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GOVERNANCE AND INFORMATION TECHNOLOGY FOR FEMALE LABOUR FORCE PARTICIPATION IN THE AFRICAN CONTINENTAL FREE TRADE AREA

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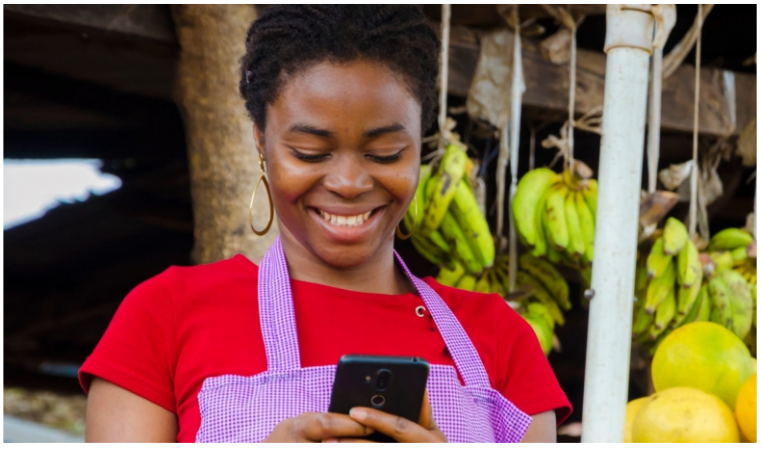

Abstract

The motivation of the present study is to complement the extant literature by assessing the relevance of governance and information technology in how African trade affects female labour force participation. The study focuses on 48 African countries using data for the period 1996 to 2021. An adopted empirical strategy is the fixed effects regressions that are designed to address concerns for simultaneity and the unobserved heterogeneity. The fractional probit model based on the pooled Bernoulli quasi-maximum likelihood method is also employed. The following main findings are established. First, governance moderates intra-African trade to engender positive synergies on female labour force participation. The positive synergies are apparent from the overall quality of institutions, government effectiveness and the rule of law. Second, information technology does not significantly moderate intra-African trade to affect female labour force participation. The established findings from fixed effects regressions are robust to fractional probit model estimations. The findings are relevant in informing policy makers on how governance can be used to moderate the influence of African trade in promoting female labour force participation. Policy implications are discussed.

Keywords: ICT; Governance; Inclusion; Gender; Africa
JEL Classification: G20; I10; I32; O40; O55

1. Introduction

African countries have a lot of potential for both the global market and intense intra-continental trade. Essentially, regional trade in Africa has the potential to significantly contribute to the following: job creation for the youth, poverty alleviation, shared prosperity, food and energy security, economic diversification, and decreased reliance on certain mineral products as exports (World Bank, 2013). At the moment, 15% of the continent's overall merchandise trade is made up of commerce within Africa. Compared to intra-regional trade on other continents, this is quite modest. As an example, intra-regional trade is 48% in North America, 58% in Asia, and 67% in Europe (ABM, 2018). Within the next five years, intra-African trade might increase by at least 50% if and when the goals of the African Continental Free Trade Area (AfCFTA) are realized (ABM, 2018). Nonetheless, it will be necessary to decrease the export of primary commodities from African nations in order to meet the demands of the continent. For example, rather than shipping the majority of their cocoa crops to the US and Europe, Ghana and Côte d'Ivoire ought to keep the majority of the underlying crops in order to manufacture chocolate and other related goods locally. These industrialized nations process cocoa and sell the completed goods for a higher price, sometimes even to the nations that export the raw material. In the instance of cobalt, direct manufacturing may take place in the Democratic Republic of the Congo and Zambia, where this mineral is abundant, rather than shipping the essential component needed to make batteries that power electric automobiles to China (United Nations, 2022; Tchamyou et al., 2023a).

The AfCFTA could avails new avenues for supplying manufactured goods and food to cities throughout Africa. Trade in services may also open-up new avenues for export diversification and increase domestic market competitiveness. In order to fully realize the promise of African trade, women are crucial to the continent's commerce (World Bank, 2013). Essentially, by serving as owners and administrators of businesses engaged in cross-border trade, women significantly contribute to trade in the majority of African nations. The bulk of farmers in many African nations are female, and they typically grow crops including maize, rice, cotton, and cassava (Efobi *et al.,* 2018). Additionally, they offer professional services including accounting and legal advice, as well as health and education (Asongu & Odhiambo, 2023). However, compared to industrialized nations and given women's capacity to contribute to economic development, the involvement of women to commerce is lower than should be realistically expected (Asongu & Odhiambo, 2023). This is primarily due to non-tariff obstacles and limitations that women may encounter, particularly when transnational trading vices such as extortion and harassment come into play. These obstacles can force these women into the informal economy, which is marked by a lack of networks, access to financing, and knowledge and can make it difficult for women to start and grow successful enterprises. African nations' aspirations to view trade as a driver of employment, prosperity, and the eradication of poverty

may be weakened by such circumstances, which might hinder women from fully utilizing the opportunities presented by trade (World Bank, 2013).

Trade policy is not gender-neutral, not least given the distribution of trade outcomes between men and women (Asongu & Odhiambo, 2023). This is because of the various chances individuals have and the various roles they play in society and the economy. Women are mostly in charge of raising and educating children, cleaning, and fetching potable water from communal wells in African nations. Some women are small-scale traders or engage in subsistence farming. Women in Africa typically have few opportunities to advance economic activity at regional and international levels (Aranda, 2018; Asongu & Odhiambo, 2019; Efobi *et al.*, 2018; Ngono, 2021; Okere et al., 2024). Many women still work in agriculture in Africa, despite the continent's economies shifting from farming to services. In order to provide context, the following statistics are provided: (i) 96% of women in Burundi, 76% in Kenya, 84% in Rwanda, 71% in Tanzania, and 77% in Uganda work in agriculture and (ii) 35% of women in Kenya and 46% in Rwanda own land (UN News, 2018).

The impact of trade policy appears to have distinct effects on social and economic activities for men and women. This is due to two factors: (i) disparities in their requirements and functions in social and economic life; and (ii) variations in their access to resources and information (Efobi *et al.,* 2018). The main causes of this include sociocultural, political, and economic variables. Thus, women appear to be more impacted by the unfavorable consequences of trade liberalization and are faced more difficulties compared to males when it comes to taking advantage of the opportunities provided by trade (Osinubi & Asongu, 2021). The gender gap in education and training, the unequal distribution of income, and the lack of equal access to resources, information, credits, land, and technology are all contributing factors to this state of affairs (Ngono, 2021).

One fundamental factor to consider in order to ensure a sustainable impact of gender equality on economic growth is improved human capital accumulation for women and girls, which is a critical component in building the capacity of national productivity. Furthermore, there are crucial components to consider when including gender considerations into trade policy (UNCTAD, 2017): (i) Before new policies are introduced in an agreement, a gender-related assessment is required. (ii) As the connection between trade, gender equity, and economic development becomes more evident, gender considerations should be included in new trade agreements (Tchamyou et al., 2023a, 2023b).

The policy relevance of the study stems from the current need to comprehend the role of the AfCFTA in macroeconomic results, particularly in terms of increasing female labour force participation, which is dependent on the dynamics of governance and information

technology (Tchamyou et al., 2023a, 2023b). As such, research on the relevance of the AfCFTA is sparse, not least, it is a relatively recent phenomenon. Therefore, given the influence of other macroeconomic factors, policy makers ought to be keen to learn how the AfCFTA impacts different prospects for economic development. It follows that the research question being answered in this study is the following: how do governance and ICT moderate the effect of African trade on female labour force participation?

In the light of the above, the current exposition concentrates on Africa for two primary reasons, which are discussed in the following in two major strands, particularly with regard to African-centric perspectives on information technology and governance. According to Dossou et *al.* (2023a), Africa has seen a growth in the mobile phone market in recent years, which is the first strand on information technology. The proliferation of mobile phones and the internet has drastically changed Africa's development landscape, as evidenced by the rise in economic activity on the continent. Additionally, research indicates that ICT has recently enhanced Africa's economic growth (Dossou *et al.,* 2023a, 2023b) and female economic inclusion (Ngoa & Song, 2021; Asongu et al., 2023). The attendant literature (Dossou *et al.,* 2023a) claims that the financial sector, trade facilitation, health, agriculture, and climate change adaptation are the primary engines of economic development in Africa. The complementary narrative, however, argues that there is little evidence linking information technology to the continent's economic development as a result of structural restructuring. This is especially within the remit of how information technology affects the influence of intra-African trade gender economic inclusion.

Despite the overwhelming evidence that strong institutions have a significant impact on economic growth, it is important to note that many African countries lack good governance, particularly when it comes to the second stream of this strand, which focuses on the relevance of governance institutions in economic prosperity. According to a study, governments that resemble electoral autocracies make-up over 79% of Africa (Dossou *et al.,* 2023a), and the electoral process is similar in these nations. The authors state that the results of the 2022 Ibrahim Index of African Governance show that political inclusion, rights, and participation are undermined in Africa, and that around one-third of Africans live under autocratic rule. It follows that understanding how governance institutions affect the manner in which trade within Africa influence gender economic inclusion is worthwhile item on the ACFTA research agenda.

The study is structured as follows for the remaining portion. While the theoretical foundations and pertinent literature are covered in Section 2, the data and technique are given in Section 3. Section 4 offers the empirical results whereas Section 5 offers conclusions and suggestions for further research.

2. Theoretical underpinning and literature review

2.1 Theoretical underpinnings, contextualization and hypotheses development

This section presents three central facets of the study: (i) The study's motivation stemming from the theoretical background on the interaction between ICT, governance, and structural transformation. (ii) The theoretical foundation applied contextually. (iii) The hypothesis developed from the theoretical bases and contextual features as mentioned in earlier sections. In the paragraphs that follow, we address each of these topics in turn.

In the first strand, we lay out the theoretical stance. The study is based on two fundamental theories, which specifically address the role that ICT plays in mediating the interaction between intra-African trade and gender economic inclusion in an economy. The endogenous growth theory and Schumpeter's innovative growth theory are the corresponding theories (Amavilah *et al.,* 2017; Hasan & Bousrih, 2020).

2.1.1 Schumpeter's innovative growth theory

In the light of the above, Schumpeter's inventive growth theory is the first hypothesis we take a look at (Amavilah *et al.,* 2017; Hasan & Bousrih, 2020). According to Schumpeter's theory of innovative growth, an economic sphere comprises fundamental information technology and good governance that promote employment and structural transformation, particularly through trade. Accordingly, good governance include: institutional and political governance systems (the rule of law and anticorruption checks), political governance systems (opinions, accountability, political stability, and peace), and economic governance systems (effective governance and regulation). We know from theoretical evidence that information technology interacts with trading processes discussed earlier to produce economic changes such as employment opportunities. In order words, information technology can be leveraged by domestic and interactional trade to affect opportunities of economic development which include the employment of women. These interactions also foster entrepreneurial innovation, which serves as a catalyst for structural transformation and employment in an economy (Amavilah *et al.,* 2017; Hasan & Bousrih, 2020).

2.1.2 The endogenous growth theory

The second theory we consider is the theory of endogenous growth (Amavilah *et al.,* 2017; Hasan & Bousrih, 2020). According to the corresponding theory, economic development and structural change are brought about by the interactions between a nation's macro and microeconomic elements. According to the idea, information technology and governance dynamics—the policy or moderating variables, used in this study—are essentially domestic in character, suggesting that domestic policies influence how they interact. Stated differently,

information technology can ascertain the ways in which trade is affected in an economy to influence employment and structural transformation. Information technology can also therefore have an impact on the relationship between structural change and economic inclusion. Moreover, governance is also likely to influence how trade eventually benefits the country in terms of, inter alia, employment prospects and economic prosperity. Hence, governance in general (i.e., which entails, opinions, accountability, political stability, peace, pro-public welfare policies, efficient governance, and high-quality regulations) influence how trade is performed in a country and by extension, economic and inclusive externalities resulting from the corresponding trade (Amavilah *et al.,* 2017; Hasan & Bousrih, 2020).

2.1.3 Contextualisation of theoretical underpinnings and hypotheses development

In the second strand, we discuss how the theoretical foundation might be applied contextually to the current study, with particular attention to how we selected the primary, moderating, and outcome factors. In relation to gender economic inclusion, the current study attempts to evaluate the moderating impact of information technology and governance dynamics on intra-African trade for gender economic inclusion. The rationale behind selecting governance dynamics and information technology dynamics as the primary moderating variables, respectively, is rooted in the previously discussed notions of endogenous growth theory and Schumpeter's innovation theory (Amavilah *et al.,* 2017; Hasan & Bousrih, 2020). It is based on the supposition that information technology and good governance moderate trade to influence employment opportunities especially as it pertains to gender economic inclusion in the formal sector. We suggest that the domestic character of our input variables suggests that domesticity affects the behaviour of our outcome variable (i.e., gender economic inclusion), which is consistent with the endogenous growth theory. Furthermore, it is assumed that governance and information technology play a key role in transforming an economy's structure through the trade channel or mechanism.

The contextualization of the theoretical findings of the current study complies with the body of contemporary governance research (Saba *et al.,* 2024). According to extant literature, the structural transformation prospects—which include externalities from trade openness used as the main channel inf this study. The prospects also involve other economic factors, such as the knowledge economy, information technology, and governance, are critical to enhancing productivity and enacting structural transformation in an economy, which entail inclusive employment opportunities for females used the outcome variable of this study. The implication of the statement is that trade development encourages the government to formulate and implement pertinent policies that support the efficient operation of related economic activities in the industrial, service and agricultural sectors that are like to influence the manner in which trade affects inclusive economic development outcomes (Saba *et al.,* 2024). Its foundation is

the idea that institutional, political, and economic governance dynamics have the capacity to produce economic development, particularly when they involve ICT access policies in governance policies. Building on the above theoretical premises, the following testable hypotheses are considered:

Hypothesis 1: Information technology positively moderates the effect of trade on female labour force participation.

Hypothesis 2: Governance positively influences the effect of trade on female labour force participation.

2.2. Empirical literature

Consistent with the relevant literature (Tchamyou et al., 2023a), for the most part, African borders are crossed by females on a daily basis in efforts for those crossing the relevant borders to contribute in one way or the other to the socio-economic development of walks of the life that jointly affect the two countries that are separated by the corresponding border. According to some estimates, a fundamental contributing factor to economic prosperity in the continent is cross border trade which involve approximately 43% of Africa's population (Afrika & Ajumbo 2012; Brenton & Soprano, 2018). To put the insights into more perspective, in Southern Africa, trade across boarders' accounts for between 30% to 40% of the total trade that is recorded from a formal standpoint among nations (SARDC, 2008). Furthermore, according to the narrative, most of the underlying cross-border trade in the continent is done by women who according to Njiwa et al. (2011) make-up approximately three-quarter of traders in the informal sector in Malawi and Zambia.

The underlying substantive representation of women in the informal sector is consistent with insights from the relevant scholarly and policy literature on the subject (Tchamyou et al., 2023a). Other relevant examples include 80% of informal cross-border in the Great Lakes regions characterised by women (Breton & Isik, 2012) and female traders making-up about 70% of those involved in informal trade in the Southern African Development Community (SADC) region on the one hand. On the other hand, female constituting almost 60% of those involved in trade across borders in the Central and Western regions of Africa (Afrika & Ajumbo 2012). It is further worthwhile to articulate that as argued by Asongu and Odhiambo (2018), for the most part, women are more involved in the informal economic sector because in the absence of formal economic participation activities, these informal sector economic endeavours enable them to create wealth, reduce poverty, *inter alia*, within the remit of small-scale corporate projects, which at times could be developed to larger scale projects.

The insights above are typically in line with Brenton and Soprano (2018), who have argued that trade across borders for the most part is in small scale, with most of the corresponding trade female-dominated. In essence, the narrative maintains that such trade endeavours are often characterised by small quantities of exchange owing to *inter alia*, lack of machinery, inefficient marketing, restricted funding possibilities, inputs of poor quality and mechanisms of distribution that are often ineffective. The authors are also supportive of the narrative in the previous paragraph that a substantial fraction of these traders are females, approximately, 70-80%, for the most part. In the light of the narrative, cross border transactions in terms of trade are the principal source of livelihood for the concerned female population. These insights are supported by Asongu and Odhiambo (2018) who maintain that females are mostly involved in informal trade because compared to men, they are more vulnerable to employment as well as exposed to more constraints in the light their educational levels and initial income streams.

It is also imperative to articulate that trade across borders represents a principal source of revenue for these females involved and by extension, is either a complementary source of livelihood in event the females are married or the main source of livelihood for the unmarried women. It is also worthwhile to articulate that the formalization and liberalisation of activities of trade are worthwhile in order to improve the abilities of these women to substantially leverage on their trading potentials. This is essentially because when the underlying trade is not regulated, women are often exposed to bribes and unnecessary transactions costs which substantially reduce their corresponding income streams (Asongu & Odhiambo, 2018; Tchamyou *et al*., 2023a, 2023b). These insights are broadly consistent with an early study by Lesser and Moise-Leeman (2009) on government rewards from the cross-border trade as well as corresponding benefits from formalisation of cross-border trading activities. The underlying is apparent, especially as it pertains to positive externalities in terms of *inter alia*, enhanced compliance with health and safety standards, reduced information asymmetry, better corporation opportunities and improved conditions of doing business.

How the present study contributes to the extant empirical literature has already been highlighted in the introduction, not least, because the adopted elements of style are tailored such that the highlighted literature in the introduction is critically engaged in Section 2.2. Hence, for lack of space and to avoid repetition, recycling of the contribution of the study to the extant literature as done in the introduction is not necessary in this section.

3. Data and methodology

3.1 Data

We analyse a panel of 48 African countries for which data are available from 1996 to 2021. The starting year of 1996 is motivated by data availability constraints in governance indicators from the World Governance Indicators (WGI) database that are only available from 1996 while the ending year of 2021 is because it is the most updated year. Governance indicators are available from 1996 to 2022, but values for the years 1997, 1999, and 2001 are missing.

Based on the corresponding gender inclusion literature, the outcome variable employed in this study is the female labour force participation rate (Asongu et al., 2020) while the independent variable of interest is intra-African trade (Tchamyou et al., 2023a). Consistent with the relevant literature, the intra-African trade is proxied with the trade integration index is which is understood in terms of the degree by which a country trades with other African countries (Tchamyou et al., 2023a).

The moderators or policy variables are ICT and governance dynamics. The choice of the moderating variables is consistent with the extant policy threshold literature supporting the relevance of positive macroeconomic signals as policy or moderating variables (Odhiambo, 2022; Ofori et al., 2022; Tadadjeu et al., 2023). According to the underlying literature, ICT and governance still have room improvement before saturation levels and hence, can robustly been employed as policy variables. This is essentially because policy makers can more feasibly formulate and implement measures designed to increase the extant levels of the moderating variables.

The choice of the control variables is also in line with the extant literature on the female labour force participation. Accordingly, following Efobi *et al*. (2018) and Tchamyou *et al*. (2023a), six control variables are adopted in the conditioning information set, namely: financial development, real gross domestic product (GDP) per capita, age dependency, fertility rate, population growth and share the female population. Financial development is measured as a combination of financial dynamics of efficiency, financial activity, financial depth and financial stability (i.e., the z-score) (Meniago & Asongu, 2018; Tchamyou, 2019; Tchamyou et al., 2019). The remaining five factors have been documented in the extant literature to affect the outcome variable (Duflo, 2012; Asongu & Odhiambo, 2020; Ofori *et al*., 2021; Ngono, 2021; Asongu *et al*., 2021). Furthermore, in interactive regressions it is difficult to discuss the expected signs, not least, because the interactive indicators can be correlated with indicators and control variables. Accordingly, as argued by Brambor et al. (2006) on the shortcomings of interactive regressions, it is because multicollinearity is overlooked that the estimated coefficients are not interpreted as in linear additive models.

Table 1: Summary statistics of main variables (1996-2021)

Variable	Observations	Mean	Std. dev.	Min	Max
Female labour force participation	1248	54.919	17.227	11.763	87.123
Intra-African Trade Integration	1248	0	1.988	-1.355	11.087
Quality of institutions	1101	-0.628	0.563	-1.957	0.87
Voice and Accountability	1104	-0.565	0.691	-1.999	1.007
Political Stability	1104	-0.521	0.847	-2.848	1.224
Government Effectiveness	1101	-0.728	0.575	-1.879	1.15
Regulatory Quality	1104	-0.659	0.582	-2.302	1.197
Rule of Law	1104	-0.659	0.605	-1.928	1.044
Control of Corruption	1104	-0.619	0.591	-1.648	1.245
Fixed telephone subscriptions	1229	3.139	5.271	0	36.885
Mobile cellular subscriptions	1239	44.683	44.683	0	206.703
Individuals using the Internet	1216	11.499	16.718	0	88.13
Financial development	1156	0.004	2.332	-3.051	12.963
Real GDP growth rate	1233	4.264	7.662	-50.339	149.973
Age dependency ratio	1248	82.574	15.744	40.421	111.477
Fertility rate	1248	4.755	1.392	1.36	7.762
Population growth rate	1248	2.454	1.151	-5.143	18.087
Share of female population	1248	50.378	0.882	46.922	53.082

Source: Authors' computations.

Appendix Table A.1 provides information on the definitions of the variables and their attendant sources whereas Appendix Table A.2 discloses the sampled countries. The corresponding summary statistics is provided in Table 1. Accordingly, as clarified in the previous paragraph, the mean values of the moderating variables are relevant for the computation of the net effects or influences, while the range (i.e., minimum to maximum levels of the moderating variables) are also useful in the establishment of whether computed thresholds are economically worthwhile and make policy sense.

3.2 Methodology

The empirical strategy of the study entails fixed effects (FE) regressions in order to take into account country-specific heterogeneities that can affect estimated coefficients, especially when the sample consists of a group of countries. Moreover, in the light of the problem statement the specification exercise is tailored such that intra-African trade is interacted with both governance and ICT to influence force labour participation, notably in Equation (1) and Equation (2), respectively. Furthermore, based on the empirical and theoretical expositions covered previously (Asongu et al., 2020), especially as it pertains to the rewards from interactive regressions in policy orientations (Ehigiamusoe & Samsurijan, 2021; Tchamyou et al., 2023a), the attendant specifications are disclosed as follows:

$$FLP_{i,t} = \gamma_1 ATI_{i,t-1} + \gamma_2 IQ_{i,t-1} + \gamma_3 (ATI_{i,t-1} \times IQ_{i,t-1}) + \phi Z_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (1)$$

$$FLP_{i,t} = \gamma_1 ATI_{i,t-1} + \gamma_2 ICT_{i,t-1} + \gamma_3 (ATI_{i,t-1} \times ICT_{i,t-1}) + \phi Z_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t} \ , \quad (2)$$

where the outcome variable FLP is the proxy for female labour force participation while the main independent variable of interest or channel is Intra-African trade integration (ATI). Consistent with the motivation of the study, the moderating variables are Information and Communication Technology (ICT) and the institutional quality (IQ) is understood as an average of the six main governance indicators, namely: voice and accountability (VA), government effectiveness (GE), political stability and absence of violence (PV), rule of law (RL), regulatory quality (RQ), and control of corruption (CC).

In essence, the governance indicators are characterized by units of a normal standard distribution with a standard deviation of one, mean of zero, and range of between -2.5 to 2.5, in which better governance correspond to high governance values. ICT is appreciated in terms of fixed telephone subscriptions per 100 people (ICT1); mobile cellular subscriptions per 100 people (ICT2) and individuals using the Internet as of population (ICT3). Furthermore, the vector Z entails a set of variables in the conditioning information set which include: real GDP growth rate (GDPG), fertility rate (FERT), population growth rate (POPG), dependency ratio (DEPR), financial development (FD) and share of female population (FPOP). The μ_i term represent the time-invariant and unobservable impacts that are country-specific, λ_t entails time effects that are unobservable in order to reflect the influence of macroeconomic shocks that could affect all the countries simultaneously, and $\varepsilon_{i,t}$ denote error terms. Subscripts i and t are respectively, country and time indicators. The explanatory variables are lagged by one year in order to reduce concerns pertaining to simultaneity with the outcome variables (Asongu *et al*., 2020). In the light of the underlying, our baseline estimation methodology of Equations (1) and (2) is based on the OLS fixed effects regressions. Augmented Dickey-Fuller (ADF) unit-root tests with a drift term in each panel unit indicates that all variables considered are stationary over the estimation sample period except the variable ICT3. The first difference of this later variable is instead used in the regressions.

It is relevant to note that cross-sectional dependence is also taken in account because the estimation technique accounts for both country-specific effects and time-specific effects. Accordingly, the control for time specific effects, while accounting for the unobserved time heterogeneity, also controls for cross-sectional dependence (Tchamyou et al., 2023a; Asongu & Odhiambo, 2023).

4. Empirical results

4.1 Fixed effects regressions

The results of the fixed effects regressions are provided in Tables 2-3. Table 2 shows nexuses between quality of governance, intra-African trade integration and female labour force participation while Table 3 shows nexuses between ICT, intra-African trade integration and female labour force participation. It is worthwhile to note that these also double as the findings of baseline regressions. Moreover, in all the regressions, the parentheses show clustered standard errors at the country level and time dummies are also included, though corresponding coefficients are not reported. It is also worthwhile to clarify that in order to address an associated concern of simultaneity or reverse causality, the independent variable variables of interest as well as the corresponding control variables are lagged by one year such that contemporary female labour force participation is affected by non-contemporary independent and control variables. This strategy of lagging the independent variables of interest by one year in order to take into account the concern of simultaneity (i.e., one of the four dimensions of endogeneity) is consistent with the extant empirical literature (Mlachila et al., 2017; Hill et al., 2021).

Prior to discussing the corresponding findings that are established in Tables 2-3, it is also worthwhile to mention that these tables also present the net effect from the role of institutional quality in moderating the incidence of Intra-African trade integration on female economic participation is $\partial FLP/\partial ATI = \gamma_1 + \gamma_3 IQ$ for Equation (1). Moreover, the net effect from the role of ICT in moderating the incidence of Intra-African trade integration on female economic participation is $\partial FLP/\partial ATI = \gamma_1 + \gamma_3 ICT$ for Equation (2).

It is important to recall that while the premise of the study is to assess the relevance of governance and information and communication technology in moderating the incidence of African trade on female economic participation, the outcome variable and data structure are such that both fixed effects and Tobit regressions can be employed in the estimation processes. On the one hand, given that the sampled in terms of data structure consists of units of group such as countries with specificities, the extant literature has argued that fixed effects regressions estimation approach can be adopted in such a scenario (Asongu et al., 2020). Moreover, given the outcome variable has a limited range and thus is censored from 0% to 100%, a double censored Tobit model can be adequately, employed, in accordance with the extant literature on the adoption of the Tobit regression estimation technique (Kölling, 2012).

Table 2: Effects of intra-Africa trade and quality of governance on female labour force participation in Africa

Female Labour Force Participation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.Intra-African Trade Integration	0.816*	0.524	0.387	0.723**	0.609	0.978***	0.452
	(0.410)	(0.464)	(0.373)	(0.298)	(0.512)	(0.292)	(0.386)
L.Quality of institutions	0.412						
	(0.798)						
L.(Quality of institutions)*(ATI)	0.866**						
	(0.376)						
L.Voice and Accountability		0.112					
		(0.813)					
L.(Voice and		0.142					
		(0.390)					
L.Political Stability			0.160				
			(0.351)				
L.(Political Stability)*(ATI)			0.396**				
			(0.185)				
L.Government Effectiveness				0.870			
				(0.858)			
L.(Government				0.616***			
				(0.194)			
L.Regulatory Quality					0.328		
					(1.031)		
L.(Regulatory Quality)*(ATI)					0.334		
					(0.310)		
L.Rule of Law						-0.443	
						(0.772)	
L.(Rule of Law)*(ATI)						1.023***	
						(0.265)	
L.Control of Corruption							-0.388
							(0.726)
L.(Control of Corruption)*(ATI)							0.151
							(0.234)
L.Financial development	0.110	0.126	0.115	0.110	0.122	0.104	0.123
	(0.109)	(0.116)	(0.116)	(0.104)	(0.111)	(0.112)	(0.111)
L.Real GDP growth rate	-0.000	-0.005	-0.004	-0.004	-0.004	0.003	-0.004
	(0.017)	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
L.Fertility rate	3.250**	3.241**	3.187**	3.500**	3.294**	2.943**	3.236**
	(1.428)	(1.394)	(1.382)	(1.438)	(1.590)	(1.428)	(1.413)
L.Agedependency ratio	-0.201***	-	-	-0.205***	-0.216***	-0.210***	-0.215***
	(0.059)	(0.060)	(0.059)	(0.059)	(0.060)	(0.056)	(0.060)
L.Populationgrowth rate	-0.391	-0.416	-0.388	-0.364	-0.417	-0.394	-0.422
	(0.286)	(0.300)	(0.289)	(0.284)	(0.308)	(0.277)	(0.301)
L.Share of female population	0.047	0.012	-0.131	0.087	0.052	0.120	0.011
	(0.953)	(0.958)	(0.970)	(0.960)	(0.965)	(0.940)	(0.966)
Net effect of ATI	0.272	na	na	0.275	na	0.303	na
Threshold	nsa	nsa	nsa	nsa	nsa	nsa	nsa
Countries\Observations	48\987	48\990	48\990	48\987	48\990	48\990	48\990
R-squared within	0.21	0.20	0.21	0.22	0.20	0.24	0.20

Notes: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Robust standard errors in parentheses are clustered at the country level. L. denotes the first lag. na: not applicable because at least one of the estimated coefficients needed for the computation of net effects and threshold is not significant. nsa: not specifically applicable because a synergy net effect is apparent. In all specifications, we control for a full set of country and year fixed effects. Hypothesis 2 is validated.

Table 3: Effects of AfCFTA and ICT on female labour force participation

Female Labour Force Participation	(1)	(2)	(3)
L.Intra-African Trade Integration	0.294	0.416	0.580
	(0.508)	(0.395)	(0.400)
L.Fixed telephone subscriptions	0.204		
	(0.156)		
L.(Fixed telephone subscriptions)x(ATI)	0.069		
	(0.097)		
L.Mobile cellular subscriptions		0.037**	
		(0.017)	
L.(Mobile cellular subscriptions).(ATI)		0.002	
		(0.004)	
L.Individuals using the Internet			0.081**
			(0.038)
L.(Individuals using the Internet)x(ATI)			0.006
			(0.009)
L.Financial Development	0.098	0.130	0.118
	(0.111)	(0.127)	(0.128)
L.Real GDP growth rate	-0.010	-0.016	-0.010
	(0.011)	(0.014)	(0.012)
L.Fertility rate	3.086**	2.078	1.625
	(1.330)	(1.510)	(1.619)
L.Age dependency ratio	-0.212***	-0.146**	-0.147**
	(0.055)	(0.059)	(0.064)
L.Population growth rate	-0.363	-0.368	-0.373
	(0.299)	(0.279)	(0.304)
L.Share of female population	-0.194	-0.224	0.384
	(0.876)	(0.945)	(0.980)
Net effect of Intra-African Trade Integration	na	na	na
Threshold	nsa	nsa	nsa
Countries\Observations	48\1102	48\1110	48\1097
R-squared within	0.21	0.24	0.23

Notes: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Robust standard errors in parentheses are clustered at the country level. L. denotes the first lag. na: not applicable because at least one of the estimated coefficients needed for the computation of net effects and threshold not significant. nsa: not specifically applicable because a synergy net effect is apparent. In all specifications, we control for a full set of country and year fixed effects. The variable 'Individuals using the Internet' enters in the estimation in first difference. Hypothesis 1 is not validated.

The following can be established from Table 2-3 on nexuses between intra-Africa trade, governance, ICT and female labour force participation. (i) Governance moderates intra-African trade to engender positive synergies on female labour force participation. The positive synergies are apparent in the following governance dynamics: overall quality of institutions, government effectiveness and the rule of law. (ii) Information technology does not significantly moderate intra-Africa trade to engender a significant effect on female labour force participation. It follows that *Hypothesis* 1 is not validated while *Hypothesis* 2 is validated. The significant control variables have the expected signs, not least, because more birth potentially imply more women available for the formal labour force and/or women having the financial means with which to look after the kids that are born owing their employment in the economic sector. Conversely, high dependency,

especially when the weight of old citizens is high, can lead to the unexpected outcome on the dependent variable.

4.2 Robustness checks

The linear fixed effects model does not ensure that the expected value is between it bound, zero and one (0 and 100 in percent terms). Following Papke and Wooldridge (2008), in alternative model, we consider a fractional probit model in Equations (3) and (4) for the interactive between intra-African trade and governance and for the interaction between intra-African trade ICT, respectively:

$$E(FLP_{i,t}) = \Phi(\gamma_1 ATI_{i,t-1} + \gamma_2 IQ_{i,t-1} + \gamma_3(ATI_{i,t-1} \times IQ_{i,t-1}) + \phi Z_{i,t-1} + \mu_i + \lambda_t) \quad (3)$$

$$E(FLP_{i,t}) = \Phi(\gamma_1 ATI_{i,t-1} + \gamma_2 ICT_{i,t-1} + \gamma_3(ATI_{i,t-1} \times ICT_{i,t-1}) + \phi Z_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{i,t}) \quad (4)$$

Where Φ **is** is the normal cumulative distribution. We estimate the fractional probit model using the pooled Bernoulli quasi-maximum likelihood (QMLE) method with standard errors that are robust to heteroskedasticity and serial correlation.

Table 4: Effects of intra-Africa trade and quality of governance on female labour force participation in Africa

Female Labour Force Participation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.Intra-African Trade	0.021**	0.013	0.009	0.018**	0.016	0.025***	0.011
	(0.010)	(0.012)	(0.009)	(0.008)	(0.013)	(0.007)	(0.010)
L.Quality of institutions	0.012						
	(0.021)						
L.(Quality of	0.022**						
	(0.009)						
L.Voice and Accountability		0.004					
		(0.021)					
L.(Voice and		0.003					
		(0.010)					
L.Political Stability			0.004				
			(0.009)				
L.(Political Stability)*(ATI)			0.010**				
			(0.005)				
L.Government Effectiveness				0.023			
				(0.023)			
L.(Government				0.016***			
				(0.005)			
L.Regulatory Quality					0.010		
					(0.028)		
L.(Regulatory Quality)*(ATI)					0.009		

					(0.008)		
L.Rule of Law						-0.012	
						(0.020)	
L.(Rule of Law)*(ATI)						0.026***	
						(0.007)	
L.Control of Corruption							-0.009
							(0.019)
L.(Control of							0.004
							(0.006)
L.Financial development	0.003	0.004	0.003	0.003	0.004	0.003	0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
L.Real GDP growth rate	-0.002	-0.016	-0.011	-0.013	-0.011	0.007	-0.011
	(0.046)	(0.045)	(0.047)	(0.049)	(0.048)	(0.047)	(0.048)
L.Fertility rate	8.991**	8.930**	8.847**	9.632**	9.123**	8.157**	8.952**
	(3.869)	(3.769)	(3.752)	(3.856)	(4.298)	(3.852)	(3.793)
L.Agedependency ratio	-0.558***	-	-	-0.569***	-0.596***	-0.579***	-
	(0.155)	(0.157)	(0.154)	(0.155)	(0.156)	(0.147)	(0.155)
L.Populationgrowth rate	-1.060	-1.114	-1.052	-0.987	-1.127	-1.069	-1.140
	(0.788)	(0.818)	(0.793)	(0.780)	(0.845)	(0.761)	(0.826)
L.Share of female	0.195	0.092	-0.263	0.294	0.187	0.397	0.090
	(2.480)	(2.509)	(2.520)	(2.499)	(2.517)	(2.452)	(2.514)
Net effect of ATI	0.003	na	na	0.003	na	0.003	na
Threshold	nsa	nsa	nsa	nsa	nsa	nsa	nsa
Countries\Observations	48\987	48\990	48\990	48\987	48\990	48\990	48\990

Notes: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Robust standard errors in parentheses are clustered at the country level. L. denotes the first lag. na: not applicable because at least one of the estimated coefficients needed for the computation of net effects and threshold is not significant. nsa: not specifically applicable because a synergy net effect is apparent. In all specifications, we control for a full set of country and year fixed effects. Hypothesis 2 is validated.

The results show that the two sets of estimates are qualitatively similar. The advantage of the linear model is that we can easily obtain the magnitude of the effect. Papke and Wooldridge (2008) found that the difference between linear and nonlinear models is not important for estimating the marginal effect of a given change in an explanatory variable.

Table 5: Effects of AfCFTA and ICT on female labour force participation

Female Labour Force Participation	(1)	(2)	(3)
L.Intra-African Trade Integration	0.007	0.010	0.011
	(0.013)	(0.010)	(0.010)
L.Fixed telephone subscriptions	0.006		
	(0.004)		
L.(Fixed telephone subscriptions)x(ATI)	0.002		
	(0.002)		
L.Mobile cellular subscriptions		0.001**	
		(0.000)	
L.(Mobile cellular subscriptions).(ATI)		0.000	
		(0.000)	
L.Individuals using the Internet			-0.009
			(0.133)
L.(Individuals using the Internet)x(ATI)			0.057
			(0.107)
L.Financial Development	0.003	0.004	0.004

	(0.003)	(0.003)	(0.004)
L.Real GDP growth rate	-0.026	-0.045	-0.011
	(0.028)	(0.036)	(0.045)
L.Fertility rate	8.604**	5.826	9.126**
	(3.604)	(4.053)	(3.704)
L.Age dependency ratio	-0.590***	-0.402***	-0.611***
	(0.146)	(0.156)	(0.156)
L.Population growth rate	-0.984	-1.011	-1.633*
	(0.821)	(0.772)	(0.967)
L.Share of female population	-0.394	-0.536	0.822
	(2.276)	(2.496)	(2.687)
Net effect of Intra-African Trade Integration	na	na	na
Threshold	nsa	nsa	nsa
Countries\Observations	48\1102	48\1110	48\1097

Notes: *** (**) (*) denotes significance at the 1 (5) (10) percent level. Robust standard errors in parentheses are clustered at the country level. L. denotes the first lag. na: not applicable because at least one of the estimated coefficients needed for the computation of net effects and threshold not significant. nsa: not specifically applicable because a synergy net effect is apparent. In all specifications, we control for a full set of country and year fixed effects. The variable 'Individuals using the Internet' enters in the estimation in first difference. Hypothesis 1 is not validated.

The corresponding findings are disclosed in Tables 4 and 5. In line with the same presentation style as in the previous section, Table 4 shows nexuses between the quality of governance, intra-African trade integration and female labour force participation whereas Table 5 shows nexuses between ICT, intra-African trade integration and female labour force participation. The following findings can be established from Tables 4-5. (i) Governance moderates intra-African trade to engender positive synergies on female labour force participation. The positive synergies are apparent in the following governance dynamics: overall quality of institutions, government effectiveness and the rule of law. These findings are consistent with those established in Table 2. (ii) Information technology does not significantly moderate intra-African trade to engender a significant effect on female labour force participation. These findings are explained in Section 5.2. These findings can consistent with those established in Table 3.

Concerning the nexus between the established findings and extant literature, the findings can be further discussed in three principal strands, especially as it pertains to the: (i) nexus between trade and inclusive development outcomes; (ii) role of governance in economic development and (iii) importance of information technology in gender inclusive outcomes. These strands are discussed in the same chronology as highlighted in what follows. First, the positive unconditional effect of intra-African trade on gender economic inclusion is consistent with the extant literature on the importance of cross-border trade on promoting the formal and informal economic activities of women (Njiwa et al., 2011; Breton & Isik, 2012; Afrika & Ajumbo 2012; Brenton & Soprano, 2018; Tchamyou et al., 2023a).

Second, the positive relevance of governance in promoting how intra-African trade influence female economic inclusion is consistent with a strand of literature on the importance of strong government institutions in structural transformation, employment and economic development

(Amavilah *et al*., 2017; Anthony-Orji *et al*., 2019; Ongo Nkoa & Song, 2020; Saba *et al*., 2024). In essence, governance has been documented to promote democracy and reduce corruption which is essential in economic prosperity (Gossel, 2018; Fambeu, 2021; Zallé & Ouédraogo, 2021; Awad & Albaity, 2022; Fambeu & Yomi, 2023; Dossou et al., 2023a, 2023b). Third, the insignificance of the information technology in boosting inclusive development within the remit of gender economic inclusion is not consistent with the strand of literature on the positive relevance of information and financial technologies is boosting employment and economic prosperity (Suri & Jack, 2016; Sioson & Kim, 2019; Adeleye & Eboagu, 2019; Fernández-Portillo, et al., 2020; Moufakkir & Mohammed, 2020; Awad & Albaity, 2022; Khera *et al*., 2022; Loko & Yang, 2022; Yeyouomo *et al*., 2023).

5. Conclusion, implications, limitation and future research directions

5.1 Conclusion

The present study has complemented the extant literature by assessing the relevance of governance and information technology in how African trade affects female labour force participation. The study focuses on 48 African countries using data for the period 1996 to 2021. An adopted empirical strategy is the fixed effects regressions that are designed to address concerns for simultaneity and the unobserved heterogeneity. The fractional probit model based on the pooled Bernoulli quasi-maximum likelihood method is also employed. The research question assessed by the study has been to know how governance and ICT moderate the effect of African trade on female labour force participation? To answer the question two main hypotheses have been tested, notably: (i) Information technology positively moderates the effect of trade on female labour force participation (*Hypothesis* 1) and (ii) governance positively influences the effect of trade on female labour force participation (*Hypothesis* 2). From the empirical results, *Hypothesis* 1 is not validated while *Hypothesis* 2 is validated. Accordingly, the following main findings are established. First, governance moderates intra-African trade to engender positive synergies on female labour force participation. The positive synergies are apparent from the overall quality of institutions, government effectiveness and the rule of law. Second, information technology does not significantly moderate intra-African trade to affect female labour force participation. The established findings from fixed effects regressions are robust to fractional probit model estimations. Policy implications are discussed in what follows.

5.2 Policy implications

First, the positive unconditional effect of intra-African trade on female labour force participation, thought insignificant in some estimations is evidence that trade within African countries should be promoted in view of increasing the participation of more women in the formal economic sector. By extension, the perspective that some unconditional estimated coefficients have the expected positive signs though not significant also shows that intra-African trade needs to be enhanced in order for the full potential benefits in terms of gender economic inclusion to be apparent. This finding within the policy remit is consistent with the adopted Protocol on the Rights of Women in Africa (the Maputo Protocol) in 2003 by the African Union, which has as fundamental goal the promotion of women by means of better political, economic, social and human rights in order to enable them realise their full potentials. The findings are also consistent with the underlying protocol on the stance, that females should be correctly anchored as main drivers of transformation within social and politico-economic circles and thus, the need for corresponding trade to also be tailored at promoting women economically in order to expect more externalities within the remit of structural transformation.

The findings also speak to the one of the goals of the AfCFTA which is to enhance and attain inclusive and socio-economic development, especially as it pertains to structural transformation

and gender parity within and across nations. It is also relevant to note that the findings are consistent with the inclusive agenda proposed by the AfCFTA, especially as it pertains to the goal of boosting trade in view of realising more investment that is tailored to *inter alia*, promote the rights of women such as the right to be more formally included in the economic sector.

Second, the positive incidence of governance in the moderating of the nexus between intra-African trade and gender economic inclusion is also evidence of the perspective that governance structures need to be improved in order to benefit from the positive relevance of intra-African trade in gender economic inclusion. (i) It follows that the proper election and replacement of political leaders (i.e., political stability/no violence and 'voice & accountability') affects the how intra-African trade ultimately influences gender economic inclusion. Hence, political stability and 'voice & accountability' should be promoted in order for the anticipated benefits of intra-African trade in terms of gender economic inclusion to be optimally leveraged. (ii) Governments of sampled countries should also improve the manner in which policies for the delivery of public commodities are formulated and implemented, because properly and effectively doing so ultimately positively influences how trade between countries affects the gender economic inclusion outcomes. It follows that policies designed to boost government effectiveness should be promoted in order for the anticipated rewards to be feasible. (iii) The positive relevance of intra-African trade in terms of inclusive development outcomes is not likely to be apparent, without respect by the citizens and the State of institutions that govern interactions between (i.e., proper institutional governance). It follows that corruption-control and the rule of law should be upheld as policy measures by which the beneficial effect of intra-African trade in terms of gender economic inclusion can be most apparent.

Third, as an extension to the preceding policy recommendation, while governance measures should be consolidated in view of moderating trade within African nations for more favorable gender inclusive outcomes, it is relevant to note that of the considered governance dynamics some are most effects. Accordingly, in the light of the empirical evidence, the rule of law, government effectiveness and overall quality of institutions are the most effective policy governance measures that can be employed to significantly influence trade within African nations for gender economic inclusion in the anticipated favourable directions.

Fourth, one of the reasons information technology dynamics do not significantly moderate intra-African trade to promote female labour force participation may be traceable to the perspective that extant penetration levels of information technology need to be improved as well as tailored towards favouring both trade within nations and gender economic inclusion. It follows that sensitisation programs should be developed and tailored to inform the population engaged in both the informal and formal economic sectors on the benefits of trade within African countries, especially in terms of gender inclusive outcome such at gender economic inclusion.

Some of the mechanisms by which inclusive technology can be promoted have been documented in the Forbes Technology Council (2023). According to the narrative, the information technology sector has been attempting to increase inclusion and diversity in its workforce and

businesses for a number of years. Given that diverse teams better reflect and satisfy the requirements of different user populations, technology leaders view it as both the morally correct thing to do and a wise commercial move. Such should be complemented with government actions and policies. Accordingly, in order to successfully integrate perspectives of diversity and inclusion, especially as it relates to gender economic inclusion by means of information technology, policy makers must address a number of issues, such as hiring, education, team recognition and involvement, and admitting inherent biases. Some of the practical, efficient strategies for governments and information technology leaders to guarantee a diverse and gender inclusive work environment include: focusing on campus hires; setting measurable diversity and inclusion metrics and goals; revamping job description to broaden employment application frameworks; implementing blind hiring practices; ensuring that everybody knows how they are valued and respected; providing events and workspaces that meet the needs of females as well as those of males; mitigate and eliminate team hierarchies that limit gender inclusion; adopt and promote hiring practices that are diverse and establish programs of mentorship that promote females.

5.3 Limitations and future research directions

The established findings evidently allow space for future research, especially as it pertains to assessing how other policy instruments can be used to influence how intra-African trade influences female labour force participation. Some examples include the potential role of other mediating variables like education and health infrastructure in female labor force participation. Furthermore, the future areas of research interest should not be limited to gender economic inclusion, but could be extended to other common continental and global objectives such as the Agenda 2063 of the African Union and complementary United Natons' Sustainable Development Goals (SDGs). Furthermore, in order to improve insights into the nexuses, future studies can consider comparative studies focusing on various regions and continents in order to establish how lessons from frontier regions and continents can be relevant to other groups of countries. Last but not the least, while only 48 African countries are used in the study due to data availability constraints at the time of the study, future studies should consider more updated data as well as country-specific and panel estimation techniques that are more robust to endogeneity and from which, causality can be more apparent.

Appendices

Table A.1: Definitions and sources of variables

Variables	Variable definitions	Sources
	Panel A: AfCFTA (proxied with trade indicators)	
Share of intra-Africa exports + imports over GDP	The value of the goods that a country has exported within the region as a percentage of that country's GDP and the value of the goods that a country has imported from within the region as a percentage of that country's GDP.	Authors calculations using UNCTAD database
Share of intra-Africa trade over total intra-Africa trade	The sum of a country's exports and imports within the region over the country's GDP as a percentage of all of the intra-Africa trade over the Africa's GDP	Authors calculations using UNCTAD database
Intra-African Trade integration (ATI)	Sum of z-score of the share of intra-Africa exports + imports over GDP and share of intra-regional trade over total intra-Africa trade	Authors calculations using UNCTAD database
	Panel B: financial development	
Financial System Depth	Liquid Liabilities (% of GDP)	World Bank (Global Financial Development Database)
Financial System Efficiency	Private credit by deposit money banks and other financial institutions (% of GDP) to financial system deposits (% of GDP)	
Financial System Activity	Private credit by deposit money banks and other financial institutions (% of GDP)	
Financial Development (FD	Sum of z-score of financial system depth, financial system efficiency, and financial activity	
	Panel C: Women's Economic Participation (WEP)	
Female labour force participation rate	Labour force participation rate, female (% of female population ages 15+)	World Bank using ILO estimates
	Panel D: Governance indicators	
Quality of institutions	Voice and Accountability Political Stability and Absence of Violence/Terrorism Government Effectiveness Regulatory Quality Rule of Law Control of Corruption	World Bank (WGI)
	Panel E: Information and Communications Technology	
Fixed telephone subscriptions	Fixed telephone subscriptions (per 100 people)	World Bank (WDI)
Mobile cellular subscriptions	Mobile cellular subscriptions (per 100 people)	World Bank (WDI)
Individuals using the Internet	Individuals using the Internet (% of population)	World Bank (WDI)
	Panel D: Control Variables	
Real GDP growth rate	Real GDP (constant 2015 US dollars) growth rate	World Bank (WDI)
Fertility rate	Fertility rate (births per woman)	World Bank (WDI)
Dependency ratio	Age dependency ratio (% of working-age	World Bank (WDI)
Population growth rate	Growth rate of the total population	World Bank (WDI)

Share of female	Female population (% of total population)	World Bank (WDI)

WDI: World Development Indicators. WGI: Worldwide Governance Indicators

Tables A.2: Number of observations per countries in the baseline estimation sample

Country	Number of observations	Country	Number of observations	Country	Number of observations
Angola	22	Ghana	22	Namibia	22
Burundi	22	Guinea	22	Niger	22
Benin	22	Gambia, The	20	Nigeria	22
Burkina Faso	22	Guinea-Bissau	22	Rwanda	22
Botswana	22	Equatorial	21	Senegal	22
Central African	21	Kenya	22	Sierra Leone	22
Cote d'Ivoire	22	Liberia	19	Sao Tome and	12
Cameroon	20	Libya	20	Eswatini	22
Congo, Dem Rep	20	Lesotho	22	Chad	21
Congo, Rep	21	Morocco	22	Togo	22
Comoros	21	Madagascar	22	Tunisia	22
Cabo Verde	19	Mali	22	Tanzania	22
Algeria	22	Mozambique	22	Uganda	22
Egypt, Arab Rep	22	Mauritania	15	South Africa	22
Ethiopia	10	Mauritius	22	Zambia	12
Gabon	21	Malawi	18	Zimbabwe	16

Note: The maximum number of observations a country can have in the estimation sample is 22.

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