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The relationship between Financial Inclusion and Monetary Stability in Mozambique: Analysis based on an Error Correction Model (VECM)

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Abstract

The present work aims to assess the existence of the relationship between financial inclusion and monetary stability in Mozambique based on the analysis of the vector correction error model (VECM) for the period from 2005 to 2020. The indicators used in the study follow the approach taken by Mbutor and Uba (2013), Lapukent (2015), Lenka and Bairwa (2016) and Hung (2016). In addition to indicators of traditional banking institutions, this article goes further by also incorporating indicators relating to services of electronic money institutions with the objective of capturing the impact of digital financial services on financial inclusion and their role in financial stability.

The study presents results consistent with economic theory. The long-term VEC model proved to be statistically significant and confirmed the existence of a long-term relationship between financial inclusion and monetary stability. It also revealed that the deviation of the CPI from its long-term equilibrium is adjusted at a speed of 10.19%. The coefficients of the short-term VEC model were negative for the variables of branches and bank accounts. The coefficients of agents and EMI accounts were not positive, and their shocks are removed after 6 quarters, after which the expected negative sign is observed achieving monetary stability.

JEL codes: G20, G21, G28.

Keywords: Financial Inclusion; Monetary Stability; VEC Model; Digital Financial Services.

1. INTRODUCTION

Financial inclusion represents the access and use of financial services by the economically active population and has been promoted through several channels, with emphasis on digital channels.

Monetary stability is ensured by the control of the widespread and persistent increase in the general price level carried out by the Central Banks through an effective monetary policy transmission mechanism (Fernandes, C. 2010).

The financial innovations observed through the availability of new channels of access and use of financial services, especially in digital form, influence financial inclusion and consequently, the transmission mechanism of monetary policy and monetary stability (Fernandes, C. 2010; Mehrotra and Yetman 2014, 2015; Gortsos 2016; Gali, et al. 2004; Khan 2011; Mbutor; Uba 2013; Ashraf et al. 2006 and C. Fernandes et.al 2020). The observed impact results from the role that financial inclusion plays in smoothing the consumption behavior of citizens and companies and, consequently, in the effectiveness of monetary policy. It is in this context that this article aims to analyze the role that financial inclusion, achieved through digital financial innovations plays in the monetary policy transmission mechanism and, consequently, in monetary stability, for the Mozambican case.

The remainder of the paper is organised as follows. After the introduction, Section 2 presents the literature review, including the concepts of financial inclusion and monetary stability, the relationship between financial inclusion and monetary stability as well as the empirical evidence on the subject. Section 3 presents the Mozambican monetary policy framework. Section 4 provides the data presents the methods and procedures used to assess the relationship between inclusion and monetary stability, including the description of indicators. Section 5 presents the results of the dispersion, correlation, variance decomposition, Granger causality, Impulse Response and VEC model results, and finally Section 6 derive the conclusions and policy implications.

2. LITERATURE REVIEW

2.1. The concepts of financial inclusion and monetary stability

Financial inclusion has impact on reducing extreme poverty and promoting sustainable economic development, through reducing inequalities in income distribution, and increasing food security (Ouma, et. al., 2017; Demirguç-kunt et. al, 2008; Lahcen & Gomis-Porqueras, 2019). More specifically, financial inclusion has a positive impact on the economy as it contributes to improving levels of access to financial services, especially for the non-banked and rural

population, thus contributing to the improvement of well-being, to the increase in savings, to the dynamization of the credit and for reducing a nation's vicious circle of poverty (Ellis and Rud, 2010).

Several definitions of financial inclusion have been established in the literature. Ellis and Rud (2010) define financial inclusion as improving access to formal financial services at affordable costs and in a fair and transparent manner. For Lenka and Bairwa (2016), financial inclusion means making banking services accessible to the vast segment of society that is poor or excluded. A more recent definition, gave by Hung (2016), argue that financial inclusion refers to the state in which individuals, those with low incomes and businesses, including small businesses, have access to and make use of a wide range of formal financial services.

The concept of financial inclusion has evolved over time because of the emergence of digital financial services offered through digital platforms such as mobile phones, internet, cards, points of sale (POS), internet, among others. Digital financial services contribute to accelerating the benefits and effects of financial inclusion on monetary stability (Hanning and Jensen, 2010; Morgan and Pontines, 2014; Ozili, 2018 and Pham and Doan, 2020). Several international organizations and central banks have been adopting the concept that includes five dimensions of financial inclusion, namely, knowledge, access, use, quality and well-being, as defined by the BM (2013, 2017a; 2017b), CGAP (2011, 2017) and AFI (2010, 2011).

The concept of monetary stability is consensual. According to Swamy, V. (2013), monetary stability refers to the stability of the general price level, that is, an environment in which inflation does not materially affect economic decisions. In general, the ultimate objectives pursued by central banks are (i) the high level of employment; (ii) economic growth; (iii) price stability; (iv) interest rate stability; (v) stability of financial markets; and (vi) stability in the domestic and international foreign exchange market (Mishikin, 2000).

There are barriers that limit the improvement of levels of financial inclusion and its impact on monetary stability. For Lenka and Bairwa (2016), on the demand side, such barriers include the potential absence of financial resources for savings, loans, and financial illiteracy. On the supply side, the barriers are based on the lack of bank branches, the high fees and commissions for financial services, the absence of documentation for opening a bank account and the need to provide guarantees for obtaining bank loans. Hariharan and Marktanner (2013), in turn, argue that barriers to improving levels of financial inclusion result from geographic, historical, cultural, religious, socioeconomic inequalities, economic structure and economic policy factors. It is in this context that these authors argue that the effectiveness of monetary policy can only be achieved with the inclusion of people in the formal financial system, as savings and investment decisions taken outside the formal financial system are not affected by monetary policy.

2.2. The relationship between financial inclusion and monetary stability

There are several studies that have demonstrated the role of financial inclusion in policy effectiveness and monetary stability. The approaches followed by the different authors diverge, considering the model, regime and monetary policy indicators used.

According to Gali, et al. (2004), Khan, (2011), Mehrotra and Yetman (2015) and Gortsos, C. (2016), financial inclusion impacts on the monetary stability for the following reasons: (a) a significant increase in financial inclusion changes the behavior of companies and consumers and influences the effectiveness of monetary policy; (b) the increase in financial inclusion leads, on the one hand, to more consumers being able to smooth their consumption over time, influencing the monetary policy transmission mechanism and, on the other hand, it encourages consumers to move their savings from physical assets and cash for deposits which influence monetary policy operations and the effectiveness of interim policy targets.

For these authors, consumption smoothing occurs as a result of financial inclusion effects on monetary policy for the following reasons: (i) the higher the percentage of financially excluded households, the higher will be the policy response needed to stabilize aggregate demand and inflation as a result of shock; (ii) as financial inclusion increases, there is an increase in money in the broad sense (M3), leading to an increase in interest on bank deposits, increasing access to financial services and, consequently, economic activity; (iii) the use of price indices such as core inflation[3] can reduce the impact of monetary policy on the low-income population, especially agricultural producers, who are financially excluded, which makes it difficult for the Central Bank to stabilize inflation.

Khan (2011) presented empirical evidence that there is a multiplier effect in the economy that makes financial inclusion contribute to the improvement of monetary policy. The evidence is that financial inclusion contributes to an increase in disposable income among the rural population, which leads to an increase in savings in banking institutions and other financial institutions. It also argues that financial inclusion leads to the involvement of different segments of society in the formal financial sector, contributing to the effectiveness of monetary policy. A large informal sector negatively impacts the monetary policy transmission process since the decisions taken by the financially excluded segment of the population and micro-entrepreneurs are less affected by the monetary policy decisions transmitted by the central bank.

It is in this context that Yetman (2017) studied how changing the level of financial inclusion can influence monetary policy by influencing consumer behavior. Yetman argues that the financially included consumer can smooth their consumption in response to shocks more effectively compared to the financially excluded consumer. This occurs because the financially included consumer is directly influenced by monetary policy decisions and reacts to them contrary

[3] According to Mehrotra and Yetman (2015), core inflation is a measure of price changes that excludes the most volatile components of consumer prices.

to the non-included one. Thus, it draws attention to the following aspects in the definition of monetary policy: (a) the choice of core inflation as the inflation target may represent a less right choice in economies with a low level of financial inclusion compared to headline inflation; (b) the effectiveness of the different monetary policy tools is greater in economies thar are more financial included, as a result of the increase in credit and deposits. This influences the determination of reference interest rates by central banks; and (c) an increase in financial inclusion influences the central bank's reaction function, that is the monetary policy rule pursued by central banks.Mehrotra and Nadhanael (2016) analyzed the links between financial inclusion and monetary policy, considering the sensitivity of interest rates to the gross domestic product and the price level, and concluded that the sensitivity of the interest rate to the gross domestic product it is higher in economies with higher levels of financial inclusion.

The study by Evans (2016) found a long-term relationship between financial inclusion and monetary policy. This study identified a statistically significant interest rate, as well as a significant effect on the level of effectiveness of monetary policy. It identified a unilateral causality between monetary policy to financial inclusion, having concluded that the effectiveness of monetary policy is the driver of financial inclusion.

Lenka and Bairwa (2016), in turn, demonstrated that the impact of financial inclusion on monetary policy is very significant. These authors concluded that increasing financial inclusion can reduce the inflation rate in the economy, leading to stability in the general price level. This conclusion is supported by Ellis, K. et al. (2010), who also defended the impact of financial inclusion in achieving the stability goals of the general price level, as it contributes to a better circulation of money in the economy, intensifies the investment rate and the parity of purchasing power with the reduction of the inflation rate.

Mbutor and Uba (2013) studied, for the case of Nigeria, the impact of financial inclusion on monetary stability based on the guidelines established by the financial inclusion strategy of this country. This strategy foresaw as one of the premises for achieving monetary and economic prices stability in the economy, is the increase the levels of savings, investment and consumption decisions made at the level of the formal financial sector. For these authors, financial inclusion contributes to improving liquidity management and economic strength.These authors also concluded that monetary stability is positively influended by reducing the cost of managing cash, strengthening the local currency and a healthy financial system.

Anthony-Orji, et. al. (2019) analyzed the impact of monetary policy shocks on financial inclusion also in Nigeria. They argued that the role of financial inclusion focuses on the ability to improve financial intermediation through improving access to and use of financial services. For these authors the access to financial services by the low-income population allows to save safely away from their homes and contributes to mitigating the risks that this population faces, resulting from economic shocks.

Lahcen and Gomis-Porqueras (2019) corroborate the postulate that financial inclusion plays an important role in the effectiveness of monetary policy. For these authors, an increase in

access to savings channels makes consumers more reactive to changes in interest rates, improving the transmission of monetary policy

2.3. Empirical Evidence

There are a considerable number of studies that have tested the impact of financial inclusion on monetary stability, such as the cases of Mbutor and Uba (2013), Mehrotra and Yetman (2014), Lapukent (2015), Evans (2016), Hung (2016), Lenka and Bairwa (2016) and Brownbrigde et. al. (2017), see Annex 1.

Mehrotra and Yetman (2014), Evans (2016), and Brownbrigde et. al. (2017) used a similar approach to study the impact of financial inclusion on policy effectiveness, using panel and cross section data. Indeed, Mehrotra and Yetman (2014) used the model by Gali et. al. (2004) and examine the implications of changes in levels of financial inclusion for maximizing the well-being achieved by financial inclusion in 130 economies around the world based on cross section data. The model assumed that only financially included households can smooth their consumption in response to income volatility, while financially excluded households consume their entire income. The study showed that the ratio of output volatility to inflation volatility has increased as a function of the percentage of consumers financially included in the economy when monetary policy is conducted optimally.

Evans (2016), studying a set of African countries, for the period 2005 to 2014, using panel data and using the Vector Error Correction Model (VECM) methodology reached a similar conclusion. The author concluded that between financial inclusion and monetary policy there are a set of long-term relationships. The study concluded (i) that financial inclusion shocks in the money supply and interest rate play a role in explaining changes in monetary policy effectiveness, since, in the long run, more than 45% of changes in monetary policy effectiveness are explained by interest rate shocks; (ii) there is a unidirectional causality relationship in the Granger sense of monetary policy to financial inclusion; and (iii) financial inclusion is not a significant explanatory factor for Monetary stability in Africa, but that monetary stability is the engine for financial inclusion.

Brownbridge et. al. (2017) used the Panel Vector Error Correction Model (PVECM) to estimate the impact of financial inclusion on the interest rate channel of the monetary policy transmission mechanism of four African countries (Uganda, Ghana, Mauritius, and South Africa), for the period 2001 to 2016. These authors concluded that the effect of a restrictive monetary policy, which involves an increase in the interest rate, is negative on inflation, in line with economic theory. The authors used the number of deposit accounts to distinguish between high and low levels of financial inclusion and concluded that the effect of monetary policy on inflation is greater for countries with high levels of financial inclusion.

In turn, Mbutor and Uba (2013), Lapukent (2015), Lenka and Bairwa (2016) and Hung (2016) studied the impact of financial inclusion on monetary policy based on time series data.

Indeed, Mbutor and Uba (2013) studied the impact of financial inclusion on Nigeria's monetary policy between 1980 and 2012 using cointegration analysis. The study showed that there is a strong but inverse relationship between the inflation rate and the volume of bank loans as a percentage of GDP, indicating that bank financing boosts investment, which reduces inflation levels. The increase in rural bank branches also shows a negative coefficient with inflation. The study reinforced the notion that financial inclusion is an effective strategy for increasing the effectiveness of monetary policy and economic growth. These authors also concluded that it is in the countries' efforts to seek mechanisms to improve the levels of financial inclusion that the creation of innovative solutions, that contribute to reducing costs and improving the efficiency of the economy and the financial system, has been observed. Such are the cases of the use of the digital platform, with emphasis on mobile payments, for the access and use of financial services, even non-banking, as well as the use of banking agents.

Lapukeni (2015) in turn used the approach followed by Mbutor and Uba (2013) to study the impact of financial inclusion on the effectiveness of monetary policy in Malawi for the period 2001 to 2013 using the Vector Autoregression (VAR) estimates, having concluded that the long-term model explains approximately 70% of the observed changes in inflation. The results found showed that only the coefficients of money supply and exchange rate were statistically significant at 5% and 10% levels. The results from this author showed that the money supply has negative sign contrary to economic theory. The financial inclusion indicators proved not to be statistically significant, but showed a correlation as expected, unidirectional granger causality from the inflation to money supply. The study concludes that improving financial inclusion will contribute to improving the predictability of the money supply and, consequently, to the effectiveness of monetary policy in Malawi.

Lenka and Bairwa (2016) studied the impact of financial inclusion for the countries of the South Asian Association for Regional Cooperation (SAARC[4]) for the period 2004-2013, based on the analysis of the main component for the construction of a financial inclusion index which served as a proxy for the accessibility of financial inclusion in these countries. These authors showed that there is a statistically significant negative relation of financial inclusion on the monetary policy variable at the level of the SAARC countries. This result showed that if financial inclusion increases, it will reduce the inflation rate in the economy, causing stability in the general price level. The interest rate on bank loans that meets the short and long-term financing needs of the private sector has a negative relationship with inflation in the countries studied, showing that the increase in the interest rate will help to reduce inflation and vice versa-versa. The negative sign was also observed in the exchange rate variable, showing that the moderate increase in the exchange rate has an impact on price stability.

Hung (2016) in turn studied the impact of financial inclusion on the effectiveness of monetary policy in Vietnam for the period 2004-2015, following the same methodology proposed

[4] Acronym for the South Asian Association for Regional Cooperation (SAARC).

by Lenka and Bairwa (2016). His results are in line with those achieved by Lenka and Bairwa, having observed that the estimated coefficient for the financial inclusion index, for the exchange rate and for the interest rate obtained the expected (negative) signs consistent with the theory. An increase in the financial inclusion index and loan interest rate can reduce inflation in Vietnam, and exchange rate depreciation can lead to a higher inflation rate. For this author, the presence of cointegration between the variables suggested a long-term relationship, as well as a long-term causal relationship of the financial inclusion index towards inflation, which led him to reinforce the conclusion that the impact of financial inclusion in monetary policy is significant, indicating that increasing financial inclusion reduces inflation. Summarizing, Hung concludes that the financial sector plays an important role in the transmission process of monetary policy and that the effectiveness of the transmission process depends on the development of the financial market, that is the level of financial inclusion.

3. THE FRAMEWORK OF MOZAMBIQUE MONETARY POLICY

Financial inclusion and monetary stability are objectives pursued by the Bank of Mozambique (BM). Indeed, the BM's current mission is “preserving the value of the national currency and promoting a solid and inclusive national financial sector”. In the BM's mission it is possible to observe that monetary stability is pursued through the preservation of the value of the national currency and financial inclusion through the promotion of an inclusive national financial system.

The BM study (2013) on the challenges of financial inclusion in Mozambique presented a preliminary approach on the relationship between financial inclusion and monetary stability. This study refers that the improvement of the formulation and implementation of financial and monetary policies is achieved through the increased in multi-sector coordination between financial and non-financial institutions with the aim of increasing the levels of access and the use of financial services by the population and increasing control over the circulation of liquidity flows in the economy.

Fernandes, C. (2010) studied the effectiveness of monetary poly rule, defined by Taylor Rule for the case of Mozambique. This study concluded that the effectiveness of monetary policy transmission depends on the effectiveness of the operational variable adopted by the BM, which, until March 2017, was limited to the Monetary Base and to the definition of the monetary target regime. The study also referred that the high component of notes and coins in circulation becomes difficult to control the monetary base and to predict within the targets set by the monetary authority, compromising the effectiveness of the monetary policy transmission mechanism. In fact, in 2005 the coins in circulation corresponded to around 61% of the total monetary base, in 2010 to around 55% and in 2020 to around 31%. Despite the efforts observed to reduce coins in circulation in the total monetary base, this indicator largely represents the cash in circulation held by a population that does not have access to financial services or that, having access, do not use financial services and are financially excluded from financial system.

The BM's Monetary Policy Committee published, in April 2017, its Monetary Policy Framework, which expresses the change in the monetary policy regime, which is now based on inflation targeting through the introduction of the policy interest rate as an operational variable, called the Mozambique Interbank Monetary Market (MIMO) rate. In May 2017 and September 2018, the agreement that standardizes the calculation basis (indexing) of the interest rate in the banking system was signed and updated, respectively. This agreement became the basis for calculating the prime rate of the financial system and for setting variable interest rates to be agreed upon by Credit Institutions and Financial Companies authorized to carry out credit operations in the country.

Under the new monetary policy framework, the policy interest rate offers financial market participants a credible and stable anchor for the determination of retail interest rates with an emphasis on credit products. Therefore, the relationship between monetary stability and financial inclusion is observed in terms of improved access to credit products since, according to the BM's monetary policy framework, one of the objectives of a low and stable inflation is to ensure a rate of attractive nominal and real interest and that allows for improved access by low-income social groups to bank credit, in addition to encouraging savings and investment.

The indicators in Table 1 below show that, despite the objective of price stability – the main objective of monetary policy – having been achieved, with the inflation rate standing at single digits since 2017, economic growth has slowed down[5].

Table 1: Financial Inclusion and Monetary Policy Indicators

		2005	2010	2015	2020
1.	**Financial Inclusion Indicators**				
	1.1. % of Adults with Bank Account in a Formal Financial Institution	6,5	14,7	31,1	31,0
	1.2. % de Adults with Account in an Electronic Money Institution (EMI)	0,0	0,0	28,6	65,6
	1.3. Nº of bank branches per 100 thousand adults	2,1	3,4	4,3	4,1
	1,4, Nº of Agents of EMI per 100 thousand adults	0,0	0,0	125,9	420,9
2.	**Monetary Policy Indicators**				
	2.1. CPI (% Anual Var.)	11,5	16,62	11,1	2,93
	2.2. GDP (%, Anual Var.)	6,6	6,5	6,7	-1,23
	2.3. Exchange Rate (MT/USD)	25,75	29,55	50,24	74,6
	2.4. Interest Rate[6]				

[5] Mozambique's economic growth contracted by 1.23% in 2020, influenced, among other factors, by exogenous shocks, namely, climatic (Cyclone Idai and Kenneth), epidemiological (covid19 pandemic) and security in the northern region of Mozambique.

[6] According to the Bank of Mozambique's metadata, the Permanent Lending Facility (FPC) rate is a rate with an "overnight" maturity, applied in the FPC window for liquidity ceding operations by the Bank of Mozambique to banks operating in the interbank money market (MMI), with temporary liquidity deficits and accessing the window on their own initiative. It is available to operators who are commercial banks. The banks lending rate is the interest rate

	2005	2010	2015	2020
2.4.1. FPC	15,5	15,5	9,75	13,25
2.4.2. Banks lending rate	19,2	21,67	19,09	18,79
2.4.3. Mimo rate	-	-	-	10,25
2.4.4. Prime rate	-	-	-	15,9

Source: INE; BM

Access to formal banking services grew between 2005 and 2015 from 6.5% to 31.1%, having remained unchanged between 2015 and 2020. However, the gains from financial inclusion were notorious in terms of electronic money services, as measured by the increase in access and use of these services compared to traditional banking.

Table 1 also illustrates that, although the financial inclusion indicators have tended to increase over the last 15 years, since 2015 the Banking financial inclusion indicator has been stable at 31% of demographic access against a doubling of measured supply side demographic access for digital financial inclusion, increasing from 28.6% to 65.5% between 2015 and 2020.

4. METHODS AND PROCEDURES

4.1. Model Specification

This study aims to test the hypothesis that financial inclusion contributes to monetary stability in Mozambique. To test this hypothesis, the model developed by Mbutor and Uba (2013), Lapukent (2015), Lenka and Bairwa (2016) and Hung (2016) was used, adapted according to equation (4) below, where MS_t represents monetary stability; FI_t represents financial inclusion; $Ctrl_t$ represents control variables; and the coefficients $\propto_0, \propto_1 and \propto_2$ represent the impact of financial inclusion indicators and control variables on monetary stability, respectively, and ε_t represents the error term.

$$\boldsymbol{MS_t = \propto_0 + \propto_1 FI_t + \propto_2 Ctrl_t + \varepsilon_t} \quad (4)$$

The adaptation made in this study consisted of incorporating, in addition to the financial inclusion indicators relating to formal banking, those relating to digital financial services, namely electronic money, in accordance with the extensive model below.

$$\boldsymbol{Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon_t} \quad (5)$$

Where Y_t represents monetary stability measured by the consumer price index, X_1 represents the number of bank branches per 100,000 adults, X_2 value the number of bank accounts

practiced by commercial banks (Bcoms) for lending operations with a maturity of 1 year. The MIMO rate is the Monetary Policy interest rate, being the main indicator for the BM intervention in the MMI overnight. The prime rate of the Mozambican financial system is the single reference rate for credit operations and results from the sum of the single index (measured by the volume of operations in the MMI for the overnight term for operations at the MIMO interest rate and repo operations between banks and liquidity swap operations between banks) and the cost premium (margin representing the risk elements of banking activity not reflected in interbank market operations).

per 100,000 adults, X_3 represents the number of agents of electronic money institutions per 100,000 adults, X_4 denotes the number of EMI accounts per 100,000 adults, X_5 represents the MT/USD Exchange Rate and X_6 represents the Interest Rate of commercial bank loans for 1 year maturity. The coefficients $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4 and\ \beta_5$ represent the intercept term and the impact of the financial inclusion and control variables on monetary stability, respectively, and ε_t represents the error term.

4.2. Estimation procedures

The analysis of the relationship between financial inclusion and monetary stability will be carried out using diagnostic and formal tests based on the following methods:

(i) the diagnostic test will be using the dispersion analysis between monetary and financial inclusion aggregates as described by Mehrotra, A. & Yetman, J. (2014; 2015); Morgan, P. & Pontines V. (2014), Evans (2016) and Yetman, J. (2017) for the indicators described in Table 2 below. According to these authors, the relation of output volatility to inflation volatility increases as a function of the percentage of financial included consumers in the economy, when a monetary policy is conducted in an optimal way, as inclusion increases, as a growing share of broad money is likely to be made up of interest-bearing bank deposits improving financial access and economic activity. Thus, this analysis aims to assess the graphic relationship and synergies between the indicators of financial inclusion, measured by demographic access to banking and electronic money services and indicators of monetary stability, measured by the variance of inflation, gross domestic product (GDP) and currency in circulation.

Table 2: Indicators for Dispersion Analysis

Category	**Indicator**
1) Financial Inclusion Indicators	a) % of adults with bank account b) % of adults with electromic money institutions account
2) Financial Stability Indicators	a) Log of GDP *per capita* b) Variance of outputgap c) Variance of inflation d) Currency in circulation in % of monetary base;

(ii) the formal test will be based on correlation analysis; decomposition of variance, Granger causality, impulse response, and the Vector Error Correction Model (VECM). The indicators used are described in table 3 below.

Table 3: Indicators Used for Formal Tests

Category		**Indicator**		**Expected sign**
1) Indicator (*proxy*) of Monetary Stability ($\boldsymbol{MS_t}$)		a) consumer price index (CPI) – anual variation ($\boldsymbol{Y_1}$)	LNVIPC	
2) Indicators (*proxies*) of financial inclusion ($\boldsymbol{FI_t}$)	i. Traditional	b) number of bank branches per 100 thousand adults ($\boldsymbol{X_1}$)	LNAB	(-)
		c) bank account per 100 thousand adults ($\boldsymbol{X_2}$)	LNCBANK	(-)
	ii. Digital	d) number of agents of electronic money institutions (EMI) per 100 thousand adults ($\boldsymbol{X_3}$)	LNAIME	(-)
		e) number of EMI accounts per 100 thousand adults ($\boldsymbol{X_4}$)	LNCAIME	(-)
3) Control variables ($\boldsymbol{Ctrl_t}$)		f) Exchange rate MT/USD ($\boldsymbol{X_5}$)	LNTC	(+)
		g) Interest rate on commercial banks loans for 1 year maturity ($\boldsymbol{X_6}$)	LNTJ	(-)

The estimation of the model with Vector Error Correction Model (VEC) followed the following steps:

a) firstly, the indicators were subjected to the stationarity test based on the augmented Dickey-Fuller (ADF) test of unit root, and the selection of the order of integration of the variables was made using the Akaike Information Criterion (AIC). The stationarity test was carried out to ensure that the variables are integrated in order 1, a necessary condition for estimating the VEC model;

b) secondly, the selection of the optimal number of lags to be included in the model was made based on the SIC criterion;

c) thirdly, the Johansen Cointegration test was carried out in order to assess the existence of cointegration of the variables, which is also a necessary condition for the estimation of the VEC model;

d) fourthly, the VEC model was estimated in order to assess the existence of long-term and short term cointegration relationship as well as the respective coefficients;

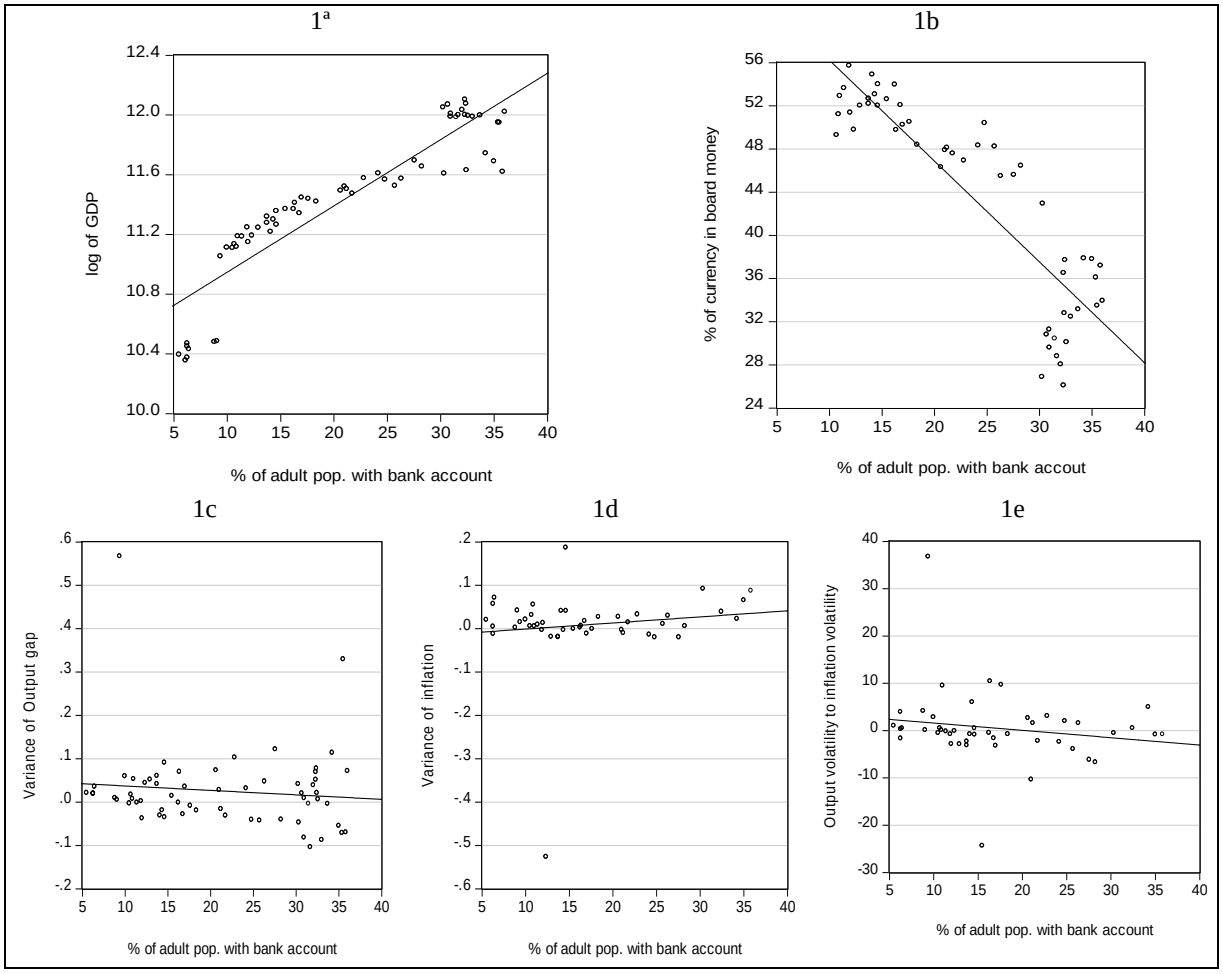
e) in fifth and last place, the following robustness tests were performed on the estimated VEC model: (i) LM test of serial correlation of the residuals; (ii) model heteroscedasticity test; (iii) cholesky normality test; and (iv) CUSUM test of model stability.

5. THE RESULTS

5.1. Dispersion Analysis

Graph 1a shows the existence of a positive relationship between financial inclusion and gross domestic product, illustrating that in the case of Mozambique, a financially included population contributes positively to the increase in GDP. Graph 1b, in turn, illustrates a negative relationship between financial inclusion and the percentage of banknotes and coins in circulation in the total monetary base, meaning a positive impact of financial inclusion in monetary policy. As the inclusion increases there is a reduction in currency in circulation, thus improving the central bank's ability to forecast and control monetary variables.

Graph 1: Relationship between monetary stability and financial inclusion indicators (traditional)

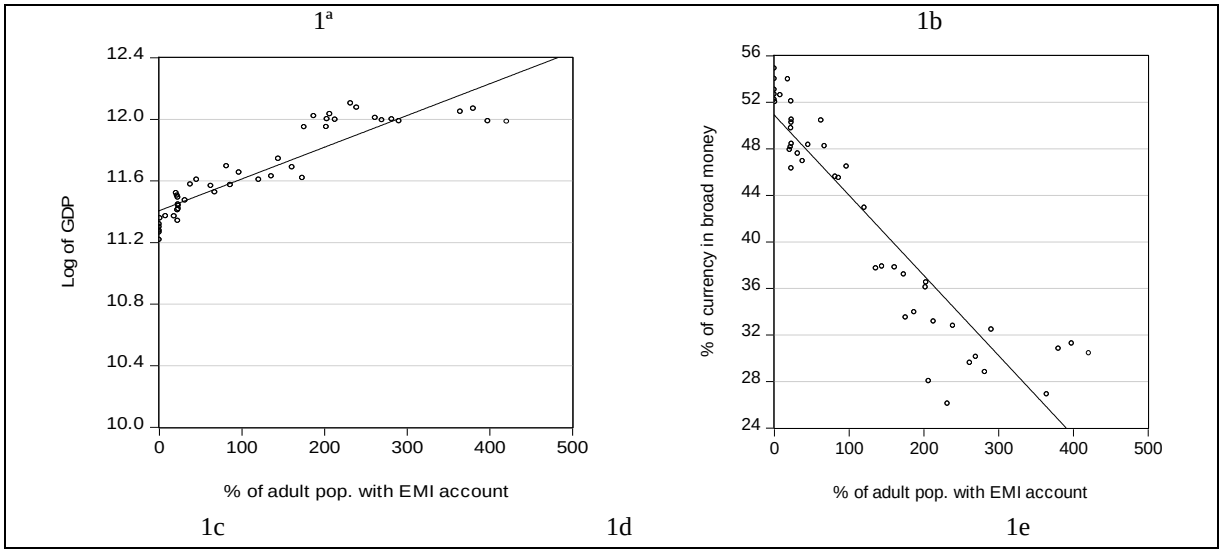


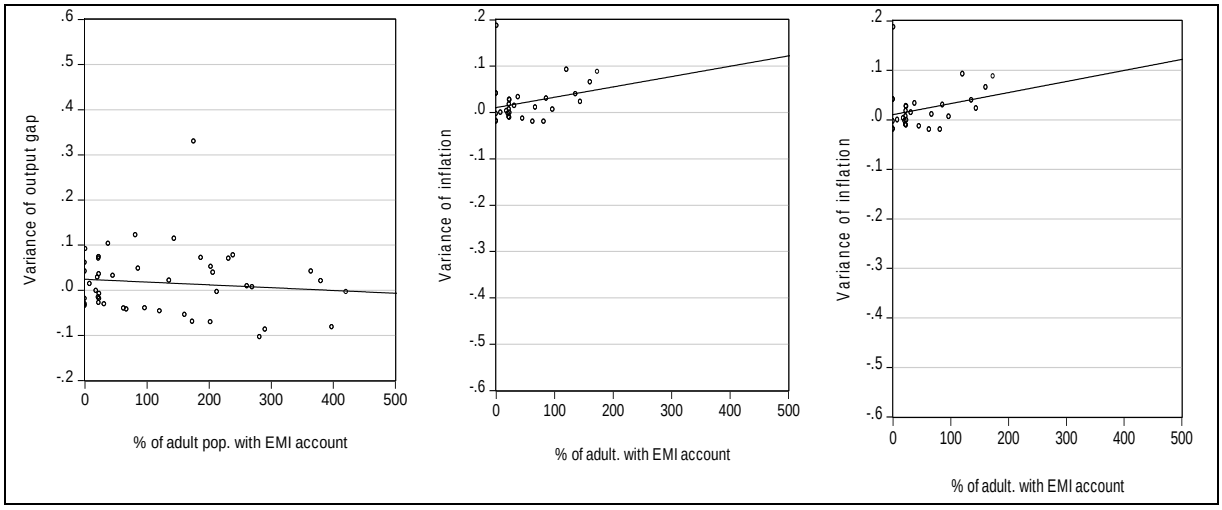
Source: Author's calculations based on BM and INE data

Graphs 1c, 1d and 1e illustrate the relationship between financial inclusion and the variance of output gap, variance of inflation and the variance of output gap to inflation gap, respectively. Graph 2 presents the same approach used in Graph 1, however relating monetary policy indicators to the financial inclusion resulting from electronic money services. The results are in line with expectations, observing a positive impact of financial inclusion, measured by electronic money services, on monetary policy.

Those graphs demonstrate that an increase in financial inclusion does not contribute to increasing the volatility of output gap and inflation, individually, but an increase in financial inclusion does contribute to increasing the volatility of output gap to inflation. This result is in line with the postulate by Mehrotra, A. & Yetman, J. (2014; 2015) when confirming that as financial inclusion increases the ratio of output volatility to inflation volatility should also rise if the central bank cares about both and sets monetary policy to optimize their trade-off. This occurs because financial included consumers are better able, than excluded consumers, to adjust their saving and investment decisions to partially insulate their consumption from output volatility. Thus, central bank become able to focus more stabilizing inflation as the degree of financial inclusion rises.

Graph 2: Relationship between monetary stability and financial inclusion indicators (digital)





Source: Author's calculations based on BM and INE data

5.2. Stationarity Test

The results of the unit root ADF test are described in Annex 2. The results showed that the financial inclusion variables, namely, number of bank branches per 100 thousand adults and number of agents of electronic money institutions per 100 thousand adults are stationary at first difference at the significance level of 1% and 5%, respectively. The variable bank accounts were shown to be stationary in level when considered without constant and with constant at the significance level of 1% and 5% respectively. When those variables are considered simultaneously with constant, it was only stationary in the first difference. The variable relating to electronic money accounts per 100,000 adults was found to be stationary in level.

Regarding the monetary stability proxy as well as the control variables, namely the annual variation of the CPI, the exchange rate of the metical to US dollar and the loan interest rate for the maturity of 1 year, were also stationary in first difference for 1% significance level, except for the interest rate when considered with constant and with constant and intercept, which proved to be stationary in level.

5.3. Lag length selection

The optimal number of lags was selected based on the Schwarz Information Criterion (SIC) statistical criterion, which indicated one (1) lag.

5.4. Correlation Analysis

The correlation analysis showed that the monetary stability indicator measured by the annual variation of the CPI presented a negative correlation with digital financial inclusion

indicators measured by the agents of electronic money institutions (-24.9%) and accounts of electronic money institutions (-27.7%), as well as in relation to traditional financial inclusion indicators, namely bank branches (-2.3%) and bank accounts (-2.9%). The negative correlation found is in line with economic theory, which predicts a negative relationship between monetary stability and financial inclusion indicators.

The exchange rate also showed a positive correlation (13.2%) in line with literature. On the contrary, the interest rate showed a positive correlation with the annual variation of the CPI, a result not in line with economic theory.

Table 4: Results of Correlation Analysis

	LNVIPC	LNAB	LNAIME	LNCBANC	LNCAIME	LNTC	LNTJ
LNVIPC	1,000	-0,023	-0,249	-0,029	-0,210	0,128	0,468
LNAB	-0,023	1,000	0,865	0,865	0,866	0,625	0,280
LNAIME	-0,249	0,865	1,000	0,887	0,955	0,660	0,257
LNCBANC	-0,029	0,865	0,887	1,000	0,885	0,851	0,282
LNCAIME	-0,210	0,866	0,955	0,885	1,000	0,609	0,193
LNTC	0,128	0,625	0,660	0,851	0,609	1,000	0,304
LNTJ	0,468	0,280	0,257	0,282	0,193	0,304	1,000

Source: Author's calculations based on BM and INE data

The inverse relationship between digital financial inclusion and inflation is justified, according to theory, by the fact that the higher the level of digital financial inclusion, the lower inflation will be due to the reduction of banknotes and coins in circulation and increasing of geographic and demographic availability of electronic money.

5.5. Variance Decomposition Analysis

The variance decomposition analysis presented in Table 5 illustrates that 70.5% of the observed variations in inflation are due to changes observed in the price level. The remaining variations observed in the CPI, 7.9% are due to the changes observed in the interest rate, 6.7% and 6.0% due to the changes observed in the number of accounts of EMI agents, respectively. The number of branches and bank accounts contributed with 5.3% and 2.1%, respectively, to the variations observed in the CPI and the exchange rate with 1.6%.

Table 5: Variance Decomposition of the annual variation of CPI – Cholesky method

Period	S.E.	LNVIPC	LNAB	LNAIME	LNCBANC	LNCAIME	LNTC	LNTJ
1	0,425	100,000	0,000	0,000	0,000	0,000	0,000	0,000
2	0,598	94,104	1,949	1,094	0,108	1,928	0,064	0,754
3	0,725	87,827	3,338	2,385	0,343	3,878	0,203	2,027
4	0,820	82,489	4,146	3,507	0,655	5,319	0,405	3,479
5	0,886	78,162	4,633	4,412	1,007	6,223	0,657	4,906
6	0,929	74,776	4,949	5,116	1,372	6,667	0,949	6,171
7	0,955	72,246	5,163	5,643	1,727	6,774	1,266	7,183
8	0,970	70,468	5,302	6,010	2,050	6,692	1,589	7,889
Cholesky Ordering: LNVIPC LNAB LNAIME LNCBANC LNCAIME LNTC LNTJ								

Source: Author's calculations based on BM and INE data

5.6. Granger Causality Tests

Granger's causality test revealed that agents of electronic money institutions Granger-cause CPI to a significance level of 10%, meaning that increasing the number of banking agents will contribute to changes in the CPI. This test also showed that the CPI Granger-causes the exchange rate and that there is a bidirectional Granger-causality between the CPI and the interest rate, for a significance level of 10% and 1%, respectively.

The Granger causality test also showed that for the significance level of 1%, 5% and 10% there is no causality between the CPI and the financial inclusion indicators represented by the number of bank branches, bank accounts and accounts of electronic money institutions.

The results were also in line with the results found by Evans (2016) when showing that the CPI Granger-causes the exchange rate and that there is a bidirectional Granger-causality between the CPI and the interest rate on commercial bank loans for maturity of 1 year.

Table 6: Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
LNAB does not Granger Cause LNVIPC	61	0.41061	0.5242
LNVIPC does not Granger Cause LNAB		0.01021	0.9199
LNAIME does not Granger Cause LNVIPC	42	2.93557	0.0946*
LNVIPC does not Granger Cause LNAIME		0.09911	0.7546
LNCBANC does not Granger Cause LNVIPC	61	0.60787	0.4388
LNVIPC does not Granger Cause LNCBANC		0.01387	0.9067

LNCAIME does not Granger Cause LNVIPC	45	0.34445	0.5604
LNVIPC does not Granger Cause LNCAIME		0.00303	0.9563
LNTC does not Granger Cause LNVIPC	61	0.02671	0.8708
LNVIPC does not Granger Cause LNTC		3.47609	0.0673*
LNTJ does not Granger Cause LNVIPC	61	7.21746	0.0094***
LNVIPC does not Granger Cause LNTJ		39.2613	5.E-08***

Source: Author's calculations based on BM and INE data

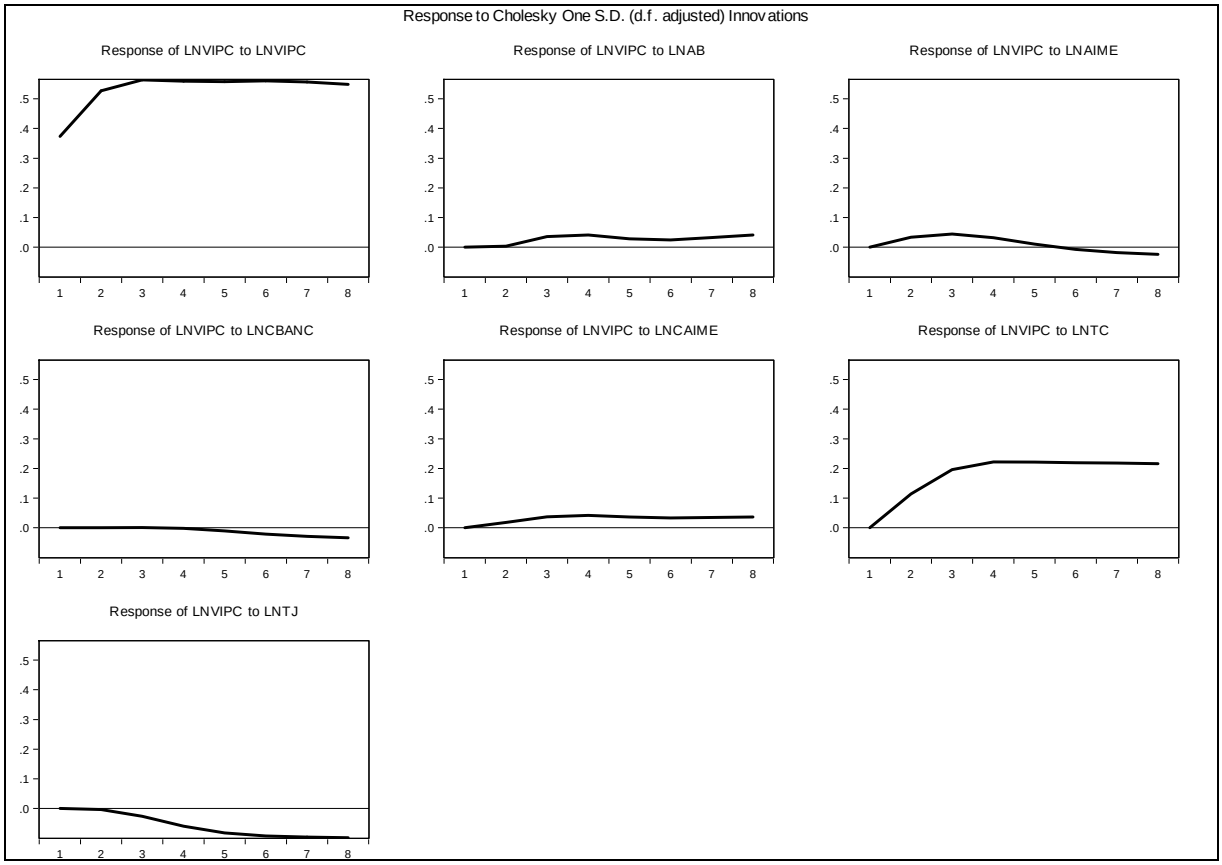
Note: (***) Rejects the H0 that x_t does not cause y_t at the 1% significance level; (**) Rejects the H0 that x_t does not cause y_t at the 5% significance level; (*) Rejects the H0 that x_t does not cause y_t at the 10% significance level

5.7. Impulse Response Test

The impulse response analysis showed that a digital financial inclusion shock measured by agents and EMI accounts in the CPI is positive (contrary to the expected sign), being canceled after 6 quarters, period after which finds the negative relationship predicted by economic theory. This occurs because the shock that leads to an increase in agents and EMI accounts will lead to a reduction in the CPI, thus contributing to the stability of the CPI after about 6 quarters.

The results also reveal that a financial inclusion shock measured by branches and bank accounts has a positive effect on the CPI for bank branches and a negative effect for bank accounts, the latter in line with the expected sign.

Graph 3: Impulse Response functions of the Monetary Stability indicator to the impulse of financial inclusion variables



Source: Author's calculations based on BM and INE data

5.8. Vector Error Correction Model (VECM)

5.8.1. Johansen Cointegration Test

The Johansen cointegration test was estimated with the variables in first difference and using a lag as suggested by the SIC and HQ criteria, thus fulfilling the requirements for estimating this test.

The Trace and Maximum Eigenvalue tests contained in the results of the Johansen cointegration test revealed that they reject the null hypothesis of no cointegration for a significance level of 5%, thus showing that there is cointegration and, consequently, a long-term relationship between the variables. It is also concluded that the VEC model can be estimated because the variables are stationary in first difference and have a cointegration relationship between the variables in the long run.

Table 7: Results of Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.998965	532.7355	125.6154	0.0001
At most 1 *	0.963783	285.2967	95.75366	0.0000
At most 2 *	0.923183	165.8409	69.81889	0.0000
At most 3 *	0.545938	73.45317	47.85613	0.0000
At most 4 *	0.526198	45.03036	29.79707	0.0004
At most 5 *	0.371648	18.13960	15.49471	0.0195
At most 6	0.038464	1.412024	3.841466	0.2347
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		**Max-Eigen**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.998965	247.4388	46.23142	0.0000
At most 1 *	0.963783	119.4558	40.07757	0.0000
At most 2 *	0.923183	92.38768	33.87687	0.0000
At most 3 *	0.545938	28.42281	27.58434	0.0390
At most 4 *	0.526198	26.89076	21.13162	0.0069
At most 5 *	0.371648	16.72758	14.26460	0.0200
At most 6	0.038464	1.412024	3.841466	0.2347
Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Author's calculations based on BM and INE data

5.8.2. Vector Error Correction Model (VECM)

The results of the VEC model on the relationship between financial inclusion and monetary stability are shown in tables 8 (long-term model) and 9 (short-term model). The estimated model presents a high log likelihood (287.61), a low AIC (-10.88) and an acceptable coefficient of determination - R^2 (between 21% to 63%), showing that there is a model adjustment and long-term equilibrium.

The long-term model is presented by equation (6) of the error correction term (ECT). All coefficients are statistically significant since the t-stat, in modular terms, is greater than 2, revealing that there is a long-term relationship between the variables.

$$ECT_{t-1} = 1.000lnvipc_{t-1} - 29{,}5lnab_{t-1} + 0{,}7lnaime_{t-1} + 7{,}2lncbanc_{t-1} - 0{,}3lncaime_{t-1} - 2{,}3lntc_{t-1} - 6{,}5lntj_{t-1} - 2{,}9 \quad (6)$$

Table 8: VECM – Long term

Cointegrating Eq:	CointEq1	Ep	t-stat
LNVIPC(-1)	1.000000		
LNAB(-1)	-29.50723	(2.70303)	[-10.9164]
LNAIME(-1)	0.664912	(0.13792)	[4.82107]
LNCBANC(-1)	7.191494	(1.15834)	[6.20846]
LNCAIME(-1)	-0.264120	(0.10693)	[-2.47004]
LNTC(-1)	-2.300906	(0.56022)	[-4.10712]
LNTJ(-1)	-6.453901	(0.83896)	[-7.69275]
C	-2.970942		

Notes: Coint Eq1 : cointegration equation 1; Ep.: standard error; t stat.: t – statistician.
Author's calculations based on the Eviews 10.0 econometric package

Table 9 shows the error correction adjustment speed that falls within the target parameters (-1<ECT<0).

Table 9: VECM – Short Term

Error Correction:	D(LNVIPC)	D(LNAB)	D(LNAIME)	D(LNCBANC)	D(LNCAIME)	D(LNTC)	D(LNTJ)
CointEq1	-0.101880	0.021086	-0.147686	-0.010634	-0.431582	0.033168	0.023618
	(0,192)	*(0,003)****	*(0,022)***	*(0,131)*	*(0,031)***	*(0,003)*	*(0,006)****
D(LNVIPC(-1))	0.399573	-0.028295	0.129824	0.017760	0.909147	-0.036241	-0.004934
	*(0,029)***	*(0,082)**	*(0,381)*	*(0,272)*	*(0,046)***	*(0,161)*	*(0,967)*
D(LNAB(-1))	-1.870977	0.379590	-1.337407	-0.249984	-3.776224	0.329681	0.224607
	(0,459)	*(0,108)*	*(0,536)*	*(0,278)*	*(0,635)*	*(0,415)*	*(0,503)*
D(LNAIME(-1))	0.095264	0.001699	0.258647	0.021611	-0.252469	0.004028	0.017521
	(0,553)	*(0,735)*	*(0,055)**	*(0,149)*	*(0,444)*	*(0,741)*	*(0,207)*
D(LNCBANC(-1))	-0.136374	-0.067518	-0.494469	0.187194	0.438635	0.006942	0.218758
	(0,938)	*(0,599)*	*(0,733)*	*(0,257)*	*(0,904)*	*(0,992)*	*(0,219)*
D(LNCAIME(-1))	0.016711	0.011378	0.104081	-0.002700	-0.171392	0.008423	-0.007431
	(0,827)	*(0,084)**	*(0,094)**	*(0,703)*	*(0,385)*	*(0,447)*	*(0,268)*
D(LNTC(-1))	2.380879	-0.035124	-1.136559	0.142905	-1.795218	0.476979	0.097135
	*(0,051)**	*(0,911)*	*(0,219)*	*(0,193)*	*(0,434)*	*(0,002)****	*(0,294)*
D(LNTJ(-1))	-0.793004	-0.013805	2.576063	-0.025721	1.673011	-0.348102	0.530867
	(0,519)	*(0,551)*	*(0,009)****	*(0,817)*	*(0,416)*	*(0,013)***	*(0,000)****
C	-0.107719	-0.000276	0.126278	0.009456	0.421253	0.000253	-0.008994
	(0,185)	*(0,915)*	*(0,060)**	*(0,207)*	*(0,038)***	*(0,901)*	*(0,303)*
R-squared	0.355312	0.354464	0.563236	0.210632	0.226781	0.543942	0.639236
Log likelihood				287.6137			
AIC				-10.88069			

() p-value; ***Statistically significant at the 1% level; **Statistically significant at the 5% level; *Statistically significant at the 10% level; Author's calculations based on the Eviews 10.0 econometric package

The coefficient of adjustment (ECT) revealed that the deviation of the previous period's CPI from the long-term equilibrium is corrected in the current period at a speed of -10.19% of adjustment, ceteris paribus.

The VEC model also illustrated that a variation in the number of bank branches and bank accounts by 1% leads to a reduction in price variation by 1.87pp and 0.14pp, respectively, ceteris paribus, in line with the expected signal predicted by economic theory.

In turn, a 1% variation in the number of agents and EMI accounts is associated with an increase in the price variation of 0.09pp and 0.016pp, respectively, ceteris paribus. This result, although contrary to the expected sign, is justified by the fact that, in the short term, the massification of agents and their electronic money accounts contribute to boosting money transfers to places and populations previously without access to financial services, improving their purchasing power.

Finally, the VEC model presented coefficients in line with expectations for the exchange rate and the interest rate by showing that a variation of 1% in the exchange rate leads to an increase in the price level by 2.4pp, while a variation of 1% of the interest rate leads to a reduction of the price level by 0.79pp, ceteris paribus.

5.8.3. Model Robustness Analysis

The analysis of the robustness of the model was based on the following tests: (i) LM test of serial autocorrelation of the residuals; (ii) heteroscedasticity test; and normality test.

The result of the serial correlation test is found in Annex 4 and shows a p-value of 0.2991 greater than the significance level of 1%, 5% and 10%, so it does not reject the null hypothesis of lack of serial correlation. Thus, it can be confirmed that the estimated VEC model does not suffer from serial autocorrelation.

The result of the heteroscedasticity test is found in Annex 5 and presents a p-value for the variables together of 0.5945 greater than the significance levels of 1%, 5% and 10%, thus rejecting the null hypothesis of the presence of heteroscedasticity. It is confirmed that the error variance of the estimated VEC model is not dispersed.

The third test performed is the normality test of the model in Annex 6, based on the Jarque-Bera test of adequacy to verify if the data have asymmetry and kurtosis corresponding to a normal distribution. The test revealed that all variables are normally distributed, confirmed by p-value >5%, except for branches and bank accounts.

Finally, the CUSUM test was performed to assess the stability of the model, in Annex 7, which confirms that the residual variances are stable as they run within the critical value of 5% significance.

6. CONCLUSIONS AND POLICY IMPLICATIONS

6.1. Conclusions

The response to the theme of this study about the existence of a relationship between financial inclusion and financial stability is positive. The analyzes conducted allowed us to reach results consistent with economic theory by confirming that financial inclusion contributes to financial stability for the case of Mozambique.

The conclusion is based on the following analysis, firstly, through the dispersion analysis, which conclude that financial inclusion contributes to the reduction of banknotes and coins in circulation, increasing credit to the economy and increasing investment. In turn, the monetary stability indicator, measured by the annual variation of the CPI, showed a negative relationship with digital financial inclusion, measured by the number of EMI accounts, being in line with economic theory, by contributing to the reduction of inflation because of the geographic and demographic expansion of the country's electronic money supply.

Second, the correlation analysis showed an expected sign in the relationship between the CPI variation and all the variables included in the model, except for the interest rate, thus revealing that the increase in financial inclusion contributes to monetary stability measured by the stability of the general price level.

Thirdly, the variance decomposition analysis showed that 70% of the variation observed in the CPI is due to changes observed in the CPI itself and the remaining 30% are due to digital financial inclusion (12.6%), traditional financial inclusion (7.3%) and changes in the interest rate (7.8%).

Fourth, Granger's causality test showed that digital financial inclusion measured by agents and EMI Granger-causes the CPI, thus revealing the role of digital financial inclusion in achieving monetary stability.

Fifth, the estimated long-term VEC model proved to be statistically significant, revealing that there is a long-term relationship between the variables. The short-term VEC model revealed that the deviation of the CPI from its long-term equilibrium is corrected in the current period at an adjustment speed of 10.19% for the variables bank branches and bank accounts. Nevertheless, EMI shows a positive short-term impact.

Finally, it can be concluded that the model results are robust since it passes the normality and stability of the model tests, as well as because were also confirmed the absence of

autocorrelation and heteroscedasticity, thus confirming the existence of a relationship between financial inclusion, especially digital, and monetary stability.

6.2. Policy Implications

Having proven the role of financial inclusion in monetary stability, the following policy implications must be taken in consideration: first, the effectiveness of monetary policy depends on the predictive capacity of its policy instruments. As financial inclusion, especially digital, has shown to contribute to price stability, there is an urgent need for the transmission and forecasting model of the monetary policy rule to incorporate financial inclusion variables, especially digital ones, to capture the dynamics of this financial segment in measures aimed at monetary stability.

Second, in a situation of increasing financial inclusion, the weight of core inflation increases, so to ensure the increase in the effectiveness of monetary policy, the forecast model of the central bank must place greater weight on core inflation in relation to headline inflation.

Finally, it must always be considered that improving financial inclusion is only achieved by observing increased financial education and financial consumer protection, as well as observing financial integrity.

7. REFERENCES

AFI (2010), “Financial Inclusion measurement for regulators: survey design and implementation”, Policy Paper, Alliance for Financial Inclusion e Bankable Frontier Associates.

AFI (2011), “Measuring Financial Inclusion: Core set of financial inclusion indicators”. Financial Inclusion Data working Group.

Abbasi, A. e Weigend, H. (2017), “The impact of Digital Financial Services on Firm´s Performance: a Literature Review”, Department of Management; Tilburg School of Economics and Management; Tilburg University.

Abel, Sanderson; Mutandwe, Learnmore & Le Roux, Pierre (2018), “A Review of Determinants of Financial Inclusion”, International Journal of Economics and Financial Issues; ISSN: 2146-4138.

ADB (2016), “Financial Inclusion in the Digital Economy”, Asian Development Bank.

Agyekum, F; Locke, S. & Hewa-Wellage, N. (2016), “Financial Inclusion and Digital Financial Services: Empirical Evidence from Ghana”, MPRA – Munich Personal RePEC Archive.

Ahamad, Shaikshakeel; Nair, Madhusoodhnan; & Varghese, Biju (2013), “A Survey on Crypto Currencies”, ACEEE – Associations of Computer Electronic and Electrical Engineers.

Alexander, K. (2017), “Financial Inclusion: The role of fintech and digital financial services”, UNCTAD, Multi-year Expert Meeting on Trade, Services and Development.

Anthony-Orji, O. et. al. (2019), “Financial Inclusion and Monetary Policy Shocks Nexus in Nigeria: A new empirical evidence”, Journal of Academic Research in Economics, Volume 11, Number 2, pp. 364-389.

Bech, Morten & Garratt, Rodney (2017), “Central Bank Criptocurrencies”, BIS Quarterly Review.

Behl, A. e Pal, A. (2016), “Analyzing the Barriers towards Sustainable Financial Inclusion Using Mobile Banking in Rural India”, Indian Journal of Science and Technology, Vol. 9(15), DOI:10.17485/ijst/2016/vpi15/92100.

BM (2013), “Desafios da Inclusão Financeira em Moçambique: Uma Abordagem do Lado da Oferta”, 37º Conselho Consultivo, Pemba, Banco de Moçambique.

BM (2017 a), “Quadro de Política Monetária do Banco de Moçambique”, Banco de Moçambique.

BM (2017 b), “Relatório de Inclusão Financeira 2016”, Relatório de Implementação da Estratégia Nacional de Inclusão Financeira 2016-2022.

CGAP (2011), “Financial Inclusion and Development: Recent Impact Evidence” Focus Note nº92, The Consultative Group to Assist the Poor (CGAP).

CGAP (2017), “Advancing Financial Inclusion to Improve the Lives of the Poor”, The Consultative Group to Assist the Poor (CGAP) Annual Report 2017.

Çakici, Mücahid (2016), “The Prophet of Innovation: Joseph Schumpeter”, Working Paper, Istambul Commerce University.

Fernandes C, et. al (2020): The contribution of digital financial services to financial inclusion in Mozambique: an ARDL model approach, Applied Economics, DOI: 10.1080/00036846.2020.1808177

CGAP (2015), “Digital Financial Inclusion: Implications for Customers, Regulators, Supervisors and Standard Setting Bodies”, Consultative Group To Assist the Poor.

Chatterjee, Amrita e Anand, Nitigya (2017), “Financial Inclusion and Communication Technology Diffusion and Economic Growth: A panel data analysis”, Working Paper nº.165/2017, Madras School of Economics.

Di Castri, Simone & Gidvani, Lara (2014), “Enabling Mobile Money Policies in Tanzania: A ´test and learn´ approach to enabling market-led digital financial services”, Mobile Money for the Unbanked, GSMA.

Ellis, K. et. al. (2010), “Financial Inclusion, household investment and growth in Kenya and Tanzania”, project Briefing, Overseas Development Institute, 43, 1-4.

Fernandes, C. (2010), “Eficácia da Regra de Taylor no Mecanismo de Transmissão da Política Monetária: O caso de Moçambique entre 1993 a 2009”, Dissertação, Programa de Pós Graduação em Economia, UEM.

Gebregziabher, Kidanemariam & Makina, Daniel (2015), "Financial Inclusion in Selected Asian Countries: Evidence Using Dynamic Panel Data Analysis", University of South Africa, Department of Finance, Risk Management and Banking, Research Gate doi:10.1314/RG.2.1.4366.0008.

GPFI (2015), "Innovative Digital Payment Mechanisms Supporting Financial Inclusion Stocktaking Report"; Turkey G20.

GPFI (2016a), "Global Standard Setting Bodies and Financial Inclusion: The evolution Landscape", Global Partnership for Financial Inclusion.

GPFI (2016b), "G20 High-level Principles for Digital Financial Inclusion", Global Partnership for Financial Inclusion.

GPFI (2017), "Digital Financial Inclusion: Emerging Policy Approaches", G20 Global Partnership for Financial Inclusion (GPFI), World Bank Group.

Gupta, S.; Keen, M.; Shah, A. & Verdier, G. (2017), "Digital Revolutions in Public Finance", International Monetary Fund, Washington, DC.

Hanning, A. e Jensen, S. (2010), "Financial Inclusion and Financial Stability: Current Policy Issues", ADBI Working Paper Series, Asian Development Bank Institute.

Harelimana, Jean Bosco (2018), "The Role of Electronic Payment System on the Financial Performance of Financial Institutions in Rwanda", Global Journal of Management and Business Research: Finance, Volume 18, Issue 1, version 1.

He, D; Leckow, R.;Haksar, V.; Mancini-Griffoli, T.; Jenkinson, N.; Kashima, M.; Khiaonarong, T.; Rochon, C.; e Tourpe, H. (2017), "Fintech and Financial Services: Initial Consideration", IMF Staff Discussion Note, SDN/17/05.

Hendry, D.F., 1995, Dynamic Econometrics, Oxford University Press, Oxford

Hung, B. (2016), "Financial Inclusion and the effectiveness of Monetary Policy in Vietnam: An empirical analysis", Banking Academy.

Khan, H. R. (2011), "Financial Inclusion and Financial Stability: are they two sides of the same coin? Bancon, 2011.

Kithionji, Emily (2017), "Effects of Digital Banking Strategy on Financial Inclusion Among Comercial Banks in Kenya", University of Nairobi.

Lagarde, Christine (2017), "Central Banking and Fintech: A Brave New World?", International Monetary Fund (MF), Washington, DC.

Lahcen & Gomis-Porqueras (2019), "A Model of Endogenous Financial Inclusion: Implications for Inequality and Monetary Policy", University of Zurich, Department of Economics, Working Paper Series nº310.

Lapukeni, A. F. (2015), "The impact of Financial Inclusion on Monetary Policy Effectiveness: The Case of Malawi", Int. J. Monetary Economics and Finance, Vol. 8, Nº.4, 2015, pp:360-384.

Lenka, S.K., Bairwa, A. K. (2016), "Does Financial Inclusion affect monetary policy in SAARC countries?", Cogent economics & finance (2016) 4:1127011.

Manyika, J. et al. (2016), "Digital Finance for all: Powering Inclusive Growth in Emerging Economies", Mckinsey Global Institute.

Mbutor, M. e Uba, I. (2013), "The Impact of Financial Inclusion on Monetary Policy in Nigeria", Journal of Economics and International Finance, Vol. 5(8), pp. 318-326, November, 2013.

Mehrotra, A. & Nadhanael, G. (2016), "Financial Inclusion and Monetary Policy in Emerging Asia Financial Inclusion (pp.93-127) Springer.

Morgan, P. e Pontines, V. (2014), "Financial Stability and Financial Inclusion", ADBI Working Paper Series, Nº. 488. Asian Development Bank Institute.

Olaniyi, E. & Adeoye, B. (2016), "Determinants of Financial Inclusion in Africa: A Dynamic Panel Data Approach", University of Mauritius, Research Journal, Vol. 22-2016.

Ouma, S. et. al. (2017), "Mobile financial services and financial inclusion: Is it a boom for savings and financial inclusion?". Science Direct, Review of Development Finance, 7(2017) 29-35.

Ouma, S.; Odongo, T. e Were, M. (2017), "Mobile financial services and Financial Inclusion: Is it a boom for savings mobilization?", Review of Development Finance, Science Direct.

Ozili, P. (2018), "Impact of digital finance on financial inclusion and stability" Borsa Istambul Review 18-4(2018) 329-340.

Pham, M. e Doan (2020), "The impact of financial inclusion on financial stability in Asian Countries" Journal of Asian finance, Economics and Business Vol. 7, nº6 (2020) 047-059.

Sarma, M. (2008), "Index of Financial Inclusion", Discussion Papers in Economics nº. 10-05, Centre for International Trade and Development, School of International Studies, Jawaharlal Nehru University, India.

Sarma, M. (2012), "Index of Financial Inclusion: A measure of Financial Sector Inclusiveness", Working Paper Nº. 04/2012, DAAd Partnership.

Sarma, M. e Pais, J. (2010), "Financial Inclusion Index and Development: A cross-country Analysis", Indian Council for Research on International Economics Relations and Institute for Studies in Industrial Development.

Schumpeter, Joseph A. (2004), "The Theory of Economic Development: An Inquiry into Profits, Capital, Interest and the Business Cycle", 10ª Edição da Original Cambrige Mass. Harvard University Press, Harvard Economics Studies V.46.

Siddiqui, T. e Siddiqui, K. (2017), "Exploring linkages between Telecom and Financial Inclusion: An Innovative Strategy for Success", Indian Institute of Technology, New Delhi, pp. 830-837.

Soriano, Miguel A. (2017), "*Factors Driving Financial Incluion and Financial Performance in Fintech New Ventures: An Empirical Study*", Singapore Management University.

Taylor, J. B. (1999b), "The Monetary Transmission Mechanism and The Evaluation of Monetary Policy Rules", California: Stanford University.

Taylor, J. B. (1999a), "Monetary Policy Rules", Chicago: National Bureau of Economic Research (NBER), Business Cycles Series, Volume 31.

World Bank Group (2016), "Innovation in Electronic Payment Adoption: The case of small retailers", World Economics Forum.

World Bank Group (2016), "Innovation in Electronic Payments Adoptions: The case of small Retailers", World Economic Forum.

Wright, G. et al. (2013), "Financial Inclusion Through Digital Financial Services: a Guide Tour linked to resources". Microsave.

Yetman, James (2017), "Adopting monetary policy to increasing financial inclusion", Bank for International Settlements, Irving Fisher Committee on Central Banks Statistics, Bank of Morocco – CEMLA – IFC Satellite Seminar at the ISI Word Statistics Congress on Financial Inclusion.

8. ANNEXES

Annex 1: Literature Indicators for financial inclusion and stability relationship

Nº.	Author (year)	Indicators		
		Monetary Stability (MS_t)	**Financial Inclusion** (FI_t)	**Control Variables** $(Ctrl_t)$
1.	Mbutor e Uba (2013)	▪ Log inflation rate	Vector of FI Indicators ▪ Number of bank branches ▪ Value of bank loans as a percentage of gross domestic product; ▪ Value of deposits and bank loans granted by rural agencies;	▪ Commercial bank loan interest rate ▪ Exchange rate
2.	Lapukent (2015)		Vector of FI indicators ▪ Value of loans as a percentage of gross domestic product; ▪ Value of deposits as a percentage of gross domestic product;	▪ Currency offer (M2) ▪ Exchange rate ▪ Loan interest rate
3.	Lenka e Bairwa (2016)	▪ Inflation rate	Financial Inclusion Index (FII): ▪ Geographic penetration: o Number of bank branches per 1000 km2; o Number of ATMs per 1000 km2; ▪ Demographic penetration: o Number of bank branches per 100,000 adults; o Number of ATMs per 100,000 adults;	▪ Commercial bank loan interest rate ▪ Exchange rate
4.	Hung (2016)			

Nº.	Author (year)	Indicators		
		Monetary Stability (MS_t)	**Financial Inclusion** (FI_t)	**Control Variables** ($Ctrl_t$)
			▪ Bank penetration: o Value of bank loans as a percentage of gross domestic product; and o Value of bank deposits as a percentage of gross domestic product	

Source: Mbutor and Uba (2013), Lapukent (2015), Lenka and Bairwa (2016) and Hung (2016)

Annex 2: ADF Unit Root Test – AIC Criterion

Serie		**Level**			**1st Difference**		
		τ	τ_μ	τ_τ	τ	τ_μ	τ_τ
1) LNVIPC	Y_1	-1,71	-1,47	-1,81	-4,91	-5,06	-5,06
		(0,08)	*(0,55)*	*(0,69)*	*(0,00)***	*(0,00)***	*(0,00)***
2) LNAB	X_1	1,85	-2,15	-0,65	-13,37	-13,73	-14,02
		(0,99)	*(0,23)*	*(0,97)*	*(0,00)***	*(0,00)***	*(0,00)***
3) LNAIME	X_2	0,51	-3,27	-2,61	*-8,58*	*-9,04*	*-9,40*
		(0,83)	*(0,02)*	*(0,28)*	*(0,00)***	*(0,00)***	*(0,00)***
4) LNCBANC	X_3	*-2,75*	*-2,68*	*-1,35*	*-2,23*	*-2,92*	*-3,79*
		*(0,00)***	*(0,08)**	*(0,87)*	*(0,03)**	*(0,05)**	*(0,02)**
5) LNCAIME	X_4	-4,23	-6,06	-7,77			
		*(0,00)***	*(0,00)***	*(0,00)***			
6) LNTC	X_5	1,58	-0,66	-2,16	-5,55	-5,82	-5,80
		(0,97)	*(0,85)*	*(0,51)*	*(0,00)***	*(0,00)***	*(0,00)***
7) LNTJ	X_6	-0,05	-3,35	-3,27	-4,47	-4,65	-4,69
		(0,66)	*(0,01)***	*(0,07)**	*(0,00)***	*(0,00)***	*(0,00)***

Notes: τ : without constant; τ_μ: with constant; τ_τ: with constant and intercept. (***) Rejects H0 at the significance level of 1%; (**) Rejects H0 at a significance level of 5%; (*) Rejects H0 at the 10% significance level.

Annex 3: VEC Residual Serial Correlation LM Tests

Null hypothesis: No serial correlation at lag h						
Lag	LRE* stat	df	Prob.	Rao F-stat	Df	Prob.
1	54.49173	49	0.2736	1.131913	(49, 95.8)	0.2991
Null hypothesis: No serial correlation at lags 1 to h						
Lag	LRE* stat	df	Prob.	Rao F-stat	Df	Prob.
1	54.49173	49	0.2736	1.131913	(49, 95.8)	0.2991
*Edgeworth expansion corrected likelihood ratio statistic.						

Annex 4: VEC Residual Heteroskedasticity Tests

Joint test:		
Chi-sq	df	Prob.
440.2203	448	0.5945

Individual components:

Dependent	R-squared	F(16,23)	Prob.	Chi-sq(16)	Prob.
res1*res1	0.292771	0.595080	0.8560	11.71083	0.7636
res2*res2	0.183554	0.323179	0.9882	7.342154	0.9661
res3*res3	0.348292	0.768243	0.7028	13.93168	0.6038
res4*res4	0.131919	0.218451	0.9986	5.276759	0.9942
res5*res5	0.347777	0.766500	0.7044	13.91107	0.6053
res6*res6	0.708245	3.489582	0.0032	28.32981	0.0289
res7*res7	0.321287	0.680479	0.7841	12.85148	0.6836
res2*res1	0.263300	0.513768	0.9132	10.53199	0.8374
res3*res1	0.430625	1.087200	0.4178	17.22501	0.3712
res3*res2	0.288268	0.582222	0.8659	11.53074	0.7756
res4*res1	0.256093	0.494866	0.9245	10.24374	0.8536
res4*res2	0.213639	0.390541	0.9715	8.545563	0.9309
res4*res3	0.432748	1.096649	0.4106	17.30994	0.3658
res5*res1	0.314525	0.659586	0.8025	12.58101	0.7031
res5*res2	0.388180	0.912048	0.5671	15.52721	0.4864
res5*res3	0.253497	0.488146	0.9283	10.13989	0.8592
res5*res4	0.216322	0.396799	0.9694	8.652881	0.9270
res6*res1	0.534491	1.650517	0.1329	21.37964	0.1644
res6*res2	0.611209	2.259859	0.0363	24.44836	0.0802
res6*res3	0.462209	1.235471	0.3143	18.48836	0.2961
res6*res4	0.364421	0.824217	0.6495	14.57683	0.5558
res6*res5	0.285294	0.573818	0.8722	11.41177	0.7834
res7*res1	0.273933	0.542345	0.8947	10.95733	0.8121
res7*res2	0.327413	0.699769	0.7666	13.09651	0.6657
res7*res3	0.275063	0.545431	0.8926	11.00252	0.8093
res7*res4	0.188432	0.333763	0.9862	7.537287	0.9615
res7*res5	0.286335	0.576752	0.8701	11.45342	0.7807
res7*res6	0.454963	1.199936	0.3371	18.19853	0.3124

Annex 5: VEC Residual Normality Tests

Component	Skewness	Chi-sq	df	Prob.*
1	-0.054221	0.019600	1	0.8887
2	-0.498911	1.659413	1	0.1977
3	1.167253	9.083193	1	0.0026
4	-0.148505	0.147025	1	0.7014
5	1.761240	20.67977	1	0.0000
6	0.053874	0.019349	1	0.8894
7	-0.376776	0.946402	1	0.3306
Joint		32.55476	7	0.0000
Component	**Kurtosis**	**Chi-sq**	**df**	**Prob.**

1	2.952361	0.003782	1	0.9510
2	3.361249	0.217501	1	0.6410
3	5.768490	12.77422	1	0.0004
4	4.111888	2.060490	1	0.1512
5	6.863405	24.87650	1	0.0000
6	2.700549	0.149452	1	0.6991
7	2.289130	0.842228	1	0.3588
Joint		40.92418	7	0.0000

Component	Jarque-Bera	Df	Prob.
1	0.023382	2	0.9884
2	1.876914	2	0.3912
3	21.85742	2	0.0000
4	2.207515	2	0.3316
5	45.55628	2	0.0000
6	0.168801	2	0.9191
7	1.788630	2	0.4089
Joint	73.47894	14	0.0000

*Approximate p-values do not account for coefficient estimation

Annex 6: CUSUM test for stability diagnostic