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Diagne, Youssoupha Sakrya and Ba, Arona

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HOW MUCH MORE CAN THE TAX ADMINISTRATION COLLECT? MEASURING TAX POTENTIAL FOR SENEGAL

By Arona BA¹ and Youssoupha Sakrya DIAGNE²

April 2019

Abstract

This paper measures tax potential in Senegal. The tax revenue structure shows a strong reliance on indirect taxes collected from foreign trade which is progressively declining thanks to trade liberalization reforms. A stochastic frontier model is used to compute the distance to potential for the main taxes. Results show that the overall tax revenue could be improved by 10.2 percentage points corresponding to a tax potential of 25.3% of GDP for Senegal. Furthermore, the income tax collection is the most distant from its potential and therefore its share in percentage of GDP can still be increased by 7.2 percentage point. However, the best performing tax is non-oil tariffs which only need a 0.2 percentage point increase to reach its potential.

Keywords: tax frontier, tax capacity, tax revenue, tax effort, stochastic tax frontier, inefficiency

JEL classification : C23, C51, H2, H21

¹ Arona BA is a Statistician Economist Ingenieur working as a researcher in the Research department of the Ministry of Economy, Planning and Cooperation of Senegal
Contact: baaronaba@gmail.com.

² Youssoupha Sakrya Diagne is a PhD economist. He is the head of the Research Department at the Ministry of Economy, Planning and Cooperation
Contact: zack.diagne@gmail.com.

I. INTRODUCTION

Public resource mobilization is key to policy implementation and success. This is a major concern in developing countries. Indeed, these economies face challenging needs in infrastructure and energy, which require very costly investments with a strong impact on their public finances. In addition, those countries share the critical issue of eradicating poverty, which also calls for important funding. In a more global prospect today, on the road to the new agenda set by the United Nations for Sustainable Development Goals (SDGs), more pressure is put on the public finances especially in developing countries. In such a context, countries are engaging in expanding resources in order to face these major challenges. However, depending on the nature of the revenue, constraints may compromise an optimal collection. In this regard, exploring the composition of public resources can help understand the limits to their expansion. To that extent, Governments have access to tax revenues, external donations, official development assistance and public debt. The constantly tested global economy lately makes support from outside more and more uncertain and scarce, while the possibilities of extending resources through debt are to be considered with caution and therefore remain limited. Thus, among the sources of revenue, Governments should put more focus on tax revenues as the other sources are beyond their control. However, expanding the tax revenue should account for the fact that an excessive taxation could ultimately harm the development of economic activity (Laffer curve). Moreover, in many cases, a significant part of the taxes include tariffs collected through customs and are therefore exposed to eventual external shocks. Thus, too much reliance on those types of resources should not be encouraged, as it is a source of vulnerability. That said, to increase tax revenue, policymakers could either push rates up or broaden the tax base. The first option is however constrained by the fact that tax rates are often attached to standards and legislation applicable in a given area and are in line with the rules of fair competition and competitiveness. The ability to expand income by influencing tax rates is thus reduced. On the other hand, broadening the tax base can offer interesting opportunities for tax revenue expansion. However, the implementation of such measures and the results are a long term process.

Furthermore, a common feature of developing economies is the presence of a sizeable informal sector which activities mostly escaping taxation. Other factors including tax evasion, corruption and the low level of modernization of tax infrastructure also limit optimal tax collection. In addition, investment incentive policies in the forms of tax exemptions, tax reductions offered to firms but result in a reduction in government resources, especially when they are not rationally allocated. Thus, the number and duration of such favors should be subject to limitations. In Senegal, tax revenues represent around 60% of total budget revenues. Those resources are dominated by indirect taxes which account for nearly 70% of revenues against roughly 30% for direct taxes. In addition, this distribution shows a certain reliance on domestic taxes on goods and services which represents more than 50% while the share of income taxes and corporate taxes remains relatively modest (around 27%). However, the country recorded the third best performance in terms of the tax revenue to GDP ratio in the WAEMU area in 2016 behind Niger and Togo. Senegal got indeed a ratio of approximately 17% in 2016, which is still below the 20% target set for WAEMU member states and monitored through the multilateral surveillance framework. Moreover, the Senegalese economy is, like many other developing countries, is characterized by the presence of a large informal sector. In this regard, the Agency for Statistics and Demography conducted in 2016 a survey on 407,882 firms which showed that 97% of them belong to the informal sector. In terms of labor, the survey also points to more than 70% of workers employed by the informal sector. Tax losses attributable to the informal sector are thus expected to be considerable. The Government of Senegal also grants significant tax exemptions and tax cuts to the private sector to stimulate investment. As such, the tax expenditure assessment report estimates these favors at CFAF 588 billion in 2014, or 39.7% of tax revenue and 6.0% of GDP.

The objective of this study is to measure Senegal's tax potential. The approach will consist in estimating the gap to be recovered in terms of tax revenue. The rest of the document will proceed as follows: after an overview of the economic literature devoted to tax potential measurement, some stylized facts of taxation in Senegal will be the subject of section 3, the methodology will be presented in section 4, section 5 will present the results of the study and finally the main conclusions and recommendations will be formulated in the last section.

II. REVIEW OF LITERATURE

The pressing challenges faced in particular in the fight against poverty and the growing needs in basic infrastructure in a context of gloomy international economic situation are leading the public authorities

in developing countries to seek to further increase their resources. Such context explains the rising interest on the issue of tax potential measurement. The tax potential of an economy represents the maximum tax revenue ratio that an economy can generate using its full capacity (Alfirman, 2003). Thus, the gap between the tax potential and the tax revenue actually collected corresponds to the tax effort. In the literature, two different approaches are found when it comes to measuring tax potential, both based on panel data. The first method estimates an equation of the tax revenue ratio as a function of a few variables (considered as determinants). The ratio predicted by the regression constitutes the tax potential and the residual of the equation represents the tax effort (Chambas and Brun, 2010). This methodology was used by Chambas and Brun (2010) in the specific case of Senegal. In the study, the authors evaluated Senegal's public revenue potential. They showed that the lagged GDP per capita, the share of the agricultural sector in the GDP and the share of mining exports in merchandise exports act negatively on the tax potential, while the impact of the import rate on the GDP and of the share of oil exports in the exports of goods is positive. The paper also shows that Senegal's level of revenue collection is close to its potential. In addition, the study by Gupta (2007) on 105 developing countries leads to the same results as Chambas and Brun (2010) with regards to the sign of the share of the agricultural sector and of the import rate on the GDP. Moreover, the author shows that structural factors such as GDP per capita, foreign aid affect positively the ratio of public revenues. However, in most specifications, variables measuring political stability, corruption, and parameters describing fiscal policy have no impact on the ratio of taxes to GDP. In addition, the study indicates that in several countries of sub-Saharan Africa, the level of revenue collection is above potential, unlike in some Latin American countries where the latter is below potential. More recently, Ahlerup et al. (2015) measured the impact of tax system reforms such as the introduction of value added tax (VAT) and the creation of autonomous revenue collection agencies in sub-Saharan African countries. The authors find that the impact of the introduction of VAT is not significant both in the short or the long run. However, the creation of new autonomous tax collection agencies has a positive effect on total tax revenue in the short run, but the effect wears off in the long run.

The second second approach is the stochastic frontier estimation technique. This method is similar to the first except that it decomposes the error term into two independent components. The first one is assumed to follow a centered normal distribution, while the second follows a strictly positive normal distribution. In this regard, Alfirman (2003) attempted to estimate the revenue potential of local authorities in the case of Indonesia using the stochastic frontier estimation method. The author showed that none of the local authorities have reached the revenue potential. He concluded that these administrations could increase their local revenues by 0.36% of GDP. The same approach was used by Davoodi and Grigorian (2007) who looked at the factors explaining the low revenue ratio in the case of Armenia. The authors found that the persistently low revenue ratio in Armenia could be attributed to

weak institutions. In addition, according to their results, the gap between the ratio of revenue actually collected and the potential is on average 6.4% of GDP over the period 1996-2006.

Pessino and Fenochietto (2010) studied the determinants of tax effort in 96 developing countries including Senegal. Using the stochastic frontier technique, this study corroborates Gupta's (2007) analysis regarding the sign of the coefficients associated to trade openness rate, GDP per capita and the share of the agricultural sector in GDP. However the authors also find a positive impact of public education expenditure as a percentage of GDP and a negative sign for the coefficients associated to inflation, the GINI coefficient on the distribution of income, and the perception index of corruption. According to the results of the study, the tax revenue ratio to GDP established at 16.1% in Senegal in 2001 should potentially reach a rate between 23.0% and 26.5%. Later, in 2013, the authors broadened the scope of their study adding 7 more countries to the sample and show that in 2011, the tax rate could be increased to 26.8% from 19.4% which corresponds to a tax effort of 7.4 percentage points for Senegal. The same methodology was used by Ndiaye and Korsu (2011) who studied the determinants of tax revenue in ECOWAS countries using them to build an indicator of tax effort for these different countries. The authors performed a stochastic frontier estimation considering separate taxes such as direct, indirect, export taxes and all taxes. The results revealed that the literacy rate has a positive effect on all tax categories considered, the financial depth ($M2 / GDP$) has a positive effect on both indirect and export taxes, the share of agricultural in GDP has a negative effect on direct and indirect taxes and the openness of economies to imports and GDP per capita have positive effects on exports' taxes. In addition, the authors showed that all ECOWAS countries are below their tax capacity. Recently, Langford and Ohlenburg (2015) quantified the tax potential for a panel of 85 economies with low natural resources. Using the stochastic frontier estimate, the study finds that the estimated tax effort for 2009 ranges from 38% in Guatemala to 90% in Sweden, with an average of 62% for the whole sample. The paper also shows that Senegal's tax potential was 25.5%, i.e. a tax effort of 74% in 2010. The IMF (2015) estimated the tax potential in a similar study for a group of 113 countries including 23 countries in sub-Saharan Africa. The article shows that the median country in sub-Saharan Africa could potentially increase its tax revenues by an additional 3 to 6.5 percentage points. Beyond the factors discussed in the studies cited above, the taxpayers' behavior when it comes to their obligations towards the tax system is critical in the tax collection process. In this regard, there are mainly five factors explaining taxpayer compliance with the tax system in the literature. Those parameters relate to disincentive, standards (both personal and social), fairness and trust (in the tax administration), the complexity of the tax system and the role of government and the economic environment (Walsh, 2012). The model of economic disincentive considers the taxpayer as a rational economic agent, who assesses the costs and benefits of evading tax, and therefore chooses not to pay, if the benefit of not complying with the tax system outweighs the costs. Standards account for the fact that when taxpayers find tax evasion to be low and the majority of agents comply with the tax system, then it creates more incentives

to comply with the tax obligations. In addition, a lack of confidence in the tax administration with respect to its fairness leads agents to not correctly declare their activities for tax collection. Finally, the author points out that a complex tax system or difficult economic conditions can sometimes lead some taxpayers to evade taxes. In the same vein, authors have looked at the tax evasion behavior of informal firms. Indeed, the informal sector is responsible for a considerable shortfall of tax revenue. As such, De Soto (1989) showed that firms choose to operate in the informal sector by adopting rational reasoning. Later, Diagne and Thiaw (2008) drew on the work of Feinstein (1991), Bardsley (1996) and Andreoni et al. (1998) and show that the behavior of informal firms and the Government mimics a Principal Agent game. From a sample of 246 Senegalese informal businesses, the authors show that the visibility indicators, the perception of fiscal policy, the presence of tax controllers as well as the information positively influence the registration of their activity. However, the education, the age of the entrepreneur, the tax rate as well as the size of the activity reveal an anticipatory and profit-maximizing behavior. According to Richardson (2005), cited by Gberegbe et al. (2015), if a tax system is perceived to be unfair and inequitable, it can encourage taxpayers to evade paying taxes and render the tax system inefficient. It is in this context that Gberegbe et al. (2015), tested the relationship between the perception of tax fairness and the behavior of agents towards the tax system on data from Ken Saro-Wiwa Polytechnique, Bori in Nigeria. The results of the study show that the relationship between officers' perception of tax fairness and compliance with the tax system is positive and significant. Thus, the perceived balance between taxes paid and available public goods influences the behavior of taxpayers to respect the tax system. From the same perspective, Bello and Danjuma (2014) underline that the theoretical factors which explain the behavior of agents to comply with the tax system are economic, socio-psychological aspects, financial transactions, comparative treatments and political legitimacy. Bird et al. (2014) also attempted to extend the simple model of fiscal effort by showing that not only factors such as the relative share of the non-agricultural sector in the economy or the weight of imports and exports in GDP are important, but other parameters such as government efficiency, political stability, absence of violence, respect for the law and control of corruption have a positive effect also matter for revenue collection.

III. STYLIZED FACTS

After gathering the theoretical and empirical elements, it is helpful to analyze some descriptive statistics of the Senegalese economy. This step should provide more understanding of the factors influencing fiscal potential in Senegal. It should include a historical review of the main policies undertaken by the public authorities aiming in particular at improving the tax revenue collection. A comparison of Senegal's tax collection performance with similar neighboring

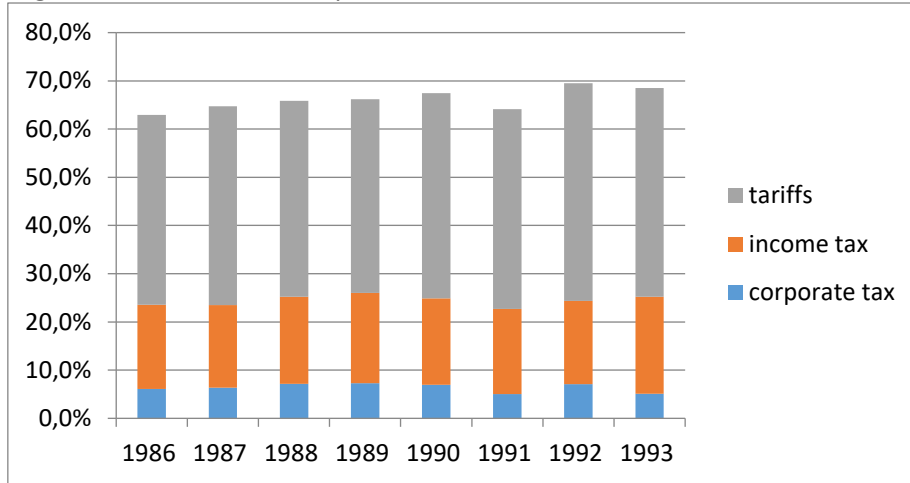
countries is also useful. Finally, factors such as corruption and tax relief policies influence the performance of tax administrations and therefore should be included in the analysis.

III.1. MAIN REFORMS OF THE TAX SYSTEM IN SENEGAL

The evolution of tax revenue in Senegal reflected major changes in the tax system. In addition, the performance of tax collection is closely related to the dynamism of the economic activity. Indeed, the output of an economy constitutes the main source of tax revenue collection. It is also worth noting that too much taxation can ultimately hamper considerably the development of economic activity, as suggested by Laffer through his famous statement "too much tax kills tax" from his Laffer curve theory in the 1970s. One can recall that Arthur Laffer suggested that there is an inverse relationship between the tax rate and the tax revenue above a certain threshold. The author explains this phenomenon by the disincentive effects of increasing taxes on labor supply and savings, leading to a decline in production. Laffer also indicates that too much tax pressure tends to encourage tax evasion. Conversely, a reduction in the tax according to the Laffer curve would result in a stimulation of economic activity which in turn would lead to an increase in the tax base. Thus, the dynamics of the tax revenue collection cannot be examined in isolation from changes in economic activity. Understanding the tax performance necessarily requires a historical review of the behavior and profile of tax revenues. This analysis will of course be done in light of the various tax policies pursued by the authorities. Going back to the 1970s, tax revenues composition was dominated by indirect taxes levied on foreign trade while the economic activity was affected by the instability of agricultural production and the prices of export products, notably phosphate and peanut. The first oil shock in 1973 considerably weakened macroeconomic stability and real GDP fell by 5.6% against an increase of 6.4% the previous year. Trade balance deteriorated considerably under the effect of the increase in the price of oil imports which caused a deficit of approximately 20% of GDP. At the same time, public finances had deteriorated sharply with budget deficits exceeding 10% of GDP and recurrent spending, particularly salaries, accounting for roughly 50% of tax revenue. Inflation was also high at around 9%. These mediocre macroeconomic results led to the Government undertaking, from 1979, a set of reforms aimed at restoring macroeconomic stability. Those measures were contained in adjustment programs signed with Bretton Woods institutions, i.e. the IMF and the World Bank. After the short-term stabilization program over the period 1979-80 which was an emergency plan to rebuild the macroeconomic indicators, the Government signed the Medium and Long-Term Adjustment Program (PAMLT) between

1985 and 1992 marking the beginning of the first real tax reforms. In the meantime, in 1979, VAT was introduced. The objectives pursued through the measures included in the PAMLT agenda were to increase fiscal revenues and reduce the tax burden on the formal sector. To that extent, the direct and indirect taxation systems have been revised. When the Government adopted the New Industrial Policy (NPI) in 1986, it accompanied it with tax measures intended in particular to improve the competitiveness of the economy and to rationalize tax expenditures. Hence, import duties have been reduced, a few tax exemptions have been revised or even withdrawn and / or limited. The reform was also an opportunity to implement measures to modernize and computerize the tax administration and to introduce innovations to fight fraud. At the same time, VAT coverage is extended with the introduction of the equalization tax to include new sectors as well as the informal sector. In addition, during the 1990 and 1992 tax reforms of the general tax code revised certain aspects of direct taxation were revised. The motivations behind these changes were the simplification and rationalization of the levy system. Thus among the major innovations, companies have been subject to a single corporate tax rate instead of a series of separate taxes. A set of scheduled taxes and the general income tax were removed leaving the Personal Income Tax (IRPP) which rate was limited at 50%. The reforms also included the reorganization of the tax and collection services. Overall, the measures implemented under the PAMLT have yielded rather disappointing outcomes. Indeed, they have failed to significantly the tax revenue ratio to GDP and change the tax revenue composition which remains dominated by indirect taxes on foreign trade. Over the period of implementation of the PAMLT, tax revenues represented on average 14% of GDP. In terms of composition, indirect taxes collected from foreign trade contributed an average of 41.5% to tax revenue while income tax accounts for 17.8% and corporate tax represented only 6.6%. In terms of progress, corporate tax collection grew more rapidly with an increase of 9.2% over the period against 5% for income tax and 7.7% for taxes levied on foreign trade. At the same time, economic activity has been weak and erratic and marked by disappointing performance in agriculture (see Figures 2 and 3). The graph in Figure 1 shows the contribution of the main tax lines to the tax revenue:

Figure 1: Tax revenue composition from 1986 to 1993



Source: General Directory of Treasury and Public Accounting

These policies continued until the devaluation of the CFA Franc in 1994 without delivering satisfactory results, suffering from a lack of realism and an absence of accompanying measures. In addition, the industrial sector remained fragile despite the efforts made, thus leading the Government to take corrective measures in particular of reversing certain tax relief decisions (import duties, for example).

Figure 2: Tax revenue (% GDP) between 1986 and 1992

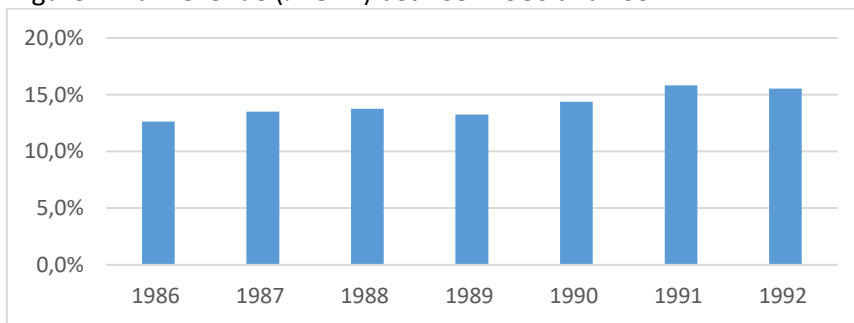
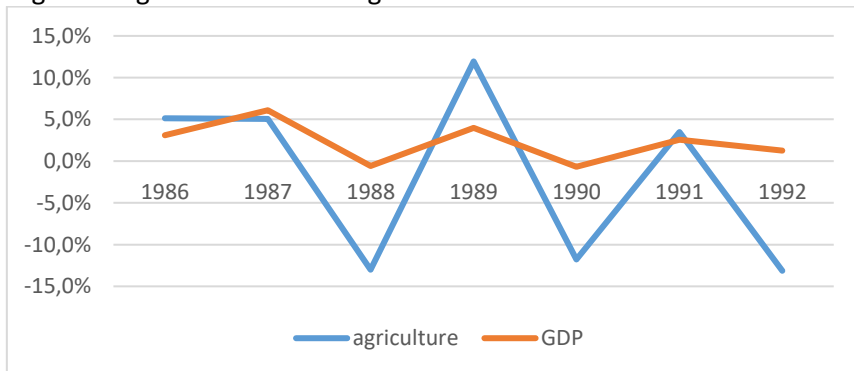


Figure 3: agriculture and GDP growth



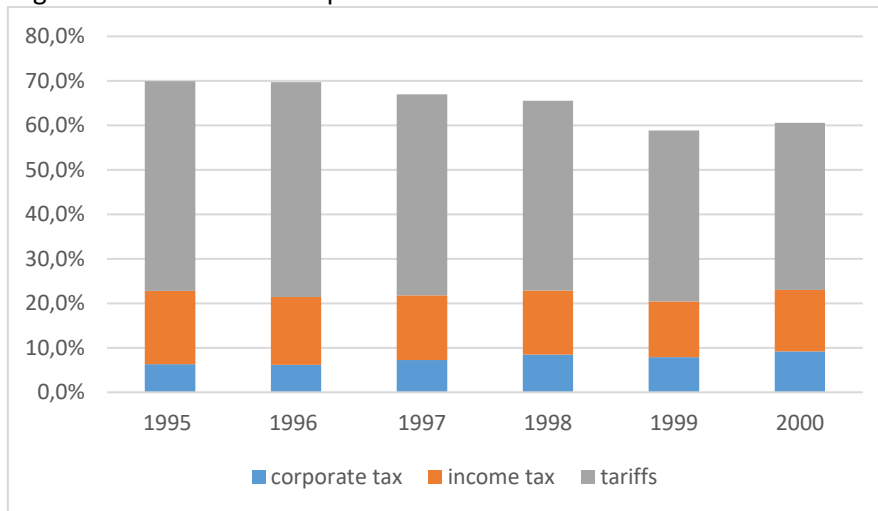
Sources: General Directory of Treasury and Public Accounting

The new context imposed by the devaluation has been the opportunity to revisit the tax legislation. In the meantime, the public finance situation had deteriorated sharply, notably as a result of an increase in the wage bill in a context of falling tax revenues. Simplification, broadening of the tax base and the competitiveness of the Senegalese economy are still the priorities on the reform agenda. In addition, a complete revision of indirect taxation was carried out to better respond to the devaluation. Among the actions taken, the burden as well as the duty tax procedures have been softened. Moreover, additional tax measures to protect local industries have been introduced by favoring imports of inputs instead of finished products which compete with local industries. In addition, a reorganization of domestic taxation by introducing more flexibility with the lowering of VAT from 5 to 2. And finally, certain favors granted to companies have been rationalized or even eliminated in a quest to broaden the tax base. The period following the devaluation was marked by a strong recovery of the economic activity thanks to regained competitiveness of exports. However, the tax measures have not significantly changed the composition of tax revenues, which still remain dominated by taxes levied on foreign trade. In contrast, their contribution is on a downward trend. The share of income tax also dropped considerably under the effect of the hiring freeze and the systematic non-replacement of retired staff. In addition, the collection of income tax has been affected by the closures and restructuring of public enterprises in particular as well as job cuts. At the community level, reforms were undertaken in 1995 with the aim of harmonizing indirect taxation as a step toward the process of regional integration of the West African Economic and Monetary Union (WAEMU) member states. Among the major decisions, governments of member countries have agreed on a gradual dismantling of tariff and non-tariff barriers in the context of inter-community trade as well as the establishment of a common external tariff (CET). Senegal contributed to this objective by introducing in 1998 a simplified tariff by category of imported goods reducing the number of rates to 4 from 7 as well as a gradual downward revision of the maximum customs duties from 65% in 1997 to 20% in 2000. Another simplification measure in Senegal's tax legislation was the establishment by the law of September 18, 2001, of a single VAT rate set at 18%.

Additional temporary protective measures have also been introduced to complete this system (the cyclical import tax (PCI) and the degressive protection tax (TDP)). Furthermore, innovative measures have been taken, the most remarkable being the creation, also in 2001, of a center for large companies. The reform aimed at securing the interests of the Public Treasury on the operations carried out by this category of taxpayers which generate nearly 80% of current revenues. These reforms, in particular the ones included in the framework of tariff disarmament, have resulted in a reduction of the dependence on revenues from foreign trade. However, the latter still outweighs the other tax

revenue components. The devaluation of the CFA Franc also contributed to the drop in customs duties under the influence of the increase in import costs, which caused volumes purchased to sharply decline. Ultimately, under the combined effects of the customs disarmament initiated in the common external tariff scheme and the strengthening of domestic resources mobilization, the share of national tax revenues increased from 55% between 1989 and 1997, to 62% over the period 1998-2000, on average. In the years that followed, the contribution of customs revenue rose somewhat to reach 39.5%.

Figure 4: Tax revenue composition from 1995 to 2000



Source: General Directory of Treasury and Public Accounting

From the beginning of the 2000s, tax policy was oriented towards investment promotion and improvement of the business environment. Among the innovations introduced for this purpose, a wide range of incentives, the most important being the reduction of the corporate tax rate, which went successively from 35 to 33% and then finally to 25%. These measures did not translate into a significant boom in investments instead private investment grew only by 0.4% between 2005 and 2010. The Government of Senegal also granted favors to companies under certain conditions through the investment code and the free export enterprise regime. In addition, the payment of the commercial tax has been considerably simplified with now a single commercial tax system applicable to taxpayers subject to the formal method of taxation. This reform thus marks the elimination of Table C reserved to flat-rate commercial taxes. At the same time, the Government introduced a major innovation to better account for the informal sector through the establishment of the Unique Global Contribution (CGU). The CGU is a simplification of the tax applied to small businesses by consolidating a set of taxes in a single,

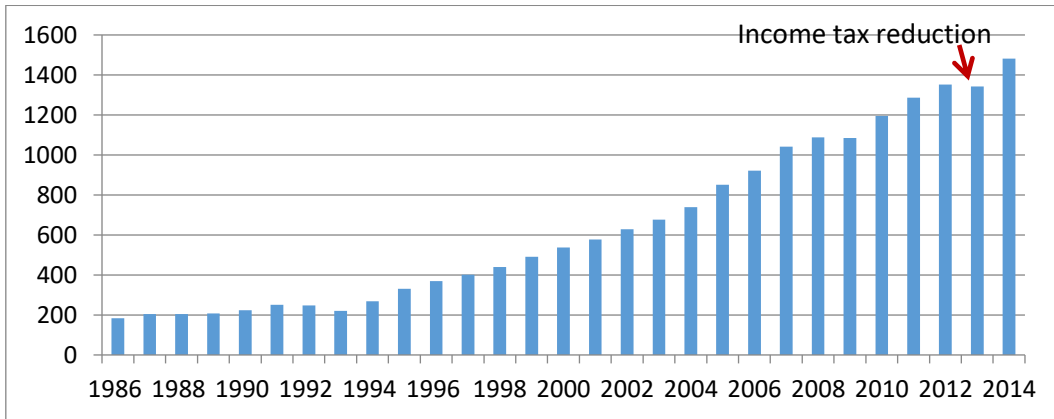
synthetic payment. The details of the taxes that have been subject to this merger are available in Law n ° 2004-12 of 6 February 2004. At the customs end also and in order to improve the country's attractiveness, measures have been taken in the form of economic regimes designed to facilitate the activities of production, storage and transportation of products. Thanks to the measures rolled out since the beginning of the 2000s, the ratio of tax revenue to GDP has increased to exceed 14% in 2007. However, significant room for improvement remains in order to reach the 20% target adopted by the WAEMU as part of the members' commitments agreed in the multilateral surveillance framework. Moreover, the Directorate General of Taxes, which collects the majority of budget revenue collection (around 60%), is committed since 2008 on a new plan through the Strategic Development Plan of the Tax Administration (PDSAF) inspired by international best practices within the framework of a performance contract with the Ministry of Economy and Finance. Under this agenda, indirect tax receipts grew by more than 30 billion CFA Francs every year, except in 2008, due in particular to difficulties related to the arrears of payment of public contracts and their consequences on the withholding tax as well as their effects on the economic activity. At the same time, the economy improved markedly until 2005 thanks to competitiveness gains from devaluation, thus contributing to the good performance in tax revenue collection. This period was followed by a series of shocks that negatively affected the economy (oil and food prices shocks, international financial crisis and crisis of the electricity sector). The average growth rate between 2006 and 2011 was 3.2% against 4.5% during the post-devaluation period. The composition of tax revenues showed a relatively low contribution of direct taxes. The analysis of the revenues they generate reveals a strong contribution of income tax (IR) revenues declared by individuals. IR revenues account for more than 53% of direct taxes collected by the Government between 2009 and 2014. They are almost entirely recovered by withholding tax on salaries (more than 92% of IR) and on remunerations for services paid to third parties (2% of IR). The portrait of the IR is quite revealing of the unbalanced distribution of the Government's revenue. Corporate tax, another major component of direct taxes, represents around 24% of total income taxes, or half of the IR paid by individuals. The contributions to the corporate tax come mainly from a few dynamic industries such as telecommunications and the financial sector, which could be a source of vulnerability. These characteristic features reflect both the difficulty in establishing mass direct taxation and the weight of the informal economy which translates into a narrowness of the tax base. The size of the informal sector is a consequence of a large part of the population. As a result of these obstacles, the tax policy strategy seems to be focused on indirect taxation on consumer goods and services. This is particularly the case with VAT. Its contribution accounts

for 40% of tax revenue during the period 1989-2014. Its share has grown sharply: it rose from roughly 20% in the early 1990s to more than 45% in the middle of the 2000s, before stagnating at almost 41% in the first half of the 2010s. However, its collection remains strongly affected by significant VAT exemptions and credits. In this regard, in 2008, tax expenditures granted under VAT represented almost half of total VAT revenues and more than 3% of GDP. In addition, nearly a third of customs VAT revenue, or about one sixth of overall VAT, comes from the trade of oil. The taxation of oil products has provided, over the last 25 years, more than 13.3% of tax resources. Tax and parafiscal tax levies account for almost half of the price of hydrocarbons.

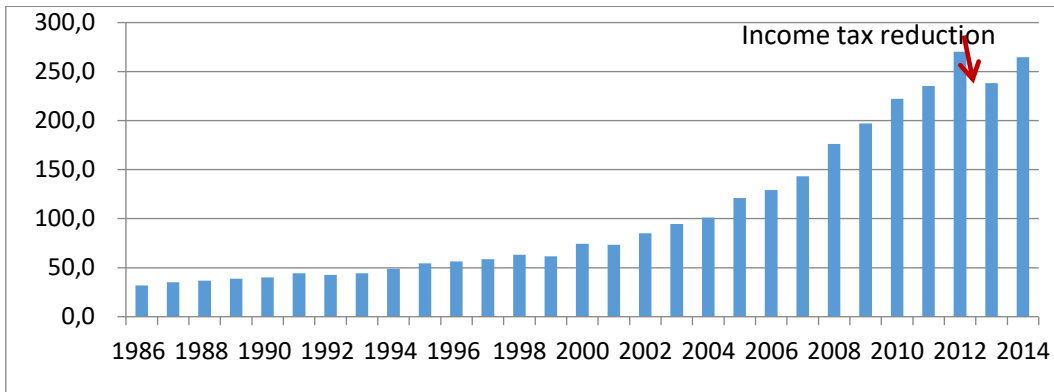
In 2013, the authorities decided to revise entirely the General Tax Code to make it more readable. On the agenda of the reform, as before, simplification is still a priority along with the strengthening the economy's attractiveness and improvement of businesses 'competitiveness'. The main changes introduced were the income tax (IR) reduction the upward revision of the corporate tax (IS) rate from 25 to 30%. A significant decline in IR revenue was noted in the first year of implementation. On The following year, however, both tax revenue collection and economic activity started to pick up. The data from Senegal following the reduction in RI are consistent with a Laffer effect even if it is difficult to isolate with precision to what extent the tax reduction is responsible for the upturn in activity and the widening of the tax base as suggested by the theory. In fact, it is one of the limits of the Laffer curve. Finally, the Government of Senegal has engaged in a major reform that should significantly help reduce tax fraud. Indeed, the innovation consists in a single identifier common to taxes, customs and the Treasury providing a better visibility of activities. In fact, tax declarations can thus be confronted with imports transactions at customs and with public market information.

Figure 5 : Income tax reduction

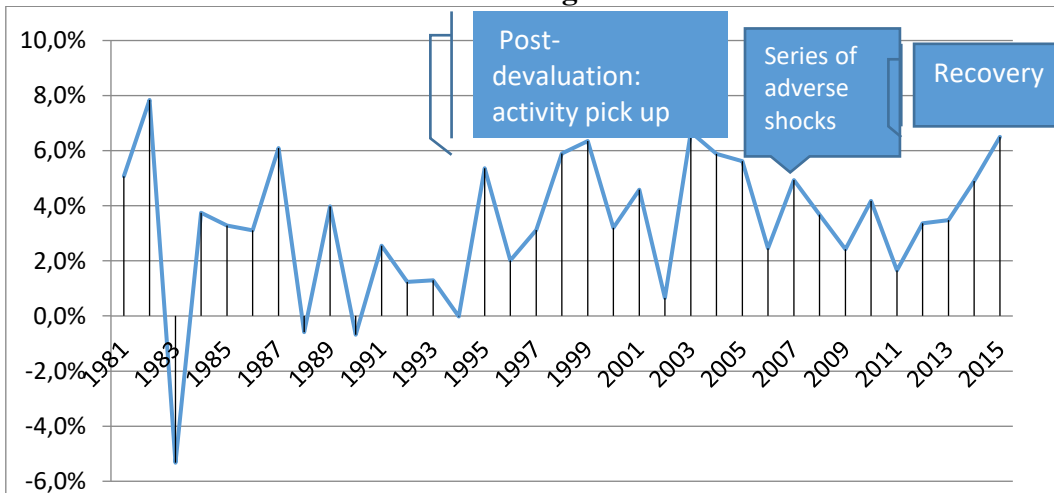
Tax revenue



Income tax



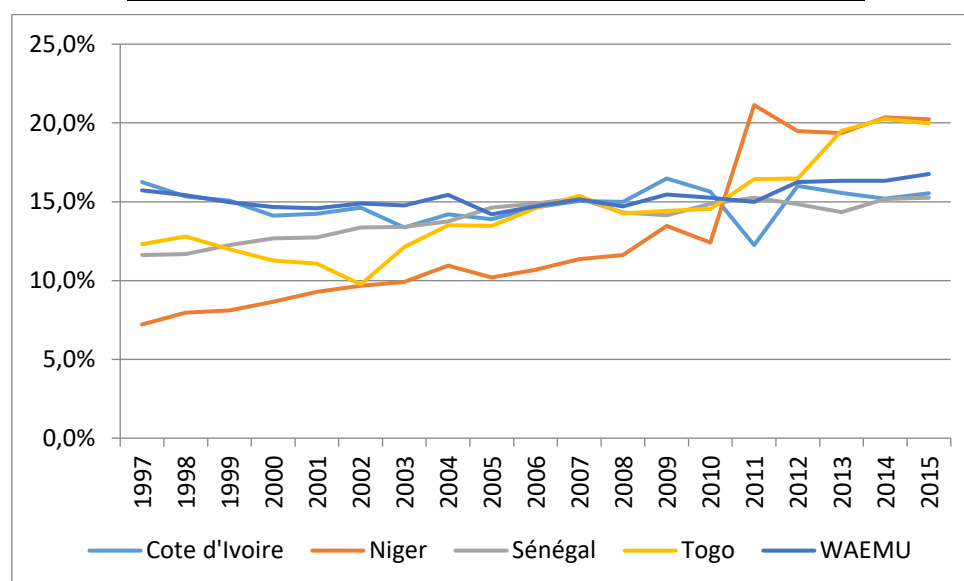
Real GDP growth



III.2. Comparing tax revenues in the WAEMU area

Senegal is below the average of the WAEMU member countries in terms of tax revenue collection as a percentage of GDP between 1997 and 1999. With an average tax revenue ratio of 11.6% between 1997 and 1998, it only outperforms Niger. From 1999, Senegal and Togo are the second best performing after Côte d'Ivoire. Subsequently, thanks to the reforms undertaken in particular at community level as well as efforts to simplify taxation, Senegal remained in second position with 13.2% on average over the period 2000-2005; Côte d'Ivoire still ahead of the other members. However, from 2006, Senegal was caught up by Togo. The two countries obtained comparable results until 2010 (14.4% on average); Côte d'Ivoire still leading the race. The oil exploitation contributed to put Niger on top in 2011, followed by Togo, while the Cote d'Ivoire was suffering from the effects of the political crisis. However, it obtained better results than Senegal except in 2011 and 2014. Togo's ratio on the other hand, exceeds the 20% target and achieved the same performance as Niger in 2014 thanks to a major reform of public finances creating the Togolese Revenue Office. This entity brings together all tax bodies.

Figure 6 : Tax revenue in WAEMU from 1997 to 2016



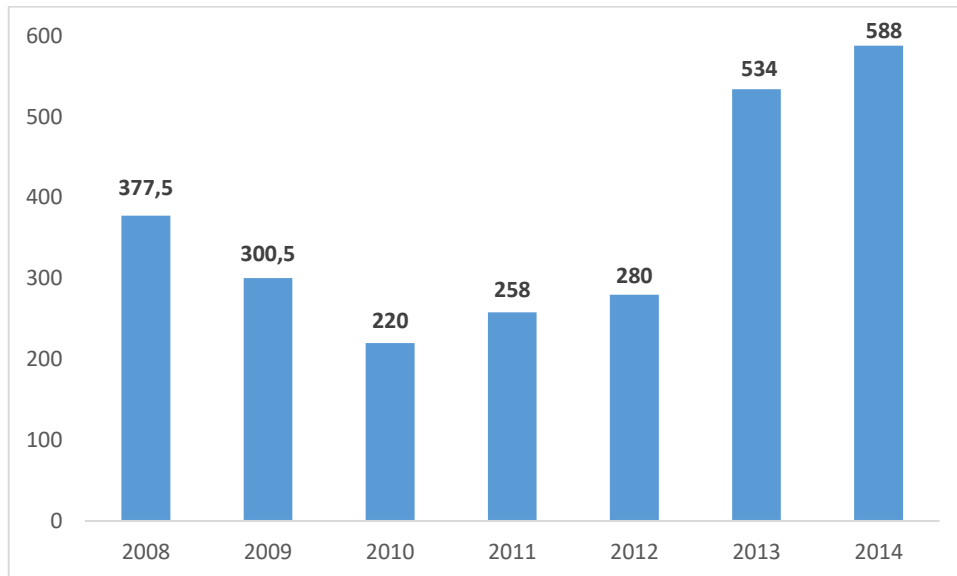
Source: BCEAO

III.3. COST OF TAX EXPENDITURES

Some firms and households benefit from favors from public authorities in the form of tax exemptions or reductions to stimulate private investment or improve household purchasing power. To that extent, the graph in figure 8 shows that the total amount of tax expenditures was CFAF 377.5 billion in 2008, which corresponding to 34.7% of foregone tax revenue. They

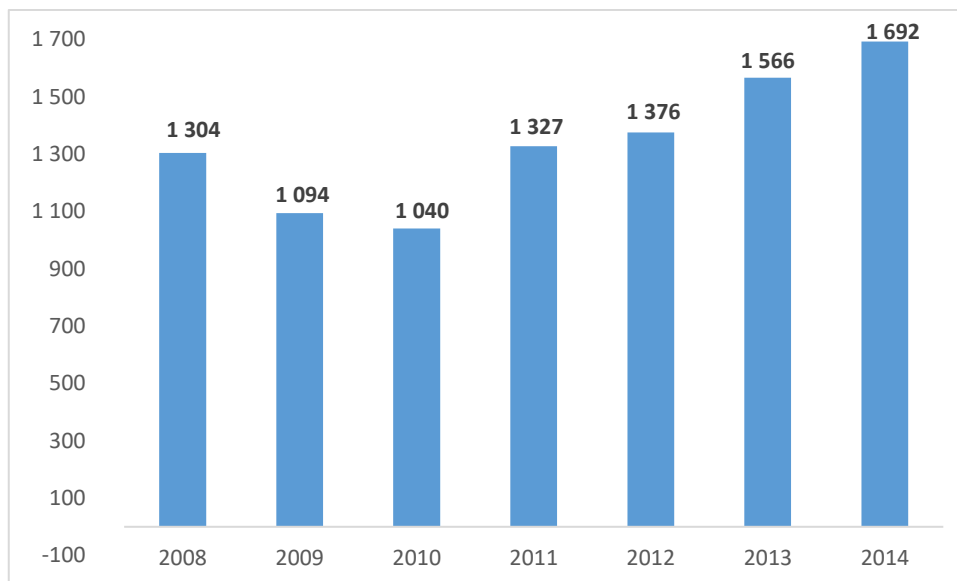
decreased between 2009 and 2010, going from 300 to 220 billion. Thus, the revenue margin attributable to tax expenditures fell from 27.7% in 2009 to 18.4% in 2010. This decrease is mainly explained by the drop of indirect tax expenditures resulting which fell by 39.2% between 2009 and 2010, while indirect taxes increased by almost 3% for the period. However, this downward trend in tax expenditures was reversed between 2010 and 2014. Indeed, they went from 220 billion in 2010 to 588 billion in 2014. The increase in tax expenditures over the period 2008-2010 is partly due to the increase in the favors granted under direct and indirect taxes by 8%. On the other hand, over the period 2013-2014, the significant increase in tax expenditures is explained, among other things, by changes in the economic situation, the greater availability of analytical data and changes in methods and approaches (report 2013 and 2014 tax expenditures). Despite the high cost of these public expenditures, their evolution remains in line with private investment trend as shown in Figure 7.

Figure 7 : Tax expenditures (billions CFA) between 2008 and 2014



Source : *Tax expenditures evaluation reports 2012, 2013, 2014*

Figure 8 : Private investment (billion CFA) between 2008 and 2014



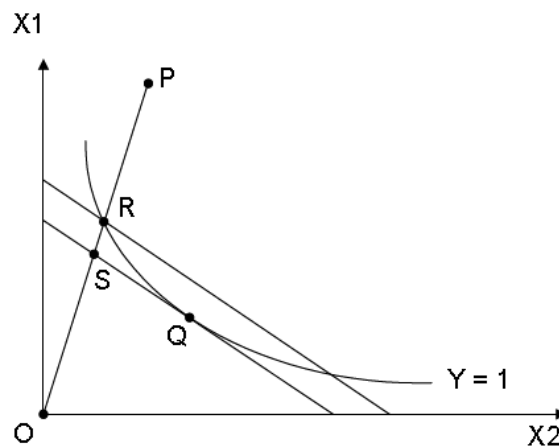
Source : *DPEE*

IV. METHODOLOGY

The approach adopted in this study is inspired by the work of Aigner, Lovell and Schmidt (1977), Kumbhakar and Lovell (2000), Kumbhakar (2001) and Greene (2005) who have

developed stochastic frontiers of efficiency. The reasoning of these authors is based on the assumption that output is suboptimal. These authors indeed propose a more realistic vision than that of the neoclassic by considering the possibility firms make mistakes in the production process. They specify a model in which output is affected by inefficiency related to mistakes made by the firm. In order to understand the sources of the producer's errors, one must turn to the pioneering work of Farrell (1957) who identified two types of inefficiency that can affect the output level and move it away from its optimal position. He thus laid the theoretical foundations for stochastic efficiency frontier models and influenced the work of the aforementioned authors. The two inefficiencies considered by Farrell are illustrated in Figure 9:

Figure 9 : Technical and allocative inefficiencies



The producer may exceed the amount of input necessary to reach a given output level. In other words, he could have saved money and thus avoided the waste of resources. This situation corresponds to what Farrell calls technical inefficiency. It is illustrated in the graph of figure 1. Indeed, the isoquant represented by the curve $Y = 1$ corresponds to the set of optimal combinations of inputs X_1 and X_2 that produce a unit of output. Therefore, the producer at point P used more input than necessary. The distance RP therefore corresponds to the production factors wasted. The gap between points R and P represents the technical inefficiency. The producer can also make the wrong choice of inputs given their prices and marginal productivity. Farrell calls this the allocative inefficiency. It is illustrated in the graph of figure 1 by the distance RS . Indeed, the point Q of tangency between the isoquant and the total cost line or isocost represents the optimal production which minimizes the factor costs.

Thus, the margin of reduction in costs by the producer corresponds to allocative inefficiency. In the context of this study, the collection of tax revenue is assimilated to a production activity to which the principle of stochastic frontier efficiency models is applied. The objective of this regression is to find the maximum level of revenue collection that can be achieved given certain characteristics of the economy, including the level of the tax base, the degree of corruption, the size of the informal sector, the quality of institutions etc. The stochastic frontiers method compares to simple panel data estimates but brings significant improvements. Indeed, the latter have the disadvantage of providing an average level of collection on the sample. Therefore, the tax effort (represented by the error term) of a given revenue tax line is compared to the average of the residuals which by construction is zero. Thus, when the tax effort is positive, the collection level is higher than the average behavior and vice versa in the case of a negative residue (Chambas and Brun, 2010). Therefore the interpretation of the results of such a model suffer from weaknesses and does not give the maximum level of collection. On the other hand, the stochastic frontier technique provides the maximum level that the economy can generate in taxes given its different characteristics. The origins of this method is the production frontier estimates (Farrell, 1957). Furthermore, according to Alfirman (2003) and Pesino and Fenechietto (2010). There are two differences between the production frontier method and the tax potential method. The first is attributable to the fact that in the case of the production frontier model, the independent variables are clearly known (labor and capital), while for the tax potential the determinants are not necessarily identified. The second difference has to do with the inefficiency term. Indeed, in the estimation of the production frontier, the inefficiency term captures only a failure resulting from the sub-optimal behavior of the firm. On the other hand, in the case of tax potential estimates, the inefficiency term incorporates both technical inefficiency and failures related to tax policy. In addition, alternative inefficiency assessment approaches exist in the literature. This is particularly the case with deterministic methods such as Data Envelopment Analysis (DEA) models. These techniques, unlike the stochastic frontier method, suffer from the limit of not specifying a production function and of assimilating any distance from the production frontier to inefficiency. The stochastic frontier model is written as follows:

$$y_{it} = f(X_{it}, \beta) + \varepsilon_{it} \quad (1)$$

With

$$\varepsilon_{it} = v_{it} - u_{it} \quad (2)$$

y_{it} is the revenue collected to GDP for the tax line i in the period t ; X_{it} , the independent variables vector; β are parameters to be estimated ; and ε_{it} is the error term. The latter is split up in two components: v_{it} is a white noise and $v_{it} \geq 0$ is the inefficiency term. Hence, the stochastic frontier is $f(X_{it}, \beta) + v_{it}$. In what follows, a log linear form for the equation (1) is adopted:

$$\log(y_{it}) = \beta_0 + \sum_{j=1}^k \beta_j \log(X_{jit}) + v_{it} - u_{it} \quad (3)$$

X_j are the explanatory variables of the level of tax collection according to the revenue line considered, in particular tax base. Thus, for corporate tax, the gross operating surplus should be a good fit. Income tax should be explained by disposable income. Final consumption will be used to explain VAT collection. Import duties and VAT will be assessed based on imports of goods and services.

V. RESULTS

The tax revenue collection function specified according to equation 1 is estimated using panel data over the period 2000-2017. The tax lines considered in this work are corporation tax (IS), income tax (IR), VAT, non-oil customs duties, and customs duties on petroleum products. The choice of these tax headings is based on their weight in total tax revenue. Indeed, the sample of revenue lines considered in this study is very representative; the total taxes introduced in the estimate of the stochastic efficiency frontier accounting for 78.6% of tax revenue on average over the period 2000-2017 (see table 1):

Table 1 : Taxes' sample

Taxes	Share of total revenue tax (average 2000-2017)
Corporate tax	8.8%
Income tax	14.1%
VAT	39.6%
Custom duties	16.0%
Total	78.6%

Source : *Directory of Treasury and Public Accounting*

The results of the stochastic frontier estimates are presented in table 2

Table 2 : Stochastic frontier estimates

Dependent variable : Tax collection		
Sample size : 90		
Explanatory variables	Coefficients	P-value
Constant	-5.21***	0.002
Tax base	1.51***	0.000
Indic 2004	0.15*	0.082
Indic 2012	0.05	0.379
Agriculture share in GDP	-3.14	0.197
Size of the informal sector	-2.92	0.509
Likelihood ratio test	65,01	

Note : ***, ** et * respectively indicate the significance of the coefficients at 1, 5 and 10% respectively. The likelihood ratio test checks the overall significance of the model. It compares the value of the maximum log likelihood generated by the model to that of a model explained by a constant only. Indic2004 and Indic 2012 are dummy variables corresponding to years when tax reforms occurred..

The determinants of tax collection used to estimate the stochastic efficiency frontier are the tax base, the share of agriculture in GDP and the share of the informal sector in the economy, as well as dummy variables capturing tax reforms' years. These variables were selected based on data availability. The likelihood ratio test statistic indicates that the equation is globally significant. The parameter associated with the tax base has the expected sign and has a significant effect on tax revenue collection for the various lines considered. In other words, tax collection is positively and significantly influenced by the size of the tax base. From the tax

collection estimates, technical efficiency parameters are generated. These correspond to the distance to the efficiency frontier for the separate taxes. Table 3 shows the improvement rooms for our sample:

Table 3 : Technical inefficiency terms

Taxes	Inefficiency parameter
Corporate tax	1.29
Income tax	7.08
VAT	0.43
Non oil custom duties	0.17
Oil custom duties	1.17
Total	10.15

Income tax is the most affected by technical inefficiency. The estimated value of the technical inefficiency parameter associated with IR is 7.08. This result shows a possible collection expansion of IR taxes as a percentage of GDP of 7.08 points. This gap from the efficiency frontier could be explained in particular by the workforce in the informal sector, fraud and tax evasion, but also by the favors granted by the Government like exemptions. As such, IR exemptions represent 25.3% of total tax expenditures in 2014, or 63.5% of total IR revenue and 1.5% of GDP (report on the assessment of tax expenditures, 2014). The second least efficient tax line the corporate tax (IS). The estimated inefficiency term for this tax is 1.29. This figure reflects a room for improvement in the ratio of IS to GDP of 1.29 percentage points. This result could in particular be attributable to exemptions, to informal sector activities that escape taxation, as well as tax evasion. As a reminder, the informal sector generates an estimated value added of CFAF 4,837 billion representing 39.8% of GDP (source ANSD, 2017). As for exemptions under the corporate tax, they account for 0.4% of GDP according to the tax expenditure assessment report for 2014.

Tariffs on petroleum products are the third furthest tax line from the efficiency frontier. The deviation from the potential is measured at 1.17. This figure indicates that the ratio of tariffs on petroleum products to GDP could be improved by 1.17 percentage points. This result could be attributed in particular to tax expenditures, fraud and tax evasion. Tariffs on petroleum

products are followed by VAT when it comes to exposure to technical inefficiency. In this regard, the distance separating VAT collection to the efficiency frontier is estimated at 0.43 percentage point. In other words, this value means that the ratio of VAT to GDP could be improved by 0.43 percentage point. This result could be explained in particular by the favors granted by the Government in the form of exemptions to VAT and for tax evasion and avoidance. In this regard, VAT tax expenditures represent 37.8% of VAT revenues and 2.2% of GDP in 2014. In addition, non-petroleum custom duties have the best performance in terms of collection. Indeed, this is the tax line that suffers the least from technical inefficiency. The technical inefficiency parameter associated with this tax is estimated at 0.17. This result means that the effort to reach the potential for this tax line coincides with a 0.17 percentage point increase in the ratio of non-oil custom duties to GDP.

The overall margin for tax revenue expansion as a percentage of GDP for the tax lines sample is estimated at 10.15 points. This result reflects a significant tax effort to be mobilized to improve tax collection. The main source of deviation from the tax potential is undoubtedly the significant weight of tax expenditures. Indeed, they accounted for 39.7% of tax revenue in 2014, or 6.02% of GDP. Moreover, the revenue losses due to the informal sector also help to explain the gap from the potential. Among the factors explaining the gap between collected revenue as a share of GDP and tax potential, fraud and evasion are difficult parameters to quantify. Nevertheless, qualitative elements make it possible to assess these behaviors based on data from the satisfaction survey of DGID users (ESAU-DGID). This survey was carried out in 2012 by the National Agency for Statistics and Demography (ANSD) on behalf of the DGID. Thus, from a representative sample of taxpayers at the national level, ESAU-DGID shows that 94.4% of taxpayers regularly declare their activity. In addition, among those taxpayers who regularly meet their reporting obligations, 94.9% regularly pay their taxes. In addition, the survey also provides information on the quality of DGID services, approximated by the level of satisfaction of taxpayers. These data may also to some extent possibly explain the propensity to defraud. It should be also noted that DGID has made efforts to improve its services to taxpayers. ESAU-DGID is a step towards that direction. Data are aimed at being used to help DGID improve the quality of its services. Satisfaction is therefore assessed through criteria detailed in table 4.

Tableau 4 : Taxpayers satisfaction

Criteria	Satisfied taxpayers (%)
Access to services	87,5
Reception and guidance	70
Phone reception	70,7
Search for information at DGID	64,4
Time to deal with procedures	60

Source : ESAU-DGID

Globally, taxpayers are satisfied with services offered by the DGID. In addition, the survey enabled the tax administration to identify priorities for improving the quality of services based on taxpayers' opinion. Thus, they believe that awareness should be on top of the actions to be carried out by the tax administration. The second priority according to the taxpayers relates to the shortening of the processing times. According to the interviewees, DGID should also place more emphasis on the development of tele-declaration and the electronic payment of taxes. Based on this information, the DGID has undertaken communication and awareness-raising actions through the media (for example the "DGID minute"). Finally, deviations from the efficiency frontier generated by the model can be used to measure in nominal terms the margins for improving of tax revenue collection. These amounts calculated for 2017 are presented in the following table:

Tableau 5 : Tax potential

Taxes	Tax revenue collected in 2017 (billion CFAF)	Tax revenue collected in 2017 (% of GDP)	Inefficiency term	Tax potential (% of GDP)	Tax potential (billion CFAF)
Corporate tax	191.7	1.6	1.29	2.9	348.5
Income tax	304	2.5	7.08	9.6	1164.9
VAT	691.8	5.7	0.43	6.1	744
Non-oil Custom duties	245.3	2.0	0.17	2.2	266
Oil custom duties	18.15	0.1	1.17	1.3	160.4
Total	1845	15.2	10.15	25.3	3079.1

The tax potential is estimated at 3,079 billion in 2017, or 25.3% of GDP against actual tax revenue collection amounting to 1,845 billion corresponding to tax revenue ratio of 15.2% of GDP. In other words, the Government could have collected 1234 billion in additional taxes, which represents a margin of increase or tax effort of 66.9% if it wasn't for technical inefficiency.

VI. CONCLUSION

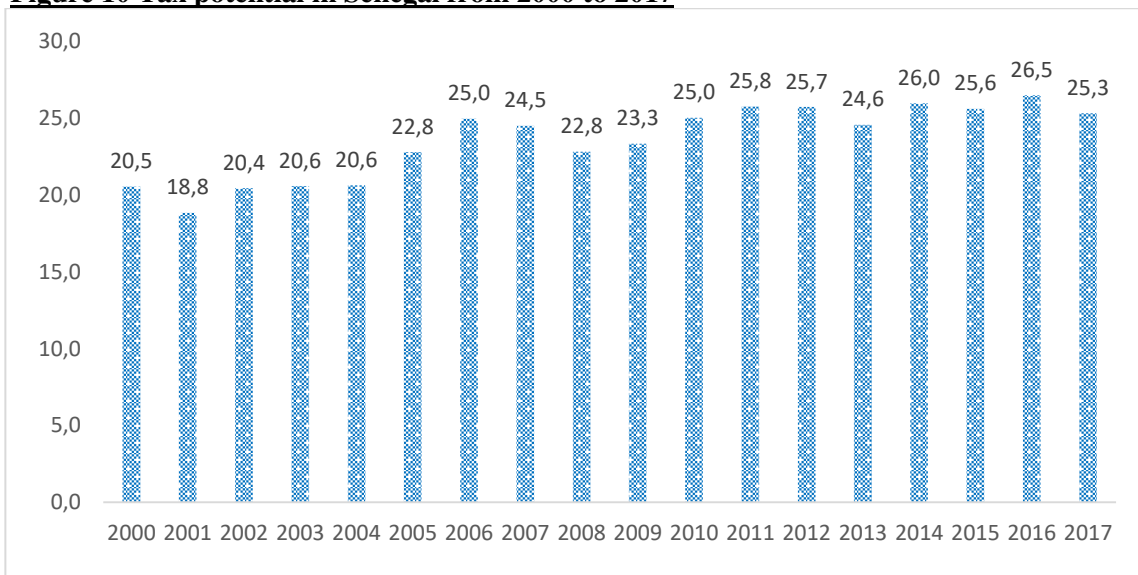
This study purpose has been to measure tax potential for Senegal. It is a top priority issue especially in the context of resource scarcity. Tax revenue in Senegal is characterized by a composition is dominated by indirect taxes levied on foreign trade. However, their share tends to decrease over time, particularly under the effect of trade liberalization measures. The stochastic frontier efficiency model approach was adopted considering the main tax lines i.e. VAT, corporate tax, income tax, import duties on petroleum products and import duties excluding petroleum products. The results show overall margins of increase in tax revenue as a percentage of GDP estimated at 10.15 points, or a tax potential of 25.3% of GDP for the year 2017. Senegal thus realizes a lower performance than the median country from " a sample of 23 countries in Sub-Saharan Africa and for which the untapped tax potential is between 3 and 6.5 percentage points (IMF, 2015). In addition, the margins of tax revenue increases were estimated according to the different tax lines. Thus, the IR collection is the least efficient with the possibility of increasing the levy level by 7.08 percentage point. The line showing the best results corresponds to import duties excluding petroleum products for which the margin for improvement is estimated at 0.1 percentage point. The factors at the origin of the underperformance of the IR collection could be in particular the informal sector workforce, fraud and tax evasion and the favors granted by the Government in the form of exemptions under the IR. These presumed reasons call for recommendations in the sense of better taking into account the informal sector, strengthening tax control and rationalizing tax expenditures which account 39.6% of tax revenue and 6.02% of GDP. In this regard, a better allocation of tax expenditures could consist in particular in making savings on IR exemptions. Indeed, these are costly (they represent 1.5% of GDP) while the performance of the IR collection is the furthest from the potential. In addition, to better take into account the informal sector, the tax administration would benefit from continuing efforts to raise awareness of tax obligations as well as simplifying the tax system. Efforts aimed at strengthening collaboration between customs, the Treasury and taxes must continue, in particular the cross-referencing of data

between institutions through a unique identifier. Indeed, such a device constitutes an effective tool in the fight against fraud by making it possible in particular to compare the turnover declared to imports and public market data.

Finally, in general, measures aimed at modernizing the tax administration should be encouraged. Indeed, they contribute in enhancing its efficiency and attractiveness for a better mobilization of tax revenues.

APPENDIX

Figure 10 Tax potential in Senegal from 2000 to 2017



Source : Authors' calculations

REFERENCES

Ahlerup, P., T. Baskaran and A. Bigsten (2015), « Tax Innovations and Public Revenues in Sub-Saharan Africa », *The Journal of Development Studies*.

Aigner, D. J., C. A. K. Lovell and P. Schmidt (1976), « Formulation and estimation of stochastic frontier production function models », *Journal of Econometrics*, 6, pages 21-37

Alfirman, L. (2003), « Estimating Stochastic Frontier Tax Potential: Can Indonesian Local Governments Increase Tax Revenues Under Decentralization? », Center for Economic Analysis, Working Paper N° 03-19.

Andreoni, J., B. Erard, and J. Feinstein, (1998), « Tax Compliance », *Journal of Economic Literature*, vol. 36, June, pages 818 – 860.

Bardsley, P., (1996), « Tax compliance games with imperfect auditing », *Public Finance*, vol 51, n°4 supplement, pages 473-89.

Bird, R. M., J. M. Vazquez and B. Torgler, (2014), « Societal Institutions and Tax Effort in Developing Countries », *Annals of Economics and Finance* N° 15-1, pages 185-230.

Bello, K. B. and I. Danjuma, (2003), « Review of Models/Theories Explaining Tax Compliance Behavior », Department of Management Technology, Modibbo Adama University of Technology.

Chambas, G. and J. F. Brun, (2010), « Evaluation du potentiel de recettes publiques », Banque Africaine de Développement.

Davoodi, H. R. and D. A. Grigorian, (2007), « Tax Potential vs. Tax Effort: A Cross-Country Analysis of Armenia's Stubbornly Low Tax Collection », International Monetary Fund, Working Paper N°07/106.

De Soto, H. (1989), « The Other Path: The Invisible Revolution in the Third World », Harper and Row.

Diagne, Y. S. and K. Thiaw, (2008), « Fiscalité et Secteur Informel Au Sénégal », Direction de la Prévision et des Etudes Economiques (DPEE), Document d'étude N°09.

Feinstein, J. S. (1991), « An Econometric Analysis of Income Tax Evasion and its Detection », *RAND Journal of Economics*, vol. 22, n°1, Spring, pages 14-35.

Fenochietto, R. et C. Pessino, (2013), « Understanding Countries' Tax Effort », International Monetary Fund, Working Paper N°13/244.

Gberegbe, F. B., G. A. Idornigie et L. O. Nkanbia-Davies, (2015), « Perception of tax Fairness and Personal Income Tax Compliance in Ken Saro-wiwa Polytechnic, Bori », Journal of Economic and Finance, vol 6, issue 6, pages 01-11.

Gupta, A. S. (2007), « Determinants of Tax Revenue Efforts in Developing Countries », International Monetary Fund, Working Paper N°07/184.

Koleva, K. (2005), « A la recherche de l'administration fiscale optimale : l'approche par les coûts d'efficience », Cahiers de la Maison des Sciences Economiques, ISSN : 1624-0340.

Langford, B. et T. Ohlenburg, (2015), « Tax revenue potential and effort: an empirical investigation », International Growth Centre, Working paper 3 aout 2015.

Ndiaye, M.B.O et R.D. Korsu, (2011), « Tax effort in ECOWAS countries », West African Monetary Agency (WAMA).

Pessino, C., et R. Fenochietto, (2010), « Determining Countries' Tax Effort », Hacienda Pública Española/Revista de Economía Pública, Vol. 195, pp. 61–68.

Walsh, K. (2012). Understanding Taxpayer Behaviour—New Opportunities for Tax Administration. The Economic and Social Review, 43(3), pages 451–475.75.