A Sectoral Analysis of E-money Consumption & Growth

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Outline

1. Motivation
2. Key Terms
3. Introduction
   ◦ Global Outlook
   ◦ Benefits
   ◦ Issues & Challenges
4. Objectives
5. Overview of Jamaica
6. Literature Review
7. Data
8. Methodology
9. Results
10. Conclusion
11. Recommendation

Motivation

- There has been rapid developments in e-money globally.

- Researchers over the years have theorized a link between growth in e-money and economic growth.

- There is a significant empirical deficiency with the literature.

- There has been consistent increases in the adoption and usage of instruments in circulation within the Jamaican payment system.

Key Terms

- **Payment Systems**

  Refers to the set of instruments, regulatory framework, banking procedures and interbank funds transfer systems (ECB).

- **Retail Payments**

  Non-time-critical payments of relatively low value and high volume(ECB).

- **E-money**

  Stored value or prepaid products in which a record of the funds or value available to the consumer is stored on a device in the consumer's possession (BIS).

  For the purpose of this study, e-money will focus solely on card payments, as other modes of electronic payment are still in developmental stages and data is not readily available.
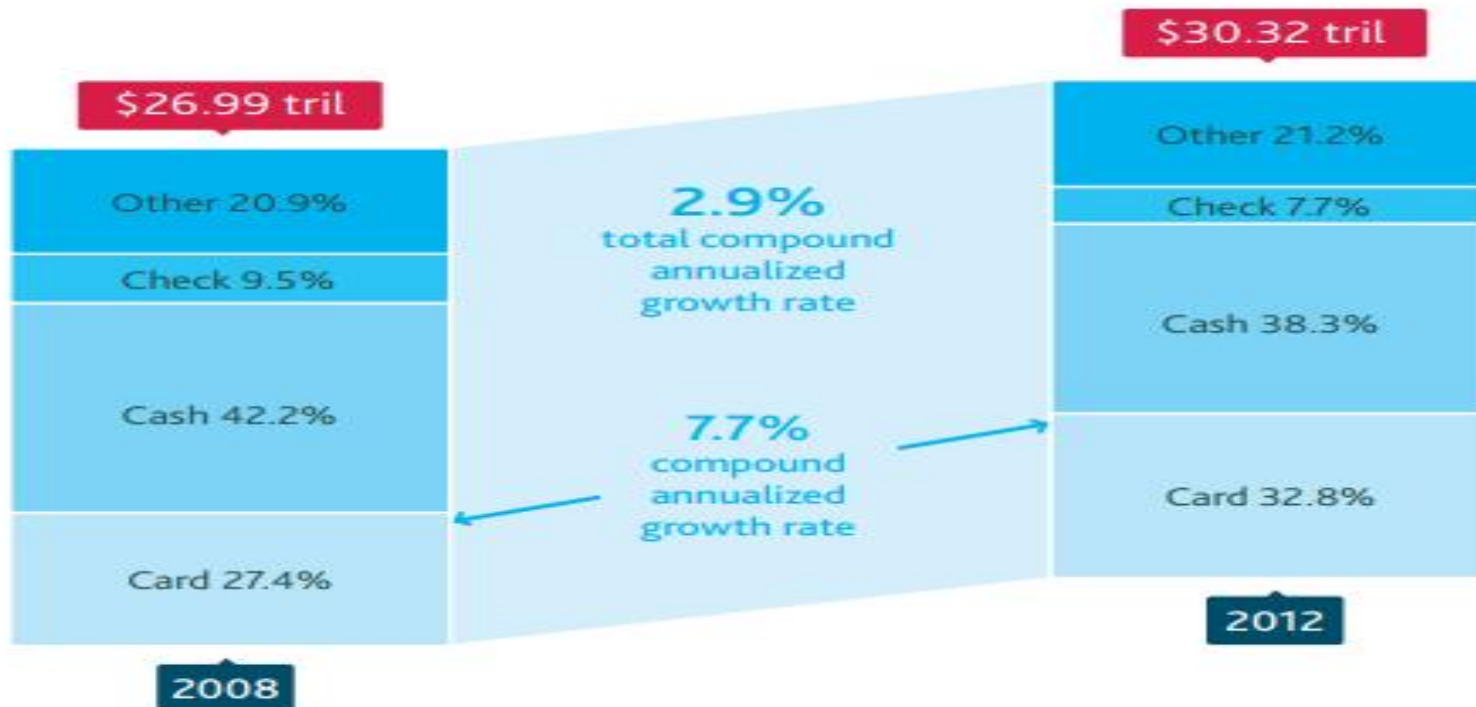
Introduction

- Technology has paved the way for the migration from paper-based forms of payments to more electronic forms.

- In 2012 , over 32% of worldwide consumer retail spending was card-based, with an average growth rate of 7.7% since 2003 (*Moody's Analytics, 2013*).

- Greater usage of electronic payments have added **US$983 billion** in global economic growth between 2008 and 2012 (*Moody's Analytics, 2013*).

Global Outlook

Global Retail Purchases Payment Breakdown *(in US$)*

Source: Euromonitor International Merchant Segment Study 2012

$26.99 tril

Other 20.9%

Check 9.5%

Cash 42.2%

Card 27.4%

2008

2.9%
total compound annualized growth rate

7.7%
compound annualized growth rate

$30.32 tril

Other 21.2%

Check 7.7%

Cash 38.3%

Card 32.8%

2012

Extracted from: Moody's Analytics (2013)

Benefits of E-money

- *Consumer:*
  - E-money reduced friction in the economy providing consumers with more convenient and secure access to their funds.
  - Allows consumers to smooth consumption .

- *Merchants:*
  - Merchants using e-money benefit from records generated after electronic transactions as well as the costs associated with the storing, processing and transportation of cash.

Issues & Challenges of E-money

▶ *Infrastructure & System Readiness*
  ◦ A considerable amount of initial capital investment and effort is required to provide the robust enabling infrastructure necessary to influence a significant change towards e-money instruments.

  ◦ A sound regulatory framework is required to safeguard the integrity of the system.

▶ *Operational Disruptions*
  ◦ The failure of major e-money issuers may lead to significant financial losses, disruption of trade, which may have significant economic implications and may also deteriorate the confidence in the system.
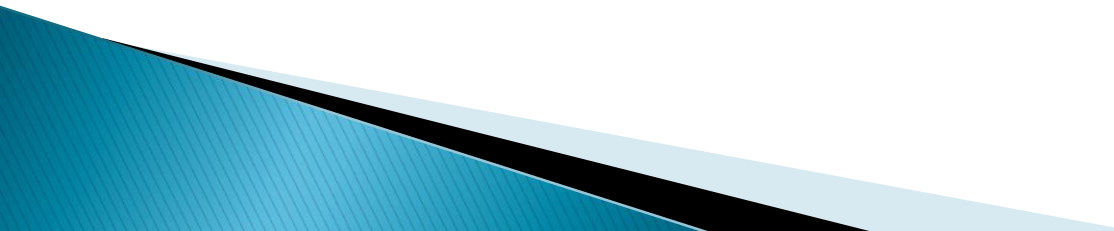
Issues & Challenges of E-money

- ***Culture***
  - The major challenge to the success of e-money is the consumer culture.

- ***Fraud***
  - The safety of funds held in e-money schemes is one of the main issues surrounding e-money products.

  - Though e-money limit the risk of conventional theft, it creates the potential for more innovative forms of theft (such as phishing, spoofing, pharming, etc.).

Objectives

- To examine growth trends in e-money for Jamaica.

- To ascertain the relationship between e-money, growth and consumption.

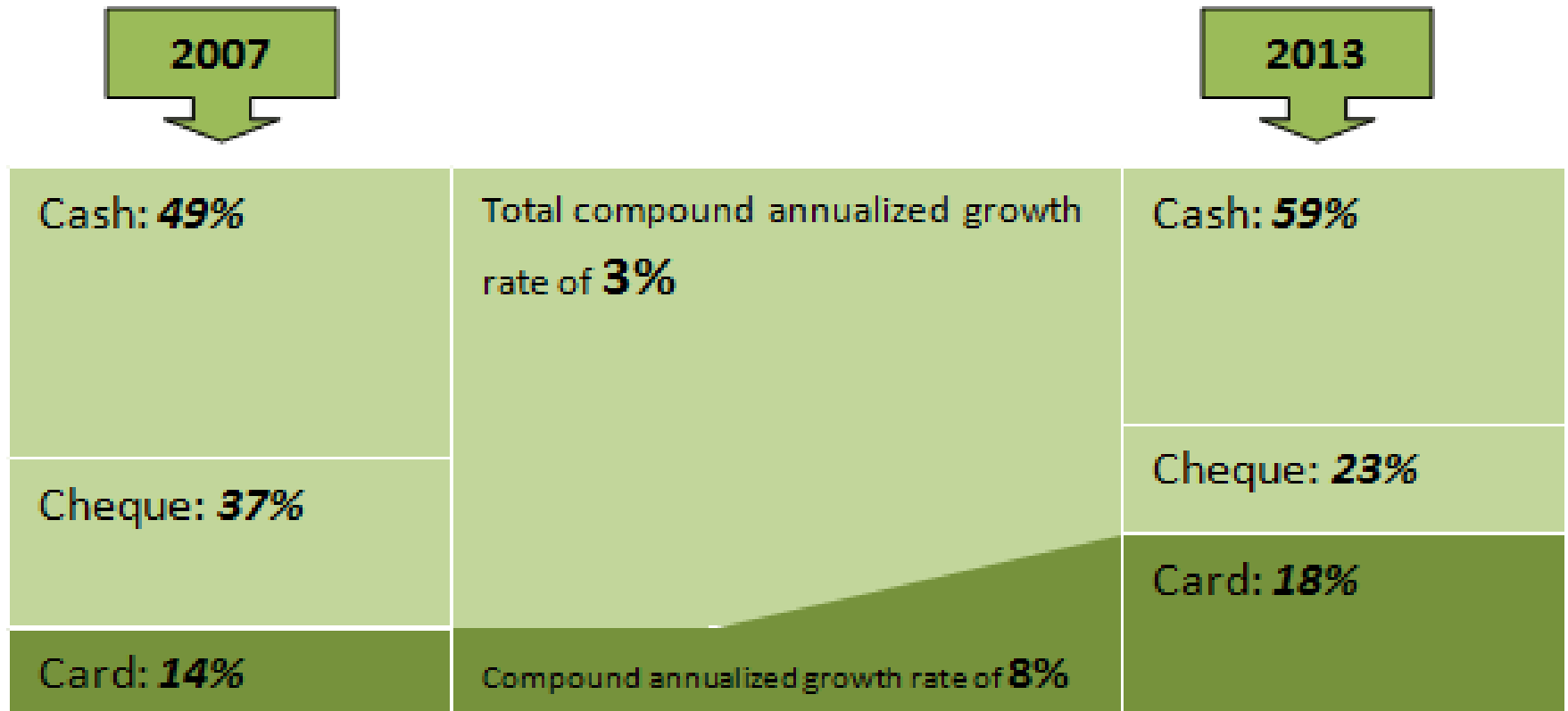- To forecast the impact of changes in e-money on consumption and growth.

Overview of Jamaica

- Predominantly paper-based
  - Cash is the dominant mode of payment
  - Cheques are mainly used for larger value retail payments

- Debit cards are the most dominant form of electronic payment.

- Recent Developments:
  - ***Conec (mobile payment)-****Jamaica Cooperative Credit Union League (JCCUL)*
  - ***M3 (microfinance through mobile and prepaid card)-*** Development Bank of Jamaica (DBJ)

Retail Payment Breakdown for Jamaica

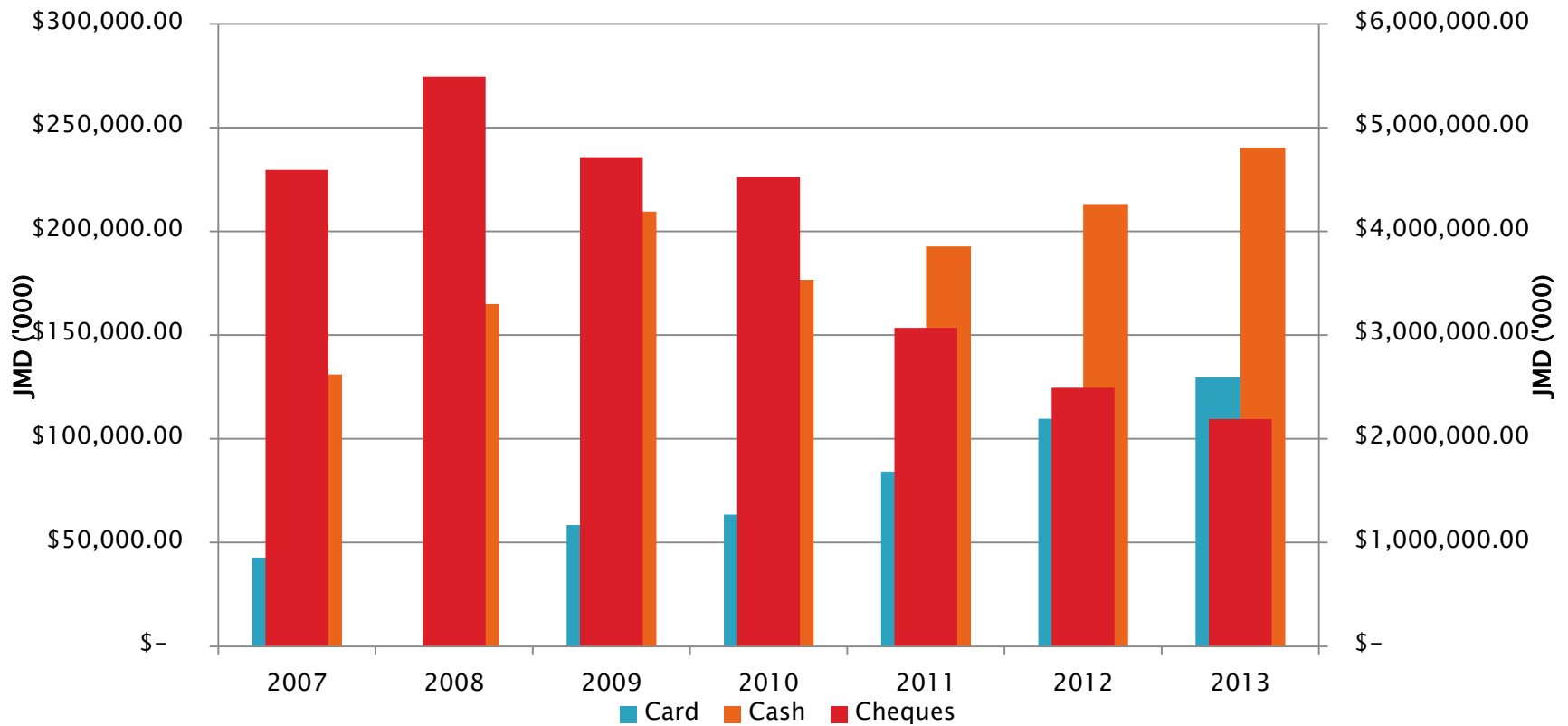| 2007		2013
Cash: **49%**	Total compound annualized growth rate of **3%**	Cash: **59%**
Cheque: **37%**		Cheque: **23%**
Card: **14%**	Compound annualized growth rate of **8%**	Card: **18%**

Data Sourced from the Bank of Jamaica

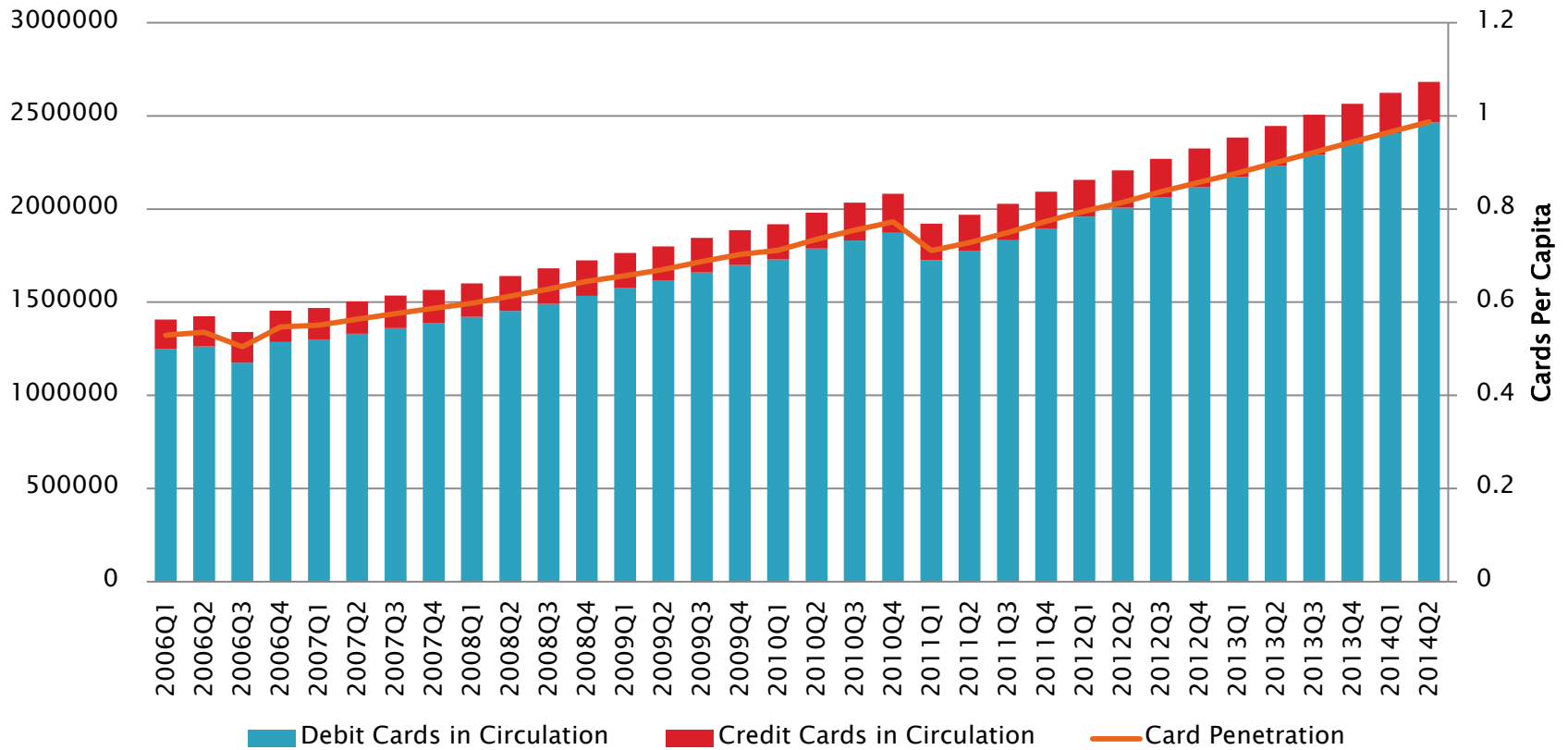# Retail Payment Breakdown for Jamaica

Retail Payment Transaction Values
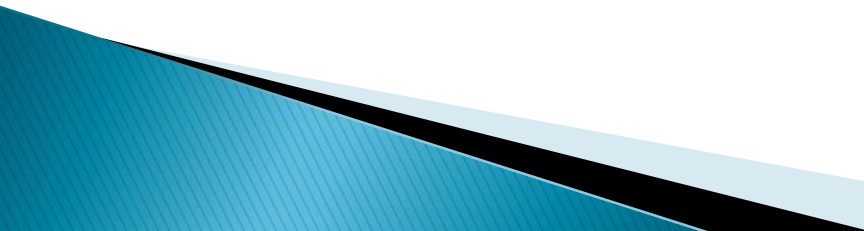(2007 – 2013)

Data Sourced from the Bank of Jamaica

E-money and the Population

Cards in Circulation

Literature

- Humphrey, Pulley and Vesala (1996)
- Pesaran and Shin (1999)
- Humphrey, Kim and Vesala (2001)
- Pesaran, Shin and Smith (2001)
- Mohammad (2008)
- Hasan Renzis and Schmiedel (2012)
- Moody's Analytics (2013)
- Fung, Molico and Stuber (2014)

Literature

- Fung, Molico and Stuber (2014) – *Electronic Money and Payments: Recent Developments and Issues:*

  ◦ Found a slower than expected adoption of e-money globally.

  ◦ However e-money innovation tends to be concentrated in cash – intensive economies.

- Hasan Renzis and Schmiedel (2012) – *Retail Payments and the Real Economy:*

  ◦ Migration to efficient electronic retail payments stimulates the overall economy, consumption and trade.

  ◦ Card Payments shows the strongest relationship between the GDP, consumption and trade.

Literature

- Moody Analytics (2013) – *The Impact of Electronic Payment on Economic Growth:*

  ◦ *Also identified a slow migration from paper-based modes of payment.*

  ◦ Found a positive relationship between e-money, consumption and growth.

  ◦ They found that electronic payments contributed to **0.3% growth in GDP** in **developed countries** and **0.8%** increases for **emerging markets.**

  ◦ Card usage raised consumption by an average of 0.7% across the 56 countries analyzed.

Data

▶ **Quarterly Data 2006:Q1 – 2014:Q2**

Source: The Bank of Jamaica

Dependent Variables
◦ Nominal GDP per Capita
◦ Nominal Sectoral GDP per capita:
- Agriculture, Forestry & Fishing
- Electricity & Water Supply
- Finance & Insurance Services
- Wholesale and Retail Trade, Repairs & Installation
◦ Consumption per capita:
- Total
- Private Consumption

Variables of Interest
◦ Card Penetration:
- Card in Circulation to the population
- Card Volume to the population

Control Variable
◦ Interest rate: *Savings rate*

Methodology

We are estimating the relationship between e-money, consumption and growth.

We adopt the model estimated by *Hasan et al. (2012)*, adding new measures of penetration .The models is outlined below:

$$LY_t = \alpha_0 + LVol_{pen_t} + LCir_{pen_t} + Int_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots.\dots\dots (1)$$

$$LCons_t = \alpha_0 + LVol_{pen_t} + LCir_{pen_t} + Int_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where:
LY_t is the natural log of GDP per capita and sectoral GDP per capita
$LCons_t$ is the natural log of consumption per capita
$LVOL_{pen_t}$ represents the natural log of card volume to the population
$LCir_{pen_t}$ represents the natural log of card in circulation to the population
Int_t is the savings rate
ε_t is the error term

Methodology

Autoregressive Distributive Lag Model (ARDL), proposed by Pesaran and Shin (1999) and Pesaran et al. (2001)

General model:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{N} \delta_i \Delta Y_{t-i} + \sum_{j=0}^{N} \beta_j \Delta X'_{t-j} + \theta_0 Y_{t-1} + \theta_i X'_{t-1} + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots. (3)$$

Where:

Y_t is the dependent variable

X' is a matrix of explanatory variables

β_j is a vector of coefficients for explanatory variables

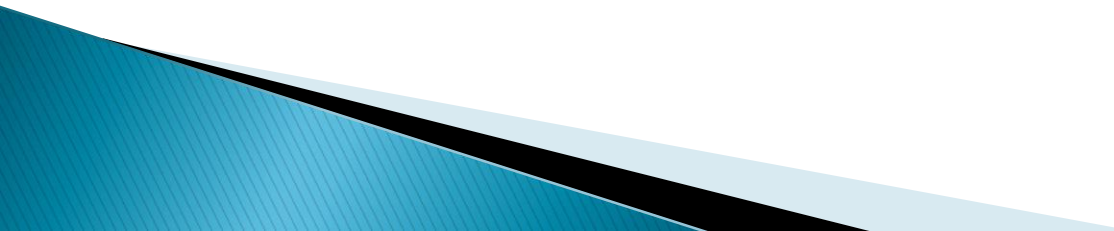δ_i is a vector of coefficients for the lagged differences of the dependent variable

θ_i are coefficents of the level variables with one lag

Δ represents variables that are in first difference

β_0 is a constant

e_t is the error term

Advantages of ARDL

▸ It can be used to estimate data with mixed order of integration (I(0) and I(1) only)

▸ It involves a single – equation setup which makes it simple to implement and to interpret

▸ Different variables can be assigned different lag-lengths as they enter the model

Methodology

▸ Model Estimated:

$$\Delta LY_t = \beta_0 + \sum_{i=1}^{2} \delta_i \Delta LY_{t-i} + \beta_1 \Delta Vol_{pen_{t-1}} + \beta_2 \Delta LCir_{pen_{t-1}} + \beta_3 \Delta Int_{t-1} + \theta_0 LY_{t-1} + \theta_1 LVol_{pen_{t-1}} + \theta_2 LCir_{pen_{t-1}} + \theta_3 Int_{t-1} + e_t \ldots \ldots \ldots \ldots (3)$$

$$\Delta LCons_t = \beta_0 + \delta_1 \Delta LCons_{t-1} + \beta_1 \Delta Vol_{pen_{t-1}} + \beta_2 \Delta LCir_{pen_{t-1}} + \beta_3 \Delta Int_{t-1} + \theta_0 LCons_{t-1} + \theta_1 LVol_{pen_{t-1}} + \theta_2 LCir_{pen_{t-1}} + \theta_3 Int_{t-1} + e_t \ldots \ldots \ldots \ldots (4)$$

Methodology

- An Ordinary Least Squares (OLS) model is estimated to generate an *error correction term*
- The Error Correction Models (ECM) is then used to establish short-run dynamics:

$$\Delta LY_t = \beta_o + \sum_{i=1}^{2} \delta_i \Delta LY_{t-i} + \beta_1 \Delta LVol_{pen_{t-1}} + \beta_2 \Delta LCir_{pen_{t-1}} + \beta_3 \Delta Int_{t-1} + \theta_1 z_{t-1}$$
$$+ e_t \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

$$\Delta LCons_t = \beta_o + \delta_1 \Delta LCons_{t-1} + \beta_1 \Delta LVol_{pen_{t-1}} + \beta_2 \Delta LCir_{pen_{t-1}} + \beta_3 \Delta Int_{t-1} + \theta_1 z_{t-1}$$
$$+ e_t \ldots\ldots\ldots\ldots(6)$$

Where:

z_t represent the error correction term

θ_1 is the coefficient on the error correct term

Results: Bounds Test

	< I(0)	>I(0) ≤ I(1)	> I(1)
Overall GDP			5.1319***
Agriculture, Forestry & Fishing			7.1801***
Electricity & Water Supply			10.3152***
Finance & Insurance Services			10.0262***
Wholesale and Retail Trade, Repairs & Installation		3.2991*	
Consumption			4.3194**
Private Consumption			3.8640**

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

Results: Long-run Relationships

	Θ_1 Penetration (Volume)	Θ_2 Penetration (Card in Circulation)	LY_{t-1}	Elasticity	
				Card Penetration (Volume)	Card Penetration (Card in Circulation)
Overall GDP	-	0.482**	-0.503**	-	0.958
		(0.2298)	(0.1963)		
Agriculture, Forestry & Fishing	-	1.431***	-1.139***	-	1.256
		(0.4305)	(0.2364)		
Electricity & Water Supply	-	1.530***	-1.892***	-	0.809
		(0.3683)	(0.2777)		
Finance & Insurance Services	-0.110**	0.339*	-0.361***	-0.304	0.941
	(0.0526)	(0.1677)	(0.1126)		
Wholesale and Retail Trade, Repairs & Installation	-	0.444**	-0.487**	-	0.913
		(0.2021)	(0.1838)		
Consumption	-0.236**	0.647*	-0.576**	-0.410	1.122
	(0.0872)	(0.3467)	(0.2289)		
Private Consumption	-0.227*	0.761**	-0.696**	-0.326	1.092
	(0.1109)	(0.3560)	(0.2471)		

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

Results: Short-Run Relationship

| Variables	(1)	(2)	(3)
	$\Delta LELEC_t$	$\Delta LCONS_t$	$\Delta LPRI\_CONS_t$
Constant	0.013	0.021*	0.017
	(0.0356)	(0.0118)	(0.0157)
$\Delta LYt\text{-}1$	0.664***	0.111	0.238
	(0.1885)	(0.2414)	(0.2478)
$\Delta LYt\text{-}2$	0.480***		
	(0.1482)		
$\Delta LVolpen_{t-1}$	0.094*	0.160***	0.171***
	(0.0470)	(0.0429)	(0.0546)
$\Delta LCirpen_{t-1}$	-0.942	0.010	0.041
	(0.9040)	(0.2255)	(0.3111)
ΔInt_{t-1}	-0.028	-0.006	-0.005
	(0.0616)	(0.0216)	(0.0229)
z_{t-1}	-1.884***	-0.567**	-0.695***
	(0.2559)	(0.2089)	(0.2227)
R^2	0.695	0.329	0.376
Adjusted R^2	0.619	0.189	0.246
Cusum Test	PASS	PASS	PASS
Cusum of Squares Test	PASS	PASS	PASS
LM Test (1,23)	3.3578	0.4476	1.3993

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

Forecasting: Vector Autoregressive (VAR(1,2)) Model

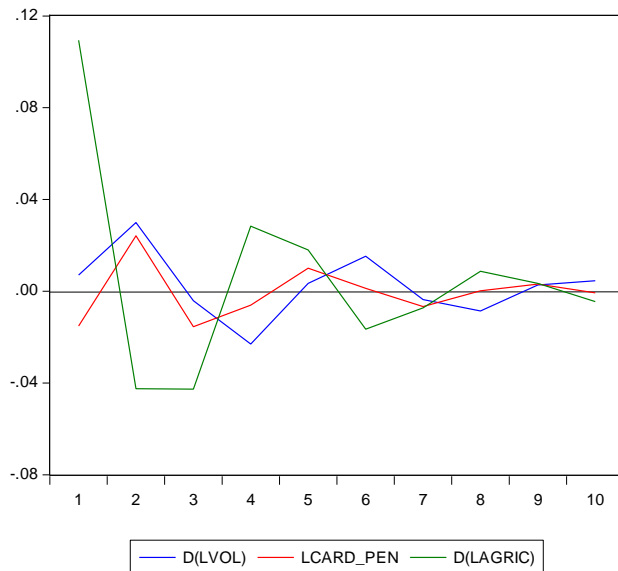Response of LGDP_CAP to Cholesky
One S.D. Innovations
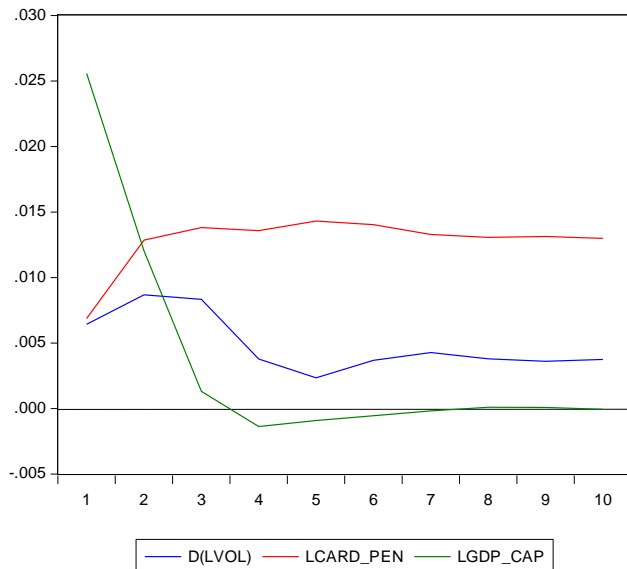
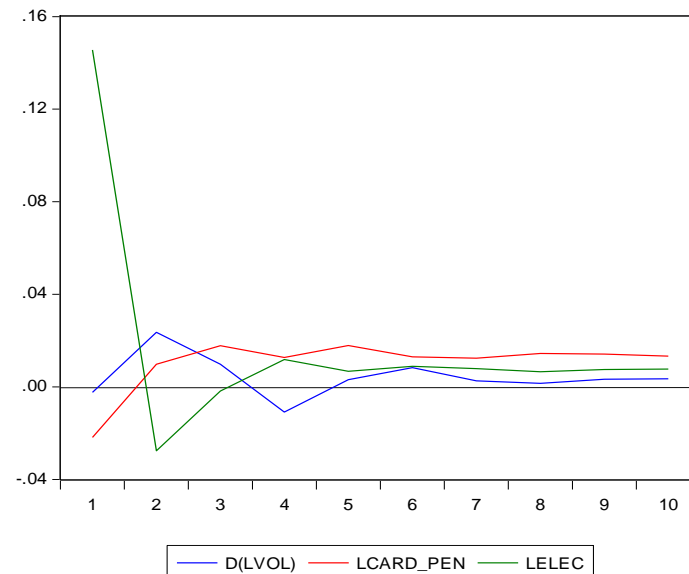Response of D(LCON) to Cholesky
One S.D. Innovations
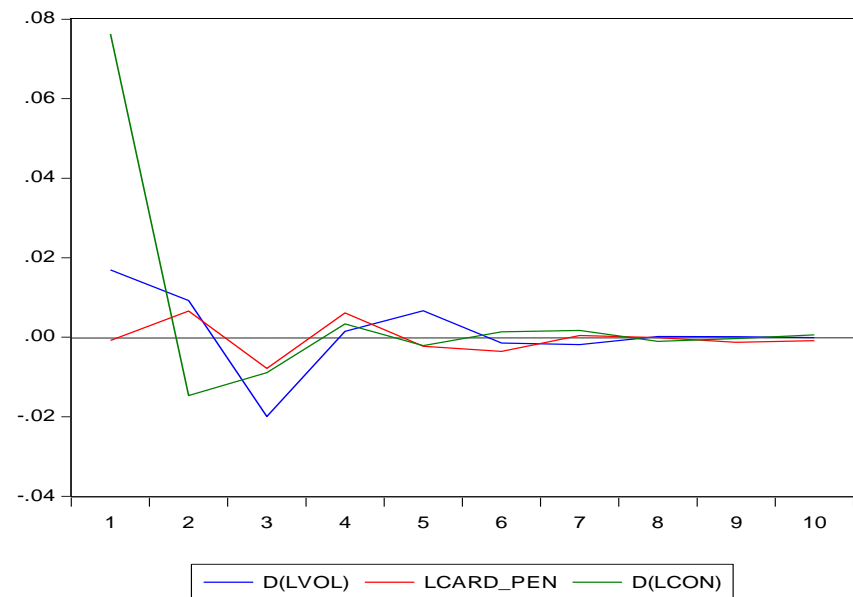
Forecasting: Vector Autoregressive (VAR(1,2)) Model
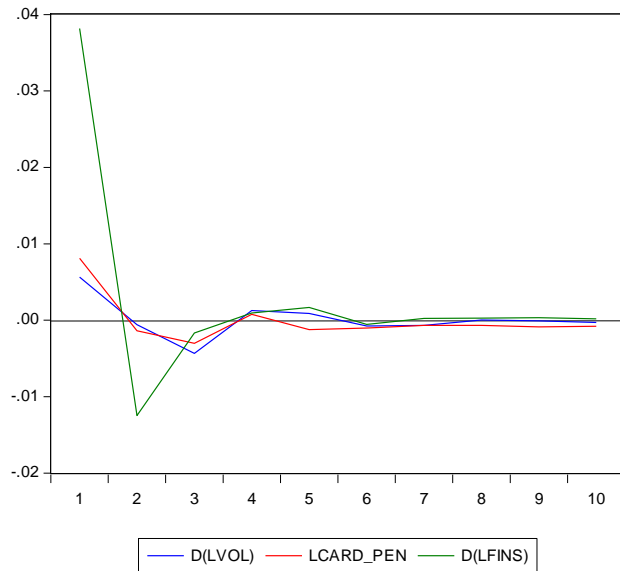

Response of D(LAGRIC) to Cholesky
One S.D. Innovations

D(LVOL) — LCARD_PEN — D(LAGRIC)

Response of LELEC to Cholesky
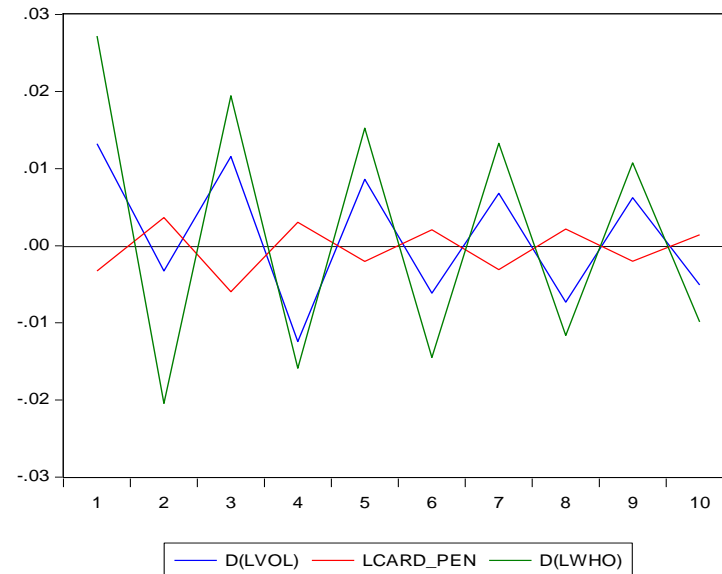One S.D. Innovations

D(LVOL) — LCARD_PEN — LELEC

Forecasting: Vector Autoregressive (VAR(1,2)) Model

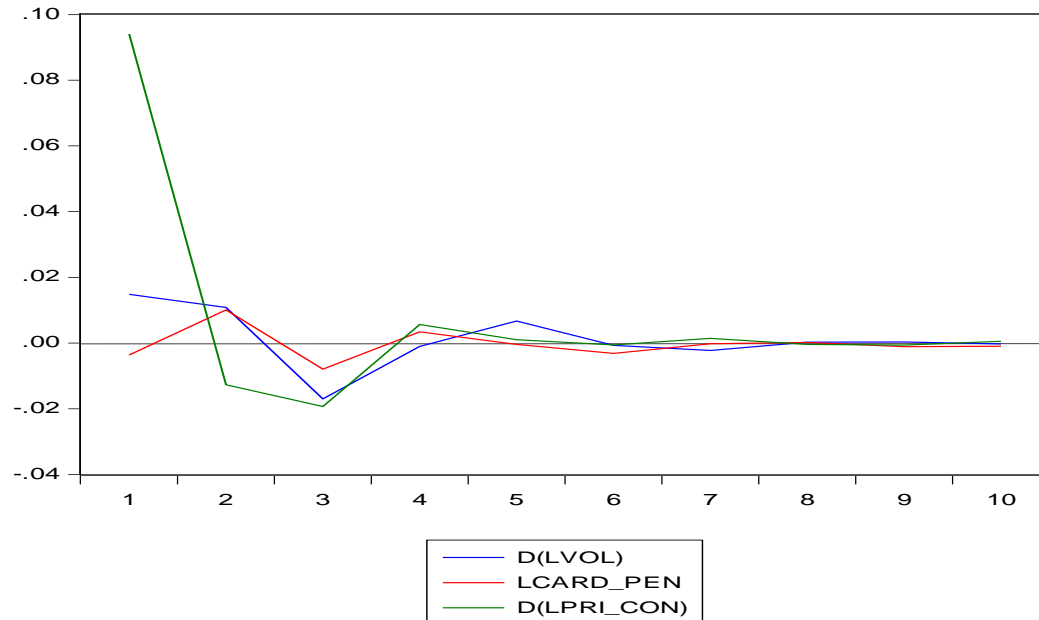Response of D(LFINS) to Cholesky One S.D. Innovations
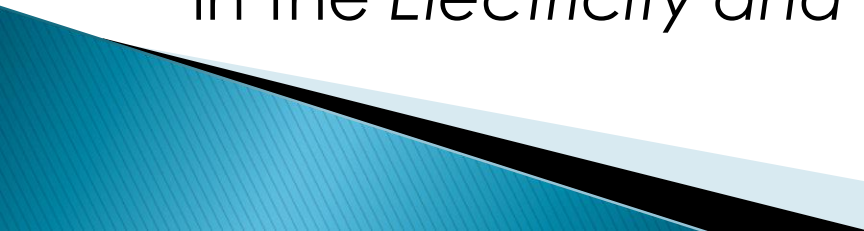

Response of D(LWHO) to Cholesky One S.D. Innovations

Forecasting: Vector Autoregressive (VAR(1,2)) Model

Response of D(LPRI_CON) to Cholesky
One S.D. Innovations

Conclusion

- The analysis of e-money, growth and consumption found a long run relationship between card penetration (card in circulation) to the population and GDP in all sectors.

- There is a long run relationship between both measures of card penetration and consumption.

- There is a short-run relationship between card penetration (volume to the population) and GDP in the *Electricity and Water Supply* sector.

Conclusion

▸ There is a short-run relationship between card penetration (volume to the population) and both Total and Private Consumption.

▸ It was observed that card penetration measured by activity seems to be a short –run phenomenon while penetration by card in circulation seems to be a long run phenomenon.