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The Relationship Between Electronic-Money Penetration and Household Consumption: *VECM Granger Causality Analysis*

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BOTSWANA INSTITUTE FOR DEVELOPMENT POLICY ANALYSIS

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ABSTRACT

The development and use of Electronic Money (e-money) remain one of the most discussed topics in developing countries, yet literature on the relationship between e-money penetration and household consumption remains negligible. Available literature confirms that e-money penetration has a significant impact on economic activity in both developed and emerging economies. In Botswana, the advancement of e-money is highly associated with the forces of consumer demand and the supply of e-money products in the market. However, the impacts of e-money on household consumption are not known. This paper, therefore, examines the causal link between e-money (EM) penetration and Household Consumption (HC) using quarterly data over the period 2007-2017. The study uses Granger causality test based on the Vector Error Correction Model. The empirical results provide evidence of the causal impact of household consumption on e-money penetration in Botswana only in the short-run. In addition, the empirical results also confirm that if the use of electronic payment technologies is developed in the long-run, e-money penetration would predict household consumption in Botswana. It can be concluded that the growth impact of e-money on household consumption is still insignificant in Botswana, but in the long-run the use of e-money technologies can impact household consumption. It is therefore, important that the government and financial service providers continue to provide a more conducive environment to increase the electronic payment outlets.

Keywords: Causality; electronic money (e-money); household consumption

1. INTRODUCTION AND BACKGROUND

Over the past half a century, Information and Communication Technologies (ICTs) have not only transformed the mode of communication but have also changed the delivery of work, learning, education and even methods of achieving personal and collective goals. ICTs have significantly contributed to global household welfare through job creation, ease of service provision and increasing inclusivity in many sectors. In the financial and commercial industries, ICT has rigorously transformed the payment systems around the world. As for the case of retail payments market, debit and credit cards (e-money) have progressively complemented and replaced the usual paper-based payment system. Digital transactions are continuing to be of vital significance in economic transactions.

During 2008–2012, after the financial crisis, a study that was undertaken by Zandi *et al.* (2016) on 56 countries which constitute 93% of the world Gross Domestics Product (GDP), found that e-money penetration added about USD938 billion to the global economy, creating about 1.9 million jobs. The value of credit and debit card transactions continues to increase in developing, transitioning and developed economies. In emerging economies, the total number of Electronic Fund Transfer (EFTs) points increased by about 185% between 2004 and 2009 (Zandi *et al.*, 2016). The gap between cash and non-cash based payments is slowly closing especially in the western countries.

The value of debit and credit cards transactions to private consumption in developed countries was estimated at 28%, whereas in emerging economies it was estimated at 8.87%, (Sclpartner, 2013). As for African countries, the average contribution of electronic payments to GDP was reported at less than 1% (Zandi *et al.*, 2016). Many African countries are at the early stages of developing their financial systems with appropriate infrastructure to support electronic payments. South Africa, the most developed economy on the African continent, recorded an average of 0.18% increase in GDP associated with the use of e-money (Zandi, Singh, and Irving, 2013).

The benefits of digitizing financial transactions go well beyond their contribution to GDP; if provided efficiently and effectively, they can transform the economic lives of those who use the technology. E-money, whether provided by banks or non-bank institutions, seeks to fill the gap in the provision of financial services, particularly to the low-income earners, and increase accessibility of these services. At a micro level, the increased penetration of e-money has created opportunities and some pressures on households. For instance, Africans are expected to switch directly to the use of more advanced e-money technologies such as mobile and internet-based transactions given the high growth of mobile phones in the continent. Thus, access to financial services for low-income earners in Africa is expected to rise. On the other hand, the exposure to digital transactions presents new threats to the financial security of many families by making them more vulnerable to surveillance and increased spending, leaving many in debt (World Bank Development Research Group, 2014).

In Botswana, the advancement of e-money is highly associated with the consumer demand and supply of e-money products in the market. Bank of Botswana data indicate that in recent years, there has been some noticeable increase in the use of electronic payment technologies, such as Automated Teller Machines (ATMs), EFT at Point of Sale (POS) (EFTPOS), debit cards and credit transfers/cards. The statistics show that between 2006 and 2016 the number of ATMs in Botswana doubled. In addition, Motsatsi (2016) found that financial technological innovation (ATMs and EFTPOS) has a positive effect on Botswana's economic growth through, among other things, increase in consumption. With regard to household consumption, the Botswana Household Income and Expenditure Survey (BHIES) 1993/94 & 2003/04 and the Botswana Core Welfare Indicators Survey (BCWIS) 2009/10 report a national average monthly household expenditure of around BWP1900 in 2003/04, an increase of 165%. Furthermore, in 2010, household consumption increased by 60% between 2004 and 2010 reporting years.

Even though there is knowledge on technological innovation and economic growth in Botswana, the direct relationship between e-money penetration and household consumption is not known. It is therefore important to have knowledge of the extent to which provision of electronic financial services can predict the future consumption patterns in Botswana. To our knowledge, a study on the causal relationship between e-money penetration and household consumption will be the first to be undertaken in Botswana. A study on the relationship between e-money and consumption is essential in expanding knowledge and coming up with relevant policies to guide and regulate the e-money industry.

The objective of this paper is to determine whether there is a causal relation between e-money and household spending in Botswana. Specifically, the paper adopted a Granger causality based on Vector Error Correction Model (VECM) to assess the causality between e-money penetration and household consumption in Botswana. The rest of the paper is organized as follows; Section 2 discusses the relevant literature. The methodology and description of data specification are discussed under Section 3. Sections 4 and 5 cover empirical results and conclusions respectively.

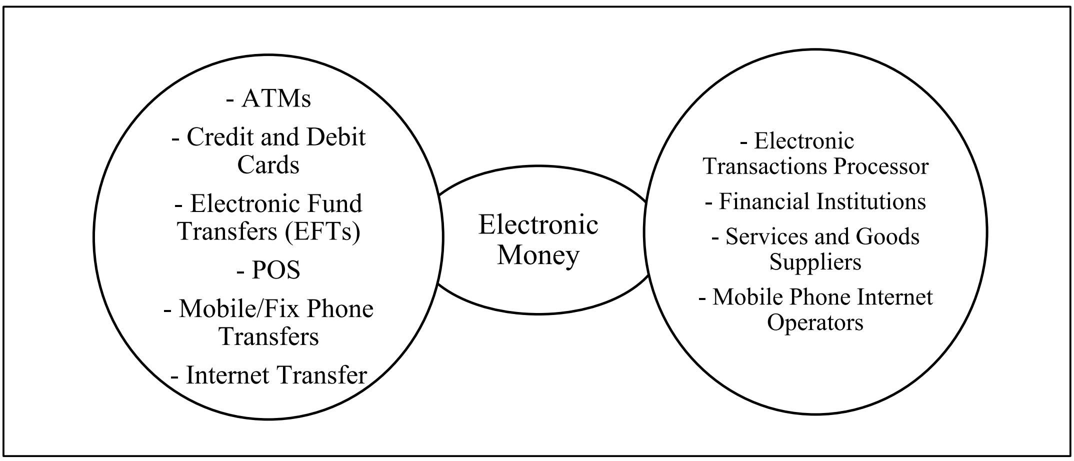
2. LITERATURE REVIEW

2.1 CONCEPTUALIZATION OF ELECTRONIC -MONEY

The term electronic-money is comprehensive, illustrating different dimensions of the electronic transfer channel. E-money could be viewed from its functions as mobile-payment, electronic-banking, online banking, internet banking, electronic-finance, electronic-payments, and electronic-transactions, just to mention the most commonly used. There are substantial attempts by researchers to define e-money. The European

Central Bank (1998) defines e-money generally as an electronic store of monetary value on some technical devices that may be commonly used for making payments without necessarily involving bank accounts in the transaction but acting as a prepaid holder instrument. Similarly, Fung, Molico, and Stuber (2014) define e-money as a monetary value stored in an electronic device that can be used to make payments. E-money is any payments and funds transfer services that make use of ICT, integrated circuit cards and cryptography, (Snellman, Vesala, and Humphrey, 2001; Oginni, 2013). Figure 1, summarizes the definition of e-money by its forms on the left-hand side and different channels of transfers of e-money on the right-hand side.

Figure 1: General Electronic Money Forms



Source: Adoption from Popescu, Popescu and Popescu (2015), with minor additions by the author

Jeffries (2004) defines e-money as part of a broad category of "electronic commerce", but distinct from e-banking: which refers to the provision of banking products and services through electronic delivery channels such as the internet or telephone. On the contrary, Bank of Botswana (2001) defines the forms of e-money as quasi-money (debit and credit cards), which are large composites of the electronic banking activities. In a nutshell, e-money is defined mainly by its medium of use and functions.

2.2 EMPIRICAL FINDINGS ON ELECTRONIC-MONEY AND CONSUMPTION

Despite the advanced developments of e-money, the literature on e-money and its impact on consumption is relatively new and has not been extensively studied both in developed and developing countries. However, there is somewhat extensive empirical knowledge on the advancements of e-money and economic growth. Economic growth measured through GDP is a function of consumption among other variables, therefore, a change in consumption normally has a direct impact on growth. Thus electronic payments contribute to economic development through the spreading of productive investment that can cause an increase in consumption, (Dupas and Robinson, 2009; Sclpartners, 2013; Slozko and Pelo, 2014).

Zandi, Singh, and Irving, (2013) found that card usage raised global consumption by an average of 0.7%, which contributed to an average additional growth in GDP of 0.17% per year to the global economy. Card usage in China increased from 31% in 2008 to an estimated 52% in 2012 which corresponded to an average of 4.9% increase in consumption during that period. In the same study declining card usage decreased consumption by 0.003% in Greece and 0.04% in Finland.

Based on retail payments data in Europe for all European countries over the period 1995-2009, Hasan *et al* (2012) provided evidence that transition to efficient electronic payment systems had a conducive impact on GDP, consumption, and trade. In particular, they found that the penetration and diffusion of ATMs and POS terminals had a positive impact on GDP. ATMs and POS terminals are intended to ease accessibility to funds by consumers and hence facilitate consumption.

In addition, POS terminals make payments more efficient, giving consumers, suppliers, and governments the confidence to transact securely. The IHS Global Insight and Visa Canada (2012) concluded that e-money supports the Canadian economic growth from consumer spending and by reducing costs for goods. On a similar note, Cassoni and Ramada (2013) concluded that in Uruguay, digital transactions methods such as debit and credit cards, online payments, vouchers and Short Message Service (SMS) transactions promote the financial inclusion of large population segments, thus, in turn, contribute to the economic activity. Similar conclusions were drawn by World Bank Development Research Group (2014) and Ho (2006) that rapid development and extension of digital platforms and payment systems provide the speed, security, transparency, and cost efficiency required to raise consumption of goods and services domestically as well as internationally.

In Malawi, a field rural experiment by Lasse *et al.* (2016) concluded that e-money technologies boosted farmer productivity, with farmers who participated in the experiment experiencing a 22% increase in revenues and a 17% increase in household consumption after the harvest. Likewise, in Uganda, Malawi, and Chile, the impact of e-money was significant on food security and consumption during drought periods (Dupas *et al.*, 2016). In Botswana, Motsatsi (2016) found that 1% increase in the EFTPOS and ATMs transaction values increased GDP by 0.09% in the long run and 0.05% in the short run. EFTPOS and ATMs provide payments systems that are efficient and cost-effective when compared to cash payments, hence they facilitate consumption of goods and services, which results to increased growth of the economy.

In contrast, a paper by Ramada-Sarasola, (2012), notes that despite the increased trade flows and consumption patterns in the rural areas of Kenya, which come as a result of the extensive affordable use of Kenyan mobile-money system known as M-Pesa, the benefits did not reflect much on the GDP. In Nigeria, only ATMs were found to have contributed positively to economic growth, while other e-payment channels contributed negatively towards economic growth (Oyewole *et al.*, 2013). The successful penetration of electronic payments has to be coupled with a well-developed financial system and a healthy economy. This is supported by conclusions from the study conducted by World Bank Development Research Group (2014) that e-money penetration in developing countries had a small increase on GDP than in the developed countries.

3. DATA AND METHODOLOGY

The objective of this paper is to analyse the causal link between e-money and household consumption. The paper, therefore, focuses on the bivariate Granger causality between the penetration of e-money and spending by households as a major analytical tool. This paper uses both the descriptive and bivariate Granger causality analysis to assess the causal link between e-money and household consumption. The descriptive analysis is essential in understanding the development trends of e-money penetration in Botswana. In addition, the descriptive analysis is beneficial in interpreting the findings of the causal research. A combination of causal and descriptive analysis is necessary for understanding "why" an intervention has a causal effect: a sound causal analysis can assess the effects of an intervention; and effective descriptive work can identify the characteristics of the population, the features of implementation, and the nature of the setting that is most relevant to interpreting the findings (Loeb *et al.,* 2017).

3.1 DATA

The paper uses quarterly time series data for the period 2007Q1 to 2017Q3. E-money (EM) penetration is measured as the total transactions value completed at the ATMs and EFTPOS, while household consumption (HC) is measured as the share of household final consumption to GDP at current prices. All variables were converted into logarithm form. The data was sourced from various Bank of Botswana publications.

3.2 UNIT ROOT TEST

To study the stationarity properties of time series, the Augmented Dickey-Fuller test (ADF) and the Philips-Perron (P-P) test are conducted. The ADF test checks for serial correlation by adding lagged values of explanatory variables, (Dickey and Fuller, 1981). The P-P unit root test uses a non-parametric method to take care of serial correlation in the error term without adding a lagged difference term, (Phillips and Perron, 1988). The P-P test estimates the modified t-value associated with the estimated coefficient so that serial correlation does not affect the asymptotic t distribution. The P-P test statistic can be viewed as ADF statistic that has been made robust to serial correlation by using the Newey-West test of heteroscedasticity and autocorrelation consistent covariance matrix estimator. The ADF test and P-P test involve estimating the regression as follows respectively,

$$\Delta X_t = \alpha + \rho t + \beta X_{t-1} + \sum_{i-1}^{m-1} \gamma_i \Delta X_{t-i} + \varepsilon_t, \tag{1}$$

$$\Delta X_t = \alpha + \beta X_{t-1} + \varepsilon_t, \tag{2}$$

In the above equations, α is the constant, ρ is the coefficient of time trend, ε_t, represents the white noise error term, $\Delta X_t = X_t - X_{t-1}$, X is the variable under consideration. In this case, the variables include log(EM), and log(HC). The test for a unit root is conducted on the coefficient of X_{t-1} in the above regression. If the coefficient, β, is found to be significantly different from zero (≠ 0), the null hypothesis that the variable X contains a unit root problem is rejected, implying that the variable does not have a unit root.

3.3 JOHANSEN COINTEGRATION TEST

The paper uses the Johansen maximum likelihood cointegration test (Johansen,1988) to determine long-run relationships among the variables being investigated (logEM and LogHC). In investigating causal relation, the Granger causality analysis is also executed. In order to obtain good results from the test, selecting the optimal lag length is important. The Johansen cointegration framework takes its starting point in the vector autoregressive (VAR) model of order p given by:

$$Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + BX_t + \varepsilon_t, \tag{3}$$

Where: Y_t is a vector of endogenous variables and X_t is the deterministic vector. A and B represents the autoregressive matrices and the parameter matrices respectively; t is a vector of innovations and p is the lag length. The Vector Autoregressive Model (VAR) can be re-written as:

$$\Delta Y_t = \prod Y_{t-1} + \sum_{i=1}^{p-1} \emptyset_i \Delta Y_{t-i} + BX_t + \varepsilon_t, \tag{4}$$

Where: $\prod = \sum_{i=1}^{p} A_i - I$ and $\emptyset_i = -\sum_{j=i+1}^{p} A_j$,

The Matrix $\prod$ has the information about the long-run coefficients of the Y_t variables in the vector. If all the endogenous variables in Y_t are cointegrated at order one, the cointegrating rank, r, is given by the rank of $\prod = \alpha\beta'$, where the elements of α are known as the corresponding adjustment of the coefficient in the VEC model and β

represents the matrix of parameters of the cointegrating vector. To indicate the number of cointegrating ranks, two likelihood ratio (LR) test statistics, namely the trace and the maximum Eigen value tests (Johansen, 1988), are used to determine the number of cointegrating vectors. The two tests are defined as:

$$\lambda trace = -F \sum_{i=r+1}^{m} log(1-\lambda_i), \text{ and} \quad (5)$$

$$\lambda max = -Flog(1-\lambda_{i+1}) \quad (6)$$

Where: λ_i denotes the estimated values of the characteristics roots obtained from the estimated $\prod$ and F is the number of observations.

Equation 5 statistic tests the null hypothesis that the number of the cointegrating vector is less than or equal to r against the alternative hypothesis of m cointegrating relations, where m is the number of endogenous variables, for r = 0, 1, …, m–1. The alternative of m cointegrating relations corresponds to the case where none of the series has a unit root. The second test tests – equation 6, tests the null hypothesis that the number of the cointegrating vectors is r, against the alternative hypothesis of 1 + r cointegrating vectors.

3.4 GRANGER CAUSALITY BASED ON THE VECM

In order to identify the long-run relationship among the series under study, the Johansen cointegration test must be done. However, the test does not indicate anything about the causal relation among the variables in the system, therefore, the Granger causality analysis must be done. If the series are cointegrated, the VECM-based Granger causality analysis is an appropriate technique used to determine the long-run and the short-run relationships (Engle and Granger, 1987). The VECM Granger causality is based on the following forms:

$$\Delta Log(EM)_t = \beta_{1,t} + \gamma_1 ECT_{t-1} + \sum_{i=1}^{n-1} \beta_{11,i} \Delta Log(EM)_{t-i} + \sum_{i=1}^{n-1} \beta_{12,i} \Delta Log(HC)_{t-i} + \varepsilon_{1t} \quad (7)$$

$$\Delta Log(HC)_t = \beta_{2,t} + \gamma_2 ECT_{t-1} + \sum_{i=1}^{n-1} \beta_{21,i} \Delta Log(HC)_{t-i} + \sum_{i=1}^{n-1} \beta_{22,i} \Delta Log(EM)_{t-i} + \varepsilon_{2t} \quad (8)$$

log(EM) and log(HC) denote the natural logarithms of e-money, and household consumption respectively. The coefficients of the ECT_{t-1} term indicate causality in the long run and the joint F-test of the coefficients of the first-differenced independent variables confirms short-run causality. Δ denotes the first-difference operator, while ε_{1t} and ε_{2t} are the stationary disturbance terms for equations (7) and (8) respectively. n is the order of the VAR, which is translated into lag of n–1 in the error correction mechanism. $\gamma_1$and γ_2 denote the coefficients of long-run Granger causality for equations (7) and (8) respectively. In equation (7), the coefficients of lagged value $\beta_{12,i}$ for i = 1, … n–1 represent short-run effects of HC on EM. In equation (8), the coefficients of lagged value $\beta_{22,i}$ for i= 1, … n-1 represent short-run effects of EM on HC. In this paper, the short-run causality is determined through the Wald test of the joint significance of lags of the independent variables, which is known as Granger causality test based on VECM. The approach has widely been used in financial development and economic growth causality models, (Sothan, 2017; Ntsosa, 2016; and Alhowaish, 2015).

4. EMPIRICAL RESULTS AND DISCUSSIONS

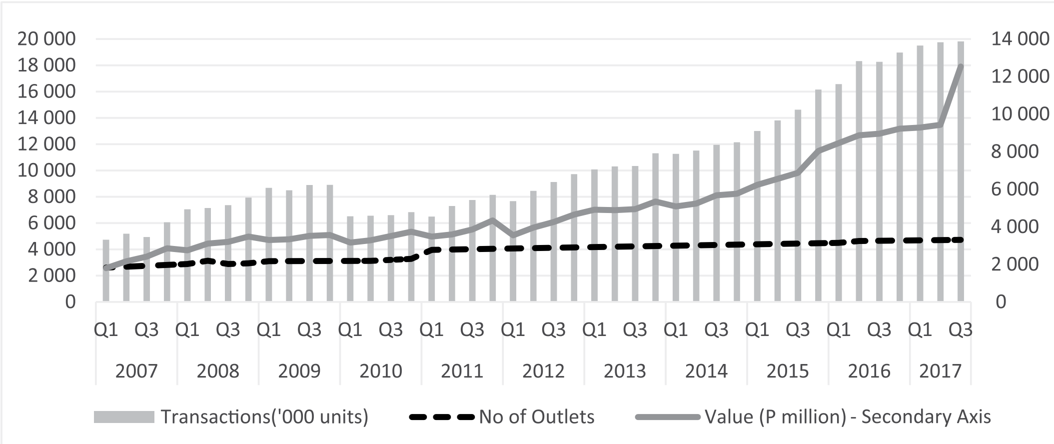
4.1 DESCRIPTIVE RESULTS

This section presents a descriptive analysis of the e-money technologies (ATMs, EFTPOS, and credit cards) graphically to demonstrate the trend in the growth of e-money. The choice to use ATMs and EFTPOS as a proxy for e-money on the empirical analysis was due to data availability. Even though data on credit cards is available from Bank of Botswana, the data was not included because Bank of Botswana started disaggregating the data only in 2011, thus the credit cards data did not cover the full study period. Data on other e-money products such as cellphone banking transactions, cellphone banking purchases, is regulated by Botswana Communications Regulatory Authority (BOCRA), and data was not available for the full study period. Data on smart cards was also omitted because the use of smart cards is not distinctly regulated by any authority in Botswana and the demand for smart cards is largely based on market demand and supply.

Figures 2 through 4 show the increase in e-money penetration and household consumption in Botswana. Over the study period, there has been a gradual increase in the number of outlets (ATMs and EFTPOS) from about 2620 outlets to 4728 outlets as indicated in Figure 2. The frequency and the value of transactions show a similar trend, in 2017Q3 the total value of transactions stood at more than BWP 12,536 million, an increase from BWP 9,284 million in 2017Q1. It is also important to note, that the graph shows a decrease in the value of transactions in every first quarter of the year. The transaction value of ATMs and EFTPOS form a repeating "seasonality" pattern. During the festive season (Q4) the value of transaction and the frequency of transaction increase and the following quarter (Q1 of the next year) the activity on transaction decreases.

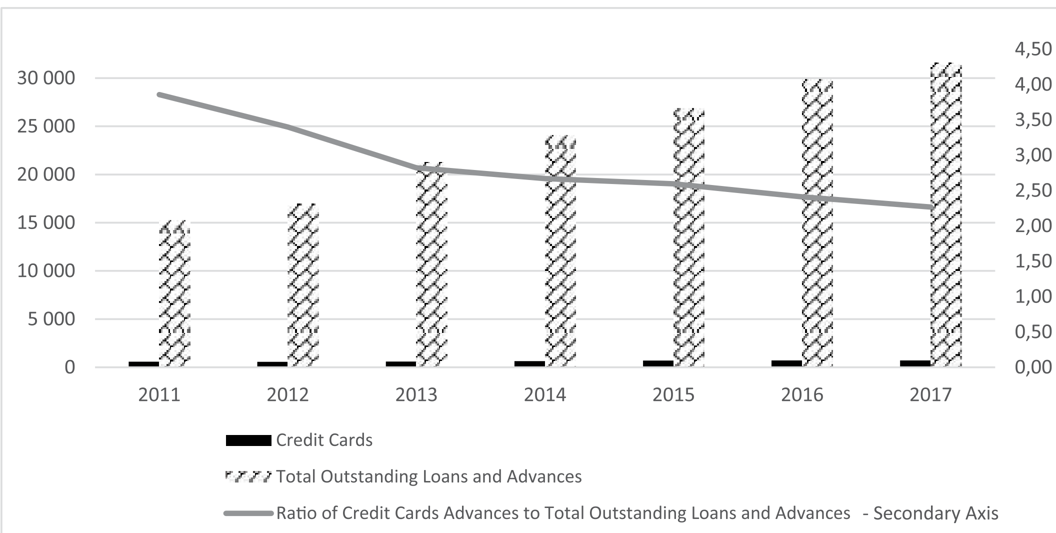
Along the increase in the penetration of ATMs and EFTPOS, the advances given to households by commercial banks have also increased. Figure 3, provides a graphical comparison of credit cards outstanding loans and advances and total outstanding loans and advances by households in Botswana. It is important to note here that, Bank of Botswana started disaggregating credit card outstanding loans from other unsecured loans in 2011. Credit card loans contribute the lowest share in comparison to other loans (vehicle, home and personal loans). Over the years the percentage share of the credit card outstanding loans to total outstanding loans has decreased from 3.86% to 2.27%. In other Bank of Botswana reports, the Bank reported a sharp rise in the household debt of 150%, between 2006 and 2016, of which a significant amount was driven by personal loans.

Figure 2: Number of Outlets, Number of Transactions and Value (in P Million) of Transactions at ATMs and EFTPOS in Botswana



Source: Bank of Botswana, 2017

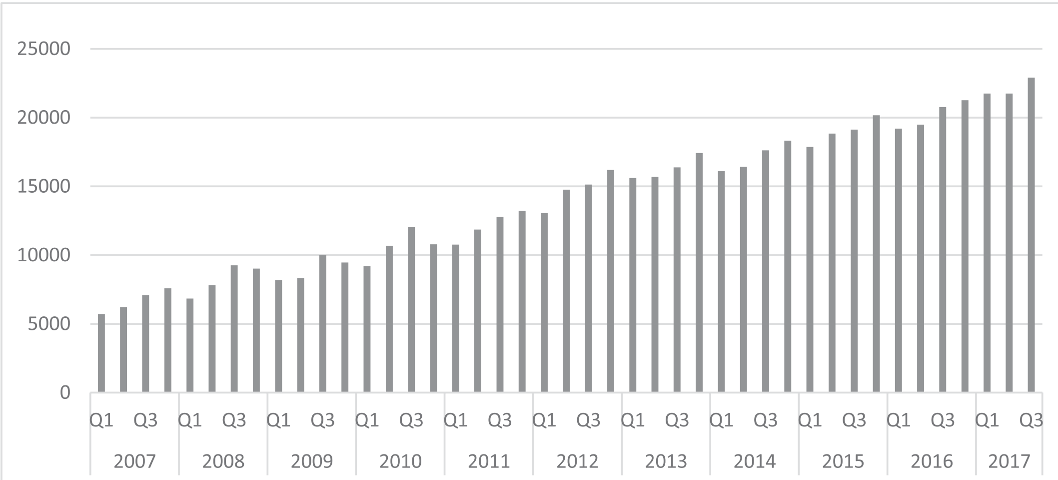
Figure 3: Outstanding Loans and Advances to Households



Source: Bank of Botswana, 2017

It is evident that along with an increase in e-money penetration, household loans have also increased. It is expected that increase in access to funds, in this case credit should have an impact on the spending levels. Figure 4 shows the trend of household consumption in Botswana over the study period. The graphical results are in line with both the BHIES 1993/94 and 2003/04, and BCWIS 2009/10. While it is evident that household expenditure has increased rapidly over time, it is also noted that the

Figure 4: Household Consumption



Source: Bank of Botswana, 2017

consumption graph has a repeating "seasonality" pattern, where consumption of the first quarter is slightly lower than consumption of the fourth quarter of the previous year.

4.2 EMPIRICAL RESULTS

In this section, the empirical findings for the stationarity test, the Johansen cointegration test, and the Granger causality test based on the vector error correction mechanism are presented. Before conducting the unit root test, we noted earlier that variables EM and HC has some traces of seasonality. To address seasonality, the paper adopted the 2 stage moving average technique (4-point moving average followed by 2 point moving average). If seasonality is not treated, it tends to violate the constant parameter assumption of VAR and VECM, (Lutz and Helmut, 2016). Transforming the variable reduced the study period to 2007Q3 through 2017Q1.

Unit Root Analysis

The results of standard ADF test and P-P test are presented in Table 1 and Table 2 respectively. All variables are not stationary at levels, therefore, there was a need to difference all the variables to ensure stationarity. All variables are stationary after first differencing using the P-P test, whereas log(EM) remained non-stationary using the ADF test. This paper adopts the P-P test results as opposed to the ADF test. As discussed in the previous section, P-P test statistics can be viewed as ADF statistics that have been made robust to serial correlation by using the Newey-West test of heteroscedasticity and autocorrelation consistent covariance matrix estimator. In addition, the use of P-P test over ADF test is because of higher structural breaks on the data.

Table 1: Unit Root Test- ADF test and P-P test

	Level		First Difference	
Series	t-statistic	Prob.	t-statistic	Prob.
Log(EM)	3.469337	1.0000	-1.006585	0.7393
Log(HC)	-2.171443	0.2197	-9.952153	0.0000***

*** Denotes rejection of null hypothesis at 1% level of significance

Table 2: Unit Root Test- P-P test

	Level		First Difference	
Series	t-statistic	Prob.	t-statistic	Prob.
Log(EM)	0.62415	0.9886	-2.7882	0.0816*
Log(HC)	-1.4321	0.5564	-9.7276	0.0000***

*** Denotes rejection of null hypothesis at 1% level of significance and * Denotes rejection of null hypothesis at 10% level of significance

Cointegration Analysis

Prior to investigating the variable cointegration, selection of optimal lag structure was determined using the VAR criterion. In this paper, we adopted the Akaike Information Criterion (AIC) statistic results which are presented in Annex 1 to select the appropriate lag structure. Results of the bivariate Johansen co-integration tests are presented in Table 3. The empirical results confirm that the values of the trace tests and those of the maximum eigenvalue tests are statistically significant ($p < 0.01$) and greater than the critical values. This confirms that the null hypothesis of no co-integration ($r = 0$) is rejected by both the maximum eigenvalue and trace statistics. The normalized cointegration equation is as follows: $\log(EM) + 0.070 \log(HC) = 0$. This indicates the existence of a long-run equilibrium relationship between log(EM) and log(HC) for the period being investigated.

Even though the cointegration results confirm the existence of long-run equilibrium relationship, Johansen cointegration test is not sufficient to analyze the existence of Granger causality in the short-run equilibrium and if there is reverse causality among the variables. Since the variables are cointegrated at the same order, I(1), causality can be divided into two important parts, the long-run and the short-run.

Table 3: The Johansen Cointegration Test

	Trace			Max-eigenvalue		
	Trace statistic	**0.05 Critical Value**	**Prob.**	**Max-Eigen statistic**	**0.05 Critical Value**	**Prob.**
r=0 | r≥1	16.9543	15.49471	0.0299**	15.719411	14.2646	0.0292**
r ≤1| r≥2	1.234889	3.841466	0.2665	1.234889	3.841466	0.2665

** Denotes rejection of null hypothesis at 5% level of significance

This paper conducted the diagnostic tests (residual and stability diagnostic) to examine the robustness of the model. The Cusum test was conducted to test the normality of the residuals. Findings confirm the residuals of the model to be normally distributed, and the results can be found in Annex 2 of the paper. A model is said to be normal and stable if the residual plot falls in between the 95% confidence plot. The results in Table 4 show the diagnostic results of the model. The model satisfies the diagnostic, and we conclude it is appropriate for inference.

Table 4: Diagnostic Test

Dependent Variable	Log(EM)	Log(HC)
R-squared	0.8712	0.7262
Adjusted R-squared	0.8038	0.5828
SE	0.0044	0.1871
DW Stat	1.6833	2.1511
Serial Correlation, Chi square prob.	0.3104*	0.2455*

* No serial correlation

Table 5: VECM Causality analysis between Log(EM), and Log(HC)

Dependent Variables	Short-run		Long-run
Y = [Log(EM), Log(HC)]	Δ Log(EM)	Δ Log(HC)	ECT(t-1)
Δ Log(EM)	-	0.5009	0.0022***
Δ Log(HC)	0.0852*	-	0.9896

*** Denotes rejection of null hypothesis at 1% levels of significance, and * Denotes rejection of null hypothesis at 10% levels of significance.

The interest of this paper is the above results, we cannot reject the null hypothesis that log(EM) does not Granger cause log(HC) in the short-run, because the chi-square probability of lagged log(HC), 0.5009 is greater than the 0.05 % (95 % confidence level), whereas we reject the null hypothesis that log(HC) does not Granger cause log(EM) at 95% confidence level. Thus, in the short-run, there is no evidence that e-money penetration can predict household consumption, whereas the reverse is that household consumption Granger causes e-money penetration. In the long-run, e-money penetration can lead to the prediction of household consumption while the reverse does not hold.

These results are fairly consistent with similar studies, Zandi *et al.* (2016), who concluded that many African countries are at the early stages of developing their financial systems, hence the contribution of e-money to consumption is still minimal. Despite the infancy of e-money penetration in Africa, Karla *et al.* (2016) found that in Kenya e-money users were able to maintain their consumption level during economic shocks than individuals who were not e-money users. E-money significantly enhances consumer well-being, by maintaining the consumers' level of consumption.

5. CONCLUSION AND POLICY RECOMMENDATIONS

Botswana has not lagged behind in introducing the electronic technology in the money market, which is highly based on forces of market demand and supply. The descriptive results show that over the study period the value of ATMs and EFTPOS transactions has increased whereas the ratio of credit card loans to total household outstanding loans and advances has slightly decreased. The penetration of e-money in Botswana market is still at infant stages. The development of e-money in the short-run is dependent on the increase in household consumption. In the long-run, if the number of ATMs and EFTPOS is increased enough to cover the consumer demands, e-money penetration would lead to increase in household consumption. Therefore, it is important that the government and financial service providers continue to provide a more conducive environment to increase the electronic payment outlets. The Government of Botswana ought to facilitate consumption through sustainable incomes, and the creation of employment opportunities as they will impact household consumption, which will in turn impact penetration of e-money. It is important to note that increase in household consumption can lead to economic growth in the long-run.

Even though Bank of Botswana has started disaggregating data on outstanding loans and advances, and reporting ATMs and EFTPOS data, extensive reporting of electronic payments is still lagging behind. This paper notes that e-money was a proxy variable on only value transaction of ATMs and EFTPOS. The value of credit cards, mobile banking products by several commercial banks, the value of transaction on cell phone network such as Mascom MyZaka, and Orange money, smart cards, and internet banking were not included due to reporting differences. Lack of reporting data uniformity is a challenge associated with lack of central regulation and fragmented policies. A large share of the unreported e-money data is regulated by different institutions other than Bank of Botswana. Cellphone banking and internet banking are regulated through the Electronic Communications and Transaction Act of 2014. Therefore, to improve the relationship between electronic payments and consumption, measures like integration (and/or update) of crosscutting e-money product regulation ought to be strengthened.

As discussed, literature on electronic payments in Botswana is limited. This presents a large pool of areas for further research such as (i) using a different approach and primary data to analyse the relationship between e-money and consumption; (ii) using improved measure of variable and extending time frame of the study, (iii) and conducting a survey to investigate the impact of e-money on GDP, money supply and savings in Botswana.

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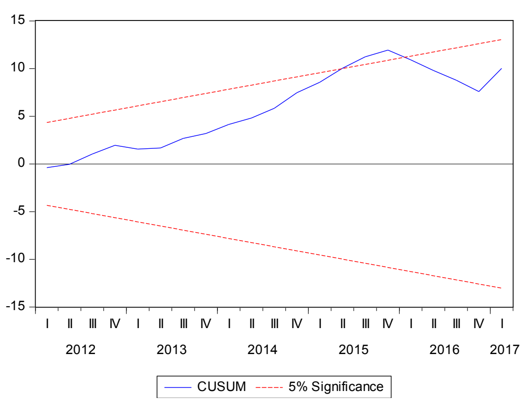
ANNEX 1: LAG LENGTH SELECTION RESULTS

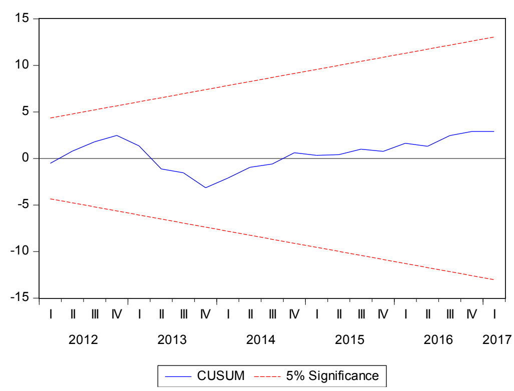
Log(EM) and Log(HC)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	72.01778	NA	3.74e-05	-4.517276	-4.424761	-4.487118
1	233.7578	292.1755	1.43e-09	-14.69405	-14.41651	-14.60358
2	256.8857	38.79526	4.17e-10	-15.92811	-15.46554	-15.77732
3	266.1103	14.28320	3.01e-10	-16.26518	-15.61757*	-16.05408*
4	267.7680	2.352844	3.56e-10	-16.11406	-15.28143	-15.84265
5	275.7127	10.25129*	2.85e-10	-16.36856*	-15.35090	-16.03683
6	280.6859	5.775333	2.80e-10*	-16.33135	-15.22865	-16.03930
7	282.9288	2.315187	3.35e-10	-16.31799	-14.93026	-15.86562
8	285.2766	2.120619	4.09e-10	-16.21139	-14.63863	-15.69871

ANNEX 2: CUSUM TEST RESULTS

Log(EM) and Log(HC)





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