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Conference Paper

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2nd Europe - Middle East - North African Regional Conference of the International Telecommunications Society (ITS): "Leveraging Technologies For Growth", Aswan, Egypt, 18th-21st February, 2019

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Mahmoud, Zeinab (2019) : Determinants of Mobile Money Adoption, 2nd Europe - Middle East - North African Regional Conference of the International Telecommunications Society (ITS): "Leveraging Technologies For Growth", Aswan, Egypt, 18th-21st February, 2019, International Telecommunications Society (ITS), Calgary

This Version is available at:

<https://hdl.handle.net/10419/201742>

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Determinants of Mobile Money Adoption

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ABSTRACT

Mobile Money (MM) services are growing very fast in the developing countries as an important tool for the financial inclusion. Many critical challenges surrounds mobile money services adoption with the most important challenges to improve the service quality, attract and retain more customers, and reduce dealing with cash. Overcoming all these challenges would allow all citizens to have full access to financial services or in other words being financially included.

Recently, Financial Inclusion has received higher priority to improve financial existing and reduce poverty on large scale. It is clear that due to the large scale of mobile phone access and the existing network, mobile money on of the most key enabler to financial inclusion. However, the differences of mobile money countries, characteristics, economy, adoption variables.

This Paper analyzes the mobile money success factors from seven developing countries (Egypt, Kenya, Ghana, Tanzania, Uganda, Zimbabwe, and Rwanda) where there has been successful penetration of mobile money services in order to extract the determinants of mobile money services adoption. Mobile money adoption is affected by several factors that includes country specific characteristics, regulatory considerations, and service provision characteristics as a result nine independent variables were selected to be included in this research. Two dependent variables are chosen to present the mobile money adoption, these are registered subscribers ratio and active subscribers ratio. The analysis is based on the data collected from the central banks published statistics in each country of the above-mentioned seven countries. The analysis is achieved using panel data analysis for a sample of seven African countries for the period from 2013 to 2017. Data is analyzed using the linear regression model for each dependent variable of the mobile money adoption using nine explanatory variables. The statistical analysis is done using Eviews and least square (LS) estimation techniques are used to provide further strength for the results

The paper aims to define a model for measuring mobile money adoption and defining the impact of each of the mobile money adoption determinants on the adoption level. This could be used to define recommendations or strategic decisions for policy makers or mobile money service providers in Egypt to improve mobile money adoption.

KEYWORDS

Financial Inclusion, Mobile Money (MM), Mobile Money Services, Mobile Money Determinants, Registered subscribers ratio, Active subscribers ratio.

1. Introduction

The existence of mobile money services is essential to a country's economy especially for developing countries where the majority of the population lack access to formal financial services due to existing level of poverty and lack of infrastructure, and supervision capabilities.

Globally, 1.7 billion adults remain unbanked and do not have access to financial services (World Bank, 2017). Of those people, 77% live on less than \$2 a day (World Bank, 2015). In this research, we analyzed list of mobile money deployments across the developing countries to attempt to understand which characteristics are critical for the success of a mobile money service.

Mobile money has many benefits, especially for the low-income and rural customers. Mobile money services typically offers safe storage, deposit, withdraw and transfer at lower cost and convenient and faster than banks; and facilitate the following services - remittances (domestic and/or international) at much low cost, bill payment, salary disbursement, retail payments, money savings, credit, and insurance. In addition, services offer methods for turning physical cash into electronic money (e-money) in a customer's mobile account and vice versa such as Agents branches, Card less ATMs, transfer from the bank account to mobile account.

Mobile money provides financial services using the existing cellular and distribution networks of Mobile Network Operators (MNOs) which are widespread. While the services associated with a financial account are rendered over a mobile device connected to their mobile wallet account, customers deposit and withdraw cash from these accounts through retailers or mobile money agents. USSD, SMS, and smartphone applications have all been used to access these services on mobile

devices. However, with such nuanced characteristics in each country and even more distinctions within each financial system and economy, mobile money as a solution may not be applicable in every country aiming for financial inclusion in the same way.

Concerned with the fostering of financial inclusion in Egypt, it is to be noted that Egypt is a country situated in the continent of Africa with a population of more than 100 million (World Bank, 2017). Currently, there are four Mobile Network Operators (MNOs) in Egypt including Vodafone, Orange, Etisalat, and Telecom Egypt. In addition, there are many mobile money players in Egypt, namely Vodafone Cash, Orange Money, Etisalat Cash, Smart wallet, and Phone Cash. Vodafone cash is the largest and the oldest mobile money player in the market.

The Government of Egypt has been a proactive supporter of Digital Financial Services, introducing mobile money friendly regulations early on. Over the past three years, there has been a growing interest in moving Egypt from a cash-based economy to a cashless economy. The mobile money service providers are licensed by the financial regulator and telecommunication regulator including Anti-Money Laundering (AML), combating the finance of terrorism (CFT), and know your customer (KYC) regulations.

This research aims to identify the determinants of mobile money adoption in Egypt. A number of questions arises from the main question, which include defining the macroeconomic determinants and regulatory specific determinants of mobile money adoption.

2. Literature Review

Mobile money is a topic, which is evolving rapidly as new entrants to the market are introduced with new technologies and applications. Some of the applications fail, some succeed, and some success stories are tried to repeat in other economic areas. This part aims to select list of variables to use them in the process of analyzing the critical determinants influencing adoption of mobile money services. Earliest applications for mobile money were implemented already in the early 21st century, however, only during the last five years, the mobile money has been able to take foothold and generate an ecosystem profitable for the service provider and useful for the people and businesses using the service, especially in developing countries.

Therefore, the mobile money in its current form is relatively new study topic, so the number of scientific articles concentrating directly on the latest breakthroughs is limited. However, there are numerous articles, reports and white papers from promoters group, such as GSM Association (GSMA) Mobile Money for the Unbanked, and researches funded by Non-Governmental Organizations (NGOs), such as World Bank, International Financial Corporation (IFC), Bill & Melinda Gates Foundation, and Consultative Group to Assist the Poor (CGAP), which are supporting the improvement of the lives of the poor and financial inclusion.

Literature review is conducted over the different case studies and reports regarding the status of available technologies and ecosystems around mobile payment and mobile money services.

2.1 Dependent Variables

❖ Mobile money registered/ Active Subscribers Ratios

The mobile money adoption significant indicators are the registered mobile money customer base and the active customer base. The registered mobile money base growth depends on the service provider's distribution network, number of existing mobile money service providers, and the existing regulations for registration requirements including the KYC processes.

The activity of the customers depends on the available mobile money services and the type of services that meet the customer needs in the developing countries such as mobile insurance, mobile saving, mobile credit, and cross border remittances.

2.2 Determinants of mobile money adoption

❖ GSMA Mobile Money Regulation Index

Country's regulatory framework is key enabler for widespread mobile money adoption. Adopting flexible regulation will help in improving the service such as adopting flexible agent regulation to improve the accessibility; using ease KYC requirements to facilitate the registration process to widespread mobile money services (Juliet Maina, 2018). In addition, facilitating an effective working relationship with all mobile money regulators is an important driver for all mobile money services; the most common regulators in the emerging markets are the financial and telecommunication regulators (Rajiv Lal, Ishan Sachdev, 2015). Given the focus on

regulation, the indicators must capture features of the regulatory framework that governments and central banks have direct control over such as Authorization, Consumer Protection, transaction limits, KYC, and Agent Network. The mobile money regulatory index has been constructed according to the previous indicators as a measure for the mobile money adoption in all countries (GSMA Intelligence, 2018).

❖ **Distribution Network**

Mobile money services face a critical challenge of improving service quality to attract and retain customers through the efficiency and the cleanliness of the agents. (Mussime David, Alinda Fred, 2016). Beside the mobile money operator's outlets availability, scaling the agent network is a mandatory to distribute the MNOs services to customers. Agents are typically either retail directly owned by the Operator or small independent stores, which have been signed up by the Operator. Agents are typically located in close proximity to the customers they will serve, and provide services including account registration, cash-in / cash-out, and OTC transactions, in addition to potentially helping market the service and educate customers. Thus, agents are the primary way in which customers interact with the system (Rajiv Lal, Ishan Sachdev, 2015). The most important factors to increase the mobile money adoption through the agent network, Firstly, facilitate cash-in / cash-out to enhance the ability of putting cash into a mobile money service (i.e. convert their physical cash into e-money) and to withdrawing cash from the service (i.e. convert their e-money into physical cash), with an convenient way anytime and anywhere. Secondly, ensuring that the agents are responsible for having enough physical cash and e-money to facilitate the customer transactions they need to perform (Rajiv Lal, Ishan Sachdev, 2015). Consequently, scaling an agent network is significant in our mobile money adoption model.

❖ **Lack of safety**

Lack of safety plays a significant role in influencing customers to use the mobile money services instead of having cash all the time (Ronald Baganzi, Antonio K. W. Lau*, 2017). In addition, Safekeeping of customer cash refers to ensuring that cash that customers put into the mobile money system are stored successfully and more secure (Rajiv Lal, Ishan Sachdev, 2015). For customers, mobile money provides a safer, more efficient and more convenient payment option than cash, saving travel time and costs and reducing the risk of theft (GSMA, 2017).

❖ Pricing/ tariff

There are many tariffs employed by mobile money services, however they are typically all either transaction-based or involve fees charged to customers. The tariffs are chosen in order to encourage customers' different behaviors to use their services and to encourage them to put money into the system, such as charging higher fees to individuals who are not registered users, to encourage them to become customers (Rajiv Lal, Ishan Sachdev, 2015). In addition, the Mobile Money fees includes transaction price, registration fee, or cost of a new device if one is needed to use the service. The transactional cost influence the customer to use the MM services (Peter Tobbin, John K. M. Kn worm, 2011).

The charges of the services vary according to type of transactions and generally increases with the amount. Withdrawal of cash and P2P transfers within the same operator are generally the cheapest type of transactions. The fees are fixed, and often for free. They are usually displayed at the retail shops. Fees are charged from the user's account, deduced from the e-money that is being transacted (Gosavi, 2015; Mas and Ng'weno, 2012). The cost of mobile money services is generally cheaper than the alternatives: cash is the cheapest alternative but inhibits risks of theft; bank accounts are often unavailable because of high interest rates; checks are time consuming taking up to five days to be processes. All services carry high alternative costs in terms of travel time and/or waiting time, generally due to lack of accessibility and geographic reach (Jensen Alnes, K., 2017). This difficulty in understanding the tariff of sending money could become a barrier to mobile money adoption in different countries.

❖ GDP (Nominal)

GDP per capita explains 73% of financial inclusion in relatively wealthy nations, but only 15% in poorer nations (Allen et al., 2016). There is an evidence of a positive link between mobile money remittances and financial development because demand for savings and credit is a function of household income. Given the high dependency on remittances in developing nations, remittances likely drive a higher adoption rate of mobile money (Ricardo Martinez-Cid, Gonzalo Pernas, 2017).

In addition, There is a positive insignificant correlation between economic growth and mobile money transfer because the mobile money industry improving individual living standards by availing job opportunities to citizens, lowering cost of sending and receiving money, and mobile money create a platform for business startups and improving country financial inclusion position (Adano Duba Habane, 2012).

❖ **Education**

Education is another significant factor for the adoption of the mobile money in the developing countries due to low levels of education because of poverty. In addition, Most of the customers informed about how during their first visit to the shop, they were given a walk through tutorial on how to use mobile money and do not explore the rest of the mobile money application. Lack of awareness considered a barrier to mobile money adoption in the developing countries (Sarah Yu, Samia Ibtasam, 2018). Lack of Customer Support to help customers with questions about the service, problems with transactions, or other concerns leads to lack of trust in the mobile money services (Rajiv Lal, Ishan Sachdev, 2015).

❖ **Number of Mobile Money Service Providers**

The providers who offer mobile money service create competitive landscape in the markets that reflects directly on the adoption of the mobile money services (Jensen Alnes, K., 2017, GSMA, 2017). Moreover, a reliable mobile network is a critical component of a mobile money service, as customers have much less patience for transmission problems when they influence financial transactions (Rajiv Lal, Ishan Sachdev, 2015).

❖ **Banking Penetration**

The banking financial systems are considered deficient in the developing countries due the the existing of high levels pf poverty. However, the competition among the commercial banks has expanded the sector and improved efficiency, but the interest rates remain high due to the risk of fraud and lack of collateral (Jensen Alnes, K., 2017). World Bank indicating that only 54% of adults in developing countries have a bank account (Demuric-Kunt et al., 2015) and others using informal financial ways to perform any financial transactions (Fanta, A.B., Mutsonziwa, K., Goosen, R., Emanuel, M. and Kettles, N., 2016).

❖ **Mobile Money balance/transaction limits**

Regulation transaction limits should be addressed based on risk assessment and introducing limits on the value and frequency of transactions, along with other limits due to functionality to facilitate and retain all types of customer needs. The mobile money regulation transaction limits have two important indicators the first one is the maximum allowed mobile money account balance limit. The second indicator is the maximum allowed daily/ monthly mobile money transaction limits across the mobile money services offered in the country (GSMA, 2018).

3. Methodology

This research is quantitative in nature. The variables considered in this study have already been used for the empirical studies conducted for various countries' context. The research uses quantitative method as it aims to extract a particular model for mobile money adoption determinants in Egypt.

The quantitative analysis starts with a descriptive statistics analysis for all the dependent and explanatory variables used in this research. Then, a linear regression model was fitted for each dependent variable of the mobile money adoption using the nine explanatory variables. The regression model is used to define the relationship between the dependent variables as a measure of mobile money adoption and the determinants (explanatory factors) of mobile money adoption.

3.1 Variables

As discussed before in the literature review, mobile money adoption is affected by several factors that includes country specific characteristics, regulatory considerations, and service provision characteristics. Consequently, the appropriate independent variables were selected to be included in this research using literature review. Similarly, two dependent variables are chosen to present the mobile money adoption, these are registered subscribers ratio and active subscribers ratio. These two dependent variables were selected because it is believed that determinants affecting each of these dependent variables differs, and even the same factors affecting both differ in their

impact on each of them in terms of direction, magnitude and significance. Figure 1 represent the dependent and explanatory variables used in this research.

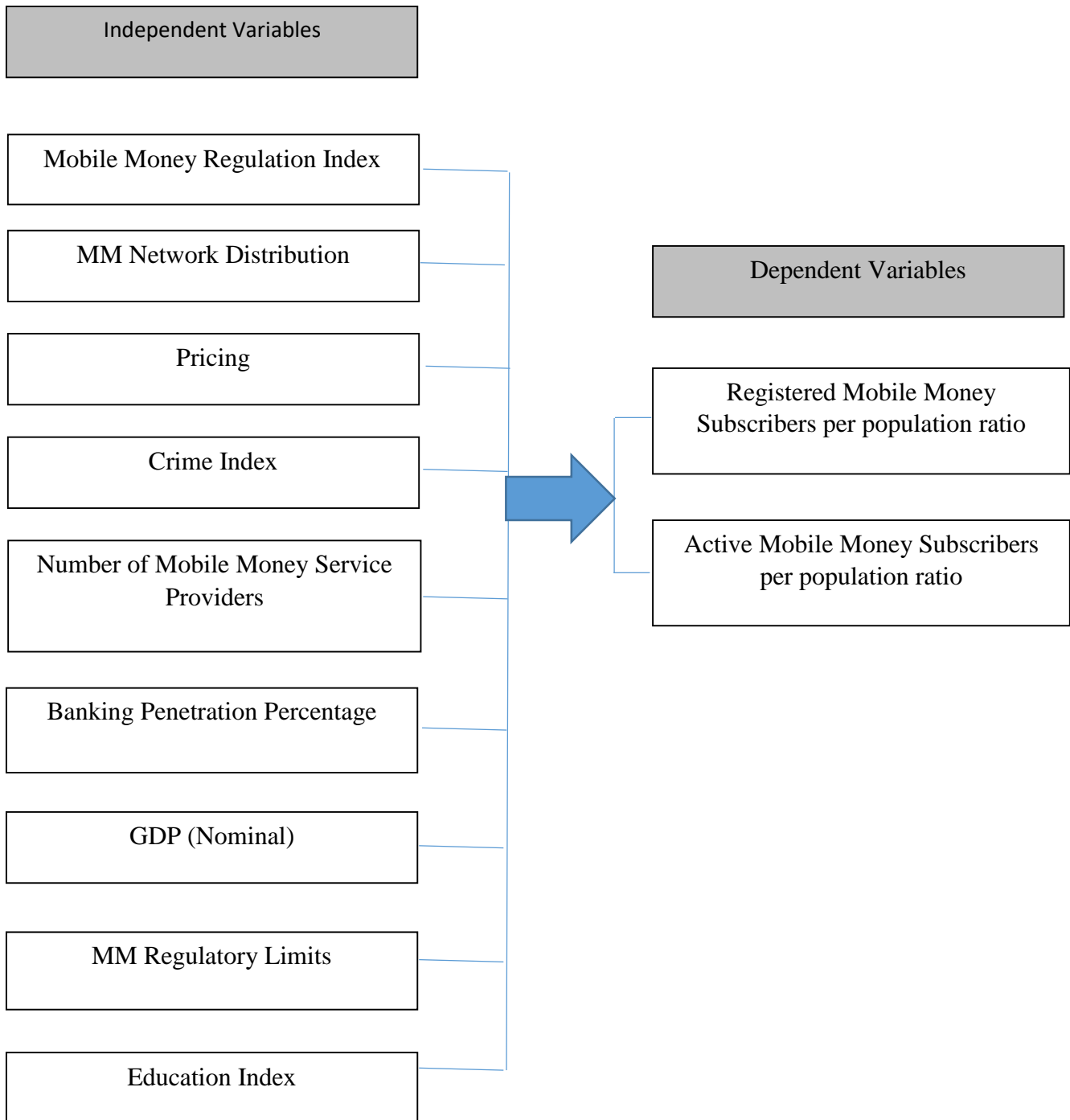


Figure 1: Variables used in the mobile money adoption model

Table 1 present the definition of dependent variables and explanatory variables.

Table 1: Summary of variables used in the mobile money adoption model

Dependent Variables	Definition	Source	
Registered Mobile Money Subscribers per population (RSR)	The cumulative number of mobile money accounts since the service launching till 2017 calculated per each country population	Central Bank of each country and World Bank population data per year	
Active Mobile Money customer accounts per population (ASR)	Number of customer accounts that have been used to perform at least one transaction during the last 30 days.	Central Bank of each country and World Bank population data per year	
Independent Variables	Definition	Source	Expected Relation
Mobile Money Regulation Index (REG)	The Mobile Money Regulatory Index score countries based on the extent to which their regulatory framework enables mobile money adoption.	GSMA Mobile Money Metrics Website	+
Mobile Money Network Distribution (DIST)	The cumulative number of mobile money agent outlets per population	Central bank of each country and World bank data for population per year	+
Crime Index (CRIME)	Crime Index is an estimation of overall level of crime in a given city or a country	NUMBEO crime index website	+

Pricing for MM services (PRICE)	The existing tariff for mobile money P2P services in each country	MNOs website for each country	-
Nominal GDP (GDP)	GDP per capita is gross domestic product divided by midyear population. GDP per capita is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products	World Bank national accounts data, and OECD National Accounts data files	-
MM Regulatory Limits (LIMIT)	Represents the allowed maximum account balance and maximum transaction limits for mobile money services per GDP per capita	World Bank, and Central bank of each country	+
Education Index (LIT)	Calculated using Mean Years of Schooling and Expected Years of Schooling	UNDP, Human Developments Reports	+/-
Banking Penetration percentage (BANK)	Total number of banking accounts to the total number of adults	World Bank: The Global Findex Database 2017	+/-
MM Service providers (COMP)	Number of mobile money service providers in each country	GSMA and countries central banks data	+

3.2 Data collection

This study uses data obtained from several databases to cover the period from 2013 to 2017. First, dependent variables (number of registered mobile money accounts and active mobile money customers) are extracted from central banks database for each of the selected developing countries.

Concerning the independent variables (GDP, education index, crime index, Network distribution per population, Banking penetration ratio, and number of service providers in each country) are collected from World Bank databases, GSMA mobile money regulatory index, GSMA mobile money metrics and other indexes databases.

The data used in this research is a panel data as it is both cross-section (different countries in same year) and time series (same countries for the period from 2013 to 2017).

3.3 Research Hypothesis

Based on the above discussion, the following hypotheses were set to be tested:

H1: There is a significant relationship between mobile money adoption determinants defined earlier and registered subscribers ratio.

H1/1: There is a significant positive relationship between mobile money distribution network penetration and registered subscribers ratio.

H1/2: There is a significant negative relationship between mobile money fees (prices) and registered subscribers ratio.

H1/3: There is a significant positive relationship between government regulations index and registered subscribers ratio.

H1/4: There is a significant positive relationship between mobile money account limits and registered subscribers ratio.

H1/5: There is a significant positive relationship between number of mobile money service providers and registered subscribers ratio.

H1/6: There is a significant positive relationship between country crime index and registered subscribers ratio.

H1/7: There is a significant negative relationship between country literacy level and registered subscribers ratio.

H1/8: There is a significant relationship between country GDP and registered subscribers ratio.

H1/9: There is a significant relationship between bank penetration and registered subscribers ratio.

H2: There is a significant relationship between mobile money adoption determinants defined earlier and active subscribers ratio.

H2/1: There is a significant positive relationship between mobile money distribution network penetration and active subscribers ratio.

H2/2: There is a significant negative relationship between mobile money fees (prices) and active subscribers ratio.

H2/3: There is a significant positive relationship between government regulations index and active subscribers ratio.

H2/4: There is a significant positive relationship between mobile money account limits and active subscribers ratio.

H2/5: There is a significant positive relationship between number of mobile money service providers and active subscribers ratio.

H2/6: There is a significant positive relationship between country crime index and active subscribers ratio.

H2/7: There is a significant negative relationship between country literacy level and active subscribers ratio.

H2/8: There is a significant relationship between country GDP and active subscribers ratio.

H2/9: There is a significant relationship between bank penetration and active subscribers ratio.

3.4 Research Model

❖ **Registered subscriber ratio (RSR):**

$$RSR = C + \beta_1(DIST) + \beta_2(PRICE) + \beta_3(REG) + \beta_4(LIMIT) + \beta_5(CRIME) + \beta_6(GDP) + \beta_7(LIT) + \beta_8(BANK) + \beta_9(COMP) + \varepsilon$$

❖ **Active subscriber ratio (ASR):**

$$ASR = C + \beta_1(DIST) + \beta_2(PRICE) + \beta_3(REG) + \beta_4(LIMIT) + \beta_5(CRIME) + \beta_6(GDP) + \beta_7(LIT) + \beta_8(BANK) + \beta_9(COMP) + \varepsilon$$

4. Results and Discussion

4.1 Registered subscriber ratio (RSR)

Using multilinear regression analysis, the relation between registered subscriber ratio (RSR) and the mobile money adoption determinants specified earlier in this paper was found. Several tests were applied on sample data which include randomness, multicollinearity, auto correlation, heteroskedasticity and heterogeneity and eventually the least square method (LS) estimator was the appropriate regression method and was selected in the analysis. The analysis was done using Eviews due to its high capability in the analysis of panel data.

First, the correlation matrix between all the variables had been extracted. It was clear that registered subscribers ratio has a strong positive correlation with distribution networks, regulatory index, banking penetration and number of service providers while RSR had a strong negative correlation with service fees (price), literacy level and GDP. It is to be noted that RSR has a very weak positive correlation with crime index and accounts financial regulatory limits.

Table 2: correlation matrix between variables and RSR

	RSR	DIST	PRICE	REG	LIMIT	CRIME	GDP	LIT	BANK	COMP
RSR	1.000	0.820	-0.828	0.721	0.121	0.028	-0.519	-0.618	0.325	0.545
DIST	0.820	1.000	-0.586	0.731	-0.049	-0.162	-0.201	-0.381	0.428	0.304
PRICE	-0.828	-0.586	1.000	-0.765	-0.374	0.044	0.754	0.626	-0.638	-0.246
REG	0.721	0.731	-0.765	1.000	0.183	-0.043	-0.455	-0.254	0.706	0.443
LIMIT	0.121	-0.049	-0.374	0.183	1.000	-0.292	-0.814	-0.597	-0.049	0.204
CRIME	0.028	-0.162	0.044	-0.043	-0.292	1.000	0.179	0.321	0.180	0.376
GDP	-0.519	-0.201	0.754	-0.455	-0.814	0.179	1.000	0.749	-0.290	-0.174
LIT	-0.618	-0.381	0.626	-0.254	-0.597	0.321	0.749	1.000	-0.032	0.036
BANK	0.325	0.428	-0.638	0.706	-0.049	0.180	-0.290	-0.032	1.000	0.476
COMP	0.545	0.304	-0.246	0.443	0.204	0.376	-0.174	0.036	0.476	1.000

The results of regression analysis using registered subscriber ratio (RSR) as a dependent variable are represented in [Table 3](#). In column (1), all the nine explanatory variables (determinants) are

used. It was clear that banking penetration and crime index variables have insignificant relations with RSR; this supports the finding from the correlation matrix presented above. In column (2), crime index and banking penetration variables were excluded from the nine explanatory variables. It was clear that the regulatory index variable has an insignificant relation with RSR. In column (3), the regulatory index variable was also excluded, resulting in six explanatory variables. It was clear that this model has the highest adjusted R² and all its six explanatory variables have significant relations with RSR.

Using the model of column (3), it was clear that the distribution network penetration has a significant positive effect on the registered subscribers' ratio (RSR). An increase of one unit in distribution network penetration induces an increase with 6.97% unit in RSR. Also, the number of service providers has a significant positive effect on RSR. An increase of one service provider induces an increase with 4.5% unit in RSR.

However, mobile money service fee (price) has a significant negative effect on RSR. An increase of one unit in service price induces a decrease with 16.2% unit in RSR. Also, level of education (literacy) has a significant negative effect on RSR. An increase of one tenth in education level induces a decrease with 18.7% unit in RSR. Also, GDP has a significant negative effect on RSR. An increase of one unit in GDP (logarithm) induces a decrease with 51% unit in RSR. Finally, financial regulatory limits have a significant negative effect on RSR. An increase of one unit in account limits induces a decrease with 6% unit in RSR.

It is clear from the results that distribution network distribution, service price and numbers of service providers have the most significant effect on RSR. It is to be noted that these findings support the expected results; however, the financial regulatory limit has a negative effect on RSR which does not match our expected results. This could be related to the fact that the account limits decrease in the countries with higher fraud risks. In these environments, mobile money may be the appropriate financial method adopted by the country citizens, and this would result in higher mobile money adoption in these countries.

Table 3: Results of regression model for Registered subscriber ratio (RSR)

	(1)	(2)	(3)
X1(DIST)	0.078777**	0.069911***	0.069778***
	0.0011	0.0016	0
X2(Price)	-0.14191	-0.162744	-0.162251*
	0.1972	0.111	0.0631
X3(REG)	0.000388	-0.000018	
	0.8361	0.9922	
X4(LIMIT)	-0.05086***	-0.060447***	-0.060477***
	0.0077	0.0004	0.0002
X5(CRIME)	0.002472		
	0.1312		
X6(GDP)	-0.46764*	-0.513248*	-0.512959**
	0.0771	0.0513	0.0459
X7(LIT)	-1.89447***	-1.867937***	-1.871781***
	0.0062	0.0063	0.0007
X8(BANK)	-0.01561		
	0.9322		
X9(COMP)	0.030037	0.045905***	0.045893***
	0.1467	0.0037	0.003
Intercept	2.679146***	2.959995***	2.960268***
	0.0013	0.0003	0.0002
Adjusted R-squared	0.913466	0.911288	0.914456
S.E. of regression	0.091714	0.09286	0.091187
Durbin-Watson	1.03642	1.089875	1.088195
F-statistic	40.87876	50.89495	61.57636
Prob (F-stat)	0	0	0

This table presents multilinear regression results of the determinants of Registered subscribers ratio (RSR). *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

4.2 Active subscribers ratio (ASR)

Similar to the analysis of registered subscriber ratio and using multilinear regression analysis, the relation between active subscribers ratio (ASR) and the mobile money adoption determinants specified earlier in this paper was found. In addition, the least square method (LS) estimator was selected as the appropriate regression method.

First, the correlation matrix between all the variables had been extracted. It was clear that active subscribers' ratio has a strong positive correlation with regulatory index, banking penetration, distribution networks and number of service providers while ASR had a strong negative correlation with literacy level, GDP and service fees (price). It is to be noted that ASR has a very weak positive correlation with accounts financial regulatory limits. It was clear that ASR and RSR have a similar direction of correlation with the explanatory variables however, the magnitude of the correlation differs as it was noticed that the distribution networks have the strongest positive correlation with RSR while regulatory index has the highest positive correlation with ASR.

Table 4: correlation matrix between variables and ASR

	ASR	DIST	PRICE	REG	LIMIT	CRIME	GDP	LIT	BANK	COMP
ASR	1.000	0.595	-0.772	0.706	0.111	0.249	-0.538	-0.342	0.700	0.369
DIST	0.595	1.000	-0.586	0.731	-0.049	-0.162	-0.202	-0.382	0.428	0.304
PRICE	-0.772	-0.586	1.000	-0.765	-0.374	0.044	0.755	0.627	-0.638	-0.246
REG	0.706	0.731	-0.765	1.000	0.183	-0.043	-0.456	-0.254	0.706	0.443
LIMIT	0.111	-0.049	-0.374	0.183	1.000	-0.292	-0.814	-0.598	-0.049	0.205
CRIME	0.249	-0.162	0.044	-0.043	-0.292	1.000	0.180	0.322	0.180	0.376
GDP	-0.538	-0.202	0.755	-0.456	-0.814	0.180	1.000	0.749	-0.291	-0.175
LIT	-0.342	-0.382	0.627	-0.254	-0.598	0.322	0.749	1.000	-0.033	0.037
BANK	0.700	0.428	-0.638	0.706	-0.049	0.180	-0.291	-0.033	1.000	0.476
COMP	0.369	0.304	-0.246	0.443	0.205	0.376	-0.175	0.037	0.476	1.000

The results of regression analysis using active subscriber ratio (ASR) as a dependent variable are represented in Table 5. In column (1), all the nine explanatory variables (determinants) are used. It was clear that account regulatory limit, service price and regulatory index variables have

insignificant relations with ASR. In column (2), account regulatory limit variable was excluded from the nine explanatory variables. It was clear that service price and regulatory index variables still have an insignificant relation with ASR. In column (3), the service price variable was also excluded resulting in seven explanatory variables, and it was clear that this model has the highest adjusted R2 and all its seven explanatory variables have significant relations with ASR.

Using the model of column (3), it was clear that the distribution network penetration has a significant positive effect on the active subscribers' ratio (ASR). An increase of one unit in distribution network penetration induces an increase with 4.7 % unit in ASR. In addition, crime index has a significant positive effect on ASR. An increase of one unit in crime index induces an increase with 0.343 % unit in ASR. Education level also has a significant positive effect on ASR. An increase of one tenth in education level induces an increase with 5.6 % unit in ASR. Regulatory index also has a significant positive effect on ASR. An increase of one unit in regulatory index induces an increase with 0.39 % unit in ASR. Finally, bank penetration also has a significant positive effect on ASR. An increase of one tenth in bank penetration induces an increase with 2.7 % unit in ASR.

However, number of service providers has a significant negative effect on ASR. An increase of one service provider induces a decrease with 1.9 % unit in ASR. Also, nominal GDP has a significant negative effect on ASR. An increase of one unit in GDP (logarithm) induces a decrease with 37.6 % unit in ASR.

It is to be noted that these findings support the expected results however; the number of service providers has a negative effect on ASR which does not match the expected results. This could be related to a statistical problem related to auto correlation of variables or to the fact that number of service providers does not vary much over the sample data, especially knowing the correlation between ASR and number of service provider was positive with a weak correlation factor.

Table 5: Results of regression model for Active subscribers ratio (ASR)

	(1)	(2)	(3)
X1(DIST)	0.039657***	0.046938***	0.046927***
	0.0061	0.0011	0.0007
X2(Price)	0.023422	0.000245	
	0.7278	0.9971	
X3(REG)	0.000563	0.000955	0.003957*
	0.6296	0.4177	0.09799
X4(LIMIT)	-0.017363		
	0.1238		
X5(CRIME)	0.00273**	0.003435***	0.003434***
	0.0103	0.0008	0.0003-
X6(GDP)	-0.551107***	-0.37689***	-0.37669***
	0.0018	0.0033	0.0009
X7(LIT)	0.489568	0.568415	0.568872*
	0.225	0.169	0.09407
X8(BANK)	0.202155*	0.277237**	0.277028***
	0.0854	0.0143	0.0037
X9(COMP)	-0.008485	-0.01964*	-0.01962**
	0.5021	0.0755	0.0465
Intercept	1.406156***	0.773434***	0.772964***
	0.0051	0.0029	0.0004
Adjusted R-squared	0.790203	0.777808	0.796038
S.E. of regression	0.056976	0.058635	0.056539
Durbin-Watson	1.673564	1.617094	1.686824
F-statistic	15.22908	15.87764	18.84379
Prob (F-stat)	0	0	0

This table presents multilinear regression results of the determinants of Active subscribers ratio (ASR). *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

5. Conclusion

The testing of the first hypothesis was executed and this hypothesis was accepted with the following findings:

- Significant positive relationship between registered subscribers ratio and the following:
 - Mobile money distribution network penetration
 - Number of service provider.
- Significant negative relationship between registered subscribers ratio and the following:
 - Mobile money fees (PRICE).
 - Level of education (LIT)
 - Nominal GDP (GDP)
 - Mobile money account limits (LIMIT)
- No significant relationship between registered subscribers ratio and the following:
 - Crime Index (CRIME)
 - Banking penetration (BANK)
 - Regulation index (REG)

The testing of the second hypothesis was done and this hypothesis was accepted with the following findings:

- Significant positive relationship between active subscribers ratio and the following:
 - Mobile money distribution network penetration (DIST)
 - Crime Index (CRIME)
 - Banking penetration (BANK)
 - Level of education (LIT)
 - Regulation index (REG)
- Significant negative relationship between active subscribers ratio and the following:
 - Nominal GDP (GDP)

- Number of service provider (COMP).
- No significant relationship between active subscribers ratio and the following:
 - Mobile money fees (PRICE).
 - Mobile money account limits (LIMIT)

Table 6 includes a summary of the results of the hypotheses testing.

Table 6: Summary of the results of hypotheses testing

	Hypotheses	Decision
H ₁	There is a significant relationship between mobile money adoption determinants defined earlier and registered subscribers ratio	Accepted
H ₂	There is a significant relationship between mobile money adoption determinants defined earlier and active subscribers ratio	Accepted

5.1 Contribution of the Research

This research contributes to the research and literature in mobile money determinants in different ways. First, this research covers the period between 2013 and 2017, to the researchers' knowledge, there is no other research regarding mobile money adoption determinants that covers this recent period.

Second, this research apply panel data analysis, this enhanced the results as this had resulted in 35 observations and took into account the evolution of mobile money during the last five years.

Third, this research used two different measures for mobile money adoption which are the registered subscribers' ratio and active subscribers' ratio. The registered subscribers ratio would provide an indicator for the subscription penetration of mobile money, however this indicator is not appropriate to account for the actual usage of mobile money. It is believed that active subscribers ratio resemble the usage penetration of mobile money.

5.2 Limitation of the Research

Some limitations concerning this research should be taken into consideration. First limitation arises from the size of the sample. The sample contains seven countries however these countries are the most successful countries in applying mobile money and they are African countries which could be helpful when applying the research results on Egypt. Research findings and results could differ when using a larger sample that includes more countries.

Second limitation is the sample period. This research sample covers five years from 2013 to 2017. It is believed that longer period would provide more robust results, however, the fact that mobile money life time is limited should be taken into consideration and the fact that mobile money determinants could change with time.

5.3 Implications of the Research

This research provides a model for mobile money adoption in different countries especially African countries. This could be a guide for policy makers in those countries in developing their policies concerning financial inclusion and mobile money. In addition, the results of this research could be very helpful to the management of the companies working in the mobile money sector when defining their decisions and strategies that are needed to foster mobile money adoption.

5.4 Suggestion for Future Research

Suggestions of future research includes many areas. A field of research could be the inclusion of more countries from different continents in the analysis. It is believed that increasing the sample size would provide more accurate results.

Another field of research could be the inclusion of new variables to measure mobile money adoption. This research uses the registered and active subscribers ratios as measures of mobile money adoption, however, a measure for transaction values could be included to enhance the decisions regarding mobile money adoption as raising the registered and active subscribers base is not enough as raising transactions size could be also a target.

Another field of research could be including more determinants for mobile money adoption. It is believed that there may exist other determinants that may affect mobile money adoption. One of

these determinants is the number and type of mobile money services provided. Countries allowing payment services, international remittance and credit services could raise mobile money adoption than countries that are not allowing such services.

5.5 Concluding Remarks

This research main objective was to explore the mobile money adoption determinants in different countries especially the African countries. It was evident from the analysis that the determinants affecting the registered subscribers ratio is slightly different from that affecting the active subscribers ratio.

These results could be used to set a governmental policy to foster mobile money adoption in Egypt. The effect of each determinant on mobile money adoption was calculated and determined in this research. The determinants could be categorized into two main categories, the first category can be directly controlled by mobile money policy which are the distribution networks, regulations, financial regulatory limits, number of service providers and mobile money fees. Using this category, the government targets for mobile money could be broken down into targets concerning each determinant. This can be done knowing the benefits that can be achieved from changing each determinant through the model and the costs that are incurred in it.

The second category includes determinants that cannot be directly controlled by mobile money policy which are GDP, crime index, literacy and banking penetration. Knowing the effect of these determinants, mobile money policy maker can predict the futuristic effect of these determinants on the proposed policy.

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