

Effect of Reforms on Tax Revenue Performance in Senegal

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Contents

List of tables

List of figures

List of abbreviations and acronyms

Abstract

1.	Introduction	1
2.	Literature review	4
3.	Methodology	8
4.	Empirical results and discussion	12
5.	Conclusion and policy implications	30
	Notes	31
	References	32
	Annex	36

List of tables

1.	Number of reforms in the tax administration in Senegal, 1970-2014	12
2.	Reforms in the tax administration in Senegal based on the PEFA indicators, from 2007 to 2011	14
3.	Number of reforms in the tax administration and tax revenue in Senegal, 15-year average	22
4.	Tax revenue performance with and without reforms in the tax administration in Senegal, 1970-2014	22
5.	Reforms based on the PEFA indicators and tax revenue performance in Senegal, from 2007 to 2011	24
6.	Effect of reforms on tax revenue performance in Senegal, 1970-2014	26
A.1.	Reforms in the tax administration in Senegal	36
A.2.	Phillips-Perron test for unit root	38
A.3.	Definition and sources of variables	39

List of figures

1.	Evolution of tax revenue in Senegal, 1970-2014	15
2.	Senegal and WAEMU countries: comparative tax revenue performance, 1994-2014	17
3.	Senegal and Africa: Cross country comparison of tax revenue performance, 2010-2014	18
4.	Tax revenue performance in Senegal and selected regions, 2010-2014	19
5.	Tax revenue versus foreign revenues in Senegal, 15-year average	19
6.	Number of tax reforms and tax revenue performance in Senegal, 1970-2014	20
7.	Number of institutional reforms and tax revenue performance in Senegal, 1970-2014	21
8.	Number of all reforms and tax revenue performance in Senegal, 1970-2014	21

List of abbreviations and acronyms

ADE	Analysis for Economic Decisions
EAC	East African Community
CEMAC	Economic and Monetary Community of Central African States
CFAA	Country Financial Accountability Assessment
CPAR	Country Procurement Assessment Report
DGD	Directorate-General of Customs
DGID	Directorate-General of Tax and Lands
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
IMF	International Monetary Fund
LDC	Least Developed countries
LIC	Low Income Countries
MDG	Millennium Development Goals
NINEA	Numéro d'Identification National des Entreprises et des Associations
OFNAC	Office National Anti-Corruption
PAM	Proportional Adjustment Method
PCRBF	Projet de Coordination des Réformes Budgétaires et Financières
PEFA	Public Expenditure and Financial Accountability
PSE	Plan Sénégal Emergent
RARMP	Revenue Administration Reform and Modernization Programme
SADC	Southern African Development Community
SENELEC	Société Nationale d'Electricité du Sénégal
TMP	Tax Modernization Programme
UNECA	United Nations Economic Commission for Africa
WAEMU	West African Economic and Monetary Union

Abstract

The tax administration in Senegal has experienced several reforms in the period 1970-2014, but little is known about the performance of those reforms in terms of tax revenue mobilization. The literature on what drives domestic resource mobilization has indeed paid little attention to reform as a determinant of tax revenue. Considering various aspects of reforms in the tax administration, including tax-related reforms and institutions-related reforms, and using various econometric methods based on ordinary least squares, instrumental variable two-stage least squares, and iteratively reweighted least squares, the paper assesses whether reforms are important for increasing tax revenue. The results show that, tax reforms, institutional reforms, and all reforms combined have contributed to significantly increased tax revenue performance. The key implication is that more tax-related reforms and more institutions-related reforms are crucial to sustainably improved tax revenue mobilization.

JEL Classification: *E02; H11; H20*

Keywords: *Tax revenue; reforms; tax reforms; institutional reforms; Senegal*

1. Introduction

The issue of tax revenue mobilization in developing countries has attracted wider and renewed interest (Stiglitz, 2010; Keen, 2012). There is a growing awareness that domestic tax revenue in developing countries must be the primary financing source for development, with foreign aid playing essentially a supporting role (Fossat & Bua, 2013). The 2008 global financial and economic crisis has shown the need to pay more attention to domestic resource mobilization because the crisis demonstrated the volatility and uncertainty that surround external sources of development finance (United Nations Economic Commission for Africa (UNECA), 2010).

The central concern is related to the need to increase sustainable domestic resource mobilization (Felix, 2008; International Monetary Fund (IMF), 2011). Indeed, several countries are still facing the fundamental need of mobilizing more resources from their own tax bases (IMF, 2011). Wilford and Wilford (1978) asserted that one of the most important policy upon which most economists agree is that developing nations must increasingly mobilize their own internal resources to support economic growth. Tanzi and Zee (1997) have demonstrated that raising domestic revenue is the most feasible way to achieve fiscal sustainability. The United Nations (2005) indicated that the achievement of the Millennium Development Goals (MDG) by low-income countries requires increasing tax revenue up to 4% of Gross Domestic Product (GDP). Mobilizing more revenue is a priority for developing countries as they have to finance their development agendas, and weak revenue mobilization is the root cause of fiscal imbalances in several countries (Drummond et al., 2012).

Tax revenue mobilization is a great concern for policy makers in Senegal. The government has indeed considered the modernization of the tax administration and the rise in tax revenue as a priority defined in the new growth strategy called Plan Sénégal Emergent (PSE) which was unveiled in February 2014, and which aims at making Senegal an emerging economy by 2035.¹ The PSE reaffirms the need to preserve fiscal sustainability, and therefore endeavours to keep the fiscal deficit on a downward trend (IMF, 2014). The reduction of the fiscal deficit and the additional investment envisaged under the PSE would require revenue mobilization efforts (IMF, 2014), which thus require systematic implementation of various reforms in the tax administration. This shows how important reforms may be for greater revenue mobilization.

The effect of reforms on tax revenue performance in Senegal, therefore, deserves serious attention for several reasons. First, several reforms in the tax administration in Senegal have been implemented since the end of the 1970s.² The number of reforms in the tax administration has indeed substantially increased from only two reforms in the

period 1970-1984 to 33 reforms in 2000-2014. Those reforms in the tax administration include tax-related reforms and institutions-related reforms.³

Second, there is a remarkable increasing trend of tax revenue in Senegal. The performance of tax revenue in this country has almost quadrupled from 4.22% of GDP in the period 1970-1984 to 16.84% of GDP in 2000-2014.⁴

Third, although tax revenue performance in Senegal is increasing, it remains low compared to some sub-Saharan African countries.⁵ In the period 2010-2014, the performance of tax revenue stands at 19.5% of GDP for Senegal while it accounts for 29.5% of GDP for Seychelles, 29.8% of GDP for Swaziland, 30% of GDP for Namibia and 41% of GDP for Angola.⁶ Senegal remains thus in the grip of a serious need to further increase tax revenue mobilization.

Fourth, Senegal seems to be caught in a “weak public investment trap”. Public investment remains still smaller than 10% of GDP, with only 6.8% of GDP in 2014 (IMF, 2017). The lack of a high tax revenue mobilization is likely to have pronounced regressive effects on public investment. Sustaining efforts to mobilize much higher tax revenue appears thus to be crucial in support of public investment and other productive activities, justifying how relevant are reforms.

A fifth reason for greater attention to reforms for tax revenue mobilization is related to the economic background of Senegal that is characterized by a large oil discovery off the coast of Senegal in October 2014, which is estimated between 250 million and 2.5 billion barrels of oil, with a mid-range estimate of 950 million barrels.⁷ This big oil find should justify the need to implement further reforms in the tax administration in order to fully benefit from the future exploitation of oil for higher domestic resource mobilization.

These facts raise the following research question: how relevant are reforms for tax revenue mobilization? This paper investigates indeed whether positive externalities in terms of increased tax revenue performance may result from the tax and institutional reforms undertaken in Senegal. This paper thus intends to explore the role of reforms in the performance of tax revenue.

The literature on the effect of reforms on tax revenue considered only limited dimensions of reforms. The importance of administrative reforms has been relatively little explored (Morisset & Izquierdo, 1993; Das-Gupta & Gang, 2000; Usui, 2011). The contribution of this paper to the literature is threefold. Firstly, this paper takes account of various aspects of reforms in the tax administration in Senegal, including tax-related reforms and institutions-related reforms. This paper thus provides a broader framework for analysing the tax revenue effect of reforms. Secondly, the relatively little attention that administrative reforms have received in the literature reflects measurement problems (Morisset & Izquierdo, 1993). This paper therefore contributes to fill this gap by providing quantitative measures of reforms as the number of tax reforms by year, the number of institutional reforms by year, and the number of all reforms by year. Thirdly, several papers used a descriptive approach or the model of tax elasticity and buoyancy (Prest, 1962; Larvin, 1968; Chelliah, 1971; Mansfield, 1972; Ole, 1975; Wilford & Wilford, 1978; Osoro, 1993; Ariyo, 1997; Muriithi & Moyi, 2003). Using a descriptive analysis and various econometric techniques, this paper provides a better understanding of the implications of reforms for tax revenue performance, which has not yet been explored for the case of Senegal, to the best of my knowledge. Indeed, although the country

implemented several reforms, little is however known about the performance of those reforms in terms of tax revenue mobilization.

The rest of this paper is organized as follows. Section 2 provides a literature review on the effect of reforms on tax revenue. Section 3 provides a descriptive analysis and an econometric framework for investigating the effect of reforms on tax revenue in Senegal. Section 4 discusses the descriptive and econometric results. Section 5 concludes the paper and discusses the policy implications.

2. Literature review

Generally, reforms in the tax administration in developing countries involve broad issues of economic policy, as well as specific problems of tax structure design and administration (Musgrave, 1987). Reforms in the tax administration have been considered as one of the most important and a major ingredient to economic development of a nation (Sohota, 1961). The immediate reason for reforms in the tax administration in many developing countries has been the need to enhance revenue (Rao, 2000). Reforms measures in the tax administration are mainly undertaken in order to, among others, restore buoyancy to revenues (World Bank, 1990). Increasing revenue is a major consideration in reforms in the tax administration (Morrissey, 2013b).

However, the mobilization of domestic resource depends on the level of political commitment (Bhattacharya & Akbar, 2013), showing how important is political will to implement the needed reforms for higher revenues. It may also depend on the change in macroeconomic policies, as a rapid change may induce a much more difficult situation for tax reforms to have important and identifiable revenue effects (Tanzi, 1988). Some authors have indicated, theoretically, that reforms in the tax administration may indeed affect tax revenue performance. For example, reforms related to changes in tax legislation, tax administration, and minimal tax evasion are among the main factors contributing to an improved revenue performance (Morrisset & Izquierdo, 1993). Increasing tax-to-GDP ratio requires growth in the tax base combined with reforms to improve tax administration (Morrissey, 2013a). Weak tax administration tends to be associated with low tax revenue collection (IMF, 2011; Morrissey, 2013a; Bhattacharya & Akbar, 2013), suggesting that reforms to strengthen the tax administration contribute to raise revenues.

Empirically, experience from various countries showed that reforms could have both positive and negative effects on tax revenue. Such effects depend on the type of reforms implemented, on whether an immediate impact or a long-term analysis is considered, on how reforms are measured and on the methodology used, either descriptive or econometric.

Positive effect of reforms on tax revenue in the literature

On the one hand, in most cases, the effect of reforms on tax revenue has been found to be positive. This was found based on both a descriptive approach as well as an econometric analysis.

Descriptive approach

Morrisset and Izquierdo (1993) assessed the contribution of reforms based on changes in tax administration to the evolution of tax revenue in Argentina. Changes in tax administration consisted of increasing tax penalties, new technologies, and administrative reforms. Those reforms were implemented during the 1989-1992 years. After the poor performance of the Argentina tax system during the 1980s, tax revenue increased significantly from 12.7% of GDP in 1989 to 22.5% of GDP in 1992, due to improvements in tax administration and tax legislation. They place the administrative dimension of tax reform at the centre of the success of the reforms programme in Argentina, as the administrative dimension of the tax reform explains to a large extent revenue increase since March 1991. In absence of such effort, the increase in tax revenue observed would have been limited to 34%, which is much lower than the observed increase of 108% with such effort.

Muñoz and Cho (2003) revealed that reform in Ethiopia that consisted of replacing sales tax with a value-added tax (VAT) in January 2003 has brought about higher revenue.

Osei and Quartey (2005) indicated that the tax-to-GDP ratio in Ghana has more than doubled, and this performance has been accompanied by a changing structure of the tax system.

The Tax Modernization Programme (TMP)-related reform, which aimed at broadening the tax base, has led to an important increase in tax revenue in Kenya (Karingi & Wanjala, 2005). Indeed, they found that the ratio of tax revenue to GDP during the post-TMP period in 1983/1984-2000/2001, which averaged 21.975%, is higher than the ratio of tax revenue to GDP during the pre-TMP period in 1963/1964-1982/1983, which averaged 15.2%.

Fossat and Bua (2013) found that the major tax administration reforms that have been implemented in the Francophone countries of sub-Saharan Africa since the early 1990s have contributed to an increase in revenue.

Hellevig et al. (2014) found that tax reforms in Russia, based on lower tax rates and simplified procedures, have skyrocketed tax revenue. Indeed, in 1999, the year prior to the onset of the tax reforms, Russia collected a mere US\$9 billion in corporate profit tax, but in 2012 the country raked in US\$76 billion, representing an increase of more than eight times compared to the year prior to the onset of reforms. The introduction of the 13% flat tax on personal income resulted in 2012 in a 15-times increase in revenue on this tax, to US\$76 billion, from the US\$5 billion in the year 1999. Revenue on various sorts of taxes on natural resources filled state coffers with US\$79 billion in 2012, whereas the corresponding figure for 1999 was a mere US\$2 billion.

Econometric analysis

Exploring the causal link between reforms and tax revenue in Argentina in the period 1983-1992, Morrisset and Izquierdo (1993) found that a more efficient tax administration and an improvement in taxpayers' compliance levels appear to precede rather than to follow increases in tax revenue.

The result of the study by Wang'ombe (1999) for the Kenyan tax system for the period 1989-1998 came up with buoyancy estimates of the total tax system as 1.26 while elasticity was 1.27. The study thus concluded that the tax system in general was both elastic and

buoyant, implying that tax reforms had greatly improved productivity. Computing elasticities and buoyancies for the pre-reform period (1973-1985) as well as the post-reform period (1986-1999) in Kenya, Muriithi and Moyi (2003) found evidence that reforms had a positive impact on the overall tax structure and on the individual tax handles. Using the Proportional Adjustment Method (PAM) in capturing the effects of tax reforms on discretionary tax measures and tax productivity in Kenya for the period 1973-2003, Kieleko (2006) showed that there had been a considerable improvement of the tax revenue productivity and that the reforms made in this period had significant effect on the responsiveness of the tax system. Kanyi and Kalui (2014) used Ordinary Least Squares (OLS) regressions for the period 2003/2004-2012/2013 and found evidence of a significant increase in tax revenue attributed to the TMP-related tax reforms in Kenya. Using regression analysis and time series data for the period 1963-2010, Omondi et al. (2014) showed that the reforms undertaken in Kenya, through the Revenue Administration Reform and Modernization Programme (RARMP) and the TMP, had positive effect on revenue generation.

Using the analysis of variance method and the Scheffe's multiple comparison techniques for Nigeria, Aminu and Eluwa (2014) concluded that each of the tax reform policy objectives – i.e., enhancement of the principles of good tax system, improvement in the tax administrative structure, removal of disincentives to tax compliance, and promotion of investment opportunities – significantly increase the personal, company, and custom duty tax revenue. Using OLS regressions and time series quarterly data in the period 1999-2012, Asaolu et al. (2015) found that tax reforms had significantly contributed to raise revenue in Lagos State of Nigeria.

Negative effect of reforms on tax revenue in the literature

On the other hand, the effect of reforms on tax revenue has been found to be negative in few cases, with both descriptive and econometric analysis.

Descriptive approach

According to IMF (1992), the drop in tax revenue experienced in Tanzania in fiscal years 1992/1993 (Fjeldstad, 1995) is not unique as experience from other developing countries shows that structural economic reforms often entail short-run revenue losses.

Tax reforms initiated in India since 1991 caused an immediate loss of revenue as there was a significant decline in tax rates and no commensurate increase in the tax base (Rao, 2000). The tax-to-GDP ratio, which was 16% in 1990-1991, declined sharply to less than 14% in 1993-1994.

Econometric analysis

Using the micro-tax model of the Central Planning Bureau, Caminada and Goudswaard (1996) simulated the effects of the implementation of the tax reform in the Netherlands in 1990 on revenue elasticity and, consequently, on tax revenue. Those reforms were characterized by base broadening in exchange for rate reduction. They found that the

Dutch income tax revenue elasticity declined by 17%, which caused an additional revenue loss of 0.6% in 1990.

Chipeta (1998) revealed that in the context of Malawi, tax reforms that consisted of increasing tax rates, extending existing taxes to new activities and introducing new taxes, were not sufficient for raising buoyancy of the tax system, which is found not to be tax elastic.

Using OLS regressions for the period 2000-2009, Gachanja (2012) found that tax reforms, measured as a dummy variable, have negatively contributed to tax revenue in Kenya.

On the basis of the introduction of China's seven main measures in tax reforms experienced, respectively, in 1953, 1958, 1973, 1980, 1983, 1984, and 1994, Zeng et al. (2013) used methods as multi-segment linear regression model and principal component analysis, and found that every tax reform showed a clear impact on the tax structure, while the impact on total tax revenue is diminishing over time.

Mitigated effect of reforms on tax revenue in the literature

Finally, the effect of reforms on tax revenue has been found mitigated in some studies that were based on a descriptive approach. The tax reform Act in the United States has the immediate effect of changing state tax revenue; most states will enjoy an increase, while some will lose revenue (Courant & Rubinfeld, 1987).

Reforms based on reduced tax rates without de facto and de jure broadening the tax base and on tax exemption caused a drop in tax revenue mobilization in Tanzania in fiscal year 1992/93, while tax administration-related reforms contributed to a more efficient tax administration, which is capable of collecting a significantly higher amount of revenues in both absolute and relative terms, in that country (Fjeldstad, 1995).

Das-Gupta and Gang (2000) found that the Indian reform did lead to initial tax revenue gains, which could not be sustained over time. The magnitude of the gains from the reform was limited and failed to significantly curtail losses from tax evasion.

Eissa and Jack (2009) indicate that in the years immediately following the introduction of the TMP in Kenya, revenue gradually increased, reaching 24.6% of GDP in 1995-1996, after which they stabilized at around 23% until the end of the decade. In the period 1999-2000, revenue fell below 20% of GDP, and this decline continued until they reached a low performance of 17.8% of GDP in 2001-2002. Since then there has been a slow increase to 20% of GDP in 2004-2005.

Abdella and Clifford (2010) showed that tax reform in Ethiopia has increased government revenue since its introduction in 2003. Although the absolute amount of taxes collected during the post-2003 reform is higher than the pre-2003 reform, the percentage in proportion to GDP has fallen.

Usui (2011) indicated that the 2005 tax reform in Philippines, based on tax rate adjustments and on tax administration measures, has induced revenue gains, but which were not sustained.

Past studies showed that the results were the same for a descriptive approach or an econometric analysis. This paper uses both a descriptive analysis and various econometric techniques, and considers broader dimensions of reforms, both tax-related reforms and institutions-related reforms.

3. Methodology

Descriptive analysis

The descriptive analysis is related to the measurement of reforms in the tax administration in Senegal. This paper uses two measurements of reforms in the tax administration in Senegal: number of reforms per year, and reforms as measured using the Public Expenditure and Financial Accountability (PEFA) indicators.⁸

Measurement of reforms as the number of reforms per year

With this first measurement, reforms are measured as the number of reforms per year. There are two components of reforms in the tax administration in Senegal, which are tax-related reforms and institutions-related reforms. Table A.1 in the Appendix provides the details of tax-related reforms and institutions-related reforms. This paper thus measures reforms as the number of tax reforms per year, the number of institutional reforms per year, and the number of all reforms combined per year.

Measurement of reforms using the PEFA indicators

The second measurement of reforms in the tax administration in Senegal is based on the PEFA indicators. The main PEFA indicators are notably: transparency of taxpayer obligations and liabilities (PI-13), effectiveness of measures for taxpayer registration and tax assessment (PI-14), and effectiveness in collection of tax payments (PI-15).

These main PEFA indicators include three components each. The three components of the indicator PI-13 are: clarity and comprehensiveness of tax liabilities (PI-13i); taxpayer access to information on tax liabilities and administrative procedures (PI-13ii); existence and functioning of a tax appeals mechanism (PI-13iii). The three components of the indicator PI-14 are: controls in the taxpayer registration system (PI-14i); effectiveness of penalties for non-compliance with registration and declaration obligations (PI-14ii); planning and monitoring of tax audit and fraud investigation programmes (PI-14iii). The three components of the indicator PI-15 are: collection ratio for gross tax arrears, being the percentage of tax arrears at the beginning of a fiscal year, which was collected during that fiscal year (average of the last two fiscal years) (PI-15i); effectiveness of transfer of tax collections to the treasury by the revenue administration (PI-15ii); frequency of

complete accounts reconciliation between tax assessments, collections, arrears records and receipts by the treasury (PI-15iii).

The main PEFA indicators and each of their components are measured using both ordinal scores as well as numerical scale ratings. Ordinal rankings are A; B+; B; C+; C; D+; D. The score A is the best ranking, meaning the best performance of the tax administration; while the score D is the worst ranking, suggesting the worst performance of the tax administration. These ordinal rankings are converted into numerical scores from 7 to 1, as follows: A=7; B+=6; B=5; C+=4; C=3; D+=2; D=1.

Econometric analysis

This section presents the econometric analysis of the role of reforms in tax revenue performance in Senegal in the period 1970-2014. The literature provides theoretical framework for modelling tax revenue. Indeed, tax revenue is explained by various determinants that are both economic and non-economic.

Economic determinants of tax revenue

The theoretical literature explains that tax revenue rises with per capita GDP, which is a proxy for the level of economic development (Tanzi, 1992).

The agriculture sector may be difficult to tax, especially if it is dominated by a large number of subsistence farmers (Ajaz & Ahmad, 2010), as it is the case of developing countries. The agriculture sector may then serve as a broad indicator of informality (Ebeke, 2010), and therefore a higher agriculture share lowers tax revenue performance (Tanzi, 1992).

Trade openness (measured as the sum of the GDP shares of imports and exports) reflects the degree of exposure of an economy to external economic influences (Ajaz & Ahmad, 2010). Trade openness affects positively the size of the government (Rodrik, 1998; Gupta et al., 2003).

The inflation rate is a proxy for macroeconomic instability. Therefore, higher inflation is supposed to reduce domestic tax yields (Ehrhart, 2012). However, the literature shows that the effect of inflation on tax revenue depends on collection lags. Tanzi (1997) explains indeed that the combination of high inflation, a relatively long average lag in tax collection, and a low elasticity of the tax system leads to a drastic fall in real revenue when inflation occurs.

The relationship between foreign aid and tax revenue is uncertain and might depend on the purposes of aid (Ehrhart, 2012). Indeed, if foreign aid is allocated to support reforms in the tax administration, this may lead to a greater tax revenue mobilization.

Non-economic determinants of tax revenue

The literature reveals that tax revenue is explained also by non-economic factors, including institutional drivers and demographic factors.

Regarding the institutional drivers of tax revenue performance, it is important to note that a distinction needs to be made between taxes collected by the tax administrators and taxes received by the treasury (Tanzi, 1999), as some of the taxes paid by taxpayers are diverted away from public accounts, showing the major problem of corruption in the tax administration. Generally, developing countries are typically unable to generate sufficient amount of revenue from taxation because these countries face a number of institutional problems in the process of revenue generation (Ajaz & Ahmad, 2010). Countries with poor institutional quality are not able to establish effective tax systems and so these economies are characterized by a persistent weakness in tax collection (Bird et al, 2006). It is widely agreed that the presence of corrupt public officials is a social phenomenon that can significantly reduce tax revenue (Ghura, 1998; Bornhorst et al, 2009; Imam & Jacobs, 2014).

In addition to corruption, tax revenue collection may be explained also by other institutional factors, notably well-organized administration, trust in government, governance and political stability (Ajaz & Ahmad, 2010), and democracy (Ehrhart, 2012). There is a close relationship between low level of tax revenue and governance (Attila et al., 2009). Theoretical considerations suggest that greater political instability and polarization reduce the efficiency of the tax collection system (Ajaz & Ahmad, 2010). Aizenman and Yothin (2005) explain that collection efficiency is determined by the penalty on underpaying and probability of audit.

With respect to demographic factors, they may play a potential role in explaining tax revenue mobilization as these variables may affect the need for the tax revenue to support those out of the labour market (Ebeke, 2010).

Specification of the model

This paper models tax revenue based on the framework provided in the literature. Therefore, the specification of the tax revenue model in this paper, not only draws on the literature, but it also considers an additional variable that can potentially affect tax revenue, that is reforms in the tax administration. Reforms may indeed influence tax revenue mobilization on the basis of the nature of the political regimes. Some political regimes may undertake and implement the needed reforms, while others do not. The implementation of the needed reforms depends then on who controls the political office, and the economic theory highlights some features of political regimes that might be of importance for tax revenue mobilization (Ehrhart, 2012). Firstly, democratic political regimes, which might take more into account the social welfare, might implement larger reforms, in order to mobilize more revenue for redistributive policies (Alesina & Rodrik, 1994). Secondly, autocratic political regimes, which act against redistribution and therefore against taxation, consider more the special interests from various lobby groups by enacting tax exemptions detrimental to public revenue and might implement less reforms to increase tax revenue mobilization (Acemoglu & Robinson, 2006).

This paper deals with the case of Senegal, which is generally known as a country that keeps the major asset of being stable with good institutions as shown by the World Bank political stability index that places Senegal in the interval 60-70 (World Bank, 2013). This country is characterized by democratic political regimes, which have implemented

several reforms in the tax administration in the period 1970-2014, as shown in Table A.1 in the Appendix. The model of this paper thus allows specifically for reforms by considering various aspects of reforms, notably reforms related to tax, reforms related to the tax administration or institution, and all reforms combined in the tax administration (Morrisset & Izquierdo, 1993; Usui, 2011; Kanyi & Kalui, 2014; Asaolu et al., 2015). The specification of the econometric model takes the form of the following equation:

$$\text{TRG}_t = \delta_0 + \delta_1 \text{TRG}_{t-1} + \delta_2 \text{Reform}_t + \mathbf{X}_t \boldsymbol{\theta} + \varepsilon_t \quad (1)$$

Where, TRG denotes the ratio of tax revenue to GDP; Reform stands for, in turn, tax reforms, institutional reforms, and all reforms combined in the tax administration; \mathbf{X} is the control variables; ε is the error term.

Tax reforms, institutional reforms, and all reforms combined in the tax administration are measured as, respectively, the number of tax reforms per year, the number of institutional reforms per year, and the number of all reforms combined in the tax administration per year. The control variables are those that have been identified as important determinants of tax revenue in the literature. This paper includes mainly the following variables as controls: the share of agriculture sector in GDP; the share of industrial sector in GDP; the ratio of foreign aid to GDP; the degree of openness of the economy, measured as the ratio of exports plus imports to GDP; per capita GDP (Leuthold, 1991; Tanzi, 1992; Ariyo, 1997; Edwards, 1998; Frankel, 1999; Brautigam & Knack, 2004; Gupta, 2007; Lucotte, 2010; Drummond et al., 2012; Benedek et al., 2014). Table A.3 in the Appendix provides the sources of all regression variables and their definitions.

Econometric techniques for estimation

As the paper is using time series data, the stationarity test for the variables in the model is carried out using the Phillips and Perron method.

To estimate the effect of reforms on tax revenue, this paper firstly uses the Ordinary Least Squares (OLS) method without caring about endogeneity problems. The paper secondly uses the Instrumental Variable Two-Stage Least Squares (IV-2SLS) method to account for possible endogeneity of regressors, notably reforms. Lagged values of endogenous variables are used as instruments. The paper thirdly uses the Iteratively Reweighted Least Squares (IRLS) method as an additional robustness check to account for possible outliers. The results of the estimations are discussed below.

4. Empirical results and discussion

Descriptive results

Number of reforms per year

Table 1 reports the number of tax reforms per year, the number of institutional reforms per year, and the number of all reforms combined per year in the tax administration in Senegal in 1970-2014.

Table 1: Number of reforms in the tax administration in Senegal, 1970-2014

	Tax reforms	Institutional reforms	All reforms
1970-1978	0	0	0
1979	2	0	2
1980-1985	0	0	0
1986	4	1	5
1987	1	0	1
1988	0	0	0
1989	1	0	1
1990	3	0	3
1991	0	0	0
1992	1	0	1
1993	0	0	0
1994	4	0	4
1995-1997	0	0	0
1998	2	0	2
1999	0	0	0
2000	1	1	2
2001	0	0	0
2002	1	1	2
2003	0	2	2
2004	1	0	1
2005	1	0	1

continued next page

Table 1 Continued

	Tax reforms	Institutional reforms	All reforms
2006	0	0	0
2007	0	1	1
2008	0	1	1
2009	0	2	2
2010	0	2	2
2011	0	3	3
2012	0	4	4
2013	1	0	1
2014	5	6	11
Total	28	24	52

Source: Author's computations using several documents, including various versions of the General Tax Code; various versions of the Customs Code; Fall and Sène (2010); Centre d'Etudes de Politique pour le Développement (CEPOD) (2004); various IMF's country reports on Senegal.

Note: The columns "tax reforms", "institutional reforms" and "all reforms" refer to the number of tax reforms per year, the number of institutional reforms per year, and the number of all reforms per year, respectively.

The results show that, from 1970 to 2014, the total number of all reforms implemented in the tax administration in Senegal was 52. These reforms were mainly tax-related reforms with a total number of 28 in that period, compared to institutions-related reforms with a total number of 24.

Reforms as measured using the PEFA indicators

Table 2 presents reforms in the tax administration in Senegal based on the PEFA indicators, from 2007 to 2011. Results regarding the PEFA indicators are presented on the basis of both ordinal scores and numerical scale ratings.

The results reveal that in 2007, the best main indicator was the transparency of taxpayer obligations and liabilities (PI-13) with the note B=5, while the second one was the effectiveness of measures for taxpayer registration and tax assessment (PI-14) with the note C+=4. In 2011, the results indicate an improvement in the effectiveness of measures for taxpayer registration and tax assessment (PI-14) with a note of B=5 compared to the note of C+=4 in 2007, while the performance of the transparency of taxpayer obligations and liabilities (PI-13) has not changed in 2011.

Regarding the components of PI-13, the results show an improvement only for the existence and functioning of a tax appeals mechanism (PI-13iii) with a note of C=3 in 2007 compared to the note B=5 in 2011. The performance of the two other indicators (clarity and comprehensiveness of tax liabilities (PI-13i), and taxpayer access to information on tax liabilities and administrative procedures (PI-13ii)) has not changed.

For the components of PI-14, there was an improvement only for the controls in the taxpayer registration system (PI-14i) with a note of C=3 in 2007 compared to B=5 in 2011; the performance of the two other indicators (effectiveness of penalties for non-compliance with registration and declaration obligations (PI-14ii), and planning and monitoring of tax audit and fraud investigation programmes (PI-14iii)) being unchanged.

Table 2: Reforms in the tax administration in Senegal based on the PEFA indicators, from 2007 to 2011

PEFA Indicators	Ordinal scores		Numerical scale ratings		Variation
	2007	2011	2007	2011	
Clarity and comprehensiveness of tax liabilities (PI-13i)	B	B	5	5	0
Taxpayer access to information on tax liabilities and administrative procedures (PI-13ii)	B	B	5	5	0
Existence and functioning of a tax appeals mechanism (PI-13iii)	C	B	3	5	+2
Transparency of taxpayer obligations and liabilities (PI-13)	B	B	5	5	0
Controls in the taxpayer registration system (PI-14i)	C	B	3	5	+2
Effectiveness of penalties for non-compliance with registration and declaration obligations (PI-14ii)	B	B	5	5	0
Planning and monitoring of tax audit and fraud investigation programmes (PI-14iii)	C	C	3	3	0
Effectiveness of measures for taxpayer registration and tax assessment (PI-14)	C+	B	4	5	+1
Collection ratio for gross tax arrears, being the percentage of tax arrears at the beginning of a fiscal year, which was collected during that fiscal year (average of the last two fiscal years) (PI-15i)	-	D	-	1	-
Effectiveness of transfer of tax collections to the treasury by the revenue administration (PI-15ii)	A	A	7	7	0
Frequency of complete accounts reconciliation between tax assessments, collections, arrears records and receipts by the treasury (PI-15iii)	B	B	5	5	0
Effectiveness in collection of tax payments (PI-15)	-	D+	-	2	-

Source: European Union (EU) and Analysis for Economic Decisions (ADE) (2011), and author's computations using data from BCEAO's Economic and Financial Database.

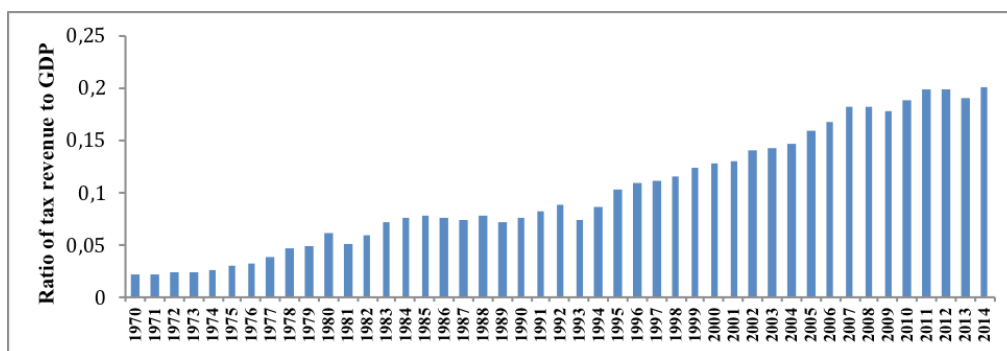
With respect to the components of PI-15, there was no change in the performance of the effectiveness of transfer of tax collections to the treasury by the revenue administration (PI-15ii) and that of the frequency of complete accounts reconciliation between tax assessments, collections, arrears records and receipts by the treasury (PI-15iii).

However, the best performance of the tax administration in Senegal between 2007 and 2011 was the effectiveness of transfer of tax collections to the treasury by the revenue administration (PI-15ii) with the best score of A=7. At the same time, the collection ratio for gross tax arrears, being the percentage of tax arrears at the beginning of a fiscal year, which was collected during that fiscal year (average of the last two fiscal years) (PI-15i) has the lowest performance with the lowest note of D=1 in 2011, followed by the effectiveness in collection of tax payments (PI-15) with the low score of D+=2 in 2011. Therefore, there was a good performance of the tax administration in Senegal as a whole.

Tax revenue performance in Senegal

Figure 1 presents the evolution of tax revenue performance in Senegal, on an annual basis, in the period 1970-2014.

Figure 1: Evolution of tax revenue in Senegal, 1970-2014



Source: Author's computations using data from Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO) *Economic and Financial Database*.

In the period 1970-2014, there was a rising trend of tax revenue in Senegal with very few episodes of decline, only nine times compared to 35 episodes of increase in the entire period. The nine episodes of fall in tax revenue were noted in 1971, 1981, 1986, 1987, 1989, 1993, 2008, 2009, and 2013. The fall in tax revenue in 1971 can be associated with unfavourable circumstances in Senegal related to the terrible drought at the early 1970s and to the unfavourable international environment with the barrel of oil that had doubled between 1970 and 1973.

In 1981, the government experienced the negative effect of the 1979 tax reform that consisted in a relief of the tax structure, and which then led to a fall in tax revenue. In 1986, Senegal was engaged in a first attempt of trade liberalization aiming to reduce the contribution of taxes on external trade to public resources (Berg & Krueger, 2003). This

liberalization has led to a decline in the customs duty. The tax liberalization component of the trade policy then caused important tax revenue losses in 1986 up to 1987, and which were not compensated by the mobilization of other tax revenues. At the end of the year 1987, Senegal had adopted a customs code that contributed to increased tax revenue in 1988.⁹ However, one year later in 1989, tax revenue had fallen again, despite the increase of 5 points in the rates of customs duty. This decline may be attributed to the continuous adverse effects of the trade liberalization policy since 1986. These significant tax revenue losses motivated the authorities to renounce, in the early 1990s, the tax liberalization policy (African Development Bank, 2010).

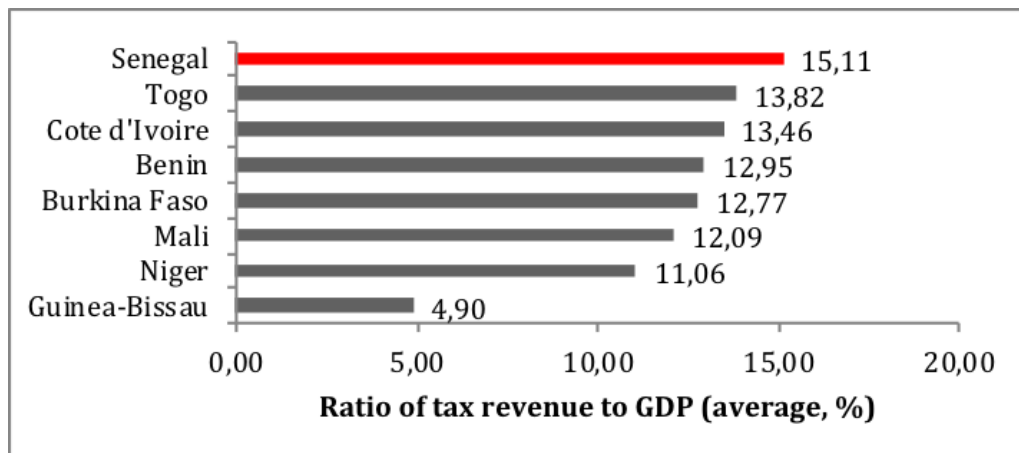
Despite the revision of the general tax code in 1992, tax revenue decreased in 1993 probably because this revision had not been fully implemented in 1993 as it was just at its first year of adoption. After the devaluation of Franc CFA in 1994, there was a full revision of indirect taxes (generalized decline in customs duty, fall in the number of the rates of VAT). And simultaneously to these falls in indirect taxes, internal tax revenues had been developed with a simplification of taxes, a widening of tax base by the withdrawal or the revision of all conventions providing tax exemptions, protections or particular advantages to some enterprises that are important in the economy. This led to a long rising revenue trend from 1994 to 2012, interrupted by various shocks in 2008 and 2009, notably international price shocks, shocks in the management of public expenditures, negative impact of public arrears, that adversely affected public resources mobilization in Senegal (African Development Bank, 2010). This rising revenue trend was also interrupted by the 2008 international financial and economic crisis (IMF, 2014).

Senegal experienced tax revenue shortfalls in 2013. According to the IMF (2014) and *Direction de la Prévision et des Etudes Economiques* (DPEE) (2014), this disappointing performance is largely attributable to VAT and individual income tax. The decline in the latter was greater than expected. The fall in VAT revenue is in part a reflection of the recent tax reform, specifically the elimination of the VAT withholding applied by the government agencies to large enterprises. IMF (2014) argues that revenue shortfalls in 2013 reflect also slower economic activity, excessive optimism on the yield of certain taxes, and larger-than-expected accumulation of tax arrears by *Société Nationale d'Electricité du Sénégal* (SENELEC), and the power utility. Only a fraction of the revenue shortfalls seems attributable to the 2013 tax reform due to the fact that the adoption of this new general tax code induced major difficulties in terms of practical implementation, while the measure related to the fall in individual income tax was implemented immediately since January 2013.

Tax revenue performance in Senegal improved in 2014, and this improvement is related to the new tax code in 2013 that bore fruit as reflected in better-than-expected revenue performance in 2014 (IMF, 2015). Indeed, the 2013 tax code includes measures that are favourable to better revenue collection, notably: reform of the system to assess staff performance of the Directorate-General of Tax and Lands (DGID); increased staffing; efforts to conduct tax audits and collect tax arrears; an audit of VAT credits followed by action to deal with cases of fraud; efforts to expand the tax base through more active use of available information, and closer cooperation with customs services.

Figure 2 presents tax revenue performance for Senegal and for other West African Economic and Monetary Union (WAEMU) countries in the period 1994-2014. This figure shows that Senegal collects higher tax revenue than other WAEMU countries.

Figure 2: Senegal and WAEMU countries: comparative tax revenue performance, 1994-2014



Source: Author's computations using data from BCEAO's *Economic and Financial Database*.

Figure 3 compares tax revenue performance for Senegal and for other African countries in the period 2010-2014. The selected African countries are: Algeria, Angola, Botswana, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo (DRC), Egypt, Equatorial Guinea, Gabon, The Gambia, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mauritius, Morocco, Mozambique, Namibia, Rwanda, Seychelles, Sierra Leone, South Africa, Swaziland, Tanzania, Tunisia, Uganda, Zambia, Zimbabwe.¹⁰

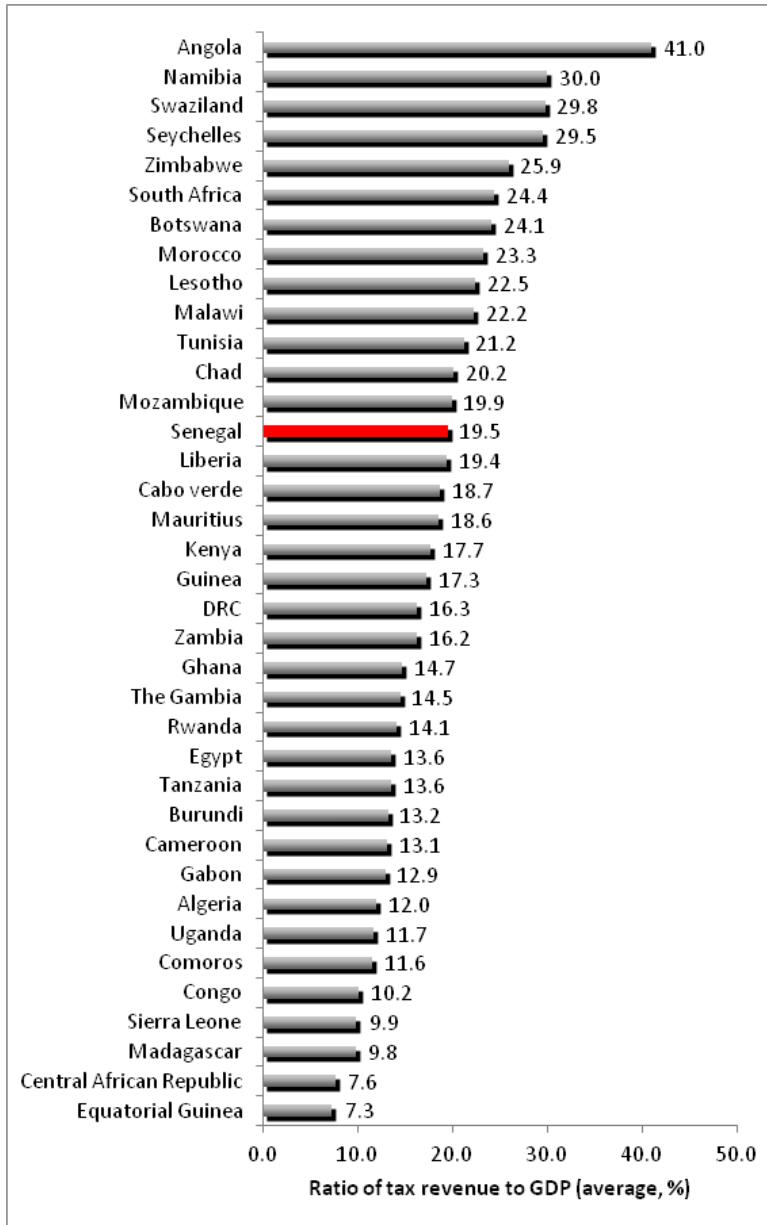
Figure 3 reveals that Senegal is doing well in terms of tax revenue collection, compared to many other African countries. Indeed, on average, Senegal is the 14th country with the largest ratio of tax revenue to GDP among 37 African countries, including countries that are yet rich in natural resources.

Figure 4 reports tax revenue performance for Senegal and for selected regions in the period 2010-2014. The selected regions are: the Southern African Development Community (SADC), the WAEMU, North Africa, the Economic Community of West African States (ECOWAS), the Franc Zone, the East African Community (EAC) and the Economic and Monetary Community of Central African States (CEMAC).

Figure 4 indicates that, on average, except for the SADC, Senegal mobilizes higher tax revenue than regions including the WAEMU, North Africa, the ECOWAS, the Franc Zone, the EAC, and the CEMAC.

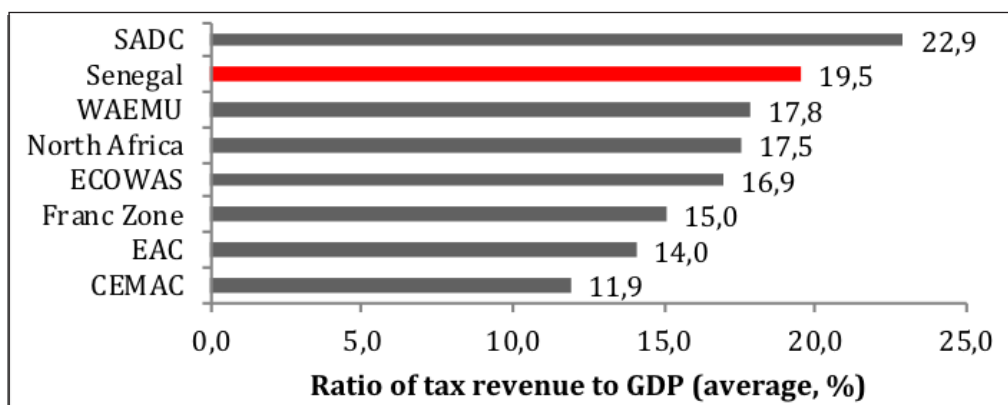
Figure 5 makes a comparison between tax revenue and foreign revenues in Senegal, on a 15-year average basis, in the period 1970-2014. Foreign revenues include foreign aid, remittances, and foreign direct investment (FDI).

Figure 3: Senegal and Africa: Cross country comparison of tax revenue performance, 2010-2014



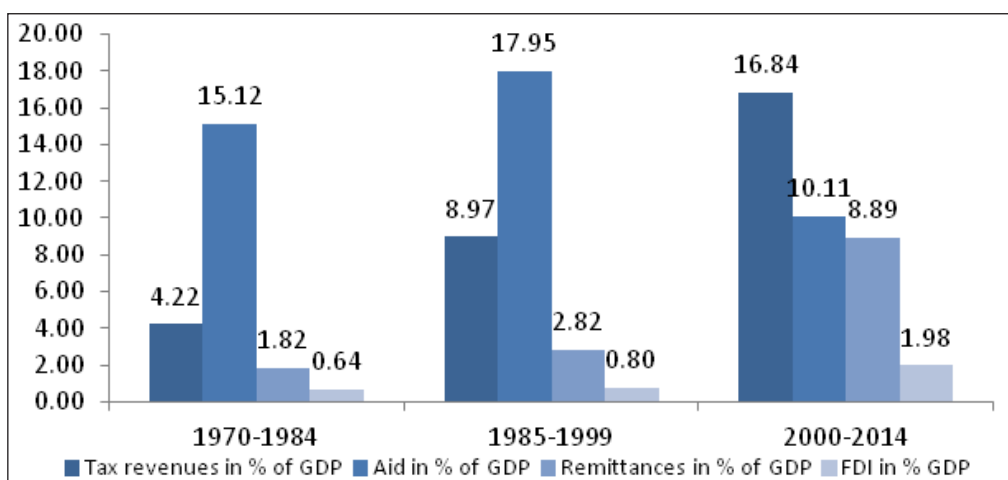
Source: Author's computations using data from BCEAO's *Economic and Financial Database* for Senegal, and various IMF's country reports for all other countries.

Figure 5 confirms the increasing trend of tax revenue in the whole period 1970-2014. Figure 5 shows that indeed the performance of tax revenue almost doubled on the one hand between the periods 1970-1984 and 1985-1999 and on the other hand between the periods 1985-1999 and 2000-2014. For the periods 1970-1984 and 1985-1999 foreign aid is ahead, while in the period 2000-2014 tax revenue is higher than all other sources of revenues.

Figure 4: Tax revenue performance in Senegal and selected regions, 2010-2014

Source: Author's computations using data from BCEAO's *Economic and Financial Database* for Senegal and WAEMU, and various IMF's country reports for all other countries.

Note: The WAEMU member states are: Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau, Mali, Niger, Senegal and Togo. The ECOWAS member states are: Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Senegal, Sierra Leone, and Togo. I have excluded Nigeria from ECOWAS due to a lack of data. The CEMAC member states are: Cameroon, Central African Republic, Chad, Republic of Congo, Equatorial Guinea and Gabon. The Franc Zone includes the WAEMU countries, the CEMAC countries and Comoros. The EAC member states are: Burundi, Kenya, Rwanda, Tanzania and Uganda. North Africa includes: Algeria, Egypt, Morocco and Tunisia. I have excluded Libya and Djibouti from North Africa due to a lack of data. The SADC member states are: Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

Figure 5: Tax revenue versus foreign revenues in Senegal, 15-year average

Source: Author's computations using data from BCEAO's *Economic and Financial Database*; *World Bank's World Development Indicators*.

Indeed, foreign aid significantly declined, while tax revenue almost doubled, standing at 16.84% of GDP in 2000-2014 compared to 8.97% of GDP in 1985-1999 and 4.22% of GDP in 1970-1984. This very large increase in tax revenue versus all other sources of revenues from 2000 to 2014 is related to the fact that Senegal experienced a political change in 2000, and a new President, Abdoulaye Wade, was elected in March 2000.

The new administration that took office in April 2000 inherited a legacy of weak implementation and ownership of the structural reform programme (IMF, 2001). The new authorities thus decided to strengthen revenue collection (IMF, 2001), and to rely less on foreign sources of revenues. A series of reforms were implemented, as reported in Table A.1 in the Appendix. The new government launched the modernization of the financial administration in 2000. On 31st March 2001 the authorities implemented a single taxpayer identification number in all revenue-collecting agencies. At the same time, the government completed a study detailing the revenue impact of tax and customs exemptions; and on 1st May 2001, the national assembly approved a law setting up a VAT at a single rate of 18% with limited exemptions and effective implementation of the new law. This revenue collection effort has been sustained, with the implementation of several other reforms in the period 2000-2014 (see Table A.1 in the Appendix).

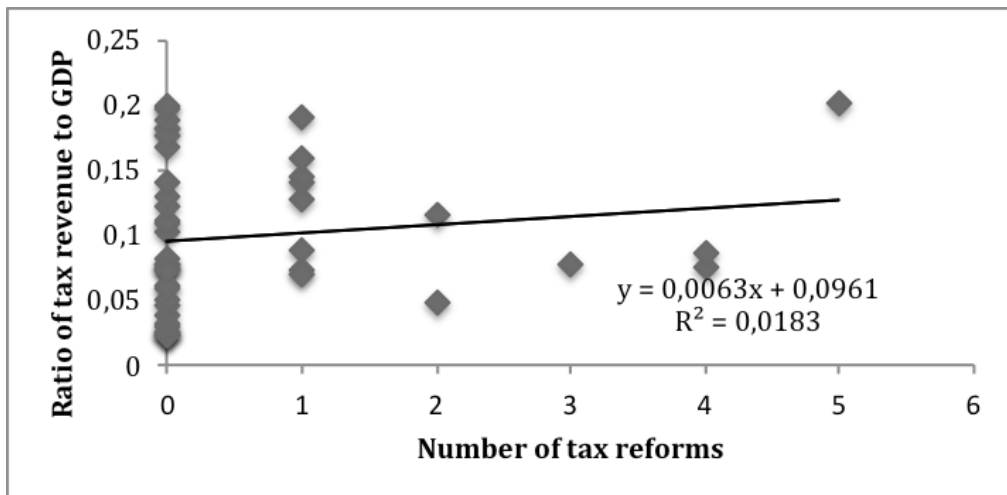
Linking reforms and tax revenue performance in Senegal

This section investigates the potential link between reforms and tax revenue performance, using the measurements of reforms above, notably in turn the number of reforms and reforms as measured using the PEFA indicators.

First link: Number of reforms and tax revenue performance

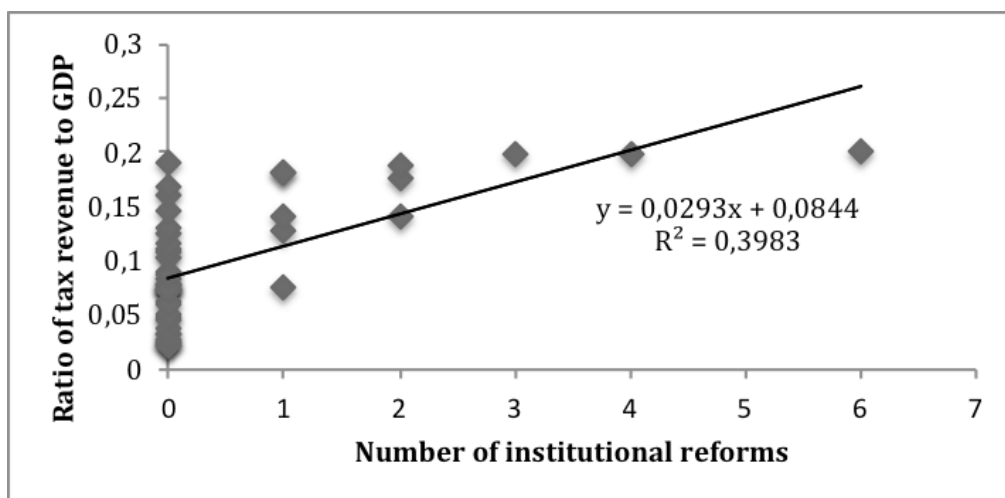
Figures 6, 7, and 8 present the relationship between tax revenue performance in Senegal and the number of tax reforms, the number of institutional reforms, and the number of all reforms combined, respectively.

Figure 6: Number of tax reforms and tax revenue performance in Senegal, 1970-2014



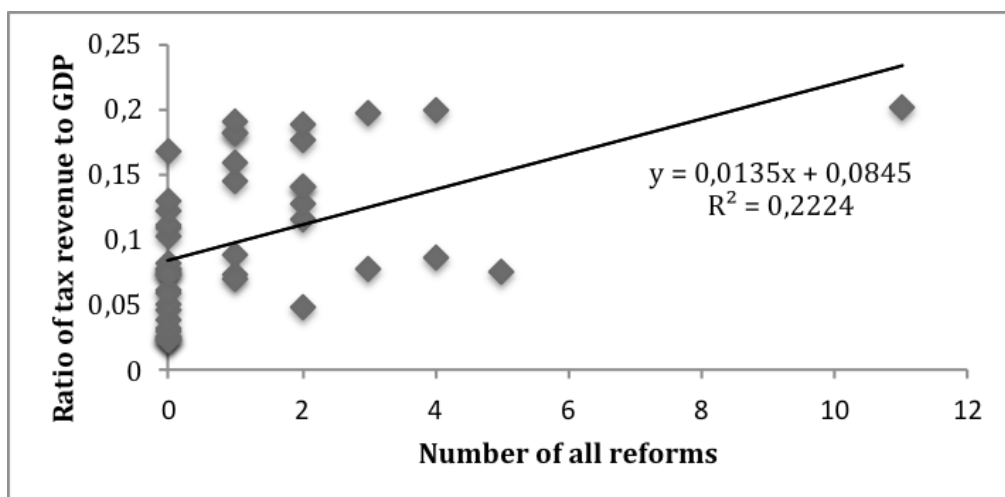
Source: Author's computations using data from BCEAO's Economic and Financial Database; author's compilations using several documents, including various versions of the General Tax Code; various versions of the Customs Code; Fall and Sène (2010); CEPOD (2004); various IMF country reports on Senegal, etc.

Figure 7: Number of institutional reforms and tax revenue performance in Senegal, 1970-2014



Source: Author's computations using data from BCEAO's Economic and Financial Database; author's compilations using several documents, including various versions of the General Tax Code; various versions of the Customs Code; Fall and Sène (2010); CEPOD (2004); various IMF country reports on Senegal, etc.

Figure 8: Number of all reforms and tax revenue performance in Senegal, 1970-2014



Source: Author's computations using data from BCEAO's Economic and Financial Database; author's compilations using several documents, including various versions of the General Tax Code; various versions of the Customs Code; Fall and Sène (2010); CEPOD (2004); various IMF country reports on Senegal, etc.

Irrespective of the type of reforms, these figures 6, 7, and 8 show a positive link between reforms and tax revenue, suggesting that reforms that have been implemented in the tax administration in Senegal have generated higher tax revenue performance.

Table 3 presents the number of all reforms combined in the tax administration and tax revenue performance in Senegal on a 15-year average basis, from 1970 to 2014.

Table 3: Number of reforms in the tax administration and tax revenue in Senegal, 15-year average

Period	All reforms	Tax revenue (% of GDP)
1970-1984	2	4.22
1985-1999	17	8.97
2000-2014	33	16.84

Source: BCEAO's Economic and Financial Database; author's computations using several documents, including various versions of the General Tax Code; various versions of the Customs Code; Fall and Sène (2010); CEPOD (2004); various IMF's country reports on Senegal, etc.

Note: The column "all reforms" refer to the total number of all reforms on a 15-year average basis.

Table 3 shows that more reforms were implemented in 2000-2014 with 33 reforms compared to 17 reforms in 1985-1999 and to only two reforms in 1970-1984. Tax revenue as a share of GDP appears to be higher in periods with higher number of reforms. This suggests that reforms in the tax administration in Senegal are favourable to higher performance of tax revenue.

Table 4 presents tax revenue performance with and without reforms in the tax administration in Senegal, in the period 1970-2014.

Table 4: Tax revenue performance with and without reforms in the tax administration in Senegal, 1970-2014

	Number of all reforms	Tax revenue performance (% of GDP)	
		With reforms	Without reforms
1970	0	-	2.2
1971	0	-	2.2
1972	0	-	2.3
1973	0	-	2.5
1974	0	-	2.6
1975	0	-	3.1
1976	0	-	3.3
1977	0	-	3.8
1978	0	-	4.6
1979	2	4.8	-
1980	0	-	6.1
1981	0	-	5.1
1982	0	-	5.8
1983	0	-	7.3
1984	0	-	7.5
1985	0	-	7.8
1986	5	7.6	-
1987	1	7.4	-
1988	0	-	7.8

continued next page

Table 4 Continued

	Number of all reforms	Tax revenue performance (% of GDP)	
		With reforms	Without reforms
1990	3	7.7	-
1991	0	-	8.2
1992	1	8.8	-
1993	0	-	7.3
1994	4	8.7	-
1995	0	-	10.2
1996	0	-	10.8
1997	0	-	11.2
1998	2	11.6	-
1999	0	-	12.3
2000	2	12.8	-
2001	0	-	13.0
2002	2	14.0	-
2003	2	14.1	-
2004	1	14.6	-
2005	1	15.9	-
2006	0	-	16.8
2007	1	18.1	-
2008	1	18.1	-
2009	2	17.7	-
2010	2	18.7	-
2011	3	19.8	-
2012	4	19.9	-
2013	1	19.1	-
2014	11	20.1	-
Average	1.2	13.6	6.8
Total	52	-	-

Source: Author's computations using several documents, including BCEAO's Economic and Financial Database; various versions of the General Tax Code; various versions of the Customs Code; Fall and Sène (2010); CEPOD (2004); various IMF's country reports on Senegal, etc.

Table 4 shows the years during which reforms were implemented and the years for which no reforms were undertaken, in the whole period. This paper makes a decomposition of tax revenue based on the existence of reforms. Table 4 indeed shows tax revenue for all years with reforms and tax revenue for all years without reforms. This paper computes the average ratio of tax revenue to GDP for the years with reforms and for the years without reforms. The results in Table 4 indicate that, in the period 1970-2014, on average, tax revenue with reforms stands at 13.6% of GDP, while tax revenue without reforms accounts for 6.8% of GDP. These results show thus that tax revenue performance with reforms is higher than tax revenue performance without reforms, supporting therefore the idea that reforms have contributed to increase tax revenue performance in Senegal, as found above.

Second link: Reforms as measured using the PEFA indicators and tax revenue performance

Table 5 presents the relationship between reforms based on the PEFA indicators and tax revenue performance in Senegal, from 2007 to 2011. The PEFA indicators that are considered in Table 5 are those whose variations between 2007 and 2011 were found to be different from zero, as reported in Table 2.

Table 5 seems to support the positive link between reforms and tax revenue in Senegal. Indeed, the table shows that a positive variation in reforms is associated with a positive variation in tax revenue. This suggests that an improvement in the existence and functioning of a tax appeals mechanism (PI-13iii), an improvement in the controls in the taxpayer registration system (PI-14i), and an improvement in the effectiveness of measures for taxpayer registration and tax assessment (PI-14), seem to be associated with an increase in tax revenue mobilization. This implies that better reforms in the tax administration leads to greater performance of tax revenue in Senegal.

Table 5: Reforms based on the PEFA indicators and tax revenue performance in Senegal, from 2007 to 2011

Indicators	Variation in reforms	Variation in tax revenue
Existence and functioning of a tax appeals mechanism (PI-13iii)	+2	
Controls in the taxpayer registration system (PI-14i)	+2	
Effectiveness of measures for taxpayer registration and tax assessment (PI-14)	+1	
Ratio of tax revenue to GDP		+0.01

Source: EU and ADE (2011), and author's computations using data from BCEAO's Economic and Financial Database.

Econometric results

Table A.2 in the Appendix reports the results for the Phillips-Perron test for unit root. The results show that agriculture, industry, foreign aid, and per capita GDP exhibit a unit root ($I(1)$), while only the degree of openness of the economy is stationary or integrated of order 0 ($I(0)$).

Table 6 reports the econometric results of the effect of reforms on tax revenue performance in Senegal. The results are presented with various econometric techniques including OLS, IRLS and 2SLS, and with various reforms including tax-related reforms, institutions-related reforms, and all reforms combined in the tax administration in Senegal.

The paper finds that tax reforms are positively and significantly related to tax revenue, irrespective of the econometric technique used. This result suggests robust evidence that tax-related reforms, which were implemented in the tax administration in Senegal, are conducive to higher performance of tax revenue. The Government of Senegal indeed adopted various tax-related reforms. Firstly, there have been various reforms of the General Tax Code and the Customs Code based on, for example, the revision of corporate taxes, income taxes, marginal rate on physical persons, customs duty, and the number of rates of VAT. Reforms were based also on the introduction of new taxes and the extension of internal taxes to the informal sector. Tax-related reforms consisted, secondly, of the simplification of the categorization of products, the simplification and relief of the tax structure with the homogenization of customs duty, and the simplification of tax procedures related to efforts to roll out online filing and online payment of taxes for taxpayers. Thirdly, there was a widening of the tax base by the revision or the withdrawal of all conventions providing tax exemptions, protections or particular advantages to some enterprises. Fourthly, there were increased efforts to conduct tax audits and to collect tax arrears. Finally, there were regional reforms related to the adoption of the WAEMU common external tariff and of a unique rate VAT of 18% by the Government of Senegal. As a whole, these reforms are relevant for higher tax revenue mobilization.

The results show a positive effect of institutional reforms on tax revenue. However, this finding is not stable across regressions. Indeed, this effect is found to be significant with the OLS and 2SLS regressions, implying that institutional reforms undertaken in the country have contributed to increase importantly tax revenue performance. But this effect is insignificant when the paper accounts for possible outliers using the IRLS estimation technique. This suggests that the effect of institutional reforms on tax revenue depends on the econometric techniques used for estimation, and that other determinants of tax revenue dominate the potential accelerator effects of institutional reforms on tax revenue. The significant contribution of institutional reforms to tax revenue mobilization may be explained by the nature of the various types of institutions-related reforms. The Government of Senegal was engaged for several exercises to evaluate the performance of its public financial management system by international institutions. These exercises suggested the need for the government to adopt several reforms. The first type of institutional reforms in the tax administration in Senegal is related to the reforms of the revenue directorates.

Table 6: Effect of reforms on tax revenue performance in Senegal, 1970-2014

VARIABLES	OLS			IRLS			2SLS		
	Tax reforms	Institutional reforms	All reforms	Tax reforms	Institutional reforms	All reforms	Tax reforms	Institutional reforms	All reforms
Tax reforms	0.003* (0.001)			0.003** (0.001)			0.002** (0.0008)		
Institutional reforms		0.004* (0.002)			0.0007 (0.0009)			0.004** (0.002)	
All reforms			0.001** (0.0006)			0.001* (0.0007)			0.001** (0.0006)
Tax revenue (lagged first difference)	0.259 (0.235)	0.046 (0.170)	0.124 (0.177)	0.202 (0.159)	-0.12 (0.145)	0.002 (0.143)	-0.013 (0.151)	0.055 (0.161)	0.128 (0.183)
Agriculture (first difference)	-0.314*** (0.077)	-0.326*** (0.092)	-0.324*** (0.089)	-0.323*** (0.075)	-0.343*** (0.088)	-0.358*** (0.082)	-0.319*** (0.078)	-0.335*** (0.08)	-0.325*** (0.077)
Industry (first difference)	-0.018 (0.125)	-0.105 (0.154)	-0.052 (0.138)	-0.073 (0.145)	-0.174 (0.169)	-0.142 (0.157)	-0.061 (0.117)	-0.117 (0.132)	-0.053 (0.118)
Foreign aid (first difference)	-0.103*** (0.031)	-0.067** (0.027)	-0.088*** (0.022)	-0.109*** (0.027)	-0.066** (0.025)	-0.086*** (0.026)	-0.064** (0.032)	-0.083** (0.034)	-0.090*** (0.033)
Openness	0.033** (0.013)	0.023* (0.013)	0.030** (0.012)	0.039*** (0.009)	0.029*** (0.010)	0.034*** (0.01)	0.028*** (0.01)	0.025** (0.011)	0.03*** (0.01)

continued next page

Table 6 Continued

VARIABLES	OLS			IRLS			2SLS		
	Tax reforms	Institutional reforms	All reforms	Tax reforms	Institutional reforms	All reforms	Tax reforms	Institutional reforms	All reforms
Per capita GDP (first difference)	0.0001** (0.00005)	0.0001** (0.00005)	0.0001** (0.00005)	0.0001** (0.00005)	0.00008 (0.00006)	0.0001* (0.00006)	0.00008* (0.00004)	0.0001** (0.00005)	0.0001** (0.00005)
Constant	-0.021** (0.009)	-0.013 (0.008)	-0.018** (0.007)	-0.025*** (0.007)	-0.015** (0.007)	-0.020*** (0.007)	-0.016*** (0.006)	-0.014* (0.007)	-0.019*** (0.006)
Observations	33	33	33	33	33	33	33	33	33
R-squared	0.555	0.537	0.543	0.678	0.574	0.638	0.578	0.530	0.543

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the first difference of the ratio of tax revenue to GDP. Reforms are measured as the number of tax reforms, the number of institutional reforms, and the number of all reforms combined in the tax administration in Senegal. The period of the regressions is 1970-2014.

For the Directorate-General of Tax and Lands (DGID), there was a structural reform through the setting up of functional directorates and operational directorates. For the Directorate-General of Customs (DGD), the reform consisted of the modernization of the customs activities and the dematerialization of public procedures, with the computerization of the customs services and the adoption of GAINDE that includes electronic systems of collection of documents (ORBUS) and of electronic payments (CORUS). There were efforts to expand the tax base through more active use of available information and closer cooperation between the DGID and the DGD based on the single taxpayer identification number NINEA (Numéro d'Identification National des Entreprises et des Associations). These revenue directorates-related reforms are important in increasing revenue mobilization. The second type of institutional reforms in the tax administration in Senegal is related to the reforms of the staff of the revenue directorates through the reform of the system to assess the staff performance, the increased staffing, and the acceptance by the government of a regional advisor from IMF's Fiscal Affairs Department to work in the tax administration in Senegal. These staff-related reforms are favourable for improving tax revenue performance. The third type of institutional reforms in the tax administration in Senegal is related to the existence of performance contracts, on the one hand between the DGID and the Ministry of Economy and Finance, and on the other hand between the DGD and the Ministry of Economy and Finance. These performance contracts are a great source of motivation to increase efforts for better revenue mobilization. The fourth type of institutional reforms in the tax administration in Senegal is related to the reforms of laws with the adoption by the National Assembly of Senegal of the law on revenue court, the law creating the bureau fighting corruption OFNAC (Office National Anti-Corruption), the transparency code, the law on the declaration of assets, and the action to deal with cases of fraud. These laws-related reforms are crucial for improving tax revenue performance.

With respect to all reforms combined in the tax administration, the estimated coefficients are found to be positive and significant, and this holds true in all regressions. This result suggests that there is robust empirical evidence that the massive reforms in the tax administration serve as a signal for stronger efforts and greater political will of policy makers, which increase tax revenue performance in Senegal. This finding supports thus the observation that tax revenue in this country remains in an increasing trend in the period of the study, during which the country experienced massive reforms in tax administration. The finding of a positive relationship between reforms and tax revenue is consistent with previous results in the literature (Morrisset & Izquierdo, 1993; Usui, 2011; Kanyi & Kalui, 2014; Asaolu et al., 2015).

The important role of tax reforms, institutional reforms, and all reforms in explaining tax revenue mobilization in Senegal remains true after controlling for several other variables. Among them, the most important variables that affect significantly tax revenue mobilization in Senegal are: the share of agriculture in GDP, the ratio of foreign aid to GDP, the degree of openness of the economy, and per capita GDP. The results indicate a negative and significant relationship between agriculture share and tax revenue in Senegal. The agriculture share is thus strongly detrimental to tax revenue collection in this country. One potential explanation of this result may be related to the fact that the agriculture sector in Senegal is largely informal and thus hard to tax. Previous empirical

works such as Ebeke (2014) and Dioda (2012) have supported this finding. The results show a negative and significant effect of foreign aid on tax revenue, as reported in Gupta et al. (2003). This shows that foreign aid is not provided to support the tax administration in Senegal, but is allocated to support other sectors. The degree of openness of the economy has positive and significant coefficients. This suggests that the openness of the economy provides a great opportunity for raising tax revenue in Senegal. This is consistent with findings from Rodrik (1998), Gupta (2007), and Ebeke (2010). The results show significant and positive coefficients of per capita GDP, implying that higher per capita GDP is conducive to higher tax revenue performance. This result is consistent with the theoretical literature, which explains that the tax revenue share rises with the level of economic development as indicated by per capita income (Chelliah, 1971; Bahl, 1971; Tanzi, 1992). Indeed, an increase in per capita income is supposed, theoretically, to generate a higher capacity to pay taxes.

The effects of the other control variables on tax revenue are found to be insignificant. The paper finds that there is no evidence that the increasing trend of the performance of tax revenue mobilization in Senegal is a predictor of a continued rising performance of tax revenue collection in the future, as the coefficients of the lagged dependent variable are insignificant in all regressions. This result is at odds with findings from Ebeke (2014). The regression coefficients of the share of industrial sector in GDP are also not significant, suggesting that the industrial sector in Senegal does not contribute importantly to raise taxes. This result, which may be explained by the existence of high informality, does not support previous findings from Ajaz and Ahmad (2010).

5. Conclusion and policy implications

This paper has investigated the effect of reforms on tax revenue mobilization in Senegal, a country that has known a growing performance of tax revenue over the long term, increasing above peers in WAEMU and with a level higher than that of several sub-Saharan African countries rich in natural resources.

Considering various aspects of reforms in the tax administration, including tax-related reforms and institutions-related reforms, and using both a descriptive approach and an econometric analysis, the results revealed that tax reforms, institutional reforms, and all reforms combined were important drivers of the increased performance of tax revenue in Senegal during the 1970-2014 period. These findings imply that more tax-related reforms and more institutions-related reforms are crucial for higher tax revenue.

Tax revenue as a share of GDP stands at roughly 20% for Senegal, while this ratio is above 20% for some sub-Saharan African countries; there is thus a strong need for the Government of Senegal to increase further tax revenue performance. The key implication of these results is that domestic resource mobilization strategies will bring more long-term benefits to Senegal only if accompanied by measures to adopt and implement tax-related reforms and institutions-related reforms over time. This will require continued substantial reforms in the tax administration to promote responsible and accountable revenue collection management. Persistent tax-related reforms and institutions-related reforms over time will provide robust support for the Government of Senegal to achieve the level of a tax revenue-to-GDP ratio near 30% or 40% like some sub-Saharan African countries. Therefore, the domestic resource mobilization strategies of the Government of Senegal should favour tax-related reforms and institutions-related reforms in order to reach this tax revenue performance target.

Notes

1. The Plan Sénégal Emergent (PSE) has been realized by the international agency McKinsey.
2. The tax system bequeathed by the colonial administration in Senegal did not fundamentally change in its structure up to the end of the 1970s.
3. Table A.1 in the Appendix provides the details of tax-related reforms and institutions-related reforms during the period 1970-2014.
4. Author's computations using data from Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO) Economic and Financial Database.
5. However, the African Development Bank (2010) argues that Senegal, which is lacking in important natural resources, succeeds to mobilize public resources for the same level than countries yet benefiting from important mining resources. The bank finds that the level of tax revenue in Senegal is high compared to the non-mining African Least Developed Countries (LDC) belonging to the Franc Zone or to the non-Franc Zone, and that generally, compared to African LDC or non-African LDC, Senegal is doing roughly better, around 1 point of GDP, and this is the same compared to Low Income Countries (LIC).
6. Author's computations using data from BCEAO's Economic and Financial Database for Senegal and various IMF's country reports.
7. The company Cairn Energy, which is an Edinburgh-based oil explorer, discovered this find in oil in Senegal.
8. In addition to these two measurements, this paper introduced another measurement of reforms called reforms duration that is the sum of the number of reforms in a given year and the number of reforms in the previous years. Although this additional measurement helps capture the dynamic character of reforms, the problem is that it is difficult to believe that a reform that took place 30 years ago, for example, is still having an impact today. Moreover, it is difficult to know when each reform end.
9. The customs code was adopted on 28 December 1987 in Senegal.
10. These countries are selected based on data availability in the period 2010-2014.

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Annex

Table A.1: Reforms in the tax administration in Senegal

Year	Tax reforms	Year	Institutional reforms
1979	Introduction of VAT; simplification and relief of the tax structure with the homogenization of customs duty.	1986	Modernization and computerization of the customs administration.
1986	Fall in the customs duty; withdrawal of certain forms of tax exemptions; limitation and strict control of other tax exemptions; extension of internal VAT to the informal sector.	2000	Modernization of the financial administration.
1987	Reform of the Customs Code.	2002	Engagement of Senegal for several exercises to evaluate the performance of its systems of management of public finance by international institutions.
1989	Increase of 5 points in the customs duty rate.	2003	Engagement of Senegal in a process of reforms of the management of public finance through the validation of the action plans of CFAA (Country Financial Accountability Assessment) and CPAR (Country Procurement Assessment Report).
1990	Reform of the General Tax Code with, among others, unique rate of 35% for corporate taxes; simplification of taxes on revenue from salaries and of taxes on non-trading revenue with the introduction of IRPP (Impôt sur le Revenu des Personnes Physiques); an upper limit of 50% for the marginal rate on physical persons.	2007	Engagement of Senegal for the first exercise to evaluate the performance of its public financial management based on the PEFA (Public Expenditure and Financial Accountability) approach developed by international technical and financial partners.
1992	Revision of the General Tax Code.	2008	Elaboration and adoption of the PCRBF (Projet de Coordination des Réformes Budgétaires et Financières) based on the diagnostic of PEFA and incorporating the CFAA action plans.

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Table A.1 Continued

Year	Tax reforms	Year	Institutional reforms
1994	After the devaluation of Franc CFA, full revision of indirect taxes: generalized decline in customs duty; simplification of taxes; fall in the number of rates of VAT; widening of tax base by the withdrawal or the revision of all conventions providing tax exemptions, protections or particular advantages to some enterprises that are important in the economy.	2009	Signature of a performance contract between the Directorate-General of Tax and Lands (DGID) and the Ministry of Economy and Finance; greater coordination and centralization of the attribution of the NINEA (Numéro d'Identification National des Entreprises et des Associations) Code.
1998	Income tax cannot exceed 50% of taxable revenue; simplification of the categorization of products from 7 to 4 with a reduction in the ceiling of the maximum level of customs duty.	2010	Transfer of the functions of collection to the Directorate-General of Tax and Lands (DGID); adoption of GAINDE which includes electronic systems of collection of documents (ORBUS) and of electronic payments (CORUS).
2000	Adoption of the WAEMU common external tariff by the Government of Senegal.	2011	Signature of a performance contract between the Directorate-General of Customs and the Ministry of Economy and Finance; acceptance by the government of a regional advisor in tax administration in Senegal from IMF's Fiscal Affairs Department; engagement of Senegal for the second exercise to evaluate the performance of its public financial management based on the PEFA (Public Expenditure and Financial Accountability) approach developed by international technical and financial partners.
2002	Adoption of a unique rate VAT of 18% by the Government of Senegal.	2012	Achievement by Senegal of the transposition of the WAEMU directives on the management of public finance; Adoption by the National Assembly of Senegal of several reforms such as law on Revenue Court, law creating OFNAC (Office National Anti-Corruption), Transparency Code.
2004	Reform of the General Tax Code with, among others, a fall in corporate taxes from 35% to 33%.	2014	Law on the declaration of assets; for the tax directorate (DGID), structural reform through the setting up of functional directorates and operational directorates, reform of the system to assess staff performance, increased staffing, action to deal with cases of fraud, efforts to expand the tax base through more active use of available information and closer cooperation with customs services based on the single taxpayer identification number (NINEA).

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Table A.1 Continued

Year	Tax reforms	Year	Institutional reforms
2005	Decline in corporate taxes from 33% to 25%.		
2013	New General Tax Code with, among others, an increase in corporate taxes from 25% to 30%.		
2014	New Customs Code; roll out online filing and online payment of taxes for all taxpayers in the Dakar region; efforts to conduct tax audits; efforts to collect tax arrears; an audit of VAT credits.		

Source: Author's compilations using several documents, including various versions of the General Tax Code in Senegal; various versions of the Customs Code in Senegal; Fall and Sène (2010); CEPOD (2004); various IMF country reports on Senegal.

Table A.2: Phillips-Perron test for unit root

Variable	T-statistic	Prob value	Decision
Ratio of tax revenue to GDP	0.892	0.9930	
D.Ratio of tax revenue to GDP	-7.375	0.0000***	I(1)
Share of agriculture sector in GDP	-1.705	0.4284	
D.Share of agriculture sector in GDP	-8.743	0.0000***	I(1)
Share of industry sector in GDP	-1.879	0.3421	
D.Share of industry sector in GDP	-7.983	0.0000***	I(1)
Ratio of foreign aid to GDP	-2.279	0.1787	
D.Ratio of foreign aid to GDP	-10.980	0.0000***	I(1)
Degree of openness of the economy	-3.473	0.0087***	I(0)
Per capita GDP	-1.427	0.5694	
D.Per capita GDP	-8.184	0.0000***	I(1)

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A.3: Definition and sources of variables

Variables	Definition	Sources
Dependent Variables		
Tax revenue	Ratio of tax revenue to GDP	BCEAO, Economic and Financial Database (Online Edition)
Variable of impact		
Reforms	Number of tax reforms by year; number of institutional reforms by year; number of all reforms combined by year (see Table A.1 in the Appendix).	Author's compilations using several documents, including various versions of the General Tax Code; various versions of the Customs Code; Fall and Sène (2010); CEPOD (2004); various IMF country reports on Senegal, etc.
Control variables		
The level of economic development	Per capita GDP	World Bank, World Development Indicators (Online Edition)
Tax base	Share of agriculture sector in GDP, share of industrial sector in GDP, degree of openness of the economy (ratio of exports plus imports to GDP)	World Bank, World Development Indicators (Online Edition); IMF, Direction of Trade Statistics (Online Edition)
External environment	Ratio of foreign aid to GDP	World Bank, World Development Indicators (Online Edition)