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Education, Financial Stability and  
Female Employment in the Industry  
in Sub-Saharan Africa**

*Simplice A. Asongu,  
Yann Nounamo,  
Henri Njangang  
&  
Sosson Tadadjeu*

**Gender Inclusive Intermediary Education, Financial Stability and Female Employment  
in the Industry in Sub-Saharan Africa\***

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**Simplice A. Asongu**

African Governance and Development Institute,  
P.O. Box 8413 Yaoundé, Cameroon

E-mails: [asongusimplice@yahoo.com](mailto:asongusimplice@yahoo.com) / [asongus@afridev.org](mailto:asongus@afridev.org)

**Yann Nounamo**

Faculty of Economics and Applied Management,  
University of Douala

E-mail: [nounamoyann@gmail.com](mailto:nounamoyann@gmail.com)

**Henri Njangang**

Faculty of Economics and Management (LAREFA),  
University of Dschang, Cameroon

E-mail: [ndieupahenri@gmail.com](mailto:ndieupahenri@gmail.com)

**Sosson Tadadjeu**

Dschang School of Economics and Management,  
University of Dschang

E-mail: [stadadjeu@yahoo.fr](mailto:stadadjeu@yahoo.fr)

**Abstract**

The study examines how financial stability modulates the effect of inclusive intermediary education on female employment in the industry for the period 2008-2018 in Sub-Saharan Africa. The empirical evidence is based on Tobit, Ordinary Least Squares (OLS) and Quantile regressions. There are positive interactive or conditional effects between inclusive intermediary education and financial stability in the Tobit, OLS and bottom quantiles estimations. A net positive (negative) effect is apparent in the 10<sup>th</sup> quantile (median) of female employment in the industry distribution. Implications are discussed.

*Keywords:* inclusive education; financial sustainability, gender economic inclusion

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## 1. Introduction

This note examines how financial stability modulates the role of inclusive intermediary or secondary education on female economic participation<sup>1</sup>. It is founded on the premise that inclusive female education engenders female economic participation and such a nexus is facilitated by financial stability. The policy importance of getting more women into the formal economic sector builds on the fact that in sub-Saharan Africa (SSA), about 90% of women are occupied in the informal economic sector (Woldemichael, 2020) and by extension, it is imperative to assess policies that could improve the participation of women in the industry.

The above narrative is consistent with an evolving stream of literature on the need for financial access in gender economic inclusion (Morsy, 2020). However, the present study departs from Morsy (2020) which is closest in terms of scholarly focus; by considering financial stability as a policy dimension via which inclusive education engenders inclusive economic participation. Accordingly, this study departs from the underlying literature by arguing that it is not enough to simply provide nexuses between channels of inclusion (i.e. financial access) and inclusive outcomes (i.e. female economic participation). This is essentially because, taking into account moderating, independent and outcome variables, provides policy makers with more policy insights into how policies designed to promote gender inclusive education can lead to gender economic inclusion, contingent on financial stability. Such is the focus of the present study which is summarized in the following research question: how does financial stability modulate the incidence of gender-parity intermediary education on female employment in the industry in SSA?

The intuition for linkages between inclusive intermediary education, financial stability and female employment in the industry is premised on two fundamental fronts. On the one hand, financial instability limits avenues by which mobilized resources by financial institutions can be efficiently allocated for productivity investment opportunities which logically entail employment opportunities (World Bank, 2020). In other words, financial stability is fundamental for economic activities (which are linked to employment) because most transactions in the formal economy are done through the formal financial system (Tchamyou, Erreygers and Cassimon, 2019). Hence, in event of financial instability, financial institutions limit investments in many sectors such as education which potentially decrease employment avenues for males as well as females. Moreover, as recently argued by Woldemichael (2020),

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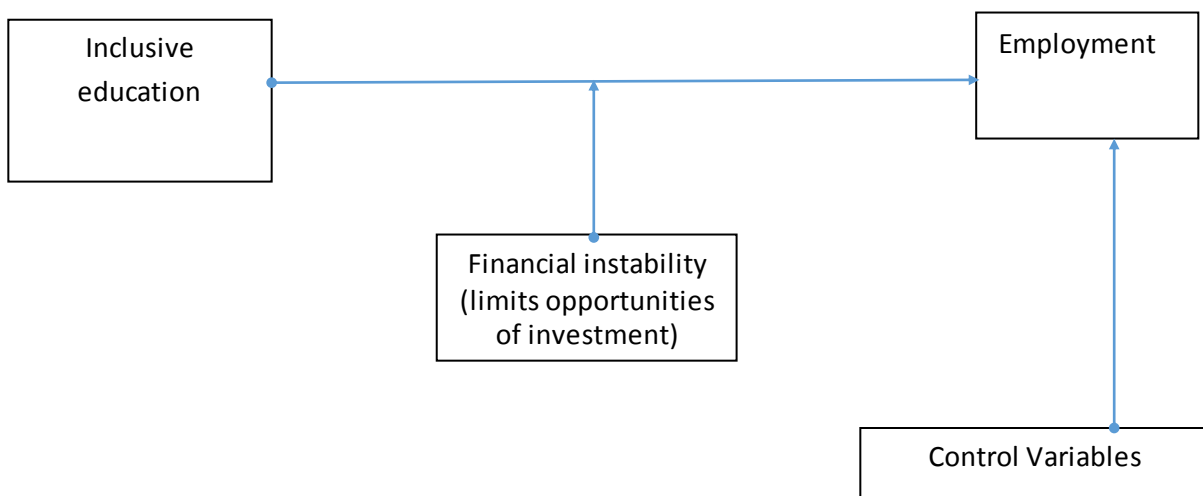
<sup>1</sup> Inclusive intermediary education, inclusive education, gender parity education and gender parity intermediary education are used interchangeably throughout the study.

since most women are employed in the informal economic sector, financial instability also limits their opportunities of making a transition towards the formal economic sector owing to limited funding avenues from formal financial enterprises. On the other hand, compared to the higher level of education and nursery education, the intermediary level of education (i.e. primary and secondary educational levels) has been documented to be more associated with positive macroeconomic externalities when countries are at initial stages of industrialization (Asiedu, 2014). It is for this reason that this study puts more emphasis on intermediary gender parity education.

The conceptual framework underpinning how financial stability modulates the effect of inclusive intermediary education on female employment in the industry is provided in Figure 1. It is apparent from the figure that the probability of bank default (i.e. financial instability) can influence the nexus between inclusive education and women's access to the industry. This is essentially because: (i) financial instability reduces the opportunity of providing financial resources to various sectors of the economy including education and (ii) less investment in education unfavorably affects the quality of gender inclusive education and by extension, limits opportunities for women to be employed in the industry owing to the potentially lower quality of education they have received.

The rest of the note is organized as follows. This motivation is followed by Section 2 on data and methodology. The empirical results are disclosed in Section 3 while Section 4 concludes with implications and directions for future research.

**Figure 1: The role of financial instability in the education-employment nexus**



## **2. Data and methodology**

### **2.1 Data**

This note focuses on annual data from 49 countries covering the period 2008-2018<sup>2</sup>. The selection of countries and attendant periodicity is motivated by data availability constraints at the time of the study. As apparent in Appendix 1 on the definitions and sources of variables, the data originate from four main sources. Consistent with the contemporary gender inclusion literature (Asongu et al., 2020), female economic inclusion and gender inclusive education are measured respectively by: (i) female employment in the industry and (ii) gender parity education in the primary and secondary schools. Financial stability is proxied with the Z-score which appreciates the likelihood of the financial system to go bankrupt (Meniago and Asongu, 2018; Anning and Adusei, 2020).

In order to account for variable omission bias, five control variables are considered in accordance with contemporary gender economic inclusion literature, namely: inequality, GDP growth, political stability, trade openness and financial access (Steinberg and Nakane, 2012; Asongu and Odhiambo, 2019a; Osinubi and Asongu, 2020). Consistent with the underlying literature, with the exception of inequality that is anticipated to have a negative incidence on the outcome variable, the other control variables are expected have the opposite influence. Appendix 2 and Appendix 3 respectively, disclose the summary statistics and correlation matrix of the underlying variables<sup>3</sup>.

### **2.2 Methodology**

#### **2.2.1 Tobit regressions**

The Tobit regression technique is adopted because of the limited range in the conception of the outcome variable (Ajide et al., 2019). Accordingly, the outcome variable is defined within an interval of 0% to 100% and therefore, censored from 0 to 100. Hence, a double censored Tobit regression model is appropriate (Coccoresse and Pellecchia, 2010).

Following Carson and Sun (2007), Equations (1) and Equation (2) reflect the standard procedure for estimating a Tobit model.

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<sup>2</sup> The 49 SSA countries are the 55 existing African countries excluding: (i) North African countries which are geographically not in SSA (Algeria, Egypt, Libya, Morocco and Tunisia) and (ii) South Sudan for which only very limited data is available.

<sup>3</sup> The identification of potential concerns of multicollinearity is a *two-step* approach. The first consists of ascertaining whether the attendant levels of correlation exceed an acceptable threshold of 0.600. The second step is engaged to assess the significance of correlated pairs that exceed the 0.600 threshold. The study did not pass the first step because no correlation exceeds 0.600 in magnitude. Such an approach is consistent with contemporary studies that focus on extending prior exposition on the premise of concerns of multicollinearity (Asongu, Biekpe and Cassimon, 2020).

$$y_{i,t}^* = \alpha_0 + \beta X_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where  $y_{i,t}^*$  is a latent response variable,  $X_{i,t}$  is an observed  $1 \times k$  vector of explanatory variables and  $\varepsilon_{i,t} \approx$  i.i.d.  $N(0, \sigma^2)$  and is independent of  $X_{i,t}$ . As opposed to observing  $y_{i,t}^*$ , we observe  $y_{i,t}$ :

$$y_{i,t} = \begin{cases} y_{i,t}^*, & \text{if } y_{i,t}^* > \gamma \\ 0, & \text{if } y_{i,t}^* \leq \gamma, \end{cases} \quad (2)$$

where  $\gamma$  is a non-stochastic constant. It follows that, the value of  $y_{i,t}^*$  is missing when it is less than or equal to  $\gamma$ . In accordance with the attendant Tobit centric literature (Lashitew et al., 2019), only the marginal effects related to the censored female employment in the industry variable are provided because of their relatively better reliability with respect of economic interpretation.

### 2.2.2. Quantile regressions

The modeling in the previous section is contingent on the mean value of the outcome variable. However, the investigated linkages can be different if assessed throughout the conditional distribution of the outcome variable. Hence, consistent with the extant literature on conditional modeling, the Quantile regressions (QR) technique is employed (Koenker and Bassett, 1978; Koenker and Hallock, 2001; Tchamyu and Asongu, 2017a; Asongu and Odhiambo, 2019b).

The  $\theta^{\text{th}}$  quantile estimator of female employment in the industry is obtained by solving for the optimization problem in Equation (3), which is disclosed without subscripts to enhance readability.

$$\min_{\beta \in R^k} \left[ \sum_{i \in \{i: y_i \geq x_i' \beta\}} \theta |y_i - x_i' \beta| + \sum_{i \in \{i: y_i < x_i' \beta\}} (1 - \theta) |y_i - x_i' \beta| \right], \quad (3)$$

where  $\theta \in (0,1)$ . The QR approach consists of minimizing the weighted sum of absolute deviations.

### 3. Empirical results

The Tobit, OLS and QR estimations are reported in Table 1 and in accordance with contemporary interactive regressions literature (Tchamyu and Asongu, 2017b); net effects are computed to assess the overall effect of financial stability in the nexus between inclusive education and female employment in the industry. For instance, in the third specification or fourth column of the table, the net effect is 6.371 ( $[0.003 \times 10.865] + [6.339]$ ). In the

attendant calculation, 10.865 is the average value of financial stability; the unconditional effect of inclusive education is 6.339 while the conditional impact related to the interaction between financial stability and inclusive education is 0.003. Where the net effects cannot be computed, na (i.e. “not applicable”) is assigned to the corresponding space. Accordingly, a net effect is not computed when at least one estimated coefficient needed for the computation is not significant. Hence, both the unconditional effect of inclusive education and the conditional effect (from the interaction between inclusive education and financial stability) should be significant before the corresponding net effect is computed.

The following findings can be established. (i) There are positive interactive or conditional effects between inclusive education and financial sustainability in the Tobit, OLS and bottom quantiles estimations. (ii) A net positive (negative) effect is apparent in the 10<sup>th</sup> quantile (median) of female employment in the industry distribution. (iii) Most of the control variables are significant with the expected signs.

**Table 1**  
Inclusive education, financial stability and female employment.

	Dependent variable: Female employment in the industry						
	Tobit dy/dx	OLS	Quantile Regressions				
			Q.10	Q.25	Q.50	Q.75	Q.90
Constant		2.466 (0.793)	<b>-8.480***</b> ( <b>0.000</b> )	2.330 (0.687)	<b>30.839***</b> ( <b>0.002</b> )	26.836 (0.177)	14.943 (0.330)
Inclusive Education (IE)	7.172 (0.244)	8.218 (0.261)	<b>6.339***</b> ( <b>0.000</b> )	-0.775 (0.874)	<b>-20.710**</b> ( <b>0.014</b> )	-18.574 (0.272)	12.954 (0.321)
Financial Stability (FS)	-0.182 (0.100)	-0.209 (0.112)	-0.007 (0.838)	0.020 (0.839)	-0.048 (0.779)	-0.234 (0.502)	<b>-0.897***</b> ( <b>0.001</b> )
IE × FS	<b>0.002***</b> ( <b>0.002</b> )	<b>0.003***</b> ( <b>0.003</b> )	<b>0.003***</b> ( <b>0.000</b> )	<b>0.003***</b> ( <b>0.001</b> )	<b>0.003*</b> ( <b>0.054</b> )	0.001 (0.684)	0.002 (0.342)
Inequality	-0.023 (0.776)	-0.026 (0.781)	0.030 (0.261)	-0.020 (0.795)	-0.046 (0.728)	0.040 (0.880)	-0.162 (0.440)
GDP Growth	-0.164 (0.380)	-0.188 (0.394)	0.013 (0.696)	-0.062 (0.552)	-0.259 (0.144)	-0.268 (0.455)	0.114 (0.681)
Political Stability	<b>2.072***</b> ( <b>0.001</b> )	<b>2.374***</b> ( <b>0.002</b> )	<b>0.451**</b> ( <b>0.023</b> )	<b>1.369**</b> ( <b>0.019</b> )	<b>4.107***</b> ( <b>0.000</b> )	3.084 (0.122)	0.131 (0.932)
Trade	<b>0.039**</b> ( <b>0.028</b> )	<b>0.044**</b> ( <b>0.035</b> )	<b>0.020***</b> ( <b>0.000</b> )	<b>0.018*</b> ( <b>0.055</b> )	0.011 (0.472)	<b>0.110***</b> ( <b>0.001</b> )	<b>0.135***</b> ( <b>0.000</b> )
Financial Access	<b>-0.007***</b> ( <b>0.000</b> )	<b>-0.008***</b> ( <b>0.000</b> )	<b>0.002*</b> ( <b>0.056</b> )	0.001 (0.813)	-0.005 (0.415)	-0.019 (0.190)	<b>-0.026**</b> ( <b>0.021</b> )
Net effect of IE	na	na	6.371	na	-20.677	na	na
Adjusted/Pseudo R <sup>2</sup>		0.244	0.214	0.202	0.183	0.165	0.352
Fisher		<b>13.72***</b>					
Observations	165	165	165	165	165	165	165

\*\*\*, \*\*, \*: significance levels at 1%, 5% and 10% respectively. dy/dx: average marginal effects. na: not applicable because at least estimated coefficient needed for the computation of the net effects is not significant. The average value financial sustainability is 10.865. OLS: Ordinary Least Squares.

#### 4. Concluding implications and future research directions

This study has shown that gender inclusive education is modulated by financial stability for positive conditional effects on female employment in the industry. Such positive conditional effects which are exclusively apparent in the bottom quantile of the female employment in the industry distribution engenders an overall positive (negative) net effect in the 10<sup>th</sup> quantile (median) of female employment in the industry distribution. The findings show that the investigated nexuses can lead to blanket policy implications if they are not assessed throughout the conditional distribution of female employment in the industry. Moreover, the findings with significant favorable conditional effects is an indication that more needs to be done to promote inclusive gender education in order to anticipate significant unconditional effects from inclusive gender education based on which, overall net effects can be computed. Hence, with the exception of findings in the 10<sup>th</sup> quantile of the female employment in the industry distribution, the overall tendency is that inclusive education needs to be improved by sampled countries.

The above findings are relevant to policy makers for a plethora of reasons, *inter alia*: (i) the concern of gender exclusion is more apparent in SSA relative to other developing countries in the world (Osabuohien et al., 2019); (ii) about 160 trillion USD in global GDP is lost due of gender economic exclusion and most of this loss relative to domestic GDP is apparent in poor countries such as in SSA (World Bank, 2018) and (iii) about half of countries in SSA failed to achieve the Millennium Development Goals (MDGs) extreme poverty target owing to concerns of exclusive development (Tchamyou, 2019) and (iv) according to scholarly projections, if inclusive development is not given the policy attention it deserves, most countries in the sub-region are still unlikely to achieve the Sustainable Development Goals (SDGs) poverty targets (Bicaba et al., 2017).

In the light of the above, promoting financial stability and inclusive education are some policy perspectives that can be taken on board by the policy makers of sampled countries in view of promoting inclusive development in the sub-region. Future studies can consider other policy mechanisms and channels in view of providing more scholarly and policy insights into how inclusive development in SSA can be further enhanced. Moreover, while the outcome variable in the present study ranges from 0% to 100%, in future studies where the outcome variable ranges from 0 to 1, fractional-type models such as Beta regression should be used to complement the Tobit regression approach.



## Appendices

### Appendix 1

#### Definitions and sources of variables.

Variables	Abbreviations	Definitions of variables (Measurements)	Sources
Female in Industry	Industry	Employment in industry, female (% of female employment) (modelled ILO estimate)	ILO
Business Sustainability	Z-Score	Prediction of the likelihood that a bank might survive and not go bankrupt.	FDSB
Inclusive education	Edu	School enrolment, primary and secondary (gross), gender parity index (GPI)	WDI
Inequality	Gini	“The Gini index is a measurement of the income distribution of a country's residents”.	WDI
Economic growth	GDPg	Gross Domestic Product growth rate (annual %)	WDI
Political stability	PolSta	“ <i>Political stability/no violence (estimate): measured as the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional and violent means, including domestic violence and terrorism</i> ”.	WGI
Trade openness	Trade	Exports plus Imports of Commodities (% of GDP)	WDI
Financial access	Finance	Private domestic credit from deposit banks and other financial institutions (% of GDP)	FDSB

Notes: ILO: International Labour Organisation. FDSB: Financial Development and Structure Database. WGI: World Governance Indicators. WDI: World Bank Development Indicators of the World Bank. No variables are provided in logarithms because the mean values are comparable in the light of the summary statistics.

### Appendix 2

#### Summary statistics (2008-2018).

	Mean	SD	Minimum	Maximum	Observations
Female in industry	8.547	7.440	0.401	34.603	528
Financial sustainability	10.865	5.686	2.176	44.412	446
Inclusive education	0.936	0.101	0.630	1.133	298
Inequality	45.328	6.736	33.000	65.700	325
Economic growth	4.155	4.908	-46.082	20.715	511
Political stability	-0.570	0.910	-3.314	1.200	536
Trade openness	76.956	42.201	19.100	347.997	498
Financial access	31.501	84.383	0.347	972.204	452

Notes: S.D: Standard Deviation. The mean values are relatively comparable in terms of units. It is apparent from the standard deviations that the variables reflect significant variations from which, reasonable estimated linkages can be established from the regressions results. Mean values are also useful in the computation of net effects. When thresholds corresponding to the attendant net effects are computed, these thresholds must be situated within the statistical range (minimum to maximum values) in order to make economic sense and have policy relevance. The total number of observations is not equal across variables because the panel dataset is not balanced.

### Appendix 3

Correlation matrix (uniform sample size: 165).

	Industry	Z-Score	Education	Gini	GDPg	PolSta	Trade	Finance
Industry	1.000							
Z-Score	0.072	1.000						
Education	0.326	0.217	1.000					
Gini	0.129	-0.174	0.217	1.000				
GDPg	-0.126	-0.239	-0.128	-0.013	1.000			
PolSta	0.389	-0.045	0.503	0.348	-0.040	1.000		
Trade	0.304	0.071	0.234	0.041	0.004	0.269	1.000	
Finance	0.027	0.080	0.051	-0.020	-0.106	0.133	0.166	1.000

Notes: Industry: female employment in the industry. Z-score: business sustainability. Education: Gender inclusive education. Gini: Inequality. GDPg: Gross Domestic Product growth. PolSta: Political Stability. Trade: trade openness. Finance: Financial access. The correlation matrix is used to identify potential concerns related to multicollinearity. A two step approach is used. The first step entails the assessment of whether the paired correlations are above a critical limit of 0.600. In the second step, for each correlated pair that exceeds the 0.600 threshold, the significance level is examined. This study did not go above the first step because no correlated pair exceeds the critical threshold of 0.600.

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