The Role of Mobile Money in International Remittances: Evidence from Sub-Saharan Africa

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Abstract

Over the past decade, remittance flow to Sub-Saharan Africa grew at an average of 12.9% and is expected to increase in the coming decade. However, the high cost of remittances remains a constraint that limits regular remittance flows. About 9.1% of remittance flows to Sub-Saharan Africa is absorbed by transfer cost, making it the most expensive remittance recipient region. With evidence that mobile money services reduce transaction costs for internal remittances, the introduction of mobile money services in international remittances should have the same effect. Against this backdrop, this study investigates the effect of introduction of mobile money services on international remittance transfer costs and determines the effect of international remittance transfer costs on international remittance flows. Least squares dummy variable model and a system General Methods of Moments (GMM) is applied to address the first and second objective, respectively. International remittance transfer cost is lower by 46% for corridors that incorporate mobile money in international money transfer channels compared to those that do not. Controlling for other factors, the gap between corridors that incorporate mobile money and those that do not goes down to 11.5%. Thus, a reduction in remittance transfer costs can be achieved by improving cross-border mobile money services interoperability.

Keywords: Remittances, Sub-Saharan Africa, Migration, Remittance cost
JEL classification: F22; F24; F65; G29.

1.0 Introduction

Over the past decade, remittance flows[1] to Sub-Saharan Africa grew at an average of 12.9% from US$ 4.8 billion in 2000 to US$ 48 billion in 2019 (World Bank, 2017; World Bank, 2020). Although global remittance flows are expected to increase in the coming decade in line with the expected increase in within- and across-borders' migration, the high cost of remittances remains a constraint that limits regular remittance flows. In 2019, the average transfer cost for remittance flows to Sub-Saharan Africa was 9.10%, about 33.4% above global remittances average price of 6.82% (World Bank, 2020). While promoting competition, combining money transfer operations with other financial services, innovation in technology, and operational efficiency are seen as the key drivers of reduction in remittance cost. Innovations in technology, particularly mobile money,[2] have great potential in reducing the cost of money transfer.

First, Global Findex data reveals that mobile money is rapidly expanding access to and use of financial services in Sub-Saharan Africa. Secondly, Remittance Price Worldwide data shows that mobile money-related access points, unlike traditional financial institutions and other access points, facilitate the flow of money at much lower transaction costs. Lastly, the percentage of ownership of mobile accounts and the cost of international remittances for source countries exhibits a negative relationship, suggesting that mobile money services are associated with lower cost of international remittances. Furthermore, mobile money services are largely limited to within-the-border transfers, unlike financial institutions that support both within- and cross-border remittance flows. However, some remittance source countries have partly or fully integrated mobile money in international remittance transfer channels. How the integration of mobile money services in international remittance transfers has impacted remittance costs and international remittance flows is not known. There is evidence that introduction of mobile money services in internal remittances reduced remittance transfer costs and increased remittance flows and diversity of senders (Jack and Suri, 2014). However, little is known about the effect of mobile money services on international remittance transfer cost and international remittance flows. This

1 Remittances or remittance flows are transfers sent by migrants from host countries to recipients, usually relatives, in the home country. These transfers are derived from migrant earnings and are not a consideration for economic transaction.

2 Mobile money is the use of mobile phone and wireless communication network to provide money transfer and banking services such as transactional and savings accounts.

paper tests whether incorporating mobile money services in international remittances leads to a reduction in remittance transfer costs. This is particularly important for Sub-Saharan Africa where 9.10% of remittance flows is absorbed by transfer costs, making it the most expensive remittance recipient region. Against this background, what are the effects of introduction of mobile money services on remittance transfer costs and international remittances?

In view of the foregoing, this study investigates the effects of introduction of mobile money services on remittance transfer costs and international remittances in Sub-Saharan Africa. First, this study investigates the effect of introduction of mobile money services on international remittance transfer costs and, secondly, it determines the effect of international remittance transfer costs and mobile money services on international remittance flows. To achieve the first specific objective, least squares dummy variable model is used on quarterly Remittance Price Worldwide data spanning the period 2011 quarter one to 2019 quarter four. For the second specific objective, a system General Methods of Moments (GMM) is used on annual panel data of all source countries of remittances to Sub-Saharan Africa spanning the period 2012 to 2017. The proposed estimation method for the second objective addresses three main concerns. First, the model includes a lagged dependent variable, which introduces endogeneity problem. Second, in the presence of lagged dependent variable, a fixed effect estimator results in inconsistent and biased estimates. Third, difference GMM can have poor finite sample properties, particularly when the dependent variable is highly persistent and, under these conditions, tends to give estimated coefficients, which are biased downward.

Sub-Saharan Africa accounts for 70% of international remittance transactions through mobile money for the countries surveyed by the World Bank, and thus provides a perfect setting to investigate how the introduction of mobile money services affects international remittance transfer costs and flows. The sample period is limited by availability of data on international bilateral remittances. This study documents evidence that remittance transfer cost was lower by 46% for transactions that incorporate mobile money compared to the cost for transactions that do not incorporate mobile money. This estimate goes down to 11.5% when other factors that affect remittance transfer costs are controlled. Remittance flows to Sub-Saharan Africa are persistent, and remittance costs do not matter.

This study is important in several ways. First, the United Nations Sustainable Development Goals (UN SDGs) target of reducing global average cost of sending remittances to 3% by 2030 is only attainable if effective strategies of reducing the costs of money transfer are identified and implemented. Second, transfer costs have a negative effect on remittance flows (Freund and Spatafora, 2008; Gibson, McKenzie and Rohorua, 2006) and lead to irregular remittance flows as migrants either refrain from sending money home or else remit it irregularly. Irregular remittance flows result in suboptimal benefits. Regular and stable flows of remittances are a prerequisite for maximization of benefits to the economy as they have a direct poverty-mitigating effect (Gupta, Pattillo and Wagh, 2009; Akobeng, 2016) and reduced harmful effects

on economic growth of volatility of remittances (Imai et al., 2014), such as through its effect on exchange rate volatility. To ensure regular flow of remittances, it is important to identify and implement strategies to reduce the cost of remittance flows.

Third, understanding how penetration of mobile money services affects remittance costs and international remittances is both economically and policy relevant. The high cost of money transfer reduces the remittances that reach the recipients, especially for small amounts when the cost per use has a fixed cost element. Identifying and implementing effective policies to reduce the cost of money transfer services would generate savings to migrants. For instance, reducing the cost of remittance flows in Sub-Saharan Africa to the global average in 2017 would save remitters US$ 811 million. Fourth, remittances have a great potential as a source of long-term finance, both for the private and the public sectors. Remittance flows have significant development potential and have been found to increase after a disaster and therefore help in reconstruction (Bettin and Zazzaro, 2018). Therefore, understanding the importance of mobile money services in international remittances is critical in the design of products and mechanisms to tap remittance flows.

This study contributes to two strands of literature: literature on remittance flows and the literature linking mobile money services and remittances. This study is related to the work of Freund and Spatafora (2008). While they studied the determinants of remittances, documenting evidence that recorded remittances depends negatively on transfer costs, and that transfer costs are lower in highly developed financial systems; this study investigates the effects of the introduction of mobile money services on remittance transfer costs and international remittance flows. Innovations in mobile money have helped to rapidly expand financial inclusion in Sub-Saharan Africa (Demirgüç-Kunt et al., 2015) and as financial inclusion expand so does financial development. With an inverse relationship between transfer costs and financial development (Freund and Spatafora, 2008) and mobile money account ownership (Figure 1), rapid expansion in mobile money services is expected to drive transfer costs down. Furthermore, money transfer services for both domestic and international remittances are shifting from traditional providers to wireless carriers that can compete for consumer market share based on technological ubiquity and low-cost services (Merritt, 2011; Darmon, Chaix and Torre, 2016).

In terms of investigation of the link between mobile money services and remittances, the papers closest to this study are those of Jack and Suri (2014) and Munyegera and Matsumoto (2016). Jack and Suri (2014) studied the effects of shocks on consumption for users and non-users of mobile money services in Kenya and found that consumption for non-users of mobile money services declined by 7%, while the consumption of user households was unaffected. In their study, mobile money services are seen as a mechanism that cushions households from shocks by increasing remittances received and the diversity of senders through reduced transaction costs. Munyegera and Matsumoto (2016) used a similar approach to that of Jack and Suri (2014) and investigated the impact of use or non-use of mobile money on household welfare in Uganda and found evidence that mobile money user households are more

likely to receive remittances, receive remittances more frequently, and a higher amount of remittances than non-user households due to low transaction, transport, and time costs associated with mobile phone-based financial transactions.

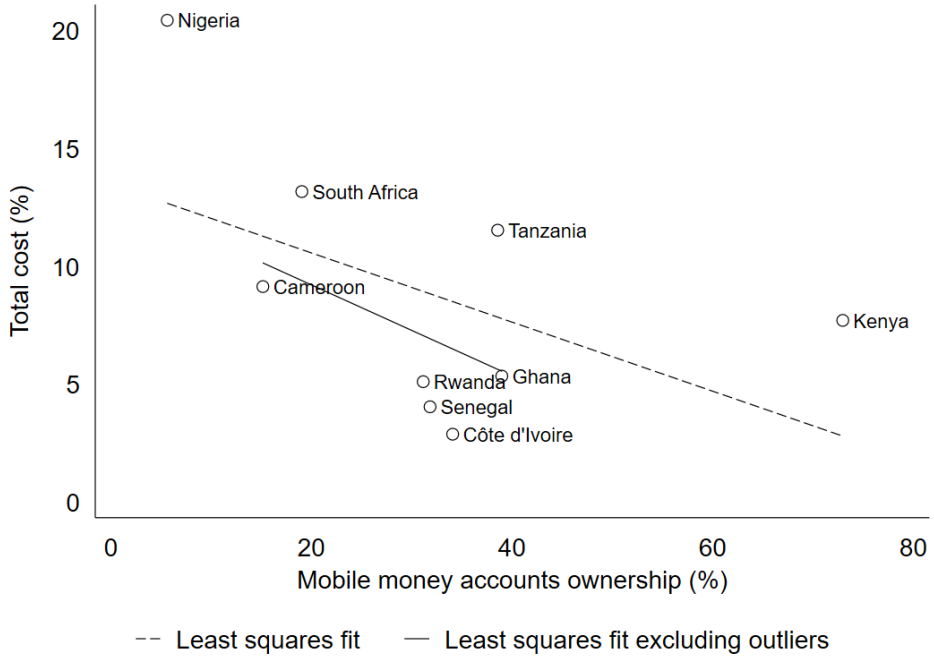
By studying the effect of mobile money transfer services in international remittances and in a multi-country context, this study departs from the work of Jack and Suri (2014) and Munyegera and Matsumoto (2016) in three ways. First, unlike this study which investigates how the introduction of mobile money services affects transaction costs and hence international remittances, Jack and Suri (2014) and Munyegera and Matsumoto (2016) investigated the impact of use or non-use of mobile money in domestic remittances on household consumption? Second, this study complements the work of Jack and Suri (2014) and Munyegera and Matsumoto (2016) by providing cross country evidence on the effect of mobile money transfer services. However, unlike these two studies that were on domestic remittance, this study focuses on international remittances as a third point of departure.

2.0 Mobile Money and Remittances in Sub-Saharan Africa

According to Global Findex data, growth in the number of accounts in the traditional banking system and its usage has been outpaced by growth in the number of accounts and use in the mobile money system. The percentage of people in Sub-Saharan Africa who own an account at a financial institution expanded by 32.0% from 26.0% in 2011 to 34.2% in 2017. Moreover, use of accounts at financial institutions to send money expanded by 52% from 23% in 2011 to 35% in 2017. The use of accounts at financial institutions to receive money in 2011 was 23% and it increased to 33% in 2017. Over the same period, the use of mobile money to send money increased by 165% from 10.4% in 2011 to 27.6% in 2017. The use of mobile money to receive money went up by 329% from 13.6% in 2011 to 58.4% in 2017.

Furthermore, Remittance Prices Worldwide data reveals a consistently lower average transfer cost of international remittance for access points using mobile phone devices compared to other access points, which include agent, call centre, Internet, Automated Teller Machine (ATM) network, bank branch, post office and post office branch. In combination, the latter costs about twice the average transfer cost of using a mobile phone to initiate international remittance transfer. Similarly, the percentage of ownership of mobile accounts and the cost of international remittances for source countries exhibits a negative relationship, suggesting that the introduction of mobile money services is associated with decrease in the cost of international remittances. Figure 2.1 plots the relationship between ownership of mobile accounts and the cost of international remittances for source countries.

Figure 2.1: Mobile money accounts ownership and the cost of international remittances



Source: Author's computation using Global Findex data and Remittance Prices Worldwide data

The dashed line in Figure 2.1 is a linear regression fit for all international remittance source countries in Sub-Saharan Africa in 2017. It shows a negative relationship between mobile money account ownership and the transfer cost of international remittances. The solid line is similar to the dashed line, except that it excludes outliers such as Kenya and Nigeria. Exclusion of outliers leads to a steeper slope, implying a stronger negative relationship.

Growth in adoption and use of mobile money is not limited to domestic remittances; its use has also been introduced in international remittances. In 2018, US$ 4.3 billion of international remittances was transacted through mobile money-enabled platforms (GSMA, 2019). In addition, access point data[3] shows increased availability of mobile phone contact points for senders to initiate international remittance transfers. Access point is defined as the point where a transaction can be initiated by the sender, and it includes: agent, bank branch, post office, Internet, mobile phone, and call centre. Remittance Prices Worldwide data shows that use of mobile money in international remittances is still limited, with its use for initiating international remittance transfers averaging about 2% between 2017 and 2019. Availability of mobile phone option to

3 The World Bank started collecting data on access point from the second quarter of 2016.

initiate international remittance transfers grew from about 0.75% in 2016Q2 to 2.71% in 2018Q1 before declining to 1.74% in 2019Q3. The rest of this paper is organized as follows. Section 3 reviews the theoretical and empirical literature on the cost of remittance flows and literature on the use of mobile-based technology in remittances. Section 4 describes the data and develops the methodology used to address the objectives of this study. In section 5, we present and discuss the findings and conclude in section 6.

3.0 Related Literature

3.1 Theoretical Literature

Theoretically, the motivations to remit include pure altruism, pure self-interest, and tempered altruism or enlightened self-interest (Lucas and Stark, 1985). In this section, these motivations to remit are elaborated (Carling, 2008 and Hagen-Zanker and Siegel, 2007) for a detailed survey of both theoretical and empirical literature. Under pure altruism, the utility of the migrant depends on the utility of the family left at home, the latter utility depends on household per capita consumption. Pure altruism nests pure subsidy, where a migrant remits to impact livelihood. According to Lucas and Stark (1985), three factors drive the pure self-interest motive. First, migrants who aspire to inherit their family property remit to get favours from their parents. Consequently, the higher the likelihood of inheritance, the higher the amount remitted. Second, migrants remit to invest in assets close to their home area and ensure their maintenance. In this case, migrants ride on family bonds of trust to engage family members as agents in acquiring and maintaining the assets. Third, migrants, in preparation to return home, remit to invest in fixed capital and social assets, such as social ties with family and friends.

Under tempered altruism or enlightened self-interest, migrants' remit because of inter-temporal, contractual arrangement between migrant and the family back at home. The first type of inter-temporal, contractual arrangement occurs since the cost of education and support during job search is borne by the migrant-sending family, which places an obligation on the migrant to remit when employed to repay these costs. In this regard, higher education should be associated with higher remittances; however, since higher education is associated with higher wages and hence higher remittances, it is difficult to separate the latter from the former. Thus, a positive effect of education on remittances does not necessarily support this theory. The second type looks at migration as diversification strategy in the presence of risk in the home area and the host country, provided the risks are uncorrelated. In times of shock to the migrant, the family supports the migrant and vice versa for shocks to the migrant sending family. Thus, remittances should be countercyclical.

Darmon et al. (2016) in their pioneering theoretical analysis extended the altruistic motive of sending remittances by introducing the use of mobile money transfer services. Mobile payments generate new consumption opportunities for the

migrant-sending family. They constructed an integrated framework with endogenous remittance decision and use of mobile money transfer services. Their model predicted that mobile payment has a positive effect on aggregate remittance flows. A decline in price of mobile money services induces more agents to switch to mobile money and reduces remittances, with the net effect being the balance of the former and the latter, which is ambiguous.

Empirical analysis has provided mixed evidence on the motives to remit. While altruism and self-interest motive drive decisions to remit (Clarke and Drinkwater, 2001), some empirical evidence, however, seems to cast doubt on some of the theoretical drivers of remittance flows. For instance, altruism may be less important in determining remittance flows than is commonly believed (Lueth and Ruiz-Arranz, 2008). Under risk-sharing motive, empirical evidence shows that remittance flows are part of risk management strategy (Stark, 1991; Stark and Lucas, 1988). Besides altruism, self-interest motive and risk-sharing motive, other drivers of remittances include the need to meet the obligation to the extended household (Agrawal and Horowitz, 2002), the bequest motive, loan repayment, and the exchange motive (Hagen-Zanker and Siegel, 2007).

In addition, empirical evidence has shown that other factors not suggested by theoretical literature are important. Factors such as information flows between senders and recipients are important since they give the migrant better control over remittance use or increased remittance recipients' social pressure on migrants, both of which lead to increased remittance flows (Batista and Narciso, 2016). Other factors such as family bonds of trust are also important to remittance flows (Hadi, 1999; Kannan and Hari, 2002; Yang, 2003).

3.2 Determinants of Remittance Flows

Determinants of remittance flows can be classified based on the level of analysis into microeconomic and macroeconomic determinants. Both macro- and micro-level determinants can be classified further based on perspectives of the study into determinants of remittance inflows and determinants of remittance outflows. The micro-level analysis uses survey data at either migrant or household or individual level, while the latter uses aggregate data at country level. Studies analysing the determinants of remittance outflows use surveys data collected from migrants while those studying the determinants of remittance inflows uses household survey data, often with a two-step design focusing on determinants of the probability of remitting in stage one, and the determinants of the remittance amount in stage two. Micro level studies also include studies using experimental approach (see for instance, Torero and Viceisza, 2015).

The determinants of remittances at micro-level include migrant's income, migrant's education level, migrant's gender, migrant's ethnicity and household's income. Most micro-level studies focus on one perspective; either migrant or household perspective. Therefore, they fail to capture migrant-remittance recipient relationship, which is key

in examining the motivations to remit. Some of the determinants at the micro level carry over, on average, to macro level such as migrant's income carry over as per capita GDP of the host country and household's or individual income as per capita GDP of the home country. Since this study uses country level data, the focus is on the determinants at the macro level.

Besides motivations to remit, costs of remittances such as transfer cost of remittances and cost associated with exchange rate conversion are important determinants of remittance flows. From economic theory, the price of sending money or the cost of money transfer services negatively affects remittance flows. Freund and Spatafora (2008) investigated the determinants of remittances and found that recorded remittances depend negatively on transfer costs, and that transfer costs are lower when financial systems are more developed and exchange rates less volatile. Unlike Freund and Spatafora (2008), this study investigates how the introduction of mobile money services impacted on the cost of remittances, and hence remittance flows. Unlike the work of Freund and Spatafora (2008), this study investigates how remittance costs vary with the introduction of mobile money services.

Kakhkharov et al. (2017) investigated the determinants of remittances in 11 countries of the former Soviet Union using panel data on bilateral remittances covering the period 2000 to 2014. They found that transaction costs and the appreciation of the currency in the host are negatively related to recorded remittances. Additional variables included in their analysis include the flow of migrants, GDP growth rate differential between Russia and the countries of the former Soviet Union, unemployment in the home country, age dependency, credit to GDP, inflation, economic crises and sharing a common border. Similarly, El-Sakka and McNabb (1999) documented evidence that exchange rate and interest rate differential determine remittance outflows in Egypt.

Macroeconomic policies such as exchange rate and capital account control policy are also important determinants of remittance flows. The effects of these policies are captured by such variables as black-market premium and liberalization of exchange rate and capital account. Gupta (2005) analysed the determinants of remittance inflows in India and found that liberalization of exchange rate and capital account controls had a positive effect on remittance flows. Aydas, Metin-Ozcan and Neyapti (2005) analysed the determinants of remittances and found that black market premium, interest rate differential, inflation rate, growth and home and host country income levels are significant drivers of remittances, with black market premium and inflation rate having negative effects.

Singh et al. (2011) analysed the determinants of remittances in Sub-Saharan Africa using panel data for 36 countries covering the period from 1990 to 2008. They found that a larger diaspora and diaspora located in high income countries boosts remittance flows. In addition, they documented evidence that remittance flows are counter-cyclical, which is consistent with risk-sharing motive of remitting. Similarly, Gupta (2005) analysed the determinants of remittance inflows in India and found that it is positively related to the number of migrants to high income countries. Risk-sharing motive was also documented by Lueth and Ruiz-Arranz (2008). They investigated

the determinants of bilateral remittance flows and found that remittance flows are countercyclical. Similar evidence is provided by Bettin, Presbitero and Spatafora (2017) for the case of developing countries.

A number of studies have investigated how labour market dynamics affect remittances. The evidence on the effect of skills is mixed. Gupta (2005) analysed the determinants of remittance inflows in India and found a positive relationship between remittance flows and the skills of the migrant. In contrast, Adams (2009) examined the determinants of remittances at micro level and found that skill composition of migrants has no effect on remittances. Al Mamun et al. (2015) used panel data from 61 top remittance-receiving countries to investigate labour productivity and remittance dynamics, and they found a positive relationship between remittance and labour productivity. This effect is stronger where there are higher remittances and labour supply and declines below a certain level of remittances and labour abundance. Investigating labour market dynamics and remittances is delicate due to endogeneity. Studies such as Azizi (2018) provide evidence that remittances affect human capital development and market supply indicators.

While there is ample evidence showing that remittance flows have a positive effect on financial inclusion (see for instance Anzoategui, Demirgüç-Kunt and Martínez Pería, 2011; Gupta, Pattillo and Wagh, 2009), there is little evidence of the reverse causality flowing from financial development to remittance flows. Anzoategui, Demirgüç-Kunt and Martínez (2011) assessed the impact of remittances on financial inclusion and documented evidence that remittance flows promote the use of deposit accounts, hence impacting positively on financial inclusion. Gupta, Pattillo and Wagh (2009) investigated the effect of remittance flows in Sub-Saharan Africa and documented evidence that remittance flows promote financial development. Their findings hold even after factoring in the reverse causality between remittance flows and financial development.

Ahamada and Coulibaly (2011) investigated the effects of financial development on the relationship between remittances and GDP growth volatility. They used data from 87 emerging and developing countries and found a time-varying non-linear effect of remittances on GDP growth volatility, which is modified by the level of financial development. At high levels of financial development, remittances have stabilizing effects on GDP growth volatility. The studies reviewed in this section reveal that macroeconomic variables, financial development, macroeconomic policies, and labour market dynamics determine remittance flows. Although some previous studies have investigated the effect of financial development on remittance flows, to the best of my knowledge, none has investigated the effect of mobile money on international remittances. This study departs from these earlier studies by investigating how the introduction of mobile money services – an innovation that is driving financial inclusion and development, and accounts for 70% of remittance transactions through mobile money in Sub-Saharan Africa – affects transfer costs and international remittance flows.

3.3 Mobile Money Services and Remittances

Mobile money services started in Kenya in 2006 and rapidly expanded to other developing countries within Africa and Southeast Asia. Global Findex data shows that between 2012 and 2017, use of mobile money to remit money expanded by 165% compared to a growth of 52% for financial institutions. The use of mobile money to receive remittances grew by 329% relative to 43% for use of accounts in financial institutions. Two observations emerge. First, each remittance sender, on average, sends to more than one recipient and hence adoption and use of mobile money is likely to be driven by remittance senders who encourage the recipients to enrol. The former constitute mainly of migrants and the latter consists mainly of remittance recipients. Morawczynski and Pickens (2009) identified two types of users of mobile money services: urban senders and rural recipients. Urban senders are largely migrants remitting money back to their relatives in rural areas.[4]

Second, the high growth in the use of mobile money transfer services relative to the use of financial institutions money transfer services to send and receive remittances implies that money transfer services for domestic remittances are shifting from traditional providers to wireless carriers. Unlike other modes of money transfer, mobile money transfer services use existing infrastructure, making it cheaper to provide and access. It is also easily accessible due to its strong technological ubiquity (Morawczynski and Pickens, 2009). Thus, mobile money providers can compete for consumer market share based on technological ubiquity and lower-cost services (Merritt, 2011; Darmon, Chaix and Torre, 2016).

Due to limited use of mobile money transfer services in international remittances arising from limited interoperability, among other factors, most of the studies investigating the role of mobile money on remittances have focused on domestic remittances. The study by Jack and Suri (2014) is one of the pioneering studies. They studied the effects of shocks on consumption for users and non-users of mobile money services and found that consumption for non-users of mobile money services declined by 7% while consumption of user households was unaffected. In their study, mobile money services are seen as a mechanism that cushions households from shocks by increasing remittances received and the diversity of senders.

Munyegera and Matsumoto (2016) investigated the impact of use or non-use of mobile money on household welfare in Uganda and found evidence that mobile money user households are more likely to receive remittances, receive remittances more frequently, and a higher number of remittances than non-user households due to low transaction, transport, and time costs associated with mobile phone-based financial transactions. The work of Jack and Suri (2014), and Munyegera and Matsumoto (2016) share three common features, which represent the points of departure of this study. First, the two studies treated usage of mobile money services as a means by which

4 With the adoption of mobile money in international remittances, international migrants are an emerging user group.

migrants sent or received remittances. Second, the two studies were conducted in a single-country context. Third, the two studies looked at domestic remittances. This study investigates the effects of the introduction of mobile money services on remittance transfer costs and international remittance flows using cross-country data. Different countries in Sub-Saharan Africa are at different levels of penetration of mobile money, and this variation allows this study to investigate the effect of introduction of mobile money services on remittance prices and international remittance flows.

3.4 Summary of Literature

Previous studies have found that the determinants of remittance flows include macroeconomic factors, macroeconomic policies, financial factors such as financial development and financial inclusion, and labour market dynamics. Financial development is a broad concept constituting a myriad of factors including access to credit and access to and use of financial services such as accounts in financial institutions and mobile money service providers. In addition, the underlying components driving financial development vary per region. For instance, mobile money has rapidly expanded in Sub-Saharan Africa and Southeast Asia compared to other regions (Demirgüç-Kunt, Klapper, Singer and Van Oudheusden, 2015). It is, however, not known whether these variations translate into variations in effects? If the effect varies per component of financial development and the size of these components vary per region, then use of aggregate level variable as opposed to disaggregated level variables in estimation result in loss of information. Additional information implies additional insights, which might have a bearing on policy implications.

This study posits that the introduction of mobile money services reduces the remittance prices and hence boosts international remittance flows. Mobile money transfer services use existing infrastructure such as wireless communication infrastructure and mobile phones, and thus it is plausible that the provision and adoption cost is low. In addition, mobile money has low access costs in terms of time and transport costs (Munyegera and Matsumoto, 2016) since mobile money services rarely require the user to travel to major urban centres to access banking services. A low mobile money transfer cost might lead to substitution away from money transfers services offered by money transfer operators and financial institutions to mobile money transfer services, leading to a fall in the average money transfer costs. This could increase remittance flows (see for instance Ahmed and Martínez-Zarzoso, 2016). This study seeks to fill this gap by investigating the effects of introduction of mobile money services on international remittance transfer costs and flows in Sub-Saharan Africa.

4.0 Methodology

4.1 Conceptual Framework

Mobile money is a substitute to other channels of remitting money. Thus, standard economic theory of demand postulates that the use of mobile money to remit money is inversely related to the ratio of the price of mobile money to the prices of other channels. Evidence from single-country studies (see for instance Jack and Suri, 2014; and Munyegera and Matsumoto, 2016) shows that introduction of mobile money reduces transaction costs, increasing remittances received and the diversity of senders. We test whether the same mechanism applies to the use of mobile money services in international remittances, such that introduction of mobile money use in international remittances should be associated with declining cost of remittances for countries that have integrated mobile money use in international remittances.

4.2 Model Specification

This study seeks to investigate the effects of introduction of mobile money services on international remittance prices and flows in Sub-Saharan Africa. To investigate the effect of introduction of mobile money services on international remittance transfer costs, this study estimates a standard cost function for remittances augmented with the mobile money variable. This is given by the following regression equation:

$$c_{kijt} = \beta_0 + \sum_{p=1}^{k} \tau_p z_{kijtp} + \delta m_{kijt} + \varphi_{ij} + \varepsilon_{kijt} \quad (1)$$

where c_{kijt} is the log of the total remittance transfer costs for remittance flows transaction k to country i from country j at time t, z_{ijtp} is a set of control variables, which include both home and host country variables, and features of transactions such as denomination amount, m_{kijt} is binary indicator measuring adoption of mobile money transfer services for remittance flows transaction k in country i -country j bilateral remittance corridor at time t, φ_{ij} captures time invariant effects of country i-country j bilateral remittance corridor, and ε_{kijt} is the error term and captures variability across transactions, time and bilateral remittance corridors. c_{kijt} , z_{kijtp} and m_{kijt} are independent and identically distributed random vectors. z_{kijtp} includes two denomination amounts: US$ 200 and US$ 500. A least square dummy

variable model with bilateral remittance corridor fixed effects and year fixed effects was estimated. The data could not be set as panel due to existence of multiple records of money transfer firms. Names of multinational money transfer agents, some of which operate franchise system and therefore multiple entries could appear in any given sample country and period, are included in the variable money transfer firms.

To determine the effect of international remittance transfer costs on international remittance flows, this study models the determinants of remittance flows. There are two approaches to modelling remittance flows, which emanate from the theoretical work of Lucas and Stark (1985). Under the first approach, the remittance flow is endogenously determined by the decision of the family to send migrant(s) and of the migrant, driven by altruism and tempered altruism, to remit. The second approach is driven by self-interest motive and, therefore, factors such as relative prices of assets and relative rates of returns determine whether savings are invested in the host country or transferred from the host country to the home country as remittances.

This study integrates these two approaches in modelling remittances and extended the integrated model to include bilateral remittance corridor fixed effects and year fixed effects. The former controls for unobserved individual characteristics and the latter capture the effect of common shocks and the aggregate trends. The extended model including lagged remittances, bilateral remittance corridor and year fixed effects was implemented by regressing the dynamic panel model specified in equation (2) below:

$$\Delta r_{ijt} = \beta_0 + \sum_{p=1}^{k} \beta_p x_{ijtp} + \varphi_{ij} + \varepsilon_{ijt} \quad (2)$$

where Δr_{ijt} is the change in log of remittances and is defined as $r_{ijt} - r_{ijt-1}$, r_{ijt} is the log of remittances to country ii from country j at time t, r_{it-1} is the lag of the log of remittances, x_{ijtp} is a set of control variables, which include both home and host country variables, including relative prices and rates of returns, φ_{ij} captures time invariant effects of country i-country j bilateral remittance corridor, and ε_{ijt} is the error term and captures variability across time and bilateral remittance corridors. Equation (2) was also implemented with r_{ijt} as remittances to GDP ratio given by remittances to country i from country j at time t to country i's GDP, and r_{ijt} as remittances per capita defined as remittances to country i from country j at time t to country i's population (see for instance Kakhkharov et al., 2017). The variables included in equation (1) and (2) are defined in Table 4.1. All stock and flow variables (excluding those measured in percentage change) are measured in US dollars.

4.3 Empirical Strategy

In estimating equation (2), there are three main concerns that might have implication on the estimates. This arises due to various estimation approaches available for equation (2), which includes ordinary least squares, fixed effect, differenced

General Methods of Moments (GMM), and system GMM. First, the lagged measure of remittances is likely to be correlated with the error term and, therefore, an ordinary least squares estimation of equation (2) yields estimates that are inconsistent and biased upward due to endogeneity. Second, a fixed effect or least squares dummy variable estimation of equation (2) also yields estimates that are inconsistent and biased downwards due to correlation between lagged remittances and the error term.

Third, if remittances follow a random walk and T is small, differenced GMM has poor finite sample properties and gives results that are biased downward. To address the above three concerns, Blundell and Bond (1998) proposed system GMM, which consists of two simultaneous equations. The first equation is in levels and uses lagged first differences as instruments while the second equation is in first differences and uses lagged levels as instruments. Other concerns include clustering due to, for instance, factors such as strong family ties and risk sharing, which might be similar within regions but different across regions. The study exploited variation in intra-Sub-Saharan Africa remittance flows and remittances from the rest of the world to Sub-Saharan Africa to estimate the effect of introduction of mobile money services on remittance transfer prices and flows.

4.4 Diagnostic Tests

We implemented two main tests to check for the validity of the GMM instruments: over-identification and serial correlation. Over-identification test is used to identify over-identification problem, which occurs when the number of individuals or groups is less than the number of instruments used. The null hypothesis under this test is over-identification restrictions are not violated. Hansen and Sargan tests were used. Sargan is adequate in the presence of homoscedasticity, while Hansen is appropriate in the case of data with heteroscedasticity. The concern on serial correlation, specifically, serial second-order autocorrelation of residual, which arises due to the endogenous nature of the lagged dependent variable, was examined using Arellano-Bond test. A null hypothesis of no autocorrelation is tested, with a rejection indicative of unit root problem. Furthermore, we checked for heteroscedasticity by comparing robust standard errors and ordinary standard errors (under homoscedasticity assumptions), where the two standard errors varied widely, robust standard errors were reported.

4.5 Data Sources and Variable Description

This study uses two datasets. The World Bank's Remittance Prices Worldwide was used to address the first objective. The Remittance Prices Worldwide database covers data collected across remittance corridors and contains money transfer firm's level variables, amounts, transfers cost, exchange rate margin, product, access point, speed of transfer and network coverage. This database contains the exchange rate spread or margin and the most visible cost of sending an amount of US$ 200 and US$

500 at the initiation point. Starting from 2016, data was collected on access points available for initiating transfer transaction. Information is also collected on the length of time it takes to transfer money from sender to recipient, network coverage of each service provider, payment instrument, and receiving method. The dataset mainly covers transactions from the main sending location/area to the capital city or most populous city in the receiving market. This is a quarterly dataset containing money transfer firm level information for 365 corridors, with remittances flowing from 48 remittance sending countries to 105 receiving countries.

For the second objective, annual data from the World Bank's Remittance Prices Worldwide, World Development Indicators and Migration and Remittances database was used. The World Bank's Remittance Prices Worldwide is as described earlier. The dataset was collapsed into annual series before merging it to the World Bank's Remittance Prices Worldwide dataset. Migration and Remittances database contains data on bilateral migrant stocks and bilateral remittance flows. Development and macroeconomic control variables were obtained from the World Development Indicators. Measures of exchange rate and capital account controls were obtained from IMF's ARREAR database. The two datasets were used to generate variables of interest as presented in Table 3.1

Table 4.1: Definition and description of variables

Variable	Description
Remittance inflows (r_{ijt})	It is measured as the log of bilateral remittances to country i from country j at time t
Denomination amount	It is measured in US$ for two denominations: US$ 200 and US$ 500 and converted into logs. Costs and other data were collected for sending two denominations: US$ 200 and US$ 500
Mobile money services (m_{it})	Equals one after, at least one, money transfer firm start accepting mobile money as payment instrument and zero, elsewhere, for each bilateral remittance corridor
Remittances transfer cost (%)	Is the fee the sender pays at the initiation point to remit money to country i from country j at time t expressed as a percentage of the amount remitted
Exchange rate margin	Is the deviation of the exchange rate for country j at time t used in the remittance transaction to country i from the official exchange rate prevailing at time t
Official exchange rate	Is the log of the annual average exchange rate between the local currency of (remittance source) country j at time t to US dollar
Stock of migrants	Is the log of the total number of migrant workers from country i resident in country j at time t
GDP per capita (destination country)	Is the annual per capita GDP for country i at time t
GDP per capita (source country)	Is the annual per capita GDP for country i at time t
Common border	Is a dummy that equals one if source country and destination country share a common border and zero, elsewhere
Exchange rate and capital accounts controls	Is a dummy that equals one if exchange rate and capital account restrictions are in place in the destination country (country i) at time t and zero, elsewhere

To construct the study sample for the second objective, this study uses the World Bank remittance matrix and the migration matrix for the period 2010 to 2018 to construct bilateral remittance corridors with two additional variables: remittance amount and migrant stock. Additional variables were added from the World Development Indicators using combination of source country – year for source country variables and destination country – year combination for destination country variables. Finally, the World Bank's Remittance Prices Worldwide were aggregated (mean values were used for price variables) to annual series and merged into the datasets using source country – destination country – year as merging variables. The data were filtered to only include destination countries in Sub-Saharan Africa. This resulted in unbalanced panel (see Annex Table A1) of 59 remittance corridors with remittance records over the period 2012 to 2017, giving a total of 239 observations. All the countries with data in all the variables of interest were included in the final sample. This implies that only countries with World Bank remittance prices were included. The World Bank monitors a few corridors, and this limits the merged observations with remittance transfer costs, access points and payment instruments. Quarterly World Bank's Remittance Prices Worldwide firm (money transfer) level data covering 86 remittance corridors with receiving countries in SSA for the period 2011Q1 to 2019Q4 was used to address the first objective.

5.0 Empirical Results

This study investigates the effects of the introduction of mobile money services on international remittance transfer price and flows in Sub-Saharan Africa. Specifically, this study investigates the effect of introduction of mobile money services on international remittance transfer costs and determines the effect of international remittance transfer costs and mobile money services on international remittance flows. To achieve the first specific objective, least squares dummy variable model is used on quarterly Remittance Price Worldwide data spanning the period 2011Q1 to 2019Q4. For the second specific objective, a system GMM is used on annual panel data of all source countries of remittances to Sub-Saharan Africa spanning the period 2012 to 2017.

5.1 Effect of Mobile Money Services on Remittance Transfer Cost

5.1.1 *Descriptive statistics*

Mobile money use in international remittances is hypothesized to be associated with declining cost of remittances for countries that have incorporated mobile money use into conventional channels of international remittances. Thus, channels that use mobile money as access points or payment instruments should have lower cost compared to options that do not incorporate mobile money. To investigate this, the study used transactional level quarterly Remittance Price Worldwide data. In this regard, descriptive statistics are grouped into those that incorporate mobile money and those that do not. Table 5.1 presents the descriptive statistics for key variables.

Table 5.1: Descriptive statistics

	Channels that do not incorporate mobile money				Channels that incorporate mobile money			
	N	Mean	Median	SD	N	Mean	Median	SD
Remittance amount (US$)	39,113	349	200.00	150.00	593	347	200.00	150.00
Remittance transfer cost (US$)	39,113	26.6	22.0	18.1	593	14.6	11.1	11.5
Foreign exchange margin (%)	39,113	8.15	5.3	11.4	593	6.03	4.0	7.9
Common Border	39,113	0.10	0.00	0.30	593	0.21	0.00	0.41

Remittance amount, which represents the amount transacted, exhibits little

variation for transactions that incorporate mobile money and transactions that do not incorporate mobile money in remittance process. Transfer cost of remittance flows as measured by transfer cost (%) of remitting money for transactions that incorporate mobile money use in international remittances is about twice that of transactions that do not incorporate mobile money use in international remittances. Using mobile money as payment instrument results in cost savings of about 46% for transfer costs (%). The implication is that integration of mobile money services with other channels of international remittances helps bring the cost of international remittance transfers down.

Similarly, the foreign exchange margin is lower for transactions that incorporate mobile money as payment instruments in their international money transfers. Foreign exchange margin is lower by about 24% for transactions that incorporate mobile money as payment instruments compared to transactions that do not. Mobile money as payment instrument is used by 21% of transactions in corridors sharing a common border. This drops by half to about 10% for transactions in corridors that do not share a border. This suggests that integration of mobile money in international remittances improves with cross-border mobile money interoperability, linking mobile money service providers in different countries, which in turn is higher for countries that share a common border.

5.1.2 *Mobile money and remittance transfer cost*

The effect of mobile money on remittance transfer cost is investigated by implementing equation (1). Estimation was done with remittance amount and remittance transfer costs in logs. The other variable was used at levels. Table 5.2 presents the regression results of this estimation. For robustness check, the Least Squares Dummy Variable (LSDV) model was estimated with clustered errors.

Table 5.2: Effects of mobile money on international remittance transfer cost

	(1)	(2)	(3)
Variables	LSDV	LSDV (clustered SE)	OLS
Log of Remittance Amount	0.070***	0.070***	0.071***
	(0.001)	(0.005)	(0.004)
Common Border	0.007	0.007	0.093***
	(0.012)	(0.007)	(0.026)
Mobile	-0.122***	-0.122***	-0.117***
	(0.005)	(0.019)	(0.015)
Log of Forex Margin	0.854***	0.854***	0.830***
	(0.005)	(0.048)	(0.039)
Constant	0.461***	0.461**	0.398**
	(0.0245)	(0.197)	(0.163)
Observations	39,706	39,706	39,706
Year FE	YES	NO	YES
Corridor FE	YES	NO	YES

*** p<0.01, ** p<0.05, * p<0.1

The Least Squares Dummy Variable (LSDV) model presents the estimation result under the assumptions that the remittance transfer cost is independently and identically distributed. However, remittance transfer cost is likely to vary across bilateral corridors and is correlated within corridors, which violates the assumptions of independently and identically distributed. To correct for the bias associated with the violation of IID assumption, LSDV was estimated, with errors clustered within bilateral corridors. Ordinary standard errors and clustered standard errors are reported in parentheses, for LSDV and LSDV with clustered standard errors. Ordinary Least Squares (OLS) are presented for comparison.

The ordinary standard errors and clustered standard errors vary widely, implying that remittance transfer cost varies across bilateral remittance corridors, and they are correlated within corridors. Thus, the model with clustered errors is more appropriate. The coefficient of remittance amount is 0.07 and is positive, implying that for every US$ 100 remitted, US$ 7.3 is absorbed by remittance transfer cost. Sharing a common border has no effect on the remittance transfer cost. This could be due to correlation between mobile money measure and the measure for sharing a common border. Corridors sharing a common border are twice as likely to adopt the use of mobile money in international remittances.

In a case where the total cost constitutes of only variable cost, a one-to-one relationship between remittance amount and variable cost is expected, and therefore the coefficient of remittance amount should be equal to 1. However, due to presence of fixed cost element in total cost of remittance, the coefficient is 0.070. Moreover, a transaction that occurs in a corridor that does not share a common border and does not incorporate mobile money in international remittances and facing zero forex margin will have a fixed cost of US$ 0.5857 and a variable cost of US$ 0.0725, giving a fixed cost share of 89% for sending a US$ 1. For the average remittance flows to SSA of US$ 91.42,[5] the share of fixed cost is 8.1%. When the main cost component of remittance transfers is fixed cost, then it is expensive to send small amounts of remittances.

Remittance transfer cost is lower by 11.5%[6] for transactions that happen in corridors that incorporate mobile money as a payment instrument. This result is consistent with the earlier results, which showed that the average cost of using non-mobile phone devices/channels to initiate international remittances is about twice the average cost of using a mobile phone to initiate international remittance transfers. A one percent increase in foreign exchange rate margin increases remittance transfer costs by 0.854%. This is hypothetically correct as exchange rate margin is expected to have a positive effect on international remittance costs. However, the distribution of forex margin ranges from US$ -80 to about US$ 250, with negative numbers implying a favourable foreign exchange rate margin that offsets the international remittance costs.

5 Average remittance was computed as the product of the average remittance to GDP for SSA of 7.25% and the average GDP per capita for remittance receiving SSA countries of 1,261 divided by 100.

6 The estimate is given by exp(-0.122) – 1.

5.2 International Remittance Transfer Cost and International Remittance Flows

5.2.1 *Descriptive statistics and correlation*

Table 5.3 presents descriptive statistics for the dependent and independent variables.

Table 5.3: Descriptive statistics

Variable Name	N	Mean	Standard Deviation	Min	Median	Max
Remittance amount to GDP (%)	239	0.07	0.17	0	0.01512	0.9384
Migrant stock	239	6.65	3.935	0	7.2724	12.6302
Official exchange rate	239	2.13	2.178	0.4748	0.8320	7.7097
Mobile money	239	0.09	0.290	0	0	1
Common border	239	0.26	0.437	0	0	1
GDP per capita (Source)	239	9.57	1.499	6.7366	10.6229	11.0014
GDP per capita (Destination)	239	7.14	0.776	5.6903	7.0987	8.9594
Remittances transfer cost	239	0.09	0.04	.0075	0.0811	0.1860

Source: Author's computation using bilateral remittance matrix, Migrant stock matrix, WDI and Remittance Prices Worldwide data

Remittances to Sub-Saharan Africa averaged 7.25% (i.e., exp(0.07)-1) of GDP per corridor per year with a standard deviation of 18.5% of GDP. The ratio of standard deviation to absolute mean is 2.55, which reflects high variation in remittance flows across Sub-Saharan Africa as a percentage of GDP, as shown in Figure 5.2. Remittance transfer costs averaged about 9.42% (i.e., exp (0.09)-1). Although we have omitted remittance corridors with missing observations in the key variables of interest, the sample average remittances transfer cost of 9.42% does not significantly deviate from the World Bank estimate of about 9.10% for Sub-Saharan Africa.

The average GDP per capita for remittance source countries is about US$ 14,328, about 11 times the per capita GDP of US$ 1,261 for remittance-receiving countries. This implies that remittances to Sub-Saharan Africa originate from relatively richer countries than an average Sub-Saharan Africa country. In the case of intra-SSA remittances, the average GDP per capita for SSA source countries is more than twice that of SSA destination countries. It is US$ 2,727 and US$ 1,284 for the former and the latter, respectively. The penetration of mobile money in international remittance flow is still very low. On average, about 9% of corridors have mobile money as part of their payment instruments while 26% of the countries in the corridor share a common border.

Table 5.4 presents pairwise correlations coefficients for the dependent and independent variables.

Table 5.4: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Migrant stock	1.000							
(2) Official exchange rate	0.474*	1.000						
(3) Mobile money	0.111	0.370*	1.000					
(4) Common border	0.471*	0.720*	0.212*	1.000				
(5) Remittance to GDP	-0.042	-0.073	-0.116	0.167*	1.000			
(6) GDP per capita (Source)	-0.584*	-0.910*	-0.337*	-0.700*	0.054	1.000		
(7) GDP per capita (Destination)	0.216*	-0.159*	-0.090	0.007	-0.039	0.078	1.000	
(8) Remittances transfer cost	0.436*	0.385*	-0.024	0.391*	-0.026	-0.481*	0.031	1.000

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation using bilateral remittance matrix, Migrant stock matrix, WDI and Remittance Prices Worldwide data

The pairwise correlation coefficients presented in Table 5.4 with * are significant at 5% and they are based on 239 observations. The correlation between remittance to GDP and remittances transfer cost is not significant. At aggregate level, there is no correlation between mobile money and remittance amount, and remittance transfer cost. Remittance transfer cost is negatively associated with GDP per capita of the source country (a correlation coefficient of -0.481) and since these countries have higher income, then this suggests that the more developed countries are, the lower the remittance transfer cost for the corridors of that country with SSA countries and vice versa. The correlation between remittance amount and GDP per capita for source countries and destination countries are insignificant.

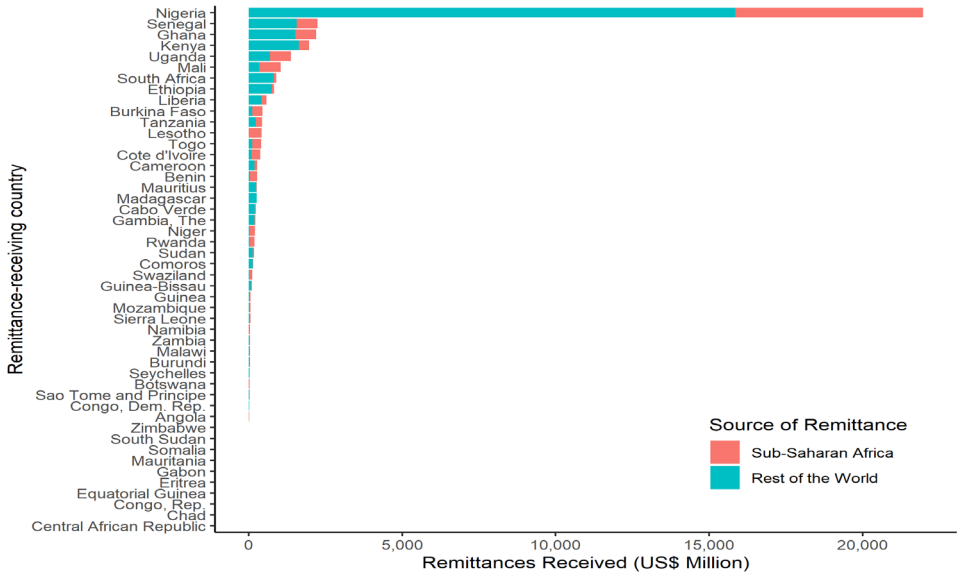
Official exchange rate of source country is positively correlated with the amount remitted (a correlation coefficient of 0.385). The correlation coefficient of 0.385 between official exchange rate of the source country and remittances transfer cost suggests that currency depreciation in the remittance sending countries is associated with increasing cost of remittance. Most remittances must be converted from source country currency into US$, then transferred to the destination country where they are converted into the destination country currency. These conversions, if the exchange rate margin is high, has an implication on remittance transfer costs. A depreciation in source country currency increases remittance transfer costs since remitters must incur more per unit of US$, thus a positive relationship between source country exchange rate and the remittance transfer costs.

5.2.2 *Source of remittances to Sub-Saharan Africa*

Figure 5.1 and 5.2 show the remittances received in absolute amount and as a percentage of receiving country GDP, respectively. Remittances received vary widely when measured in absolute terms than when measured as a percentage of GDP. In absolute terms, Nigeria received about US$ 21,967 million, about four times the second highest recipient, Senegal, which received about US$ 2,238 million. Ghana received US$ 2,190 million, while countries such as Kenya, Uganda and Mali received remittances ranging from US$ 1,000 million to US$ 2,000 million. The rest of the SSA countries received less than US$ 1,000 million.

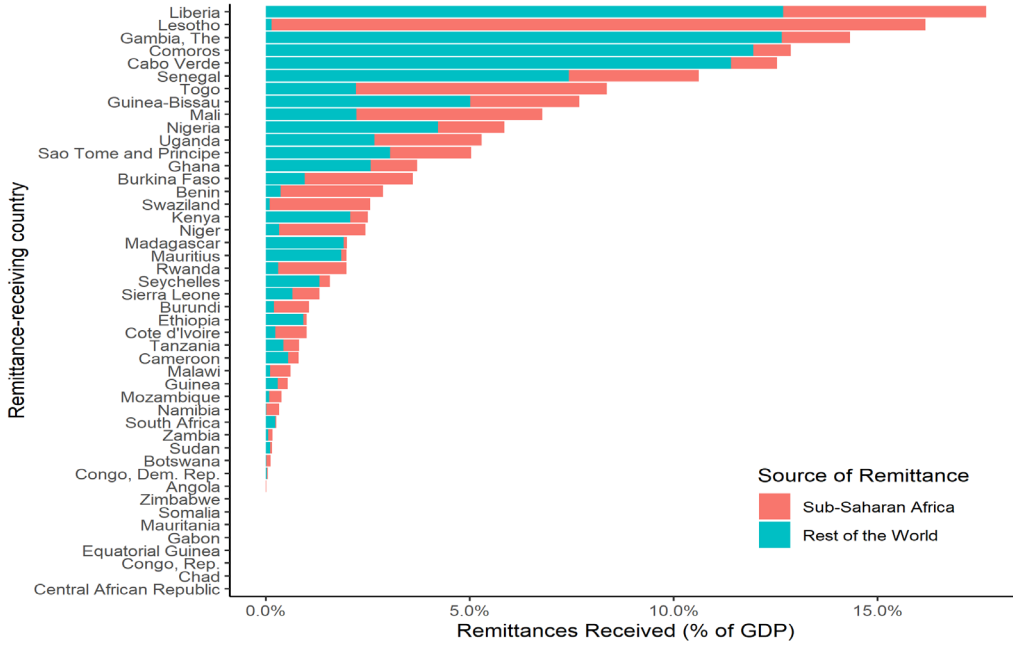
Similar variability is also present when remittances received is measured as a percentage of GDP. However, overall variability declines. In 2017, remittance received (% GDP) varied widely across SSA countries, with Liberia and Lesotho recording more than 15% while countries such as Mozambique, Namibia, South Africa, Zambia, Sudan, Botswana, Democratic Republic of Congo, and Angola recorded less than 1%. Intra-SSA remittances from other SSA countries exceed remittance from the rest of the world for seventeen (17) out of thirty-eight (38) countries with recorded remittance received/amounts. Lesotho has the highest remittance received as a percentage of GDP from SSA followed by Togo.

Figure 5.1: Remittances to SSA countries by source (US$ million)



Source: Author's computation using bilateral remittance matrix data

Figure 5.2: Remittances to SSA countries by source (% of GDP)



Source: Author's computation using bilateral remittance matrix and WDI data

5.2.3 *Role of mobile phone-based money transfer services in international remittances*

This study investigates the effects of introduction of mobile money services on international remittance transfer price and flows in Sub-Saharan Africa. Mobile money has been integrated in international money transfer and, therefore, it affects international remittances through its effect on remittance transfer costs. These effects arise from the integration of mobile-phone based money transfer services with other channels of cross-border transfer. Table 5.5 presents the results of equation 2.

Table 5.5: Determinants of international remittance

Variables	(1) OLS	(2) Fixed Effect	(3) Diff. GMM	(4) System GMM
Lag of remittances to GDP	1.0146***	0.5534***	0.5667***	0.9693***
	(0.0168)	(0.0632)	(0.1763)	(0.0368)
Remittances transfer cost	0.0433	0.1537	0.4645	0.0317
	(0.0657)	(0.1523)	(0.8990)	(0.1153)
Migrant stock	0.0002	0.0026	0.0023	0.0011
	(0.0005)	(0.0059)	(0.0263)	(0.0013)
GDP per capita (US$) - source	0.0044	0.0377*	0.0489	0.0043
	(0.0033)	(0.0215)	(0.2137)	(0.0045)
GDP per capita (US$) - receiving	0.0008	-0.0229*	-0.0565	-0.0033
	(0.0020)	(0.0115)	(0.0601)	(0.0035)
Official exchange rate - source	0.0019	-0.0156	-0.1386	0.0007
	(0.0022)	(0.0256)	(0.2005)	(0.0025)
Mobile money	0.0009	-0.0062	-0.0117	-0.0014
	(0.0048)	(0.0062)	(0.0201)	(0.0054)
Common border	-0.0051		0.0000	0.0007
	(0.0082)		(0.0000)	(0.0099)
Constant	-0.0596	-0.1701		
	(0.0462)	(0.2739)		
Observations	239	239	180	239
R-squared	0.98	0.44		
Number of corridors		59	50	59
Year FE	YES	YES	YES	YES
All	522.1	56.85	7.468	200.4
Sargan test			17.38	51.36
Sargan test: p-value			0.183	0.0893
Hansen test			8.847	38.79
Hansen test: p-value			0.784	0.130
Arellano-Bond test for AR(2)			0.337	-0.267
Arellano-Bond AR(2): p-value			0.736	0.789

Source: Author's computation using bilateral remittance matrix, Migrant stock matrix, WDI and Remittance Prices Worldwide data.

The model presents the estimation result of the determinants of change in international remittance flows. Adoption of mobile money as a payment instrument in international remittance is included as one of the determinants. The OLS model reports the results of the pooled OLS regression, which provides the upper bound while the Fixed Effect model provides estimates of fixed effects regression and it provides lower bound estimates for the coefficient of the lagged dependent variable. The Diff. GMM and System GMM present the estimates of Difference GMM and System GMM, respectively. The levels of significance are: * p<0 .1; ** p<0 .05; *** p<0 .01. Standard errors are in parenthesis below the coefficients. Robust standard errors are in parentheses.

The dependent variable for the regression results presented in Table 5.5 is the change in remittance flows to GDP. Sargan test statistic and Hansen J statistic of over-identifying restrictions are statistically insignificant for the differenced GMM, and thus the instruments are valid. Similarly, the Sargan test and Hansen J statistic are not

rejected for the system GMM at 5% level of significance, suggesting the instruments are valid. The test for AR(2) in first differences was, however, not rejected implying that there is no autocorrelation in levels. The results conform, to a great extent, to the expectations in terms of sign and shows that remittance flows to SSA are persistent.

The coefficient of lagged remittance flows to GDP is 0.9693 and is significant at 1%, indicating that remittance flows are persistent. The implication is that shocks to remittances do not dissipate immediately but will last longer, thus affecting more than one year. Insignificance of key theoretical drivers of remittances such as income of the remittance-receiving country, income of the migrant host country, remittance transfer costs and migrant stock suggests that these factors do not matter in international remittance flows to SSA.

5.3 Discussion of the Results

The characteristics of the final sample analysed is consistent with the characteristics of the initial sample before cleaning to remove observations with missing data on key variables of interest and unmerged data. Final sample statistics such as the average remittances transfer cost of 9.42% is consistent with the World Bank estimate of about 9.10% for Sub-Saharan Africa. This study finds that intra-SSA remittances – remittances from other SSA countries exceeded remittance from the rest of the world for seventeen (17) out of thirty-eight (38) countries with recorded remittance received/amounts. This translates to about 45%, suggesting close to half of remittances received in SSA are intra-SSA; i.e. come from other SSA countries. Moreover, remittance-sending countries are richer than remittances-receiving countries, even for intra-SSA remittances. Remittance received (% GDP) varied widely across SSA countries, with the highest receiving about 15% of GDP and the lowest as low as 1% or less of GDP.

Although this study did not find evidence of the effect of international remittance transfer costs and mobile money services on international remittance flows, there is evidence that incorporating mobile money services in international remittances is associated with lower remittance transfer costs. Remittance transfer cost was lower by 46% for transactions that incorporate mobile money compared to the cost for transactions that do not incorporate mobile money, and this estimate goes down to 11.5% when other factors that affect remittance transfer costs are controlled for. Similar evidence was documented by Jack and Suri (2014) for internal remittances; however, no evidence of this effect had been documented for international remittances. The major remittance transfer cost driver component, the foreign exchange rate margin, exhibited a similar pattern. A one percent increase in foreign exchange rate margin increases remittance transfer costs by 0.854% and forex margin is lower for transactions that incorporate mobile money by 24% relative to transactions that do not incorporate mobile money in international remittances.

Moreover, mobile money use in international remittances for corridors that share a common border is twice that of corridors that do not share a common border. These

findings imply that improving cross-border mobile money service interoperability, linking mobile money service providers in different countries, will lead to reduction in remittance transfer cost with the increase in cross-border mobile transactions. The study also documented evidence that, holding other factors constant, a remitter would incur 89% as fixed cost of sending US$ 1 and the fixed cost will be 8.1% for average remitter to SSA. When the main cost component of remittance transfers is fixed cost, then it is expensive to send small amounts of remittances. The policy implication of this is two-fold. First, a reduction in the fixed-cost component of remittance transfer cost will benefit remitters of small amounts than remitters of large amounts.

Second, to encourage regular remittances or the increase frequency of remittances, policy should target reducing fixed-cost component of remittance transfer cost. Regular remittances ensure maximum benefits accrue to the economy through its poverty-mitigating effects (Gupta, Pattillo and Wagh, 2009; Akobeng, 2016) and reduction of harmful effects of volatility of remittances on economic growth (Imai et al., 2014). Furthermore, remittance flows to SSA are persistent, implying that shocks to it do not dissipate but instead persist. The insignificance of key theoretical drivers of remittances such as income of the remittance-receiving country, income of the migrant host country, remittance transfer costs and migrant stock in our model suggests that these drivers do not matter in the case of remittance flows to SSA.

6.0 Conclusion

This study investigates the effects of the introduction of mobile money services on international remittance transfer price and flows in Sub-Saharan Africa. This objective was implemented as follows. The investigation of the effect of introduction of mobile money services on international remittance transfer costs is attained by use of least squares dummy variable model on quarterly Remittance Price Worldwide data spanning the period 2011Q1 to 2019Q4. To determine the effect of international remittance transfer costs and mobile money services on international remittance flows, a system GMM is used on annual panel data of all source countries of remittances to Sub-Saharan Africa spanning the period 2012 to 2017.

On the Remittance Price Worldwide dataset, remittance amount exhibited little variations between transactions that incorporate mobile money and transactions that do not incorporate mobile money. However, remittance transfer cost is lower by 46% for transactions that incorporate mobile money compared to the cost for transactions that do not incorporate mobile money. The gap between the groups incorporating mobile money and those that do not is 11.5%, when other factors are controlled for. Similarly, foreign exchange rate margin for transactions that incorporate mobile money is lower by 24% relative transactions that do not incorporate mobile money. Mobile money use in international remittances is common among countries that share common borders. The use of mobile money in international remittances for corridors that share a common border is twice that of corridors that do not share a common border.

For every US$ 100 remitted, US$ 7.3 is absorbed by remittance transfer cost. For the average remittance flows to SSA of US$ 91.42,[7] the share of fixed cost is 8.1%. When the main cost component of remittance transfers is fixed cost, then it is expensive to send small amounts of remittances. A reduction in the fixed cost component of remittance transfer cost will benefit remitters of small amounts than remitters of large amounts. To encourage regular remittances or increase frequency of remittances, policy should target at reducing fixed cost component of remittance transfer cost.

Except for a few countries such as Lesotho and Togo, the main source of remittance flows to SSA is outside of SSA. In 2017, intra-SSA remittances exceeded remittances from the rest of the world for 45% of the countries with recorded remittances.

7 Average remittance was computed as the product of the average remittance to GDP for SSA of 7.25% and the average GDP per capita for remittance receiving SSA countries of 1,261 divided by 100.

Furthermore, remittance received (% GDP) varied widely across SSA countries, with the highest receiving about 15% of GDP and the lowest as low as 1% or less of GDP. International remittance transfer costs and mobile money services have no effect on international remittance flows. Other key theoretical drivers of remittances, such as income of the remittance-receiving country, income of the migrant host country, remittance transfer costs and migrant stock do not matter in the case of remittance flows to SSA. The evidence that corridors that incorporate mobile money face lower remittance transfer cost by almost half compared to corridors that do not incorporate mobile money implies that improving cross border mobile money service interoperability, linking mobile money service providers in different countries, will lead to reduction in remittance transfer cost.

References

Adams, Jr, R. H. (2009). "The determinants of international remittances in developing countries". *World Development*, 37(1):, 93-–103.

Agarwal, R. and , & Horowitz, A. W. (2002). "Are international remittances altruism or insurance? Evidence from Guyana using multiple-migrant households". *World Ddevelopment,* 30(11): , 2033-2044.

Ahamada, I., and Coulibaly, D. (2011). "How does financial development influence the impact of remittances on growth volatility?" *Economic Modelling*, 28(6):, 2748-–2760.

Ahmed, J. and , & Martínez-Zarzoso, I. (2016). "Do transfer costs matter for foreign remittances?" *Economics: The Open-Access, Open-Assessment E-Journal,* 10(2016-4): , 1-36.

Akobeng, E. (2016). "Out of inequality and poverty: Evidence for the effectiveness of remittances in Sub-Saharan Africa". *The Quarterly Rreview of Eeconomics and Ffinance,* 60: , 207-223.

Al Mamun, M., Sohag, K., Uddin, G. S., and Shahbaz, M. (2015). "Remittance and domestic labour productivity: Evidence from remittance recipient countries". *Economic Modelling*, 47: , 207-–218.

Anzoategui, D., Demirgüç-Kunt, A. and , & Martínez Pería, M. S. (2011). Remittances and financial inclusion: Eevidence from El Salvador. *The World Bank.*

Aydas, O. T., Metin-Ozcan, K. and , & Neyapti, B. (2005). "Determinants of workers' remittances: Tthe case of Turkey". *Emerging Markets Finance and Trade,* 41(3): , 53-69.

Azizi, S. (2018). "The impacts of workers' remittances on human capital and labour supply in developing countries". *Economic Modelling*, 75: , 377-396.

Batista, C. and , & Narciso, G. (2016). "Migrant remittances and information flows Evidence evidence from a field experiment". *The World Bank Economic Review,* 32(1*)*: *,* 203-219.

Batista, C. and , & Narciso, G. (2018). "Migrant remittances and information flows: evidence from a field experiment". *The World Bank Economic Review*, *32*(1): , 203-219.

Batista, C. and , & Umblijs, J. (2016). "Do migrants send remittances as a way of self-insurance?" *Oxford Economic Papers,* 68(1): , 108-130.

Bettin, G. and , & Zazzaro, A. (2018). "The impact of natural disasters on remittances to low-and middle-income countries". *The Journal of Development Studies*, 54(3): , 481-500.

Bettin, G., Presbitero, A. F., and & Spatafora, N. L. (2017). "Remittances and vulnerability in developing countries". *The World Bank Economic Review*, 31(1): , 1-23.

Blundell, R, and Bond, S, 1998. "GMM Estimation with Persistent Panel Data: An Application to Production Functions", *Econometric Reviews*, 19(3), 32 1-340 (2000).

Carling, J. (2008). "The determinants of migrant remittances". *Oxford Review of Economic Policy, 24(3): , 581-–598.*

Clarke, K. and , & Drinkwater, S. (2001). An investigation of household remittance behaviour. Manchester School of Economic Studies Discussion Paper, Manchester, England.

Darmon, E., Chaix, L. , and Torre, D. (2016). "M-payment use and remittances in developing countries: A theoretical analysis". Revue d'économie Industrielle, 156, 159–183. https://doi.org/10.4000/rei.6469.

Demirguc-Kunt, A., Klapper, L., Singer, D. and , & Van Oudheusden, P. (2015). The global findex database 2014: Measuring financial inclusion around the world. Washington DC: The World Bank.

Elbadawi, I. A. and , & Rocha, R. R. (1992). Determinants of expatriate workers' remittances in North Africa and Europe (No. 1038). Country Economics Department, World Bank.

El-Sakka, M. I., and McNabb, R. (1999). "The macroeconomic determinants of emigrant remittances". World Development, 27(8): , 1493-–1502.

Freund, C. , and Spatafora, N. (2008). "Remittances, transaction costs, and informality". Journal of Development Economics, 86(2): , 356-–366.

Gibson, J., McKenzie, D. and , & Rohorua, H. T. A. S. (2006). How cost elastic are remittances? Estimates from Tongan migrants in New Zealand. NewZealand.

GSMA. (2019). Global Mobile mobile Money money Datasetdataset. https://www.gsma.com/mobilemoneymetrics/#global?y=2017?v=overview?g=global.

Gupta, M. P. (2005). Macroeconomic determinants of remittances: Eevidence from India (No. 5-224). International Monetary Fund.

Gupta, S., Pattillo, C. A. and , & Wagh, S. (2009). "Effect of remittances on poverty and financial development in Sub-Saharan Africa". World Development, 37(1):, 104-115.. Hadi, 1999

Hadi, A. (1999). "Overseas Migration and the Well-being of those Left Behind in Rural Communities of Bangladesh." Asia-Pacific Population Journal, 14(1), 43-58.

Hagen-Zanker, J. and Siegel, M. (2007). The Determinants determinants of Remittancesremittances: A Review review of the Literatureliterature. MGSoG Working Paper No. 003. Available at SSRN: https://ssrn.com/abstract=1095719 or http://dx.doi.org/10.2139/ssrn.1095719

Imai, K. S., Gaiha, R., Ali, A. and , & Kaicker, N. (2014). "Remittances, growth and poverty: New evidence from Asian countries". Journal of Policy Modeling, 36(3): , 524-538.

Jack, W. and , & Suri, T. (2014). "Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution". American Economic Review, 104(1):, 183-223.

Kakhkharov, J., Akimov, A., and Rohde, N. (2017). "Transaction costs and recorded remittances in the post-Soviet economies: Evidence from a new dataset on bilateral flows". Economic Modelling, 60, 98-–107.

Kannan, K. P. and , & Hari, K. S. (2002). *Kerala's gulf connection: Eemigration, remittances and their macroeconomic impact*, 1972-2000.

Lucas, R. E. B., and Stark, O. (1985). "Motivations to Remitremit: Evidence from Botswana". *Journal of Political Economy*, *93*(5): , 901-–918. JSTOR. https://www.jstor.org/stable/1833062.

Lueth, E. and , & Ruiz-Arranz, M. (2008). "Determinants of bilateral remittance flows". *The BE Journal of Macroeconomics, 8(1)*.

Merritt, C. (2011). Mobile money transfer services: the next phase in the evolution of person-to-person payments. *Journal of Payments Strategy & Systems*, *5*(2), 143-160.Morawczynski & Pickens (2009)

Merritt, C. 2011. "Mobile money transfer services: The next phase in the evolution of person-to-person payments". *Journal of Payments Strategy and Systems*, 5(2): 143-160.

Morawczynski O., Pickens M.. 2009. "Poor People Using Mobile Financial Services: Observations on Customer Usage and Impact from M-PESA." *CGAP Brief*, Washington DC: World Bank.

Munyegera, G. K. and , & Matsumoto, T. (2016). "Mobile money, remittances, and household welfare: Ppanel evidence from rural Uganda". *World Development*, 79: , 127-137.

Singh, R. J., Haacker, M., Lee, K., and Le Goff, M. (2011). "Determinants and macroeconomic impact of remittances in Sub-Saharan Africa". *Journal of African Economies*, *20*(2): , 312-–340.

Stark, O. (1991). "The migration of labour." *Oxford: Basil Blackwell*.

Stark, O., & Lucas, R. E. (1988). *Migration, remittances, and the family. Economic Development and Cultural Change*, 36(3), 465–481. doi:10.1086/451670

Torero, M., and Viceisza, A. (2015). "To remit, or not to remit: That is the question. A remittance field experiment". *Journal of Economic Behaviour & and Organization*, 112, 221–236. https://doi.org/10.1016/j.jebo.2015.01.012.

World Bank. (2017). Remittance Prices Worldwide. Issue 21, March 2017. Available at https://remittanceprices.worldbank.org/en/resources.

World Bank. (2017). Remittance Prices Worldwide. Issue 24, December 2017. Available at https://remittanceprices.worldbank.org/en/resources.

World Bank. (2020). Remittance Prices Worldwide. Issue 36, December 2020. Available at https://remittanceprices.worldbank.org/en/resources

Yang, D. (2003). Remittances and Human human Capital capital Investmentinvestment: Child Schooling schooling and Child child Labour labour in the Origin origin Households households of Overseas overseas Filipino Workersworkers. Unpublished manuscript Gerald R. Ford School of Public Policy and Department of Economics. Ann Arbor: University of Michigan.

Annex

Table A1: Sample of corridors included in the analysis

Corridor	Remittance-sending Country	Remittance-receiving Country	Year						Total
			2012	2013	2014	2015	2016	2017	
AGONAM	Angola	Namibia						1	**1**
ARESDN	United Arab Emirates	Sudan						1	**1**
AUSSOM	Australia	Somalia					1	1	**2**
AUSZWE	Australia	Zimbabwe					1	1	**2**
CANGHA	Canada	Ghana	1	1	1	1	1	1	**6**
CANKEN	Canada	Kenya	1	1	1	1	1	1	**6**
CANNGA	Canada	Nigeria					1	1	**2**
CANRWA	Canada	Rwanda	1	1	1	1	1	1	**6**
CANZWE	Canada	Zimbabwe					1	1	**2**
CIVMLI	Cote d'Ivoire	Mali						1	**1**
CMRNGA	Cameroon	Nigeria						1	**1**
GBRETH	United Kingdom	Ethiopia	1	1	1	1	1	1	**6**
GBRGHA	United Kingdom	Ghana	1	1	1	1	1	1	**6**
GBRGMB	United Kingdom	Gambia, The	1	1	1	1	1	1	**6**
GBRKEN	United Kingdom	Kenya	1	1	1	1	1	1	**6**
GBRNGA	United Kingdom	Nigeria	1	1	1	1	1	1	**6**
GBRRWA	United Kingdom	Rwanda	1				1	1	**3**
GBRSLE	United Kingdom	Sierra Leone	1	1	1	1	1	1	**6**
GBRSOM	United Kingdom	Somalia					1	1	**2**
GBRTZA	United Kingdom	Tanzania	1	1	1	1	1	1	**6**
GBRUGA	United Kingdom	Uganda	1	1	1	1	1	1	**6**
GBRZAF	United Kingdom	South Africa	1	1	1	1	1	1	**6**
GBRZMB	United Kingdom	Zambia	1	1	1	1	1	1	**6**
GBRZWE	United Kingdom	Zimbabwe					1	1	**2**
GHANGA	Ghana	Nigeria	1	1	1	1	1	1	**6**
KENRWA	Kenya	Rwanda	1	1	1	1	1	1	**6**
KENTZA	Kenya	Tanzania					1	1	**2**
KENUGA	Kenya	Uganda	1	1	1	1	1	1	**6**
NGABEN	Nigeria	Benin						1	**1**
NGAMLI	Nigeria	Mali						1	**1**
NGATGO	Nigeria	Togo						1	**1**
QATSDN	Qatar	Sudan					1	1	**2**
RWAKEN	Rwanda	Kenya						1	**1**

Corridor	Remittance-sending Country	Remittance-receiving Country	Year						
			2012	2013	2014	2015	2016	2017	Total
SAUETH	Saudi Arabia	Ethiopia					1	1	**2**
SAUSDN	Saudi Arabia	Sudan					1	1	**2**
SENMLI	Senegal	Mali	1	1	1	1	1	1	**6**
SWESOM	Sweden	Somalia					1	1	**2**
TZAKEN	Tanzania	Kenya	1	1	1	1	1	1	**6**
TZARWA	Tanzania	Rwanda	1	1	1	1	1	1	**6**
TZAUGA	Tanzania	Uganda	1	1	1	1	1	1	**6**
USACPV	United States	Cabo Verde			1	1	1	1	**4**
USAETH	United States	Ethiopia	1	1	1	1	1	1	**6**
USAGHA	United States	Ghana	1	1	1	1	1	1	**6**
USAKEN	United States	Kenya	1	1	1	1	1	1	**6**
USALBR	United States	Liberia		1	1	1	1	1	**5**
USANGA	United States	Nigeria	1	1	1	1	1	1	**6**
USASOM	United States	Somalia					1	1	**2**
USAZAF	United States	South Africa					1	1	**2**
ZAFAGO	South Africa	Angola	1	1	1	1	1	1	**6**
ZAFBWA	South Africa	Botswana	1	1	1	1	1	1	**6**
ZAFKEN	South Africa	Kenya					1	1	**2**
ZAFLSO	South Africa	Lesotho	1	1	1	1	1	1	**6**
ZAFMOZ	South Africa	Mozambique	1	1	1	1	1	1	**6**
ZAFMWI	South Africa	Malawi	1	1	1	1	1	1	**6**
ZAFNGA	South Africa	Nigeria						1	**1**
ZAFSWZ	South Africa	Swaziland	1	1	1	1	1	1	**6**
ZAFTZA	South Africa	Tanzania					1	1	**2**
ZAFZMB	South Africa	Zambia	1	1	1	1	1	1	**6**
ZAFZWE	South Africa	Zimbabwe					1	1	**2**
Total			**32**	**32**	**33**	**33**	**50**	**59**	**239**

Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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