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Promoting female economic inclusion for tax performance in Sub-Saharan Africa

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Abstract

This study explores whether female economic inclusion enhances tax performance in a sample of 48 countries in Sub-Saharan Africa from 2000 to 2018. The study's empirical evidence is based on the generalized method of moments in order to account for endogeneity concerns. Three tax performance measurements are used, notably, total taxes revenue excluding social contributions, reported tax revenue derived from natural resources sources, and total non-resource tax revenue. Three female inclusion indicators are used, namely, female employment in industry, female labour force participation, and female employment. The following empirical evidences are documented; (i) There is a negative net effect from the enhancement of female employment in the industry on the total tax revenue. (ii) There is a positive net effect of female employment in the industry on the non-resource taxes. An extended threshold analysis is performed to establish the critical masses that could further influence tax performance positively. The following thresholds are established. (i) a minimum of 15.35 "employment in industry, female (% of female employment)" for the total tax revenue and (ii) a maximum of 23.75 "employment in industry, female (% of female employment)" for the non-resource tax revenue. These critical masses are crucial for sustainable development because, below or beyond these thresholds, policy makers should complement the female economic inclusion with other economic measures designed to improve tax performance in Sub-Saharan Africa.

Keywords: Gender, economic inclusion, tax performance, sustainable development, Africa
JEL Classification: H20, H71, I28, J08, J21

Introduction

The premise of this study on the relevance of female economic inclusion on tax performance in Sub-Saharan Africa (SSA) is motivated by four main elements in the scholarly and policy literature, notably: (i) the importance of tax income in funding the post-2015 development agenda of Sustainable Development Goals (SDGs); (ii) the low participation of women in formal economic activities; (iii) the critical relevance of gender inclusion in SDGs and (iv) gaps in the taxation and gender inclusion literature. These elements of the motivation underlying the focus of the study are expanded below.

First, with respect to the relevance of tax income in funding SDGs, it is worthwhile to note that most countries in SSA have increasingly been experiencing large fiscal deficits over the past years. This fiscal imbalance is caused by rapid expenditure expansions and low levels of revenue mobilization (Matei & Drumasu, 2015). Endogenous growth models establish that reduction of fiscal imbalance will surge growth through lowering expenditure or increasing revenue mobilization (Asongu & Jellal, 2016). However, expansive expenditure, especially in health, education and infrastructure, has been reduced in the region without inclusive development (Asongu & le Roux, 2017). Hence, a feasible alternative is required for the region to achieve sustainable development. Accordingly, to achieve the SDGs, additional finances need to be mobilized, particularly independent resources, to fund the public goods and services. In essence, the means by which to finance the recent 2030 Agenda both in developed and developing countries emerged as the central concern after the ratification of the SDGs in September, 2015. Thus, governments' abilities to organize and allow efficient use of various financing sources and policies would be critical to realizing the SDGs. Tax mobilization is crucial for sustainable development as it provides a domestic resource channel for governments to invest in both human resource and infrastructural development (OCED, 2014).However, such mobilization is contingent on the participation of the countries' human resources in formal economic activities.

Second, the low participation of women in formal economic activities in SSA, compared to other regions of the world is well documented, not least because women in this region are mostly involved in informal economic activities such as subsistence agriculture and petty trading (Food and Agricultural Organisation-FAO, 2011; Ellis et al., 2007; Tandon & Wegerif, 2013;

Ramani et al., 2013; Efobi et al., 2018; Asongu & Odhiambo, 2018, 2019; Uduji & Okolo-Obasi, 2019, 2020). Against this backdrop, there is also an evolving strand of literature on the need to get more women on board in formal economic activities in order to optimize human resources for economic and sustainable development avenues (Marquez, 2017; Luo, et al., 2017; Vancil-Leap, 2017; Moras, 2017; Uduji & Okolo-Obasi, 2018;Uduji, Okolo-Obasi & Asongu, 2019). This is essentially in the light of the documented relevance of gender inclusion in SDGs.

Third, the criticality of gender inclusion in SDGs builds on the evolving perspective that the ineluctable phenomenon of globalization (United Nations, 2013) has to be given a human face in order for the phenomenon to contribute more toward inclusive development. It is in this light that calls have been made for globalization to be more gender inclusive (Asongu et al., 2020a), notably because of the documented evidence of discrimination against women in SSA (Hazel, 2010; Elu & Loubert, 2013; Osabuohien et al., 2019), partly owing to the phenomenon of globalization. The perspective is better articulated by the World Bank (2018) report which establishes that the gender gap between men and women account for about a 160 trillion USD loss in GDP, with some of the negative externalities of the underlying most detrimental in poor countries in SSA which failed to achieve most Millennium Development Goals (MDGs) (Asongu & le Roux, 2019). Hence, the focus of this study on how promoting gender inclusion can be leveraged for more tax income is premised on both the relevance of tax income in funding the post-2015 global development agenda of SDGs as well as an apparent gap in the scholarly literature.

Fourth, the gaps in the attendant literature motivating this study can be discussed in two main strands, notably: studies on tax performance and gender inclusion, respectively. On the one hand, in relation to the literature on taxation, prior studies have established that tax performance is mostly influenced by conventional and non-conventional factors (Bird et al., 2007; Fasoranti, 2013; Fenochietto & Pessino, 2013; Yohou & Goujon, 2017). Most studies have focused on the conventional factors such as income per capita, openness of the economy and the various sectors pertaining to gross domestic products, which tend to determine the tax effort of a country (Breu et al., 2008; Castro & Camarillo, 2014a; Mara, 2015; Mauricio & Rodríguez, 2018; Andrejovská et al., 2018). However, this traditional approach is not sustainable to generate tax revenues needed for development (Bird et al., 2007). In essence, Drummond et al. (2012) assert that

compared to non-conventional factors such as transparency, governance and accountability, developing countries cannot alter the conventional factors in the short term to achieve the desired tax revenue levels. Hence it is relevant to consider a non-conventional approach such female economic inclusion, not least because: (i) the intuition (discussed in the penultimate paragraph of this section) for the linkage between gender economic participation and taxation performance is strong and (ii) there is to the best of our knowledge only few contemporary studies on the underlying nexus between female economic participation and tax performance in SSA. Barnett and Grown (2004) provide a review of the avenues along which systems of taxation could be gender biased and suggest recommendations through which gender analysis can be improved. Grown and Valodia (2010) provide a methodological and conceptual framework for analyzing the nexus between gender equity and taxation in both developed and developing countries. The present study departs from the underlying studies by assessing how promoting female economic inclusion affects tax performance in SSA.

On the other hand, with respect to the contemporary gender inclusive literature on SSA, the attendant literature has largely been concerned with, *inter alia*: the relevance of fostering the gender dimension in science education (Elu, 2018); nexus between financial access and gender inclusion (Bayraktar & Fofack, 2018; Mannah-Blankson, 2018; Nanziri, 2020; Morsy, 2020); connections between information technologies and access to financial services (Bongomin et al., 2018; Efobi et al., 2018; Asongu & Odhiambo, 2018) and linkages between information technologies, the involvement of women in agricultural activities and corporate social responsibility (Uduji et al., 2019; Uduji & Okolo-Obasi, 2018, 2019, 2020).

The intuition for the nexus between gender inclusion and tax performance is simple to follow. Involving more women in formal economic activities obviously implies more tax income associated with the attendant involvement of the women. However, the nexus can be non-monotonic in the perspective that when a general policy of involving more women in formal economic activities is taken on board, the effect of such a policy on tax income can be apparent only when a certain threshold of gender economic inclusion has been attained. Hence, this study aims to provide thresholds of gender economic inclusion relevant for the promotion of tax performance in the sub-region[1]. It follows that the focus of this study is consistent with the

[1] It is important to note that a threshold is an optimal point at which the sign of effect changes.

evolving strand of applied economics literature which is motivated by the premise that, a study based on sound intuition is a relevant scientific activity that could set the ground work for theory-building (Costantini & Lupi, 2005; Narayan et al., 2011; Asongu et al., 2018).

The rest of the study is organized as follows. Section 2 covers the data and methodology while the empirical analysis and corresponding discussion are engaged in Section 3. The study concludes in Section 4 with implications and future research directions.

2 Data and Methodology

2.1 Data

This study explores a panel dataset of 48 Sub-Saharan African countries for the period 2000-2018. The data availability limits the sampled countries and periodicity. The study extracts data from various sources, notably, (a) the International Centre for Tax and Development (ICTD)/United Nations University World Institute for Development Economics Research (UNU-WIDER) Government Revenue Dataset for tax performance variables (i.e. the total taxes revenue excluding social contributions, non-resource taxes and resource taxes). (b) The International Labour Organization (ILO) is used for female economic inclusion variables (i.e. female employment in industry, female labour force participation and female employment). (c) World Development Indicators of World Bank are employed for two control variables (i.e. gross domestic product per capita and trade openness).

Prior studies have engaged existing data sources(such as the International Monetary Fund, the Organization for Economic Co-operation and Development, the World Bank and the Economic Commission for Latin America databases) for tax performance measures (Adam et al., 2013; Baunsgaard & Keen, 2010; Guner, Lopez-Daneri, & Ventura, 2016; Mutti & Grubert, 2004; Poterba, 2007). However, these measures have resulted in discrepancies in the literature and the proliferation of conflicting research results, which tend to complicate comparison and replication (Mawejje, 2019). The issues with the current data are widely recognized. The ICTD has provided a database with the intentions to meet the immediate needs of researchers for significant improvements in data coverage and quality. ICTD/UNU-WIDER Government Revenue Dataset (GRD), constructed by the ICTD with the United Nations University, provides harmonized tax

and non-tax revenue data for genuine comparability across countries. The updated dataset offers much more detailed, reliable information on tax collection rates and patterns over time. For this study, three indicators for tax performance are used, notably; (i) the total taxes revenue excluding social contributions,(ii) reported tax revenue derived from natural resources sources, and (iii) total non-resource tax revenue (i.e. the total tax revenue minus resource tax revenue as a percentage of gross domestic product). Notably, the further distinction for tax performance measure is based on what is termed "earned" and "unearned" income (Moore, 1998). In general, 'earned income' refers to non-resource taxes, which are raised on a reasonably broad tax base rather than particular service payment and require typically social contract in form of negotiation with the populace. Unearned revenue, on the other hand, applies to revenue from natural resources derived relatively from controlled and concentrated sources, thereby allowing relatively low collection cost and less dependent of the population. This makes it possible to compare the extent to which female economic inclusion influences the sub-component of the total tax revenue (i.e. earned income and unearned income mobilization) in the sampled countries. These three tax performance indicators are consistent with recent taxation literature (Addison & Levin, 2011; Castro & Camarillo, 2014; Gamze, 2019; Gnangnon & Brun, 2018a, 2018b; Macek, 2014; Martorano, 2016; Mawejje, 2019; Wang et al., 2019).In addition, the use of various outcome indicators is in view of increasing room for policy implications.

This study engages three gender economic participation indicators, namely; female employment in industry, female labour force participation, and female employment. These measures are consistent with recent literature on female participation in the formal sector (Asongu & Odhiambo, 2020a, 2020b).In addition, the two control variables used in this study (i.e. gross domestic product per capita and trade openness) are motivated by recent taxation literature (Gnangnon & Brun, 2018a; Macek, 2014; Martorano, 2016; Mawejje, 2019; Wang et al., 2019). The limited control variables are adopted to eliminate issues surrounding instrument proliferation that could significantly bias the coefficient estimates. This procedure is consistent with GMM-centric empirical studies that select less than three control variables (Asongu & Odhiambo, 2020c; Kavya & Shijin, 2020). In addition, we expect these control variables to influence tax performance in Sub-Saharan Africa. We anticipate that GDP per capita will positively affect tax performance. This claim aligns with prior studies that establish that higher per capita income would mirror arising demand for public goods, which affects tax performance (Crivelli &Gupta,

2014). Alcala and Ciccone (2004) have established that trade openness is positively associated with effective tax effort and by extension economies that are more open are associated with higher levels productivity. On the basis of this underpinning, a positive nexus between trade openness and tax performance is expected.

2.2Methodology

2.2.1 GMM specification

Following recent GMM-centric literature, the GMM empirical method is used for this present study bearing in mind the specific four factors identified by prior studies (Asongu & Odhiambo, 2020a, 2020c; Fosu, 2017; Tchamyou, 2019, 2020a). These fundamental factors include; (i) The number of the countries considered in this study (i.e. N) exceeds the number of years in each cross-section (i.e. T). Thus, the asymmetry (i.e. N>T) that warrants the adoption of the approach is met. (ii) The adopted three indicators of tax performance remain persistent as the correlation between their respective level, and first lag values exceed 0.800, which is the criterion for establishing persistence (Asongu & Odhiambo, 2020c; Tchamyou et al., 2020a, 2020b). (iii) The panel structure unveils that cross-country variations are taken into consideration in the estimation approach. (iv) The concern of endogeneity is dealt with as the reverse causality or simultaneity issue is tackled through internal instrumentation, whereas the concern of unobserved heterogeneity is addressed utilizing time-invariant omitted indicators.

The GMM approach adopted in this study is the Roodman (2009a, 2009b) approach, an improvement of Arellano and Bover (1995) technique, which has been documented in recent literature to limit instruments proliferation (Asongu & Odhiambo, 2019).

Below equations in level (1) and first difference (2) recapitulate the standard system GMM estimation technique.

$$T_{i,t} = \sigma_0 + \sigma_1 T_{i,t-\tau} + \sigma_2 G_{i,t} + \sigma_3 GG_{i,t} + \sum_{h=1}^{2} \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$\begin{aligned} T_{i,t} - T_{i,t-\tau} = {} & \sigma_1 (T_{i,t-\tau} - T_{i,t-2\tau}) + \sigma_2 (G_{i,t} - G_{i,t-\tau}) + \sigma_3 (GG_{i,t} - GG_{i,t-\tau}) \\ & + \sum_{h=1}^{2} \delta_h (W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} - \varepsilon_{i,t-\tau}) \end{aligned} \quad (2)$$

where $T_{i,t}$ is the tax performance indicator (i.e. the total taxes excluding social contributions, non-resource taxes and resource taxes) of the country i in period t, σ_0 is a constant, G represents the female economic inclusion (i.e. female employment in industry, female labour force participation, and female employment), GG denotes the quadratic interactions between the female economic inclusion dynamics ("female employment in industry x female employment in industry", "female labour force participation x female labour force participation", and "female employment x female employment"). *W* is the vector of control variables (GDP per capita and Trade openness), τ denotes the coefficient of autoregression that is one within the framework of this study because a year lag is capable of capturing past information, ξ_t is the time-specific constant, η_t is the country-specific effect and $\varepsilon_{i,t}$ is the error term.

2.2.2 Identification and exclusion restrictions

It is important to express the identification strategy and the exclusion constraints underlying such an approach for a robust GMM specification. This approach is consistent with prior studies (Asongu et al., 2020b; Asongu & Nwachukwu, 2016; Tchamyou & Asongu, 2017), where "years" are considered strictly exogenous and the independent variables (i.e. the female economic inclusion indicators and the control variables) are acknowledged to be "predetermined" or "endogenous explaining". This simply means that the strictly exogenous variables are presumed to influence the tax performance outcomes variables explicitly via the exogenous mechanisms of female economic inclusion. This strategy is consistent with the arguments of Roodman (2009b) and Meniago and Asongu (2018) that favour the stance that, time-invariant measures are not quite feasible to be endogenous on a first difference.[2]

In view of the above, the condition for determining the validity of the identification and exclusion restrictions strategy is the Difference in Hansen Test (DHT) for instrument exogeneity. The null hypothesis of Difference in Hansen Test holds that such instruments influence the outcome variable explicitly through the predetermined or endogenous explaining variables (i.e. instruments demonstrate strict exogeneity). Thus, the null hypothesis of DHT should not be rejected for this restriction assumption to hold in the findings reported in the empirical section.

[2]Hence, the procedure for treating ivstyle (years) is "iv (years, eq [diff])" whereas the gmmstyle is employed for predetermined variables.

The explanation of the identification and exclusion constraints leading to the validity of the adopted instruments is not different from the criterion in standard instrumental variable (IV) techniques demanding that the Sargan/Hansen test's null hypothesis should not be rejected in order to validate the instruments.

3. Results

3.1 Presentation of results

This section unveils the findings presented in Tables 1-3. Accordingly, Tables 1-3 focus on the total taxes, non-resource taxes and resources taxes, respectively. Each of the tables has three main sets of specifications in line with the three main independent variables of interest (i.e. female employment in industry, female labour force participation, and female employment). Each specification has two sub-specifications (i.e. one excluding conditioning information indicators and the other encompassing the two conditioning information indicators). Notably, all the specifications are relevant for the interpretation of results and concluding implications following the narrative established in the data section. Following the empirical studies based on GMM technique, four information criteria are adopted to establish the validity of the estimated models.[3]In light of these established information criteria, all the specifications are valid. Notably, this research emphasized more on the validity of the Hansen test as opposed the Sargan test because the former is more robust though affected by instrument proliferation issues. However, this issue (i.e. proliferation of instruments) is addressed by ensuring that the number of groups (i.e. cross-section) is higher than the number of instruments.

To investigate the overall effect of enhancing female economic inclusion on tax performance, this study computes net effects in accordance with the recent literature based on the interactive regressions (Asongu & Nwachukwu, 2018; Asongu & Odhiambo, 2020b). For instance, in the

[3] ''*First, the null hypothesis of the second-order Arellano and Bond autocorrelation test (AR (2)) in difference for the absence of autocorrelation in the residuals should not be rejected. Second the Sargan and Hansen over-identification restrictions (OIR) tests should not be significant because their null hypotheses are the positions that instruments are valid or not correlated with the error terms. In essence, while the Sargan OIR test is not robust but not weakened by instruments, the Hansen OIR is robust but weakened by instruments. In order to restrict identification or limit the proliferation of instruments, we have ensured that instruments are lower than the number of cross-sections in most specifications. Third, the Difference in Hansen Test (DHT) for exogeneity of instruments is also employed to assess the validity of results from the Hansen OIR test. Fourth, a Fisher test for the joint validity of estimated coefficients is also provided*'' (Asongu & De Moor, 2017, p. 200).

Column 2 of Table 1, the net effect of the female employment in the industry on the total taxes is -0.0006 [2 x (0.0000456 x 8.728) + (-0.0014)]. In this calculation, the mean value of female employment in the industry is 8.728 as apparent in Appendix 2; the conditional effect of female employment in the industry is 0.0000456; the unconditional effect of female employment in the industry is -0.0014, and the leading 2 is from the quadratic derivation.

This study establishes the following findings from Tables 1-3. (i) There is a negative net effect from the enhancement of female employment in the industry on the total tax revenue. (ii) There is a positive net effect of female employment in the industry on the non-resource taxes.

It is worthwhile to emphasize that the absence of net effects from the enhancing of female economic inclusion on resources tax. Generally, there are gender structural inequalities that restrict certain groups of people from owning and accessing natural resources while this discrimination could ultimately exclude females from economic activities in the sector. Hence, the established results reflect the likelihood of female economic exclusion in the natural resource industry compared to the non-resource industry.

The fact that the net effect of the resource tax revenue becomes impalpable can also be seen in the light of the male-female complementarity in production. Accordingly, an issue that is not often engaged concerning family stability and the corresponding productivity of the male is that the productivity of a male is largely anchored on the stability that he enjoys in his home. This is an indication that even within the framework of an employment terrain that is skewed in favour of men, the contribution of the female is still worthwhile because it is also understood as ensuring the productivity of the male. Hence, such male-female complementarity in production could explain the net effect of the resource tax revenue.

Table 1: Female economic inclusion and total taxes

	Dependent Variable: Total taxes revenue excluding social contributions					
Variables	Industry		Participate		Employ	
Total taxes (-1)	**0.938*** **	**0.939*** **	**0.966*** **	**0.972*** **	**0.962*** **	**0.966*** **
	(0.0197)	**(0.0142)**	**(0.0481)**	**(0.0253)**	**(0.0248)**	**(0.0232)**
Industry	0.000108	**-0.00140****	--	--	--	--
	(0.000886)	**(0.000645)**	--	--	--	--
Industry x Industry	0.00000335	**0.0000456****	--	--	--	--
	(0.0000261)	**(0.0000196)**	--	--	--	--
Participate	--	--	0.000327	-0.00148	--	--
	--	--	(0.00222)	(0.00183)	--	--
Participate x Participate	--	--	-0.000002	0.0000135	--	--
	--	--	(0.0000186)	(0.0000156)	--	--
Employ	--	--	--	--	0.00618	0.00102
	--	--	--	--	(0.00376)	(0.00261)
Employ x Employ	--	--	--	--	-0.000057	-0.0000095
	--	--	--	--	(0.0000341)	(0.0000245)
GDP	--	**0.000331*****	--	**0.000323*****	--	**0.000390****
	--	**(0.0000988)**	--	**(0.000109)**	--	**(0.000159)**
Openness	--	**0.0000288***	--	0.0000346	--	0.0000531
	--	**(0.0000155)**	--	(0.000025)	--	(0.0000344)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	-0.0006	na	na	na	na
Positive Threshold(s)	na	15.35	na	na	na	na
AR(1)_P-value	[0.0226]	[0.0214]	[0.0177]	[0.0202]	[0.0239]	[0.0214]
AR(2)_P-value	**[0.0782]**	**[0.0714]**	**[0.0721]**	**[0.0700]**	**[0.0748]**	**[0.0658]**
Hansen Prob	**[0.131]**	**[0.0932]**	**[0.317]**	**[0.188]**	**[0.205]**	**[0.0727]**
Sargan Prob	**[0.151]**	**[0.210]**	**[0.423]**	**[0.436]**	**[0.143]**	**[0.313]**
DHT for instruments						
(a)Instruments in levels	--	--	--	--	--	--
H excluding group	--	[0.023]	--	[0.072]	--	[0.048]
Dif (null, H=exogenous)	**[0.315]**	**[0.348]**	**[0.635]**	**[0.382]**	**[0.489]**	**[0.195]**
Fisher	**3065*****	**2656*****	**381.8*****	**11354*****	**2071*****	**819.6*****
No. of Instruments	28	36	28	36	28	36
Number of Country	45	44	45	44	45	44
Observations	733	729	733	729	733	729

***, **, *: significance levels at 1%, 5% and 10% respectively.Abbreviation: Industry; the Female employment in industry; Participate, Female labour participation; Employ, Female employment; GDP, Gross Domestic Product per capita; Openness, Trade Openness. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen tests.Constants are included in all regressions. ( ) for standard errors of estimated coefficients and [ ] for p-values of all other tests with the exception of the Fisher test. na: not applicable because at least one estimated coefficient needed for the computation of net effects or thresholds is not significant.The mean value of female in industry is 8.728.

Table 2: Female economic participation and non-resource taxes

	Dependent Variable: Non-resource taxes					
Variables	Industry		Participate		Employ	
Non-resources taxes (-1)	**0.854*** **	**0.855*** **	**0.773*** **	**0.799*** **	**0.835*** **	**0.890*** **
	(0.0209)	**(0.0294)**	**(0.0281)**	**(0.0256)**	**(0.0620)**	**(0.0492)**
Industry	**0.00152*** **	0.000740	--	--	--	--
	(0.000525)	(0.000812)	--	--	--	--
Industry x Industry	**-0.000032*** **	-0.0000147	--	--	--	--
	(0.0000118)	(0.0000196)	--	--	--	--
Participate	--	--	0.00188	0.00118	--	--
	--	--	(0.00325)	(0.00314)	--	--
Participate x Participate	--	--	-0.0000186	-0.0000121	--	--
	--	--	(0.000026)	(0.0000253)	--	--
Employ	--	--	--	--	0.00747	0.00123
	--	--	--	--	(0.00445)	(0.00267)
Employ x Employ	--	--	--	--	**-0.000074***	-0.0000166
	--	--	--	--	**(0.0000408)**	(0.0000256)
GDP	--	**0.000200** **	--	**0.000284*** **	--	0.000174
	--	**(0.0000963)**	--	**(0.000105)**	--	(0.000153)
Openness	--	0.0000534	--	0.0000195	--	0.0000211
	--	(0.0000336)	--	(0.000049)	--	(0.0000394)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	0.0010	na	na	na	na	na
Thresholds	23.75	na	na	na	na	na
AR(1)_P-value	[0.0108]	[0.0133]	[0.00799]	[0.00892]	[0.00783]	[0.00657]
AR(2)_P-value	**[0.212]**	**[0.201]**	**[0.206]**	**[0.200]**	**[0.200]**	**[0.192]**
Hansen Prob	**[0.232]**	**[0.595]**	**[0.281]**	**[0.539]**	**[0.560]**	**[0.589]**
Sargan Prob	**[0.157]**	**[0.350]**	[0.0408]	**[0.405]**	**[0.324]**	**[0.279]**
DHT for instruments						
(a)Instruments in levels	-	[0.029]	-	[0.040]	-	[0.074]
H excluding group	**[0.449]**	**[0.988]**	**[0.912]**	**[0.944]**	**[0.864]**	**[0.901]**
Dif (null, H=exogenous)						
Fisher	**989.1*** **	**1490*** **	**270.5*** **	**714.9*** **	**265.9*** **	**1374*** **
No. of Instruments	28	36	28	36	28	36
Number of Country	45	45	45	45	45	45
Observations	710	706	710	706	710	706

***, **, *: significance levels at 1%, 5% and 10% respectively.Abbreviation: Industry; the Female employment in industry; Participate, Female labour participation; Employ, Female employment; GDP, Gross Domestic Product per capita; Openness, Trade Openness. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen tests.Constants are included in all regressions. ( ) for standard errors of estimated coefficients and [ ] for p-values of all other tests with the exception of the Fisher test. na: not applicable because at least one estimated coefficient needed for the computation of net effects or thresholds is not significant.The mean value of female in industry is 8.728.

Table 3: Female economic participation and resource taxes

	Dependent Variable: Resources taxes					
Variables	Industry		Participate		Employ	
Resources taxes (-1)	**0.905*** **	**0.900*** **	**0.914*** **	**0.909*** **	**0.906*** **	**0.892*** **
	(0.0194)	**(0.0133)**	**(0.0169)**	**(0.0208)**	**(0.0136)**	**(0.0172)**
Industry	-0.00207	-0.00183	--	--	--	--
	(0.00160)	(0.00134)	--	--	--	--
Industry x Industry	0.0000543	0.0000512	--	--	--	--
	(0.0000416)	(0.0000309)	--	--	--	--
Participate	--	--	-0.000448	0.000980	--	--
	--	--	(0.00137)	(0.00158)	--	--
Participate x Participate	--	--	0.00000603	-0.00000533	--	--
	--	--	(0.0000118)	(0.0000133)	--	--
Employ	--	--	--	--	0.00419	-0.000281
	--	--	--	--	(0.00278)	(0.00156)
Employ x Employ	--	--	--	--	-0.0000343	0.0000043
	--	--	--	--	(0.0000246)	(0.0000144)
GDP	--	0.000103	--	**0.000241****	--	0.0000999
	--	(0.0000823)	--	**(0.0000908)**	--	(0.0000675)
Openness	--	-0.0000937	--	-0.0000135	--	-0.0000512
	--	(0.0000678)	--	(0.0000516)	--	(0.0000641)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	na	na	na	na
Thresholds	na	na	na	na	na	na
AR(1)_P-value	[0.0511]	[0.0456]	[0.0494]	[0.0502]	[0.0521]	[0.0520]
AR(2)_P-value	**[0.259]**	**[0.248]**	**[0.255]**	**[0.253]**	**[0.259]**	**[0.260]**
Hansen Prob	**[0.665]**	**[0.519]**	**[0.291]**	**[0.702]**	**[0.0752]**	**[0.218]**
Sargan Prob	**[0.417]**	[0.000]	**[0.708]**	[0.000]	**[0.302]**	[0.000]
DHT for instruments						
(a)Instruments in levels	--	[0.231]	-	[0.252]	-	[0.194]
H excluding group	[0.853]	[0.617]	[0.484]	[0.800]	[0.281]	[0.275]
Dif (null, H=exogenous)						
Fisher	35414***	4580***	20677***	12129***	20311***	20932***
Number of Country	46	45	46	45	46	45
No. of Instruments	28	36	28	36	28	36
Observations	757	743	757	743	757	743

***, **, *: significance levels at 1%, 5% and 10% respectively.Abbreviation: Industry; the Female employment in industry; Participate, Female labour participation; Employ, Female employment; GDP, Gross Domestic Product per capita; Openness, Trade Openness.

DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen tests.Constants are included in all regressions. ( ) for standard errors of estimated coefficients and [ ] for p-values of all other tests with the exception of the Fisher test. na: not applicable because at least one estimated coefficient needed for the computation of net effects or thresholds is not significant.

3.2 Discussion and policy implications through estimated thresholds

From Table 1, it is established that the unconditional effect of female inclusion is negative, whereas the marginal effect of the phenomenon is positive. These effects indicate that whereas female inclusion reduces the tax revenue, enhancing female inclusion increases the tax revenue. This may be traceable to the fact that the current female employment in the industry is not sufficient to increase tax revenue. However, additional female involvement in the formal economic sector could translate to increased tax revenue. Thus, this motivates the thresholds computations at which further enhancing female inclusion increases tax revenue. These thresholds are worthwhile for policy. In the light of these clarifications, in Column 2 of Table 1,

a threshold of 15.35 ([0.0014]/[2 x 0.0000456]) “employment in industry, female (% of female employment)” is the critical mass at which the net effect of enhancing female employment in the industry on the total tax revenue is 0 (2 x [0.0000456 x 15.35] + [-0.0014]). Hence, above the established threshold of 15.35, further enhancing female employment will surge tax performance (i.e. total taxes revenue). It follows that below these thresholds, female inclusion in the formal economic sector will reduce tax performance.

In Table 2 of Column 1, whereas the unconditional effect of female inclusion is positive, the marginal effect of the phenomenon is negative. These effects indicate that whereas female inclusion increases the non-resource tax revenue, enhancing female inclusion reduces the non-resource tax revenue. This may be traceable to the fact that additional female involvement in the formal economic sector might not translate into increased non-resource tax revenue. Thus, this motivates threshold computation at which further enhancing female inclusion reduces non-resource tax revenue. In this light, a threshold of 23.75 ([0.00152]/[2 x 0.000032]) “employment in industry, female (% of female employment)” is the critical mass at which the net effect of enhancing female employment in the industry on the non-resource tax revenue is 0(2 x [-0.000032 x 23.75)+ [0.00152]). However, it is established that beyond the threshold of 23.75, further enhancing of female employment in industry will reduce non-resource tax revenue. It follows that above the established threshold, complementary policies should be implemented to ensure female involvement in the industry surge non-resource tax. Given that the computed thresholds fall within the minimum and maximum values in the summary statistics, it is concluded that such thresholds have economic significance and make economic sense.

Notably, we have observed that the estimated coefficients corresponding to the female inclusion variables have shown very small effects. This could be explained from the fact that a greater number of the female group remains unrecorded in the national Accounts (Klasen & Lamanna, 2009). Hence, an increase in productivity may not be recorded in the economy; since in some ways, these female groups had been contributing to the economy, but unrecorded. This could plausibly explain the almost zero coefficients to the variables noted in Tables 1-3. This study therefore concentrated only on signs and not the magnitude of signs.

4. Concluding implications, caveats and future research directions

This study examines the relevance of female economic inclusion for tax performance in 48 Sub-Saharan African countries for the period 2000-2018. Female economic inclusion is measured with female employment in industry, female labour force participation and female employment. Tax performance is measured with the total taxes excluding social contributions, non-resource taxes and resource taxes. The empirical evidence is based on the generalized method of moments in order to account for endogeneity concerns. The following findings are established: (i) There is a negative net effect from the enhancement of female employment in the industry on the total tax revenue. (ii) There is a positive net effect of female employment in the industry on the non-resource taxes. It is worthwhile to emphasize that the absence of net effects from the enhancing of female economic inclusion on resources tax is an indication that the resource tax revenue is mainly influenced by commodity prices, which tends to be more volatile and could undermine economic predictions.

The study further computes the critical masses at which female inclusion could influence tax performance. These thresholds are worthwhile for policy. The thresholds are: (a) a minimum of15.35 "employment in industry, female (% of female employment)" is the critical mass at which the net effect of enhancing female employment in the industry on the total tax revenue. (b) A maximum of 23.75 "employment in industry, female (% of female employment)" is the critical mass at which the net effect of enhancing female employment in the industry on the non-resource tax revenue.

The complementary policies could entail governance and information and communication technology (ICT). Accordingly, ICT policies have been recently used to enhance tax performance in most countries. An example is "tax on web" that enables both male and female participants in the formal economic sector to pay their taxes without much waste of time and other intermediary costs. It follows that tax payers should be accompanied with the relevant ICT mechanisms that would facilitate the payment of their taxes on time and with less effort.

Another worthwhile complementary mechanism is the enhancement of governance standards related to tax payments. In essence, enhancing institutional governance (i.e. consisting of the rule of law and corruption-control) can improve the tax performance because credible

institutions limit the corrupt tax collectors on the one hand and on the other, stringent rule of law enables tax defrauders and corrupt tax collectors to be sanctioned in accordance with the rule of law. It follows that enhancing corruption-control and the rule of law are complementary measures that can be taken on board to improve the relevance of enhancing female economic participation on tax performance. This perspective of institutional governance should also be understood in the light of its definition from the governance literature: institutional governance is the respect of citizens and the State of institutions that govern interactions between them (Ajide & Raheem, 2016a, 2016b; Tchamyou, 2020b).

A caveat of this study is that the findings should be treated with caution and not interpreted as entirely causal in the light of apparent shortcomings in the estimation technique. In essence, in the absence of external instruments, this study used internal instruments which obviously have shortcomings in the establishment of causality. Moreover, this study is based on quadratic and not on interactive regressions. While interactive regressions engage channels of transmission, the scope of the present study is on quadratic regressions. Hence, interactive regressions that focus on channels of transmission can be considered in future research. Future studies can focus on assessing the relevance of complementing female economic participation dynamics with the suggested ICT and governance policy variables in view of promoting tax performance in SSA. Moreover, the study could also be replicated in other developing countries in Latin America and Asia that are experiencing similar concerns of low participation of women in the formal economic sector and less tax income.

Another caveat worth mentioning is that the estimation technique is tailored to control for endogeneity by eliminating fixed effects which potentially correlate with the error terms to cause endogeneity. This is an inherent shortcoming in the GMM approach. It is for this reason that "country fixed-effects" is not taken into account. Hence, future studies should use the relevant estimation techniques in accounting for some heterogeneities documented in Bardhan and Klasen (1997) and Ostry et al (2018), *inter alia*: country-specific laws that empower husbands to prevent their wives from working and the prevalence of sexual harassment at work that discourage women from engaging in certain activities in the formal economic sector.

As the suggested future research directions are considered, it is important to note that at the onset of the study, we provided an intuition for the study and an empirical strategy with

which to assess the intuition. The fact that the empirical analysis proves that the intuition is not as sound as we expected does not make the research a useless scientific activity. This is essentially because in the discussion of results section of the study, we have provided some justifications for the findings. We have also acknowledged the limits of the study as it pertains to the empirical strategy and conceptualization. This clarification is important because the magnitude of the estimated coefficients in an empirical exercise that is designed to be robust in the light of the problem statement should not be an issue if some explanation is provided to elucidate the attendant magnitude of estimated coefficients. Hence, by disclosing these findings, the study departs from a practice in social science of refusing to consider some findings when such do not totally align with the intuition of the study or because such findings are either insignificant or associated with null effects. This is essentially because such refusal amounts to publication bias (i.e. a practice in social science where strong, significant and expected results are preferred to weak, insignificant and unexpected (Rosenberg, 2005; Franco, Malhotra & Simonovits, 2014).

5. Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendices

Appendix 1: Definitions and Sources of Variables

Variables	Acronyms	Definitions	Sources
Tax Performance	Tax	The total taxes revenue excluding social contributions	GRD
	Resource	Component of reported tax revenue (i.e. from natural resource sources, most often corporate taxation of resource firms)	
	Nonresource	Total non-resource taxes (i.e. total taxes resource minus resource taxes)	
Female in Industry	Industry	Employment in industry, female (% of female employment) (modelled ILO estimate)	ILO
Female labour participation	Participate	Labour force participation rate, female (% of the female population ages 15+) (modelled ILO estimate)	ILO
Female employment	Employ	Employment to population ratio, 15+, female (%) (modelled ILO estimate)	ILO
GDP per capita	GDP	Gross Domestic Product per capita (constant 2010 dollars)	WDI
Trade openness	Openness	Exports and Import in GDP	WDI

GRD: ICTD/UNU-WIDER Government Revenues Dataset. ILO: International Labour Organization. WDI: World Bank Development Indications. Abbreviation: Tax, the total taxes revenue excluding social contributions; Nonresource, the non-resource tax revenues; Industry; the Female employment in industry; Participate, Female labour participation; Employ, Female employment; GDP, Gross Domestic Product per capita; Openness, Trade Openness.

Appendix 2: Descriptive Statistics

Variables	Observation	Mean	SD	Minimum	Maximum
Tax	800	.142	.082	.01	.6
Nonresource	775	.128	.074	.008	.6
Resource	824	.022	.064	-.081	.556
Industry	893	8.728	7.748	.319	43.503
Participate	893	60.507	16.07	20.463	87.682
Employ	893	55.597	17.636	18.143	86.011
GDP	871	4.421	5.56	-46.082	63.38
Openness	912	66.669	41.924	0	311.354

Abbreviation: Tax, the total taxes revenue excluding social contributions; Nonresource, the non-resource tax revenues; Industry; the Female employment in industry; Participate, Female labour participation; Employ, Female employment; Unemploy, Female unemployment; GDP, Gross Domestic Product per capita; Openness, Trade Openness; SD, standard deviation.

Appendix 3: Correlation matrix

	1	2	3	4	5	6	7	8
1.Tax	1							
2.Nonresource	0.822***	1						
3.Resource	0.413***	-0.179***	1					
4.Industry	0.290***	0.408***	-0.151***	1				
5.Participate	-0.0591	-0.128***	0.103**	-0.281***	1			
6.Employment	-0.199***	-0.276***	0.0978**	-0.365***	0.974***	1		
7.GDP	-0.0369	-0.102**	0.0989**	-0.0939*	0.0556	0.0722	1	
8.Openness	0.386***	0.301***	0.185***	0.396***	-0.0392	-0.107**	-0.0982**	1

*p< 0.05, **p< 0.01, ***p< 0.001. Abbreviation: Tax, the total taxes revenue excluding social contributions; Nonresource, the non-resource tax revenues; Industry; the Female employment in industry; Participate, Female labour participation; Employ, Female employment; GDP, Gross Domestic Product per capita; Openness, Trade Openness

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