A Stochastic Frontier Estimation of Tax Efficiency in the Economic Community of West African States (ECOWAS)

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Abstract

The objective of this study is to investigate the determinants of non-natural resource tax revenue and estimate its efficiency in ECOWAS countries. A stochastic frontier tax function was estimated using annual data from 2001 to 2015 by use of Maximum Likelihood procedure. The results show that trade openness, financial deepening, and urbanization matter for tax revenue mobilization in ECOWAS, with the first two variables having a positive effect and the latter having a negative effect; tax inertia is found to be strong. The estimated non-natural resource tax efficiencies show that during the period 2001-2015, the tax efficiencies of ECOWAS countries were above 90.0% of their potential,

except for Nigeria, which had 67.7%. The losses in non-natural resource tax revenue due to inefficiencies were generally low, ranging from 0.6% of Gross Domestic Product (GDP) in Sierra Leone to a maximum of 1.8% in Liberia, followed by 1.7% in Cape Verde, Ghana, and Guinea Bissau. In addition, countries with high natural resource taxes tend to have low efficiency on non-natural resource taxes, and this efficiency tends to be high where non-natural resource tax is high. Tax revenue mobilization in the ECOWAS countries should therefore be strengthened through continued policy efforts to improve financial deepening, trade openness and decentralization that can reduce urbanization. It is also imperative for ECOWAS tax authorities to consider the level of their tax potential in setting targets for non-natural resource tax mobilization. In addition, more efforts should be put on raising non-natural resource tax revenue than the volatile natural resource tax. Tax restructuring policies that favour direct tax revenue, especially business income tax, and domestic indirect taxes such as Value Added Tax or Goods and Services Tax should be given priority, as the African tax structure and performance review shows that countries with high shares of direct and domestic indirect tax led on tax GDP ratios.

Introduction

Globally, tax revenue mobilization is considered an important activity of government as it is expected to improve government effectiveness in service delivery and government accountability. In developing countries, it reduces the probability of strong aid dependency. Effective tax systems have, therefore, always been desired by all economies. It is globally recognized that investment in human and physical capital is important to sustainable growth. However, in Sub-Saharan Africa, there have often been limited resources to invest to ensure robust and sustained growth. Rooted in this, some donor partners of the developing countries have interest in the restructuring of tax systems to boost tax performance. Interest in tax mobilization thus remains important in the developing economies. The mobilization of tax revenue a key resolution adopted at the Third International Conference on Financing for Development held in New York in July 2015, which emphasized the need to mobilize resources for development in post-2015. However, what a government should raise from tax (target) and what it can raise (capacity) are different, making the efficiency of tax system imperative to policy makers in Sub-Sahara Africa, where tax revenue (% of GDP) is low for a number of countries, which is also the case for a number of developing countries.

Governments have the obligation to spend on social services for the well-being of the people, and they also spend in other areas to run the State. The expenditure can be recurrent or capital, but they must be financed by revenue from the domestic economy or abroad. However, domestic resource mobilization is more important than foreign resource mobilization on the basis that foreign resource mobilization (grants and loans)

is volatile. They are volatile because, among others, they depend on the performance of the economies where the resources come from. In addition, in the case of loans, domestic currency depreciation increases the burden of debt servicing in domestic currency terms. In this regard, domestic resource mobilization, especially taxation, is an important instrument for financing government expenditure. This is more important in countries of the Economic Community of West African States (ECOWAS)[1] given the need for more resources for the relaxation of infrastructural gap, and for poverty alleviation.

The Economic Community of West African States (ECOWAS) has various regional integration protocols, including trade integration under the ECOWAS Trade Liberalization Scheme (ETLS) and Common External Tariff-CET (under the ECOWAS CET), and are working towards monetary integration. However, the 15 countries as a group do not have a common tax regime while, among them, there is a sub-union of eight (8) countries which has common directives on taxation.[2]

Based on the data from World Bank's African Economic Outlook and World Development Indicators, there has been improvement in tax performance of ECOWAS member States, especially since the early 2000s. However, the tax-GDP ratio remains low. For example, the number of ECOWAS countries with tax-GDP ratios above the median of the African tax-GDP ratio increased from six (6) during the period 2001-2005 to nine (9) during the period 2011-2015. The number of ECOWAS countries above the average of the African tax-GDP ratio increased from three during the period 2001-2005 to five during the period 2011-2015, and the number of ECOWAS countries below the African bottom 25% of tax-GDP ratio reduced from four (4) during the period 2001-2005 to three (3) during the period 2011-2015. In addition, the median tax-GDP ratio of the ECOWAS countries increased from 11.5% during the period 2001-2005, to 14.9% during the period 2011-2015 and the average increased from 11.3% during the period 2001-2005 to 14.1% during the period 2011-2015.

The number of ECOWAS countries that were in the top 25% of African tax-GDP ratio remained at three (3) during the periods 2001-2005, 2006-2010 and 2011-2015. These countries were Cabo Verde, Ghana, and Senegal during the period 2001-2005, Cape Verde, Senegal, and Liberia during the period 2006-2010 and Niger, Liberia and Togo during the period 2011-2015. However, none of these countries were in the top 15% of the African tax-GDP ratio. Moreover, Nigeria which has more than 80% of the GDP of ECOWAS and the largest economy in Africa, consistently remained below the bottom 25% of African tax-GDP ratios.

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1   The ECOWAS consists of 15 out of 16 West African countries, which are Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The West African country that is not part of ECOWAS is Mauritania.

2   These countries are referred to as the West African Economic and Monetary Union (WAEMU)) and use a common currency with fixed parity to the Euro (the CFA).

During the periods 1996-2000, 2001-2005, 2006-2010 and 2011-2015, the African countries that were consistently in the top 15% of the distribution of the African tax GDP-ratios were Lesotho, Namibia, South Africa, Swaziland, Seychelles, and Morocco. Cape Verde, which is the only country from ECOWAS in this list, was in the top 15% for only the period 2006-2010. During the period 2011-2015, the countries in the top 15% of African tax-GDP ratios were Lesotho (38.4%), Morocco (21.9%), Namibia (28.6%), Seychelles (25.9%), South Africa (24.9%), Swaziland (27.4%) and Zimbabwe (23.3%). These observations suggest that tax revenue is low in the ECOWAS countries, with median and average tax-GDP ratio being 14.9% and 14.1%, respectively, during the period 2011-2015.

Considering these observations from the ECOWAS tax performance, important research questions worthy to consider in ECOWAS are:

• What are the determinants of tax revenue ?

• What is the degree of efficiency in tax revenue mobilization?

The broad objective of this study is therefore to investigate the tax efficiencies of the various ECOWAS member States and the specific objectives are: to investigate the determinants of tax revenue in ECOWAS; and estimate the degree of efficiency of tax revenue mobilization in ECOWAS.

There are a number of studies on tax efficiency estimation, which include the stochastic efficiency estimations by Bothole (2010) who used corruption and voice and accountability among the regressors of a sample of 46 countries in Sub-Sahara Africa, with data from 1990 to 2007; Fenochietto and Pessino (2013) who included a measure of income inequality and public expenditure on education among the traditional variables, and Langford and Ohlenburg (2016) who included Massachusetts Institute of Technology's economic complexity index and ethnic tension, and private sector credit to the model variables.

Despite the recent interest in tax efficiency estimation, there is no study that focuses specifically on all or only the ECOWAS countries, even though tax mobilization is still challenging in the region. The study focuses on estimation of tax revenue frontier and efficiency by using only non-natural resource taxes, since the natural resource component is volatile. It also includes natural resource tax revenue as an explanatory variable to capture the responsiveness of non-natural resource taxes to changes in natural resource tax revenue. The possibility of the existence of tax revenue inertia, which is the tendency for tax revenue to continue increasing once it has increased, is also tested. In addition, considering that real GDP and not GDP per capita reflects the effect of changes in tax base on tax revenue, real GDP is used to capture the impact of tax base. The study considers only the ECOWAS counties, given the tax mobilization challenges in the region.

Tax performance and structure of ECOWAS

The median non-natural resource tax revenue (% of GDP) for the African countries was 10.8% during the period 1996 to 2000. It increased to 11.8% during the period 2001-2005 to 13.1% during the period 2006-2010 and to 14.4% during the period 2011-2015. The average for the African countries, which was 14.8% during the period 1996-2000, was also 14.8% during the period 2001-2005, which increased to 15.6% during the period 2006-2010 and to 16.7% during the period 2011-2015. This suggests that non-natural resource tax revenue (% of GDP) for the African countries was on a rising trend during the period 1996 to 2015.

The rising trend observed for Africa was also observed in the countries of the Economic Community of West African States (ECOWAS). In ECOWAS, the average non-natural resource tax revenue increased from 10.4% of GDP during the period 1996-2000, to 11.3% during the period 2001-2005, to 12.2% during 2006-2010 and to 14.1% during the period 2011-2015. The median non-natural resource tax-GDP ratio for ECOWAS also followed a rising trend, with 11.1% during 1996-2000, 11.5%, 13.5% and 14.9%, respectively, during the periods 20001-2005, 2006-2010 and 2011-2015. These figures imply that despite the rising trend in non-natural resource tax performance in the ECOWAS countries as a percentage of GDP, it remains low in the region.

During the period 1996-2000, only one ECOWAS country was among the top 25% of the tax-GDP ratio of African countries, which was Cape Verde. During the period 2001-2005, Ghana and Senegal joined Cape Verde from ECOWAS to be in the top 25% of African tax performance. While Cape Verde and Senegal remained in the top 25% of African tax-GDP ratio during the period 2006-2010, Ghana was no longer among the group and Liberia joined Cape Verde and Senegal in the top 25% of African tax-GDP ratio. During the period 2011-2015, Niger and Togo added to the African top 25% group, both Cape Verde and Senegal were out of it and Liberia remained in the group. This also implies that there has been improvement in the performance of some countries, but the good performance of some countries was not sustained for up to a decade, except for Cape Verde and Senegal.

During the period 2011-2015, the countries in the top 15% of African tax-GDP ratios (excluding natural resource taxes) were Lesotho (38.4%), Namibia (28.6%), Swaziland (27.4%), Seychelles (25.9%), South Africa (24.9%), Morocco (21.9%) and Zimbabwe (23.3%). These were the countries in the top 15% during the periods 1996-2000, 2001-2005 and 2006-2010, with Cape Verde replacing Zimbabwe during the period 2006-2010. Although Nigeria is the largest economy in Africa and has more than 80% of the GDP of ECOWAS, it is not among the countries in the top 15% of African tax-GDP

ratio. Moreover, while Cape Verde has the highest per capita income in ECOWAS, it was among the top 15% of the African tax GDP ratios only during the period 2006-2010 and it had the least in the group.

Conclusion and policy recommendation

Domestic revenue mobilization, in which tax revenue is an important element, is critical to the financing of infrastructure for development and the growing government expenditure of States. In the ECOWAS countries, tax revenue mobilization is a challenge despite the need for infrastructural development and poverty reduction. The study sought to estimate tax efficiencies in ECOWAS member countries. The focus was on non-natural resource taxes since it does not depend on export commodity prices, implying that it can be relied upon for long term planning. In addition, it is predictable and sustainable when its mobilization is well designed.

A Stochastic Frontier tax function for non-natural resource tax was estimated using annual data from 2001 to 2015. The estimation was done in the spirit of the Maximum Likelihood approach in the context of technical efficiency estimation proposed by Aigner, Lovell and Schmidt (1977); Battese and Coelli (1992) and applied by Fenochietto and Pessino (2013) in the tax literature. The tax efficiencies were then obtained as the ratio of actual tax-GDP ratio to the estimated potential or maximum tax-GDP ratio. This approach is preferred to the average regression in panel and time series regression, which estimates average regression instead of a maximum (frontier) regression and does not allow for strictly positive inefficiency terms.

The results show that there is persistence in mobilization of non-natural resource taxes, and financial deepening, openness to trade and urbanization significantly determine tax revenue in the ECOWAS countries. While openness and financial deepening have positive effects, urbanization has a negative effect. In addition, agricultural share of GDP, inflation and real GDP are insignificant when we account for the impact of lagged dependent variable and other lags, though significant in the static model. The result further shows that the coefficient of the inertia term (lagged tax-GDP ratio) is 0.80, suggesting that higher (lower) tax GDP ratio has a higher tendency to be replicated in the following year.

Natural resource tax revenue has a positive effect on non-natural resource tax revenue but, after a year, the impact is diminished, though the overall impact remains positive. This suggests that resources from natural resource taxes do not go much into building non-natural resource tax revenue in ECOWAS on a sustainable basis. In addition, countries with high natural resource tax revenue tend to be associated with low efficiency on non-natural resource taxes, and high non-natural resource tax countries tend to be associated with higher tax efficiencies on non-natural resource tax. The

results of the tax efficiency estimates show that actual tax-GDP ratios for non-natural resource taxes of the ECOWAS countries were more than 90% of their potential during the period 2001 to 2015, with the exception of Nigeria, which was below 70%.

As the tax efficiency estimates show that tax efficiencies in the ECOWAS countries are generally above 90%, tax authorities in the ECOWAS member countries should leverage on factors that can shift the tax frontier, thereby having higher tax revenue under the same efficiency. Moreover, because the efficiency figures do not have much disparity, it is important for the authorities to coordinate tax policies in an effort to keep the closeness in tax efficiencies among countries as they work on a strong Free Trade Area and Customs Union, with the ultimate aim of a common market and monetary union.

Because natural resource tax does not have a sustainable impact on non-natural resource taxes, it is useful for the countries to lower the shares of natural resource taxes in total taxes by putting in place more mechanisms to improve on non-natural resource tax collection. This is more important as high natural resource tax tends to be associated with low efficiency on non-natural resource tax. This can be done by giving more weight to policies focused on increasing direct tax revenue (such as business income tax) and domestic indirect taxes (such as the Value Added Tax or the Goods and Services Tax). This is imperative as the African tax structure and performance review also shows that periods and countries with high direct and domestic indirect tax shares led on tax GDP ratios.

Given the positive effects of financial deepening on tax-GDP ratio, further efforts to deepen the financial sector to increase monetization and financial inclusion are imperative. Strengthening of trade openness efforts is also useful, which include policies that can constrain non-tariff barriers, as trade openness has a positive effect on tax-GDP ratio. Efforts at decentralization that can reduce urbanization are important in the ECOWAS region, as urbanization has a negative effect on tax revenue.

References

Aigner, D. J., Lovell, K.C.A and Schmidt P. 1977. "Formulation and estimation of Stochastic Frontier Production Function models", *Journal of Econometrics*, Vol. 6: 21–37.

Barros C. P. 2005. "Performance measurement in tax offices with a Stochastic Frontier model", *Journal of Economic Studies*, Vol. 32: 497–510.

Battese, G. and Coelli, T. 1992. "Frontier production functions, technical efficiency and panel data: With application to paddy farmers in India", *Journal of Productivity Analysis*, 3: 153-169.

Bothole T. D. 2010. Tax effort and the determinant of tax ratio in Sub-Sahara Africa. International Conference on Applied Economics Athens, Greece. August 26–28, 2010,

Brun J. F., Chambas G. and Mansour M. 2014. "Tax effort of developing countries: An alternative measure", in M. Boussichas and P. Guillaumont (eds), Financing *sustainable development by addressing vulnerabilities* Paris: Economica.

Chelliah, R.J., Baas, H. J and Kelly, M.R. 1975. "Tax ratios and tax effort in developing countries, 1969–1971", *IMF Staff Papers*, Vol. 22, No. 1: 187–205.

Fenochietto, R. and Pessino, C. 2010. "Determining countries' tax efforts", *Hacienda Publica Espanola/ Revista de Economia Publica*, Vol. 195: 61–83.

Fenochietto, R. and Pessino, C. 2013. Understanding countries' tax effort. International Monetary Fund Working Paper WP/13/244.

Kumbhakar, S. and Lovell, K. 2000. *Stochastic Frontier Analysis*. Cambridge: Cambridge University Press.

Langford, B. and Ohlenburg, T. 2016. "Tax revenue potential and effort: An empirical investigation. IGC Working Paper, S-43202-UGA-1.

Lotz, J.R. and E.R. Morss. 1967. "Measuring tax effort in developing countries", *IMF Staff Papers*, Vol. 14: 478–499.

Martinez-Vazquez J. 2001. Mexico: An evaluation of the main features of the tax system. International Studies Programme Working Paper 01–12, Atlanta, Georgia, Andrew Young School of Policy Studies.

Ndiaye M.B.O. and Korsu R.D. 2014. "Tax effort in ECOWAS countries", In: Seck D. (ed), *Regional Economic Integration in West Africa*. Switzerland: Springer International Publishing.

Stotsky, J.G. and WoldeMariam A. 1997. Tax effort in Sub-Saharan Africa. IMF Working Paper, WP/97/107 73.

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