Public sector efficiency: the role of financial sector development

**Aguima Aimé Bernard LOMPO[[1]](#footnote-1)**

1 Université Clermont Auvergne, CNRS, IRD, CERDI, F-63000 CLERMONT FERRAND, France, aguimaaimebernardlompo@gmail.com, <https://orcid.org/0000-0001-5986-4151>

**Abstract**

The purpose of this paper is to assess the extent to which financial sector development can increase public sector efficiency. We take advantage of new global public sector efficiency scores for developing and developed countries to address this issue. Public efficiency scores are computed via Stochastic Frontier Analysis (SFA). Then, we rely notably on panel methodology to estimate the effect of financial development on changes in efficiency scores. For a sample of 158 developing and developed countries over the period 1990–2017, we find that a high level of financial development contributes to high public expenditure efficiency. Robustness checks confirm these results and rule out potential biases from omitted variables, simultaneity, or reverse causality. The article explores the channels through which financial development influences expenditure efficiency, emphasizing the role of fiscal performance, per capita income, and institutional quality, particularly corruption control. The analysis also examines heterogeneity in the effectiveness of financial development based on various factors, such as types of financial development variables, macroeconomic conditions, and institutional factors.

**Keywords:** Financial development, Public sector efficiency, Parametric approach, Government spending, Tax revenue, Economic growth.

**JEL classification** : C23, C19, E02, E62, G21, H20, O11

# Introduction

In both developed and developing countries, governments are concerned with efficiency in public provision. It has long been recognized that the sources of inefficiencies are many, but the working of the financial system is obviously important. The importance of financial system is well-documented in the existing literature. The financial systems of most developing and developed countries (particularly developing countries) have witnessed an impressive evolution over the last two decades. This evolution is accompanied by significant changes in business and political practices. A higher level of financial development facilitates the provision by banks of credit to public companies, local authorities, and the state to finance public expenditure. Banks reduce credit costs, increase access to credit, and allocate resources to strategic projects; in other words, they allow the government to finance public spending at lower costs and produce the most significant possible benefit for the country’s population.

There's scarce empirical evidence on how financial development influences the efficiency of public expenditures, both in developed and developing countries. Public expenditure is efficient when, given the amount spent, they produce the most significant possible benefit for the country's population (see alsoAfonso and Aubyn, 2006b)). According to Lonti and Woods (2008), López (2006), and López, (2009), efficiency is a relative concept that refers to the ratio of outputs to inputs about a standard ratio considered optimal. In other words, for Mandl**,** Dierx, and Ilzkovitz (2008), efficiency corresponds to the measure of productivity concerning the idea of the frontier of production possibilities, which indicates the achievable levels of production given the scale of operations. Governments that create more of these outputs while spending less on inputs can be considered more efficient than governments that make fewer outputs and use more inputs, other things being equal (Gupta and Verhoeven, 2001).

Public sector efficiency has been the focus of many studies in the theoretical literature. One first strand of this literature reviews studies of efficiency in the management of public services and its relationship with other economic and financial variables.Antonio Afonso, Schuknecht, and Tanzi (2010a), Giménez and Prior (2007), and Lonti and Woods (2008), attempt to identify the socio-economic variables affecting public expenditure efficiency and the consequences of this relationship on public expenditure management. Eugène (2007) states that the correlation between several indicators makes it more challenging to identify the individual impact of each of them, which is complex from a statistical point of view. Antonio Afonso, Schuknecht, a**nd** Tanzi (2005), Antonio Afonso, Schuknecht**,** and Tanzi **(2010a)**, António Afonso and Aubyn (2005), (Afonso and Aubyn, 2006b), and (Herrera and Pang, 2005a) focused their work on analyzing the efficiency of certain expenditures, including those related to education and health, using non-parametric methods. Eugène (2007) studied the efficiency of health and education cost management in Belgian municipalities, while Aubyn (2002), analyzed public expenditure efficiency on health and education in Portugal. Other authors, such as TeresaBalaguer-**Coll and Prior (2009)**, examine the factors that influence the efficient management of public services in municipalities and how these expenditures affect economic growth. Despite the extensive literature on the impact of macroeconomic variables on public expenditure efficiency, no literature has dealt with the impact of financial development as a factor influencing public expenditure efficiency. One of the main problems that all the studies mentioned above have encountered is identifying and measuring efficiency. Research on the factors that impact public spending efficiency is highly complicated because of its methods (López 2006), the availability of data (homogeneous, relevant, valid, and reliable), measurement difficulties, and the potential effects of many external factors. To address some of these limitations and assess how financial development affects public expenditure efficiency, the purpose of this paper is to provide a new methodology for the measurement of relative public sector efficiency (PSE) in general, and to characterize financial systems that are successful in terms of efficient provision of public services. These countries are compelling case studies for two reasons. First, public expenditure efficiency has become a critical issue in public finance, increased public spending efficiency will complement increased social expenditure if the Millennium Development Goals are reached (Hauner and Kyobe, 2010). The latter is facing a new problem; rationalizing public spending to guarantee the priority burdens of the State better is the new objective that these countries have set themselves, namely, to reduce the excessive lifestyle of the State. Second, in most countries, public goods satisfy specific individuals who control the State for their interests. They act as they wish and reinforce their domination over the rest of the population, abusive and unnecessary public spending to make it easier for some people to live (the conditions) in the dangerous conditions of others, a natural inequality. Citizens want more accountability and transparency from their governments.

This paper contributes to the literature by analyzing whether financial development improves public expenditure efficiency for a large set of 158 countries[[2]](#footnote-2) of all income levels, over the period 1990-2017. This article contributes to the literature by analyzing whether financial development improves public expenditure efficiency for a large number of 158 countries at all income levels from 1990 to 2017. Efficiency scores are limited to the interval ]0; 1][[3]](#footnote-3). The most commonly encountered approach for modeling efficiency scores against exogenous variables is the Tobit regression, which is suitable when dependent variables are censored or corner solution outcomes.

The results suggest that financial development leads to a significant increase in expenditure efficiency, with economically significant effects. Robustness has been checked in several ways, including considering alternative samples, using alternative measures, additional controls, and alternative estimation strategies, especially ordinary least squares (OLS) or fixed-effects regression, the generalized method of moments (GMM), and an instrumental variables (IV) approach. Next, we analyze three transmission channels through which financial development could affect expenditure efficiency. We demonstrate that improving tax performance through increased revenue mobilization, higher GDP per capita, and better institutional quality (especially corruption control) are channels through which financial development positively affects expenditure efficiency. Finally, we deepen the analysis by exploring several potential heterogeneities in the effect of financial development, depending on a range of macroeconomic and institutional factors.

The rest of the paper is organized as fellows. Section **2** presents the conceptual framework and the methodology for measuring scores efficiency. Section **3** describes our theoretical predictions, and Section **4** reports some stylized facts. The data is discussed in Section **5**. The econometric model and empirical results are present in Section **6**. Section **7** focuses on channel transmission validity checks; Section **8** discusses their sensitivity, and final section concludes.

# Measuring public sector performance and efficiency scores

## **Measuring public sector performance (PSP) indices**

We compute sectoral performance indices from series of specific economic and social indicators (I). If there are *i* countries and *j* areas of government performance, which together determine overall performance in country *i,* , we can then write.

(1)

With . Therefore, an improvement in PSP depends on improving the values of the relevant socio-economic indicators:

. (2)

Following Antonio Afonso, Schuknecht, and Tanzi (2005), we consider two categories of performance indicators. The first, described as opportunity performance, reflects the government’s performance in the administration, education, health, and infrastructure sectors. The administrative performance of the government is measured as a composite of the following indices: the quality of government, the independence of the judiciary, the level of the shadow economy, and the quality of property rights.

The social rate of return justifies public spending on secondary education. It is necessary to identify an appropriate outcome indicator that represents the output of the education system. In terms of output, it is generally agreed that one crucial goal of the education system is to improve population education. As measures of the education system, we consider the gross enrollment rate and the expected years of schooling as a quantitative indicator. For the quality of education, we use the pupil/teacher ratio (secondary) and the average number of years of schooling.

The argument for public spending on primary health care is based on reducing disease during the productive years of life. It is also essential to identify an appropriate outcome indicator that represents the output of the primary health care system. Based on data availability across countries and over time, we select the following indicators: child (aged 0 to 5 years) mortality rates, Infant (aged 0 to 1 year) mortality rates per 1000 births, women mortality rate. As a quality measure, we add Life expectancy at birth.

A country's endowment with infrastructure is critical in sustaining economic growth, attracting foreign direct investment, and promoting trade. In developing countries, deficient infrastructure can seriously affect people's daily lives and work. However, no comprehensive measure is available that encompasses all relevant components of economic infrastructure. Following Donaubauer, B. E. Meyer and Nunnenkamp (2016a; 2016b), we compute a global infrastructure index based on three sub-categories of infrastructure: transport (via air, land, and sea), communication (ICT), and energy infrastructure. We use six sub-indexes of infrastructure classified into three main groups: -Transport: we use as a quantitative indicator the length of total roads in kilometers, normalized by the country’s area. For the quality of the road, we also use the paved roads as a percentage of total roads. -ICT: We select the fixed telephone subscriptions and the faults for 100 fixed telephone lines per year. - Energy: We use the proportion of households with electricity, the electric power consumption (in kWh per capita) as quantity, and the electric power transmission and distribution losses (in percentage of production) as the quality of energy.

The Musgravian indicators include three sub-indicators: distribution, stability, and economic performance. To measure income distribution and inequality, we use the Gini index. For the stability sub-indicators, we use the standard deviation of the three-year moving average of GDP growth and inflation. To measure economic performance, we include GDP per capita, the 10-year average of GDP growth, and the unemployment rate (10-year average).

Finally, to capture the common features of the performance sub-indicators used, we compute a composite outcome index for each sector, following Anderson (2008) This method applies generalized least squares (GLS) estimators that account for variables with missing data, giving them less weight than the principal component analysis (PCA) method, which, moreover, is particularly sensitive to the presence of outliers.[[4]](#footnote-4)

Appendix A describes all the variables used in the study and their sources.

Our input measure, Public Expenditure (PE) as a percentage of GDP, weights each area of government expenditure, lagging one year. More specifically, we consider government consumption as input for administrative performance, government expenditure in education as input for education performance, health expenditure as input for health performance, and public investment as input for infrastructure performance. For the distribution indicator, we consider the costs of transfers and subsidies. The stability and economic performance are related to the total expenditure.

## **Measuring public sector efficiency**

Several estimation methods are used in the economic literature to estimate the efficiency frontier: parametric and non-parametric methods. The principle of the non-parametric method concerning the Free Disposal Hull (FDH) analysis and the Data Envelopment Analysis (DEA), is to impose no restrictions on the distribution of inefficiency, no behavioral assumptions (profit maximization objective) unlike the parametric method which is based on econometric estimation methods and techniques. However, non-parametric approaches, as deterministic methods, ignore measurement errors as well as any stochastic influence, considering any variation between units as inefficiency (Kumbhakar, Denny and Fuss, 2000; Kumbhakar and Lovell, 2003). Such an assumption can led to major estimation biases, as the level of public expenditure is also impacted by exogenous shocks (e.g., commodity price shocks, environmental shocks, etc.), which in turn affect public sector performance, irrespective of the resulting efficiency (or inefficiency). Another limitation, these methods are very sensitive to random variations in the data and to measurement errors, sample variations, heterogeneity between units, and the presence of outliers (Fiorentino, Karmann and Koetter, 2006). Among the non-parametric methods, the DEA approach is commonly used in the literature. A few other studies use the FDH approach (e.g., see some pioneering work: Deprins and Simar 1984; Tulkens 2007). In contrast to the DEA analysis, the latter imposes only slight restrictions on the production technology, while allowing for a comparison of efficiency between units (see Bauer 1990; Seiford and Thrall 1990) for further discussion on the merits of these methods). However, as it remains a non-parametric approach, the correction of random factors not related to efficiency is not possible.

These explain why the parametric method is often preferred in the literature, using stochastic production functions called Stochastic Frontier Analysis (SFA). This latter approach allows the error term to have two components: a negative term which measures inefficiency and an idiosyncratic error allowing to capture idiosyncratic shocks (Aigner, Lovell and Schmidt, 1977; Meeusen and van Den Broeck, 1977). However, these methods require strong hypotheses on the distribution of the data. The most used distributions are semi-normal, exponential, and truncated normal.

## **Estimation efficiency scores**

There is a trend in the literature on estimates of technical efficiency measures to use inefficiency specification models, apparently often without fully considering the assumptions behind these models. We adopt a more recent approach, that of Kumbhakar, Lien, and Hardaker (2014), for two main reasons. First, the latter approach allows distinguishing unobserved heterogeneity between units from inefficiency, unlike older methods (Kumbhakar, Ghosh and McGuckin, 1991; Battese and Coelli, 1992; Lee and Schmidt, 1993). This, therefore, improves the analysis, by capturing countries’ heterogeneous characteristics such as their level of development, structural, or institutional features, etc. Second, unlike Greene (2005) and Kumbhakar and Wang (2005) who merely separate firm effects (fixed or random) are separated from inefficiency, where inefficiency can be either independent and identically distributed (iid) or a function of exogenous variables, Kumbhakar, Wang, and Horncastle (2015) propose a further decomposition of inefficiency by distinguishing between persistent (long-run) and transitory or variant (short-run) inefficiency. This makes it possible to consider inefficiency resulting from structural characteristics that persist over time and those resulting from short-term features.

The model of Kumbhakar, Wang, and Horncastle (2015) is specified as follows:

(3)

Where ; and

represents a measure of government performance, proxied by the public sector performance index, in country *i*, in the year *t*. is the vector of inputs. The model is estimated in three steps.

In step 1, we estimate equation (3) using a standard random effect regression model for panel data. This gives consistent estimates of . We also obtain predicted values of and as a by-product of using a random effects panel model.

In step 2, persistent technical efficiency is estimated using the predicted values of . If we have reported them by , then persistent technical inefficiency can be estimated from:

(4)

Finally, the persistent technical efficiency measure (PTE) is obtained from exp (-)

In step 3, the residual technical efficiency (RTE) is estimated. To do so, we return to step 1 and obtain the residues (i.e., ). Assuming that is *iid* N ~ (0, ), and is *iid* N ~ (0, ), we can simply maximize the log likelihood function for the next standard normal stochastic frontier model for the grouped data:

(5)

or . In practice, we use the estimated values of and to define . In other words, the sampling variability associated with and is ignored. Using the standard boundary model on Equation (5) we obtain estimates of , and .

The result of Jondrow et al. (1982) can then be used to estimate the residual technical inefficiency, , based on the estimated residues, . We can use these to calculate the residual time-varying technical inefficiency defined as , then find the overall technical efficiency defined as the product of PTE and RTE, i.e.,

(6)

# **Financial development and public sector efficiency : theoretical predictions**

The literature on the effects of financial development, particularly its persistent constraints on fiscal policy management, is few extensive. Drawing on this body of literature, we contend that a well-developed financial system can impact the efficiency of public expenditures for two primary reasons.

**Financial development as a policy to promote fiscal discipline:**

One major benefit shared by a part of this few literatures is the discipline effect of financial development on fiscal policy. From a broad perspective, fiscal discipline is related to the ability of a government to maintain sustainable public finance. Several tools could enable us to reach this objective namely fiscal consolidation programs (see, Bamba, Combes and Minea (2020)), fiscal rules, and external anchors, such as an IMF-supported program (see, for example, (Celasun, Ostry and Debrun, 2006; Debrun, Epstein and Symansky, 2008; Poplawski-Ribeiro, 2009; Ghosh *et al.*, 2013), or the financial development (see, for example, Ma and Lv, 2023). Specifically, existing literature shows that the conduct of fiscal policy is undoubtedly linked to financial factors, and there are various channels through which finance can influence the behavior of fiscal policy. For instance, fiscal deficits must be financed through financial resources, the availability of which is largely contingent on the level of financial development. Another example is the impact of the financial cycle. Typically, during the upswing of the financial cycle, an economic expansion tends to occur, accompanied by a general increase in public revenues and expenditures. Conversely, during the downturn of the financial cycle, especially in times of financial instability, the economic cycle enters a phase of uncertainty, generally resulting in heightened volatility in fiscal policy. For example, Gruss, Nabar and Poplawski-Ribeiro (2020); Osei and Kim (2020), Jalles (2021), Mawejje and Odhiambo, (2022), Afonso and Carvalho (2022) show that financial development releases financing constraints for the real economy, which fosters economic growth and fiscal policy stability.

Fiscal discipline through deficit or public debt reduction, can originate from two primary areas. Similar to the literature on monetary delegation, where the government loses seigniorage opportunities, necessitating efforts to increase taxes or cut public expenditure (Lucotte, 2012; Barbier-Gauchard, Baret and Minea, 2021) financial development provides governments with access to a variety of funding sources, including capital markets and financial institutions. As a result, the government can better manage its budget and exercise fiscal discipline in controlling expenditures. If the government can borrow at favorable terms due to financial development, it can help manage public debt more efficiently and reduce the cost of servicing that debt, allowing for better control over public expenditure. For governments opting for the tax avenue, the responsibility and willingness of taxpayers to contribute, linked to the quality of public goods provided, may lead to improved management of public resources to achieve the highest possible outcome.

From this perspective, a well-functioning financial system may promote fiscal discipline by ensuring transparent and accountable use of public funds. This can be achieved through effective monitoring mechanisms tied to credit disbursement. Improved fiscal discipline can lead to more efficient public spending, minimizing wastage and enhancing the overall effectiveness of government programs.[[5]](#footnote-5)

**The effectiveness of financial development in terms of tax performance:**

Second, the favorable effect of financial development on fiscal discipline is more likely to come from an impact on tax revenues rather than public expenditure, in contrast to the impact of budgetary rules, as demonstrated by Asatryan, Castellón and Stratmann (2018).[[6]](#footnote-6) As a result, the accountability arising from taxation might motivate the government to use public resources wisely, consequently enhancing the efficiency of public expenditure. The subsequent discussion outlines how financial development can impact tax revenues. Financial development can influence budgetary discipline through various revenue generation and management channels.

**Main channel**

The main channel refers to the state's capacity to mobilize tax revenue. It should be noted that public expenditure is the total expenditure incurred by public administrations, and general revenues ensure its financing. Financial sector development facilitates the collection of taxes by the tax administration and the payment of taxes by taxpayers to finance public expenditure. For example, Elliott (2010) explains how financial development is a crucial determinant of government revenue. According to him, Banks, other financial institutions, and insurers provide liquidity to businesses and consumers by providing various payment systems essential for monetary transactions. Therefore, if a country has well-developed, transparent, and efficient financial institutions, taxpayers and businesses will use them to conduct their transactions. Tax authorities can obtain valuable information from these financial institutions, such as taxpayers' income and assets.

Tax revenues play an essential role in public expenditure by giving resources efficiently. However, the existing literature leaves enough ambiguity further to warrant tax revenue's effect on public sector efficiency. For example, António Afonso, Jalles, and Venâncio (2021) evaluates the relevance of taxation for public spending efficiency in a sample of OECD economies for the period of 2003–2017 and find that expenditure efficiency is negatively associated with taxation. On the contrary, the improvement of public resources mobilization may increase public expenditures efficiency via the accountability of policymakers. A higher level of financial sector development facilitates the provision by banks of credit to public companies, local authorities, and the State to finance public spending. The mechanism of this influence can be elaborated as follows. According to Hur, Raj, and Riyanto (2006), dependence on external financing and the agency problem are inevitably linked and defines the entrepreneur-financier relationship. The level of financial system development, the extent of investor protection, productive monitoring technologies, and property-rights enforcement are the degree of financial development factors that help limit the seriousness of the agency problem and protect the interests of financiers. In the proper functioning of these factors, financiers are protected against possible non-payment by debtors. Banks reduce credit costs, increase access to credit, allocate resources to strategic projects; in other words, they allow the government to finance public expenditure at lower prices and produce the most significant possible benefit for the country’s population. Banks and other financial institutions also will enable the receipt and disbursement of public revenues to efficiently finance public expenditure for the use of the entire population. They can also monitor expenses. Once the financing of expenses comes from banks and other financial institutions, they can exercise control over costs, allowing a high efficiency.

In addition, the state’s capacity to mobilize tax revenue may become increasingly affected by financial development’s indirect transmission channels as they intensify with inflation. Inflation is an indicator of macroeconomic stability. Financial sector development may positively affect public spending efficiency through lower inflation ( Mehrotra and Yetman, 2015). Indeed, low inflation rates mitigate the negative Oliveira-Keynes-Tanzi effect, as the erosion in the actual value of taxes between the date of imposition and the date of collection will decrease (see Tanzi, 1992). Moreover, the decrease in inflation volatility engendered by financial development (see, Mehrotra and Yetman 2015) should help stabilize and make more predictable the tax base. As a result, better tax collection may be associated with financial development. Sound public financial management should lead to better fiscal performance and public spending efficiency. In addition, higher levels of financial sector development allow the central bank to use interest rates more effectively to manage the inflation rate and its variability. Suppose financial development implies better access to finance and financial inclusion. This will allow more significant consumption smoothing so that the central bank can focus more on inflation than on stabilizing output, thus facilitating lower and more stable inflation rates (Mehrotra and Yetman, 2015). According to Hauner and Kyobe (2010a), the ratio of spending to GDP - the denominator of efficiency scores - will be lower than the policy target if inflation is higher than budgeted and there is no supplementary budget to raise spending limits. This would tend to lead to a scramble for resources as the public sector is squeezed in real terms. It is evident that by reducing the rise in inflation, fiscal development should achieve consistent budget planning and improve public spending efficiency.

Finally, the other channel refers to the state's capacity to fight tax evasion. Financial development help to reduce corruption and tax evasion. Financial development help to reduce corruption and tax evasion. According to Beck, Lin, and Ma (2014), financial development reduces a company's tax evasion degree. (Hasan *et al.*, 2014) note that access to external credits is costly for companies with more tax evasion practices. For example, large companies owned by foreign investors and other companies whose financial accounts are subject to external audits are less likely to evade tax. Companies and individuals who avoid taxes or engage in illegal activities hide their income. Financial development promotes greater transparency for companies more dependent on external financing. Therefore, since developing countries are the most affected by tax evasion, a certain level of financial sector development reduces the loss of tax revenue associated with tax evasion.

A report by UNCTAD (2015) reveals that developing countries are losing about $100 billion in tax revenue annually due to widespread tax evasion and fraud. This significant loss of public expenditure financing resources leads to chronic budgetary imbalances and affects public spending efficiency. Through the domestic credit channel and in the presence of conditionalities, financial development reduces the degree of tax evasion of a company. It tends to improve the efficiency of public spending.

**Indirect channel**

A first indirect channel relies on governments' desire to ensure the economy's long-run growth. For instance, domestic credit to the private sector may impact the development of the private sector (both consumption and investment), the long-run output growth, and the GDP per capita. Financial development should increase investment productivity and reduce transaction costs (increase investment liquidity), which would strengthen the competitiveness of firms, improve savings, and thus promote economic growth. An increase in investment productivity and a reduction in transaction costs directly impact companies. It should not be forgotten that productivity measures the efficiency with which an economy mobilizes resources to produce goods and services. Improving productivity requires better management of scarce resources and total employment of economic capacity. This then leads to an increase in efficiency. The effect of per capita income on the efficiency of public expenditure could be a two-way street. On the one hand, it could reduce efficiency by increasing the relative cost of public services (Baumol, 1967). On the other hand, it was often found that higher income was associated with better health and education outcomes (see Antonio Afonso, Schuknecht, and Tanzi 2010b; Herrera and Pang 2005b), while on the other hand, poorer countries had lower performance (La Porta *et al.*, 1999).

A second channel relies on the desire of the government to fight corruption. Financial development help to reduce corruption. According to Levine (2004), financial sector development includes finance's role in exercising governance. Financial institutions (and other creditors) effectively control borrowers (states) and encourage them to improve the efficiency of their resource allocation. Bank credits reduce corruption to the extent that they are associated with conditions that limit the discretion of the recipient country's officials. Financing can play an essential role in improving governance more generally. The corruption affects the provision of social services provided by the public. It can drive prices and reduce production and public services (Shleifer and Vishny, 1993), including feeding and financing health, education, and defense services in many countries. According to Jayasuriya and Wodon (2003), corruption reduces government and business efficiency by enabling people to assume power through patronage rather than ability and introduces inherent instability in the political system. Then, corruption reduces investment in human capital (Ehrlich and Lui, 1999). Lastly, corruption reduces public revenues (see Shleifer and Vishny (1993) and Hindriks, Keen, and Muthoo (1999)), which in turn can weaken the quality of services provided by the public sector. In other words, it negatively influences public spending efficiency. It reduces their willingness to pay for them (through tax evasion), reducing the tax base and reducing the government's ability to provide quality public services. In the end, financial development help to reduce corruption and thus will increase public spending efficiency.

Altogether, these two arguments —concerning to fiscal discipline and tax performance—provide substantial grounds to assume that financial sector development may positively influence public expenditure efficiency.

# **Stylized facts**

We present descriptive statistics for the computed scores and financial development across the span of 1990-2017, examining a broad panel of 158 countries chosen based on data availability. Subsequently, we establish correlations between the scores calculated and the focal variable of interest—Financial Development.

## **Calculated efficiency scores**

Figure 1 illustrates the evolution of average scores for 158 countries over the period 1990-2017, distinguishing between advanced and developing countries. It shows a steady increase in efficiency in both advanced and developing economies from the mid-1990s onwards, with a peak around the year 2000. While the latter marks the beginning of a gradual decline in efficiency in developing economies, advanced economies show a slight upward trend until 2007. A downward trend in both groups of countries can be observed from 2008, with an acceleration of the pace for developing economies and further recovery from 2015. On average, advanced countries are closest to the efficiency frontier, with a score of 0.71, while the reported average efficiency for developing countries is 0.64 (see figure 2). The top 10 performing countries have scores ranging from 0.73 to 0.79, all of which are advanced economies, while the bottom 10 countries have scores between 0.56 and 0.60, with seven being African economies (see Table C3).

Une image contenant texte, Tracé, diagramme, ligne

Description générée automatiquementUne image contenant texte, Tracé, diagramme, ligne

Description générée automatiquement

Figure 1. Plot showing overall public and public sector efficiency by income group trends from 1990 to 2017.

Source : Author's calculations using SPEED-IFPRI /ICTD/UNU-WIDER GRD, 2019.



Figure 2. Average public sector efficiency scores (1990-2017).

Source: Author's calculations using SPEED-IFPRI /ICTD/UNU-WIDER GRD, 2019.

## **Financial sector development**

Focusing on the financial development index, Figure 3 depicts an upward trend in our sample, suggesting progress in financial sector. Specifically, the evolution of the financial sector has shown significant improvement, increasing from 0.21 in 1990 to 0.35 in 2017, on average. Advanced economies, on average, exhibit the highest levels of financial development, while the reported average financial development index for developing countries remains comparatively low over the period 1990-2017.

 

Figure. 3: Financial development index Over Time (1990-2017).

Figure 4 illustrates the level of financial development by income group. It appears that high-income countries have the highest level of financial development in the sample, with an average overall financial development index of 0.61. Conversely, it is evident that the level of financial development is lowest in low-income countries, with an average overall financial development index equal to 0.17. This remains significantly lower compared to developed countries over the period 1990-2017.



Figure 4. Average financial development index (1990-2017).

Source : Authors, from the Financial Structure and Economic Development Dataset (FSED), 2019

In Figure 5, we present the correlation between financial development and the scores measuring public sector efficiency. It clearly appears that increased financial sector development is linked to higher scores of public sector efficiency.



Figure.5 Correlation Between the financial development and public sector efficiency score

Author's calculations using SPEED-IFPRI /ICTD/UNU-WIDER GRD, 2019 and FSED Database, 2019.

# **Data**

Our study, dictated by data availability, covers the period 1990-2017. The dependent variable is represented by the previously calculated efficiency scores, which can range from 0 to 1. The variable of interest is the measure of the overall level of financial development of a country i during year t. We collected the financial development index from the Financial Structure and Economic Development Database (FSED) for its estimation.

Following the existing literature on the determinants of public sector efficiency, we retain several vital factors, including structural factors, that influence countries’ public sector efficiency, which must be included in the public sector efficiency equation to avoid speciation bias in the financial development– public sector efficiency relationship. The following paragraphs discuss the justification of each control variable included in the equation:

**GDP per capita** - By taking **the logarithm of GDP per capita**, we account for the income effect. In reality, wealthier countries may exhibit lower efficiency due to higher wage levels. However, they are also likely to possess better organizational structures, contributing to increased efficiency. Moreover , GDP per capita is expected to positively impact public expenditure efficiency because physical capital stock facilitates the efficient production of goods and services. But this may also enable monitoring of policymakers (Afonso, Schuknecht and Tanzi, 2010a).

**Tax revenues** - Tax revenue mobilization is a critical concern for both advanced and developing economies. Advanced economies, facing population aging, are increasingly channeling public spending toward social sectors, leading to concerns about potential fiscal stress (Leeper and Walker, 2011). On the other hand, developing countries, heavily reliant on external financial flows, are undertaking reforms to enhance tax revenue mobilization, especially in the context of growing trade liberalization over the past decades, resulting in a decline in tariff revenues. Domestic taxation is vital for these nations, enabling them to finance their development independently and reduce reliance on external funding. This self-sufficiency supports essential state functions, fosters economic growth, and encourages responsive and accountable governance. From a theoretical standpoint, Barro (1990) highlights a non-linear relationship between government spending and economic growth, influenced by taxation levels, and suggests potential threshold effects. According to this model, an increase in taxes can fund productive public spending. Still, beyond a certain threshold, taxation introduces distortions, akin to the Laffer curve, resulting in decreased private capital productivity. Consequently, the impact of taxation on government efficiency is ambiguous, potentially driven by a threshold effect. Empirically, studies by Chan, Ramly and Karim (2017) for a global panel and Afonso, Jalles and Venâncio (2021) for OECD countries from 2003-2017 reveal complex associations between taxation, government spending efficiency, and economic growth.

**Trade globalization**- The impact of trade globalization on the efficiency of the public sector is ambiguous. On one hand, globalization has the potential to enhance overall economic performance by facilitating the transfer of skills, knowledge, and technologies (Hauner and Kyobe, 2010). This, in turn, could foster technological progress and the adoption of more efficient production techniques, promoting effective public sector management. Additionally, knowledge diffusion resulting from trade globalization, including within the public sector, may strengthen domestic knowledge and enhance capacities in public administration (see, Apeti, Bambe and Lompo, 2023). Conversely, globalization could indirectly influence government efficiency through taxation, yielding ambiguous effects. Schulze and Ursprung (1999) explore the relationship between globalization and fiscal policy, identifying two distinct effects. The efficiency effect suggests that in the context of liberalization, countries aiming to attract more international capital may be motivated to reduce domestic taxes, potentially limiting their ability to provide public goods. The compensation effect posits that globalization, likely contributing to increased income inequalities, may drive higher demand for social insurance programs, leading to an upward shift in taxation and spending levels.

**The level of public debt** - is a crucial factor influencing the government's capacity to achieve the specified goals for fiscal aggregates (Calderón and Schmidt-Hebbel, 2008). The expected effect of this variable is ambiguous. Well-managed public debt can be a valuable tool for economic development and enhancing public sector efficiency through strategic, long-term investments in human capital, such as education and healthcare. A well-educated and healthy workforce positively influences public sector services' efficiency. Public debt allows governments the flexibility to implement countercyclical policies, stabilizing the economy during downturns and maintaining public sector efficiency. Conversely, high public debt requires substantial interest payments, diverting resources from critical public services and limiting efficient fund allocation to sectors like education, healthcare, and infrastructure. Elevated public debt may challenge fiscal discipline, leading to deficit spending and potential financial instability. Additionally, high public debt levels may heighten the likelihood of implementing austerity measures, disproportionately impacting public services and further compromising overall efficiency.

**Institutional quality,** measured by the level of democracy[[7]](#footnote-7) and government fragmentation, plays a crucial role in public sector management. A robust institutional framework, such as good governance or strengthened democracy, encourages governments to justify their control of the state apparatus, promotes budgetary transparency, and provides a comprehensive overview of public sector activity, thereby limiting the risk of fraud. On the other hand, **government fragmentation** [[8]](#footnote-8), as studied by Kontopoulos and Perotti (1999), has implications for public sector management, particularly in OECD countries. Their research reveals a correlation between fragmentation and larger expenditures, especially since spending ministers play a pivotal role in representing individual spending interests in European governments. This trend is consistent with findings from other studies by Edin and Ohlsson (1991); Borrelli and Royed (1995); Franzese Jr (2000); Balassone and Giordano (2001); Volkerink and De Haan (2001); and Artés and Jurado (2018). Despite these observations, some scholars, including De Haan and Sturm (1994, 1997); Harrinvirta and Mattila (2001); Ricciuti (2004), have failed to identify statistically significant effects resulting from government fragmentation.

The data on control variables originate from the World Bank's World Development Indicators, the International Monetary Fund’s World Economic Outlook (WEO), Penn World Tables (PWT9.1) and the Polity4 project.

Table 2 contains the list of variables used in this paper and a brief description of the data. [[9]](#footnote-9)

**Table 2 : Descriptive statistics for main variables**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Obs | Mean | Std. Dev. | Min | Max |
| Public Sector Efficiency | 3802 | .664 | .078 | .247 | .896 |
| Financial development | 3617 | .3 | .218 | 0 | 1 |
| Public debt (log) | 3106 | 55.926 | 45.451 | 0 | 600.623 |
| Tax revenues (log) | 3509 | 17.482 | 8.465 | .086 | 60.946 |
| GDP per capita growth | 3733 | 2.274 | 6.185 | -64.992 | 140.371 |
| Trade globalization | 3794 | 53.171 | 17.529 | 11.275 | 96.028 |
| Democracy | 3583 | 6.719 | 2.995 | 0 | 10 |
| Government Fragmentation | 3381 | .25 | .286 | 0 | 1 |

**Sources :** *Author's estimate*

# **Econometric model and results**

## **Econometric model and baseline results**

Table 1 provides an overview of the distribution of technical efficiency (TE) scores. The scores, as constructed, can range from 0, indicating the worst performance, to 1, representing the best performance. We report 3,002 country-year observations with an average score of 0.66 over the sample and the period considered. There are 44.61% of countries with efficiency scores below this value. The results show that, on average, countries could increase about one-third (1-0.66) of their technical efficiency (TE).

Table 1 **: Distribution of efficiency Score**

|  |  |  |  |
| --- | --- | --- | --- |
| Efficiency score | Nbr | Percent | Cum |
| 0-0.5 | 119 | 3.13 | 3.13 |
| 0.6-0.7 | 571 | 15.02 | 18.15 |
| 0.7-0.8 | 1816 | 47.76 | 65.91 |
| 0.8-0.9 | 1188 | 31.25 | 97.16 |
| 0.9-0.1 | 108 | 2.84 | 100.00 |
| Average | 0.66 |  |  |
| Min | 0.25 |  |  |
| Max | 0.90 |  |  |
|  |  |  |  |

From these technical efficiency (TE) scores, we assess the impact of financial development on TE with Tobit model (Table 5). Tobit regression is an alternative to ordinary least squares regression (OLS) and is used when the dependent variable is bounded from below, above, or both, with a positive probability of concentration at the interval ends, either due to censoring or corner solutions (Wooldridge, 2002). In the case of censoring, observations outside the limiting interval are recorded as the border values. For instance, if the range is [a; b], observed y < a is recorded as y = a, and observed y > b is recorded as y = b. In the case of corner solutions, observations are naturally limited from below, above, or both, with a positive probability at the 'corners' (interval ends). Technical efficiency (TE) scores range continuously between 0 and 1, with a positive probability of reaching 1. Therefore, it is logical to employ a two-limit Tobit technique to model these scores based on exogenous variables. Tobit has been widely chosen as the natural method for modeling DEA scores in second-stage evaluations in numerous studies( see, e.g., Coelli *et al.*, 2005; Afonso and Aubyn, 2006b; Bravo-Ureta *et al.*, 2007; Afonso, Schuknecht and Tanzi, 2010c).[[10]](#footnote-10) Our main empirical specification is as follows: Our analysis is based on the following Tobit model:

(7)

Where: is the public sector efficiency measure (PSE) from a country *i* in period *t*; *FD* indicates the level financial development for a country *i* in year *t*. We are mainly interested in *β*1, the coefficient of financial development. is the vector of control variables; these include the total factor productivity, the total non-resources tax ratio, the population density, the public debt, the trade globalization, the government fragmentation, and democracy.

The error term in panel data application is generally defined as follows: (8)

where is the unobservable individual effects and is the unobservable individual and random effects. Individual effects are addressed in two different ways as follows: If is assumed fixed for each individual, then it is referred to as a ‘‘Fixed Effect’’ estimator; or if it is considered to be picked up randomly from a probabilistic distribution, then it should be referred to as a ‘‘Random Effect’’ estimator (Kaya Samut and Cafrı, 2016). Nevertheless, since each country has its characteristics that may or may not influence the predictors, we added country-fixed effects to control for this. However, in the present setting this is not possible as a fixed effects (conditional) Tobit model cannot be estimated parametrically (Adam, Delis and Kammas, 2011). Given the nonlinearity of the Tobit model, employing fixed effects in Panel Tobit Analysis would result in an augmentation of ai with the increase in N, leading to incidental parameter issues and biased outcomes (Fernández-Val and Weidner, 2016). There is a highlighted concern about the distribution of the disturbance variance estimator in fixed-effect Tobit models, extending beyond the incidental parameter problem, as underscored by Greene (2004). Hence, opting for a random effect estimation for Panel Tobit is considered more suitable.

Table 3 presents the baseline results of estimating the effect of financial development on public sector efficiency. Column (1) estimated the effect using financial development index as an explanatory variable. The results show a positive and significant impact of financial development on public sector efficiency at the 1% threshold. However, this specification suffers from an omitted variable. Based on the literature, we then iterated the model using additional explanatory variables that may affect public sector efficiency. The effect of financial development on public sector efficiency remains positive and significant (columns 2-7). The results in column 7 indicate that, on average, for the countries in the sample, an increase in financial development level by one unit leads to an improvement of public sector efficiency by 10.9 percentage points. This effect is particularly robust when controlling for the favorable impact of annual GDP per capita growth, trade globalization, and democracy on the efficiency of public sector; also, by the negative impact of tax revenue, and the no significatively effect of public debt and government fragmentation (regression (7)). The results in table 3 support that financial development has a positive and significant impact on the efficiency of public sector.

**Table 3. Benchmark estimations of the impact of financial development on public sector efficiency.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Dependent Variable** | **Public Sector Efficiency (PSE)** | | | | | | |
| **Regressions** | Reg1 | Reg2 | Reg3 | Reg4 | Reg5 | Reg6 | Reg7 |
|  |  |  |  |  |  |  |  |
| Financial development | 0.1467\*\*\* | 0.1409\*\*\* | 0.1316\*\*\* | 0.1362\*\*\* | 0.1158\*\*\* | 0.1068\*\*\* | 0.1090\*\*\* |
|  | (0.0102) | (0.0111) | (0.0120) | (0.0120) | (0.0131) | (0.0140) | (0.0141) |
| Public debt (log) |  | -0.0056\*\* | -0.0024 | -0.0011 | 0.0020 | 0.0019 | 0.0020 |
|  |  | (0.0022) | (0.0023) | (0.0023) | (0.0024) | (0.0024) | (0.0025) |
| Tax revenues (log) |  |  | 0.0109\*\* | 0.0090\* | 0.0047 | -0.0111\*\* | -0.0121\*\* |
|  |  |  | (0.0047) | (0.0048) | (0.0048) | (0.0055) | (0.0057) |
| GDP per capita growth |  |  |  | 0.0017\*\*\* | 0.0017\*\*\* | 0.0017\*\*\* | 0.0016\*\*\* |
|  |  |  |  | (0.0002) | (0.0002) | (0.0003) | (0.0003) |
| Trade globalization |  |  |  |  | 0.0299\*\*\* | 0.0217\*\*\* | 0.0228\*\*\* |
|  |  |  |  |  | (0.0075) | (0.0078) | (0.0079) |
| Democracy |  |  |  |  |  | 0.0066\*\*\* | 0.0049\*\*\* |
|  |  |  |  |  |  | (0.0011) | (0.0011) |
| Government Fragmentation |  |  |  |  |  |  | 0.0077 |
|  |  |  |  |  |  |  | (0.0066) |
| Constant | 0.6178\*\*\* | 0.6439\*\*\* | 0.6053\*\*\* | 0.5995\*\*\* | 0.4872\*\*\* | 0.5225\*\*\* | 0.5301\*\*\* |
|  | (0.0040) | (0.0093) | (0.0155) | (0.0155) | (0.0309) | (0.0321) | (0.0326) |
| / |  |  |  |  |  |  |  |
| sigma\_u | 0.0253\*\*\* | 0.0287\*\*\* | 0.0297\*\*\* | 0.0299\*\*\* | 0.0295\*\*\* | 0.0297\*\*\* | 0.0274\*\*\* |
|  | (0.0020) | (0.0023) | (0.0024) | (0.0024) | (0.0024) | (0.0026) | (0.0025) |
| sigma\_e | 0.0647\*\*\* | 0.0626\*\*\* | 0.0613\*\*\* | 0.0608\*\*\* | 0.0603\*\*\* | 0.0606\*\*\* | 0.0603\*\*\* |
|  | (0.0008) | (0.0009) | (0.0009) | (0.0009) | (0.0008) | (0.0009) | (0.0009) |
| Observations | 3246 | 2829 | 2692 | 2686 | 2679 | 2506 | 2307 |
| Number of countries | 134 | 134 | 134 | 134 | 133 | 126 | 121 |
| Log likelihood | 4179 | 3712 | 3581 | 3596 | 3608 | 3361 | 3110 |
| Countries/Time fixed effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Chi2 | 206.2 | 163.5 | 158 | 204.4 | 226.7 | 223.3 | 199.5 |

*Note: Robust Standard Errors are in parenthesis.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

## **Additional controls**

We further enhance our main specification by including additional covariates. In column [2] of Table 8, we include openness degree instead of trade globalization, as is the case in the baseline specification, we rely on an alternative measure, namely, the combined value of exports and imports expressed as a percentage of GDP. In columns [3] to [12], we augment our main specification with the following variables: Total factor productivity, government durability, political stability and the absence of violence/terrorism, financial openness, credit rating, a dummy variable banking crisis, a dummy variable for monetary union, a dummy variable for inflation targeting regime, presidential system, and political checks and balances, respectively. The results remain robust.

**The population density** - as one of the demographic indicators. Hauner and Kyobe (2010) contend that a larger population, leveraging economies of scale, could enhance public sector efficiency by reducing the cost of public service provision. However, our interpretation introduces complexity by considering other factors. Higher population density may not only yield economic benefits but also impose pressure on natural resources and public infrastructure, potentially leading to social tensions in areas with limited opportunities. Additionally, population density might indirectly impact fiscal efficiency, as administering income or sales taxes becomes more challenging in sparsely populated regions.

**Total factor productivity** - as a measure of firm-level productivity. The effect of the business cycle may be ambiguous since it is well known that fiscal policy is primarily procyclical in developing economies, with an excess of debt and spending in the high cycle period. Increasing spending when economic conditions improve is inconsistent with Keynesian optimality and may produce poor outcomes. Better factor productivity may reflect better organizational or technological innovation or more efficient use of production factors. This can lead to efficiency gains in the economy, including in managing government expenditure. Furthermore, improved factors of production leading to increased productivity can provide additional government resources, potentially allocated to more productive sectors. Finally, as productivity gains are crucial components of the growth process (Bosworth and Collins, 2003), enhancing factor productivity is crucial for a dynamic economy and improved household welfare, especially if gains benefit the less privileged.

**Government durability**- The durability of a government, reflecting its capacity to implement consistent long-term policies, influences expenditure efficiency. However, this argument requires nuance, as government durability in less democratic regimes may indicate weak institutions, potentially adversely affecting efficiency, especially considering that countries with poorer institutional performance often exhibit poor economic performance (Acemoglu and Robinson, 2008).

**Political stability and the absence of violence/terrorism** allude to the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. Political volatility can complicate coherent budget planning and undermine effectiveness (Hauner and Kyobe, 2010). Political stability and the absence of violence/terrorism could positively affect public spending efficiency.

**Financial openness-** the impact of financial openness on the efficiency of the public sector is nuanced. Financial openness allows for diversification and access to international financial markets. This can be crucial in mitigating the impact of external economic shocks, providing the public sector with greater resilience and adaptability. However, financial openness poses challenges in terms of managing debts and external risks. Ineffective financial management can lead to vulnerabilities, hindering the public sector's ability to allocate resources efficiently.

A **positive credit rating** indicates to investors that a government is a trustworthy borrower, attracting investments for productive projects and improving overall public sector efficiency. Higher credit ratings typically result in lower borrowing costs, allowing the public sector to fund projects efficiently and allocate resources wisely. On the flip side, lower credit ratings may create budgetary constraints, restricting the government's access to funds and potentially leading to less efficient resource allocation. Membership in a **monetary union** typically involves following shared fiscal rules, fostering fiscal discipline within the public sector and promoting responsible budgetary practices, thereby enhancing overall efficiency. The use of a common currency within the union results in decreased transaction costs and minimized exchange rate uncertainties. This stability is advantageous for the public sector, facilitating more seamless fiscal planning and mitigating financial risks associated with currency fluctuations. **Inflation targeting** necessitates disciplined fiscal policies, fostering efficient resource allocation and reducing the risk of financial mismanagement in the public sector. However, strict adherence to inflation targets may limit fiscal flexibility, hindering the effective implementation of counter-cyclical policies and potentially impeding efficient resource allocation in challenging economic periods. In a **presidential system**, centralized executive leadership facilitates decisive decision-making, positively impacting public sector efficiency by streamlining policymaking and enabling prompt responses to emerging issues. The clear delineation of executive powers enhances accountability, contributing to efficient public sector operations through transparent decision-making and responsible resource allocation. **Checks and balances** - enhance accountability and transparency in the public sector by holding decision-makers accountable for actions and resource allocations. These mechanisms serve as a safeguard against the abuse of power, distributing authority and implementing oversight measures to prevent inefficiencies and corruption resulting from unchecked decision-making. A **banking crisis** poses a substantial threat to financial stability, impeding the public sector's access to essential funds and introducing economic uncertainties that disrupt the efficiency of public service delivery. The fiscal pressures arising from such crises often require government interventions and financial bailouts, diverting resources from public programs and exacerbating challenges in resource allocation. The direct consequences, including credit shortages and economic downturns, can hinder the public sector's ability to deliver essential services efficiently. Reduced revenues and heightened demands for public assistance may strain existing resources further.

**Table 4. Robustness/ The impact of financial development on public sector efficiency: Additional controls**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Dependent Variable** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
| **Regressions** | Reg1 | Reg2 | Reg3 | Reg4 | Reg5 | Reg6 | Reg7 | Reg8 | Reg9 | Reg10 | Reg11 | Reg12 | Reg13 | Reg14 | Reg15 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Financial development | 0.1090\*\*\* | 0.1260\*\*\* | 0.1079\*\*\* | 0.1101\*\*\* | 0.1016\*\*\* | 0.1232\*\*\* | 0.1053\*\*\* | 0.1194\*\*\* | 0.1076\*\*\* | 0.1103\*\*\* | 0.1173\*\*\* | 0.1119\*\*\* | 0.1343\*\*\* | 0.0423\*\* | 0.1117\*\*\* |
|  | (0.0141) | (0.0138) | (0.0141) | (0.0167) | (0.0173) | (0.0153) | (0.0146) | (0.0185) | (0.0142) | (0.0145) | (0.0145) | (0.0141) | (0.0158) | (0.0166) | (0.0145) |
| Public debt (log) | 0.0020 | 0.0034 | 0.0025 | 0.0125\*\*\* | 0.0018 | 0.0062\*\* | 0.0016 | 0.0116\*\*\* | 0.0021 | 0.0020 | 0.0030 | 0.0022 | -0.0032 | 0.0046\* | 0.0002 |
|  | (0.0025) | (0.0026) | (0.0025) | (0.0030) | (0.0026) | (0.0027) | (0.0025) | (0.0035) | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0027) | (0.0027) | (0.0026) |
| Tax revenues (log) | -0.0121\*\* | -0.0207\*\*\* | -0.0125\*\* | -0.0304\*\*\* | -0.0125\*\* | -0.0207\*\*\* | -0.0098\* | -0.0297\*\*\* | -0.0122\*\* | -0.0121\*\* | -0.0134\*\* | -0.0126\*\* | -0.0204\*\*\* | -0.0064 | -0.0096 |
|  | (0.0057) | (0.0064) | (0.0058) | (0.0085) | (0.0059) | (0.0064) | (0.0058) | (0.0076) | (0.0058) | (0.0057) | (0.0059) | (0.0057) | (0.0072) | (0.0060) | (0.0061) |
| GDP per capita growth | 0.0016\*\*\* | 0.0020\*\*\* | 0.0016\*\*\* | 0.0010\*\*\* | 0.0017\*\*\* | 0.0017\*\*\* | 0.0016\*\*\* | 0.0022\*\*\* | 0.0016\*\*\* | 0.0016\*\*\* | 0.0017\*\*\* | 0.0016\*\*\* | 0.0017\*\*\* | 0.0025\*\*\* | 0.0018\*\*\* |
|  | (0.0003) | (0.0003) | (0.0003) | (0.0004) | (0.0003) | (0.0004) | (0.0003) | (0.0004) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| Trade globalization | 0.0228\*\*\* |  | 0.0248\*\*\* | 0.0227\*\* | 0.0211\*\* | 0.0114 | 0.0178\*\* | 0.0153 | 0.0232\*\*\* | 0.0228\*\*\* | 0.0162\*\* | 0.0200\*\* | 0.0185\*\* | 0.0070 | 0.0199\*\* |
|  | (0.0079) |  | (0.0080) | (0.0095) | (0.0082) | (0.0086) | (0.0082) | (0.0104) | (0.0080) | (0.0079) | (0.0080) | (0.0079) | (0.0084) | (0.0089) | (0.0083) |
| Democracy | 0.0049\*\*\* | 0.0056\*\*\* | 0.0051\*\*\* | 0.0073\*\*\* | 0.0049\*\*\* | 0.0063\*\*\* | 0.0046\*\*\* | 0.0035\*\* | 0.0049\*\*\* | 0.0050\*\*\* | 0.0046\*\*\* | 0.0046\*\*\* | 0.0051\*\*\* | 0.0033\*\*\* | 0.0061\*\*\* |
|  | (0.0011) | (0.0012) | (0.0011) | (0.0015) | (0.0012) | (0.0013) | (0.0011) | (0.0014) | (0.0011) | (0.0011) | (0.0011) | (0.0011) | (0.0012) | (0.0012) | (0.0013) |
| Government Fragmentation | 0.0077 | 0.0195\*\*\* | 0.0084 | 0.0096 | 0.0070 | 0.0116 | 0.0070 | 0.0240\*\*\* | 0.0076 | 0.0077 | 0.0147\*\* | 0.0081 | 0.0074 | 0.0169\*\* | 0.0011 |
|  | (0.0066) | (0.0069) | (0.0066) | (0.0074) | (0.0069) | (0.0072) | (0.0067) | (0.0077) | (0.0066) | (0.0066) | (0.0067) | (0.0068) | (0.0068) | (0.0071) | (0.0069) |
| Trade openness (Log) |  | 0.0154\*\*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | (0.0054) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Population density |  |  | -0.0018 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | (0.0021) |  |  |  |  |  |  |  |  |  |  |  |  |
| Total factor productivity |  |  |  | 0.1083\*\*\* |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | (0.0143) |  |  |  |  |  |  |  |  |  |  |  |
| Government durability |  |  |  |  | 0.0001 |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | (0.0001) |  |  |  |  |  |  |  |  |  |  |
| Government Stability |  |  |  |  |  | 0.0057\*\*\* |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | (0.0009) |  |  |  |  |  |  |  |  |  |
| Financial openness |  |  |  |  |  |  | 0.0137\*\* |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | (0.0070) |  |  |  |  |  |  |  |  |
| Credits rating |  |  |  |  |  |  |  | 0.0007 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | (0.0008) |  |  |  |  |  |  |  |
| Monetary union (dummy) |  |  |  |  |  |  |  |  | 0.0050 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | (0.0059) |  |  |  |  |  |  |
| Inflation targeting(dummy) |  |  |  |  |  |  |  |  |  | -0.0022 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | (0.0055) |  |  |  |  |  |
| Presidential System |  |  |  |  |  |  |  |  |  |  | 0.0002\*\*\* |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  | (0.0000) |  |  |  |  |
| Checks and Balances |  |  |  |  |  |  |  |  |  |  |  | 0.0000 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | (0.0012) |  |  |  |
| Bank crisis (dummy) |  |  |  |  |  |  |  |  |  |  |  |  | 0.0199\* |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  | (0.0108) |  |  |
| Control Corruption |  |  |  |  |  |  |  |  |  |  |  |  |  | 0.0007\*\*\* |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  | (0.0001) |  |
| Inflation |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 0.0005 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | (0.0007) |
| Constant | 0.5301\*\*\* | 0.5603\*\*\* | 0.5288\*\*\* | 0.4216\*\*\* | 0.5388\*\*\* | 0.5193\*\*\* | 0.5415\*\*\* | 0.5719\*\*\* | 0.5278\*\*\* | 0.5297\*\*\* | 0.5544\*\*\* | 0.5433\*\*\* | 0.5808\*\*\* | 0.5647\*\*\* | 0.5314\*\*\* |
|  | (0.0326) | (0.0269) | (0.0329) | (0.0409) | (0.0340) | (0.0364) | (0.0329) | (0.0433) | (0.0329) | (0.0327) | (0.0332) | (0.0326) | (0.0344) | (0.0358) | (0.0344) |
| / |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| sigma\_u | 0.0274\*\*\* | 0.0319\*\*\* | 0.0274\*\*\* | 0.0381\*\*\* | 0.0278\*\*\* | 0.0304\*\*\* | 0.0272\*\*\* | 0.0347\*\*\* | 0.0279\*\*\* | 0.0276\*\*\* | 0.0289\*\*\* | 0.0272\*\*\* | 0.0301\*\*\* | 0.0266\*\*\* | 0.0285\*\*\* |
|  | (0.0025) | (0.0029) | (0.0025) | (0.0040) | (0.0027) | (0.0029) | (0.0026) | (0.0035) | (0.0026) | (0.0026) | (0.0026) | (0.0025) | (0.0029) | (0.0024) | (0.0027) |
| sigma\_e | 0.0603\*\*\* | 0.0577\*\*\* | 0.0602\*\*\* | 0.0524\*\*\* | 0.0616\*\*\* | 0.0549\*\*\* | 0.0606\*\*\* | 0.0530\*\*\* | 0.0603\*\*\* | 0.0603\*\*\* | 0.0597\*\*\* | 0.0601\*\*\* | 0.0593\*\*\* | 0.0581\*\*\* | 0.0592\*\*\* |
|  | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0010) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0010) | (0.0009) |
| Observations | 2307 | 2225 | 2292 | 1780 | 2156 | 1907 | 2262 | 1778 | 2307 | 2307 | 2307 | 2293 | 2192 | 1837 | 2147 |
| Number of countries | 121 | 120 | 121 | 89 | 113 | 98 | 120 | 103 | 121 | 121 | 121 | 121 | 113 | 121 | 114 |
| Log likelihood | 3110 | 3078 | 3094 | 2615 | 2862 | 2736 | 3040 | 2595 | 3110 | 3110 | 3130 | 3099 | 2983 | 2537 | 2929 |
| chi2 | 199.5 | 193.1 | 204.7 | 197.3 | 182.7 | 224.6 | 205.1 | 137.4 | 198 | 198.4 | 231.8 | 196 | 202.2 | 208.3 | 202.7 |

*Note: Robust Standard Errors are in parenthesis.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

## **Alternatives estimations methods**

On the econometrics side, we further extend our tests by using four alternative estimation methods: panel fixed effects, Generalized Method of Moments (GMM), and Instrumental Variable (IV) estimation.

**OLS estimates.** Tobit has commonly been chosen as the natural method for modeling DEA or SFA scores in second-stage evaluations. However, the two-limit Tobit technique is inherently mis-specified when applied to DEA or SFA scores, given that these only take on the value 1 with positive probability (and not the opposite limiting value 0). Despite this mis-specification, Tobit still produces sensible results in second-stage DEA or SFA analyses[[11]](#footnote-11)(Hoff, 2007). For sensitivity analysis we have also estimated a simple linear regression using OLS estimation or panel fixed effects. The results presented in Column [1] of Table 5 indicate a positive and significant impact of financial development on expenditure efficiency, with an estimated magnitude of approximately 8.94 percentage points. This effect is qualitatively comparable to the main model, which shows a 1.96 percentage point decrease. The findings suggest that financial development contributes positively to the efficiency of expenditures.

**GMM estimates.** Second, a possible reserve causal effect between financial development and public spending efficiency was suspected. Here, we assume that public spending efficiency impacts financial sector development. One of the dependent variables (TE) is public spending variability over time. (Colombo and Caldeira, 2018) and (Schandlbauer, 2017) have found that the level of taxes (and hence tax revenue) could affect financial institutions and, therefore, the depth of financial development. For example, an increase in tax revenue provides more public expenditure, which generally contributes to improving the state of infrastructure, leading to a better environment for developing the financial sector in the economy. Consequently, there is a causality bias due to the correlation between the error term and the financial development variable. Second, this public spending efficiency also tends to be persistent since the country’s current public spending efficiency may depend on the previous year’s efficiency. If this consideration is not considered, the regressions may suffer from the severe problem of a lack of relevant explanatory variables. Third, the error term in equation (8) incorporates unobserved country heterogeneities, inducing a bias of the omitted variables if correlated with the other explanatory variables. These findings imply that a potential endogeneity problem may exist for our study. We confront this potential problem by using generalized method of moments (GMM) systems estimators[[12]](#footnote-12). This method allows for controlling the persistence of budgetary outcomes, particularly the efficiency of public expenditures. It addresses the (Nickell, 1981)’s bias present in a dynamic panel model with fixed effects, limits the influence of time-varying unobservable factors that may affect both the outcome and treatment variable, and mitigates the challenge of finding an exogenous instrument to estimate the effect of public sector efficiency. Finally, to address potential issues related to non-stationarity in certain variables and the public sector efficiency score over the 28-year analysis period (1990 to 2017), we adopt an approach from the existing literature (Combes and Ebeke, 2011; Docquier *et al.*, 2016; Fosu and Abass, 2020; Pleninger and Sturm, 2020). We restructure our panel data into six sub-periods, each spanning five non-overlapping years. This division into five-year averages is designed to enhance the efficiency of our estimates and alleviate concerns about spurious regressions.

The results of the GMM estimation using the two-stage dynamic panel system are presented in Table 4. Statistical tests confirm the validity of this econometric method: the null hypotheses of the Sargen/Hasen and AR (2) tests are accepted. To minimize the number of instruments in the regressions, we collapse the matrix of instruments as suggested (Roodman, 2009). Moreover, the positive coefficient of the lagged dependent variable highlights an inertia effect that legitimizes the specification of the dynamic panel. The new results presented in Column [2] of Table 5 lead to qualitatively similar conclusions as the baseline results.

**IV estimates. Third,** to address the endogeneity issue, other studies in the literature employ an instrumental variable (IV) approach using origin of law as the instrument. The origin of law[[13]](#footnote-13), initially proposed by Porta *et al.*(1998) and Levine (1998), is linked to investor protection and contract enforcement. A country with better investor protection and a conducive environment for contract enforcement is more likely to experience high financial development, particularly in banking. Column [1] of Table 6 presents the first-stage equation, where financial development is regressed on the instrument and all other explanatory variables of the baseline model. The instrument ("the origin of law") significantly and positively explains financial development, suggesting the relevance of the instrument used. Column [1] reports the results of the causal impact of financial development on expenditure efficiency after instrumentation. The findings suggest a significant improvement in expenditure efficiency with financial development at the 1% threshold. Moreover, the estimated effect (18.49 percentage points) remains comparable to that of the baseline model (10.9 percentage points).

**Table 5. Robustness/ The impact of financial development on public sector efficiency Alternatives estimations methods**

|  |  |  |
| --- | --- | --- |
| **Dependent Variable** | **Public Sector Efficiency** | |
| **Regression** | Reg1  **(Fixed effect)** | Reg2  **(System GMM)** | |
| **Lagged. Public Sector Efficiency** |  | 0.6312\*\*\* | |
|  |  | (0.0996) | |
| Financial development | 0.0894\*\*\* | 0.0915\*\*\* | |
|  | (0.0282) | (0.0323) | |
| Public debt (log) | 0.0025 | 0.0005 | |
|  | (0.0043) | (0.0044) | |
| Tax revenues (log) | -0.0018 | -0.0032 | |
|  | (0.0127) | (0.0056) | |
| GDP per capita growth | 0.0012\*\* | 0.0037\*\*\* | |
|  | (0.0006) | (0.0008) | |
| Trade globalization | -0.0084 | -0.0098 | |
|  | (0.0116) | (0.0111) | |
| Democracy | 0.0078\*\*\* | 0.0017 | |
|  | (0.0017) | (0.0011) | |
| Government Fragmentation | 0.0145\* | 0.0201\*\* | |
|  | (0.0082) | (0.0099) | |
| Constant | 0.5639\*\*\* | 0.2104\*\* | |
|  | (0.0701) | (0.0854) | |
|  |  |  | |
| Observations | 2307 | 511 | |
| Number of countries | 121 | 121 | |
| R-Squared | 0.4675 |  | |
| Countries/Times fixed effect | Yes | Yes | |
| Instruments |  | 29 | |
| AR1-pvalue |  | 0.0193 | |
| AR2-pvalue |  | 0.7694 | |
| Hansen-P-value |  | 0.2839 | |

*Note: Robust Standard Errors are in parenthesis. The variables “Public debt (log)”; “GDP growth “, “Financial development “, “Trade globalization”, Tax Revenue over GDP "have been. considered as endogenous across all model specifications. The variables “*Democracy *", and “Government Fragmentation* *" have been considered as exogenous.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

**Table 6. Robustness/ The impact of financial development on public sector efficiency Alternatives estimations methods**

|  |  |  |
| --- | --- | --- |
| **Dependent Variable** | **Financial development** | **Public Sector Efficiency** |
| **Regression** | Panel A : First stage | Panel B : IV estimates |
| Law and order (Instrument) | 0.0887\*\*\* |  |
|  | (0.0034) |  |
| Financial development |  | 0.1842\*\*\* |
|  |  | (0.015) |
| Public debt (log) | 0.0341\*\*\* | 0.0013 |
|  | (0.0048) | (0.002) |
| Tax revenues (log) | 0.0206\*\*\* | -0.0067 |
|  | (0.0077) | (0.004) |
| GDP per capita growth | -0.0038\*\*\* | 0.0022\*\*\* |
|  | (0.0009) | (0.000) |
| Trade globalization | 0.1411\*\*\* | -0.0226\*\*\* |
|  | (0.0128) | (0.006) |
| Democracy | 0.0170\*\*\* | 0.0015\*\* |
|  | (0.0016) | (0.001) |
| Government Fragmentation | -0.0159 | 0.0007 |
|  | (0.0123) | (0.005) |
| Constant | -0.8495\*\*\* | 0.6743\*\*\* |
|  | (0.056) | (0.028) |
|  |  |  |
| IV |  | Law and order |
| Stock-Yogo Stats test. |  | 90 |
| Stock-Wright p-value |  |  |
| Observations | 1935 | 1571 |
| Number of countries | 98 | 90 |
| R-Squared | 0.6346 |  |
| Countries /Time fixed effect | Yes | Yes |

*Notes: This table presents the results of the effect of financial development on expenditure efficiency, using as an instrumenta-*

*tion strategy the geographical diffusion of rule adoption. The instrument (Law and order) captures the protection of investors and implementation of contracts. Panel A reports the first stage equation, where the endogenous variable (financial development) is regressed on the instrument and on the set of controls in the baseline model. Panel B reports the results of the causal effect of financial development after instrumentation.*

*Robust standard errors in parentheses.\*p<0.1,\*\*p<0.05,\*\*\*p<0.01 \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01.*

## **Alternative measures of efficiency scores**

We investigate the robustness of their results by exploring various alternative measures of the dependent variable. The outcomes are presented in Table 6, with the baseline model result detailed in Column [1].

The study explores the robustness of its findings through alternative measures of the dependent variable, employing True Fixed Effects (TFE) using (Greene, 2005) approach. Initially, the (Kumbhakar, Lien and Hardaker, 2014) model was utilized for efficiency score estimation, considering unobserved heterogeneity and distinguishing inefficiency into persistent and transient components. This involved a two-stage estimation procedure and four error term components. Shifting to (Greene, 2005) for efficiency estimators adds flexibility to the specification. Re-estimating efficiency scores under Greene's methodology validates the qualitative robustness of the baseline results, reinforcing the consistency of the findings. The analysis also introduces a subjective indicator of well-being for robustness. This involves adopting a "subjective" well-being approach, replacing GDP per capita with a happiness measure as an outcome indicator for economic performance. The economic performance now considers happiness, GDP growth (10-year average), and unemployment rate (10-year average). The happiness index reflects respondents' feelings about their well-being, with a score of 10 representing the best possible life and 0 the worst. The new estimates, presented in Column [3] of Table 6, maintain consistency with previous results, affirming the robustness of the findings. In the third step, the analysis excludes public administration based on the considerations outlined by Afonso, Schuknecht and Tanzi (2005). This decision stems from the recognition that high-quality public administration, characterized by a strong judicial system, efficient property rights, and well-functioning markets, is essential for establishing a level playing field in society and fostering conditions conducive to robust and sustained economic growth. The outcome indicators for public administration encompass variables such as the independence of the judiciary, the quality of property rights, the quality of government, and the level of the shadow economy. While these indicators may seem intuitive, skepticism arises as they can be strongly influenced by various other factors. For robustness, public administration is removed from the studied sectors, focusing solely on education, infrastructure, and health. The new results, presented in Column [4] of Table 7, confirm the validity of this adjustment.

**Table 7. Robustness/ The impact of financial development on public sector efficiency: Alternative efficiency estimators**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Dependent Variable** | **Public Sector Efficiency (PSE)** | | | |
| **Regressions** | PSE (Kumbhakar et al. (2015)) | PSE (Greene 2005) | PSE (Including a  subjective indicator of  well-being) | PSE (Excluding  Public  administration) |
|  |  |  |  |  |
| Financial development | 0.1090\*\*\* | 0.1408\*\*\* | 0.1113\*\*\* | 0.2290\*\*\* |
|  | (0.0141) | (0.0191) | (0.0142) | (0.0160) |
| Public debt (log) | 0.0020 | -0.0067\*\* | 0.0072\*\*\* | -0.0099\*\*\* |
|  | (0.0025) | (0.0028) | (0.0025) | (0.0026) |
| Tax revenues (log) | -0.0121\*\* | -0.0320\*\*\* | -0.0152\*\*\* | -0.0354\*\*\* |
|  | (0.0057) | (0.0073) | (0.0058) | (0.0069) |
| GDP per capita growth | 0.0016\*\*\* | 0.0008\*\*\* | 0.0017\*\*\* | 0.0014\*\*\* |
|  | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| Trade globalization | 0.0228\*\*\* | 0.0308\*\*\* | 0.0116 | 0.0610\*\*\* |
|  | (0.0079) | (0.0097) | (0.0079) | (0.0083) |
| Democracy | 0.0049\*\*\* | 0.0082\*\*\* | 0.0046\*\*\* | 0.0036\*\*\* |
|  | (0.0011) | (0.0015) | (0.0011) | (0.0013) |
| Government Fragmentation | 0.0077 | -0.0001 | 0.0147\*\* | 0.0181\*\*\* |
|  | (0.0066) | (0.0074) | (0.0066) | (0.0063) |
| Constant | 0.5301\*\*\* | 0.5263\*\*\* | 0.5636\*\*\* | 0.4301\*\*\* |
|  | (0.0326) | (0.0405) | (0.0329) | (0.0346) |
| / |  |  |  |  |
| sigma\_u | 0.0274\*\*\* | 0.0482\*\*\* | 0.0284\*\*\* | 0.0484\*\*\* |
|  | (0.0025) | (0.0040) | (0.0026) | (0.0038) |
| sigma\_e | 0.0603\*\*\* | 0.0631\*\*\* | 0.0598\*\*\* | 0.0486\*\*\* |
|  | (0.0009) | (0.0010) | (0.0009) | (0.0008) |
| Observations | 2307 | 2360 | 2307 | 2167 |
| Number of countries | 121 | 121 | 121 | 118 |
| Log likelihood | 3110 | 3022 | 3125 | 3307 |
| Chi2 | 199.5 | 149.5 | 190.8 | 448.9 |
| Countries fixed effect | Yes | Yes | Yes | Yes |

*Note: Robust Standard Errors are in parenthesis.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

## **Alternative measures of financial development**

We employ alternative measures of financial development to check the robustness of our results. The outcomes are presented in Table 8, with the baseline model result detailed in Column [1]. Our alternative measure of financial development in a country, is defined as the domestic credit to the private credit as a share of GDP. This variable measured banking sector performance and size come from the Global Financial Development Database of the World Bank. Domestic credit to the private sector refers only to financial resources provided to the private sector by financial corporations through loans, purchases of nonequity securities, trade credits, and other accounts receivable that establish a claim for repayment. Table 8 suggests that across all the specification, the estimated coefficient of financial development is positive and generally statistically significant, implying that our findings are not significantly affected by the measurement of financial development.

**Table 8. Robustness/ The impact of financial development on public sector efficiency: Alternative measures of financial development**

|  |  |  |
| --- | --- | --- |
| **Dependent Variable** | **Public Sector Efficiency (PSE)** | |
| **Regressions** | Reg1 | Reg2 |
|  |  |  |
| **Financial development** | 0.1090\*\*\* |  |
|  | (0.0141) |  |
| **Domestic credit to private sector (Log)** |  | 0.0095\*\*\* |
|  |  | (0.0037) |
|  |  |  |
|  |  |  |
| Public debt (log) | 0.0020 | 0.0061\*\* |
|  | (0.0025) | (0.0028) |
| Tax revenues (log) | -0.0121\*\* | -0.0024 |
|  | (0.0057) | (0.0061) |
| GDP per capita growth | 0.0016\*\*\* | 0.0015\*\*\* |
|  | (0.0003) | (0.0003) |
| Trade globalization | 0.0228\*\*\* | 0.0368\*\*\* |
|  | (0.0079) | (0.0089) |
| Democracy | 0.0049\*\*\* | 0.0065\*\*\* |
|  | (0.0011) | (0.0012) |
| Government Fragmentation | 0.0077 | 0.0133\* |
|  | (0.0066) | (0.0076) |
| Constant | 0.5301\*\*\* | 0.4250\*\*\* |
|  | (0.0326) | (0.0341) |
| / |  |  |
| sigma\_u | 0.0274\*\*\* | 0.0287\*\*\* |
|  | (0.0025) | (0.0026) |
| sigma\_e | 0.0603\*\*\* | 0.0621\*\*\* |
|  | (0.0009) | (0.0010) |
| Observations | 2307 | 1893 |
| Number of countries | 121 | 122 |
| Log likelihood | 3110 | 2491 |
| Chi2 | 199.5 | 153.2 |
| Countries fixed effect | Yes | Yes |

*Note: Robust Standard Errors are in parenthesis.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

# **Channel transmission validity checks**

Our findings indicate that financial development increases public sector efficiency. This section aims to shed light on the mechanisms underlying this result. Building upon the discussion in Section 3 (theoretical predictions), we test the relevance of our potential transmission channels using tax revenues, GDP per capita, and corruption control as indicators of tax performance, economic activity, and institutional quality. We adopt a simple two-step approach to test the primary transmission channels. In the first step, before testing our channels, we assess their relevance for public sector efficiency using simple Pearson correlations[[14]](#footnote-14). The goal of this approach is to determine if our identified channels are individually correlated with public sector efficiency. The results presented in Table 9 suggest that tax revenues, GDP per capita, and corruption control are strongly correlated with public sector efficiency, representing potentially significant transmission channels through which financial development can positively affect public sector efficiency. Additionally, the magnitude of the relationship extends from 26% to 40%, significant at the 1% threshold.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 9. Correlation between Financial development and main channels.** | | | | |
| **Panel A** | Reg1 | Reg2 | Reg3 |
|  | **Public Sector Efficiency** | **Public Sector Efficiency** | **Public Sector Efficiency** |
| Tax revenue (Log) | 0.2570\*\*\* |  |  |
| GDP per capita (log) |  | 0.4043\*\*\* |  |
| Control corruption |  |  | 0.4062\*\*\* |
|  |  |  |  |

***Notes****: This table reports the results of the main channels through which financial development may affect public sector efficiency (PSE). Columns [1]–[3] of Table 9 present the relationship between different channels and public sector efficiency, based on simple Pearson’s correlations. \*\*\* indicates significance at the 1% threshold.*

In the second step, we use the same covariates as in our baseline specification, carefully controlling for country and time fixed effects, to test if our three channels are linked to financial development. The results compiled in Table **10** demonstrate that financial development is associated with a significant increase in tax performance, GDP per capita, and institutional quality. In summary, financial development enhances public sector efficiency through improved fiscal performance, institutional quality, and a broader tax base due to higher GDP per capita. This finding is in line with our main hypothesis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 10. Transmission channels.** | | | | |
| **Panel A** | Reg1 | Reg2 | Reg3 |
|  | **Tax revenue** | **GDP per capita** | **Control corruption** |
| Financial development | 0.1261\*\*\* | 1.0541\*\*\* | 0.2424\*\* |
|  | (0.0389) | (0.0704) | (0.1075) |
|  |  |  |  |
|  |  |  |  |
| Including all controls | Yes | Yes | Yes |
| Countries fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |
|  |  |  |  |
| Number of countries | 89 | 89 | 89 |
| Observations | 2208 | 2208 | 1764 |
| R-Squared | .9341 | .9745 | .9737 |

***Notes:*** *This table reports the effect of financial development on the potential channels, based on panel fixed-effects regression(OLS). The equation specified is the same as in the main model, replacing the dependent variable with the potential channel. Channel is either Tax revenue (column (1)),* GDP per capita *(column (2)) or Control of corruption (column (3)). Robust Standard Errors* *are in parenthesis \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

# **Heterogeneity**

In summary, our findings indicate a positive association between financial development and public sector efficiency. To further validate this result, we conduct a sensitivity analysis examining different components of financial development services and various structural factors.

## **Financial development components**

The study, utilizing the Financial Structure and Economic Development Dataset (FSED), breaks down the financial development variable into eight key indicators : Financial institutions, Financial markets, Financial institutions depth, Financial markets depth, Financial institutions access, Financial markets access, Financial institutions efficiency, and Financial markets efficiency. The objective is to examine whether public sector efficiency responds differently based on the specific financial development indicator. The objective is to examine whether public sector efficiency responds differently based on the specific financial development indicator. The findings in Table 11 support this hypothesis. The study reveals that the financial development increases public sector efficiency irrespective of the indicator type. Nonetheless, there are observed relative variations in the coefficients based on the type of financial service, corroborating our intuition.

**Table 11. Heterogeneity/ The impact of financial development on public sector efficiency: disaggregating financial development services**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Dependent Variable** | **Public Sector Efficiency (PSE)** | | | | | | | | |
| **Regressions** | Reg1 | Reg2 | Reg3 | Reg4 | Reg5 | Reg6 | Reg7 | Reg8 | Reg9 |
|  |  |  |  |  |  |  |  |  |  |
| Financial development | 0.1090\*\*\* |  |  |  |  |  |  |  |  |
|  | (0.0141) |  |  |  |  |  |  |  |  |
| Financial institutions |  | 0.0743\*\*\* |  |  |  |  |  |  |  |
|  |  | (0.0152) |  |  |  |  |  |  |  |
| Financial markets |  |  | 0.0866\*\*\* |  |  |  |  |  |  |
|  |  |  | (0.0105) |  |  |  |  |  |  |
| Financial institutions depth |  |  |  | 0.0688\*\*\* |  |  |  |  |  |
|  |  |  |  | (0.0133) |  |  |  |  |  |
| Financial institutions access |  |  |  |  | 0.0290\*\* |  |  |  |  |
|  |  |  |  |  | (0.0115) |  |  |  |  |
| Financial institutions efficiency |  |  |  |  |  | 0.0437\*\*\* |  |  |  |
|  |  |  |  |  |  | (0.0147) |  |  |  |
| Financial markets depth |  |  |  |  |  |  | 0.0787\*\*\* |  |  |
|  |  |  |  |  |  |  | (0.0096) |  |  |
| Financial markets access |  |  |  |  |  |  |  | 0.0624\*\*\* |  |
|  |  |  |  |  |  |  |  | (0.0097) |  |
| Financial markets efficiency |  |  |  |  |  |  |  |  | 0.0398\*\*\* |
|  |  |  |  |  |  |  |  |  | (0.0069) |
| Public debt (log) | 0.0020 | 0.0025 | 0.0022 | 0.0015 | 0.0030 | 0.0031 | 0.0019 | 0.0029 | 0.0025 |
|  | (0.0025) | (0.0025) | (0.0025) | (0.0026) | (0.0025) | (0.0025) | (0.0025) | (0.0025) | (0.0025) |
| Tax revenues (log) | -0.0121\*\* | -0.0122\*\* | -0.0085 | -0.0143\*\* | -0.0089 | -0.0083 | -0.0082 | -0.0081 | -0.0076 |
|  | (0.0057) | (0.0057) | (0.0057) | (0.0060) | (0.0057) | (0.0058) | (0.0059) | (0.0057) | (0.0057) |
| GDP per capita growth | 0.0016\*\*\* | 0.0016\*\*\* | 0.0015\*\*\* | 0.0016\*\*\* | 0.0016\*\*\* | 0.0015\*\*\* | 0.0015\*\*\* | 0.0015\*\*\* | 0.0014\*\*\* |
|  | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) | (0.0003) |
| Trade globalization | 0.0228\*\*\* | 0.0315\*\*\* | 0.0286\*\*\* | 0.0351\*\*\* | 0.0419\*\*\* | 0.0434\*\*\* | 0.0260\*\*\* | 0.0358\*\*\* | 0.0422\*\*\* |
|  | (0.0079) | (0.0081) | (0.0077) | (0.0078) | (0.0079) | (0.0077) | (0.0079) | (0.0075) | (0.0073) |
| Democracy | 0.0049\*\*\* | 0.0051\*\*\* | 0.0058\*\*\* | 0.0053\*\*\* | 0.0059\*\*\* | 0.0066\*\*\* | 0.0061\*\*\* | 0.0057\*\*\* | 0.0064\*\*\* |
|  | (0.0011) | (0.0011) | (0.0011) | (0.0011) | (0.0011) | (0.0011) | (0.0011) | (0.0011) | (0.0011) |
| Government Fragmentation | 0.0077 | 0.0078 | 0.0088 | 0.0100 | 0.0091 | 0.0078 | 0.0091 | 0.0094 | 0.0091 |
|  | (0.0066) | (0.0066) | (0.0066) | (0.0067) | (0.0067) | (0.0068) | (0.0067) | (0.0066) | (0.0067) |
| Constant | 0.5301\*\*\* | 0.4966\*\*\* | 0.5068\*\*\* | 0.5021\*\*\* | 0.4597\*\*\* | 0.4295\*\*\* | 0.5166\*\*\* | 0.4790\*\*\* | 0.4549\*\*\* |
|  | (0.0326) | (0.0331) | (0.0318) | (0.0338) | (0.0331) | (0.0306) | (0.0327) | (0.0312) | (0.0306) |
| / |  |  |  |  |  |  |  |  |  |
| sigma\_u | 0.0274\*\*\* | 0.0263\*\*\* | 0.0286\*\*\* | 0.0285\*\*\* | 0.0271\*\*\* | 0.0287\*\*\* | 0.0301\*\*\* | 0.0279\*\*\* | 0.0279\*\*\* |
|  | (0.0025) | (0.0024) | (0.0026) | (0.0025) | (0.0025) | (0.0025) | (0.0026) | (0.0025) | (0.0024) |
| sigma\_e | 0.0603\*\*\* | 0.0610\*\*\* | 0.0601\*\*\* | 0.0607\*\*\* | 0.0611\*\*\* | 0.0610\*\*\* | 0.0600\*\*\* | 0.0606\*\*\* | 0.0607\*\*\* |
|  | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) | (0.0009) |
| Observations | 2307 | 2307 | 2307 | 2307 | 2307 | 2307 | 2307 | 2307 | 2307 |
| Number of countries | 121 | 121 | 121 | 121 | 121 | 121 | 121 | 121 | 121 |
| Log likelihood | 3110 | 3090 | 3114 | 3093 | 3082 | 3083 | 3114 | 3100 | 3096 |
| Chi2 | 199.5 | 176.9 | 206.6 | 169 | 159.9 | 155.8 | 206.1 | 184.4 | 182.9 |
| Countries fixed effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Note: Robust Standard Errors are in parenthesis.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

## **The role of** **macroeconomic and institutional factors**

We investigate the sensitivity of our baseline finding relative to several structural characteristics. The idea here is that structural factors can magnify or alleviate the effect of financial development on public sector efficiency. Various macroeconomic factors contribute to heterogeneity, including the position in the business cycle, fiscal policy stance, macroeconomic stability, government size, human capital (education level), international trade and capital account openness, and exchange rate regime.

Firstly, one concern over the abovementioned findings is that these parameters may be heterogeneous across countries. Since the sample includes developing and developed countries, one would assume that a specific group drives financial development's positive and significant effect. A natural way to confront this problem is to investigate more homogeneous subsamples. Therefore, we have split the sample into developing and developed countries. Table 12 presents the result obtained for the Tobit benchmark estimation when splitting the model into two groups. Results presented in columns [2]-[3] of table 12 show that financial development increases public sector efficiency in both groups. However, the effect of financial development is higher in developed countries than in developing countries. Secondly, we investigate the fiscal stance by categorizing countries into "low" and "high" levels of public debt, using the median of total government debt as a percentage of GDP to delineate the two groups. As indicated by our findings in Table 12, columns [4]-[5], financial development significantly enhances public sector efficiency specifically in countries characterized by "high" levels of debt. Thirdly, we explore the potential influence of capital account openness on the relationship between financial development and public sector efficiency. By using the median level of the Chinn-Ito index, we distinguish between "low capital openness" and "high capital openness" countries. Table 12, columns [5]-[6], indicate that the impact of financial development on public sector efficiency appears to be more substantial in countries with a high capital account openness. Fourthly, we scrutinize the role of natural resources by dividing the sample into "Rich" and "Poor" natural resources based on the IMF classification. Table 12, columns [7]-[8], indicate that financial development has a more significant impact on public sector efficiency in countries with abundant natural resources. Fifthly, we examine the sensitivity of our findings in relation to education levels. The objective is to evaluate whether education plays a role in enhancing the efficiency of financial development. Education is viewed as a facilitator of financial literacy among individuals (Santoso, 2013). The sample is divided into two groups based on the sample median: countries with high and low human capital. Table 12, columns [9]-[10], indicate that the impact of financial development on public sector efficiency appears to be more substantial in countries with a high education condition. Sixthly , we investigate the impact of inflation on financial development, considering its potential to alleviate inflationary pressures. We hypothesize that financial development can enhance tax performance by mitigating the Keynes-Oliveira-Tanzi effect. Utilizing the sample median, columns [11]-[12] in Table 12 reveal a more substantial effect of financial development during periods of high inflationary pressure, supporting our intuition.

**Table 12. Heterogeneity / The role of macroeconomic factors**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Regressions** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **Public Sector Efficiency (PSE)** | Developed  countries | Developing  countries | Low debt | High  debt | Low capital  openness | High capital  openness | Poor  resources | Rich  resources | Low  education | High  education | Low  inflation | High  inflation |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Financial development | 0.2364\*\*\* | 0.0424\* | 0.1151\*\*\* | 0.1543\*\*\* | 0.0931\*\*\* | 0.1268\*\*\* | 0.1475\*\*\* | 0.1480\*\*\* | 0.0933\*\*\* | 0.1668\*\*\* | 0.1599\*\*\* | 0.0378\* |
|  | (0.0192) | (0.0231) | (0.0219) | (0.0193) | (0.0323) | (0.0170) | (0.0180) | (0.0344) | (0.0285) | (0.0226) | (0.0185) | (0.0215) |
| Public debt (log) | -0.0347\*\*\* | 0.0037 | -0.0091\*\* | -0.0011 | -0.0060 | 0.0091\*\*\* | -0.0037 | 0.0016 | 0.0065\* | -0.0106\*\*\* | 0.0034 | 0.0001 |
|  | (0.0051) | (0.0030) | (0.0046) | (0.0064) | (0.0044) | (0.0031) | (0.0033) | (0.0046) | (0.0037) | (0.0038) | (0.0035) | (0.0034) |
| Tax revenues (log) | -0.1867\*\*\* | -0.0041 | 0.0046 | -0.0351\*\*\* | 0.0116 | -0.0213\*\*\* | -0.0480\*\*\* | 0.0046 | -0.0178\*\* | -0.0182\* | -0.0198\*\* | -0.0033 |
|  | (0.0228) | (0.0059) | (0.0075) | (0.0091) | (0.0108) | (0.0074) | (0.0094) | (0.0079) | (0.0072) | (0.0103) | (0.0086) | (0.0068) |
| GDP per capita growth | -0.0005 | 0.0018\*\*\* | 0.0022\*\*\* | 0.0003 | 0.0021\*\*\* | 0.0006 | 0.0013\*\*\* | 0.0017\*\*\* | 0.0006 | 0.0019\*\*\* | 0.0012\*\*\* | 0.0022\*\*\* |
|  | (0.0005) | (0.0003) | (0.0003) | (0.0004) | (0.0004) | (0.0004) | (0.0004) | (0.0004) | (0.0005) | (0.0003) | (0.0003) | (0.0004) |
| Trade globalization | 0.1341\*\*\* | 0.0276\*\*\* | 0.0129 | 0.0274\*\*\* | -0.0031 | 0.0271\*\* | 0.0458\*\*\* | -0.0196 | 0.0142 | 0.0401\*\*\* | 0.0040 | 0.0358\*\*\* |
|  | (0.0237) | (0.0089) | (0.0129) | (0.0104) | (0.0128) | (0.0110) | (0.0097) | (0.0150) | (0.0105) | (0.0141) | (0.0118) | (0.0099) |
| Democracy | 0.0141\*\* | 0.0054\*\*\* | 0.0060\*\*\* | 0.0024 | 0.0041\*\*\* | 0.0042\*\*\* | 0.0053\*\*\* | 0.0029\* | 0.0065\*\*\* | 0.0060\*\*\* | 0.0041\*\* | 0.0047\*\*\* |
|  | (0.0071) | (0.0012) | (0.0016) | (0.0017) | (0.0016) | (0.0016) | (0.0015) | (0.0017) | (0.0016) | (0.0021) | (0.0017) | (0.0012) |
| Government Fragmentation | 0.0132 | 0.0051 | 0.0196\*\* | 0.0092 | -0.0057 | 0.0205\*\* | 0.0147\*\* | -0.0043 | -0.0094 | 0.0223\*\* | 0.0399\*\*\* | -0.0136 |
|  | (0.0114) | (0.0079) | (0.0096) | (0.0098) | (0.0115) | (0.0080) | (0.0072) | (0.0145) | (0.0093) | (0.0098) | (0.0096) | (0.0088) |
| Constant | 0.5947\*\*\* | 0.4988\*\*\* | 0.5443\*\*\* | 0.5936\*\*\* | 0.6026\*\*\* | 0.5104\*\*\* | 0.5496\*\*\* | 0.6528\*\*\* | 0.5601\*\*\* | 0.4898\*\*\* | 0.5982\*\*\* | 0.4866\*\*\* |
|  | (0.1278) | (0.0371) | (0.0521) | (0.0506) | (0.0502) | (0.0463) | (0.0420) | (0.0630) | (0.0439) | (0.0615) | (0.0486) | (0.0412) |
| / |  |  |  |  |  |  |  |  |  |  |  |  |
| sigma\_u | 0.0638\*\*\* | 0.0260\*\*\* | 0.0354\*\*\* | 0.0418\*\*\* | 0.0255\*\*\* | 0.0334\*\*\* | 0.0365\*\*\* | 0.0158\*\*\* | 0.0280\*\*\* | 0.0487\*\*\* | 0.0341\*\*\* | 0.0243\*\*\* |
|  | (0.0099) | (0.0029) | (0.0036) | (0.0042) | (0.0039) | (0.0036) | (0.0041) | (0.0057) | (0.0037) | (0.0055) | (0.0036) | (0.0030) |
| sigma\_e | 0.0369\*\*\* | 0.0652\*\*\* | 0.0614\*\*\* | 0.0492\*\*\* | 0.0715\*\*\* | 0.0509\*\*\* | 0.0507\*\*\* | 0.0794\*\*\* | 0.0529\*\*\* | 0.0599\*\*\* | 0.0540\*\*\* | 0.0642\*\*\* |
|  | (0.0011) | (0.0012) | (0.0013) | (0.0011) | (0.0018) | (0.0010) | (0.0009) | (0.0023) | (0.0013) | (0.0012) | (0.0012) | (0.0014) |
| Observations | 638 | 1669 | 1196 | 1111 | 858 | 1449 | 1682 | 625 | 875 | 1432 | 1209 | 1098 |
| Number of countries | 26 | 95 | 98 | 97 | 72 | 89 | 84 | 37 | 56 | 82 | 98 | 115 |
| Log likelihood | 1144 | 2126 | 1566 | 1674 | 1016 | 2171 | 2529 | 687.3 | 1286 | 1901 | 1734 | 1412 |
| Chi2 | 476.6 | 86.65 | 136.5 | 118 | 62.98 | 128.2 | 161.8 | 46.94 | 45.34 | 146.4 | 148.2 | 86.14 |

*Note: Robust Standard Errors are in parenthesis.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

From the political standpoint, we account for control corruption, government stability, investment profile, law and order, internal and external conflict, and state fragility. In our first analysis, we explore the impact of institutions, specifically corruption, on our results as good institutions are believed to enhance public sector efficiency. We categorize countries into low and high corruption based on the sample median. Table 13, columns [1]-[2] demonstrate that financial development positively influences public sector efficiency irrespective of institutional quality. Notably, the effect of financial development on public sector efficiency is more pronounced in the presence of better institutional quality, indicating a stronger impact in countries with lower corruption levels. Second, we incorporate the phase of political stability into our analysis, distinguishing between "low" and "high" stability. The estimations in columns [3]-[4] reveal that, contrary to its positive impact in periods of high political stability, financial development does not exhibit a statistically significant effect on public sector efficiency during periods of low political stability. Third, as indicated in columns [5]-[6], our findings demonstrate that financial development enhances public sector efficiency irrespective of the investment profile, with a more pronounced effect observed under a high investment profile. Fourth, we examine the role of the rule of law. By categorizing countries into "high" and "low" rule of law based on the median level, columns [7]-[8] demonstrate that, unlike its positive impact in contexts of high rule of law, financial development does not statistically affect public sector efficiency in situations of low rule of law. Fifth, a more detailed examination of conflicts reveals that in a context of relatively low internal conflicts (captured by values below the median of the variable internal conflict) financial development strengthens its impact on public sector efficiency, while its significant enhancement of public sector efficiency is less effective under relatively high internal conflicts (captured by values of internal conflict above the median) as shown in estimations on lines [9]-[10] in Table 7. Sixth, we explore the sensitivity of financial development to internal conflict by distinguishing between "low" and "high" levels of external conflict using the median of the variable. As highlighted in columns [11]-[12], financial development significantly increases public sector efficiency regardless of the level of external conflict, with a more pronounced effectiveness observed under low levels of external conflict. Lastly, our analysis reveals distinctions between fragile states and non-fragile states. According to estimations in columns [13]-[14], financial development is less effective in increasing public sector efficiency in fragile states compared to non-fragile states. In summary, these results show that the effect of financial development on public sector efficiency displays some heterogeneity related to the various economic contexts.

**Table 12. Heterogeneity/ The role of institutional factors**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Regressions** | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| **Public Sector Efficiency (PSE)** | Low  corruption | High  corruption | Low  stability | High  stability | Low  Invest  profile | High  Invest  profile | Low  rule/ law | High  rule/ law | Low  internal  conflict | High  Internal  conflict | Low  external  conflict | High  external  conflict | Fragile  state | Nonfragile  state |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Financial development | 0.1155\*\*\* | 0.0548 | 0.0141 | 0.1719\*\*\* | 0.0621\*\*\* | 0.0840\*\*\* | 0.0283 | 0.1279\*\*\* | 0.0533\*\* | 0.1608\*\*\* | 0.0755\*\*\* | 0.1328\*\*\* | -0.0659 | 0.1000\*\*\* |
|  | (0.0164) | (0.0354) | (0.0287) | (0.0188) | (0.0238) | (0.0151) | (0.0364) | (0.0177) | (0.0241) | (0.0177) | (0.0239) | (0.0179) | (0.1399) | (0.0146) |
| Public debt (log) | 0.0060\* | -0.0008 | 0.0095\*\* | -0.0072\*\* | 0.0007 | 0.0047 | -0.0013 | 0.0092\*\*\* | 0.0092\*\* | -0.0089\*\*\* | 0.0104\*\*\* | -0.0061\* | 0.0181\*\*\* | -0.0011 |
|  | (0.0032) | (0.0043) | (0.0043) | (0.0032) | (0.0045) | (0.0029) | (0.0041) | (0.0034) | (0.0042) | (0.0032) | (0.0037) | (0.0034) | (0.0061) | (0.0027) |
| Tax revenues (log) | -0.0133\* | -0.0118 | -0.0027 | -0.0207\*\*\* | -0.0230\*\*\* | -0.0009 | -0.0004 | -0.0134\* | 0.0119 | -0.0311\*\*\* | 0.0124 | -0.0325\*\*\* | 0.0131 | -0.0094 |
|  | (0.0069) | (0.0111) | (0.0088) | (0.0073) | (0.0087) | (0.0061) | (0.0109) | (0.0074) | (0.0076) | (0.0073) | (0.0084) | (0.0076) | (0.0158) | (0.0062) |
| GDP per capita growth | 0.0006\*\* | 0.0033\*\*\* | 0.0024\*\*\* | 0.0011\*\*\* | 0.0025\*\*\* | 0.0012\*\*\* | 0.0033\*\*\* | 0.0007\*\* | 0.0022\*\*\* | 0.0013\*\*\* | 0.0024\*\*\* | 0.0013\*\*\* | -0.0004 | 0.0018\*\*\* |
|  | (0.0003) | (0.0005) | (0.0005) | (0.0003) | (0.0006) | (0.0003) | (0.0005) | (0.0003) | (0.0006) | (0.0003) | (0.0005) | (0.0003) | (0.0007) | (0.0003) |
| Trade globalization | 0.0443\*\*\* | 0.0028 | 0.0062 | 0.0280\*\*\* | 0.0069 | 0.0178\* | -0.0078 | 0.0486\*\*\* | 0.0046 | 0.0344\*\*\* | 0.0192 | 0.0272\*\* | -0.0172 | 0.0307\*\*\* |
|  | (0.0103) | (0.0125) | (0.0124) | (0.0104) | (0.0114) | (0.0098) | (0.0125) | (0.0107) | (0.0122) | (0.0106) | (0.0122) | (0.0106) | (0.0178) | (0.0087) |
| Democracy | 0.0060\*\*\* | 0.0020 | 0.0045\*\* | 0.0043\*\*\* | 0.0029\* | 0.0053\*\*\* | 0.0025 | 0.0062\*\*\* | 0.0041\*\*\* | 0.0040\*\*\* | 0.0033\*\* | 0.0063\*\*\* | 0.0061\* | 0.0048\*\*\* |
|  | (0.0014) | (0.0016) | (0.0017) | (0.0015) | (0.0016) | (0.0012) | (0.0016) | (0.0015) | (0.0016) | (0.0015) | (0.0017) | (0.0015) | (0.0032) | (0.0012) |
| Government Fragmentation | -0.0060 | 0.0223\*\* | 0.0303\*\*\* | -0.0053 | -0.0077 | 0.0086 | 0.0140 | 0.0065 | 0.0292\*\*\* | -0.0176\*\* | 0.0284\*\*\* | -0.0091 | 0.0285 | 0.0058 |
|  | (0.0082) | (0.0110) | (0.0110) | (0.0084) | (0.0107) | (0.0076) | (0.0108) | (0.0086) | (0.0111) | (0.0080) | (0.0108) | (0.0085) | (0.0180) | (0.0071) |
| Constant | 0.4303\*\*\* | 0.6367\*\*\* | 0.5573\*\*\* | 0.5601\*\*\* | 0.6408\*\*\* | 0.5215\*\*\* | 0.6540\*\*\* | 0.3905\*\*\* | 0.5162\*\*\* | 0.5797\*\*\* | 0.4607\*\*\* | 0.5883\*\*\* | 0.5497\*\*\* | 0.5080\*\*\* |
|  | (0.0432) | (0.0513) | (0.0508) | (0.0434) | (0.0470) | (0.0406) | (0.0486) | (0.0459) | (0.0485) | (0.0449) | (0.0500) | (0.0442) | (0.0774) | (0.0359) |
| / |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| sigma\_u | 0.0333\*\*\* | 0.0265\*\*\* | 0.0345\*\*\* | 0.0348\*\*\* | 0.0286\*\*\* | 0.0255\*\*\* | 0.0258\*\*\* | 0.0372\*\*\* | 0.0241\*\*\* | 0.0344\*\*\* | 0.0342\*\*\* | 0.0340\*\*\* | 0.0218\*\*\* | 0.0274\*\*\* |
|  | (0.0037) | (0.0043) | (0.0040) | (0.0039) | (0.0036) | (0.0025) | (0.0040) | (0.0043) | (0.0037) | (0.0036) | (0.0039) | (0.0035) | (0.0070) | (0.0028) |
| sigma\_e | 0.0528\*\*\* | 0.0683\*\*\* | 0.0620\*\*\* | 0.0538\*\*\* | 0.0598\*\*\* | 0.0573\*\*\* | 0.0670\*\*\* | 0.0527\*\*\* | 0.0616\*\*\* | 0.0563\*\*\* | 0.0564\*\*\* | 0.0576\*\*\* | 0.0484\*\*\* | 0.0610\*\*\* |
|  | (0.0010) | (0.0018) | (0.0016) | (0.0011) | (0.0016) | (0.0011) | (0.0017) | (0.0010) | (0.0017) | (0.0011) | (0.0015) | (0.0011) | (0.0026) | (0.0010) |
| Observations | 1487 | 820 | 870 | 1437 | 747 | 1560 | 855 | 1452 | 719 | 1588 | 770 | 1537 | 193 | 2114 |
| Number of countries | 113 | 74 | 80 | 117 | 88 | 110 | 72 | 110 | 72 | 107 | 81 | 107 | 14 | 107 |
| Log likelihood | 2175 | 1003 | 1130 | 2069 | 1001 | 2178 | 1064 | 2118 | 953.1 | 2222 | 1065 | 2116 | 301.5 | 2831 |
| Chi2 | 151.9 | 51.17 | 48.77 | 168.7 | 32.55 | 153 | 49.48 | 157.6 | 70.01 | 171.1 | 89.17 | 139.2 | 22.1 | 174.2 |

*Note: Robust Standard Errors are in parenthesis.*

*Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

# **Conclusion and policy implications**

This article assesses the impact of financial development on the efficiency of public expenditures. Initially, using a parametric approach, we calculate efficiency scores for 158 developed and developing countries over the period 1990-2017. Subsequently, based on the obtained scores, we employ the Tobit method to evaluate the effect of financial development on public expenditure efficiency, specifically used when the dependent variable is limited from below, from above, or from both, with a positive probability of concentration at the ends of the interval due to censorship or corner solutions (Wooldridge, 2002). Evidence indicates that an increase in financial development positively and significantly enhances public expenditure efficiency, with economically significant effects. Robustness is verified through a set of economic and econometric tests. Additionally, we demonstrate that our results are not due to model misspecification and are not confounded by potential biases induced by omitted variables, simultaneity, or reverse causality. To check consistency, we have also used a pure cross-sectional instrumental variable. Both the panel and cross-sectional results tell the same story: the exogenous component of financial development is positively associated with expenditure efficiency; more precisely, the significant and positive link between financial development and expenditure efficiency is not due to potential biases induced by omitted variables, simultaneity, or reverse causality. In the continuation of this article, we examine the channels through which financial development is associated with expenditure efficiency. In this article, we argue that the link between finance and efficiency primarily occurs through fiscal performance, the level of per capita income, and institutional quality (especially corruption control). Finally, we deepen the analysis by examining some sources of heterogeneity in the effectiveness of financial development, depending on the types of financial development variables, and macroeconomic and institutional factors. On the one hand, all components and sub-components of the overall financial development index have a positive and significant effect on public expenditure efficiency. On the other hand, economic cycle, fiscal policy orientation, macroeconomic stability, government size, education level, international trade and capital account openness, development level, and institutional quality (especially political stability, corruption control, government stability, investment profile, public order, internal and external conflicts, and state fragility) amplify the positive effect of financial development on public expenditure efficiency. Our results have both theoretical and policy implications. Theoretically, unlike previous literature that mainly focused on the economic and institutional determinants of fiscal policy volatility, our article highlights the significant role of finance in determining fiscal policy volatility, where a broad and stable financial system proves useful in mitigating fiscal policy volatility. From a policy perspective, this implies that strong structural reforms, including budgetary rules, aimed at reducing fiscal policy volatility, should also consider the impact of financial factors. Firstly, these reforms aimed at correcting political biases that drive decision-makers to overspend and generate deficits not only promote greater budgetary discipline while preserving the countercyclical stabilizing role of fiscal policy but also improve the efficiency of government spending. Secondly, mechanisms such as the legal and regulatory system and institutional quality are important to foster greater reform effectiveness. In particular, policymakers must be aware that promoting financial development and maintaining financial stability are essential for the smooth conduct of fiscal policy. These results also emphasize that there are still opportunities for improvement in public expenditure management in developing countries where the level of financial sector development is limited. This also indicates that countries could achieve significantly higher levels of outcomes. This means that governments still have the opportunity to achieve social improvements at a relatively low cost.

# Appendix A.

|  |  |  |
| --- | --- | --- |
| **Table A1 Definition and sources of variables.** |  |  |
| **Variables** | **Descriptions** | **Sources** |
| **Public sector efficiency** | Public spending scores | Authors calculator |
| **Education expenditure (%GDP)** | Government expenditure on education, total (% of GDP) | Public Expenditures for Economic Development (SPEED) |
| **Health expenditure (%GDP** | Government expenditure on health, total in percentage of GDP | Public Expenditures for Economic Development (SPEED) |
| **Infrastructure expenditure (%GDP)** | Government expenditure on Infrastructure, total (% of GDP) | Public Expenditures for Economic Development (SPEED) |
| **Government final consumption (%GDP)** | It includes domestic and foreign liabilities such as currency and money deposits, securities other than shares, and loans. | World Economic Outlook (WEO) |
| **Primary enrollment** | Primary school enrolment ratio, | World Development Indicators (WDI) |
| **Secondary enrollment** | Secondary school enrolment ratio, | World Development Indicators (WDI) |
| **Expected years of schooling** | The number of years during which a 2-year-old child can expect to spend in schooling, based on the school enrolment rates at a given date | World Development Indicators (WDI) |
| **Life expectancy at birth** | Life expectancy at birth reflects the overall mortality level of a population. It summarizes the mortality pattern that prevails across all age groups - children and adolescents, adults, and the elderly. | World Development Indicators (WDI) |
| **Infant mortality rate (per 1000 live births)** | The number of infants dying before reaching one year of age, per 1,000 live births each year. | World Development Indicators (WDI) |
| **Total length of roads in kilometers** | Total road length (in kilometer) | World Telecommunication/ICT Indicators Database |
| **Number of paved roads (% total roads** | Paved roads are those surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete, or with cobblestones, as a percentage of all the country's roads, measured in length. | World Telecommunication/ICT Indicators Database |
| **Fixed telephone subscriptions (per 100 people)** | A fixed telephone line (previously called main telephone line in operation) is an active line connecting the subscriber's terminal equipment to the public switched telephone network (PSTN) and which has a dedicated port in the telephone exchange equipment. The number of fixed telephone lines is measured relative to population. | World Telecommunication/ICT Indicators Database |
| **Fixed broadband subscriptions (per 100 people)** | Refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. | World Telecommunication/ICT Indicators Database |
| **Faults for 100 fixed telephone lines per year** | The total number of reported faults to fixed telephone lines for the year. Faults, which are not the direct responsibility of the public telecommunications operator, should be excluded. The number of faults per 100 fixed lines per year should reflect the total reported by all PSTN service providers in the country. | World Telecommunication/ICT Indicators Database |
| **Proportion of households with electricity** | The percentage of population with access to electricity. | World Telecommunication/ICT Indicators Database |
| **Electric power consumption (in kWh per capita)** | Electric power consumption (in kWh) measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants. The variable is measured relative to population. | World Telecommunication/ICT Indicators Database |
| **Electric power transmission and distribution losses (%production)** | Electric power transmission and distribution losses include losses in transmission between sources of supply and points of distribution and in the distribution to consumers, including pilferage. | World Telecommunication/ICT Indicators Database |
| **Independence of the judiciary** | Quality of judiciary index | (Teorell *et al.*, 2021) |
| **Quality of property rights** | Quality of property rights | (Teorell *et al.*, 2021) |
| **Quality of government** | Quality of government | (Teorell *et al.*, 2021) |
| **Level of the shadow economy** | Shadow economy index | (Teorell *et al.*, 2021) |
| **Standard deviation of the three-year moving average of GDP growth** | Standard deviation of the three-year moving average of GDP growth | Authors, from WDI |
| **Standard deviation of the three-year moving of inflation** | Standard deviation of the three-year moving of inflation | Authors, from WDI |
| **Gini Index** | The Gini index is a measure of the distribution of income across a population. | Standardized World Income Inequality Database (SWIID) |
| **GDP Per capita** | GDP Per capita | World Development Indicators (WDI) |
| **GDP growth (10-year average)** | The annual percentage growth rate of GDP at market prices is based on constant local currency (average). | World Development Indicators (WDI) |
| **Unemployment rate (10-year average)** | Average Unemployment with advanced education (% of total labor force with advanced education) | World Development Indicators (WDI) |
| **Domestic credit to private sector (% of GDP)** | Domestic credit to private sector refers to financial resources provided to the private sector. (as a proxy for financial development) | World Development Indicators (WDI), World Bank |
| **Credit to government and state-owned enterprises to GDP (%)** | Ratio between credit by domestic money banks to the government and state-owned enterprises and GDP. | International Financial Statistics (IFS), IMF |
| **Tax revenue** | Tax revenue divided by GDP | World Development Indicators (WDI), World Bank |
| **Non-Resource Tax Revenue** | It is Calculated as total tax revenue (excluding grants and social contributions) minus resource tax revenue (% GDP). | International Centre for Tax and Development (ICTD). |
| **Trade Openness** | Sum of exports and imports of goods and services, % of GDP. | World Development Indicators (WDI), World Bank |
| **Total factor productivity** | TFP at constant national prices (2017) | Penn World Table (PWT |
| **Government fragmentation** | The probability that two deputies picked at random from among the government parties will be of different parties. Equals NA if there is no parliament. If there are any government parties where seats are unknown (Cell is blank), GOVFRAC is also blank. No parties in the legislature (0 in 1 GOVSEAT) results in NA, just as in the Herfindahl. | World Bank DPI database |
| **Democracy Index** | Index ranging from 0 to 10 | Freedom House database |
|  |  |  |
| **Table A1. (continued)** |  |  |
| **Definition and sources of variables.** |  |  |
| **Control of corruption** | Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as” capture” of the state by elites and private interests. | International Country Risk Guide (ICRG) |
| **Government effectiveness** | capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. | (Kaufmann, Kraay and Mastruzzi, 2011) |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Table A2. List of countries used in the analysis** | | |
| **Full Sample** | | |
| Afghanistan | Ghana | Netherlands |
| Angola | Guinea-Bissau | Norway |
| Albania | Equatorial Guinea | Nepal |
| Argentina | Greece | New Zealand |
| Armenia | Grenada | Oman |
| Australia | Guatemala | Pakistan |
| Austria | Hong Kong | Panama |
| Azerbaijan | Honduras | Peru |
| Burundi | Croatia | Philippines |
| Belgium | Hungary | Papua New Guinea |
| Benin | Indonesia | Poland |
| Burkina Faso | India | Portugal |
| Bangladesh | Ireland | Paraguay |
| Bulgaria | Iran, Islamic Rep. | Qatar |
| Bahrain | Iraq | Russian Federation |
| Bahamas, The | Iceland | Rwanda |
| Bosnia and Herzegovina | Israel | Saudi Arabia |
| Belarus | Italy | Sudan |
| Belize | Jamaica | Senegal |
| Bolivia | Jordan | Singapore |
| Brazil | Japan | Solomon Islands |
| Barbados | Kazakhstan | Sierra Leone |
| Bhutan | Kenya | El Salvador |
| Botswana | Kyrgyz Republic | Serbia |
| Central African Republic | Cambodia | Suriname |
| Canada | Kiribati | Slovak Republic |
| Switzerland | Korea, Rep. | Slovenia |
| Chile | Kuwait | Sweden |
| China | Laos | Swaziland |
| Cote d'Ivoire | Lebanon | Seychelles |
| Cameroon | Liberia | Togo |
| Congo, Dem Rep | Sri Lanka | Thailand |
| Congo, Rep | Lesotho | Tajikistan |
| Colombia | Lithuania | Timor-Leste |
| Cabo Verde | Luxembourg | Tonga |
| Costa Rica | Latvia | Trinidad and Tobago |
| Cyprus | Morocco | Tunisia |
| Czech Republic | Moldova | Turkey |
| Germany | Madagascar | Tanzania |
| Dominica | Maldives | Uganda |
| Denmark | Mexico | Ukraine |
| Dominican Republic | Mali | Uruguay |
| Algeria | Malta | United States |
| Ecuador | Myanmar | Uzbekistan |
| Egypt, Arab Rep. | Mongolia | St Vincent and the Grenadines |
| Spain | Mozambique | Venezuela, RB |
| Estonia | Mauritius | Vietnam |
| Ethiopia | Malawi | Vanuatu |
| Finland | Malaysia | Samoa |
| Fiji | Namibia | Yemen, Rep. |
| France | Niger | South Africa |
| United Kingdom | Nigeria | Zambia |
| Georgia | Nicaragua | Zimbabwe |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Panel A : Advanced economies** | | | | | | | | | | | |
| Australia | Austria | | | Belgium | | | Canada | | |
| Switzerland | Cyprus | | | Czech Republic | | | Germany | | |
| Denmark | Spain | | | Estonia | | | Finland | | |
| France | United Kingdom | | | Greece | | | Hong Kong | | |
| Ireland | Iceland | | | Israel | | | Italy | | |
| Japan | Korea, Rep. | | | Lithuania | | | Luxembourg | | |
| Latvia | Malta | | | Netherlands | | | Norway | | |
| New Zealand | Portugal | | | Singapore | | | Slovak Republic | | |
| Slovenia | Sweden | | | United States | | | Slovak Republic | | |
|  |  | | |  | | |  | | |
|  | | |  | | |  | | |  | | |
| **Panel B : Developing economies** | | |  | | |  | | |  | | |
| Afghanistan | | Angola | | | Albania | | | Argentina | | |
| Armenia | | Azerbaijan | | | Burundi | | | Benin | | |
| Burkina Faso | | Bangladesh | | | Bulgaria | | | Bahrain | | |
| Bahamas, The | | Bosnia and Herzegovina | | | Belarus | | | Belize | | |
| Bolivia | | Brazil | | | Barbados | | | Bhutan | | |
| Botswana | | Central African Republic | | | Chile | | | China | | |
| Cote d’Ivoire | | Cameroon | | | Congo, Dem Rep | | | Congo, Rep | | |
| Colombia | | Cabo Verde | | | Costa Rica | | | Dominica | | |
| Dominican Republic | | Algeria | | | Ecuador | | | Egypt, Arab Rep. | | |
| Ethiopia | | Fiji | | | Georgia | | | Ghana | | |
| Guinea-Bissau | | Equatorial Guinea | | | Grenada | | | Guatemala | | |
| Honduras | | Croatia | | | Hungary | | | Indonesia | | |
| India | | Iran, Islamic Rep. | | | Iraq | | | Jamaica | | |
| Jordan | | Kazakhstan | | | Kenya | | | Kyrgyz Republic | | |
| Cambodia | | Kiribati | | | Kuwait | | | Laos | | |
| Lebanon | | Liberia | | | Sri Lanka | | | Lesotho | | |
| Morocco | | Moldova | | | Madagascar | | | Maldives | | |
| Mexico | | Mali | | | Myanmar | | | Mongolia | | |
| Mozambique | | Mauritius | | | Malawi | | | Malaysia | | |
| Namibia | | Niger | | | Nigeria | | | Nicaragua | | |
| Nepal | | Oman | | | Pakistan | | | Panama | | |
| Peru | | Philippines | | | Papua New Guinea | | | Poland | | |
| Paraguay | | Qatar | | | Russian Federation | | | Rwanda | | |
| Saudi Arabia | | Sudan | | | Senegal | | | Solomon Islands | | |
| Sierra Leone | | El Salvador | | | Serbia | | | Suriname | | |
| Swaziland | | Seychelles | | | Togo | | | Thailand | | |
| Tajikistan | | Timor-Leste | | | Tonga | | | Trinidad and Tobago | | |
| Tunisia | | Turkey | | | Tanzania | | | Uganda | | |
| Ukraine | | Uruguay | | | Uzbekistan | | | St Vincent and the Grenadines | | |
| Venezuela, RB | | Vietnam | | | Vanuatu | | | Samoa | | |
| Yemen, Rep | | South Africa | | | Zambia | | | Zimbabwe | | |

**Table A3. Countries' rankings by average efficiency global scores:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Country** | **Score** | **Rank** | **Country** | **Score** | **Rank** | **Country** | **Score** | **Rank** | **Country** | **Score** | **Rank** |
| United Kingdom | 0.78973 | 1 | Mauritius | 0.68867 | 41 | Dominican Republic | 0.66272 | 81 | Cambodia | 0.63643 | 121 |
| United States | 0.75612 | 2 | Sri Lanka | 0.68838 | 42 | Kuwait | 0.66114 | 82 | Sudan | 0.63514 | 122 |
| Japan | 0.74748 | 3 | Czech Republic | 0.68658 | 43 | Colombia | 0.66078 | 83 | Pakistan | 0.63493 | 123 |
| New Zealand | 0.74223 | 4 | Kiribati | 0.68591 | 44 | Paraguay | 0.66048 | 84 | Honduras | 0.63477 | 124 |
| Korea, Rep. | 0.74117 | 5 | Greece | 0.68210 | 45 | Mozambique | 0.65968 | 85 | Bangladesh | 0.63400 | 125 |
| Australia | 0.73770 | 6 | Kazakhstan | 0.68210 | 46 | El Salvador | 0.65929 | 86 | Central African Republic | 0.63380 | 126 |
| Netherlands | 0.73134 | 7 | Grenada | 0.68178 | 47 | Croatia | 0.65925 | 87 | Benin | 0.63022 | 127 |
| Norway | 0.72870 | 8 | Tonga | 0.68160 | 48 | Serbia | 0.65908 | 88 | Sierra Leone | 0.62766 | 128 |
| Italy | 0.72766 | 9 | Belarus | 0.68127 | 49 | Luxembourg | 0.65880 | 89 | Mongolia | 0.62617 | 129 |
| Malta | 0.72749 | 10 | Argentina | 0.68112 | 50 | Bosnia and Herzegovina | 0.65844 | 90 | Congo, Rep | 0.62593 | 130 |
| Bolivia | 0.72685 | 11 | Finland | 0.68112 | 51 | Russian Federation | 0.65710 | 91 | Malawi | 0.62579 | 131 |
| Belgium | 0.72626 | 12 | Tunisia | 0.68099 | 52 | Morocco | 0.65699 | 92 | Nepal | 0.62567 | 132 |
| Vietnam | 0.72560 | 13 | Barbados | 0.68081 | 53 | Trinidad and Tobago | 0.65678 | 93 | Namibia | 0.62509 | 133 |
| Denmark | 0.72204 | 14 | Bahrain | 0.68078 | 54 | Sweden | 0.65602 | 94 | Albania | 0.62499 | 134 |
| Egypt, Arab Rep. | 0.72155 | 15 | Mexico | 0.68042 | 55 | Burkina Faso | 0.65581 | 95 | Bhutan | 0.62243 | 135 |
| Iceland | 0.72026 | 16 | Turkey | 0.67792 | 56 | Slovak Republic | 0.65566 | 96 | Congo, Dem Rep | 0.62177 | 136 |
| Canada | 0.72019 | 17 | Uzbekistan | 0.67790 | 57 | Bulgaria | 0.65544 | 97 | Zimbabwe | 0.62108 | 137 |
| Germany | 0.71912 | 18 | Uruguay | 0.67691 | 58 | Ukraine | 0.65295 | 98 | Cameroon | 0.62046 | 138 |
| St Vincent and the Grenadines | 0.71467 | 19 | Dominica | 0.67678 | 59 | Timor-Leste | 0.65140 | 99 | Madagascar | 0.61995 | 139 |
| Austria | 0.71420 | 20 | Seychelles | 0.67601 | 60 | Oman | 0.64884 | 100 | Mali | 0.61594 | 140 |
| Ireland | 0.71352 | 21 | Panama | 0.67561 | 61 | Botswana | 0.64773 | 101 | Kenya | 0.61425 | 141 |
| Israel | 0.71331 | 22 | Latvia | 0.67473 | 62 | Guatemala | 0.64706 | 102 | Yemen, Rep. | 0.61249 | 142 |
| Slovenia | 0.71251 | 23 | Malaysia | 0.67158 | 63 | Venezuela, RB | 0.64682 | 103 | Afghanistan | 0.60815 | 143 |
| Spain | 0.71234 | 24 | Thailand | 0.67117 | 64 | Laos | 0.64541 | 104 | Burundi | 0.60528 | 144 |
| France | 0.70855 | 25 | Indonesia | 0.66874 | 65 | Solomon Islands | 0.64468 | 105 | Liberia | 0.60472 | 145 |
| Hong Kong | 0.70809 | 26 | Hungary | 0.66793 | 66 | Armenia | 0.64425 | 106 | Zambia | 0.60415 | 146 |
| Portugal | 0.70622 | 27 | Senegal | 0.66722 | 67 | Cote d'Ivoire | 0.64353 | 107 | Equatorial Guinea | 0.60392 | 147 |
| Singapore | 0.70580 | 28 | Qatar | 0.66629 | 68 | Suriname | 0.64341 | 108 | Lesotho | 0.60321 | 148 |
| Samoa | 0.70569 | 29 | Estonia | 0.66537 | 69 | Niger | 0.64264 | 109 | Bahamas, The | 0.60224 | 149 |
| Costa Rica | 0.70558 | 30 | Iran, Islamic Rep. | 0.66520 | 70 | Guinea-Bissau | 0.64242 | 110 | Myanmar | 0.59897 | 150 |
| Poland | 0.70367 | 31 | Belize | 0.66520 | 71 | Philippines | 0.64210 | 111 | Nicaragua | 0.59793 | 151 |
| Switzerland | 0.69951 | 32 | Saudi Arabia | 0.66477 | 72 | Rwanda | 0.64180 | 112 | Swaziland | 0.59755 | 152 |
| Cyprus | 0.69787 | 33 | Algeria | 0.66423 | 73 | Tajikistan | 0.64123 | 113 | Uganda | 0.59539 | 153 |
| Lithuania | 0.69557 | 34 | Jordan | 0.66404 | 74 | Ghana | 0.63980 | 114 | Angola | 0.59468 | 154 |
| China | 0.69450 | 35 | Jamaica | 0.66403 | 75 | Iraq | 0.63866 | 115 | Papua New Guinea | 0.59086 | 155 |
| Chile | 0.69373 | 36 | Georgia | 0.66372 | 76 | Maldives | 0.63803 | 116 | Ethiopia | 0.57838 | 156 |
| Lebanon | 0.69321 | 37 | Fiji | 0.66315 | 77 | Kyrgyz Republic | 0.63793 | 117 | Togo | 0.56789 | 157 |
| Peru | 0.69309 | 38 | Ecuador | 0.66307 | 78 | Azerbaijan | 0.63745 | 118 | Nigeria | 0.56459 | 158 |
| Brazil | 0.69121 | 39 | Vanuatu | 0.66283 | 79 | India | 0.63730 | 119 | Tanzania | 0.56286 | 159 |
| Cabo Verde | 0.69083 | 40 | Moldova | 0.66280 | 80 | South Africa | 0.63648 | 120 |  |  |  |

# Appendix B.



Figure A1. Evolution of financial development index, financial institutions and financial markets(1990-2017)

Une image contenant texte, capture d’écran, diagramme, carte

Description générée automatiquement  
Figure A2. Plot showing domestic credit to private sector / Credit to government and state-owned enterprises and public sector efficiency.

**Source :** Authors, from the Financial Structure and Economic Development Dataset (FSED), 2019

Acemoglu, D. and Robinson, J. (2008) *The role of institutions in growth and development*. World Bank Washington, DC.

Adam, A., Delis, M. and Kammas, P. (2011) ‘Public sector efficiency: leveling the playing field between OECD countries’, *Public Choice*, 146(1–2), pp. 163–183.

Afonso, A. and Aubyn, M.S. (2005) ‘Non-parametric approaches to education and health efficiency in OECD countries’, *Journal of applied economics*, 8(2), pp. 227–246.

Afonso, A. and Aubyn, M.S. (2006a) ‘Cross-country efficiency of secondary education provision: A semi-parametric analysis with non-discretionary inputs’, *Economic modelling*, 23(3), pp. 476–491.

Afonso, A. and Aubyn, M.S. (2006b) ‘Cross-country efficiency of secondary education provision: A semi-parametric analysis with non-discretionary inputs’, *Economic modelling*, 23(3), pp. 476–491.

Afonso, A. and Carvalho, F.T. (2022) ‘Time-varying cyclicality of fiscal policy: The case of the Euro area’, *The North American Journal of Economics and Finance*, 62, p. 101778. Available at: https://www.sciencedirect.com/science/article/pii/S106294082200119X (Accessed: 10 November 2023).

Afonso, A., Jalles, J.T. and Venâncio, A. (2021) ‘Taxation and public spending efficiency: An international comparison’, *Comparative Economic Studies*, 63(3), pp. 356–383.

Afonso, A., Schuknecht, L. and Tanzi, V. (2005) ‘Public sector efficiency: an international comparison’, *Public choice*, 123(3–4), pp. 321–347.

Afonso, A., Schuknecht, L. and Tanzi, V. (2010a) ‘Income distribution determinants and public spending efficiency’, *The Journal of Economic Inequality*, 8(3), pp. 367–389.

Afonso, A., Schuknecht, L. and Tanzi, V. (2010b) ‘Public sector efficiency: evidence for new EU member states and emerging markets’, *Applied Economics*, 42(17), pp. 2147–2164.

Afonso, A., Schuknecht, L. and Tanzi, V. (2010c) ‘Public sector efficiency: evidence for new EU member states and emerging markets’, *Applied Economics*, 42(17), pp. 2147–2164.

Aigner, D., Lovell, C.K. and Schmidt, P. (1977) ‘Formulation and estimation of stochastic frontier production function models’, *Journal of econometrics*, 6(1), pp. 21–37.

Anderson, M.L. (2008) ‘Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects’, *Journal of the American statistical Association*, 103(484), pp. 1481–1495.

Apeti, A.E., Bambe, B.-W.-W. and Lompo, A.A.B. (2023) ‘Determinants of public sector efficiency: a panel database from a stochastic frontier analysis’, *Oxford Economic Papers*, p. gpad036.

Artés, J. and Jurado, I. (2018) ‘Government fragmentation and fiscal deficits: a regression discontinuity approach’, *Public Choice*, 175, pp. 367–391.

Asatryan, Z., Castellón, C. and Stratmann, T. (2018) ‘Balanced budget rules and fiscal outcomes: Evidence from historical constitutions’, *Journal of Public Economics*, 167, pp. 105–119.

Aubyn, S.M. (2002) ‘Evaluating efficiency in the Portuguese health and education sectors’, in *conference organized by Bank of Portugal, IMF Working Paper*.

Balassone, F. and Giordano, R. (2001) ‘Budget deficits and coalition governments’, *Public Choice*, 106(3–4), pp. 327–349.

Bamba, M., Combes, J.-L. and Minea, A. (2020) ‘The effects of fiscal consolidations on the composition of government spending’, *Applied Economics*, 52(14), pp. 1517–1532.

Barbier-Gauchard, A., Baret, K. and Minea, A. (2021) ‘National fiscal rules and fiscal discipline in the European Union’, *Applied Economics*, 53(20), pp. 2337–2359.

Barro, R.J. (1990) ‘Government spending in a simple model of endogeneous growth’, *Journal of political economy*, 98(5, Part 2), pp. S103–S125.

Battese, G.E. and Coelli, T.J. (1992) ‘Frontier production functions, technical efficiency and panel data: with application to paddy farmers in India’, *Journal of productivity analysis*, 3(1–2), pp. 153–169.

Bauer, P.W. (1990) ‘Recent developments in the econometric estimation of frontiers’, *Journal of econometrics*, 46(1–2), pp. 39–56.

Baumol, W.J. (1967) ‘Macroeconomics of unbalanced growth: the anatomy of urban crisis’, *The American economic review*, 57(3), pp. 415–426.

Beck, T., Lin, C. and Ma, Y. (2014) ‘Why do firms evade taxes? The role of information sharing and financial sector outreach’, *The Journal of Finance*, 69(2), pp. 763–817.

Borrelli, S.A. and Royed, T.J. (1995) ‘Government ‘strength’and budget deficits in advanced democracies’, *European Journal of Political Research*, 28(2), pp. 225–260.

Bosworth, B. and Collins, S.M. (2003) ‘The empirics of growth: An update’, *Brookings papers on economic activity*, 2003(2), pp. 113–206.

Bravo-Ureta, B.E. *et al.* (2007) ‘Technical efficiency in farming: a meta-regression analysis’, *Journal of productivity Analysis*, 27, pp. 57–72.

Calderón, C. and Schmidt-Hebbel, K. (2008) ‘The choice of fiscal regimes in the world’, *Documentos de Trabajo (Banco Central de Chile)*, (487), p. 1.

Celasun, O., Ostry, J.D. and Debrun, X. (2006) ‘Primary Surplus Behavior and Risks to Fiscal Sustainability in Emerging Market Countries: A “Fan-Chart” Approach’, *IMF Staff Papers*, 53(3), pp. 401–425.

Chan, S.-G., Ramly, Z. and Karim, M.Z.A. (2017) ‘Government spending efficiency on economic growth: Roles of value-added tax’, *Global Economic Review*, 46(2), pp. 162–188.

Coelli, T.J. *et al.* (2005) *An introduction to efficiency and productivity analysis*. Springer Science & Business Media.

Colombo, J.A. and Caldeira, J.F. (2018) ‘The role of taxes and the interdependence among corporate financial policies: Evidence from a natural experiment’, *Journal of Corporate Finance*, 50, pp. 402–423.

Combes, J.-L. and Ebeke, C. (2011) ‘Remittances and household consumption instability in developing countries’, *World Development*, 39(7), pp. 1076–1089.

De Haan, J. and Sturm, J.-E. (1994) ‘Political and institutional determinants of fiscal policy in the European Community’, *Public choice*, 80(1–2), pp. 157–172.

De Haan, J. and Sturm, J.-E. (1997) ‘Political and economic determinants of OECD budget deficits and government expenditures: A reinvestigation’, *European Journal of Political Economy*, 13(4), pp. 739–750.

Debrun, X., Epstein, N.P. and Symansky, S. (2008) ‘A New Fiscal Rule: Should Israel Go Swiss?’

Deprins, D. and Simar, L. (1984) ‘Measuring labor efficiency in post offices, the performance of public enterprises: Concepts and measurements, m. marchand, p. pestieau and h. tulkens’. Amsterdam, North (Holland, 243 (267.

Docquier, F. *et al.* (2016) ‘Emigration and democracy’, *Journal of Development Economics*, 120, pp.

Donaubauer, J., Meyer, B. and Nunnenkamp, P. (2016) ‘Aid, infrastructure, and FDI: Assessing the transmission channel with a new index of infrastructure’, *World Development*, 78, pp. 230–245.

Donaubauer, J., Meyer, B.E. and Nunnenkamp, P. (2016) ‘A new global index of infrastructure: Construction, rankings and applications’, *The World Economy*, 39(2), pp. 236–259.

Edin, P.-A. and Ohlsson, H. (1991) ‘Political determinants of budget deficits: Coalition effects versus minority effects’, *European Economic Review*, 35(8), pp. 1597–1603.

Ehrlich, I. and Lui, F.T. (1999) ‘Bureaucratic corruption and endogenous economic growth’, *Journal of Political Economy*, 107(S6), pp. S270–S293.

Elliott, D.J. (2010) ‘Tax policy and bank regulation’, *Manuscript, Brookings Institution, Washington, DC* [Preprint].

Eugène, B. (2007) ‘The efficiency of the Belgian general government in an international perspective’, *Frankfurt: National Bank of Frankfurt. Accessed on November*, 8, p. 2016.

Fernández-Val, I. and Weidner, M. (2016) ‘Individual and time effects in nonlinear panel models with large N, T’, *Journal of Econometrics*, 192(1), pp. 291–312.

Fiorentino, E., Karmann, A. and Koetter, M. (2006) ‘The cost efficiency of German banks: a comparison of SFA and DEA’, *Available at SSRN 947340* [Preprint].

Fosu, A.K. and Abass, A.F. (2020) ‘Domestic credit and export diversification: Africa from a global perspective’, in *Contemporary Issues and Prospects in Business Development in Africa*. Routledge, pp. 6–25.

Franzese Jr, R.J. (2000) ‘Electoral and partisan manipulation of public debt in developed democracies, 1956–90’, in *Institutions, politics and fiscal policy*. Springer, pp. 61–83.

Ghosh, A.R. *et al.* (2013) ‘Fiscal fatigue, fiscal space and debt sustainability in advanced economies’, *The Economic Journal*, 123(566), pp. F4–F30.

Giménez, V.M. and Prior, D. (2007) ‘Long-and short-term cost efficiency frontier evaluation: Evidence from Spanish local governments’, *Fiscal Studies*, 28(1), pp. 121–139.

Greene, W. (2004) ‘Fixed Effects and Bias Due to the Incidental Parameters Problem in the Tobit Model’, *Econometric Reviews*, 23(2), pp. 125–147.

Greene, W. (2005) ‘Reconsidering heterogeneity in panel data estimators of the stochastic frontier model’, *Journal of econometrics*, 126(2), pp. 269–303.

Gruss, B., Nabar, M. and Poplawski-Ribeiro, M. (2020) ‘Growth Accelerations and Reversals in Emerging Market and Developing Economies: External Conditions and Domestic Amplifiers’, *Open Economies Review*, 31(4), pp. 753–786.

Gupta, S. and Verhoeven, M. (2001) ‘The efficiency of government expenditure: experiences from Africa’, *Journal of policy modeling*, 23(4), pp. 433–467.

Harrinvirta, M. and Mattila, M. (2001) ‘The hard business of balancing budgets: A study of public finances in seventeen OECD countries’, *British Journal of Political Science*, 31(3), pp. 497–521.

Hasan, I. *et al.* (2014) ‘Beauty is in the eye of the beholder: The effect of corporate tax avoidance on the cost of bank loans’, *Journal of Financial Economics*, 113(1), pp. 109–130.

Hauner, D. and Kyobe, A. (2010) ‘Determinants of government efficiency’, *World Development*, 38(11), pp. 1527–1542.

Herrera, S. and Pang, G. (2005a) *Efficiency of public spending in developing countries: an efficiency frontier approach*. World Bank Publications.

Herrera, S. and Pang, G. (2005b) *Efficiency of public spending in developing countries: An efficiency frontier approach Vol. 1, 2 & 3*. The World Bank.

Hindriks, J., Keen, M. and Muthoo, A. (1999) ‘Corruption, extortion and evasion’, *Journal of Public economics*, 74(3), pp. 395–430.

Hoff, A. (2007) ‘Second stage DEA: Comparison of approaches for modelling the DEA score’, *European journal of operational research*, 181(1), pp. 425–435.

Hur, J., Raj, M. and Riyanto, Y.E. (2006) ‘Finance and trade: A cross-country empirical analysis on the impact of financial development and asset tangibility on international trade’, *World Development*, 34(10), pp. 1728–1741.

Jalles, J.T. (2021) ‘Dynamics of government spending cyclicality’, *Economic Modelling*, 97, pp. 411–427.

Jayasuriya, R. and Wodon, Q. (2003) ‘Measuring and explaining country efficiency in improving health and education indicators’.

Jondrow, J. *et al.* (1982) ‘On the estimation of technical inefficiency in the stochastic frontier production function model’, *Journal of econometrics*, 19(2–3), pp. 233–238.

Kaufmann, D., Kraay, A. and Mastruzzi, M. (2011) ‘The Worldwide Governance Indicators: Methodology and Analytical Issues’, *Hague Journal on the Rule of Law*, 3(02), pp. 220–246.

Kaya Samut, P. and Cafrı, R. (2016) ‘Analysis of the Efficiency Determinants of Health Systems in OECD Countries by DEA and Panel Tobit’, *Social Indicators Research*, 129(1), pp. 113–132.

Kontopoulos, Y. and Perotti, R. (1999) ‘Government fragmentation and fiscal policy outcomes: Evidence from OECD countries’, in *Fiscal institutions and fiscal performance*. University of Chicago Press, pp. 81–102.

Kumbhakar, S.C., Denny, M. and Fuss, M. (2000) ‘Estimation and decomposition of productivity change when production is not efficient: a paneldata approach’, *Econometric Reviews*, 19(4), pp. 312–320.

Kumbhakar, S.C., Ghosh, S. and McGuckin, J.T. (1991) ‘A generalized production frontier approach for estimating determinants of inefficiency in US dairy farms’, *Journal of Business & Economic Statistics*, 9(3), pp. 279–286.

Kumbhakar, S.C., Lien, G. and Hardaker, J.B. (2014) ‘Technical efficiency in competing panel data models: a study of Norwegian grain farming’, *Journal of Productivity Analysis*, 41(2), pp. 321–337.

Kumbhakar, S.C. and Lovell, C.K. (2003) *Stochastic frontier analysis*. Cambridge university press.

Kumbhakar, S.C., Wang, H. and Horncastle, A.P. (2015) *A practitioner’s guide to stochastic frontier analysis using Stata*. Cambridge University Press.

Kumbhakar, S.C. and Wang, H.-J. (2005) ‘Estimation of growth convergence using a stochastic production frontier approach’, *Economics Letters*, 88(3), pp. 300–305.

La Porta, R. *et al.* (1999) ‘The quality of government’, *The Journal of Law, Economics, and Organization*, 15(1), pp. 222–279.

Lee, Y.H. and Schmidt, P. (1993) ‘A production frontier model with flexible temporal variation in technical efficiency’, *The measurement of productive efficiency: Techniques and applications*, pp. 237–255.

Leeper, E.M. and Walker, T.B. (2011) ‘Fiscal limits in advanced economies’, *Economic Papers: A journal of applied economics and policy*, 30(1), pp. 33–47.

Levine, R. (1998) ‘The legal environment, banks, and long-run economic growth’, *Journal of money, credit and banking*, pp. 596–613.

Levine, R. (2004) *Finance and Growth: Theory, Evidence, and Mechanisms. Handbook of Economic Growth. Eds. P. Aghion and S. Durlauf*. Amsterdam: North-Holland Elsevier Publishers, forthcoming.

Lonti, Z. and Woods, M. (2008) ‘Towards government at a glance: Identification of core data and issues related to public sector efficiency’.

López, N.R. (2006) ‘El objetivo de la mejora de la eficiencia p ú blic a. Reflexiones a partir de la evidencia empírica’, *Auditoría Pública*, 40, pp. 61–74.

López, N.R. (2009) ‘Sector público y eficiencia económica: ingresos y gastos públicos’, *Temas actuales de economía*, (4), pp. 383–410.

Lucotte, Y. (2012) ‘Adoption of inflation targeting and tax revenue performance in emerging market economies: An empirical investigation’, *Economic Systems*, 36(4), pp. 609–628.

Ma, Y. and Lv, L. (2023) ‘Financial development, financial instability, and fiscal policy volatility: International evidence’, *The North American Journal of Economics and Finance*, 64, p. 101873.

Mandl, U., Dierx, A. and Ilzkovitz, F. (2008) *The effectiveness and efficiency of public spending*. Directorate General Economic and Financial Affairs (DG ECFIN), European ….

Mawejje, J. and Odhiambo, N.M. (2022) ‘The determinants and cyclicality of fiscal policy: Empirical evidence from East Africa’, *International Economics*, 169, pp. 55–70.

Meeusen, W. and van Den Broeck, J. (1977) ‘Efficiency estimation from Cobb-Douglas production functions with composed error’, *International economic review*, pp. 435–444.

Mehrotra, A.N. and Yetman, J. (2015) ‘Financial inclusion-issues for central banks’, *BIS Quarterly Review March* [Preprint].

Nickell, S. (1981) ‘Biases in dynamic models with fixed effects’, *Econometrica: Journal of the econometric society*, pp. 1417–1426.

Osei, M.J. and Kim, J. (2020) ‘Foreign direct investment and economic growth: Is more financial development better?’, *Economic Modelling*, 93, pp. 154–161.

Pleninger, R. and Sturm, J.-E. (2020) ‘The effects of economic globalisation and ethnic fractionalisation on redistribution’, *World Development*, 130, p. 104945.

Poplawski-Ribeiro, M. (2009) *New evidence on the effectiveness of Europe’s fiscal restrictions*. CEPII research center.

Porta, R.L. *et al.* (1998) ‘Law and finance’, *Journal of political economy*, 106(6), pp. 1113–1155.

Ricciuti, R. (2004) ‘Political fragmentation and fiscal outcomes’, *Public choice*, 118(3–4), pp. 365–388.

Roodman, D. (2009) ‘How to do xtabond2: An introduction to difference and system GMM in Stata’, *The stata journal*, 9(1), pp. 86–136.

Schandlbauer, A. (2017) ‘How do financial institutions react to a tax increase?’, *Journal of Financial Intermediation*, 30, pp. 86–106.

Schulze, G.G. and Ursprung, H.W. (1999) ‘Globalisation of the Economy and the Nation State’, *World Economy*, 22(3), pp. 295–352.

Seiford, L.M. and Thrall, R.M. (1990) ‘Recent developments in DEA: the mathematical programming approach to frontier analysis’, *Journal of econometrics*, 46(1–2), pp. 7–38.

Shleifer, A. and Vishny, R.W. (1993) ‘Corruption’, *The quarterly journal of economics*, 108(3), pp. 599–617.

Tanzi, V. (1992) ‘Structural factors and tax revenue in developing countries: a decade of evidence’.

Teorell, J. *et al.* (2021) ‘The quality of government standard dataset, Version Jan21’, *University of Gothenburg: The Quality of Government Institute, http://www. qog. pol. gu. se doi*, 10.

Teresa Balaguer-Coll, M. and Prior, D. (2009) ‘Short- and long-term evaluation of efficiency and quality. An application to Spanish municipalities’, *Applied Economics*, 41(23), pp. 2991–3002.

Tulkens, H. (2007) ‘ON FDH EFFICIENCY ANALYSIS: SOME METHODOLOGICAL ISSUES AND APPLICATIONS TO RETAIL BANKING, COURTS AND URBAN TRANSIT’, *Public Goods, Environmental Externalities and Fiscal Competition: Selected Papers on Competition, Efficiency, and Cooperation in Public Economics by Henry Tulkens*, 4(1/2), p. 311.

Volkerink, B. and De Haan, J. (2001) ‘Fragmented government effects on fiscal policy: New evidence’, *Public choice*, 109(3–4), pp. 221–242.

Wooldridge, J.M. (2002) ‘Econometric analysis of cross section and panel data MIT press’, *Cambridge, MA*, 108.

1. [↑](#footnote-ref-1)
2. The issue is particularly relevant for these countries, where the population is deprived of essential services and marked income disparities exist among regions. [↑](#footnote-ref-2)
3. and the model used to replicate the scores must therefore be limited to this interval, and thus nonlinear. [↑](#footnote-ref-3)
4. We use the Stata procedure proposed by Schwab et al. (2020). [↑](#footnote-ref-4)
5. It's important to note that while financial development facilitates government borrowing, responsible fiscal policies and debt management practices are crucial to ensure that the debt remains sustainable. Excessive or poorly managed debt can still pose risks to a country's financial stability and economic health. [↑](#footnote-ref-5)
6. In their study, the beneficial effect of fiscal rules on budgetary discipline is more likely to arise from a reduction in public expenditure, with the taxation channel not achieving statistical significance. The reduction in public expenditure may have compositional implications in two distinct ways: (i) a more substantial reduction in current expenditure, and (ii) a more substantial reduction in public investment. [↑](#footnote-ref-6)
7. Democracy - which measured by the polity indicator from the Polity IV database. This index is a combination of democracy and autocracy indicators of polity IV. Polity2 represents the quality of governance that measures democracy in a country. [↑](#footnote-ref-7)
8. Government fragmentation measures the probability that two deputies picked at random among from the government parties will be of different parties. [↑](#footnote-ref-8)
9. Table C in the appendix presents the matrix of correlation of the variables studied. [↑](#footnote-ref-9)
10. For sensitivity analysis we have also estimated a simple linear regression using OLS, GMM and IV estimations and our results remain qualitatively intact. [↑](#footnote-ref-10)
11. Even so tobit yields sensible results in second-stage DEA or SFA, and it has as such never been questioned whether tobit is actually the most appropriate method, regarding predictability of scores and effects of the exogenous variables. [↑](#footnote-ref-11)
12. Therefore, the model can be written as follows:

    (8) [↑](#footnote-ref-12)
13. The data on the origin of law are obtained from the International Country Risk Guide (ICRG). [↑](#footnote-ref-13)
14. to capture the relationship between the potential channels and public sector efficiency. [↑](#footnote-ref-14)