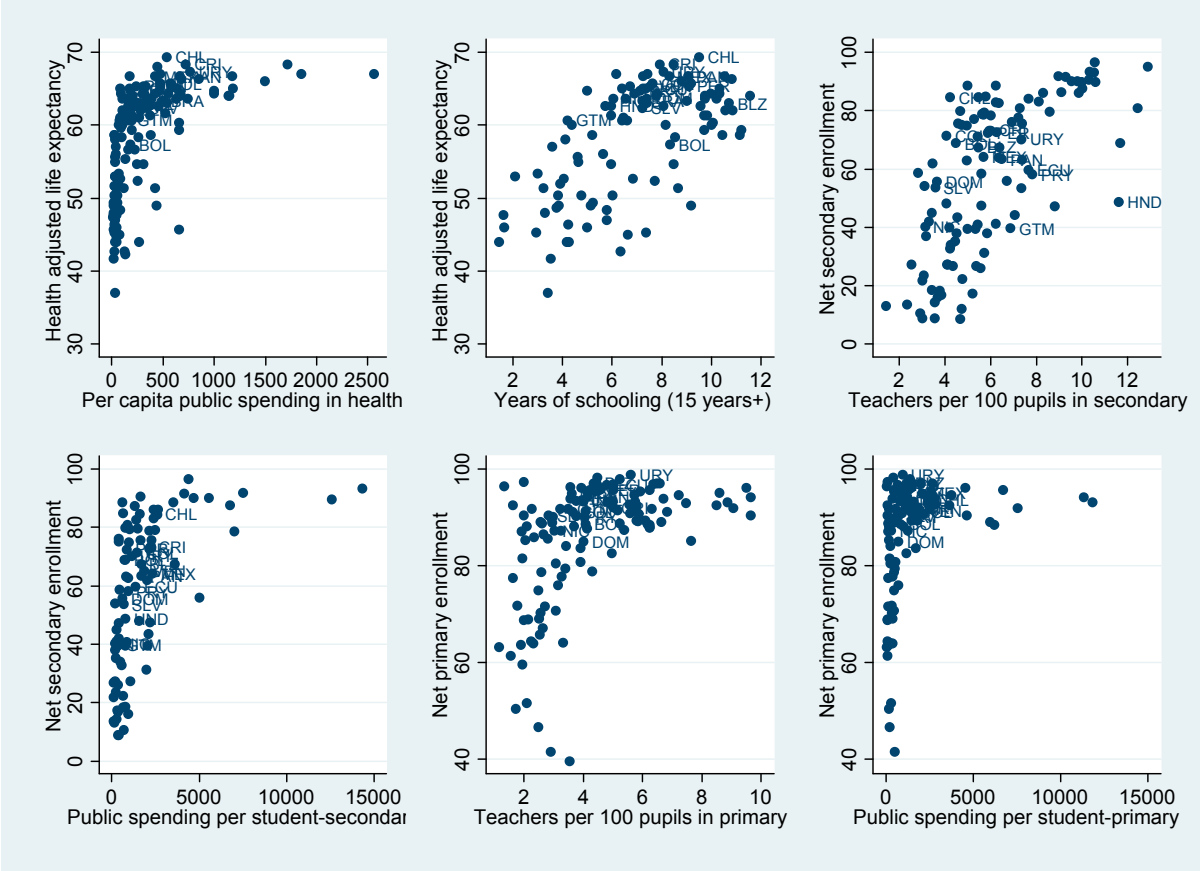
Based on the above-mentioned models, we estimate the efficiency scores and their corresponding confidence intervals using the bootstrapped DEA approach described in Section II. We have estimated the efficiency scores for health, primary and secondary education spending using 2000 replications based on a sample of emerging and low-income economies. All variables are averages starting from 2000 until the last available observation. Figure 3 shows scatter plots for selected input-output combinations. To facilitate visual inspection, labels are shown only for Latin American countries. As we can see, all bijections seem positive.

[8] The fact that price levels in wealthier countries are higher than in poorer countries is known as "Harrod-Balassa-Samuelson effect". See Obstfeld and Rogoff, 1996, chapter 4.

[9] HALE is estimated by the WHO and is defined as the average number of years that a person can expect to live in "full health" thus deducting years lived in disease and/or injury from the regular life expectancy.

[10] Net enrollment rates reflect only students enrolled relative to the corresponding school age excluding repeaters.

Figure 3. Selected Inputs and Outputs for Social Spending



Sources: The World Bank, WHO, UNESCO and Barro-Lee database.

Figure 4 shows the main results of the paper, that is the estimated efficiency scores for Central America countries. Detailed efficiency scores and confidence bands for all countries in the sample are available in the annex of the paper.

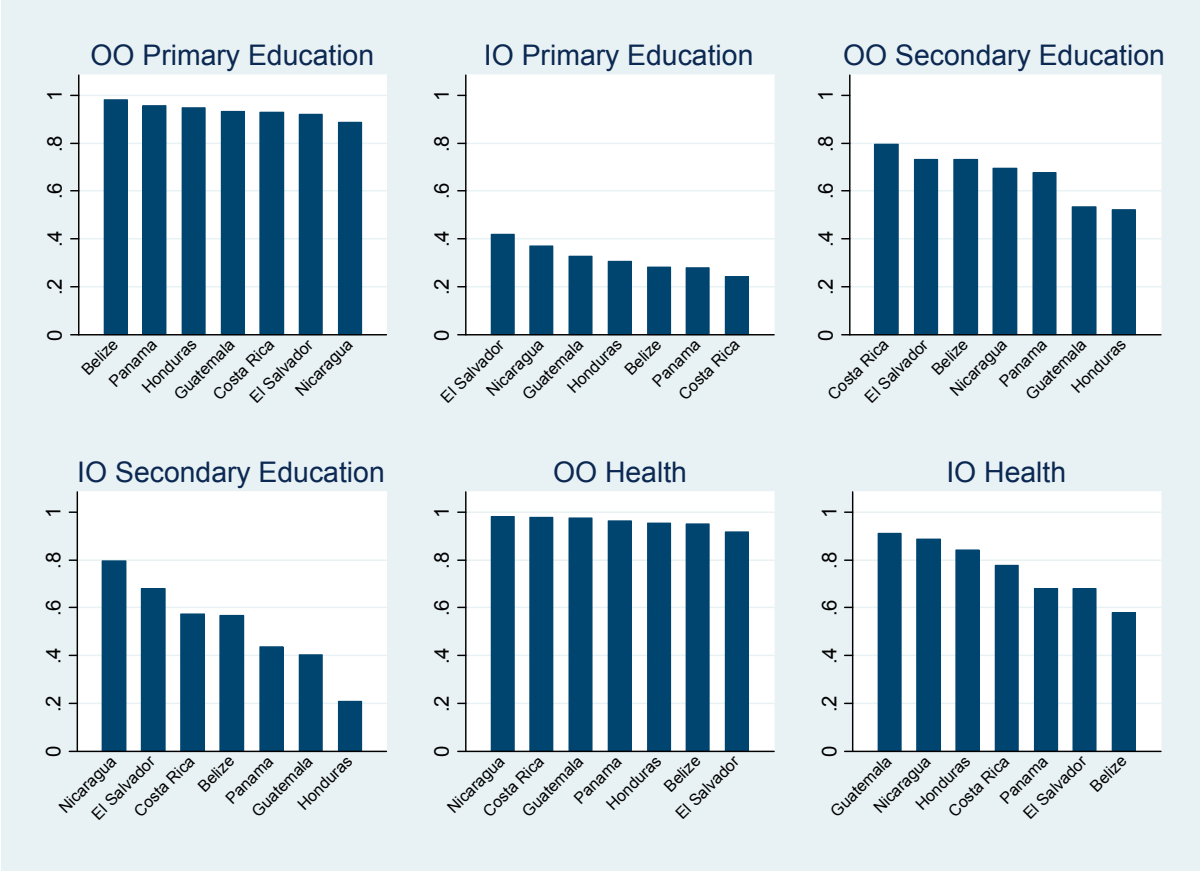
The output-oriented score for health in Honduras is 0.955 showing limited room for getting better outcomes by using inputs efficiently, however, the input-oriented score is 0.840 meaning that all inputs could be reduced by around 15 percent without a marked reduction in the output. In education, Honduras performed poorly in secondary education ranking last among 88 countries in the input-oriented score (0.208) and 66/88 in the output-oriented measure (0.522). The score is better in primary education reaching 0.307 in the input-oriented and 0.948 in the output-oriented measures. These results imply potential efficiency savings in educational inputs between 70-80 percent. On the potential efficiency gains, they seem only significant in secondary education (around 50 percent).

The output-oriented score for health in Guatemala is 0.976 which also shows limited room for getting better outcomes by using inputs efficiently, however, the input-oriented score is 0.910 meaning that all inputs could be reduced by around 10 percent without a reduction in the output. In education, Guatemala performed poorly in secondary education ranking 69/88 countries with an input-oriented score of 0.403 and 65/88 in the output-oriented measure (0.534). The result is better in primary education in the output-oriented measure scoring 0.932

while it is worse for the input-oriented case (0.328). These results imply potential efficiency savings in educational inputs of between 60-70 percent. On the potential efficiency gains, they seem only significant in secondary education by around 50 percent.

The output-oriented score for health is 0.918 in El Salvador, pointing to a margin of around 8 percent to increase outcomes by using inputs efficiently. The estimated input-oriented score is 0.679 showing significant room for efficiency savings, whereby all inputs could be reduced by around 33 percent without a reduction in the output. El Salvador performed better than Honduras and Guatemala in the secondary education, achieving higher input- and output-oriented scores (0.681 and 0.733, respectively), but there are still efficiency savings and gains to be realized. The results are not as good in primary education with scores of 0.419 for the input-oriented measures but better for the output-oriented measures, with scores of 0.921. These results imply potential efficiency savings in educational inputs of between 30-60 percent. About potential efficiency gains, they seem only significant in secondary education by around 30 percent.

Figure 4. Benchmarking Social Spending Results



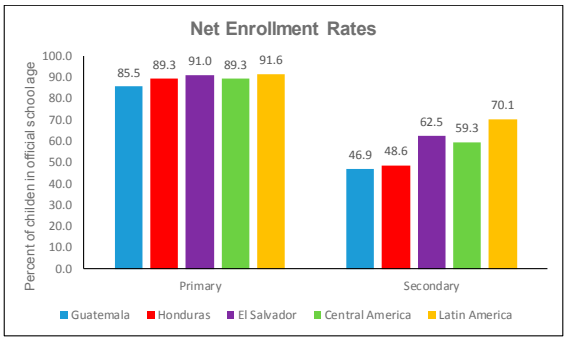
Source: Author's estimations.

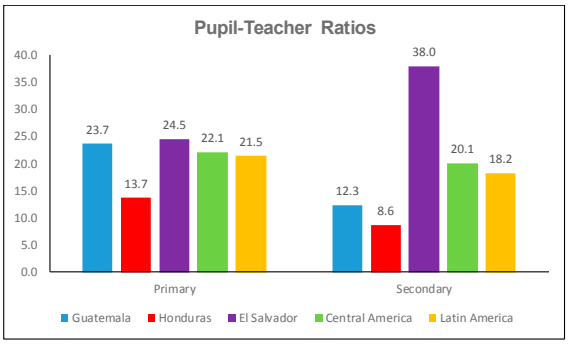
In conclusion and with a Central American view, the efficiency metrics estimated in this paper show that there is limited room to increase health outcomes without an increase in the inputs; however, there is room for savings particularly in El Salvador. In primary education, we do not see space for sizeable improvements in outcomes but all countries show ample room for savings. In secondary education, there is room for sizeable efficiency gains and savings to achieve better outputs and to save on inputs.

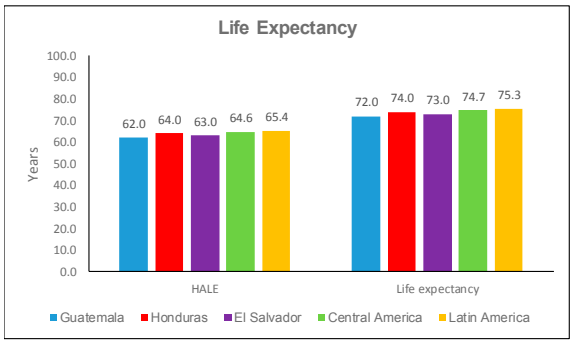
If Honduras were to remove all the inefficiencies in education spending, the maximum savings would amount to about 4.3 percent of GDP. Savings in education in Guatemala would amount to 1.9 percent of GDP, whereas in El Salvador to about 1.6 percent of GDP. In health, savings from using inputs efficiently would amount to 1.1 percent of GDP in El Salvador, 0.9 percent of GDP in Honduras, and 0.3 percent of GDP in Guatemala. Such maximum savings could likely be achieved over the medium to long term, supported by deeper structural reforms (see policy recommendations section).

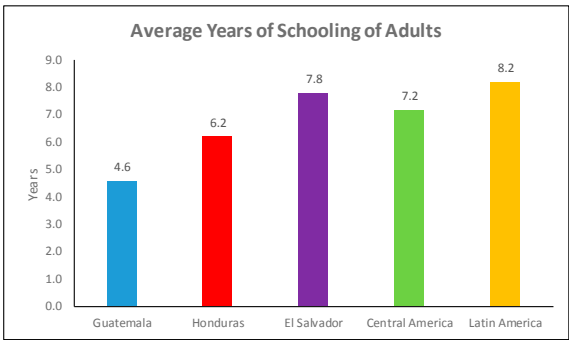
The results of the benchmarking exercise seem consistent with the main observed facts. Figure 5 shows some interesting comparisons. We can see that Honduras, Guatemala, and El Salvador (and Latin America in general) have a large enrollment gap in secondary education. This is consistent with the current demography of the region, given a relatively young population, large drop-out rates and low average years of schooling. Population aging, while gradual so far, is expected to accelerate over the next decades. With an aging population, this enrollment gap would entail the need for allotting more public resources in the future to higher levels of education, and achieving more efficiency of spending at the same time. For example, pupil-teacher ratios in Honduras are very low relative to its peers. Guatemala also lags its peers in pupil-teacher ratios in secondary education. This points out to a currently overfunded educational system and the need to rationalize resources with a focus on improving outcomes in secondary and tertiary education. As we can see in Figure 6 the fact that public spending in education is highly concentrated toward primary grades is even greater in Honduras compared to regional peers. Public spending in education is also highly concentrated toward primary grades in Guatemala and El Salvador. If spending is raised in the future to account for the aging of the population, it should be focused on higher levels of education, rather than primary levels.

Figure 5. Selected Inputs and Outputs Comparisons



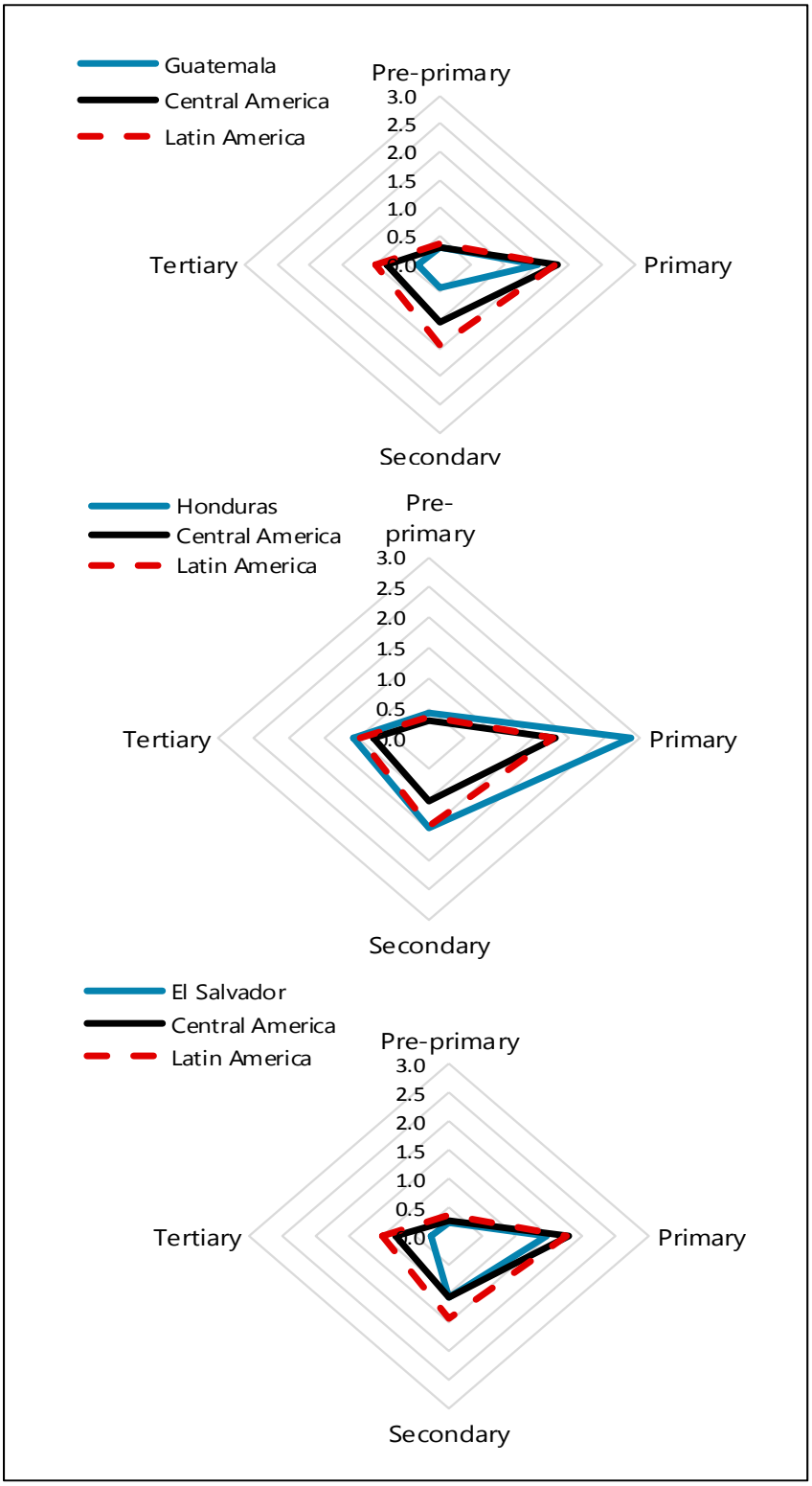






Sources: The World Bank, WHO, UNESCO and Barro-Lee database.

Figure 6. Education Spending in Central America by Level of Education (Percent of GDP)



Sources: The World Bank and UNESCO.

V. Implications and Policy Recommendations

This paper shows that there is significant room to improve social spending efficiency with potentially large fiscal savings. From an input-oriented point of view, Guatemala and Honduras perform poorly in education spending efficiency; with respect to health spending efficiency, Guatemala is the best performer in the region, while Honduras and El Salvador have room for improvement. From an output-oriented point of view, health spending efficiency in all three countries appears to be in line with regional comparators and relatively efficient, while there is some room to improve education spending efficiency, particularly in secondary education (to a lesser extent in El Salvador). Considering increasing social needs in these countries, but also the need to build fiscal buffers (El Salvador) or maintain them (Honduras), improving spending efficiency could contribute to reducing the risk of fiscal stress.

Based on the identified efficiency gaps, we discuss below some possible measures to generate savings and align policies with the international best performer.

El Salvador

The wage bill represents 68 percent and 65 percent of the education and health budgets, respectively, stressing the need to focus on compensation in a fiscal consolidation effort. In El Salvador, the main issue is the presence of a large public-private wage premium (García-Escribano and others, 2015). Such a large premium is mainly explained by structural rigidities stemming from different compensation frameworks (*escalafones*). Given its size and that it is the most inequitable among the many compensation frameworks, the main priority should be to limit the fiscal pressure from the health sector *escalafón*.[11] Other—broader—alternatives could be explored such as wage bill limits or rightsizing employment but, from a fairness point of view, tackling the health sector wage bill is critical.

In education, the problem seems to be also the wage bill. The education budget has been turning more rigid over time due to wage increases based on the teachers' *escalafón* and the incorporation of teachers form the formerly community-based program EDUCO. The education wage bill is 82 percent higher in 2014 compared to 2007. As in the case of Honduras, wage increases are unrelated with teachers' productivity or performance evaluations. As an example, El Salvador ranked among the worst in math/science tests (49 out of 53 countries in the 2007 TIMS). Also teachers' wages seem too compressed as the wage gap for teachers with graduate studies is only 10 percent higher than for teachers with only undergraduate studies (García-Escribano and others, 2015).

Pupil-teacher ratios in primary and secondary education are higher compared to regional peers (Figures 5 and 6). To account for the ageing of the population, the number of primary teachers should decline in favor of those in secondary education. El Salvador has a sizeable coverage gap

[11] The law was enacted in 1994 when inflation was around 8 percent annually and the economy was not dollarized. Notwithstanding the dollarization of the economy since 2001, the law is still valid with no modifications.

in secondary and tertiary education while the bulk of the spending in education is at the primary level (Figures 5 and 6).

Guatemala

Guatemala presents a more complex issue as its social spending level is systematically below the regional average and other comparators. Public education spending in Guatemala has been virtually flat since 2006 at around 3 percent of GDP, being the lowest in the region despite the fact that in 1991 the national law on education established the earmarking of 35 percent of total revenues for financing education. The law also establishes that the government should target an increase in spending on education to 7 percent of GDP. Spending on education is also extremely rigid with most of it allocated for paying teachers' salaries leaving only a small fraction for infrastructure investment. The education wage bill went up from 53 percent of total education expenditure in 2007 to 70 percent in 2013.

Similarly, public spending in health has only slightly increased as a share of GDP since 2000, remaining by far the lowest in the region. Public spending in health has been on average around 2.2 percent of GDP, rising only slightly from 1.9 percent of GDP in 2000 to 2.3 percent of GDP in 2013 (Figure 1). More than 50 percent of spending is allocated to personnel salaries/benefits and another 40 percent to medical supplies.

Therefore, achieving better outlays in health and education would require an increase in inputs, notably in public spending. Low spending is clearly tied to low tax revenues. In the case of Guatemala, the situation is dramatic as it has the lowest tax burden in the region (CEPAL, 2017). The necessity of higher revenues is more pressing considering the high poverty rate (close to 60 percent).

Honduras

In health and education, the priority for Honduras is to tackle the disconnect between compensation rules and labor productivity. As we mentioned before, the wage bill represents 80 percent of the education budget and 60 percent of the health one, therefore, there is no way to achieve sizeable savings in both sectors without doing deep reforms in the compensation policies of both sectors. IMF (2016) has identified the fragmentation of the public compensation framework as the main problem of the wage bill. These different compensation frameworks are mainly the result of pressures from powerful interest groups, particularly teachers. The many compensation schemes also generate incentives for leap frogging particularly for worker groups in the same sector.

As mentioned in Box 1, PASCE has been the main driver of the increase in education spending. This agreement allows for indexation to the minimum wage of teachers' wages alongside with performance evaluations. Not surprisingly the latter never happened. Given the size of the education sector in the budget, we suggest the revision of this policy in line with the original agreement to align compensations to performance and ultimately to the improvement by students in standardized tests. Additionally, as suggested by Arcia and Gargiulo (2010), the

required affiliation to a trade union for being a teacher grants excessive bargaining power to unions and could be revised.

Also, over the coming years, Honduras needs to adjust its public policies to face the impact of population aging. This would entail moving resources from primary to secondary and tertiary education and changing the composition of the teachers' population such that the number of primary teachers should decline in favor of those in higher levels of education. In Honduras, pupil-teacher ratios indicate overstaffing. Honduras has a sizeable coverage gap in secondary and tertiary education while the bulk of the spending in education is at the primary level (Figures 5 and 6). At least part of these coverage gaps are explained by the relatively small instructional time effectively received by students[12]. The estimations in this paper show that this process of moving resources from primary to higher levels of education can be done through efficiency savings, therefore preventing a dramatic short-term adjustment on spending.

The issue of compensation fragmentation is particularly severe in the health sector. The health sector has six of the eight compensation frameworks currently existing in Honduras. Some of them favor only a small group of workers but are largely inequitable.[13] These frameworks should be revised in light of the need to expand coverage stated in the law of social protection. Additionally, as the provision of health care services is a goods-intensive activity, administrative measures could be implemented to exploit economies of scale stemming from the size of the public sector as a purchaser (World Bank, 2015).

[12] On average, the effective instructional time is 64 percent of total teachers' time but for schools in the bottom quintile of the distribution it is only 37 percent. In practice, this means that students in top quintile schools receive 96 days more school days compared with students in the bottom quintile schools (Bruns and Luque, 2014).

[13] For example, because of the application of the pharmaceutical-chemists' *estatuto,* they earn the same wage as a doctor and two times a dentist's wage (IADB, 2014).

References

Arcia, Gustavo and C. Gargiulo, 2010, "Análisis de La Fuerza Laboral en Educación en Honduras", Banco Interamericano de Desarrollo, Notas Técnicas N°7.

Banco Interamericano de Desarrollo, 2014, "*Mejorando la Eficiencia de los Recursos Humanos del Estado: Informe sobre Empleo Público y Política Salarial en Centroamérica, Panamá y la República Dominicana*".

Banco Interamericano de Desarrollo, 2016, "*La Eficiencia del Gasto Público en Educación y Salud en El Salvador, 2003-2013"*.

Celasun, Oya and others, 2015, "Fiscal Policy in Latin America: Lessons and Legacies of the Global Financial Crisis", IMF Staff Discussion Note SDN/15/06, International Monetary Fund, Washington DC.

Banco Interamericano de Desarrollo, 2016, "*La Eficiencia del Gasto Público en Educación y Salud en Guatemala, 2003-2013"*.

Banco Mundial, 2015, "*Honduras. Estudio de Gasto Público Social y sus Instituciones*".

Bogetoft, Peter and L. Otto, 2011, "Benchmarking with DEA, SFA, and R", Springer.

Bruns, Barbara and J. Luque, 2014, "Great Teachers: How to Raise Student Learning in Latin America and the Caribbean", The World Bank.

CEPAL, 2017, "Panorama Fiscal de América Latina y el Caribe 2017".

De la Fuente, Angel, 2011, "Human Capital and Productivity", Nordic Economic Policy Review, N°2, pp. 103-132.

García-Escribano, Mercedes, E. Flores, J. Kapsoli, and M. Soto, 2015, "Gasto en Salarios Gubernamentales: Análisis y Desafíos". Retrieved from http://www.mh.gob.sv/portal/page/portal/PMH/Documentos_O_M/Fondo_Monetario_Internacional/Documentos/2016/GASTOS_EN_SALARIOS_GUBERNAMENTALES_ANALISIS_Y_DESAFIOS_2016.PDF

Grigoli, Francesco and J. Kapsoli, 2013, "Waste Not, Want Not: The Efficiency of Health Expenditure in Emerging and Developing Economies", IMF Working Paper 13/187, International Monetary Fund, Washington DC.

Gupta, S. and M. Verhoeven, 2001, "The Efficiency of Government Expenditure: Experiences from Africa", *Journal of Policy Modelling*, Vol. 23, pp. 433-67.

Farrell, M. J., 1957, "The Measurement of Productive Efficiency", *Journal of the Royal Statistical Society*, Vol. 120 N°3, pp. 253-90.

Herrera, S. and G. Pang, 2005, "Efficiency of Public Spending in Developing Countries: An Efficiency Frontier Approach", World Bank Policy Research Working Paper N° 3645

International Monetary Fund, 2010, "Emerging from the Global Crisis: Macroeconomic Challenges Facing Low-Income Countries", Policy Paper. IMF, Washington.

_____, 2014, World Economic Outlook, "Legacies, Clouds, Uncertainties: Is It Time for an Infrastructure Push? The Macroeconomic Effects of Public Investment".

_____, 2015, "Honduras: First Reviews under the Stand-By Arrangement and Standby Credit Facility".

_____, 2016, "Managing Government Compensation and Employment: Institutions, Policies, and Reform Challenges".

Kumbhakar, Subal, H. Wang, and A. Horncastle, 2015, "A Practitioner's Guide to Stochastic Frontier Analysis Using Stata", Cambridge University Press.

Obstfeld, Maurice and K. Rogoff, 1997, "Foundations of International Macroeconomics", The MIT Press.

Simar, Léopold and P. W. Wilson, 1998, "Sensitivity Analysis of the Efficiency Scores: How to Bootstrap in Nonparametric Frontier Models," Management Science, Vol. 44, N°1, pp. 49-61.

_____, 2000, "A General Methodology for Bootstrapping in Non-Parametric Frontier Models," *Journal of Applied Statistics*, Vol. 27, N°6, pp. 779-802.

Appendix I

Appendix Table 1. Point Estimates and Confidence Intervals. Input Oriented – Primary Education

Country	Lower bound	Efficiency score	Upper bound	Country	Lower bound	Efficiency Score	Upper bound
Central African Republic	0.616	0.714	0.906	Laos	0.262	0.306	0.358
Mozambique	0.572	0.657	0.737	Chile	0.263	0.302	0.330
Malawi	0.555	0.641	0.907	Botswana	0.274	0.301	0.320
Vanuatu	0.551	0.641	0.911	Iran	0.252	0.299	0.381
Uruguay	0.538	0.628	0.924	Samoa	0.253	0.298	0.362
Cambodia	0.542	0.627	0.922	Jamaica	0.265	0.298	0.319
Chad	0.527	0.616	0.714	Fiji	0.250	0.294	0.356
Congo, Republic of	0.549	0.609	0.662	Algeria	0.256	0.293	0.325
Rwanda	0.505	0.590	0.773	Bolivia	0.258	0.289	0.313
Ethiopia	0.507	0.575	0.649	Dominican Republic	0.259	0.289	0.313
Tanzania	0.494	0.566	0.628	Guyana	0.255	0.287	0.313
Zambia	0.471	0.554	0.651	Equatorial Guinea	0.243	0.285	0.335
Cameroon	0.455	0.531	0.611	Belize	0.241	0.281	0.356
Benin	0.453	0.529	0.606	Panama	0.240	0.278	0.314
Mali	0.448	0.515	0.589	Cape Verde	0.225	0.262	0.325
Burkina Faso	0.431	0.482	0.538	St. Lucia	0.215	0.246	0.271
Uganda	0.408	0.480	0.622	Costa Rica	0.213	0.241	0.259
Bangladesh	0.395	0.463	0.562	Mauritius	0.201	0.238	0.289
India	0.393	0.451	0.501	Sri Lanka	0.201	0.236	0.300
Tunisia	0.377	0.448	0.586	Armenia	0.212	0.234	0.251
Burundi	0.380	0.448	0.551	Vietnam	0.197	0.232	0.283
Kenya	0.399	0.442	0.478	Tonga	0.195	0.230	0.292
Cote d`Ivoire	0.396	0.440	0.487	Indonesia	0.198	0.229	0.259
Lesotho	0.393	0.437	0.471	Peru	0.194	0.228	0.281
Madagascar	0.361	0.427	0.525	Ecuador	0.195	0.226	0.290
El Salvador	0.373	0.419	0.455	Jordan	0.185	0.219	0.261
Mauritania	0.374	0.419	0.461	Trinidad &Tobago	0.191	0.218	0.235
Senegal	0.368	0.414	0.455	Ukraine	0.186	0.210	0.225
South Africa	0.369	0.411	0.436	Grenada	0.181	0.207	0.230
Philippines	0.345	0.394	0.435	Romania	0.184	0.206	0.220
Guinea	0.329	0.390	0.489	Moldova	0.185	0.206	0.222
Niger	0.333	0.388	0.449	Thailand	0.175	0.204	0.230
Mongolia	0.332	0.374	0.403	Dominica	0.179	0.203	0.224
Namibia	0.336	0.371	0.394	Malaysia	0.167	0.198	0.252
Nicaragua	0.318	0.369	0.418	Antigua and Barbuda	0.177	0.197	0.210
Togo	0.308	0.362	0.467	United Arab Emirates	0.176	0.195	0.206
Nepal	0.298	0.354	0.430	Bulgaria	0.162	0.192	0.222
Swaziland	0.320	0.353	0.380	Maldives	0.159	0.186	0.233
Gambia, The	0.298	0.351	0.418	Oman	0.165	0.183	0.194
Comoros	0.305	0.350	0.395	Serbia	0.152	0.180	0.211
Djibouti	0.313	0.349	0.389	Barbados	0.153	0.177	0.195
Ghana	0.308	0.346	0.380	Lithuania	0.139	0.162	0.182
Yemen	0.294	0.333	0.367	Seychelles	0.140	0.159	0.174
Colombia	0.297	0.332	0.355	Brunei	0.125	0.142	0.153
Bhutan	0.294	0.330	0.359	Qatar	0.119	0.136	0.147
Guatemala	0.285	0.328	0.369	Saudi Arabia	0.120	0.134	0.144
Morocco	0.292	0.324	0.346	Hungary	0.113	0.126	0.134
Mexico	0.274	0.321	0.365	Kuwait	0.107	0.123	0.135
Paraguay	0.276	0.312	0.342	Georgia	0.098	0.116	0.148
Honduras	0.265	0.307	0.347	Poland	0.094	0.112	0.135

Source: Author's calculations.

Appendix Table 2. Point Estimates and Confidence Intervals. Output Oriented – Primary Education

Country	Lower bound	Efficiency score	Upper bound	Country	Lower bound	Efficiency Score	Upper bound
Uruguay	0.985	0.991	0.998	Romania	0.907	0.913	0.918
Vanuatu	0.982	0.991	0.997	Grenada	0.906	0.912	0.918
Tunisia	0.981	0.987	0.992	Hungary	0.904	0.911	0.915
Iran	0.979	0.984	0.987	Nepal	0.897	0.911	0.917
Belize	0.977	0.982	0.986	Uganda	0.872	0.907	0.926
Fiji	0.972	0.978	0.982	India	0.896	0.906	0.912
Malaysia	0.970	0.977	0.982	Philippines	0.897	0.905	0.909
Cambodia	0.940	0.977	0.998	Malawi	0.759	0.901	0.996
Ecuador	0.968	0.975	0.981	Bolivia	0.893	0.899	0.902
Cape Verde	0.969	0.975	0.979	Moldova	0.893	0.899	0.904
Maldives	0.968	0.974	0.980	Antigua and Barbuda	0.892	0.898	0.903
Mauritius	0.967	0.973	0.976	Oman	0.891	0.898	0.902
Vietnam	0.963	0.969	0.974	Togo	0.875	0.897	0.910
Poland	0.962	0.969	0.974	Benin	0.879	0.895	0.904
Peru	0.960	0.966	0.972	Morocco	0.889	0.895	0.898
Sri Lanka	0.958	0.966	0.972	United Arab Emirates	0.885	0.892	0.896
Mexico	0.960	0.965	0.969	Central African Republic	0.677	0.890	0.996
Jordan	0.959	0.965	0.970	Namibia	0.882	0.888	0.891
Serbia	0.957	0.964	0.969	Nicaragua	0.875	0.885	0.890
Tonga	0.954	0.962	0.968	Zambia	0.860	0.881	0.893
Bulgaria	0.953	0.960	0.965	Cameroon	0.847	0.864	0.874
Panama	0.951	0.956	0.959	Dominican Republic	0.855	0.861	0.864
Georgia	0.949	0.955	0.961	Laos	0.840	0.852	0.858
Lithuania	0.945	0.952	0.957	Botswana	0.844	0.848	0.851
Thailand	0.946	0.952	0.957	Armenia	0.829	0.834	0.838
Samoa	0.942	0.951	0.956	Tanzania	0.810	0.827	0.837
Chile	0.945	0.950	0.953	Guyana	0.812	0.818	0.822
Honduras	0.943	0.949	0.952	Comoros	0.805	0.815	0.821
Kuwait	0.941	0.948	0.953	Bhutan	0.800	0.807	0.810
Algeria	0.942	0.947	0.950	Lesotho	0.793	0.802	0.806
Barbados	0.938	0.945	0.950	Yemen	0.781	0.789	0.793
St. Lucia	0.938	0.943	0.947	Mozambique	0.737	0.778	0.799
Indonesia	0.934	0.940	0.945	Swaziland	0.767	0.773	0.776
Qatar	0.931	0.938	0.942	Kenya	0.754	0.763	0.767
Seychelles	0.929	0.935	0.940	Congo, Republic of	0.705	0.726	0.737
Mongolia	0.928	0.935	0.938	Gambia, The	0.711	0.726	0.734
Trinidad &Tobago	0.927	0.933	0.937	Ghana	0.712	0.718	0.722
Brunei	0.926	0.932	0.937	Senegal	0.707	0.715	0.719
Guatemala	0.925	0.932	0.936	Mauritania	0.694	0.703	0.706
Bangladesh	0.915	0.932	0.940	Madagascar	0.670	0.694	0.706
Dominica	0.924	0.930	0.936	Burundi	0.651	0.686	0.705
Costa Rica	0.924	0.929	0.933	Cote d`Ivoire	0.642	0.650	0.655
Jamaica	0.921	0.927	0.930	Equatorial Guinea	0.640	0.650	0.654
Colombia	0.921	0.926	0.929	Guinea	0.624	0.647	0.660
Saudi Arabia	0.919	0.926	0.930	Mali	0.628	0.644	0.652
Ukraine	0.918	0.924	0.929	Chad	0.567	0.608	0.631
El Salvador	0.912	0.921	0.924	Burkina Faso	0.515	0.524	0.528
South Africa	0.911	0.918	0.922	Ethiopia	0.491	0.509	0.518
Paraguay	0.910	0.916	0.919	Niger	0.465	0.473	0.476
Rwanda	0.848	0.915	0.952	Djibouti	0.418	0.421	0.423

Source: Author's calculations.

Appendix Table 3. Point Estimates and Confidence Intervals. Input Oriented – Secondary Education

Country	Lower bound	Efficiency score	Upper bound	Country	Lower bound	Efficiency Score	Upper bound
Philippines	0.808	0.878	0.979	Togo	0.487	0.542	0.603
Chile	0.781	0.873	0.974	Brunei	0.462	0.539	0.612
Guinea	0.758	0.853	0.972	Hungary	0.449	0.522	0.601
Ethiopia	0.753	0.838	0.972	Mexico	0.475	0.509	0.540
Tonga	0.701	0.833	0.980	Qatar	0.436	0.507	0.565
Central African Republic	0.726	0.827	0.976	Seychelles	0.455	0.495	0.521
Samoa	0.708	0.825	0.971	Antigua and Barbuda	0.434	0.493	0.537
Colombia	0.762	0.821	0.864	Yemen	0.429	0.490	0.558
Fiji	0.716	0.818	0.905	Bhutan	0.456	0.489	0.515
South Africa	0.751	0.807	0.855	Malaysia	0.449	0.480	0.506
Nicaragua	0.705	0.795	0.884	Bulgaria	0.417	0.479	0.544
Nepal	0.698	0.791	0.978	Pakistan	0.420	0.455	0.492
Thailand	0.727	0.787	0.830	Moldova	0.392	0.447	0.495
Cambodia	0.680	0.770	0.975	Uruguay	0.404	0.447	0.486
Serbia	0.635	0.760	0.949	Panama	0.408	0.437	0.468
Jordan	0.641	0.735	0.816	Mali	0.401	0.434	0.468
Mongolia	0.661	0.734	0.782	Ukraine	0.374	0.433	0.499
Guyana	0.609	0.730	0.970	Mozambique	0.369	0.425	0.476
Lithuania	0.605	0.728	0.977	Georgia	0.354	0.425	0.503
Bolivia	0.657	0.722	0.775	Djibouti	0.374	0.420	0.456
Malawi	0.639	0.708	0.786	Bahrain	0.365	0.417	0.471
Sierra Leone	0.601	0.687	0.777	Morocco	0.388	0.416	0.440
Saudi Arabia	0.578	0.687	0.797	Lesotho	0.383	0.416	0.442
Bangladesh	0.614	0.686	0.769	Cameroon	0.378	0.409	0.440
El Salvador	0.629	0.681	0.741	Guatemala	0.353	0.403	0.446
Barbados	0.588	0.677	0.782	Indonesia	0.364	0.401	0.448
Dominican Republic	0.620	0.674	0.738	Burkina Faso	0.352	0.401	0.456
Sri Lanka	0.552	0.672	0.826	Chad	0.346	0.400	0.460
Grenada	0.589	0.670	0.736	Vanuatu	0.368	0.394	0.415
Jamaica	0.611	0.665	0.708	Ghana	0.355	0.384	0.413
Kuwait	0.539	0.652	0.787	Botswana	0.353	0.379	0.404
Kenya	0.599	0.649	0.700	Lebanon	0.322	0.377	0.438
Madagascar	0.568	0.632	0.695	Senegal	0.334	0.372	0.409
Oman	0.576	0.627	0.677	Mauritania	0.322	0.365	0.402
Dominica	0.543	0.623	0.687	Benin	0.329	0.365	0.398
Poland	0.522	0.616	0.736	Uganda	0.324	0.363	0.406
Peru	0.518	0.577	0.633	Burundi	0.319	0.362	0.411
Mauritius	0.534	0.576	0.609	Comoros	0.306	0.352	0.414
Namibia	0.536	0.575	0.608	Ecuador	0.310	0.337	0.370
Costa Rica	0.532	0.574	0.605	Niger	0.291	0.336	0.388
Laos	0.508	0.570	0.624	Paraguay	0.307	0.335	0.372
Belize	0.530	0.568	0.601	Swaziland	0.300	0.323	0.340
Cape Verde	0.524	0.567	0.612	Equatorial Guinea	0.290	0.319	0.349
St. Lucia	0.508	0.549	0.578	Honduras	0.184	0.208	0.241

Source: Author's calculations.

Appendix Table 4. Point Estimates and Confidence Intervals. Output Oriented – Secondary Education

Country	Lower bound	Efficiency score	Upper bound	Country	Lower bound	Efficiency Score	Upper bound
Serbia	0.943	0.975	0.995	Lebanon	0.693	0.736	0.772
Barbados	0.926	0.959	0.977	El Salvador	0.693	0.733	0.764
Lithuania	0.914	0.946	0.989	Belize	0.701	0.732	0.753
Saudi Arabia	0.910	0.943	0.971	Malaysia	0.704	0.727	0.741
Tonga	0.869	0.928	0.989	Mexico	0.672	0.699	0.714
Kuwait	0.891	0.928	0.964	Sierra Leone	0.611	0.698	0.762
Chile	0.883	0.927	0.990	Nicaragua	0.596	0.694	0.786
Poland	0.897	0.927	0.960	Bangladesh	0.628	0.692	0.744
Jordan	0.879	0.919	0.945	Indonesia	0.639	0.679	0.706
Samoa	0.864	0.916	0.986	Panama	0.654	0.678	0.694
Brunei	0.877	0.909	0.942	Cape Verde	0.629	0.671	0.705
Ukraine	0.879	0.906	0.929	Ecuador	0.621	0.644	0.659
Hungary	0.872	0.902	0.937	Yemen	0.587	0.631	0.665
Guyana	0.842	0.902	0.990	Paraguay	0.596	0.629	0.649
Qatar	0.865	0.901	0.934	Kenya	0.577	0.615	0.652
Bulgaria	0.869	0.896	0.920	Botswana	0.584	0.602	0.613
Fiji	0.833	0.888	0.930	Malawi	0.523	0.594	0.658
Dominica	0.851	0.885	0.909	Comoros	0.546	0.585	0.623
Sri Lanka	0.826	0.884	0.952	Namibia	0.552	0.579	0.602
Georgia	0.832	0.878	0.904	Laos	0.507	0.551	0.587
Philippines	0.804	0.877	0.990	Guatemala	0.502	0.534	0.562
Bahrain	0.844	0.877	0.911	Honduras	0.493	0.523	0.545
Antigua and Barbuda	0.847	0.873	0.895	Morocco	0.497	0.518	0.529
Colombia	0.825	0.865	0.899	Bhutan	0.454	0.477	0.501
Nepal	0.742	0.859	0.987	Madagascar	0.413	0.473	0.517
Moldova	0.829	0.859	0.878	Ghana	0.407	0.435	0.455
Oman	0.826	0.859	0.876	Vanuatu	0.410	0.428	0.440
Jamaica	0.824	0.858	0.878	Pakistan	0.391	0.416	0.444
Grenada	0.803	0.851	0.882	Cameroon	0.388	0.415	0.442
Guinea	0.698	0.847	0.973	Mali	0.371	0.394	0.415
Thailand	0.788	0.828	0.866	Togo	0.345	0.384	0.418
South Africa	0.776	0.822	0.869	Swaziland	0.326	0.340	0.347
Mongolia	0.754	0.802	0.842	Benin	0.317	0.337	0.357
Seychelles	0.773	0.796	0.815	Lesotho	0.317	0.332	0.343
Bolivia	0.751	0.796	0.829	Djibouti	0.245	0.259	0.272
Mauritius	0.766	0.795	0.811	Uganda	0.229	0.243	0.256
Costa Rica	0.765	0.794	0.810	Equatorial Guinea	0.226	0.242	0.259
St. Lucia	0.758	0.784	0.800	Senegal	0.229	0.241	0.251
Peru	0.730	0.777	0.809	Burundi	0.218	0.234	0.248
Ethiopia	0.547	0.773	0.990	Mauritania	0.204	0.214	0.222
Cambodia	0.543	0.770	0.988	Burkina Faso	0.195	0.213	0.227
Central African Republic	0.547	0.769	0.990	Mozambique	0.144	0.158	0.174
Uruguay	0.725	0.758	0.779	Chad	0.128	0.139	0.150
Dominican Republic	0.711	0.749	0.782	Niger	0.118	0.125	0.131

Source: Author's calculations.

Appendix Table 5. Point Estimates and Confidence Intervals. Input Oriented – Health

Country	Lower bound	Efficiency score	Upper bound	Country	Lower bound	Efficiency Score	Upper bound
Morocco	0.866	0.919	0.973	Libya	0.628	0.662	0.689
Guatemala	0.864	0.911	0.983	Haiti	0.593	0.659	0.744
Colombia	0.793	0.891	0.986	Kyrgyzstan	0.566	0.643	0.743
Nicaragua	0.799	0.888	0.983	Bahrain	0.591	0.638	0.702
Maldives	0.823	0.878	0.982	Egypt	0.602	0.635	0.669
Thailand	0.793	0.876	0.965	Barbados	0.581	0.634	0.681
Kuwait	0.781	0.869	0.984	Rwanda	0.579	0.632	0.696
Nepal	0.784	0.859	0.983	Yemen	0.553	0.628	0.718
Honduras	0.785	0.840	0.889	Brazil	0.576	0.611	0.659
Cambodia	0.737	0.836	0.984	United Arab Emirates	0.550	0.595	0.647
Tajikistan	0.688	0.836	0.990	India	0.518	0.587	0.655
Liberia	0.755	0.836	0.984	Belize	0.529	0.581	0.641
Senegal	0.741	0.823	0.985	Mauritania	0.528	0.576	0.647
Brunei	0.649	0.819	0.979	Fiji	0.493	0.572	0.665
Tunisia	0.754	0.816	0.891	Poland	0.508	0.565	0.616
Gambia, The	0.747	0.815	0.896	Saudi Arabia	0.527	0.565	0.618
Mali	0.713	0.811	0.914	Iran	0.536	0.565	0.598
Malawi	0.711	0.810	0.986	Togo	0.505	0.557	0.627
Central African Republic	0.701	0.805	0.985	Sierra Leone	0.484	0.551	0.605
Afghanistan	0.720	0.802	0.893	Jordan	0.520	0.548	0.573
Mozambique	0.702	0.799	0.982	Philippines	0.476	0.541	0.613
Niger	0.709	0.799	0.984	Albania	0.481	0.539	0.596
Algeria	0.752	0.796	0.833	Malaysia	0.506	0.538	0.566
Romania	0.708	0.796	0.867	Jamaica	0.495	0.536	0.574
Turkey	0.754	0.795	0.827	Serbia	0.499	0.528	0.556
Papua New Guinea	0.667	0.787	0.985	Lithuania	0.478	0.506	0.531
Vietnam	0.640	0.782	0.984	Bulgaria	0.476	0.504	0.533
Bangladesh	0.661	0.780	0.984	Tanzania	0.448	0.492	0.536
Tonga	0.668	0.780	0.981	Ghana	0.422	0.482	0.562
Costa Rica	0.632	0.778	0.986	Armenia	0.406	0.476	0.558
Uruguay	0.678	0.777	0.869	Kenya	0.430	0.476	0.533
China	0.628	0.771	0.982	Moldova	0.437	0.475	0.514
Chile	0.574	0.767	0.986	Bolivia	0.419	0.463	0.523
Paraguay	0.686	0.766	0.834	Ukraine	0.423	0.458	0.489
Ecuador	0.659	0.749	0.831	Cameroon	0.412	0.457	0.506
Mexico	0.648	0.741	0.825	Mongolia	0.412	0.440	0.475
Venezuela	0.676	0.734	0.790	Hungary	0.397	0.421	0.445
Qatar	0.648	0.726	0.823	Congo, Republic of	0.364	0.404	0.455
Sri Lanka	0.624	0.724	0.832	Guyana	0.359	0.394	0.435
Iraq	0.678	0.718	0.751	Uganda	0.332	0.372	0.421
Pakistan	0.629	0.711	0.793	Namibia	0.334	0.372	0.412
Dominican Republic	0.641	0.699	0.743	Trinidad &Tobago	0.341	0.361	0.390
Benin	0.630	0.690	0.752	Cote d`Ivoire	0.296	0.341	0.395
Croatia	0.591	0.685	0.775	Kazakhstan	0.318	0.338	0.358
Burundi	0.616	0.684	0.776	Russia	0.298	0.314	0.337
Laos	0.608	0.681	0.768	Lesotho	0.274	0.309	0.353
Panama	0.597	0.680	0.754	Swaziland	0.259	0.300	0.340
El Salvador	0.644	0.679	0.708	Zambia	0.244	0.273	0.310
Peru	0.578	0.678	0.773	Gabon	0.201	0.230	0.259
Indonesia	0.603	0.672	0.749	South Africa	0.175	0.199	0.219
Mauritius	0.626	0.671	0.712	Botswana	0.144	0.162	0.185

Source: Author's calculations.

Appendix Table 6. Point Estimates and Confidence Intervals. Output Oriented – Health

Country	Lower bound	Efficiency score	Upper bound	Country	Lower bound	Efficiency Score	Upper bound
Colombia	0.974	0.987	0.998	Yemen	0.899	0.931	0.952
Morocco	0.966	0.982	0.997	Armenia	0.906	0.931	0.947
Thailand	0.966	0.982	0.996	Mozambique	0.782	0.931	0.998
Brunei	0.968	0.981	0.998	Central African Republic	0.783	0.931	0.998
Chile	0.969	0.981	0.998	Pakistan	0.908	0.930	0.945
Nicaragua	0.963	0.981	0.998	Serbia	0.919	0.928	0.937
Romania	0.969	0.980	0.988	Mali	0.880	0.928	0.956
Costa Rica	0.967	0.980	0.998	Lithuania	0.918	0.928	0.935
China	0.957	0.976	0.998	Saudi Arabia	0.917	0.927	0.937
Guatemala	0.957	0.976	0.998	Jamaica	0.913	0.925	0.935
Kuwait	0.955	0.975	0.998	Philippines	0.901	0.924	0.940
Qatar	0.963	0.975	0.984	Libya	0.912	0.922	0.932
Tunisia	0.959	0.972	0.983	Jordan	0.913	0.922	0.928
Uruguay	0.962	0.972	0.983	Iraq	0.902	0.920	0.933
Tajikistan	0.923	0.972	0.998	Laos	0.898	0.919	0.935
Cambodia	0.944	0.970	0.998	Indonesia	0.894	0.919	0.942
Vietnam	0.942	0.969	0.999	Hungary	0.908	0.919	0.927
Croatia	0.957	0.969	0.980	Afghanistan	0.866	0.918	0.949
Nepal	0.943	0.969	0.998	El Salvador	0.905	0.918	0.931
Mexico	0.959	0.969	0.978	Iran	0.906	0.916	0.923
Maldives	0.940	0.965	0.998	Ukraine	0.903	0.915	0.923
Peru	0.951	0.964	0.978	India	0.894	0.911	0.924
Sri Lanka	0.943	0.964	0.981	Egypt	0.895	0.909	0.920
Panama	0.953	0.964	0.974	Moldova	0.894	0.908	0.920
Kyrgyzstan	0.948	0.964	0.975	Mauritania	0.874	0.894	0.909
Tonga	0.927	0.964	0.998	Bolivia	0.880	0.893	0.906
Venezuela	0.952	0.963	0.970	Rwanda	0.867	0.887	0.905
Ecuador	0.941	0.959	0.974	Benin	0.853	0.879	0.900
Poland	0.948	0.958	0.967	Mongolia	0.866	0.877	0.886
Paraguay	0.940	0.958	0.970	Burundi	0.826	0.864	0.891
Honduras	0.939	0.955	0.971	Ghana	0.835	0.862	0.885
Barbados	0.945	0.955	0.963	Kazakhstan	0.854	0.862	0.868
Senegal	0.898	0.954	0.998	Trinidad &Tobago	0.849	0.860	0.871
Turkey	0.938	0.951	0.962	Guyana	0.840	0.854	0.865
Belize	0.939	0.950	0.959	Russia	0.843	0.852	0.860
Gambia, The	0.923	0.949	0.971	Haiti	0.813	0.852	0.877
Bangladesh	0.879	0.947	0.998	Kenya	0.798	0.824	0.839
United Arab Emirates	0.936	0.947	0.956	Namibia	0.808	0.821	0.835
Albania	0.933	0.946	0.955	Tanzania	0.794	0.818	0.832
Bahrain	0.934	0.945	0.956	Togo	0.766	0.808	0.831
Algeria	0.928	0.944	0.956	Congo, Republic of	0.779	0.800	0.813
Mauritius	0.933	0.944	0.953	Cameroon	0.758	0.775	0.787
Papua New Guinea	0.840	0.940	0.998	Gabon	0.758	0.769	0.777
Dominican Republic	0.923	0.939	0.951	Uganda	0.741	0.754	0.766
Fiji	0.915	0.935	0.953	South Africa	0.733	0.741	0.749
Malaysia	0.926	0.934	0.940	Cote d`Ivoire	0.720	0.734	0.746
Brazil	0.924	0.934	0.941	Swaziland	0.715	0.728	0.738
Bulgaria	0.925	0.934	0.940	Zambia	0.708	0.720	0.730
Malawi	0.782	0.933	0.998	Botswana	0.709	0.717	0.725
Liberia	0.785	0.933	0.998	Lesotho	0.686	0.701	0.709
Niger	0.782	0.932	0.999	Sierra Leone	0.630	0.649	0.665

Source: Author's calculations.