Fintech gender disparities in Africa

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Abstract

This paper investigates the drivers of fintech gender disparities in Africa. We use a novel fintech dataset for 35 economies in Africa over three different years 2014-2017 and 2021. Using the Generalized Linear Model (GLM) and Panel Least Squares methods. It finds significant gender disparities in fintech usage; 38% of men use fintech, compared to only 29% of women. It also demonstrates that socioeconomic and cultural factors are the main drivers of gender disparities in Africa, as women in the continent face greater inequality in the workplace, in education, literacy, and the law, which makes it more difficult for them to access digital finance. In addition, we find that women use fintech more frequently, financial services are easier to get, and financial inclusion is encouraged when women are empowered politically, included in democratic decision-making processes, and gender equality is advanced globally.

Keywords: *Fintech, Gender disparities, Africa region, Gender inequality, Financial inclusion.*

1. Introduction

The financial system in Africa is limited in scope and lacks development. In Africa, low- and unstable-income levels, inflationary environments, high rates of illiteracy, inadequate infrastructure, governance issues, and the high cost of banking are some of the factors cited to explain the underdeveloped financial sector and its limited outreach (Triki and Faye, 2013). In Africa, adults who live in rural areas usually mention the distance to a bank as a deterrent to opening an account, while younger adults typically cite inadequate documentation. The idea that easily available financial services may contribute to the fight against poverty and promote economic growth is gaining traction. The belief that the poor can be lifted out of the cycle of poverty through access to and usage of quality financial services is the driving force behind the widespread adoption of policies, programs, and reform measures that aim to promote financial inclusion. The continent has experienced a notable upsurge in financial technology innovation in the last ten years, which has transformed the accessibility and utilization of financial services. An expanding middle class, the need to close the financial inclusion gap, and the increasing adoption of smartphones have all contributed to this issue. Across the continent, fintech businesses have proliferated, providing a wide range of services, including digital payment systems, insurtech, peer-to-peer lending, and mobile

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banking. Financial inclusion has been primarily fueled by the use of digital financial services (GSMA, 2020; Pazarbasioglu *et al*., 2020; World Bank, 2020a, 2020b). Recent technological developments and the adoption of digital financial services, such as mobile money, internet banking, and electronic payment systems, have not only increased the efficiency of service delivery but also decreased the cost of financial transactions, increasing financial inclusion for the poor (Sahay *et al*., 2020; World Bank, 2020a). Alsan *et al*. (2017) found a direct link between gender inequality in financial inclusion and overall inequality.

African women face significant challenges in accessing financial services, which hampers their economic participation. Traditional gender roles and social norms further restrict their economic activities and decision-making power. According to the International Monetary Fund (IMF), women's limited access to financial services in Africa significantly impacts social and economic progress, particularly in sectors like agriculture where women are predominant. Furthermore, there are no equal opportunities for women because they are underrepresented in leadership positions, higher-paying professions, and even education which widens socioeconomic inequality. Kerras *et al*. (2022) emphasize that women's access to technology and education plays a crucial role in promoting sustainability in the agri-food sector. In the same vein, Parrilla González and Ortega Alonso (2022) point out that gender perspectives, heritage, and innovation are critical for achieving sustainability goals in the olive oil cooperative sector, a model that could inspire gender-inclusive fintech strategies in Africa.

The usage of financial products and services is a topic covered in a higher proportion of digital financial inclusion literature than in financial inclusion literature. Inequality affects efforts to reduce poverty in low- and middle-income countries. Because of discriminatory social norms that deprive women of their rights and educational opportunities, there is a gender gap in technology use, financial illiteracy, digital illiteracy, and ultimately financial exclusion and digital financial exclusion (Ojo, 2022). The impact of the gender gap on financial inclusion is confirmed by Delechat *et al*. (2018). The unbanked population is proof that low- and middle-income countries have a high degree of financial exclusion (Naumenkova *et al*., 2019).

Moreover, absence of financial literacy initiatives to facilitate loan availability could lead to impoverished people accruing excessive debt, thereby exacerbating their poverty. In every area of the economy, including manufacturing, distribution, education, banking, and health, digital technology has changed everything. These include time limits, lack of digital expertise, access, which makes internet connectivity difficult, and the usage of Digital Financial Services (DFS) (Mariscal *et al*., 2018). Obstacles to DFS for women include societal beliefs, trust, confidence, a lack of digital devices like laptops and smartphones, the high cost of internet data, laws that discriminate against women, gaps in digital knowledge and skills, and a lack of technical skills and competencies (Molinier, 2019; Krieger-Boden and Sorgner, 2018), but previous research and data is not sufficient and the issue needs further investigation. Additionally, low earnings, low incomes, low literacy rates, sociocultural factors, digital exclusion and education, issues about pricing and accessibility, fears about safety and security, and discouragement from loved ones Knowledge and information asymmetry is one of the barriers to DFS for women (Chetty *et al*., 2018). Despite their focus on DFS, the researchers contend that the use and spread of Information Communication Technologies (ICT) has a positive relationship with the decrease of poverty and inequality.

The purpose of this paper is to determine the factors that contribute to gender differences in fintech in Africa. We examined the relationship between gender inequality and fintech, examining the gender disparities from the perspective of using digital financial services. We also looked at the elements related to law, culture, social norms, and uneven access to the employment, education, and literacy. In addition, we offer several suggestions that help address the gender gap in digital financial inclusion. In addition to improving access to financial services and reducing economic and financial exclusion, digital financial inclusion may help women gain more power and see the UN Sustainable Devel-

opment Goals (SDG) in developing countries fulfilled by 2030.

The rest of this paper is organized as follows. Section 2 presents a review of the literature. Section 3 describes our empirical analysis. In section 4, we present our findings and discuss them in line with the relevant literature and findings, and we develop analysis of robustness checks. Our conclusions will be outlined in section 5.

2. Literature review

Women are still more likely to be unbanked or unbanked globally than men. They manage their household finances less frequently than males do (Guiso and Zaccaria, 2021) and are less likely to own a bank account (Demirgc-Kunt *et al*., 2017). There is rising optimism that new financial technologies, or "fintechs," can increase financial inclusion and eliminate the gender gap in access to financial services. Traditional financial institutions and more recent fintech companies are both using new technologies and non-traditional data to make investments that are more cost-effective and cater to consumer requirements (Thakor, 2020; Philippon, 2019; Boot *et al*., 2021 and Arner *et al*., 2020). Fintech may be used to assist close the gender disparities in access to and use of financial services; however, there is insufficient evidence to support this claim.

By expanding access to financial services and eliminating financial and economic exclusion, digital financial inclusion could help in the empowerment of women and the achievement of the United Nations 2030 Sustainable Development Goals (SDG) in developing nations. Over the past ten years, there has been a noticeable increase in the use of technology and the acceptance of digital financial services (DFS), such as conducting financial transactions online and using mobile devices. This trend was further exacerbated during the COVID-19 pandemic. Since it allows those, who would not have otherwise been able to access traditional financial services to conduct financial transactions from home, and businesses fintech has proven very useful in achieving the objectives of financial inclusion. Nonetheless, disparities in financial inclusion across genders still exist. Women have accounted for 65% of the world's population, compared to 72% of men (Demirgüç-Kunt *et al*., 2018). As financial technologies become more accessible and easier to use, they can help women overcome some of these barriers and become financially empowered (Sioson and Kim, 2019).

Although there are still significant differences between regions and nations, financial inclusion indexes created by Sahay *et al*. (2020) indicate that DFSs have in fact assisted in closing gender gaps in a number of nations. Investigating the reasons behind these discrepancies is crucial for bridging the gender disparities in fintech since increased digital financial inclusion is linked to economic growth, which is good for society overall (Khera *et al*., 2021). Furthermore, barriers to DFS for women include a lack of digital equipment such as laptops and mobile phones, high internet data costs, discriminatory legislation, digital knowledge, and skill gaps, as well as social beliefs, trust, confidence, and inadequate technical skills and competences (Krieger-Boden and Sorgner, 2018). Disadvantageous social norms that deny women's rights and educational opportunities are also to blame for the gender disparity in technology use, financial illiteracy, digital illiteracy, and, ultimately, financial and digital financial exclusion.

According to Ahmed and Gillwald (2021), and Antonio and Tuffley (2014), the digital divide is rooted in historically established and persistent gender inequities related to barriers to internet access and technology use. The digital divide is associated with a skills gap and a lack of access to ICT. Fintech can play a pivotal role in alleviating income inequality. It can generate opportunities for the poor through job creation.

It can also lead to improved government services and tax collection while reducing corruption. Asongu et al (2017) investigated the interplay between ICT (i.e. mobile, internet, and broadband penetration) and inclusive growth in Sub-Saharan Africa over the period 2000–2012. They found a positive relationship between ICTs and inclusive growth. Asongu (2015) found an inverse relationship between income inequality and mobile penetration in Africa. Likewise, Asongu and Odhiambo (2019) identified an inverse relationship between mobile, internet, and

broadband penetration and inequality using a panel of 48 African countries. Most studies have found that FinTech and ICT are key drivers of financial inclusion (Kulkarni and Ghosh, 2021; Tchamyou *et al*., 2019). However, the fintech-financial inclusion nexus might differ depending on the financial inclusion dimensions, in addition to the type of financial service (payments, savings, credit, and insurance). Chea *et al*. (2021) looked into the extent of the gender disparity in the Association of Southeast Asian Nations (ASEAN) payments ecosystem in light of this. They found that women are more likely than males to employ conventional cash payment methods. In contrast, they discovered evidence of gender differences in the more advanced mobile money payment channels. These results, which are believed to withstand many sensitivity tests, also show that in more developed ASEAN countries like Singapore and Malaysia, there is a significant gender difference in the usage of mobile money. To assess data on the recent use of different payment channels and ascertain if the post-pandemic divide in ASEAN has widened or contracted, more study is desperately needed.

According to Ahmed and Gillwald (2021), gender differences that have historically been associated with barriers to internet access and technology use are at the root of the digital divide. The lack of access to ICT and the skills disparities are related to the digital divide. In Zambia Mwenge and Bwalya (2020) found that Women are typically more risk cautious and have lower risk tolerance levels. Low earnings also limit women because they are typically employed in low-paying jobs including domestic work, farming, and self-employment. Gammage *et al*. (2017) determine that digital finance is essential for enhancing the resilience, earnings, and standard of living of marginalized populations including women and young people. By lowering the costs of providing and gaining access to financial services, enhancing security, and lowering the risks involved in accessing financial services, DFSs play a crucial role in promoting financial inclusion. Fintech makes financial transactions faster and guarantees that low-income individuals receive specialized services that are tailored to their needs. Were *et al.* (2021) has provided research of Tanzania's gender differences in financial inclusion utilizing metrics including usage and access to digital and traditional bank-based financial services, especially mobile money services. Several socioeconomic factors, such as low income, restricted access to digital financial tools like smartphones, and low financial literacy, all contribute to the gender gap in financial inclusion by preventing women from effectively accessing and using formal financial services.

The data demonstrates that the gender gap in digital financial inclusion is not influenced by the state's level of economic growth. Important obstacles preventing women from using digital financial services are also identified in the study. Although most studies focused on the fintech gender gap, not on gender disparities, few researchers have analyzed gender disparities, especially in Africa. Our study contributes to the literature by utilizing recent databases to analyze the drivers of gender disparities in Africa, using socio-economic and cultural indicators.

3. Empirical Analysis

3.1. *Methodology and data*

To carry out this empirical study we used a database of the Global Findex Database over three times of periods 2014, 2017, and 2021. This data launched by the World Bank in 2011, provides comparable indicators showing how people around the world save, borrow, make payments, and manage risk. The 2014 edition of the database reveals that 62 percent of adults worldwide have an account at a bank or another type of financial institution or with a mobile money provider. Between 2011 and 2014, 700 million adults became account holders while the number of those without an account the unbanked dropped by 20 percent to 2 billion. A growth in account penetration of 13 percentage points in developing economies and innovations in technology particularly mobile money, which is helping to rapidly expand access to financial services in Sub-Saharan Africa. Along with these gains, the data also show that big opportunities remain to increase financial inclusion, especially

among women and poor people. The indicators in the 2017 Global Findex database are drawn from survey data covering almost 150,000 people in 144 representing more than 97 percent of the world's population. The 2021 edition, based on nationally representative surveys of about 128,000 adults in 123 economies. We did not use the database of 2011 because of the lack of data when we compared it by 2014, 2017, and 2021.

3.2. *Model specifications*

To understand and analyze the drivers of gender diversities in fintech in Africa. We use two methods of estimation: the method of Generalized Least Squares (GLS) and the method of Least-Squares Estimation of panel models.

We regress the gender diversities in digital financials on socio-economic and cultural factors, and measures of gender disparities in fintech across three times – 2014, 2017, and 2021. The sample of study composed of 35 economies in Africa (See Appendix 1). The model is largely inspired by Khera *et al*. (2022).

We estimate the following model:

$$FinDPF_{it} = \alpha_1 + \alpha_2 EDU_{it} + \alpha_3 WBL_{it} + \quad (1)$$
$$+ \alpha_4 GDP_{it} + \alpha_5 PEM_{it} + \alpha_6 LFP_{it} + \alpha_7 LIT_{it} + \varepsilon_{it}$$

We used a panel data analysis in which the index *t* refers to the observation years and *i* refers to a group of African countries.

Where: *FinDPF*: represents the percentage of females who made or received a digital payment (% age 15+). *EDU*: Educational attainment of female over male value in country *i* in year *t*. *LIT*: Female literacy rate over male value in country *i* in year *t*. *PEM*: Process of transferring various elements of power (resources, capabilities, and positions). Political empowerment requires inclusion in democratic decision-making processing country *i* in year *t*. *LFP*: is the ratio of female to male labor force participation rate in country *i* in year *t. WBL*: is the Women, Business, and Law index for country *i* for year *t* measures cultural factors that might affect gender disparities and GDP is the Real GDP *per capita*.

According to Table 2, the mean value we find

Table 1 - Variables definitions.

Variables	*Measurements/Definitions*	*Sources*
DPF	Made or received a digital payment, female (% age 15+).	Global Findex Database World Bank Asongu and Nwachukwu, 2018; Asongu and Odhiambo, 2019
WBL it	Women, Business and Law index for country I for year t	World Bank 2014, 2017 and 2021
Educational attainment	Educational attainment of female over male value	The Global Gender Gap Report 2014, 2017 and 2021; World Economic Forum Bank
Political Empowerment	Process of transferring various elements of power (resources, capabilities, and positions). Political empowerment requires inclusion in democratic decision-making process	The Global Gender Gap Report 2014, 2017 and 2021; World Economic Forum Bank
Ratio of female to male labor force participation rate (%) (modeled ILO estimate)	Ratio of female to male labor force participation rate in country *i*-year *t*. Dividing female labor force participation rate by male labor force participation rate and multiplying by 100	World BANK: https://data.worldbank.org/indicator/SL.TLF.CACT.FM.ZS
Literacy	Female literacy rate over male value	The Global Gender Gap Report 2014, 2017 and 2021; World Economic Forum Bank
Control variable		
Economic development	GDP per capita	WDI (2022)

Table 2 - Descriptive statistics.

	DPF	*DPM*	*LIT*	*EDU*	*WBL*	*GDP*	*PEM*	*LAB*
Mean	0.2914	0.3829	1.0554	0.8208	67.7607	96.6231	0.22070	61.6831
Median	0.26	0.4	0.751	0.85	71.875	6	0.2	67
Maximum	0.75	0.84	13	1	88.125	968	0.66	95.1869
Minimum	0.04	0.04	0.3	0.3	38.75	1.19	0.0089	22.3227
Std. Dev.	0.1771	0.1815	1.8973	0.1489	13.3122	248.4562	0.1353	21.6226
Skewness	0.7182	0.1529	5.6474	-1.41012	-0.3500	2.6193	0.9950	-0.42828
Kurtosis	2.8339	2.7094	33.323	5.1879	1.9165	8.0614	3.9080	1.9365
Jarque-Bera	9.1480	0.7787	4580.9	55.7423	7.2797	232.1506	20.9327	8.15730
Probability	0.0103	0.6774		0.0000	0.0262	0.0000	0.0000	0.01693
Sum	30.599	40.207	110.82	86.194	7114.875	10145.428	23.174	6476.731
Sum Sq.	3.2636		374.40	2.3065	18430.534	6419974.29	1.9061	48624.15
Observations	105	105	105	105	105	105	105	105

large fintech gender disparities in Africa; while 38% of men use fintech products, only 29% of women do. Descriptive statistics further shed light on the relationship between the dependent variable, representing digital payments made or received by females (DPF), and the independent variables (LIT, EDU, WBL, PEM, and LAB). On average, a one-unit increase in the corresponding independent variable (LIT, EDU, WBL, PEM, LAB) is associated with a 0.26-unit increase dependent variable.

Examining the distribution of the dependent variable (DPF), we observe a maximum value of 0.75. This signifies that the highest recorded value for this variable in our dataset is 0.75. Identifying such extreme values is crucial for detecting outliers and understanding the variability within our dataset. Conversely, the minimum value for DPF is 0.04, indicating that the lowest observed values for digital payments made or received by females are 0.04. These minimum values offer insights into the lower bounds of the data distribution. Our analysis also includes an assessment of the standard deviation, which is relatively small at 0.177. This small standard deviation suggests that the values of the variables are closely clustered around their respective means.

Analysis of correlation is presented in Table 3. The dependent variable, which stands for digital payments made or received by women (DPF), has a negative correlation (-0.129) with GDP and a substantial positive correlation (0.268) with WBL (0.293).EDU has a negative correlation (-0.447) with LIT and a positive correlation (0.268, 0.415, and 0.287) with DPF, WBL, and LAB.

WBL shows a negative correlation (-0.214) with LIT and positive correlations (0.415, 0.019) with EDU and LAB.GDP has a minor

Table 3 - Correlation Matrix.

	DPF	*EDU*	*WBL*	*GDP*	*PEM*	*LAB*	*LIT*
DPF	1	0.2680	0.2938	-0.1299	0.2598	-0.0316	-0.0563
EDU	0.2680	1	0.4146	-0.0144	0.1603	0.2871	-0.4467
WBL	0.2938	0.4146	1	0.1010	0.1068	0.0186	-0.2136
GDP	-0.1299	-0.0144	0.1010	1	0.0328	-0.0757	-0.0356
PEM	0.2598	0.1603	0.1068	0.0328	1	-0.0256	-0.1360
LAB	-0.0316	0.2871	0.0186	-0.0757	-0.0256	1	0.1927
LIT	-0.0563	-0.4467	-0.2136	-0.0356	-0.1360	0.1927	1

positive association with WBL (0.101) and a negative correlation with DPF (-0.130). PEM and DPF (0.260), EDU (0.160), and WBL (0.107) have favorable associations. LAB exhibits a negative correlation (-0.032) with DPF and a positive correlation (0.287) with WBL and 0.019. The correlations between LIT and WBL (-0.214), PEM (-0.136), and EDU (-0.447) are all negative. The magnitude and direction of the linear relationships between the variables are shown by these values.

These correlations provide insights into the relationships between variables. The correlations between predictor variables are very small (close to zero) or moderate; it suggests that the variables are likely independent of each other, reducing concerns about multicollinearity.

3.3. *Specification tests*

The Breusch-Pagan Test is used to determine whether or not heteroscedasticity is present in a regression model (Table 4). The test uses the following null and alternative hypotheses:

- Null Hypothesis (H0): Homoscedasticity is present (the residuals are distributed with equal variance);
- Alternative Hypothesis (HA): Heteroscedasticity is present (the residuals are not distributed with equal variance).

The p-value of (0.0000) suggests that there is evidence to reject the null hypothesis of homoscedasticity (constant variance of errors). So, there might be heteroscedasticity in our model. Heteroscedasticity refers to the situation where the variance of the errors is not constant across all levels of the independent variables. The Pesaran Scaled LM Test is associated with panel data and is used to test for cross-sectional dependence. The low probability value (0.0000) suggests evidence against the null hypothesis of no cross-sectional dependence. So, it proves that there is cross-sectional dependence in our data.

The output provided from a Likelihood Ratio (LR) Test concerns heteroskedasticity in the context of a regression model (Table 5). The null hypothesis being tested is that the residuals are homoskedastic (constant variance) against the alternative hypothesis that the residuals exhibit (heteroskedasticity-varying variance). Here is a breakdown of the key elements in the output.

The p-value is associated with the Likelihood Ratio Test. In this case, it is very small (0.0001), suggesting strong evidence against the null hypothesis. The LR test strongly rejects the null hypothesis of homoskedastic residuals, suggesting the presence of heteroskedasticity. The

Table 4 - The Breusch-Pagan and Persaran Test.

Test	*Statistic*	*d.f.*	*Prob.*
Breusch-Pagan LM	922.4877	595	0.0000*
Pesaran scaled LM	9.493394		0.0000*

**Indicate significance at 1 % significance.*

Table 5 - Likelihood Ratio (LR) Test for Heteroskedasticity.

	Value	*df*	*Probability*
Likelihood ratio	75.85191	35	0.0001
LR test summary:	Value	df	
Restricted LogL	44.47944	99	
Unrestricted LogL	82.40539	99	

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
LAB	-0.001645	0.000541	-3.042630	0.0030
EDU	0.049579	0.053272	0.930669	0.3543
PEM	0.183305	0.057804	3.171173	0.0020
LIT	0.008249	0.007881	1.046780	0.2978
WBL	0.004397	0.000404	10.88713	0.0000
GDP	-0.000100	2.89E-05	-3.453506	0.0008

coefficients and associated statistics provide information about the relationship between the dependent variable (DPF) and the independent variables (LAB, EDU, PEM, LIT, WBL, GDP). The weighted statistics are also provided, indicating the performance of the model with cross-section weights applied.

4. Results and discussions

4.1. *Results*

Tables 6 and 7, show the results of the random effects panel Linear Regression Model with two methods generalized least squares (GLS) and Least-squares estimation of panel models. The application descriptive statistics of the data used in this study for the period 2014, 2017, and 2021. Digital Payment made by Females as measured by the percentage of females who made or received digital payment.

The first objective of our study was to investigate what are the drivers of gender disparities in Fintech in African countries by exploring socioeconomic and cultural factors. Excluding the index of economic development GDP per capita, all other variables show a substantial positive impact on the dependent variable. The findings reveal a significant positive relation between the dependent variable which represents the percentage of females who made or received a digital payment (% age 15+) and independent variables (Education, literacy rate, women's political empowerment, and the Women, Business and Law index), we find that all coefficients have statistical significance. This indicates that the independent variables in our model significantly influence the dependent variable, DPF.

4.2. *Discussion of Findings*

Using a novel fintech dataset for 35 economies in Africa over three distinct years 2014-2017 and 2021, we find large fintech gender disparities in Africa; while 38% of men use fintech, only 29% of women do, we determine that the drivers of gender disparities in Africa consist of socio-economic and cultural factors because

Table 6 - Results of estimation.

Dependent Variable: DPF Method 1: Generalized Linear Model (Newton-Raphson / Marquardt steps)												
	Model 1			*Model 2*			*Model 3*			*Model 4*		
Variable	*Coef*	*Std. Error*	*Prob*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*
WBL	0.0038	0.0007	(0.0000)***	0.0037	0.0012	(0.0035)***	0.0019	0.0012	(0.0059)***	0.0023	0.0012	(0.0522)*
LIT	0.0038	0.0087	(0.0000)***	0.0039	0.0090	(0.0018)***	0.0091	0.0093	(0.0060)***	0.0030	0.0083	(0.0039)***
PEM	0.3092	0.1179	(0.0087)***	0.3073	0.1227	(0.0123)***	0.2623	0.1207	(0.0290)***	0.2757	0.1200	(0.0217)**
EDU							0.2070	0.1212	0.0878	0.0994	0.9958	(0.3193)
GDP	-0.0001	6.55^{e}-05	(0.0640)							-0.0001	6.53^{e}-05	(0.0831)
LAB	-0.0004	0.0006	(0.0003)***	-0.0003	0.0007	(0.6796)	-0.0011	0.0008	0.1656			
Dependent Variable: DPF Method 1: Generalized Linear Model (Newton-Raphson / Marquardt steps)												
Variable	*Coef*	*Std. Error*	*Prob*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*
WBL	0.0022	0.0012	(0.0682)*									
LIT	0.0090	0.0092	(0.0061)***							0.0007	0.0098	(0.0068)***
PEM	0.2687	0.1194	(0.0245)**				0.5904	0.1173	(0.0000)***	0.5914	0.1187	(0.0000)***
EDU	0.1995	0.1200	(0.0963)*									
GDP	-0.0001	6.50E-05	0.0003	-1.19^{E}-05	7.96^{E}-05	0.8809	-5.67E05	7.22^{E}-05	0.4323	-5.66^{E}-05	7.25e-05	0.4349
LAB	-0.0012	0.0008	(0.01378)**	0.0041	0.0003	0.0000	0.0023	0.0004	(0.0000)***	0.0023	0.0005	(0.0000)***

*P-value in parentheses ***, **, * indicate significance at 1,5 and 10 % levels.*

Table 7 - Result of estimation.

Dependent Variable: DPF Method 2: Panel Least Squares												
Variable	*Coef*	*Std. Error*	*Prob*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*
WBL	0.0039	0.0012	(0.0023)***	0.0037	0.0012	(0.0043)***	0.0019	0.0012	(0.0091)***	0.0023	0.0012	(0.0551)*
LIT	0.0040	0.0089	(0.0042)***	0.0039	0.0090	(0.0027)***	0.0091	0.0093	(0.0084)***	0.0030	0.0083	(0.0000)***
PEM	0.3119	0.1213	(0.0116)**	0.3073	0.1227	(0.0139)***	0.2623	0.1207	(0.0322)**	0.2757	0.1200	(0.0237)**
EDU							0.2070	0.1212	(0.0909)*	0.0994	0.9998	(0.0018)***
GDP	-0.0001	6.58^{e}-05	(0.0684)*							-0.0001	6.53^{e}-05	(0.0862)
LAB	-0.0004	0.0007	(0.5782)	-0.0003	0.0007	(0.0005)***	-0.0011	0.0008	(0.1668)**			
Dependent Variable: DPF Method 2: Panel Least Squares												
Variable	*Coef*	*Std. Error*	*Prob*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*	*Coef*	*Std. Error*	*Prob.*
WBL	0.0022	0.00012	(0.0712)*									
LIT	0.0090	0.0092	(0.0085)***							0.0007	0.0098	(0.0070)***
PEM	0.2687	0.1194	(0.0267)**				0.5904	0.1173	(0.0000)***	0.5914	0.1187	(0.0000)***
EDU	0.1995	0.1200	(0.0099)*									
GDP	-0.0001	6.50E-05	(0.0733)	-1.19^{E}05	7.96^{E}-05	0.8812	-5.67E05	7.22^{E}-05	0.4341	-5.66^{E}-05	7.25e-05	(0.4367)
LAB	-0.0012	0.0008	(0.1409)	0.0041	0.0003	(0.0000)***	0.0023	0.0004	(0.0000)***	0.0023	0.0005	(0.0000)***

*P-value in parentheses ***, **, * indicate significance at 1,5 and 10 % levels.*

women in Africa face more inequality in education, literacy, law and employment, which hinders their ability to access digital finance. Our findings are consistent with those of (Aziz & Naima, 2021), they determine that women lack of basic connectivity, financial literacy, social awareness, and the knowledge to utilize financial services. In our case, we find novel data in digital financial services, this is related to low literacy levels in some countries as a result of socio-cultural and socioeconomic variables. We find that when the level of education increases the use of digital finance services, women who have secondary education or more use DFSs more than women who have primary education. Understanding how to use digital technologies, in this case, digital platforms and DFSs, safely, securely, and effectively is referred to as digital literacy. Our findings are supported by previous studies in the field. For example, Boileau and Yuanchen (2022) find that women face more inequality in education, which inhibits their ability to access digital finance measured by the share of women who complete upper secondary education and graduate in STEM fields respectively. We find a similar result to Khera *et al*. (2022) that women face more inequality in education, which hampers their ability to access digital finance measured by the share of women who complete upper secondary education, and graduates in STEM fields respectively. Additionally, we find that legal norms, inequality in law, and employment were identified as limitations to DFSs. We use the Women, Business, and Law Index from the World Bank to capture socio-cultural norms and legal discrimination against women. The index measures gender inequality in the law by analyzing laws and regulations affecting women's economic inclusion in the country, such as those related to mobility, labor force participation, job restrictions gender wage gap and marriage. Elouardighi and Oubejja (2023) underscore the potential of digital financial inclusion to enhance women's labor force participation in Africa, noting that access to digital finance can help overcome several barriers to employment by providing women with the tools to manage finances, access credit, and engage in business activities. Their study highlights that digital financial inclusion promotes women's economic participation by addressing issues such as limited access to traditional banking ser-

vices, which disproportionately affects women in the region. Our research is similar in that it also emphasizes the importance of digital financial services (DFSs) in improving women's economic outcomes in Africa. Like Elouardighi and Oubejja (2023), we find that increasing access to DFSs can empower women by overcoming socio-economic and cultural barriers to financial inclusion. However, our study also introduces a focus on the interplay between education, legal norms, and political empowerment, further deepening our understanding of the multifaceted factors influencing women's ability to utilize fintech services in the region.

Unlike previous research, our findings demonstrate that the political empowerment of women and inclusion in the democratic decision-making process, as well as global progress toward gender equality in the law, boost the use of fintech by women. This creates more accessible financial services and promotes financial inclusion. Improving women's political engagement and representation can lead to larger societal reforms, even while the relationship between political empowerment and financial gender disparities seems complicated. Through quotas and other affirmative action policies, governments should work to achieve gender parity in political representation. Cultivating a culture of political inclusion and assisting women in leadership positions can also address underlying gender biases and establish a supportive environment for women's involvement in fintech. Building on Chinoda and Kapingura (2024), we further emphasize the importance of institutions and governance in advancing digital financial inclusion. They highlight how robust institutional frameworks and good governance practices promote trust in digital financial systems, indirectly benefiting gender equity in fintech access. Institutions with a strong commitment to inclusive policies ensure that regulatory environments are conducive to addressing disparities in digital finance access. Our study complements this perspective by showing how the empowerment of women in governance structures can further strengthen these institutional effects, advancing financial inclusion for women. Notably, this research paper is the first to highlight that when women in Africa are well-represented in political life and decision-making, gender equality is advanced, and, more specifically, African women's use of fintech is furthered.

4.3. *Robustness checks*

Despite the outputs generated by the estimation methods, we tried to extend our research beyond these results through a detailed database interpretation. To provide a more comprehensive view of gender disparities in fintech usage, this further research will look at the data. We can make more meaningful connections and tell a more complete story about the variables impacting women's adoption of fintech in Africa.

Figure 1 illustrates gender-specific disparities in the use of digital payments across African countries in 2014. Notable observations include Kenya, where both females and males exhibit high engagement in digital payments, reflecting a more inclusive adoption. South Africa also shows balanced participation between genders

Figure 1 - Financial institution account - Made or received a digital payment, female and male (% age 15+), 2014.

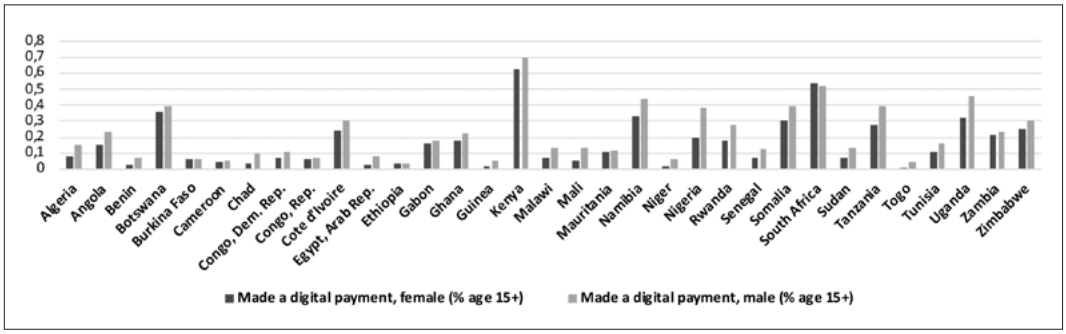


Figure 2 - Financial institution account - Made or received a digital payment, female and male (% age 15+), 2017.

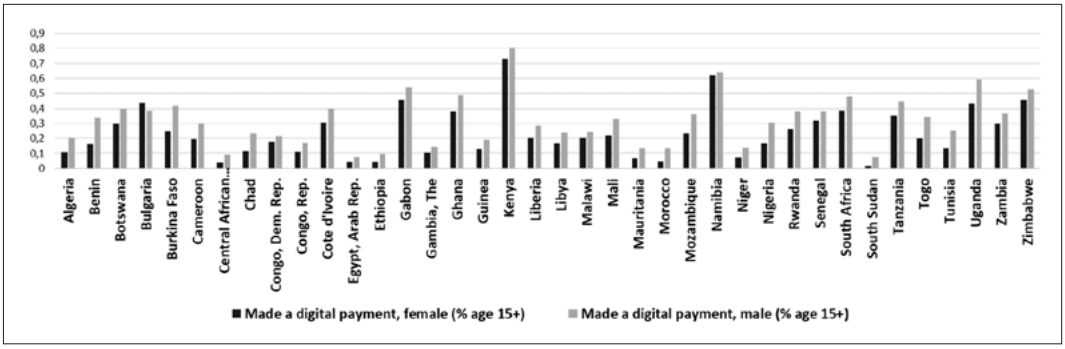
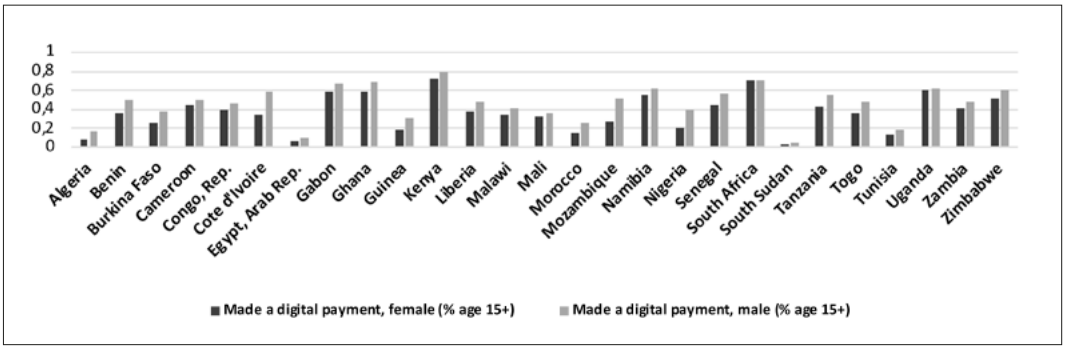


Figure 3 - Financial institution account - Made or received a digital payment, female and male (% age 15+), 2021.



but makes the exception with all other African countries where females use digital payment more than men do. However, in some countries like Togo and Guinea, the overall percentages are low, indicating a potential area for improvement in digital financial inclusion.

The variations in percentages suggest that factors such as socioeconomic conditions, cultural norms, and access to technology may influence gender-specific digital payment behaviors.

An examination of the statistics from 2014 and 2017 (Figure 2) regarding the percentage of females and males making digital payments (percentage age 15+) in various countries provides insights into the evolving landscape an overall increase in Digital Payment Adoption. The percentage of men and women who make digital payments increased overall in the aforementioned nations between 2014 and 2017.

This indicates a favourable pattern in the three-year adoption of digital financial services. There is a persistent pattern of gender inequality in both years, with men adopting digital payments at a higher rate than women in many nations. The gender difference persists despite an increase in adoption rates overall, suggesting that initiatives to close this imbalance may need to take precedence. Kenya's remarkable continuity, Kenya stands out in both years as a country with exceptionally high digital payment adoption rates for both genders. The country not only maintains its high percentages but also sees a further increase in adoption from 2014 to 2017, indicating sustained growth and acceptance of digital financial services. The usage of digital payments is generally on the rise, although gender disparities still exist. To guarantee that more people have access to digital financial services, efforts should be focused on resolving these gaps.

All figures indicate that the use of FDS by females is lower than males; the gender disparities are remarkable from 2014 to 2021.

We have noticed also, that the use of digital finance has increased from 2014 to 2021 let's take the case of Tunisia for example 14% of women used FDS in 2014 against 21% in 2021, in Alge-

Figure 4 - Financial institution account - Made or received a digital payment, primary education or less, or secondary education or more (% age 15+), 2014.

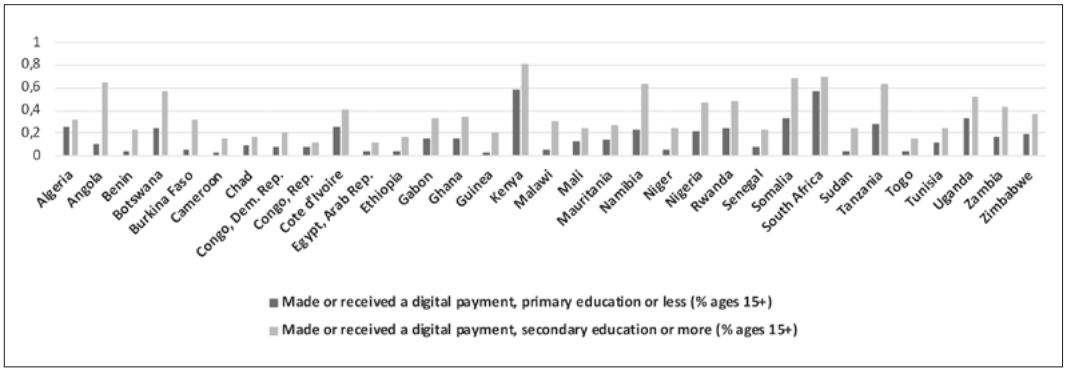
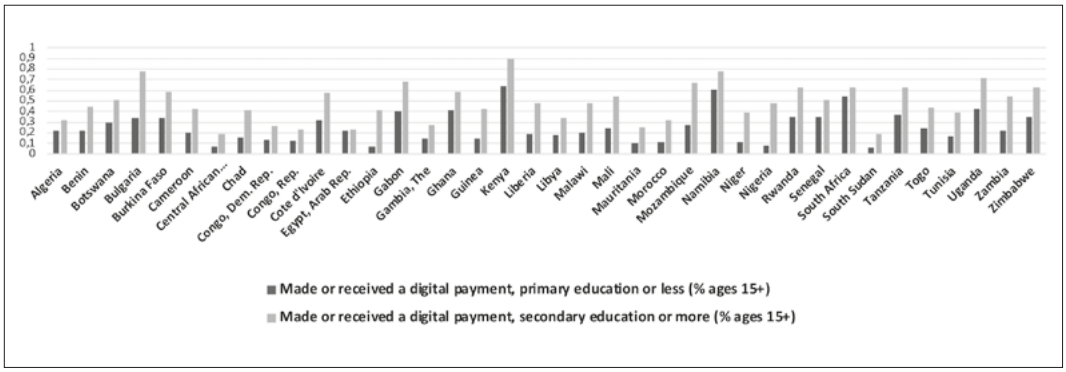


Figure 5 - Financial institution account - Made or received a digital payment, primary education or less or secondary education or more (% age 15+), 2017.

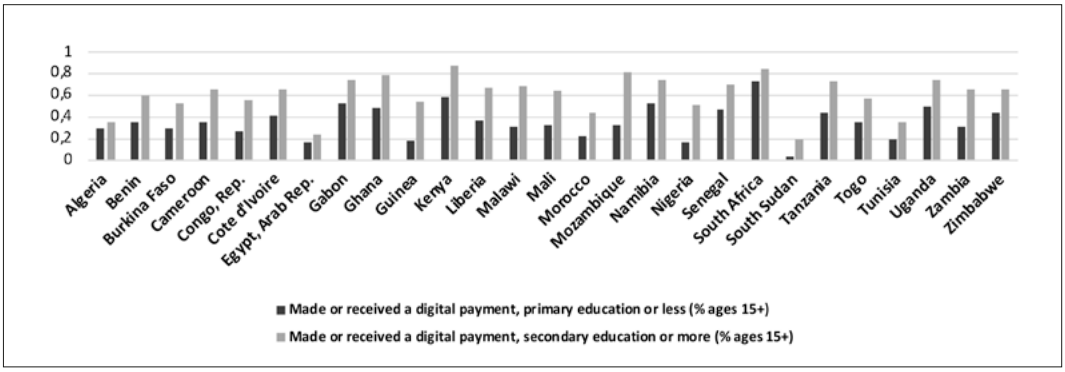


ria 19% in 2014 to 23% in 2021, in Ivory Coast, it goes from 26 % to 35%. Besides, figures show that there are differences between countries regarding the use of DFS for example we notice that in Cameroon the use of women increased from 7% in 2014 to 48% in 2021, and in Kenya also from 67% in 2014 to 74% in 2021. The gender disparity persists even in countries with high use of DFS. North African countries like Algeria and Egypt exhibit lower overall digital payment adoption rates compared to East African countries like Kenya and Rwanda. The regional context may play a role in shaping these trends. Figures show that gender disparities persist in all African countries except South Africa which makes a difference even with the increase of DFS from 2014 to 2021 the use of FDS by females is higher than by males in 2014 and it's almost equal in 2021.

Figure 4 indicate that the acceptability of digital payments throughout African countries is depicted in a variety of ways by the 2014 statistics, with usage trends indicating significant variations between individuals with only primary education and those with a secondary degree or more. Kenya boasts an exceptionally high digital payment participation rate across all educational levels, indicating a robust digital infrastructure. South Africa is another country that stands out from the rest due to its high adoption rate, whereas Cameroon and Chad have lower overall percentages. Remember that since 2014, there might have been substantial changes in the digital payment landscape, calling for a reevaluation based on more recent data to identify patterns and advancements.

The data from Figure 5 relatated to 2017 indicates a discernible increase in the use of digital payments in several nations when compared

Figure 6 - Financial institution account, Made or received a digital payment, primary education or less, or secondary education or more (% ages 15+), 2021.



to the statistics from 2014, 90% of those with at least a secondary education use digital payments, placing Kenya atop the education rankings in both categories. Other African nations including Ghana, Namibia, and Uganda are also seeing notable development, indicating that the use of digital financial services is increasing. However, there are still differences, with several countries having lower percentages, which emphasizes the need for targeted programs to raise digital literacy and accessibility. It's crucial to monitor these rapidly evolving trends and modify initiatives and regulations to support inclusive digital financial ecosystems.

The 2021 statistics (Figure 6) on the adoption of digital payments among people in different nations (% of adults aged 15 and above) and based on varying educational levels show many noteworthy trends:

Persistent Growth in Digital Payments: In 2021, the proportion of people in the aforementioned nations who make or receive digital payments increased noticeably. This points to a sustained pattern of digital financial services adoption and acceptance.

Impact of Education Level: People with secondary education or higher have a higher percentage of digital payment uptake than people with primary education or less in almost all nations. This underscores the role of education in influencing digital financial literacy and access. High Adoption in Kenya and Ghana continue to lead in digital payment adoption, with high percentages for both education groups. This suggests a robust digital infrastructure and a widespread acceptance of digital financial services in these countries. varied progress across Countries. While some countries like South Africa and Gabon show high overall digital payment adoption rates, others like South Sudan exhibit lower percentages. The variations highlight the diverse landscape of digital financial inclusion efforts across different regions. The gender disparities in digital payment adoption remain an important aspect to consider for our analysis. Despite the progress, there are still countries with relatively lower adoption rates, indicating opportunities for targeted initiatives to enhance digital financial literacy and accessibility.

Impact of the COVID-19 Pandemic (the dataset is from 2021, a period during which the COVID-19 pandemic might have influenced digital payment behaviors): The pandemic accelerated the shift towards digital transactions globally, and this data may reflect the increased reliance on digital financial services during such times.

5. Conclusion

We discover that the primary drivers of gender inequality in Africa are socioeconomic and cultural factors. Women face particular disadvantages in work, education, literacy, and legal rights, which restricts their access to fintech. Furthermore, we find that worldwide advancements in gender equality in the legal system boost women's usage of fintech, enhance the accessibility of financial services, and promote

financial inclusion. Additionally, we discover that gender differences still exist throughout all of Africa, except South Africa.

This is significant since, despite the rise in DFSs between 2014 and 2021, females used FDS at a higher rate than males in three different years: 2014, 2017, and 2021. Additionally, we discover that gender differences still exist throughout all of Africa, except South Africa. This is significant since, despite the rise in DFSs between 2014 and 2021, females used FDS at a higher rate than males in three different years: 2014, 2017, and 2021. We find that the use of digital financial services rises with education level; that is, women with at least a secondary education use DFS at a higher rate than women with only a primary education. Understanding the differences in fintech among African nations is a priority for African policymakers. We also find that, except for South Africa, gender inequality persists in Fintech throughout the continent of Africa. This is noteworthy because, in three different years 2014, 2017, and 2021 females employed FDS at a higher rate than males, despite the rise in DFSs between those years. Khera *et al*. (2022) explored the gender gap of digital financial inclusion, they explored drivers of gender gap of digital financial inclusion from the side of socio-economic and cultural factors associated with law, culture and social norms unequal opportunities to work force, education and literacy, which aligns with our findings. We find that women who have completed at least secondary school are more likely to utilize DFS than women who have only completed primary school. This indicates that the use of DFS increases with education level. African authorities should prioritize learning about the variations in fintech across African countries. In addition to focusing on accessibility, affordability, safety, usability, and training of digital skills, as well as the availability of pertinent content, applications, and services, we also need to address issues of gender equality, social norms, and reforms. Furthermore, African policy makers should increase their investments in education and capacity-building initiatives that boost the digital literacy and self-assurance of women and girls. Our findings highlight the importance of legal laws in African nations that uphold and level the sociocultural norms to reduce gender differences in digital financial services. Our findings are supported by previous studies in the field. For example, Boileau and Yuanchen (2022) find that women face more inequality in education, which inhibits their ability to access digital finance measured by the share of women who complete upper secondary education and graduate in STEM fields respectively. We find a similar result to Khera *et al*. (2022) that women face more inequality in education, which hampers their ability to access digital finance measured by the share of women who complete upper secondary education, and graduates in STEM fields respectively. Moreover, we find also that legal norms, inequality in law, and employment were identified as a limitation to DFSs. We use the Women, Business, and Law Index from the World Bank to capture socio-cultural norms and legal discrimination against women. Elouardighi and Oubejja (2023) highlight the potential of digital financial inclusion to enhance women's labor force participation in Africa, emphasizing that access to digital finance can help overcome various employment barriers by providing women with the tools to manage finances, access credit, and engage in business activities. Their study underscores how digital financial inclusion promotes women's economic participation by addressing challenges like limited access to traditional banking services, which disproportionately affect women in the region. Our research aligns with this perspective, emphasizing the role of digital financial services (DFSs) in improving women's economic outcomes in Africa.

Like Elouardighi and Oubejja (2023), we observe that expanding access to DFSs can empower women by overcoming socio-economic and cultural barriers to financial inclusion. However, our study also adds a focus on the interplay between education, legal norms, and political empowerment, providing a more comprehensive understanding of the factors influencing women's ability to utilize fintech services in the region. Building on Chinoda and Kapingura (2024), we further highlight the significance of institutions and governance in advancing digital

financial inclusion. They emphasize how strong institutional frameworks and good governance practices foster trust in digital financial systems, indirectly benefiting gender equity in fintech access. Institutions committed to inclusive policies create regulatory environments conducive to addressing disparities in digital finance access. Our research builds on this by showing how women's empowerment in governance structures can further strengthen these institutional effects, enhancing financial inclusion for women. Notably, this paper is the first to demonstrate that increased female representation in political life and decision-making not only advances gender equality but also promotes greater adoption of fintech services among African women.

Our contribution to this research is the conclusions we draw, which show that women's usage of fintech is enhanced and financial inclusion is promoted when they are included in political empowerment and democratic decision-making processes. We believe that more research should be done on how to close the gender gap, with a special emphasis on the case of South Africa, which is the only African nation where women used FDS more than men in 2014 and nearly equally in 2021. Other research should also look at how Fintech is affecting SDG, how to increase the representation of women in politics, and what factors contribute to the gender gap in Fintech in African countries.

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Appendix 1 - List of countries included in the sample

N°	*Country*	*N°*	*Country*
1	Algeria	19	Mauritania
2	Benin	20	Morocco
3	Botswana	21	Mozambique
4	Burkina Faso	22	Namibia
5	Cameroon	23	Niger
6	Central African Republic	24	Nigeria
7	Chad	25	Rwanda
8	Congo, Dem. Rep.	26	Senegal
9	Congo, Rep.	27	South Africa
10	Cote d'Ivoire	28	Tanzania
11	Egypt, Arab Rep.	29	Togo
12	Ethiopia	30	Tunisia
13	Gabon	31	Uganda
14	Ghana	32	Zambia
15	Guinea	33	Zimbabwe
16	Kenya	34	Mali
17	Liberia	35	Malawi
18	Libya		