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The Implications of Innovations in the Financial Sector on the Conduct of Monetary Policy in East Africa

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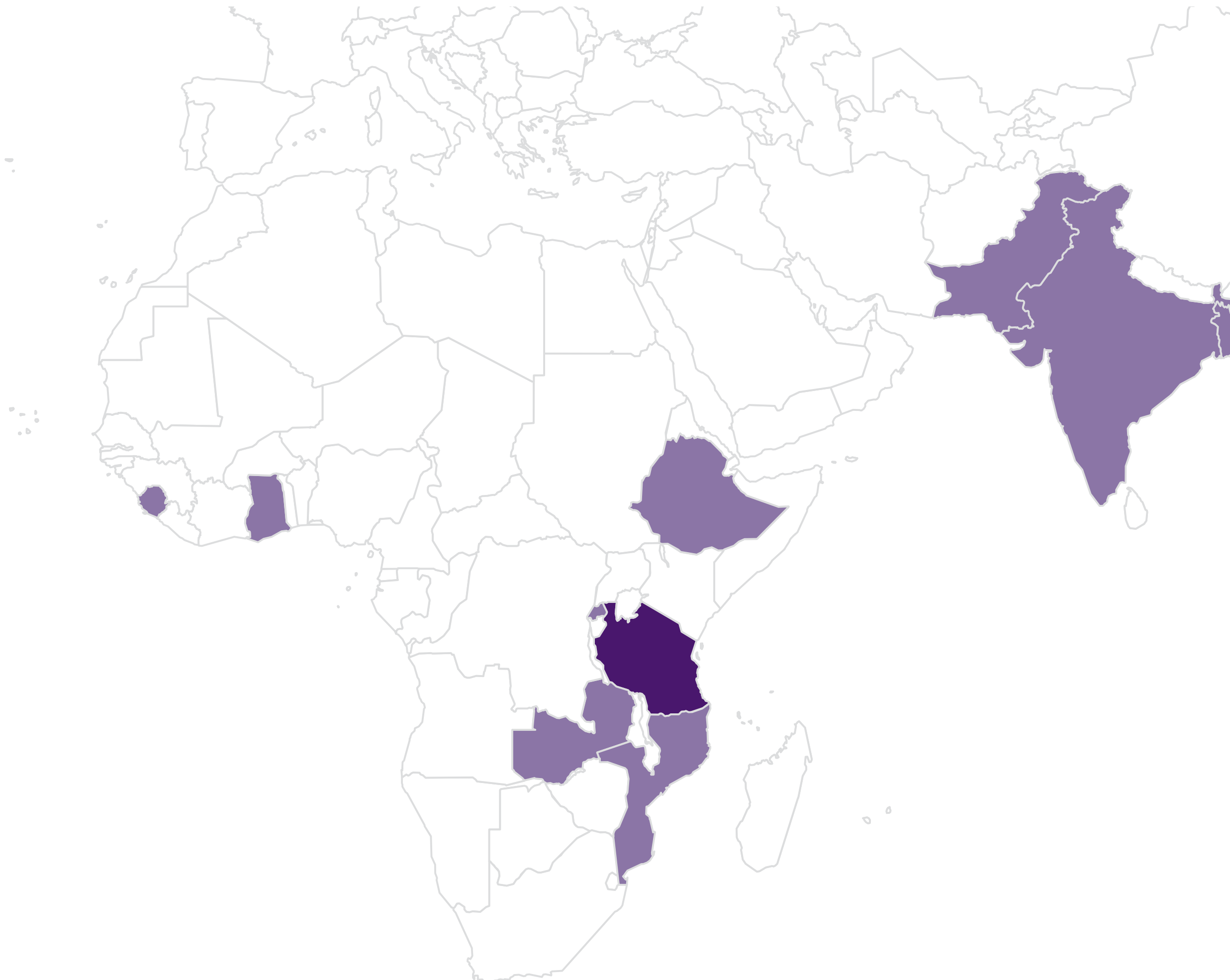

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The Implications of Innovations in the Financial Sector on the Conduct of Monetary Policy in East Africa.

Report submitted to the International Growth Centre Tanzania Country Programme

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Executive Summary

The rapid adoption of electronic payment systems such as M-Pesa in Kenya has dramatically reshaped the operations and practices of individuals, firms and financial institutions such as banks. Nationally representative data from Kenya, Tanzania and Uganda shows that the use of new financial products grew rapidly over a three year period from 2006 to 2009. For instance the adoption of ATM/debit cards in Kenya and Tanzania doubled over this period. Despite this impressive growth in adoption these products have been overshadowed by the phenomenal growth in the adoption of mobile money products such as M-Pesa. In 2009, just two years after the introduction of M-Pesa into the marketplace, close to 40% of the Kenya population had sent or received a transfer through the system. Current estimates suggest that 70 percent of households and 60 percent of adults regularly use the system (Jack and Suri, 2011). Data from the Central Bank of Kenya (CBK) also reveal the ubiquity of mobile money. In 2011, close to 18 million Kenyans were registered mobile money users, whereas 1.4 million had an ATM card and a 7 million had a debit card (CBK, 2011). Moreover, the data show that close to 1 trillion shillings was transferred through mobile money in 2011, which far exceeded the value of transactions via ATM cards. As such, most of the report will focus on the monetary policy implications of mobile money systems as they represent the largest electronic payment medium in East Africa. Since these products are also relatively new and their macroeconomic effects are not yet well understood, thus we further aim to highlight their effects on the aggregate economy.

While Kenya, is far ahead of its neighbours in terms of mobile money adoption, there is evidence of some convergence in adoption rates across the three East African Nations. Recent survey data shows that 52 percent of Kenyan adults made a mobile money transaction in a 30 day reference period, Tanzania and Uganda seems to be closing the gap with 24 percent and 15 percent of adults conducting a mobile money transaction (Kendall and Maurer, 2012). Kendall and Maurer also show that adoption rates in other

African countries was significantly lower than in East Africa, suggesting that the ubiquity of mobile money systems in East Africa could generate macroeconomic effects which would not be observed in other parts of the continent.

The widespread use of these systems has also spawned the development of numerous applications that use mobile money as a payment platform. For instance many commercial banks now offer customers the ability to transfer funds between their bank accounts and their M-Pesa accounts. These innovations are likely to further fuel the growth and expansion of mobile money transactions by (perhaps) lower transactions costs (Kendall, Machoka, Veniard and Maurer, 2011).

We use a variety of data sources and analytical methods to examine the monetary policy implications of mobile money systems. Using aggregated data, we find evidence of a structural break post-2007 (the year M-Pesa was launched) in monetary aggregates perhaps suggesting some changes in the macroeconomic environment were driven by mobile money systems. However, as this analysis relies on pre- and post comparisons, we note that this provides merely suggestive evidence of a causal effect of M-Pesa on macroeconomic aggregates as there could be other contemporaneous factors at play. We complement this analysis by using aggregate data from Safaricom, the largest mobile money provider in East Africa, to compute the "M-Pesa Velocity" – a measure analogous to the standard transactions velocity of money. The M-Pesa velocity sheds light on the degree to which the system is used for savings or is merely a person to person transfer vehicle. We find that it is a hybrid of these functions. In addition, we find that the velocity of M-pesa rises over time, which indicates that users are more inclined to use the system as a transaction vehicle. The average balance of e-money held by customers has also been relatively stable, whereas the value of transfers per customers has been slowly rising and is the main source of the rise in M-Pesa velocity that we observe. Overall, we find that M-Pesa velocity is not higher than the velocity of cash or other monetary components. Furthermore, since mobile money is small relative to other monetary aggregates we conclude that the monetary implications of mobile money are currently minimal in Kenya –the largest market in East Africa. Hence, we believe that they would equally minimal in Tanzania and Uganda, which have much smaller mobile money markets. However, as the system is continually evolving from a mere payment vehicle into more advanced payment platform or "ecosystem". The developments and innovations in this space could fuel the growth of mobile money such that it reaches levels where it could have implications for monetary policy.

We conclude our report by discussing the regulation of e-money services and their implications for the path of EAC countries toward monetary union. An important step along this path is the harmonization of regulation. It is notable that at present the regulator approaches toward e-money differ significantly between Kenya, on the one hand, and Uganda and Tanzania, on the other. Harmonization will require one or more countries to significantly change how they regulate e-money. Further, the current clashing approaches will be increasingly non-viable as the countries move toward integrating their economies, even in the absence of monetary union.

Introduction

The rapid pace of technical change in the financial sector has led to the development of new products and forms of payment. In Kenya, mobile phone payment platforms such as M–Pesa dramatically changed the financial landscape by offering customers a simple efficient and cost-effective method to transfer money and make payments. In addition, government regulations such as the Kenyan National Payment System have also spurred investments in technologies that facilitate the instantaneous flows of finances between institutions. Specifically the production of the real Time Gross settlement system and the production of the electronic check clearing system have improved the efficiency of the banking system.

While there is evidence that these changes have increased consumer welfare (Aker and Mbiti (2010), Jack and Suri (2011), Mbiti and Weil (2011)) there is limited evidence on the impacts of these technological developments on monetary aggregates and relations. This report reviews the literature on economic impact of ICT developments in the financial sector on the conduct of monetary policy in East Africa. It further examines the development and adoption of various products in East Africa and examines factors that drive the demand for these products. Using a combination of data the report discusses the implications of the rapid adoption of these products on the conduct of monetary policy in East Africa.

Mobile phone based financial services have been at the forefront of this revolution. From virtually uncovered in the 1990's, more than 85% of the East Africans are now covered by the mobile phone network (World Bank, 2012). The proliferation of mobile phones enabled the development and adoption of mobile money services in the region with Safaricom's pioneering service M-Pesa being the largest and most prominent service. Safaricom introduced M-Pesa in Kenya in March 2007 and its adoption far exceeded expectations. In its first eight months of operating over 1.1 million Kenyans had registered to use M-Pesa, and over US$87 million had been transferred over the system (Safaricom, 2007). By September 2009, over 8.5 million Kenyans had registered to use the service and US$3.7 billion (equivalent to 10 percent of Kenya's GDP) had been transferred over the system since inception (Safaricom, 2009). This explosive growth was also mirrored in the growth of M-Pesa agents (or service locations), which grew to over 28,000 locations by April 2011, from a base of approximately 450 in mid-2007 (Safaricom, 2009 and Vaughan, 2007). By contrast, Kenya had only 491 bank branches, 500 postbank branches, and 352 ATMs during this period (Mas and Ng'weno, 2009).

The Adoption of ICT in the Financial Sector

We analyze the Finaccess Data from Kenya and the Finscope data from Tanzania and Uganda in order to document the trends in the adoption of mobile technology and banking services in the table below. Across all three countries the adoption of mobile phones is quite impressive. In 2006, 27.2 percent of the Kenyan population owned a mobile phone and in 2009 that proportion increased to 46.7 percent. This growth was mirrored in Tanzania and Uganda. In 2006, 13.5 percent of the Tanzanian population owned a mobile phone growing to 38.4 percent in 2009, while the proportion in Uganda grew from 25.7 percent in 2006 to 41.0 percent in 2009. Due to sharing norms the proportion of the population with access to phones is much larger across the three countries. The proportion of individuals with access to a mobile phone also grew over this period.

The proportion of the population that had a bank account also increased between 2006 and 2009 across all three countries. The percentage of Kenyans who had a bank account grew from 16.5 percent in 2006 to 24.4 percent in 2009. The growth was much lower in Tanzania the proportion of individuals with a bank account grew from 7.4 percent in 2006 to 8.4 percent in 2009. In contrast Uganda experienced moderate growth in the proportion banked which increased from 18.0 percent in 2006 to 22.0 percent in 2009.

The adoption of an ATM/Debit card increased between 2006 and 2009 in Kenya and Tanzania (5.8 percent to 12.9 percent in Kenya; 2.7 percent to 8.4 percent in Tanzania); however in Uganda on the other hand, the proportion of the population with and ATM/Debit card marginally declined from 10.1 percent in 2006 to 7.9 percent in 2009. The proportion of those who had a credit card was virtually zero across all three countries in both years of the survey. The growth in the proportion of the population with ATM/Debit cards is also reflected in the growth in the number of ATM cards issued, the number and value of transactions conducted and the number of ATM machines. Data from the Central Bank of Kenya show that the number of ATMs grew from 1,078 in 2007 to 2,183 in 2011, while the number and value of transactions also doubled over this period. Surprisingly this data reveals that despite the increases in ATM usage, the average size of transactions remained relatively stable over this period at approximately 5400Kshs.

The data show that the growth of mobile money services has been especially strong in Kenya relative to Tanzania and Uganda. In part this reflects the fact that the data were collected in 2009 when mobile money services were in their infancy in Tanzania and Uganda. The data show that 38.3 percent of Kenyans used these systems to send or receive money via a mobile phone in 2009. This value was much larger than in Tanzania and Uganda (0.8 percent and 3.5 percent respectively).

Table 1: Summary Statistics on the Adoption of Mobile Phone and Banking Services (*portion of population*)

	Kenya		Tanzania		Uganda	
	2006 Mean	**2009 Mean**	**2006 Mean**	**2009 Mean**	**2006 Mean**	**2009 Mean**
Has Mobile Phone	0.272	0.467	0.135	0.384	0.257	0.410
Has Landline	0.028	0.021	--	0.007	0.006	0.017
Has Access to Mobile Phone	0.537	0.801	0.305	0.711	0.428	0.656
Has Access to Computer	--	0.079	0.119	0.095	0.069	0.059
Hass Access to Internet	--	0.071	0.093	0.084	0.046	0.042
Sends or Recieves Money via Mobile Money	-	0.383	-	0.008	-	0.035
Has Bank Account	0.165	0.244	0.074	0.084	0.180	0.220
Has ATM/Debit Card	0.058	0.129	0.027	0.061	0.101	0.079
Has Credit Card	0.007	0.008	--	0.001	0.003	0.001
Formal Savings	0.151	0.144	0.075	0.070	0.240	0.220
Informal Savings	0.549	0.739	0.565	0.661	0.490	0.500
Formal Loans	0.075	0.079	0.034	0.034	0.051	0.059
Informal Loans	0.152	0.149	0.103	0.063	0.042	0.030
Age 25 to 39	0.393	0.375	0.405	0.446	0.440	0.439
Age 40 to 54	0.213	0.224	0.182	0.216	0.177	0.162
Age over 55	0.145	0.183	0.133	0.119	0.160	0.118
Male	0.440	0.413	0.479	0.461	0.479	0.451
Married	0.610	0.602	0.612	--	0.550	0.555
Completed Primary School	0.314	0.315	0.541	0.572	0.631	0.636
Completed Secondary School	0.161	0.165	0.111	0.067	0.269	0.263
Completed College	0.089	0.085	0.007	0.007	0.015	0.021
Urban	0.319	0.285	0.281	0.278	0.290	0.273
Number of Observations	*4,214*	*6,598*	*4,962*	*7,680*	*2,959*	*3,001*

Sources: For Kenya the data is from the FinAccess 2006 and 2009 Surveys. The data for Uganda and Tanzania come from the FinScope 2006 and 2009 Surveys.
Notes: "-" indicates that the service was not available in 2006, therefore there were no adopters; "--" indicates that the measure was not obtained in the current survey.

Explaining the trends in Mobile Money Adoption

The trends in adoption of mobile money can clearly be seen in figures below. In Kenya, the use of mobile money displaced the sending and receiving of money through all of other means, i.e. informal methods, the post office, the bank and other money transfer companies such as Western Union for example. In Tanzania, the use of mobile money, banking services and money transfer companies increased between 2006 and 2009. These means of sending and receiving money in 2009 shifted money transfers away from informal methods and the post office given the reported levels in 2006. The trends in Uganda were very similar. With the introduction of mobile money, as well as with an increase in the use of bank transfer services, the demand for sending and receiving money via informal methods and the post office was dampened. The use of other money transfer companies remained relatively flat between 2006 and 2009.

Figure 1: Sending Methods, Kenya

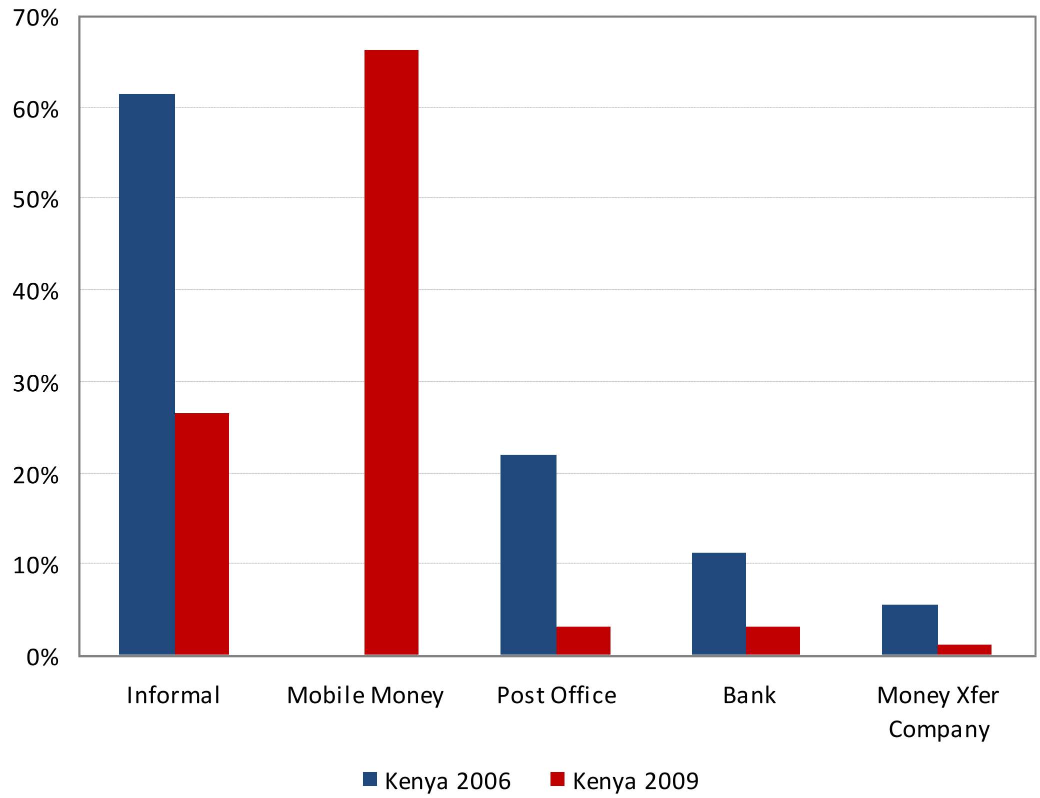
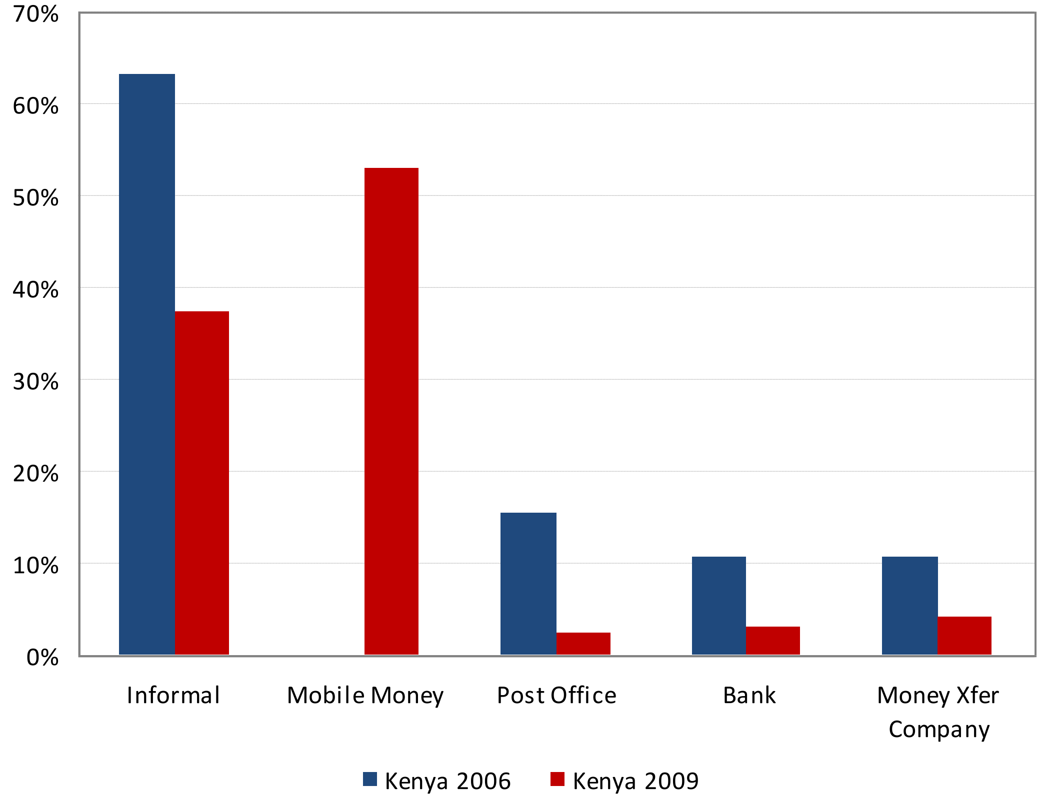


Figure 2: Receiving Methods, Kenya



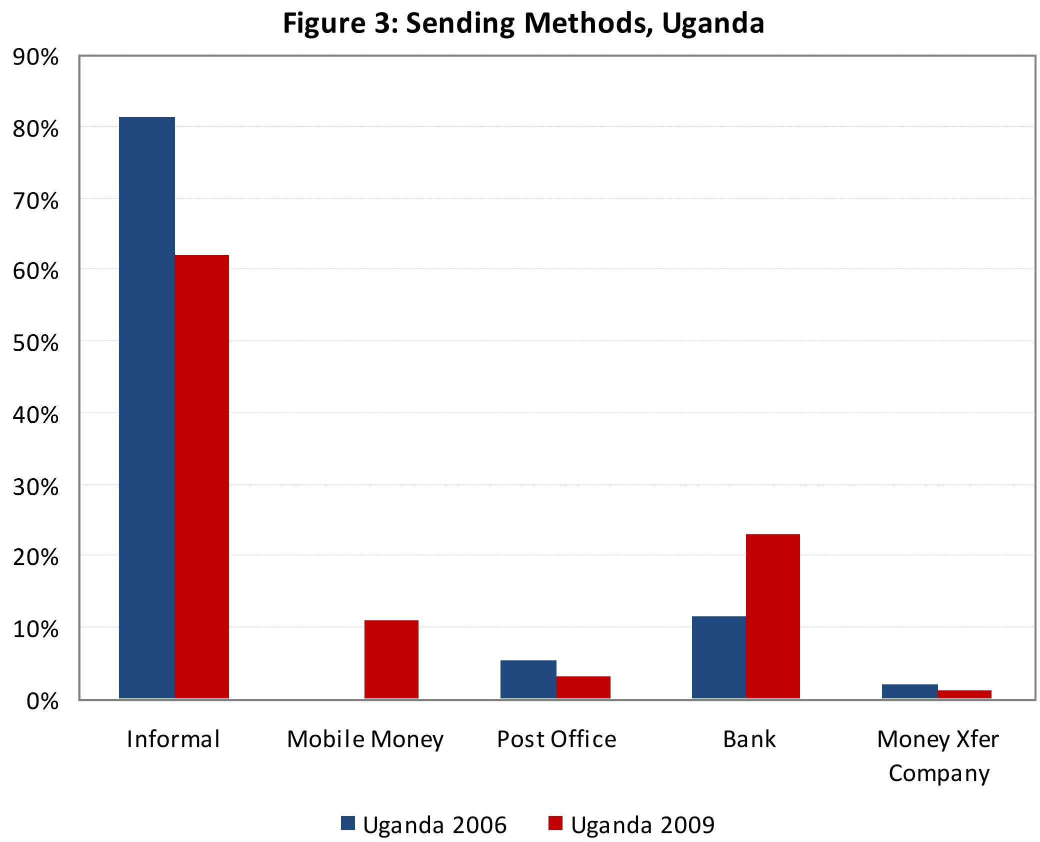


Figure 3: Sending Methods, Uganda
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Informal
Mobile Money
Post Office
Bank
Money Xfer Company
Uganda 2006
Uganda 2009

Figure 4: Receiving Methods, Uganda

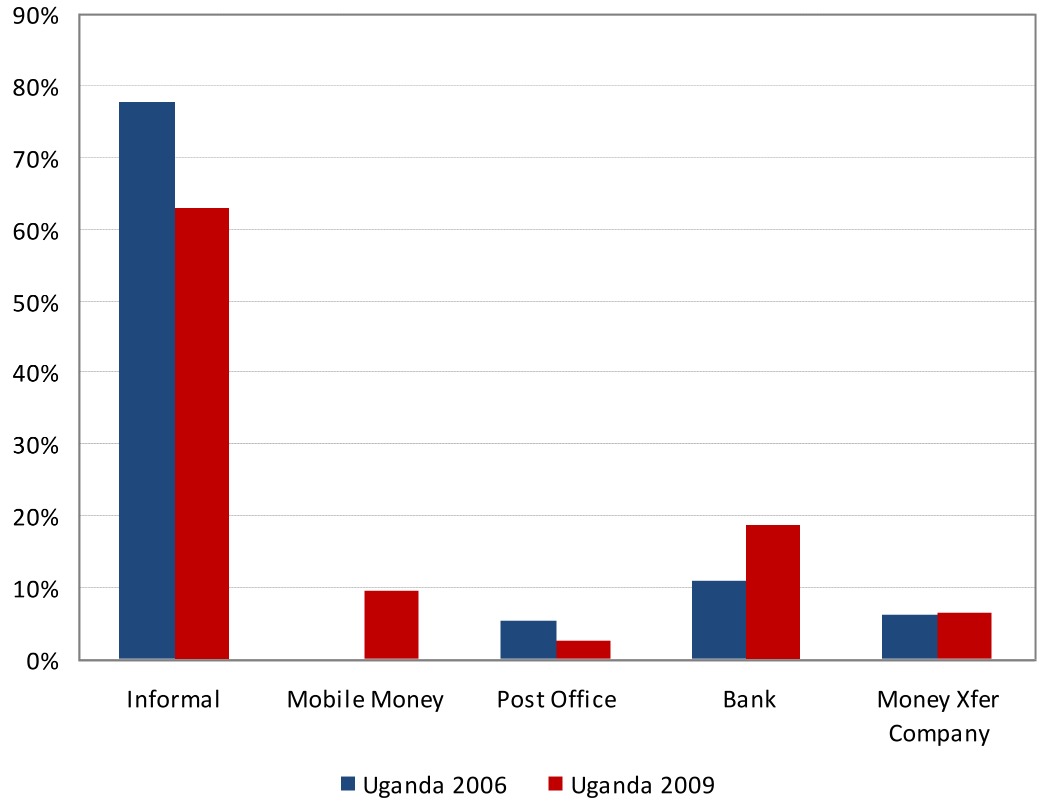


Figure 5: Sending/Receiving Methods, Tanzania

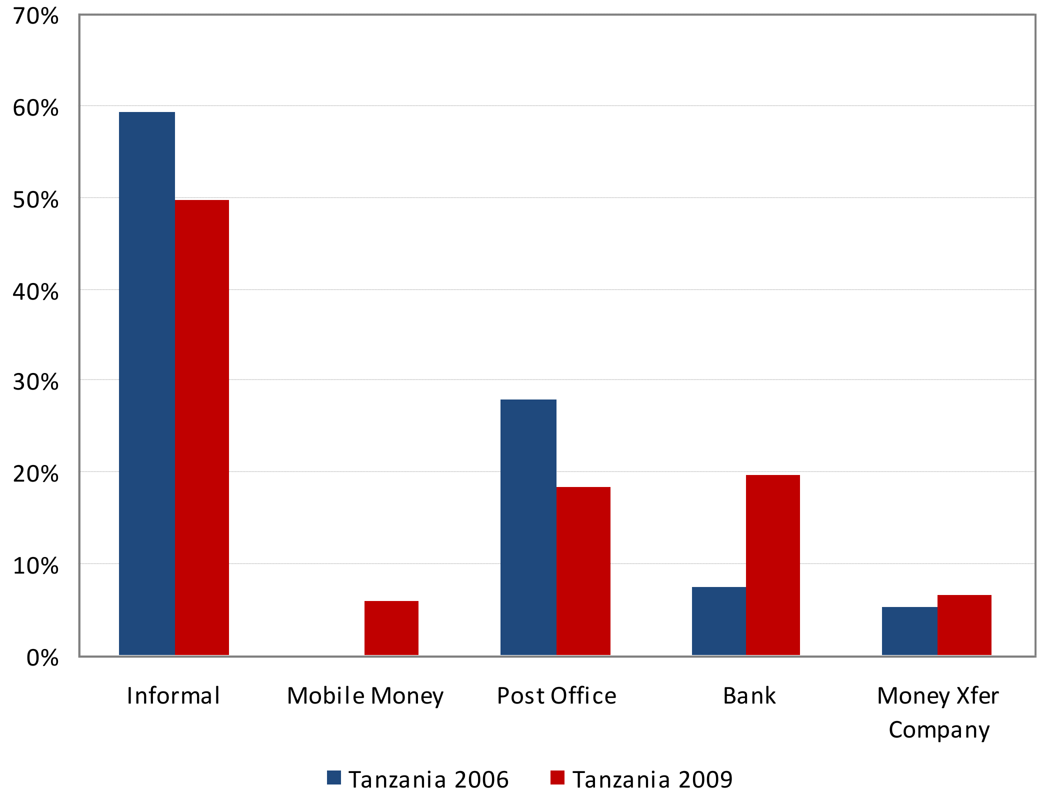
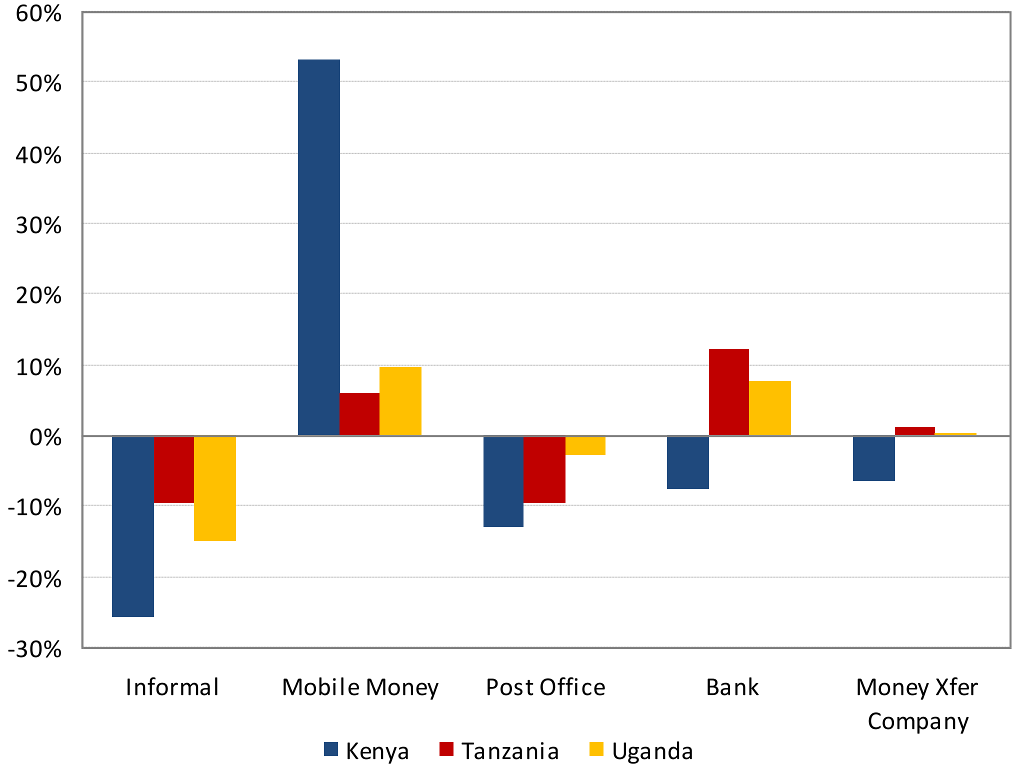
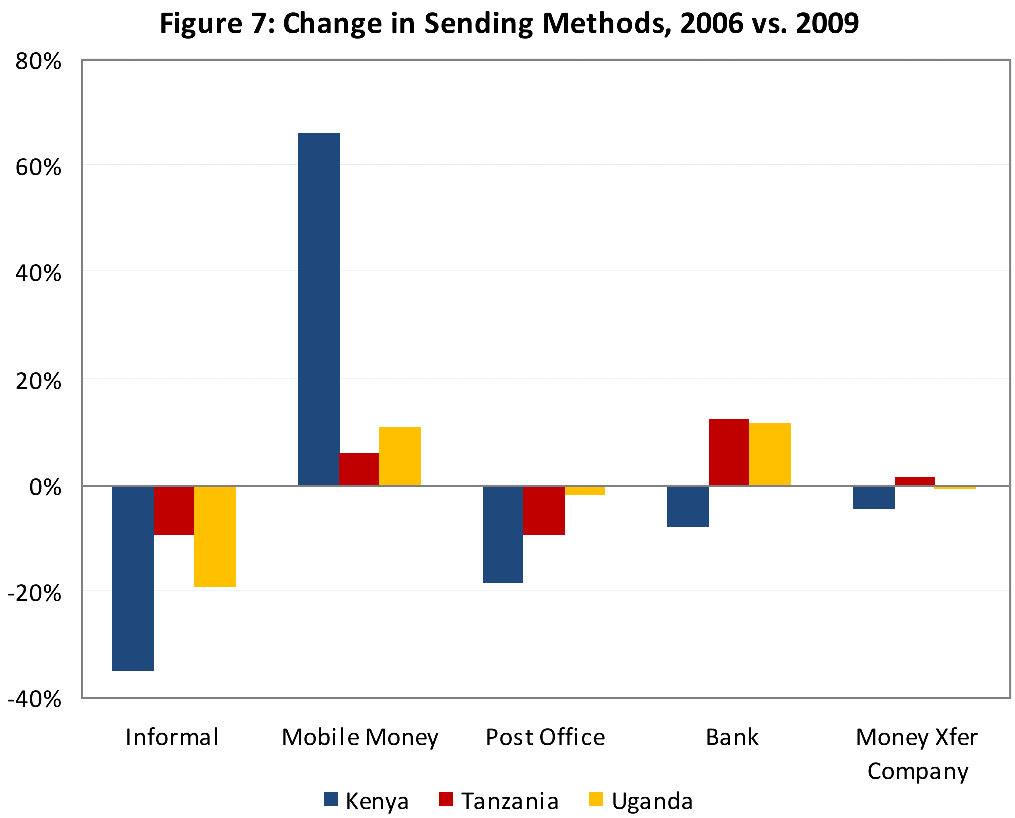


Figure 6: Change in Receiving Methods, 2006 vs. 2009





By regressing whether an individual uses mobile money on individual characteristics (results below), we can see that adopters of mobile money are more likely to be younger, wealthier, better educated and to reside in urban areas. This trend holds across all three countries. For example, in Kenya a person residing in an urban area is 17.4 percent more likely to use mobile money than is someone living in a rural part of the country. As well, a poor individual is 11.7 percent less likely to use mobile money relative to a non-poor person. In Tanzania, an urban individual is 1.7 percent more likely to use mobile money and a poor person is 0.34 percent less likely to use mobile money, when compared to a rural and a wealthy person, respectively. In Uganda, an individual residing in an urban area is 2.6 percent more likely to adopt mobile money relative to their rural counterpart, and a poor person is 2.2 percent less likely to adopt mobile banking technology.

When looking at the frequency of mobile money transactions in Kenya, we can see that the same general story holds true. In Table 2, we can see that an urban individual engages in roughly 6 more transactions a year relative to a non-urban individual, and a poor person transacts roughly 5 fewer times annually when compared to a non-poor person. Further, someone who has completed secondary education transacts approximately 9 more times a year compared to someone who hasn't completed primary school, and an individual who completes a college degree engages in roughly 21 more transactions per annum relative to those who have never finished primary school. Due to a lack of observations, we were unable to conduct the same regressions for Tanzania and Uganda.

Table 2

Determinants of Using Mobile Money

	Kenya	Tanzania	Uganda
Male	0.016	0.00303	-0.0086
	(0.0278)	(0.00317)	(0.00687)
Married	0.0569*	-	-0.00564
	(0.0291)	-	(0.00607)
Complete Primary School	0.162***	-0.00191	0.0237**
	(0.0228)	(0.00385)	(0.01)
Completed Secondary School	0.446***	0.0248*	0.0780***
	(0.0363)	(0.0116)	(0.0215)
Completed University	0.429***	0.0114	0.100*
	(0.114)	(0.0288)	(0.0512)
Age 16 to 24	0.0517	0.00126	0.0297***
	(0.0386)	(0.00211)	(0.00998)
Age 25 to 39	0.0630**	0.00937***	0.00655
	(0.0257)	(0.00188)	(0.00861)
Age 40 to 54	0.052	0.00445	0.0124
	(0.0339)	(0.00292)	(0.0101)
Poor	-0.117***	-0.00337*	-0.0218***
	(0.0249)	(0.00177)	(0.00691)
Urban	0.174***	0.0166***	0.0261*
	(0.0416)	(0.00255)	(0.0135)
Constant	0.126***	-0.00338	0.0147
	(0.0457)	(0.00206)	(0.0108)
Observations	3,385	7,680	2,522
R-squared	0.246	0.022	0.042

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1; Marriage was not recorded in the Tanzania survey.

Table 3

Determinants of the Frequency of Mobile Money Transactions in Kenya

	Kenya*
Male	4.921
	(3.64)
Married	3.358
	(4.398)
Complete Primary School	0.682
	(1.437)
Completed Secondary School	9.520**
	(4.326)
Completed University	21.34***
	(2.963)
Age 16 to 24	1.963
	(2.707)
Age 25 to 39	2.229
	(1.864)
Age 40 to 54	1.62
	(3.563)
Poor	-5.273***
	(1.767)
Urban	6.381**
	(2.591)
Constant	5.08
	(4.548)
Observations	1,306
R-squared	0.034

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

* There was insufficient data to analyze Tanzania and Uganda

M-Pesa Velocity

For the purposes of understanding where M-Pesa fits into a broader monetary framework, we are interested in calculating the "velocity" of M-Pesa. In standard monetary economics, there are two different definitions of velocity that are used. “Income velocity” is the nominal GDP divided by the relevant money stock. Below, for example, we examine the properties of M3 income velocity. “Transactions velocity" is defined as the frequency with which the average unit of money is used in transactions. Although in some ways more fundamental than income velocity, transactions velocity is much harder to measure, because doing so requires being able to observe actual transactions.

In the case of M-Pesa, the potentially relevant transactions are deposit of money (creation of a unit of M-Pesa), transfer, and withdrawal of money (extinguishing of a unit of M-Pesa). Further, among transfers that take place, some will be in the nature of payments (for example, a user transfers e-cash from her account to that of a merchant in return for goods and services), while others will be in the form of a gift (for example, a one family member sending money to another). Anecdotally, we believe that the majority of transfers observed are of the latter type, although this may change as the system matures.

As our measure of M-Pesa velocity, we focus only on transfers. Our measure of M-Pesa velocity is thus the total value of person-to-person transfers per unit time divided by the average outstanding balance of e-float (by "person-to-person transfers" we mean any transfer in which neither party is an M-Pesa agent. One party could be an institution or firm.) We call this "transfer velocity." For example, if 100 units of e-float are created at the beginning of month, transferred from person to person five times in the month, and extinguished at the end the month, then monthly transfer velocity will be five. Notice that having 100 units of e-float transferred from person to person five times in the month could happen either because the people receiving transfers then transferred the e-float to someone else or because each time a transfer was received, the recipient withdrew his cash and a new user deposited cash and received e-float.

Of the two numbers required to measure velocity, the harder one to obtain is the outstanding balance of e-float. All money deposited to create e-float is held by a trust fund which holds deposits in commercial banks. Thus, the outstanding balance of e-float is in principle perfectly observable at any point in time, although the information is not normally made public. Mbiti and Weil (2011) attempted to estimate this quantity at a point in time based on information in the Ministry of Finance's 2009 audit of M-Pesa.[1] For the purposes of this report, we were able to obtain monthly data on the size of the trust balance monthly from July, 2007 through December, 2011.

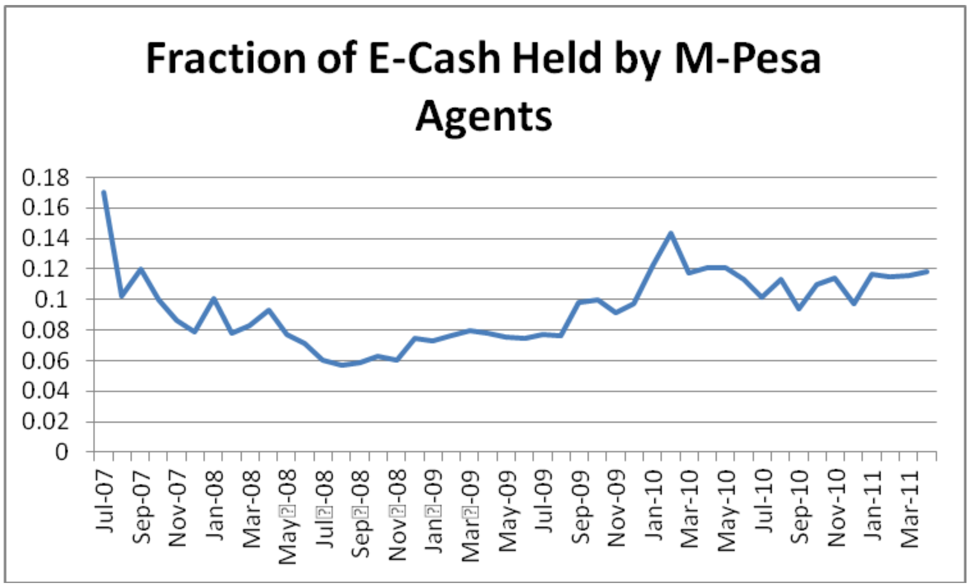
While the trust balance is by construction identical to the quantity of e-float outstanding, in the calculation of transfer velocity it is not clear how to treat e-cash that is held by M-Pesa agents. Conceptually, one might want to think of the relevant aggregate for calculating transfer velocity to be e-cash held on the phones of customers only. We can construct an estimate of this quantity by subtracting estimated e-cash held on the phones of M-Pesa agents from the trust balance. Kendall, and Mas (2010) report end of day e-float for different types of M-Pesa outlets. These range from 90,000 Ksh. for rural stores to 40,000 Ksh. for city stores. Rural stores have particularly high end of day float because they do a primarily cash-out business. City stores did a more balanced business, though with an excess of cash-in over cash-out. These end-of-day figures do not correspond to beginning-of-day figures, of course. In our calculations we chose a value of 50,000 Ksh. per M-Pesa agent. Multiplying this by the number of M-Pesa agents gives

[1] Mbiti and Weil interpreted the phrase "the net deposit/residual value per customer (i.e. deposit less withdrawals) was kshs. 203" as implying that outstanding e-cash per customer was 203 Kshs. We now think that this interpretation was incorrect.

our estimate of total e-cash held by M-Pesa agents. From the Safricom web set, we have data on the number of agents monthly from April 2007 through April of 2011.[2]

Figure 8 shows our estimate of the fraction of total e-cash that is held on the phones of M-Pesa agents, based on the above assumption and data. For most of the existence of M-Pesa, this ratio has been relatively stable, and there is no discernable trend. For the last year in which we have data, if fluctuates narrowly within the range of 10-12%

Figure 8

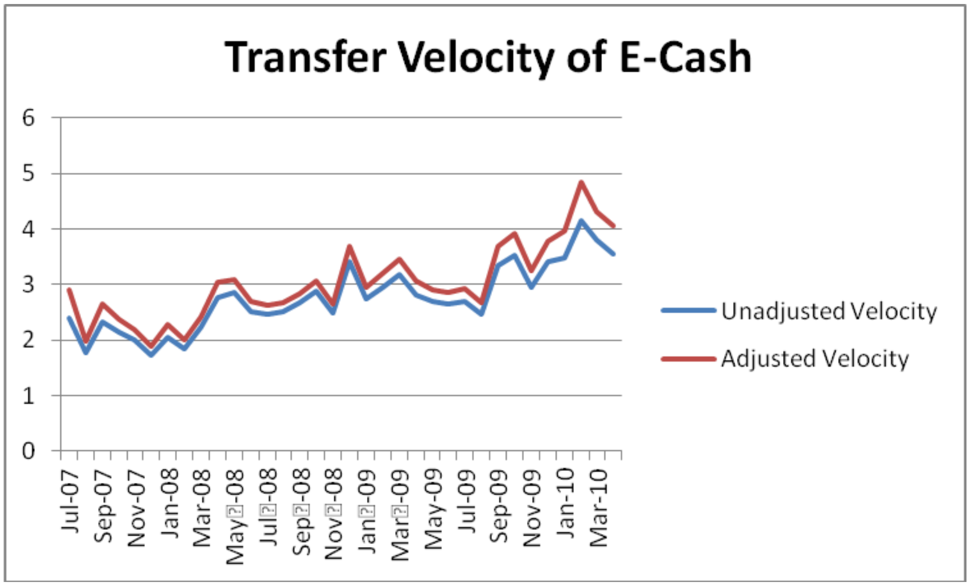


The other piece of information required for the calculation of transfer velocity is the monthly value of person to person transfers. This is reported by Safaricom for the period April 2007-April 2010. Using this data, Figure 9 shows our calculated value of transfer

[2] The Safaricom web site currently reports number of customers and number of outlets for the period April 2007-April 2011. Previously, the web site also reported the monthly value of person to person transfers, which was available for the months April 2007 through April 2010. Our attempts to get updated information on the value of person to person transfers, which would allow us to extend the time period of the velocity calculation, have not been successful.

velocity monthly. We show velocity both using the full size of the trust balance (labeled unadjusted) and subtracting our estimate of e-cash held by M-Pesa agents.

Figure 9



Both series show a significant upward trend. For example, adjusted velocity rises from roughly two transfers per month in the first year of M-Pesa's operation to roughly four in the last few months for which we have data.

The calculated values of velocity seem to indicate that M-Pesa is functioning as a hybrid of a money transfer system, on the one hand, and a means for storing value, on the other. Velocity of four, for example, implies that the average unit of e-cash was transferred once per week. If M-Pesa were purely being used as a money transfer system, we might expect that velocity would be significantly higher. For example, a simple deposit-transfer-withdraw transaction might involve e-cash being created (in the sense that it is transferred from an agent to a customer), transferred, and extinguished (transferred back to an agent's phone) in much less than a day. This would imply a velocity of over 30 transfers per month. Since we know anecdotally that at least some users indeed do not keep e-cash on their phones for very long, our estimates of velocity imply that some other users are keeping their cash on phones for significantly longer than one week. To give an example with made-up numbers: velocity of four would be consistent with 30 users each making one transfer of 1,000 Ksh. per month where the e-cash existed for only one day while at the same time 9 users made one transfer of 1,000 Ksh. per month but held on to e-cash for an entire month. Note that in this example, most e-cash at any point in time is held by non-frequent transactors, even though most transfers are done by frequent transactors.

The fact that velocity is trending upward over time suggests that the balance of users within the system is moving in the direction of people who are less inclined to hold e-cash on their phones and more inclined to use the system solely for transfers. This idea can be tested to some extent by looking at the trends in balances per customer and monthly transactions per customer. To construct balances per customer, we use the trust fund balance along with our estimate of e-cash held by M-Pesa agents. Figure 10 shows our calculated value. Balances of e-cash per customer are remarkably stable, in the neighborhood of Ksh. 700. (Note, however, that there is an interesting decline between September of 2009 and April 2010. Since the latter month is the last for which we can currently calculate velocity, this decline does explain some of our measured rise in velocity.) This average figure represents a distribution of cash balances about which we have no data, although presumably it is highly skewed with most customers at any point in time having balances at or near zero. In the future we hope to get data on this distribution.

Figure 10

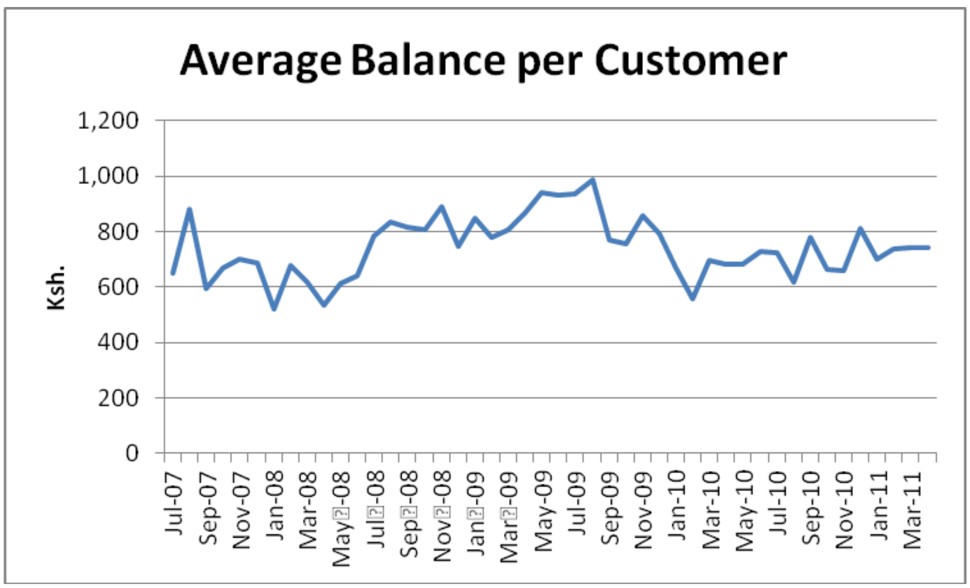
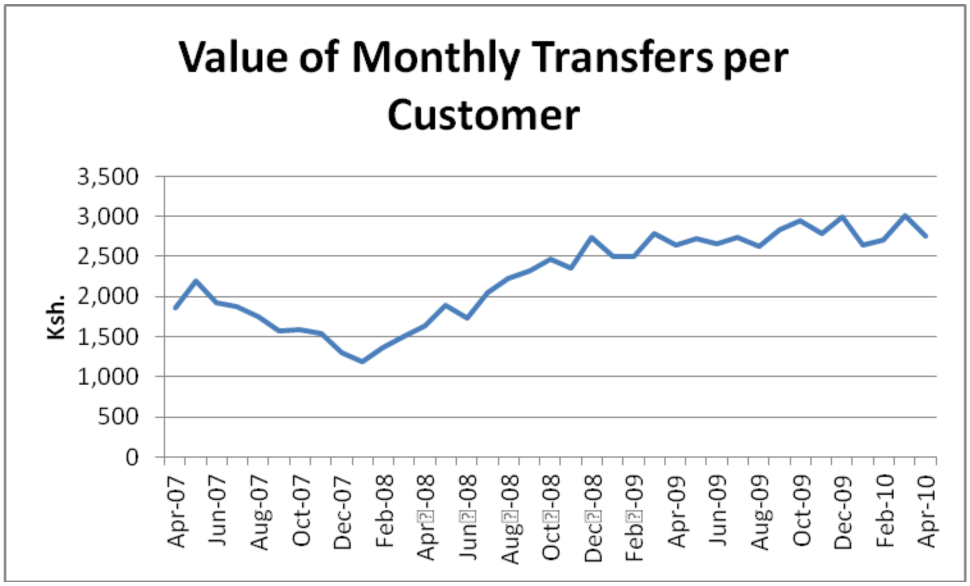


Figure 11 shows the value of monthly transfers per customer. This trends upward, and is clearly the major source of the rise in velocity that we measure, although it is quite stable after December, 2008. If this series remained trendless after April 2010 (the last month for which we have data on transfers), it would imply that velocity had also remained stable.

Figure 11



In terms of examining the future of the system (or its maturation), two other interesting ratios are the number of customers per outlet agent and the monthly value of transaction per outlet agent. As figure 12 shows, following rapid growth in the early period of M-Pesa's existence, customers per outlet has shown some tendency toward decline, albeit fairly slowly. Monthly transfers per outlet have shown a relatively similar pattern (note that because of data limitations, the series for transfers per outlet is one year shorter than the series for customers per outlet.)

Figure 12

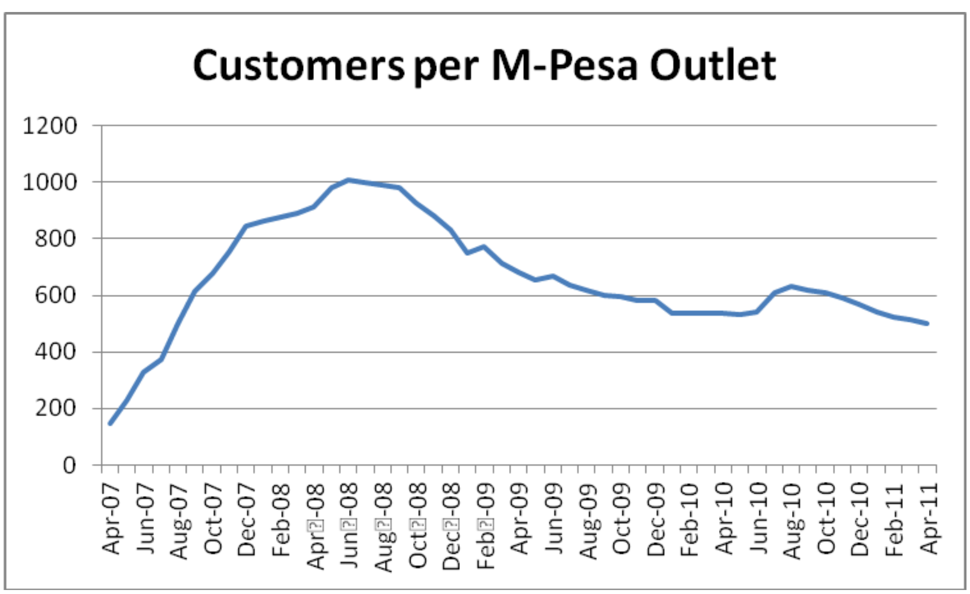
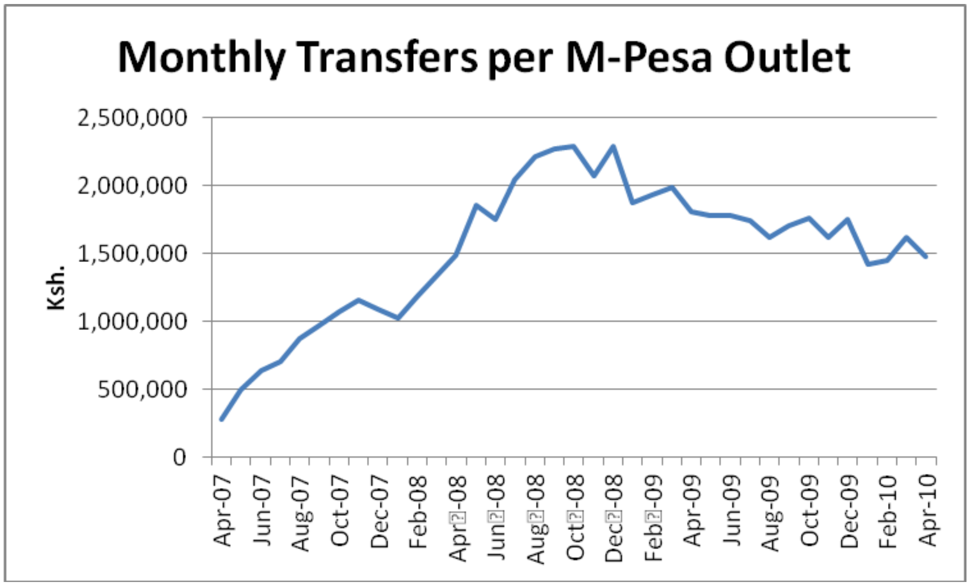


Figure 13



Implications for Measuring the Money Supply

As M-Pesa and other forms of electronic money have become more prevalent, economists have turned their attention to the implications for measurement of monetary aggregates and the relationship between money, prices, and real variables. To the extent that e-float is a form of money, failure to measure it in monetary aggregates could lead policy makers astray. For example, if the stock of e-float grew while conventional money did not, monetary policy would be looser than policy makers thought.

A natural initial approach to this problem would be to simply add the stock of e-money into the measures of, say, M1. This is problematic for two reasons. First, at least in the case of M-Pesa, the existing stock of e-money is backed 100% by transactions accounts held at commercial banks (i.e. the trust fund discussed above). If these accounts are subtracted from M1 while M-Pesa balances are added, the net effect is zero. Secondly, however, the transactions velocity of e-money may be higher than the transactions velocity of other components of M1, such as cash. Put differently, a small amount of M-Pesa, by circulating frequently, provides the same transaction (and transfer) services as a much larger quantity of cash.

If one had estimates of the transactions velocities of M-Pesa and the other components of a monetary aggregate, it would then be possible to create a velocity-weighted index, in which those components with higher velocity received a higher weight (see Spindt, 1985, for a discussion). As shown above, getting a rough approximation of the velocity of M-Pesa is not difficult, and with better data one could get a truly precise estimate.

Unfortunately, measuring the velocity of other monetary aggregates -- a problem on which monetary economists have been working since the time of Jevons -- is much harder.

For this reason, and also out of curiosity of how M-Pesa compares to other monies, we have pulled together the few estimates of transaction velocity. The estimates span a number of countries and historical eras and, therefore, pertain to a variety of institutional structures and transaction technologies. This may explain some of the vast variation in the data.

A common measure of the velocity of demand deposits is the "demand deposit turnover rate," defined as the ratio of debits to demand deposits in a period to the average value of demand deposits. In the United States, between 1919 and 1941, the annual turnover rate on demand deposits at commercial banks varied between 19.4 and 53.6 (Board of Governors of the Federal Reserve System, 1976) . In more recent data, the turnover rate for banks excluding major New York banks rose from 135 to 475 per month over the period 1980-1995 (U.S. Census Bureau, Statistical Abstract, 1996). Engber (1965) presents data on demand deposit turnover in East Africa between 1950-1963, over which period it rose from 4.1 to 9.9 per quarter. Using data from Cletus (2004) the demand deposit turnover rate in Gambia between 1983 and 1993 varied between 2 and 11 transactions per month. In Taiwan in 2007, the annual turnover rate on demand deposits was 328 (Republic of China, 2009). In Thailand, monthly demand deposit turnover in 2009 averaged 41.

As far as currency goes, there are even fewer estimates of velocity. Irving Fisher's calculations for the years around the beginning of the 20th century in the United States found that transactions velocity of cash was in the neighborhood of 20 per year. Spindt (1985) applies a method suggested by Laurent (1970) to look at the velocity of circulation of currency. His estimate is that the velocity of currency in the United States ranged between 7 and 10 transactions per month over the period 1970-85. A study by the US Federal Reserve based on household surveys (Avery et al., 1986) estimated the velocity of currency in 1984 at between 50 and 55 transactions per year.

A preliminary conclusion from this data is that the value of transfer velocity of M-Pesa that we calculate is not noticeably higher than the velocity of cash. Further, the velocity of M-Pesa is significantly lower than the velocity of some other monetary components, such as demand deposits, although the data do not really come from comparable economies, and further we believe that demand deposit turnover is dominated by large corporations. For the present, however, even with a velocity adjustment, M-Pesa does not compare with other parts of the monetary aggregate. The average over the period January-June 2008 of currency (M0) was 85.2 billion shillings, while currency plus demand deposits (M1) was 393 billion shillings (Central Bank of Kenya, Statistical Bulletin, June 2008). By contrast, the outstanding stock of e-float in April 2008 was 1.4 billion Ksh.

The Stability of Velocity, Money Demand and the Money Multiplier in Kenya Post-2007

This section looks at the effects of new ICT products on monetary relationships such as the quantity equation. This entails providing insights on whether these products have led to breakdown of the various assumptions underlying the current conduct of monetary policy including the stability assumptions in velocity and the money multiplier.

The starting point for a monetary aggregate programme is that money matters, that the behaviour of monetary aggregates will have a major bearing on macroeconomic prices (inflation, exchange rates and interest rates) as well as upon investment, growth and other aspects of the 'real' economy. Without such a presumption this area of policy would scarcely be worth much research effort (Killick and Mwega 1990).

If monetary variables are important, the question arises of how they may be regulated in pursuit of policy objectives. Here it is useful to distinguish the demand for money from its supply. Standard theory tells us that macroeconomic stability will be served if the supply of money (M) is expanded at approximately the rate at which the demand for it is growing. An understanding of the money demand is therefore a prerequisite for the conduct of monetary policy. The effects of monetary policy actions on the economy cannot be explained if the demand for money is unstable and shifts about often and significantly with for example changes in expectations or the general institutional setting. It is of considerable interest and concern for monetary policy to ascertain the stability of the money demand.

Income Velocity of Circulation

One of the earliest approaches to the analysis of the money demand is the quantity theory of money based on the identity MV=PY, where M is money, V is velocity, P is the price level and Y is the level of transactions in this case proxied by national income. V is taken to be a constant due to technological and institutional factors. From this identity, one can derive a simple money demand equation $\frac{M}{P} = \frac{1}{V}Y$.

Monetarist policy models are based on the standard assumption that the velocity of circulation (V) is either constant or at least predictable. Without that, the macroeconomic effects of a given change in money supply are problematic. We therefore examine the behaviour of the M3 income velocity of circulation in Kenya over 2000:1 -2011:2 to test for its stability. M3 is the current intermediate target under the country's monetary policy framework. It is composed of currency in circulation, demand and time deposits as well as foreign currency deposits held in commercial banks. Quarterly GDP data are only available from 2000, hence determining the selection of the study period[3].

Figure 14 show a clear accelerated decline in the velocity V post-2007 coinciding with the introduction of M-PESA. For the period as a whole there was a trend term of -0.0128,

[3] The Kenya National Bureau of Statistics quarterly GDP data are also given in real terms, hence they were converted to nominal terms using interpolated GDP deflator data reported in the IMF World Economic Outlook database.

highly significant at the 1% level (Table 4). Relative to the first quarter, the velocity is significantly lower in the second quarter at 5% level, but is not significantly different in the third and fourth quarters.

There are various ways to formally determine the stability of a function. One is through recursive coefficients estimates[4]. These estimates trace the evolution of coefficients as more and more of the sample data are used in the estimation. Figure 15 show the recursive estimates of the time trend model, with the two standard errors bands around the estimated coefficients. Figure 15 shows significant variation in the coefficients as more data are added in the post-2007 period, indicating instability, with some episodes outside the two standard error bands in 2008Q1 and 2009Q4-2010Q4.

The more traditional approach to assess stability of a model is through the breakpoint tests. The Chow Breakpoint Test fits the equation separately for each sub-sample and then assesses whether there are significant differences in the estimated equations. On the hand, the Quandt-Andrews Breakpoint Test seeks for one or more unknown breakpoints in the sample. Under this test, the single Chow breakpoint test is performed at every observation between two dates which are then summarized into one test statistic against the null hypothesis of no breakpoints in the sample period.

The Chow breakdown test results in Table 5 show a significant difference in the estimated equations, decisively indicating a structural change in the relationship post-2007 (breakpoint is set at 2007Q1). On the other hand, all three statistic measures in the Quandt-Andrews breakpoint test (with 15% trimmings on both data tail-ends) fail to reject the null hypothesis of no structural breaks within the 32 possible dates tested (2001Q4 – 2009Q3). The maximum statistic is in 2009Q3, the most likely breakpoint location which is consistent with the recursive estimates.

It is clear that V is unstable, with unpredictable fluctuations around the trend value which has been exacerbated by the introduction of mobile money. Ignoring signs, the mean quarterly percentage deviation of V from its trend value was ±2.5% (or ±10% per annum), with minimum and maximum quarterly deviations of 0.07% and 4.94% respectively. A mean quarterly deviation of ± 2.5% is substantial for effective monetary control. As an illustration, assume that the government adopts an annual growth target for current-price GDP in a given year at 10%, of which about 5% is expected to be real growth, and that this target is consistent with its monetary programme. It may decide that the ΔM that is consistent with those targets is +10%. Now let V increase unexpectedly by 10%. It can be calculated that if M goes up by 10% and V by 10% the resulting growth in nominal GDP will be almost 20%. With real output growth virtually predetermined in the short run (say at 5%), this would imply an inflation rate of 15% rather than the intended 5%, hence the government's inflation target would be seriously breached.

Demand for money

The income velocity of circulation provides only a first approach to the stability of the demand for money. While many of the previous studies on the demand for money found it

[4] These methodologies and the references are discussed in the econometric package, *Eviews 6*.

stable (Darrat 1985, Mwega 1990, Adam 1992), recent studies find it unstable (Sichei and Kamau 2011) following financial innovations from electronic and mobile money as well other exogenous shocks to the economy. It is a well-known hypothesis (Gurley and Shaw 1960) that such financial innovations lead households and firms to economize on money holdings. It is therefore important to assess whether this has rendered the demand for money in Kenya unstable.

Monetary theory suggests that the demand for real money balances (RM) is a positive function of a scale variable such as the measured real income (RGDP) and a negative function of the opportunity cost of holding money. Since money can be substituted by physical and financial assets, the opportunity cost of holding money is measured by the expected rate of inflation (π) and a relevant expected rate of interest (R) respectively. Previous studies on Kenya have utilized the 91-day treasury bill rate (TBR) as the opportunity cost variable as it fluctuates relatively freely in accordance with conditions in the money market even the central bank influences the rate by manipulating the tendering process in an effort to ensure that it moves in line with other short-term interest rates. The TBR is therefore be taken as a representative measure of the opportunity cost of holding money *vis-a-vis* other financial assets, especially for large money-holders. In addition, we include the opportunity cost of holding Kenya shillings vis a vis foreign currency, measured by the dollar exchange rate (EXR).

Figure 14: Income Velocity of Money Circulation

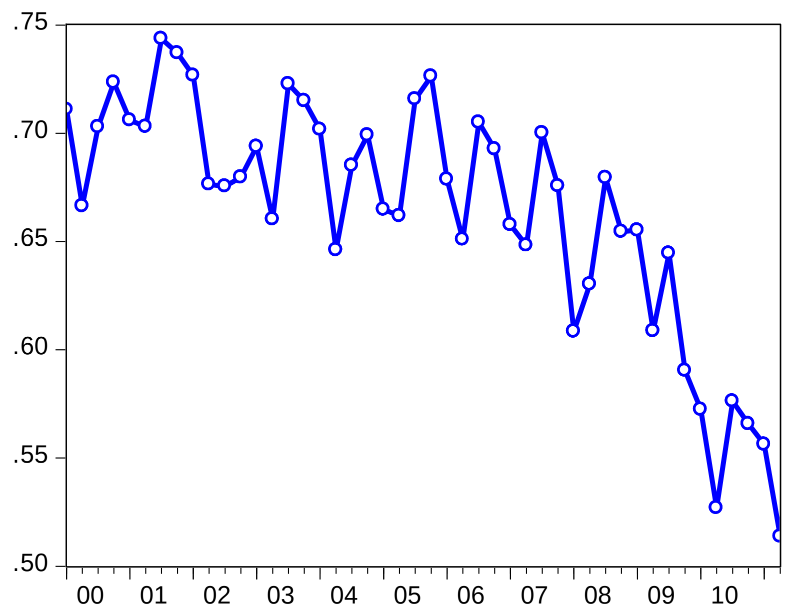


Table 4: Regression of Velocity on Time Trend Factors

Dependent Variable: VELOCITY
Method: Least Squares
Sample: 2000Q1 2011Q2
Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.744554	0.012330	60.38579	0.0000
QUARTER2	-0.028327	0.012324	-2.298581	0.0267
QUARTER3	0.018976	0.012619	1.503827	0.1403
QUARTER4	0.010682	0.012619	0.846557	0.4022
YEAR	-0.012848	0.001342	-9.573526	0.0000

R-squared	0.734027	Mean dependent variable	0.663820
Adjusted R-squared	0.708078	S.D. dependent vary	0.055871
S.E. of regression	0.030187	Akaike information criterion	-4.060477
Sum squared residual	0.037362	Schwarz criterion	-3.861711
Log likelihood	98.39096	Hannan-Quinn criteria.	-3.986018
F-statistic	28.28771	Durbin-Watson stat	0.516856
Prob(F-statistic)	0.000000		

Figure 15: Recursive Estimates of the Velocity Model

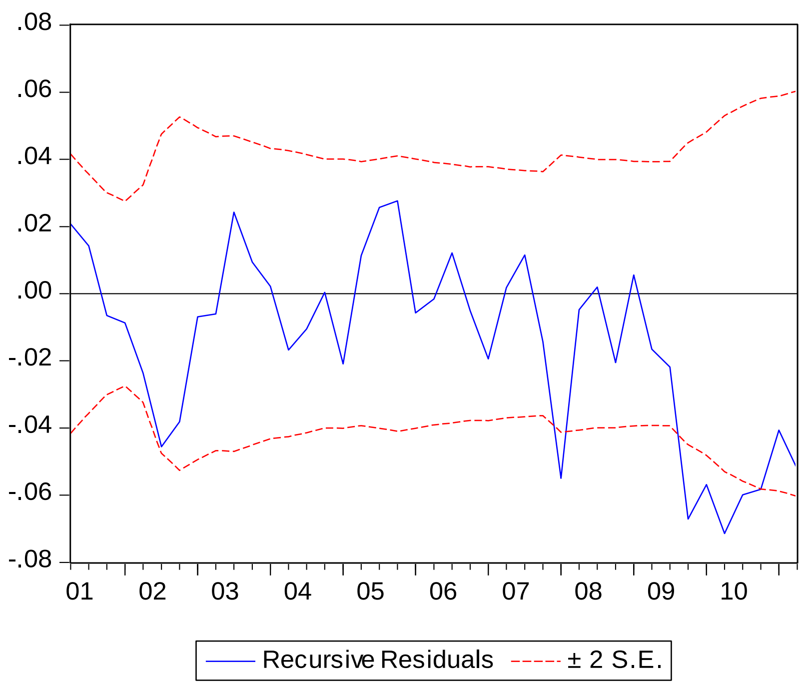


Table 5: Breakpoint Tests of Stability

Chow Breakpoint Test: 2007Q1
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 2000Q1 2011Q2

F-statistic	11.05516	Prob. F(5,36)	0.0000
Log likelihood ratio	42.79686	Prob. Chi-Square(5)	0.0000
Wald Statistic	55.27579	Prob. Chi-Square(5)	0.0000

Quandt-Andrews unknown breakpoint test
Null Hypothesis: No breakpoints within trimmed data
Varying regressors: All equation variables
Equation Sample: 2000Q1 2011Q2
Test Sample: 2001Q4 2009Q3
Number of breaks compared: 32

Statistic	Value	Prob.
Maximum LR F-statistic (2009Q3)	12.47608	0.2982
Maximum Wald F-statistic (2009Q3)	12.47608	0.2982
Exp LR F-statistic	5.065829	0.1117
Exp Wald F-statistic	5.065829	0.1117
Ave LR F-statistic	7.767611	0.1013
Ave Wald F-statistic	7.767611	0.1013

Note: probabilities calculated using Hansen's (1997) method

To estimate the demand for money, it is necessary to specify the functional form of the model used. Following general practice, we use the following semi log-linear model attributed to Cagan (1956):

$$\text{Log RM3 (t)} = a_0 + a_1 \log \text{RGDP(t)} + a_2 \text{Log EXR(t)} + a_3 \text{TBR(t)} + a_4 \pi \text{ (t)} + \text{u(t)}$$

with $a_1 > 0$, $a_2 < 0$, $a_3 < 0$ and $a_4 < 0$ where t denotes the time period and u, is a log-linear error term.

Figure 16 shows the evolution of the five variables over 2000Q1-2011Q4. Table 6 shows RM3, RGDP, EXR and TBR are I(1), but become stationary (I(0)) at least at the 5% level after first differencing, while the level of inflation is I(0). Table 7 indicates lack of evidence that the I(1) variables (RM3, RGDP, EXR and TBR) are cointegrated during the study period. Hence the model can be estimated without the error correction term.

Table 8 shows the parsimonious model results derived from a general model where three lags of each variable was included . The results conform to expectations. They show the first lag of real money to be significant at the 1% level is influencing the demand for money with a coefficient indicating that about 30% of the gap between desired and actual money balances is adjusted for in one quarter. The income variables (current, lag 1 and lag 3) are also significant at least at the 5% level with a cumulative coefficient of 0.60. The EXR (lag

2), TBR (lag 2)and INFL (current and lag 3) all have negative and significant coefficients at least at the 5% level. A 10% increase in the nominal exchange rate reduces the demand for money by 0.2%. The TBR has a coefficient of -0.49 and INFL a cumulative coefficient of -0.58.

Figure 17 shows the recursive estimates of model stability. The results show increasing volatility in the demand for money post-2007, with the demand for money outside the two standard error bands in 2007Q2 and 2008Q4. These results are consistent with those by Sichei and Kamau (2011) who found the Kenya money demand function unstable during their study period (1996Q1-2009Q4). They found that the monetary balances were consistently below equilibrium from 2007 to the early 2009 implying that the CBK supplied too little money relative to what was optimal, hence deflating the economy.

Table 6: Augmented Dickey Fuller Tests of Stationarity

	Level	First difference
RM3	1.665	-4.584
RGDP	0.683	-3.362
EXR	-0.819	-4.795
TBR	-2.212	-5.084
INFL	-3.795	

Test critical values:	1% level	-3.584743
	5% level	-2.928142
	10% level	-2.602225

Figure 16: Evolution of RM3, RGDP, EXR, TBR and INFLATION over 2000Q1-2011Q2

Table 7: The Johansen Test for Cointegration

Sample (adjusted): 2000Q3 2011Q2
Included observations: 44 after adjustments
Trend assumption: Linear deterministic trend
Series: LRM3 LGDP LEXR TBILL INFLATION
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.417946	56.95211	69.81889	0.3407
At most 1	0.373796	33.13962	47.85613	0.5491
At most 2	0.161488	12.54415	29.79707	0.9113
At most 3	0.082311	4.794591	15.49471	0.8302
At most 4	0.022807	1.015128	3.841466	0.3137

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.417946	23.81249	33.87687	0.4693
At most 1	0.373796	20.59547	27.58434	0.3014
At most 2	0.161488	7.749555	21.13162	0.9184
At most 3	0.082311	3.779463	14.26460	0.8819
At most 4	0.022807	1.015128	3.841466	0.3137

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

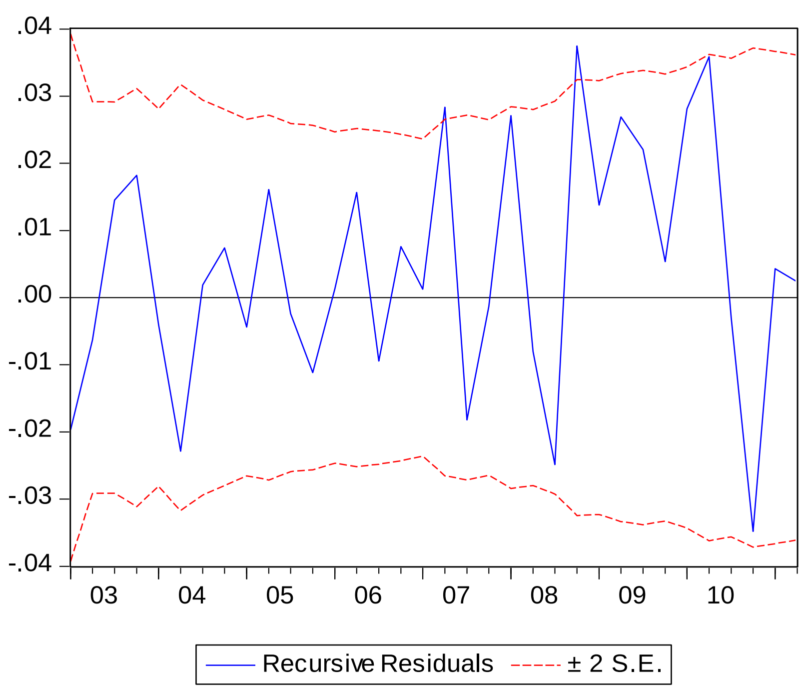
Table 8: Parsimonious model results

Dependent Variable: ΔLRM3
Method: Least Squares
Sample (adjusted): 2001Q1 2011Q2
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔLRM3(-1)	0.297234	0.101379	2.931900	0.0060
ΔLRGDP	0.199200	0.055976	3.558669	0.0011
ΔLRGDP(-1)	0.251632	0.069820	3.603996	0.0010
ΔLRGDP(-3)	0.153900	0.066370	2.318827	0.0265
ΔLEXR(-2)	-0.200714	0.089613	-2.239791	0.0318
ΔTBR(-2)	-0.492315	0.227711	-2.162015	0.0377
ΔINFL	-0.377707	0.090212	-4.186857	0.0002
ΔINFL(-3)	-0.205801	0.094177	-2.185258	0.0359

R-squared	0.636228	Mean dependent variable	0.012555
Adjusted R-squared	0.561334	S.D. dependent variable	0.027252
S.E. of regression	0.018050	Akaike info criterion	-5.021720
Sum squared residual	0.011077	Schwarz criterion	-4.690735
Log likelihood	113.4561	Hannan-Quinn criteria.	-4.900401
Durbin-Watson stat	1.906733		

Figure 17: Recursive Estimates of Money Demand Model Stability



Money Supply: The Money Multiplier

Manipulation of money supply is often - but not solely - attempted by policies to influence the supply of 'high-powered' money, the reserve base upon which the credit creation of the monetary system is based. Money supply is therefore usually analyzed through the money supply equation where M=mB where money supply (M) is a product of the money multiplier (m) and monetary base (B). Over time, growth of money supply will approximated be equal to the growth of the money multiplier and that of the monetary base.

The monetary base (B) on the other hand comprises of the money component that is supplied by the monetary authorities and consist of currency in circulation and the cash held in the commercial banks tills plus their deposits at the central bank. It is this money that forms the base for credit creation by commercial banks. The monetary base has two sources: the net foreign assets (NFA) and the net domestic assets (NDA) of the monetary authorities. Changes in NFA will reflect movements on the overall balance of payments. These, in turn, will result from various external and domestic factors, including changes in the terms of trade, the exchange rate, capital movements and so forth. NDA, on the other hand, comprises of outstanding claims on the public sector (CBG) and outstanding claims on commercial banks (CBC). Changes in CBG mainly reflect the government's budget position – budget deficits and performance of public enterprises or parastatals. Change in CBC reflects domestic economic conditions, especially the commercial banks liquidity status. The dynamics are such that an increase in central bank credit to government and commercial banks may be reflected in deterioration in the balance of payments or NFA (offset effects) as some of that credit will be used to finance imports and net capital outflows. On the other hand, the monetary authorities could manipulate changes in CBG and CBC to sterilize the impact of changes in NFA on the monetary base (ΔB).

Assume now that it is possible for the authorities to control B. What is then necessary is for B to bear a stable, predictable money multiplier (m) - so that the stock and rate of change of M can indeed be controlled via B. The money multiplier can be expressed as $m=\frac{1+c}{c+r}$ where c is the currency deposits ratio and r is commercial banks cash reserves deposits ratio, with the money multiplier (m) declining with an increase in both c and r. The cash reserves deposit ratio in turns can be decomposed into the required reserves and excess reserves ratios, with the former set by the monetary authorizes as a tool of monetary policy.

Figure 18 show a clear accelerated increase in the money multiplier post-2007:2 coinciding with the coming with M-PESA. For the period as a whole there was a trend term of 0.40, highly significant at the 1% level (Table 9). Relative to the first quarter, the multiplier is significantly lower in the fourth quarter, but is not significantly different in the second and third quarters.

Figure 19 show the recursive estimates of the time trend model, with the two standard errors bands around the estimated coefficients. Figure 15 show significant variation as more data is added in the post-2007 period, indicating instability, with some episodes outside the two standard error bands in 2009Q4 and 2010Q2 (earlier episodes were in 2003Q4 and 2004Q4).

The Chow breakpoint test results in Table 10 show a significant difference in the estimated equations, decisively indicating a structural change in the relationship post-2007 (breakpoint is set at 2007Q1). On the other hand, all the three statistic measures in the Quandt-Andrews test (with 15% trimmings on both data tail-ends) fail to reject the null hypothesis of no structural breaks within the 32 possible dates tested (2001Q4 – 2009Q3). The maximum statistic is in 2003Q3, the most likely breakpoint location which is consistent with the recursive estimates, so that instability in the money multiplier started much earlier.

It is clear that M3 money multiplier is unstable, with unpredictable fluctuations around the trend value which has been exacerbated by the introduction of mobile money. Ignoring signs, the mean quarterly percentage deviation of the money multiplier from its trend value is ±19.9%, with minimum and maximum quarterly deviations of 0.035% and 53.4% respectively. A mean quarterly deviation of ±19.9% (which is much higher than for velocity) is clearly substantial for effective monetary control.

As seen in Figure 20, the reason for the substantial increase in the money multiplier is the decline in the currency and cash reserves ratios, the latter reflecting monetary policy actions. Although the minimum cash reserves ratio has existed since June 1978, it was not actively utilized until the early 1990s. As a result of the Goldenberg scandal in the early 1990s which resulted in injection of a lot of money into the economy, the ratio was systematically raised from a low of 6% in 1992 to a high of 20% in March 1994 before being reduced gradually to a low of 10% in October 2000, calculated on average of over 14 days with 8% minimum on any one day. In July 2003, the ratio was revised from a monthly average of 10% to 6% maintained daily. On December 1, 2008, the cash reserves ratio was reduced to 5%; and on June 11, 2009, to 4.5%. On May 31, 2011, the MPC raised the minimum cash ratio to 4.75%.

There is clear accelerated decline in the currency ratio post-2007 period coinciding with the introduction of M-PESA. The results for the currency ratio equation (not shown) show a significant negative trend variable as well as positive and significant fourth quarter coefficient at the 1% level. The recursive estimates show increased volatility post-2007, with the ratio outside the two standard errors range in 2009Q4 (there is also an earlier episode in 2003Q1). The Chow breakpoint test show the currency equation is unstable, while the Quandt-Andrews test (with 15% trimmings on both data tail-ends) gives mixed results. The maximum statistic is in 2003Q1, so that instability in the currency ratio started much earlier.

Similar results (not shown) obtain for the cash reserves ratio. The currency ratio has a significant negative trend variable at the 1% level, with the fourth quarter coefficient positive and significant at the 5% level. The recursive estimates however show the reserves ratio to be fairly stable with no episode outside the two standard errors range, which is supported unambiguously by the Quandt-Andrews breakpoint test (with 15% trimmings on both data tail-ends).

Figure 18: The Money Multiplier

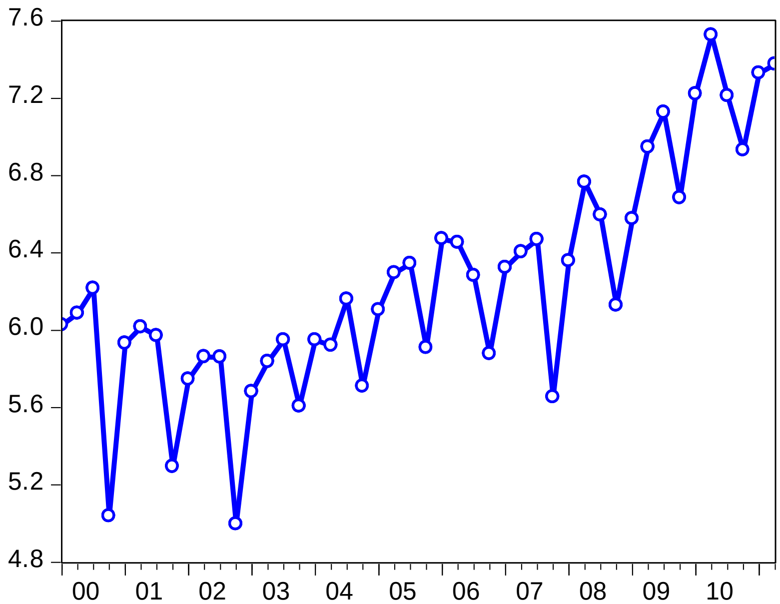


Table 9: The M3 Money Multiplier Equation

Dependent Variable: MULTIPLIER
Method: Least Squares
Sample: 2000Q1 2011Q2
Included observations: 46

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.400714	0.103658	52.10126	0.0000
QUARTER2	0.147597	0.103607	1.424583	0.1618
QUARTER3	0.140644	0.106085	1.325763	0.1923
QUARTER4	-0.437645	0.106085	-4.125403	0.0002
YEAR	0.139853	0.011282	12.39601	0.0000

R-squared	0.829499	Mean dependent variable	6.243795
Adjusted R-squared	0.812864	S.D. dependent variable	0.586659
S.E. of regression	0.253784	Akaike info criterion	0.197655
Sum squared residual	2.640657	Schwarz criterion	0.396420
Log likelihood	0.453938	Hannan-Quinn criteria.	0.272114
F-statistic	49.86682	Durbin-Watson stat	0.590965
Prob(F-statistic)	0.000000		

Figure 19: The Recursive Estimates of the Multiplier model

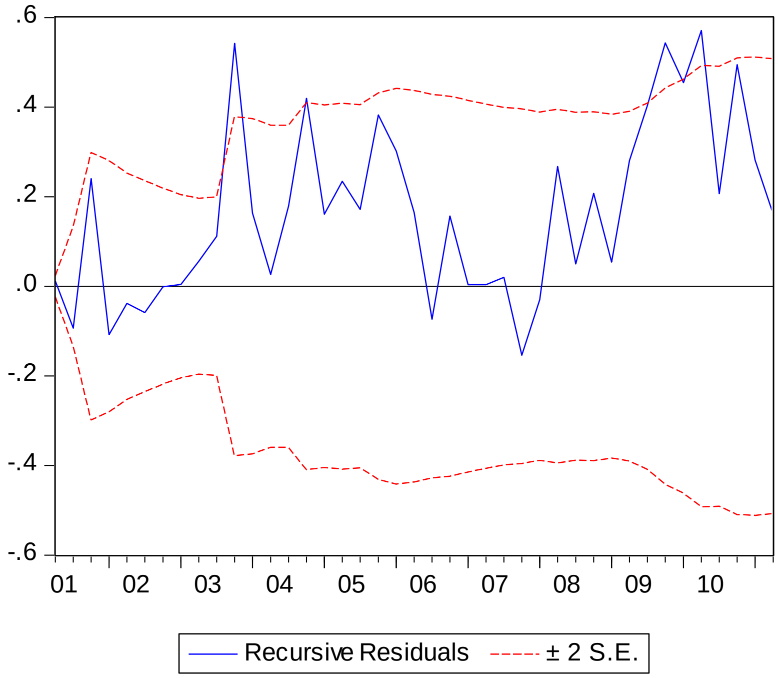


Table 10: Breakpoint Tests of Stability of the Multiplier

Chow Breakpoint Test: 2007Q1
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 2000Q1 2011Q2

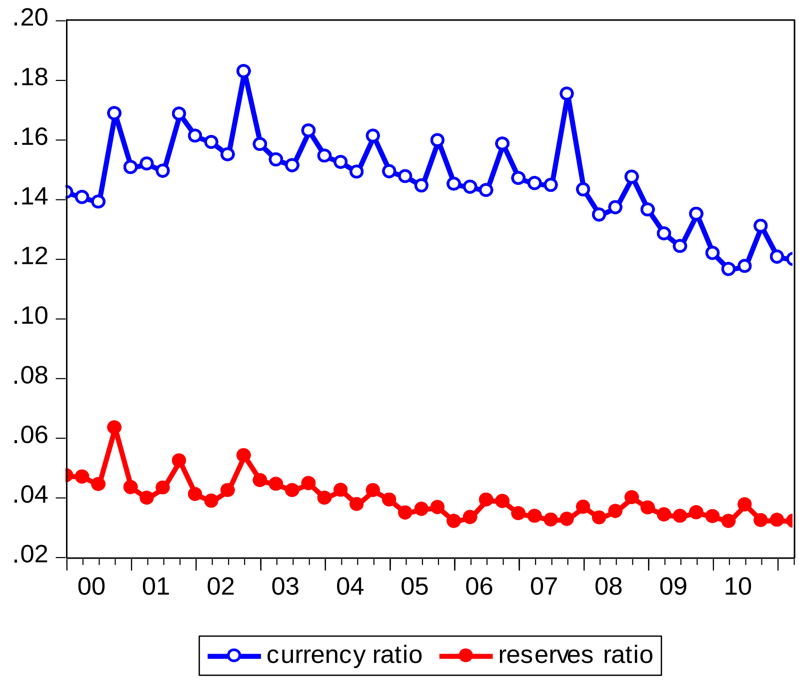
F-statistic	6.423056	Prob. F(5,36)	0.0002
Log likelihood ratio	29.33340	Prob. Chi-Square(5)	0.0000
Wald Statistic	32.11528	Prob. Chi-Square(5)	0.0000

Quandt-Andrews unknown breakpoint test
Null Hypothesis: No breakpoints within trimmed data
Varying regressors: All equation variables
Equation Sample: 2000Q1 2011Q2
Test Sample: 2001Q4 2009Q3
Number of breaks compared: 32

Statistic	Value	Prob.
Maximum LR F-statistic (2003Q2)	9.758269	0.5697
Maximum Wald F-statistic (2003Q2)	9.758269	0.5697
Exp LR F-statistic	3.840528	0.2799
Exp Wald F-statistic	3.840528	0.2799
Ave LR F-statistic	7.161038	0.1432
Ave Wald F-statistic	7.161038	0.1432

Note: probabilities calculated using Hansen's (1997) method

Figure 20: The currency and cash reserves ratios



The Regulatory Implications of Mobile Money

The regulation of e-money services is relevant to the larger project of East African economic integration, and the potential establishment of an East African Monetary Union. The 2010 ECB "Study on the establishment of a monetary union among the Partner States of the East African Community," stresses that the eventual creation of an EAMU will have to be proceeded by an extended period of regulatory harmonization, macroeconomic convergence, cooperation in monetary and exchange rate policy, and the creation of appropriate institutions. The current structure of regulation of e-money services is a good example of non-harmonious regulation.

Kenya, where e-money services first emerged and have the deepest level of penetration, has a very unusual regulatory structure. While mobile phone companies are licensed and supervised by the Communications Commission of Kenya, mobile payment services are within the mandate of the CBK as set out in Section 4A 1(d) of the CBK Act. According to this section, an objective of CBK is to formulate and implement such policies as to best promote the establishment, regulation and supervision of an efficient and effective clearing and settlement process. As with M-Pesa, the CBK issues a 'no letter of objection' before a mobile money service is launched, while the mobile operator agrees to provide monthly reports of pre-determined metrics; and to regularly engage the regulator and key stakeholders, with additional products approved on a case-by- case basis. While non-banks issue of e-money and operation of payments systems were not prohibited by the then existing legislation, explicit authority has now been given by the

National Payments System Act of 2011. In assessing an application, the CBK identifies various risks: operational risk and bank continuity arrangements, money laundering risks, system integrity, insolvency, legal risks and liquidity risks; and how they can be mitigated. The basic premise is that mobile money does not fall under the category of banking business as no intermediation is involved (interest on the e-float goes to a not-for-profit trust), while funding is ring-fenced so that it is not available for firm operations or passed on to customers. The approach in Kenya is to regulate mobile-stored value accounts separately from traditional banking activities which gives the operators the authority to certify their own agents (Must and Ludewig 2010).

Mas and Radcliffe (2010) attribute the rapid growth to mobile money, especially M-Pesa, to this benign regulatory framework. Safaricom had a good working relationship with CBK and was given regulatory space to design the M-Pesa in a way that fitted the market. In return, CBK insisted that customer funds be deposited in regulated financial institutions and reviewed the security features of the technology platform, with M-Pesa operating outside the provisions of the banking law, despite pressure from banks at least initially and challenges in courts.

Both Uganda and Tanzania take a different approach to regulation. In both countries, e-money licenses are awarded by the central bank (Bank of Uganda and Bank of Tanzania), and are only given to commercial banks and not to mobile phone companies. To be more specific, in each country mobile phone companies (such as MTN in Uganda and Vodacom in Tanzania) manage the network of agents and provide customer services, but are partnered with commercial banks, which are regulated by the central bank (Davidson, 2011). In Burundi, the mobile money service Econet is run in partnership with the national postal service, and is regulated by the central bank.

This sort of heterogeneity of in regulatory environment is exactly the sort that the ECB suggests needs to be eliminated in the run-up toward monetary union.

A further and more difficult problem arises in considering how to regulate e-money services that cross national borders. The EAC Common Market protocol of 2009 calls for the free movement of service providers among EAC countries. It is not clear to the authors of this study whether this provision applies to telecommunications services, although it would certainly seem that as the EAC moves toward economic integration it will be desirable for such services to be mobile across borders. If mobile phone services do cross borders, it is not hard to imagine that mobile money services will do so as well. Of course, the existence of separate currencies in the period before full monetary integration would make the construction of such a system complex, and would introduce new regulatory issues, and would certainly tax the ability of national regulators to cooperate. This would be all the more difficult if regulatory structures continued to be a differentiated across countries as they currently are. This is another reason why it would be useful to harmonize the form of regulation of e-money.

Given the desirability of harmonizing regulation, the question arises, which model is best? Davidson (2011) argues that the model of issuing e-money licenses only to banks significantly slows down the development of such services. He takes the view that because such e-money is largely a low-value money transfer service, it does not pose the type of systemic or prudential risk that would require supervision by a bank regulator. Our findings in this report are largely in line with Davidson's views. Specifically, as we argue above, the amount of e-float within M-Pesa, which is by far the most developed e-money system currently, are sufficiently small that they have very little systemic effect on the conduct of monetary policy in Kenya. However, to the extent that current money-transfer systems represent only the beginning of a much larger extension of financial services to poor households via mobile phones, this conclusion might change.

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