IMPACT OF THE GLOBAL FINANCIAL CRISIS AND ITS IMPLICATIONS FOR THE ZAMBIAN BANKING SECTOR: AN ECONOMETRIC STUDY

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Abstract

The research examines how the banking sector in Zambia faired in the wake of the global financial crisis, and the ensuing global recession that followed. Even prior to the crisis, weaknesses within the Zambian Banking sector were already identified by a World Bank/IMF financial sector assessment. The research therefore aims to gain a better understanding of the potential destabilizing factors to the Zambia Banking sector, and provide key players (Policymakers, Regulators and Banks) with knowledge on how best to manage and overcome these adverse effects, in times of a financial crisis.

A *Vector Error Correction Model (VECM)* is estimated using commonly identified macro-economic and banking sector indicators from selected Anglophonic African countries that were affected by the crisis at the time. The selected variables include, Return on Assets (ROA); Non-Performing Loans (NPL); Foreign Assets (FA); Interbank Lending Rate (IBLR); Liquidity (LQD); Credit to Private Sector (PRV); Foreign Exchange Rate (FOREX); Inflation (INFL); Copper Price (CU); and a 'dummy' variable (CRISIS). The direction of causality between the variables is further established using the *VAR Granger Causality* Test.

Results of the model suggests that although the CRISIS was found to cause the ROA, it had no significant effect on its outcome, implying that overall the crisis had very little effect on the Zambian banking sector's profitability. It was the liquidity (LQD) variable instead which was found to have a significant effect on the ROA.

In times of a financial crisis, it is therefore recommended that policy makers and regulators apply more stringent regulatory and monetary policy instruments. This would counter the adverse effects on the liquidity and profitability of the Banking sector, and thus ensure its stability.

JEL Classification: G01; G21; G28
Key Words: Financial Crisis, Zambian Banking Sector, Foreign Ownership, Banking Sector Factors, Macro-Economic Factors, Econometric Models, VECM, VAR Granger Causality

Acronyms

AfDB	African Development Bank
BFS	Banking and Financial Services
BoZ	Bank of Zambia
FDI	Foreign Direct Investment
FPI	Foreign Portfolio Investment
FSAP	Financial Sector Assessment Programme
FSDP	Financial Sector Development Programme
GDP	Gross Domestic Product
LUSE	Lusaka Stock Exchange
NPL	Non-Performing Loan
SME	Small Medium Enterprises
VAR	Vector Auto-Regression
VEC	Vector Error Correction Model

CHAPTER 1

Introduction

1.1 Research Background

The onset of the global economic and financial crisis (2008-2009), which had its origins in the United States (US), following the sub-prime lending crisis of 2007, had far-reaching implications for most developing countries. In Africa especially, the low level of financial integration meant that most African economies were relatively shielded from the direct impact of the crisis. They only began to feel the effects in the second half of 2008 from the ensuing global recession (Louis, Leonece, & Taoufik, 2009).

For the Zambian economy, the crisis happened at a time when the country's economy was recovering and beginning to show signs of growth. This was following decades of grappling with macroeconomic imbalances, negative growth and declining per capita incomes (Mwega, 2009). Like most African countries, Zambia is endowed with natural resources, and therefore suffers from the commodity dependency syndrome, with Copper being its main source of exports. In 2008, Copper exports accounted for over 74% of total export earnings, which still is the case to date (Mwega, 2009). It is therefore not surprising that the secondary effects of the crisis were initially felt through the trade sector, as commodity prices of copper drastically fell, owing to the slow-down in the global economy. This further produced macroeconomic imbalances in the country that manifested itself in reduced revenue earnings from Copper exports; reductions in the availability of credit and trade finance; lower foreign capital inflows; and loss of foreign exchange reserves.(Ndulo, Mudenda, Ingombe, & Muchimba, 2010).

The banking sector appeared to show more resilience in the wake of the crisis, despite several weaknesses having been highlighted in an earlier comprehensive survey assessment carried out under the Financial Sector Assessment Programme (FSAP) in 2004(Ministry of Finance & National Planning, 2004).

This research, therefore, aims at identifying the macro-economic and banking sector related factors, and their causality, which are most vulnerable to instability in times of an external crisis. Closer attention to these vulnerable factors would ensure a better response by regulatory and supervisory authorities in the sector and in Government.

1.2 Statement of the Problem

The Zambian banking sector has been undergoing a reform process following weaknesses identified within the sector even prior to the crisis (Fundanga, 2011). As already alluded to, in 2004 the Zambian banking sector was characterized by low financial intermediation, with a large section of the population, having limited, or no access to affordable financial services. A few of these key weaknesses were highlighted in the FSAP Survey carried out in 2004 (IMF/World Bank, 2003).Although the Central Bank had earlier taken a policy decision to implement Basel II at that time, its implementation had been impeded by the absence of a risk management framework, and weak governance structures in the local banking sector (Ministry of Finance & National Planning, 2004).

The dominance of the financial system by commercial banks had created a financial intermediary gap within the sector which excluded a large section of the population and/or user groups, due to its costly and unaffordable banking services (Melzer, Agasi, & Botha, 2010). According to the findings of the FSAP, the sector's high operational costs made the provision of low-cost and affordable services very difficult for most banks. In addition, the lack of a sufficiently developed financial market limited the alternatives for financial asset investments to mostly government bonds, which further hampered the market's liquidity and efficiency (IMF/World

Bank, 2003).Investments in these instruments, not only made the banks more vulnerable to adverse changes in the financial markets, but also had a crowding-out effect on private sector credit.

Furthermore, the persistent fiscal deficits that characterized the economic environment at the time, and to date, has made the coordination of fiscal and monetary policy a challenge for the Government. This has created unanticipated shifts in money market liquidity, adding further to the already high banking costs in the sector (IMF/World Bank, 2003).

According to Kalyalya, the above identified weaknesses in the Zambian banking sector has contributed to the dwindling role of the private sector in economic development. As stability of the banking sector is fundamental if it is to play a facilitatory role in economic development, it is crucial that policymakers and regulators are equipped with relevant and objective information on potential destabilizing factors to the sector, in times of a financial crisis (Deputy Governor - Bank of Zambia, 2008). This would enable the implementation of better and more targeted regulatory and supervisory practices by the Central bank.

1.3 Research Aims & Objectives

Aims of the Research

The research therefore aims to achieve the following:

i) ***Aim 1.*** To identify Sub-Saharan African countries with similar foreign bank ownership structures, to that of the Zambian structure.

ii) ***Aim 2.*** To identify the independent and dependent variables, within the identified countries, that were most affected by the crisis, and thus get a broader understanding of its impact on the banking sectors of selected African countries.

iii) ***Aim 3.*** To estimate an appropriate econometric model to use in analyzing the relationships that exist between the identified variables, and to be able to get a deeper understanding of the performance of the Zambian banking sector, and its effect on the economy, before, during and after the crisis

iv) ***Aim 4.*** To equip policy decision-makers, and regulators, with relevant tools to better understand the key factors that affect the performance of the Zambian banking sector in times of global external shocks.

Objectives of the Research

Having stated the aims of the research, the following are the related research objectives:

i) ***Objective 1:*** To review country-specific studies done on the impact of the crisis on Anglophonic banking sectors in selected Sub-Saharan African countries.

ii) ***Objective 2:*** To critically review studies done on selected Sub-Saharan African countries, and isolate the macroeconomic variables, and bank performance indicators, which were impacted by the crisis.

iii) ***Objective 3:*** To estimate the appropriate Vector Auto Regression (VAR) model [*unrestricted or restricted (Vector Error Correction Model - VECM)*] and further establish the direction of the long and/or short-run causality among the variables, using the *Granger Causality Test.*

iv) ***Objective 4:*** To develop a framework that would aid policy decision-makers, and regulators, in addressing macroeconomic and bank performance challenges, in times of global external shocks.

1.4 Significance of the Study

It is widely recognized world-over, that one of the key impediments to economic growth is the state of the financial system. In Zambia, the dominance of the banking sector, therefore, makes the sector the key player within the country's financial system (Deputy Governor - Bank of Zambia, 2008).

The focus of the research will be on the Zambian banking sector, as opposed to the macro-economy and financial system as a whole. This, therefore, adds a different dimension to the already existing knowledge on the wider subject area in Zambia, which has tended to focus on the macroeconomic effects of the crisis at a multi-sectoral level.

The research will aim at gaining a better understanding of the key impediments within the Zambian banking sector. This will provide the banks with key information on how best to manage operations and, to the policymakers and regulators, how best to regulate and supervise the sector in times of a financial crisis. Further, a detailed understanding of some of the key challenges of the sector would enable the provision of more efficient and practical solutions that would better serve its clients/customers in the real economy.

More specifically, the study will aim to answer the following key questions, and thus contribute to the existing studies that have been done on the subject:

i) ***Question 1:*** What effect did the foreign ownership structure of the banking sector have on the performance of the banking sector and the economy, before, during, and after the crisis?

ii) ***Question 2:*** Which macroeconomic variables and bank performance indicators were more sensitive to the effects of the crisis?

iii) ***Question 3:*** What are the causal relationships that exist between identified macroeconomic variables and bank performance indicators and how can they be objectively measured?

iv) ***Question 4:*** What framework would best aid policy decision makers and regulators in addressing macroeconomic and bank performance challenges, both in times of economic stability, and global external shocks?

1.5 Rationale for the Study

A few studies citing the impact of the crisis on the Zambian economy have previously been done. The rationale for this study, therefore, draws from the fact that there is a potential information gap that would provide answers to the aforementioned key questions regarding the banking sector in Zambia.

Previous studies usually tended to focus more at the macro-economic level, by taking a multi-sectorial and qualitative approach in understanding the effects of the crisis on the Zambian economy. Therefore, there was very little in-depth quantitative analysis of any single sector, especially the financial sector.

In the two papers done by Manenga Ndulo, Dale Mudenda, Lutangu Ingombe and Lillian Muchimba for the Overseas Development Institute's (ODI's) *"Global Financial Crisis Discussion Series",* the authors, only by way of graphs and tables, explored the impact of the crisis on trade, FDI, development assistance and remittances, which were the main transmission mechanisms. They also looked at government's response and possible options. Prior and more detailed work, however, was done under the Financial Sector Development Programme (FSDP). The FSDP is a government document that was initially a 5-year plan (2004-2009), involving all key actors in the financial sector, that aimed at addressing identified structural weaknesses within the sector (Ministry of Finance & National Planning, 2004). Although the plan was

commissioned prior to the crisis, it highlighted all the key challenges faced by the sector at the time, which are still prevalent to date. It has since been extended following its expiry in 2009.

The approach to this study will however differ from previous studies in that it will focus solely on the banking sector and not on the overall financial system, or other specific economic sectors. Furthermore, it will adopt an econometric approach, using *E-views Software,* to estimate the appropriate Vector Auto Regression (VAR) model and determine the direction of the long and/or short-run causality among the variables, using the *Granger Causality Test.*

1.6 Research Limitations

The research had several limitations which should be borne in mind as the results of the analysis and conclusions are made.

Firstly, it is limited to the period just prior, during, and after the financial crisis of 2008 (2004-2014), and whose implications today are still having an impact on banking regulation and supervision, not only in Zambia but worldwide.

Secondly, it adopts a more quantitative approach using the VAR Granger Causality econometric model to describe the causality of the selected variables. As the data could only be accessed through the Bank of Zambia (BoZ) website, it is mostly aggregated and therefore cannot be cross-checked with individual bank performance data within the sample.

Finally, although variables from selected African countries were used as a basis for inclusion in the research, the research is limited to understanding the crisis and its impact on the Zambian Banking Sector, which may have differed from the other selected countries.

1.7 Ethical Consideration

The study will mainly be based on secondary sources of data and information, mostly from articles and publications on the internet, and therefore there are no major ethical considerations to take into account. The appropriate ethics documentation has since been signed, submitted, and approved for the same.

1.8 Chapter Summary

The global economic and financial crisis (2008-2009) had its origins in the United States following the sub-prime lending crisis of 2007. For the Zambian economy, this happened at a time when the country was recovering and beginning to show signs of growth, following decades of negative growth. Like most African countries, Zambia suffers from the commodity dependency syndrome, with Copper being its main source of exports. Therefore it not surprising that the secondary effects of the crisis were initially felt through the trade sector as commodity prices of copper drastically fell, owing to the slow-down in the global economic growth.

Even prior to the crisis, the dominance of commercial banks in the Zambian financial sector had created a financial intermediary gap which excluded a large section of the population and/or user groups, due to its costly and unaffordable banking services. This was highlighted in an IMF/World Bank Survey – Financial Sector Assessment Programme (FSAP) in 2004. Stability of the banking sector is therefore crucial if it is to play its facilitatory role in economic development, through its support to the private sector.

The research therefore aims to gain a better understanding of the potential destabilizing factors to the sector, and provide key players (Policymakers, Regulators and Banks) with knowledge on how to best to manage and overcome these adverse effects in times of a financial crisis.

A quantitative approach will be adopted using the appropriate Vector Auto Regression (VAR) econometric model and causality tests.

CHAPTER 2

Literature Review

2.1 Global Overview of the Crisis

The global financial crisis, and the ensuing global recession that gripped the world from the third quarter of 2008 to the second quarter of 2009, had its origins in United States in 2007 (Baldwin, 2009). Although many have argued that the writing was on the wall for many years prior to 2007, it is generally accepted that it had a very profound effect, not only on the stability of the global financial system, but also on the policy regulation of banking systems globally. Although banks globally were in the process of migrating to Basel III at the time, the effects of the global crisis accelerated the need for its immediate implementation.

Ashamu & Abiola differentiates the 2008 crisis from previous crises of the emerging economies (Asia, Russia, and Mexico) by its trigger mechanism. In the case of these previous crises, they were mainly triggered by the abrupt reversal of the large-scale capital flows these emerging economies had been receiving, and accustomed to over the years (Ashamu & Abiola, 2012).

The 2008 crisis was characterized by a number of factors stemming from financial deregulation and unchecked speculative behavior of the major financial institutions ((Ntsosa, 2011). According to Ntsosa, in the United States, financial deregulation of 1993 removed the distinction between commercial banks, who tended to be more risk averse, and investment banks, who were more risk tolerant and speculative.The unintended consequence of this was that institutions began to operate in “unfamiliar territory” when it came to developing innovative financial products (Ntsosa, 2011). Further, the combination of deregulation; high liquidityfrom the lack of investment opportunities in the financial markets; and low interest rates, following the burst of the dotcom bubble, encouraged financial innovation by the banks. With too much investment money chasing

fewer investment opportunities, banks took on excessive risks which very often involved complex derivative instruments, creating a 'moral hazard'. This was further compounded by the availability of credit insurance and implicit guarantees of Government bailout to institutions deemed too big to fail (Mwega, 2009).

The potential for higher returns in the housing market, presented an opportunity for investment banks to create complex mortage-backed securitieswhich, in a good number of cases, were triple-A rated by the top rating agencies(Ntsosa, 2011). These were then sold world-wide to individuals, hedge-funds, private equity and institutional investors. The borrowers of these mortages were mostly sub-prime borrowers and as the US government began to adopt a tighter monetary policy by increasing interest rates, default rates amongst these borrowers increased and housing prices fell. This led to downgrading of these mortaged-backed bonds by the credit rating agencies (Ntsosa, 2011). Financial institutions that had guaranteed these assets suffered huge financial loses. As they stopped extending funds to each other, this created a credit crunch which marked the beginning of the global financial crisis (Ssewanyana et al., 2009).

2.2 Theoretical Literature

Role of the Banking Sector

According to Sufian, the banking sector is the backbone of most emerging and developing economies, and therefore its health is very critical to the health of the economy as a whole (Sufian & Habibullah, 2017). A knowledge of the factors that have an impact on the sector's performance is therefore critical to better understand the relationship that exists between the well being of the sector and the growth of the economy (Levine, Ross, & Zervos, 1998). According to the modern theory of financial intermediation, the Banking Sector plays a critical role in liquidity creation and risk transformation (Al-Khouri, 2012).

The Diamond-Dybvig Model provides a framework that best describes this role. According to Diamond, banks make loans that cannot be sold quickly at a high price, and at the same time, issue demand deposits that allow depositors to withdraw at any time, thus creating a liquidity mismatch (Diamond, 2007). By accepting short-term liquid liabilities in the form of deposits and making longer-term loans which are illiquid, not only does the Banking sector directly affect the successful transfer of funds from savings to investment, but also play a fundamental role in facilitating investment and production, and thus contribute to the economic growth (Al-Khouri 2012). On the other hand, this mismatch of liquidity, in which a bank's liabilities are more liquid than its assets, makes the banks' capital structure more fragile, and therefore more susceptible to illiquidity risk, further increasing the risk of a "bank run" (Diamond, 2007).

Closely associated with this aspect of liquidity creation and transformation, is insolvency. When the value of the Banks' assets (comprising of both short and long term loans to businesses and consumers) falls below it liabilities (comprising mainly of its short-term deposits) they become insolvent, due mainly to borrowers' inability to service their debt. According to Demirguc-Kunt & Detragiache, the banks' ability to manage both this default and credit risk is therefore critical in safe-guarding the banks' assets, especially in times of a crisis (Demirguc-Kunt & Detragiache, 1998). Should a significant proportion of banks within the banking system become insolvent, then a systemic crisis is said to occur. Theory therefore predicts that, shocks that adversely affect borrowers' ability to service their debt, should be positively correlated with systemic banking crisis (Demirguc-Kunt & Detragiache, 1998).

Determinants of Bank Performance

Relatively few studies have looked at bank performance in developing countries, more especially in Sub-Saharan Africa (Sufian & Habibullah 2017) . A commonly used framework in Bank Supervision, and by scholars, to measure the stability and performance of the banking system, is the CAMEL (**C**apital Adequacy, **A**sset Quality, **M**anagement Efficiency, **E**arnings

Ability, and **L**iquidity) framework, which assigns a rating to each aspect of the Banking System (Sloan Swindle, 1995). A broad consensus of literature, however, further points to profitability and stability as the key indicators. According to Mirzaei, a profitable banking system would be in a better position to withstand any negative shocks and provide the necessary stability to the banking system as a whole (Mirzaei 2013).

A study done by Guru et al, investigated the determinants of bank profitability in Malaysia. The results revealed that profitability was determined by both internal determinants (liquidity, capital adequacy, expenses management|), of which expenses management was most significant, and external determinants (ownership, size, economnic conditions), of which macro-economic indicators such as interest and inflation have a significant impact (Guru, Balachandher K., Staunton J., 2002). Subsequent empirical findings by Sufian however sugget that Malysian banks with higher credit risk and loan concentration exhibited lower profitability levels, in contrast to banks with higher capitalization, higher proportion of income from non-interest sources, and higher operational expenses, which tended to be more profitable (Sufian & Habibullah, 2017).

A further study done by Demirguc-Kunt**,** on the impact of the level of financial development and bank profitability for a large number of developed and developing countries over the period 1990-1997, found that higher bank development resulted in increased competition, and therefore lower bank performance. On the other hand, a lower level of financial development led to higher profitability and margins for banks, further suggesting complimentarity between the two (Asli Demirguc-Kunt and Harry Huizinga, 2000).

The Structure-Conduct-Performance (SCP) paradigm, is another model that has traditionally been used to assess the performance of a banking system. The SCP postulates that market structure influences the conduct or behavior of the banks, through pricing and/or investment policies, which in turn influences performance. According to Mirzaei, an empirical study of 6,540 banks from 49 emerging and advanced countries done over the period of the financial

crisis 2007-2010 found that banks operating in more concentrated (less competitive) markets, although profitable and stable during normal periods, were less so during the crisis (Mirzaei 2013).

According to Spitt however, the key drivers of banks operational performance through the economic cycle are GDP growth and level of interest rates (Spitt 2010). In a dynamic economic environment, the increase in wealth arising from the increase in GDP allows banks to collect more deposits. On the other hand, a buoyant economic environment would increase the demand for loans and support for investment banking activities, with resulting lower levels of default among banks customers. This would increase net revenues, and given banks fixed cost structure, would positively affect banks margins and return on assets (ROA) (Reference & Fresard, 2011)

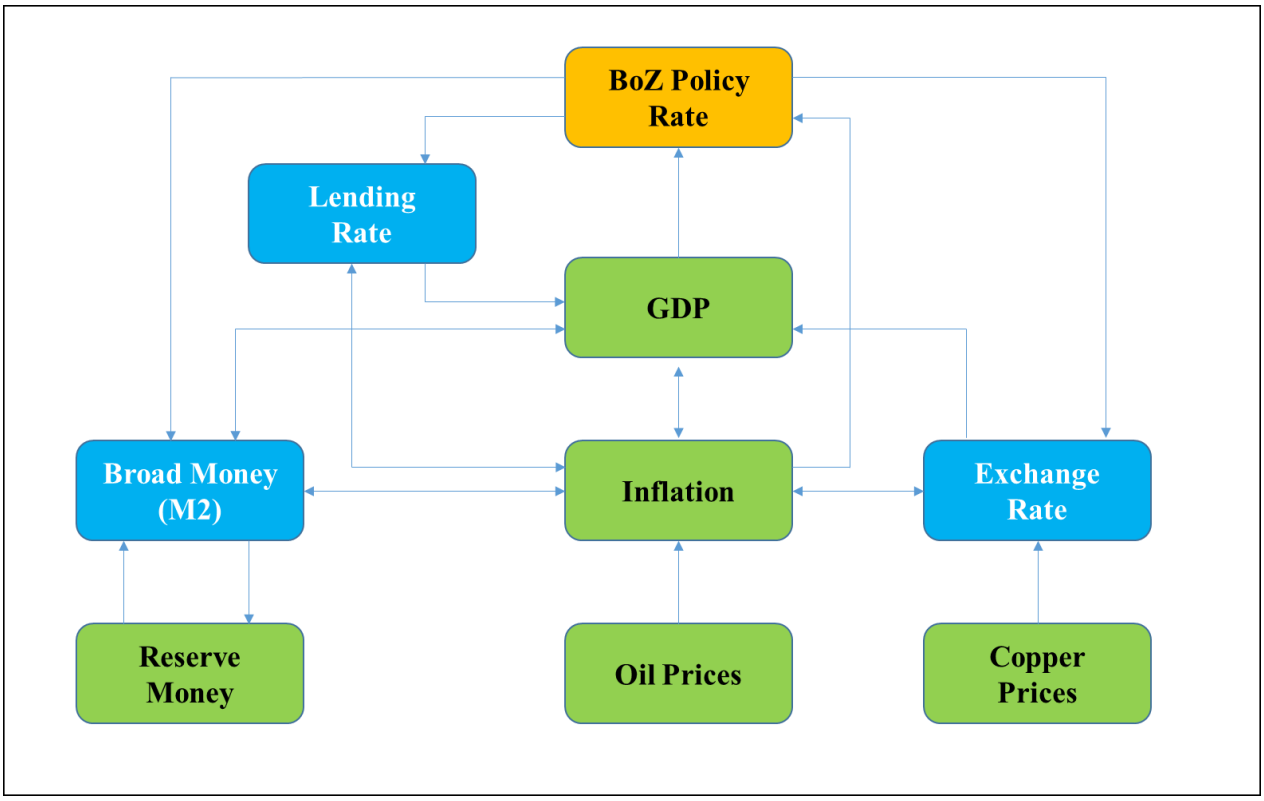
Interest rates also play a significant role, according to Berger, as they determine the price at which banks have to pay to secure wholesale short-term funding. This has an impact on the Banks' interest rate spread (difference between interest charged to loan customers and interest paid for customer deposits), which generates much of the banks' revenue. (Berger, 2009). On the other hand, even in the absence of an increase in non-performing loans, banks return on assets may deteriorate due to an increase in short-term interest rates, which would easily be passed on to depositors, but not so for the long term bank borrowers (Demirguc-Kunt & Detragiache, 1998). Berger further concludes that, a large increase in short-term interest rates may likely lead to systemic banking sector problems.

With regards to inflation, there is evidence that strongly suggests that there is a negative and nonlinear relationship between inflation, and banking sector lending activities (Boyd, Levine, & Smith, 2000). Rate of inflation plays an important role in determining short-term interest rates, which is a critical tool for monetary policy (Demirguc-Kunt & Detragiache, 1998).

Monetary Policy and the Banking Sector

The response of Government to any crisis is critical, if the financial and banking systems are to remain stable. In this regard, monetary policy plays a crucial role in ensuring that the banking sector remains buoyant. According to the Federal Reserve, the monetary policy refers to the Central Bank's actions in influencing the quantity, availability and cost of money, or credit in the economy (Federal Reserve. (n.d.). Federal Education Reserve.Org - Monetary Policy Basics). Currently in Zambia, the key transmission channels of monetary policy are the interest rate; exchange rate; and expectation channels (Bank of Zambia. (n.d.). Bank of Zambia - Monetary Policy). The schematic representation of this mechanism is illustrated in the figure below:

Figure 1: Schematic Representation of Monetary Policy Transmission as at Present



Source: Bank of Zambia

Figure 1 above clearly shows that monetary policy in Zambia, currently, anchors squarely on the policy rate. This being the reference rate for banks' pricing of products and services, any changes in the policy rate, directly affects the key transmission channels mentioned, which ultimately affect the level of activity in the economy as a whole, and the banking sector's ability to operate cost efficiently (Bank of Zambia. (n.d.). Bank of Zambia - Monetary Policy). During the period of the crisis, the BoZ monetary policy framework was still anchored on a monetary aggregate measure of *Broad Money* (Bank of Zambia, 2009) to manage liquidity. It was only in 2012 that the current monetary policy regime was changed, by the introduction of the BoZ policy rate to influence the average interbank rate as a means to managing liquidity (Bank of Zambia, 2012).

2.3 Empirical Literature

The Crisis in Africa

Within Africa, conventional wisdom would suggest that the impact of the crisis would be minimal, given its low level of financial integration with the more advance global financial markets (Africa Development Bank - AfDB, 2009). With the exception of Nigeria and South Africa, the transmission mechanisms between the financial systems of most African countries and the rest of the world were considered weak at the time (Samuel, Maimbo, & Group, 2008).

According to the AfDB, the African financial systems were dominated by the Banking sector, and at the time, the financial markets were relatively weak and in some cases non-existent (Africa Development Bank - AfDB, 2009). The World Bank, in its Access Finance Newsletter, argued that most African banks relied mostly on deposits and interbank lending to fund their loan portfolios. This therefore limited their exposure to the more risky, and often toxic financial instruments such as derivatives, which are commonly used in the financial markets of the more developed economies.(Samuel et al., 2008).

The slowdown in economic growth of most African countries during the latter part and ensuing period of the crisis, would however seriously question this conventional thinking. Evidence

suggests that the immediate and distinguishable effects of the crisis were felt on the two (2) key drivers of economic growth for most African economies namely: the primary commodity prices and its demand, which were both driven by China's strong economic growth; and capital flows of both foreign portfolio and direct investments (FDI) (Africa Development Bank - AfDB, 2009).

Bank Ownership Structure

Of further significance, is the role that the sector's foreign ownership structure played which is still prevalent in most African countries. A description of the ownership structure of banks in Sub-Saharan Africa, at the time, is given in the table below:

Table 1: Predominant Form of Bank Ownership in Sub-Saharan Africa

Mainly Government	*Mainly Foreign*	*Mainly Local Private Sector*	*Foreign plus Government*	*Equally Shared*
Eritrea	Botswana	Benin	Burkina Faso	Angola
Ethiopia	Cape Verde	Mali	Congo DRC	Burundi
Togo	Central African Republic	Mauritania	Sierra Leone	Cameroon
	Chad	Mauritius		Congo
	Côte d'Ivoire	Nigeria		Gabon
	Equatorial Guinea	Rwanda		Ghana
	Gambia	Somalia		Kenya
	Guinea	South Africa		Rwanda
	Guinea-Bissau	Sudan		Senegal
	Lesotho	Zimbabwe		
	Liberia			
	Madagascar			
	Malawi			
	Mozambique			
	Namibia			
	Niger			
	Seychelles			
	Swaziland			
	Tanzania			
	Uganda			
	Zambia			

Source: (Honohan & Beck, 2007)

From the above table it can clearly be seen that the potential for repatriation of funds, by these foreign banks, to theirs countries of origin was high, thereby putting African countries in a more vulnerable position (Osakwe, 2010).

According to the World Bank, the presence of foreign banks may have mixed implications for the local banking sector. Whereas on one hand, it brings in a different level of competition, new skills and technology, and on the other hand, it might reduce access to credit especially to SMEs, as they tend to focus more on corporate clients (Honohan & Beck, 2007). Although evidence supports the former, it however does not seem to support the latter argument.

Prior to the crisis, the new wave of entry of multinational banks in Africa, prompted mainly by the improvements in international communications on the continent, saw the re-emergence of former colonial and regional banks. These were mainly Anglophonic, Francophonic, and Portuguese banks (Honohan & Beck, 2007). The table below shows the multinational Anglophonic banks operating in the different Anglophonic and Sub-Saharan African countries, including Zambia, at the time *(detailed list is shown in Appendix 1).*

Table 2: International Anglophonic Banks and Branch/Subsidiary Locations in Africa

Country	Banks				
	Absa (SA)	Stanbic (SA)	Barclays (UK)	Stanchart (UK)	Citi (USA)
Angola	✓				
Botswana		✓	✓	✓	
Cameroon				✓	✓
Côte d'Ivoire				✓	✓
Congo DR		✓			✓
Gambia		✓		✓	
Ghana	✓		✓	✓	✓
Kenya	✓	✓	✓	✓	✓
Lesotho	✓				
Madagascar		✓	✓		
Malawi		✓			
Mauritius	✓				
Mozambique	✓				
Namibia		✓			
Nigeria		✓	✓	✓	✓
South Africa	✓	✓	✓	✓	✓
Swaziland		✓			
Tanzania	✓	✓	✓	✓	✓
Uganda		✓	✓	✓	✓
Zambia		✓	✓	✓	✓
Zimbabwe		✓	✓	✓	

Source: (Honohan & Beck, 2007)

Effects on Selected African Countries

The table above shows that 7 countries, namely **Botswana; Ghana; Kenya; Nigeria; South Africa; Tanzania; and Uganda**. had a comparable foreign ownership structure to the Zambian one. Although **Zimbabwe** may also have been comparable, there were serious structural economic issues happening in the economy at the time, which may have masked the true effects of the crisis.

The effects of the crisis on these selected countries was further explored to get a better understanding of the macro-economic and banking sector indicators that were adversely affected at the time.

i) Botswana. An overview of the Botswana financial sector indicated that it had long been characterized by excess liquidity due in part to the accumulation of government budget surpluses in previous years (Jefferis & Tacheba, 2009). Credit to the public sector was virtually non-existent, therefore government securities made up a very small percentage of commercial banks' asset base. The strong liquidity position partly explains the sectors' immunity to the international financial markets in the wake of the crisis.

The fall in trade, FDI and remittances adversely affected the country's current account and foreign reserves, hence putting pressure on the local currency exchange rate to other major currencies, and ultimately inflation (Ntsosa, 2011).

According to the ***Banking Supervision Annual Report 2008***, the sector remained resilient in the wake of the crisis as both deposit liabilities and assets, which remained predominantly domestic, grew to exceed the 2007 levels. This was on the back of a favorable macroeconomic and investment climate. The non-mining corporate sector dominated corporate borrowing, which was consistent with the robust growth of the non-mining private sector GDP in 2009 (Bank of Botswana, 2009). Although the sector recorded healthy earnings in the same year, credit conditions were tightened, in anticipation of the global slow-down and fall in commodity prices on the domestic mining sector.

NPLs grew at a much slower pace than the growth in loan portfolios, indicating an improvement in the asset quality. In 2009, however, the rate of profit growth for most banks declined significantly, as provisions for impaired loans rose sharply (Bank of Botswana, 2009). Capital adequacy was 2% above the prudential norm of 15%, with core capital continuing to command a dominant proportion of the bank capital. Notwithstanding these challenges, in 2009, the sector remained strong, with most banks reporting high levels of liquidity, and capital adequacy ratios (Bank of Botswana, 2009).

ii) Ghana. The crisis occurred at the same time as the food and fuel price shocks in the region, and this coupled with the global economic slowdown, impacted negatively on the country's current account, reducing it to very worrisome deficit levels (Ackah, Bortei-dorku, Aryeetey, & Aryeetey, 2009). Although commodity revenues for cocoa and gold the country's main exports, improved towards the latter part of the crisis, these were offset by the high import bill d made up of oil and non-oil imports (Bank of Ghana, 2009)**.** According to the Ghana Central Bank, this exerted pressure on the exchange rate, resulting in the depreciation of the currency. Given the high import content of non-food items in the consumer basket, a further result was an increase in inflation, which led the central bank to adopt a tighter monetary policy stance by raising interest rates (Bank of Ghana, 2008).

The first round effects in the banking sector were minimal like most African countries. The sector was not exposed to the more complex financial instruments in the international capital markets and therefore relied mostly on low-cost domestic deposits for funding. Signs of contagion however began to show as the credit crunch began to take its toll on the economy (Ackah et al., 2009).

According to the ***2008 Annual Report,*** liquidity in the sector grew during 2008 due to the rapid growth of deposits, driven mainly by the strong growth in foreign deposits. This was on the back of the sharp depreciation of the currency (Bank of Ghana, 2008). Total assets increased funded mainly by the increased deposits, with loans and advances to private enterprises making up the bulk of the assets. Although total assets continued to increase in 2009, unlike in 2008 the growth was driven by domestic assets (Cobbinah & Okpalaobieri, 2014).

As interest spreads decreased, banks' profitability also declined. The banks remained solvent throughout 2008, with capital adequacy ratios all above the regulatory minimum of 10%. The average for the year was 13.8% (Bank of Ghana, 2008). Asset quality deteriorated marginally, as impaired assets increased due to substandard and doubtful loans. The resulting NPLs and loan loss provision further reduced the banks' earnings.

iii) Kenya. Like most African countries, the Kenyan banking system showed signs of resilience in the wake of the crisis, with all banks in the sector meeting the minimum capital-adequacy ratio of 12% through most parts of the crisis. As at November 2008, the sector's adequacy ratio, as measured by total capital to total risk weighted assets, was 18.1%. (Nyangito, 2009).

According to the Deputy Governor, the sector saw an increase in its asset-base in 2008, as deposits continued increasing. Profitability levels, as measured by the Return on Assets (ROA), increased whilst asset quality, as measured by the level of NPLs to assets, reduced. This could largely be attributable to the banks' enhanced risk management and NPL recovery practices (Nyangito, 2009).

Credit to the private sector dominated the asset portfolio of the commercial banks in Kenya which increased in nominal terms during the crisis period. Although loans and advances made up the bulk of the sectors' assets, a minimum proportion of the portfolio was held as derivatives or asset-based securities, mainly as risk-free government securities (Mwega, 2009).

In terms of macro effects, there was a widening of the current account deficit, due mainly to the reduced trade effects from tourism,which had suffered a major blow, and commodity exports (tea, horticulture and coffee). This coupled with the large import bill on food and oil greatly contributed to the deficit, increasing from US$1.1billion in 2007 to US$ 2.12 billion in 2008 (Mwega, 2009).

iv) Nigeria. Although not well integrated into the global markets, the crisis had a serious destabilizing effect on the Nigerian capital markets in July 2008, as major international hedge funds withdrew and international credit-lines for FDI purposes faded (Ajakaiye & Fakiyesi, 2009). According to a paper by Cobbinah & Okpalaobieri, about 90% of the assets in the financial system in Nigeria was dominated by the Banking sector, making it the key driver of the economy (Cobbinah & Okpalaobieri, 2014). The widespread practice of '*Margin Lending*' by

banks' to investors, particularly stock-brokers, for IPO and secondary market purchases of securities on the stock market had a further destabilizing effect, as the weak performance of the stock markets correspondingly affected the overall quality of the sectors' asset base (Ajakaiye & Fakiyesi, 2009). Although within acceptable limits, this was evidenced by the increased NPLs and bad debt provisions.

In the wake of the crisis in 2008, the sector showed some resilience as assets increased by over 47% (Central Bank of Nigeria, 2008) composed mainly of loans and advances. Although aggregate deposits increased during the same time, these were predominately demand deposits. While all other indicators remained within acceptable limits, credit in the economy began to dry up, as the global credit crunch wore on (Central Bank of Nigeria, 2008). According to the Central Bank, Interest rates became increasingly under pressure from the dwindling liquidity in the financial and inter-bank markets (Central Bank of Nigeria, 2008). To try and curb this, the Central Bank reduced certain regulatory requirements for the sector such as, the monetary policy rate; cash reserve requirement and the liquidity ratios. These pressures on the economy, therefore, allowed the freely floating exchange rate to depreciate during this period of the crisis.

v) South Africa. Prudent regulation and sound macro-economic policies at the time, shielded the South African banking sector from the primary effects of the crisis. Limited exposure to the more complex structured finance products, as well as capital controls pertaining to residents, further contributed to the insulation of the domestic financial system from the global financial markets (South African Reserve Bank, 2009b).

According to the 2008 Supervision Annual Report, during the onset of the crisis, the banking system remained fairly stable. The total capital-adequacy ratio of 13% was above the minimum requirement of 9.5%, with the tier 1 capital adequacy ratio increasing from 8.9% to 10.2% during the period. The ratio further improved in 2009 to 14.1% (South African Reserve Bank, 2008). Banking assets grew by over 24%, with gross loans and advances making up the bulk of the assets. This reduced in 2009 amid the crisis (South African Reserve Bank, 2009a).

Deposits represented the bulk of the sector's liabilities, the main contributors being fixed and notice deposits (25%), call deposits (22.1%) and negotiable certificates of deposit (16.3%). In 2009 these deposits grew by 5.6%. Liquid assets exceeded the statutory minimum requirement and despite the turmoil surrounding the crisis, the sector profitability ratios were favourable. Credit risk ratios, expressed as a percentage of gross loans and advances, had deteriorated as impaired advances continued to rise due mainly to the increase in interest rates.

In 2009 profitability levels were negatively impacted, mainly by an increase in credit losses and operating expenses. In the same year, liquid assets grew by 20% whilst credit risk ratios continued to deteriorate, exacerbated by the impact of negative annual growth in gross loans and advances (2009 Supervision Annual Report)

Interbank market continued to function normally but with slight caution and a preference for shorter term funding. Credit criteria were tightened and a general decline in the rate of growth in all types of lending. Foreign banks' exposures were mainly concentrated in the corporate sector, and as the crisis wore on, funding from their head offices dried up and local long term funding became scarcer, thereby increasing spreads on short-term funding (South African Reserve Bank, 2009b).

vi) Tanzania. Like most African countries, the country was able to wither the first-round effects of the crisis, due in part to its low levels of integration with international financial markets and, more importantly, it operated under a regime of capital account restrictions which significantly lowered the country's exposure to toxic financial assets. However, by late 2008, as commodity prices began to lose value, trade financing within the banking sector became increasingly more risky (H.B. Lunogelo, 2010).

According to the financial indicators published by the Bank of Tanzania (Bank of Tanzania, 2009) lending to the private sector grew by 26.6% during the year to September 2009. Other key indicators that performed favorably were the capital adequacy ratio; liquidity ratio; gross non-performing loan (NPLs) ratio and the interbank cash market which continued to be liquid with stable interest rates.

The low level of foreign assets in the commercial bank system (which stood at 11% of total assets at the time), as per the Bank and Financial Institutions Act (2006), was a manifestation of the banking sector's low integration with international capital and financial markets. A further stabilizing factor was the country's regulations regarding 'foreign' ownership within the sector.At the time, the country did not permit 'foreign' commercial banks to operate as branches of parent banks abroad, but as independent subsidiaries. Therefore any decision made by the parent banks abroad had little or no influence on the local subsidiary's bank operations (H.B. Lunogelo, 2010).

With regards to the macroeconomic indicators, the country's foreign reserves had over 6 months import cover, held by the BOT and commercial banks. This was way above the internationally recommended 3-months. Despite this however, the country foreign exchange rate depreciated due to the increased demand resulting mainly from market speculation. Inflationary pressure emanated from the soaring world oil prices in the early period of the crisis. This was compounded by the food supply shocks resulting from poor rains in the first half of 2009. The resulting increase in food costs, strongly influenced the country's headline inflation rate (Bank of Tanzania, 2009).

vii) Uganda. Uganda, like most sub-Saharan African countries, suffered the second-round effects of the crisis which mostly included fluctuation in commodity and food prices. Within the Banking sector, banks' balance sheets were at risk, as the level of NPLs threatened to increase. However according to the *Bank of Uganda*, in 2008 the sector showed signs of stability as indicated by i) the growth in total assets, which were mainly composed of loans and advances;

government securities; and investments in foreign assets. ii) growth in total deposits, with demand and call deposits making up just over 56.7% of the deposits; iii) well capitalized in terms of Capital adequacy, with all banks meeting the statutory minimum requirements; iv) strong asset quality with the reduction in NPLs, thereby indicating strong risk management practices; v) growth in earnings; and vi) strong liquidity position as indicated by the growth in liquid assets to deposits ratio (Bank of Uganda, 2008) .

At the same time, however, investments in government securities, declined significantly, as investors retreated to safer destinations like the US, which had seen a strengthening of the USD, and was able to offer more attractive US Treasury bill rates, stemming from the massive stimulus packages the US government was committing to the US economy.

Tight global credit conditions lowered any expectations of external financing for FDI and borrowing needs purposes, thereby adding more pressure to the foreign exchange and domestic interest rates (Ssewanyana et al., 2009). Because of the anticipated high inflation, the Bank of Uganda therefore adopted a tight monetary policy stance that saw an increase in the interest rates (by 2% in January 2009) (Bank of Uganda, 2009).

According to the *2009 Annual Supervision Report,* stress-testing conducted on selected variables namely, net interest margin; NPLs, Interest Income on Government Securities; Depreciation of Uganda Shilling; and default by each bank's largest borrower, revealed the potential for an adverse effect on the capital adequacy of the sector (Bank of Uganda, 2009).
With regards to foreign ownership structure, the banking regulations required that all local foreign banks be licensed as subsidiaries, as opposed to branches, thus giving them more autonomy, and reducing the risk capital withdrawal by the parent bank (Ssewanyana et al., 2009).

Summary of the Key Factors Affected by Crisis

A summary of the key factors, that were affected by the crisis, within the selected countries described above, is given in the table below

Table 3: Key Factors Affected by the Crisis

Country/ Affected Variables	Botswana	Ghana	Kenya	Nigeria	South Africa	Tanzania	Uganda
Banking Sector Factors (Internal Determinants)							
1. Call Deposits					✓		
2. Capital Adequacy Ratios			✓				
3. Cash Reserve Requirement;				✓			
4. Demand Deposits				✓			✓
5. Domestic Deposits,		✓					
6. Earnings	✓	✓			✓	✓	
7. Fixed Deposits,					✓		
8. Foreign Assets		✓				✓	✓
9. Foreign Deposits,		✓					
10. Inter-Bank Lending Rates				✓		✓	✓
11. Interest Spread		✓			✓		✓
12. Liquidity Ratio,			✓	✓	✓	✓	✓
13. NPLs	✓	✓		✓	✓	✓	✓
14. Private Sector Lending	✓	✓	✓	✓	✓	✓	✓
15. Public Sector Lending			✓				✓
Macro-Economic Factors (External Determinants)							
1. Commodity Prices	✓		✓	✓	✓		
2. Current Account,	✓	✓	✓		✓	✓	✓
3. Exchange Rate,	✓	✓		✓	✓	✓	✓
4. Foreign Direct Investment (FDI)							✓
5. GDP,	✓				✓		
4. Inflation,	✓	✓		✓	✓	✓	✓
5. Policy Rate		✓		✓			✓
6. Stock Market Index,				✓	✓		

It is evident from the above table that certain factors were commonly affected in most of the selected countries, more especially the following:

i) ***Banking Sector Factors***: Earnings; Foreign Assets; Inter-Bank Lending Rates; Interest Spread; Liquidity Spread; NPLs; and Private Sector Lending

ii) ***Macro-Economic Factors***: Commodity Prices; Current Account; Exchange Rate; Inflation; and Policy Rate.

The status of BASEL implementation gives an indication of the Banking sector's regulatory and supervisory environment. This is given for the selected countries, both during and post the crisis periods, in the table below:

Table 4: Level of BASEL Accords Implementation

Country		Status of BASEL Implementation[1]	
		2008 (During Crisis)	2015 (Post Crisis)
i)	Botswana	Post-implementation of Basel I	Pre-Implementation of Basel II
ii)	Ghana	Implementation of Basel I	Post-implementation of Basel I
iii)	Kenya	Pre-implementation of Basel II	Implementation of Basel II
iv)	Nigeria	Pre-implementation of Basel II	Implementation of Basel II
v)	South Africa	Post-implementation of Basel II	Pre-implementation of Basel III
vi)	Tanzania	Pre-implementation of Basel I	Implementation of Basel I
vii)	Uganda	Pre-implementation of Basel II	Implementation of Basel II
viii	Zambia	Implementation of Basel I	Pre-Implementation of Basel II

[1] Surveys are carried periodically, by the Financial Stability Institute (FSI) of the Bank for International Settlements, to access each country's level of implementation of the Basel Accords (Financial Stability Institute, 2015)

2.4 Zambian Banking Sector and the Crisis

In Zambia, government's policy to pursue an open economy, since the 1990s, has made the banking sector potentially vulnerable to external shocks. Although the first-round effects of the crisis were not immediately or directly felt, the sector was one of the key mechanisms for transmission of the secondary effects.

At the time, and like most African countries, the banking sector was dominated by foreign owned banks. The table below shows the ownership structure of the banking sector and percentage distribution of the assets during the time of the crisis:

Table 5: Number of Commercial Banks and Distribution of the Banking Sector's Assets

Ownership	2007		2008		2009	
	No.	Assets (%)	No.	Assets (%)	No.	Assets (%)
- Foreign	8	62.8	8	63.8	10	65.8
- Local	4	23.1	4	20.6	4	21.2
- Partly Govt.	2	14.1	2	15.5	2	13.0
Total	**14**	**100**	**14**	**100**	**16**	**100**

Source: Bank of Zambia

The table clearly shows the dominance of the foreign banks, both by size and number, within the Zambian banking sector.

Regulation and supervision of the sector is carried out by the central bank, the Bank of Zambia (BoZ), which draws its mandate from both the Bank of Zambia (BoZ), and the Banking and Financial Services (BFS) Acts. At the time of the crisis, the sector was still implementing BASEL I, despite the BoZ having taken an earlier policy decision for all commercial banks to implement BASEL II in 2004.

Prior to the crisis, financial intermediation in the sector was generally considered very weak as most banks held a significant proportion of their assets in government securities and foreign currency assets, which were mostly held outside the country. This reduced the funds available for lending to the private sector within Zambia.

In 2004, in an effort to try and address some of these earlier impediments in the sector, the World Bank and the IMF undertook a comprehensive assessment of the country's financial system, through the Financial Sector Assessment Programme (FSAP). The assessment found that in 2003, the sector not only had one of the highest public sector credit to bank assets ratio, but also the lowest private sector credit to GDP ratio on the continent (Ministry of Finance and National Planning 2004). This speaks a lot about the structure of the sector, prior to the crisis, and its source of earnings, which were predominately from foreign exchange trading and interest on government securities. There was therefore, no incentive for banks to expand intermediation to the private sector.

The plummeting commodity prices of Copper on the international markets had a serious impact on the country export revenues, which in turn had a destabilizing effect on the country's economic fundamentals (Fundanga, 2009). As domestic inflation increased, so did interest rates, and this had a significant impact on lending, and credit availability. Corporate and household balance sheets began to deteriorate, and so did the banks', with the increased levels of non-performing loans (NPLs) (Fundanga, 2009).

The contagion effects of the crisis on the foreign exchange markets led to a depreciation of the local kwacha currency. Foreign portfolio investors opted to liquidate their investments and externalize the foreign exchange, thereby reducing the available foreign exchange and adversely affecting the exchange rate. This further contributed to the rise in inflation, due to the country's high dependency on imports of both consumer goods and domestic production inputs (Fundanga, 2009).

2.5 Chapter Summary

Overview of the Crisis. According to literature, key among the factors that characterized the 2008 financial crisis was the deregulation of the financial sector in the United States. Coupled with the high liquidity from the limited investment opportunities in the financial markets, and low interest rates following the burst of the dotcom bubble, this encouraged financial innovation and

unchecked speculative behavior by the banks. This was more prevelent in the housing market as investment banks created complex derivative instruments with a weak underlying asset base, predominately composed of sub-prime mortgage borrowers. Falling prices in the housing market led to increased default rates amongst these borrowers and the subsequent downgrading of the mortgaged backed bonds. This translated into huge financial losses for some of the big financial institutions and sparked the begining of the financial crisis, from the ensuing credit crunch.

Determinants of Bank Performance. A commonly used framework to access the performance of the banking system, is the CAMEL (**C**apital Adequacy, **A**sset Quality, **M**anagement Efficiency, **E**arnings. Other studies done on Bank performance have revealed that profitability is determined by both internal determinants (liquidity, capital adequacy, expenses management|), of which expenses management was most significant, and external determinants (ownership, size, economnic conditions), of which macro-economic indicators such as interest and inflation have a significant impact.

The Crisis in Africa and the Zambian Banking Sector. Evidence suggests that the immediate and distinguishable effects of the crisis were felt through commodity prices, which were both driven by China's strong economic growth, and capital flows of both foreign portfolio and direct investments. It further suggests that it may also be attributed to the foreign ownership structure of the Banking sector, that is still prevalent in most African countries. The new wave of entry of multinational banks in Africa saw the re-emergence of former colonial and regional banks at the time.

Sub-Saharan Anglophonic countries, with similar foreign bank ownership structures to the Zambian one, were identified as Botswana; Ghana; Kenya; Nigeria; South Africa; Tanzania and Uganda. Factors that commonly affected these selected countries before, during, and after the crisis were categorized as Banking Sector Factors *(Earnings; Foreign Assets; Inter-Bank Lending Rates; Interest Spread; Liquidity Spread; NPLs; and Private Sector Lending)* and Macro-Economic Factors *(Commodity Prices; Current Account; Exchange Rate; Inflation; and Policy Rate)*

With regards to the Zambian Banking Sector at the time, the main source of earnings for most banks was predominately from foreign exchange trading and interest on government securities. As foreign portfolio investors opted to liquidate their investments and externalize the foreign exchange, it resulted in the depreciation of the local kwacha currency. The high dependency on foreign imports gave rise to inflation, and subsequently high interests, which significantly impacted on lending and credit availability to the private sector.

CHAPTER 3

Research Methodology

3.1 Research Approach, Strategy and Design

The research methodology will take a predominantly quantitative analysis approach. This will involve estimating the appropriate Vector Auto Regression (VAR) model [*unrestricted or restricted (Vector Error Correction Model - VECM)*] and further establishing the direction of the long and/or short-run causality using the VAR Granger Causality Test, among the identified variables in the literature review.

Although not much has been written about the impact of the crisis on the Zambian banking sector, a lot of research and articles have been written about it on the continent and more so in other parts of the developed and emerging economies. Therefore the research approach will essentially involve the collection and reviewing of secondary data comprising mainly of journal articles, and publications done by credible bi/multilateral institutions such as the Africa Development Bank (AfDB), World Bank, International Monetary Fund (IMF) and the Central Banks of selected African countries.

The review will cover selected African countries with similar ownership banking structures to the Zambian one. This is to better isolate the effects of the crisis on those selected countries. The performance of identified macro-economic and banking sector indicators in each of the selected countries will be assessed during the periods before, during and after the crisis. These identified indicators will then be used to assess the effects of the crisis within the Zambia banking context. This is illustrated in the figure below:

Table 6: Research Information Requirements & Tools

Description	Level			
	Global	**Continental**	**Country**	**Sector**
Information Requirements	- Origins of the crisis	- Effects on the continent and the transmission channels - Understanding of the ownership structure of the Banking sector at continental level - Segmentation of countries with similar Banking systems into Anglophonic, Francophonic, Portuguese etc. - Selection of countries with Anglophonic banking systems and similar foreign banking entities - Understanding the effects on the selected countries' and selection of key macro-economic and banking sector indicators/variables	- Understanding of the transmission channels on the Zambian economy - Data on the selected macro-economic indicators/variables for the 8-year period: 2005 - 2012	- Description of the Zambian Banking and challenges faced prior to the crisis. - Data on the selected Banking sector indicators/variables for the 8-year period: 2005 - 2012 - Data analysis and results
Main Tools	Articles, Research Reports, Publications etc.	Articles, Publications and Central Bank Reports etc.	Articles, Publications and Central Bank Reports etc.	Articles, Central Bank Reports and Econometric models: VAR Model and Granger Causality Test using EViews

3.2 Variable Selection

From the literature review, the key banking sector and macro-economic factors most commonly affected within the selected countries were consolidated to create the variables to be used in the models for data analysis. The following key factors were identified for consolidation:

i) ***Banking Sector Factors (Internal)***: Earnings; Foreign Assets; Inter-Bank Lending Rates; Interest Spread; Liquidity; NPLs; and Private Sector Lending

ii) ***Macro-Economic Factors (External)***: Commodity Prices; Current Account; Exchange Rate; Inflation; and Policy Rate.

Monthly data will be used for the 8-year period 2005-2012, thus covering the period before, during and after the crisis. The table below gives the description of the selected variables:

Table 7: Variable Definition and Sources

Variable	Abbreviation	Description	Type	Source
Banking Sector Variables (Internal Factors):				
1. Return on Assets – *(Net Income/Total Assets)*	ROA	Measure of *Earnings* relative to its total assets. It reflects management's ability to utilize the bank's financial and real investment resources to generate profits.	Dependent Variable	Bank of Zambia (BoZ) website: www.boz.zm
2. Non-Performing Loans – *(NPLs/total gross loans)*	NPL	A measure of asset quality and is also used as a proxy for credit risk. Bad loans indicate inefficiency in lending and a lack by the management to manage risk.	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm
3. Foreign Assets – *(Investment in Foreign Asset)*	FA	A proxy for foreign ownership	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm
4. Interbank Lending Rate *(%)*	IBLR	Interest charged on short-term loans made between banks to manage liquidity and meet the statutory reserve requirements. The basis of the rate is the *Policy Rate*, and therefore has an impact on the *Interest Spread*.	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm
5. Liquidity *(Total Customer Deposits/Total Assets)*	LQD	Measure of the banks' ability to fulfil its short term obligations, mainly to depositors. It's also used as a proxy to liquidity risk.	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm
6. Credit to Private Sector	PRV	An increase in credit extended to the private sector will lead to an increase in investment and therefore a growth in output and GDP	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm

Table 7: Variable Definition and Sources (Cont.)

Variable	Abbreviation	Description	Type	Source
Macro-Economic Variables (External Factors):				
7. Foreign Exchange Rate	FOREX	Measures exchange movements to the US Dollar	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm
8. Inflation:	INFL	year-on-year change in consumer prices	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm
9. Copper Price:	CU	Commodity price of Copper, which also has an impact on the *Current Account*	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm
10. Crisis (Dummy Variable)[2]	CRISIS	"Dummy" variable that captures the shock effects of the crisis	Independent Variable	Bank of Zambia (BoZ) website: www.boz.zm

[2] The dummy variable is a categorical variable that simulates the effects of the crisis by indicating a value of 1, corresponding to the "Presence of a CRISIS", and 0 corresponding to the "Absence of a CRISIS"

3.3 Model Specification

The estimated regression model will take the following form:

$$y_t = \beta_1 + \beta_{2t} X_{it} + \beta_{3t} X_{et} + e_t$$

Where X_i are the *Internal Factors*; X_e are the *External Factors; t* refers to the time in months; y_t is return on assets (ROA); and e_t is the error term.

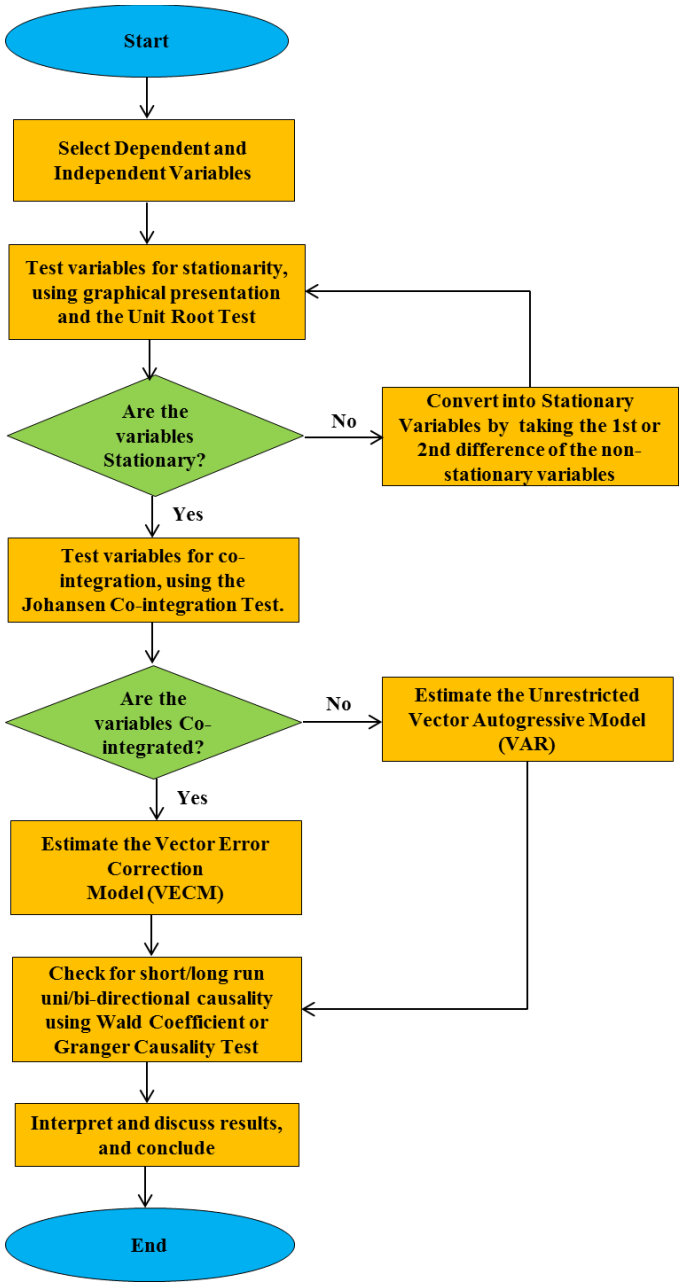
Extending the equation to reflect the selected variables in the table, the baseline model is formulated as follows:

$$\begin{aligned} ROA_t = \beta_1 + \beta_{2t} (&NPL + FA + IBLR \\ &+ LQD + PRV)_t + \beta_{3t} (FOREX \\ &+ INFL + CU)_t + e_t \end{aligned}$$

3.4 Analytical Framework and Tools

The flowchart below gives an overview of how the data series of the identified variables will be analysed using the (unrestricted) VAR model or VEC model, and associated Granger Causality econometric models:

Figure 2: Flowchart of the Modeling Process



3.4.1 *Basis of the Econometric Model*

Hill tells us that in modeling relationships between variables, the nature of the data has an important bearing on the choice of econometric model to adopt. Unlike *cross sectional data*, which is collected at a specific point in time, *time series data* of a particular variable, is collected over a period of time, and therefore likely to be correlated. In addition, relationships between variables can be dynamic, as changes in a variable may have behavioral implications extending beyond the time period it occurred (R. Carter Hill, William E. Griffiths, 2007). In modeling the dynamic nature of the time-series data, therefore, recognition should be given to both current and past values (referred to as 'lags'). These lags may be via the independent variable, dependent variable and/or the error term.

3.4.2 *Autocorrelation*

Considering the standard regression model:

$$y_t = \beta_1 + \beta_2 x_1 + e_t$$

According to Hill, unexpected shocks to the system are transmitted through the error term (e_t) of the model. Therefore an error term in any one period will not only include the effects of the current shocks, but also the carryover from previous shocks, leading to the existence of **autocorrelation** in the error terms. These effects are captured in the error model below:

$$e_t = \rho e_{t-1} + v_t$$

where ρe_{t-1} is the carry-over from the random error in the previous period and v_t is the "new" shock such as the announcement of a new policy. The model is referred to as a first-order autoregressive or **AR(1) model** due to one-period lag (R. Carter Hill, William E. Griffiths, 2007).

The existence of *autocorrelation* has an important bearing on the modeling of dynamic relationships and choice of estimation technique. It is therefore important to be able to test for *autocorrelation* prior to use of the data. Hill proposes two methods are commonly used namely**:** **residual correlogram** and **Lagrange Multiplier (LM) test**.

According to Hill it follows that e_t is uncorrelated when $\rho = 0$. The *residual correlogram* therefore tests the hypothesis:

$H_0 : \rho = 0$ for no autocorrelation, and
$H_1 : \rho \neq 0$ for autocorrelation.

3.4.3 *Stationarity and Cointegration*

The time series concepts of S*tationarity* and *Cointegration* are key in dynamic regression modeling and are further elaborated by Hill (R. Carter Hill, William E. Griffiths, 2007).

Stationarity

According to Hill, before embarking on a regression analysis it is important to ensure that the time series data is *stationary* to avoid getting misleading results from unrelated data, such as that obtained from a *non-stationary* data series.

Although observation of the plotted time series data is usually the starting point, the more formal tests for stationarity are *Unit Root Tests*, the most popular one being the **Dickey-Fuller test.**

Most economic time series variables follow a *random* or *stochastic process* whereby a single variable y, is related to past values of itself and current and past values of the error term v_t, with no explanatory variable. This may be considered an AR(1) process given by:

$$y_t = \rho y_{t-1} + v_t$$

In the special case where $\rho = 1$, the model becomes a non-stationary *random walk process*, dependent only on the previous year's value and error/"shock" term as given by:

$$y_t = y_{t-1} + v_t$$

The *stochastic* time series appears to wander about with real pattern, a characteristic of a *non-stationary* series variable that may include or exclude a constant and/or a time trend, and may or may not need to be incorporated in the *Dickey-Fuller test.*

It then follows that y_t is non-stationary when $\rho = 1$. The *Dickey-Fuller test,* also known as **unit root tests for stationarity**, therefore tests the hypothesis:

$H_0 : \rho = 1$ for non-stationarity, and
$H_1 : \rho \neq 1$ for stationarity.

Cointegration

From the foregoing, it follows that non-stationary "stochastic" variables can be converted to stationary by taking the first difference.

$$\Delta y_t = y_t - y_{t-1} = v_t$$

v_t is stationary and therefore by taking the first difference Δy_t, the stochastic variables become stationary, *integrated of order 1* or **I(1)**. A linear combination of non-stationary I(1) variables will therefore also be expected to result in a non-stationary I(1) process. In the special case, where it results in a stationary **I(0)** process, **cointegration** will be said to exist, implying that the variables exhibit similar stochastic trends, and therefore will have a long-run association.

As the residuals e_t cannot be observed in any linear combination of non-stationary I(1) variables, the test for *cointegration* would effectively be a test of stationarity of the residuals e_t , based on the test equation:

$$\Delta e_t = \gamma e_{t-1} + v_t$$

where $\Delta e_t = e_t - e_{t-1}$. It then follows that Δe_t is non-stationary when $\gamma = 1$. The *Dickey-Fuller test* therefore tests the hypothesis:

$H_0 : \gamma = 1$ for non-stationarity, and therefore no cointegration; and
$H_1 : \gamma \neq 1$ for stationarity, and therefore cointegration

An alternative, and more straight-forward, test for co-integration is the **Johansen Cointegrating Test,** which uses the *Trace* and/or *Maximum Eigenvalue* Statistics to test the hypothesis for cointegration, directly, among the variables.

3.4.4 *Vector Error Correction (VEC) and Vector Auto-Regression (VAR) Granger Causality Models*

The VAR model is the general framework that describes the dynamic interrelationship between stationary variables. For stationary I(0) variables, this is given by a system of equations:

$$y_t = \beta_{10} + \beta_{11}\, y_{t-1} + \beta_{12}\, x_{t-1} + v_t^y$$
$$x_t = \beta_{20} + \beta_{21}\, y_{t-1} + \beta_{22}\, x_{t-1} + v_t^x$$

where each variable is a function of its own lag, and the lag of the other variable in the system. Together the equation constitute a system known as a vector autoregression (VAR).

For nonstationary I(1) variables that are not cointegrated, the system of equations is given by:

$$\Delta y_t = \beta_{11}\Delta y_{t-1} + \beta_{12}\,\Delta x_{t-1} + v_t^{\Delta y}$$
$$\Delta x_t = \beta_{21}\Delta y_{t-1} + \beta_{22}\,\Delta x_{t-1} + v_t^{\Delta x}$$

which are converted to stationary variable by first differencing (denoted byΔ)

In the special case where nonstationary I(1) variables are cointegrated, the VAR model may be modified to allow for the cointegrating relationship between the I(1) variables. Incorporating the cointegrating relationship to the **VEC model**, given by a system of equations:

$$\Delta y_t = \alpha_{10} + \alpha_{11}(y_{t-1} - \beta_0 - \beta_1 x_{t-1}) + v_t^y$$
$$\Delta x_t = \alpha_{20} + \alpha_{21}(y_{t-1} - \beta_0 - \beta_1 x_{t-1}) + v_t^x$$

where α_{11} and α_{21} are the error correction coefficients which show how much, and at what speed, Δy_t and Δx_t respond to the cointegrating error $y_{t-1} - \beta_0 - \beta_1 x_{t-1}$. The cointegrated model, within the VEC model, therefore determines the speed of adjustment towards the long-run equilibrium position (R. Carter Hill, William E. Griffiths, 2007).

VAR Granger Causality

According to Petersen, the *Granger Causality test* is a technique based on the linear regression modeling of stochastic processes. In contrast to the standard regression models that simply establishes an association between variables, the Granger Causality test goes further to establish the direction of the causality, whether uni- or bidirectional. This presents a powerful forecasting tool that enables past values of one time series variable to forecast future values of another time series variable (Mark Petersen; Janine Mukkudem-Petersen, 2014).

Given a bivariate linear autoregressive (VAR) model of two variables x and y (Granger, 1969):

$$y_t = \sum_{i=1}^{n} \beta_{10}\, y_{t-1} + \sum_{j=1}^{n} \beta_{11}\, x_{t-1} + v_t^y$$
$$x_t = \sum_{i=1}^{n} \beta_{20}\, x_{t-1} + \sum_{j=1}^{n} \beta_{21}\, y_{t-1} + v_t^x$$

Where n is the maximum number of lagged observations included in the model (the model order); and v_t^y and v_t^x are the uncorrelated "white noise"/residual error series.

In conducting the test, selection of the number of lags is critical in reducing serial correlation between the error terms (Mark Petersen; Janine Mukkudem-Petersen, 2014). A test would therefore need to be done to ensure that the optimum number of lags (model order n), are selected. The Akaike Information Criterion (AIC) (Akaike, 1998), can be used to determine the appropriate model order.

To ensure that the model is a **Best Linear Unbiased Estimator (BLUE)**, it is critical to further test the statistical characteristics of the VAR model, by conducting residual tests for **residual autocorrelation**, **normality** and **Heteroscedasticity.**

From the VAR model, the definition of causality therefore implies that x_t causes y_t provided that β_{11} is not zero, and similarly, y_t causes x_t , provided that β_{21} is not zero (Granger, 1969). For each equation in the VAR model, the Granger Causality will therefore use the *F-Statistic* to test the hypotheses that, for y_t:

$H_0 : \beta_{11} = 0$, for *no-causality* from x_t to y_t
$H_1 : \beta_{11} \neq 0$, for *causality* from x_t to y_t

And similarly for x_t:

$H_0 : \beta_{21} = 0$, for *no-causality* from y_t to x_t
$H_1 : \beta_{21} \neq 0$, for *causality* from y_t to x_t

3.5 Chapter Summary

The research approach will essentially involve the collection and reviewing of secondary data from selected African countries with similar ownership banking structures to the Zambian one. This is to better isolate the effects of the crisis on those selected countries. The performance of commonly identified macro-economic and banking sector indicators in each of these selected countries will be used to assess the effects of the crisis within the Zambia banking context. Monthly data will be used for the 8-year period 2005-2012, thus covering the period before, during and after the crisis.

The selected variables included the dependent variable - Return on Assets (ROA), and the independent variables - Non-Performing Loans (NPL); Foreign Assets (FA); Interbank Lending Rate (IBLR); Liquidity (LQD); Credit to Private Sector (PRV); Foreign Exchange Rate (FOREX); Inflation (INFL); and Copper Price (CU). In addition, a 'dummy' variable (CRISIS) was introduced in the analysis as a proxy for the crisis.

The basis of the applied *Econometric Model* is the dynamic nature of the time-series data used, which recognizes the effects of both current and past values (referred to as 'lags') of the variables. Given a standard regression model ($y_t = \beta_1 + \beta_2 x_1 + e_t$) any unexpected shocks, ie a crisis, to the system are transmitted through the error term (e_t) of the model.

The error term in any one period will not only include the effects of the current shocks, but also the carryover from previous shocks, leading to the existence of **autocorrelation** in the error terms, which have an important bearing on the modeling of dynamic relationships and choice of estimation technique. It is therefore important to be able to test for *autocorrelation* prior to use of the data. Two methods are commonly used namely**: residual correlogram** and **Lagrange Multiplier (LM) test**.

Prior to embarking on the regression analysis it is important to ensure that the time series data is **stationary** to avoid getting misleading results from unrelated data. The more formal tests for stationarity are *Unit Root Tests,* the most popular one being the **Dickey-Fuller test.** Variables exhibiting similar 'stochastic' trends will have a long-run association and **cointegration** will be said to exist. The test for co-integration is the **Johansen Cointegrating Test.**

The **Vector Auto-Regression (VAR)** model is the general framework that describes the dynamic interrelationship between stationary variables. Where there is *cointegration*, the VAR model may be modified to incorporate the cointegrating relationship to the **Vector Error Correction** (**VEC) Model**. The cointegrated model within the VEC model determines the speed of adjustment towards the long-run equilibrium position.

In contrast to the standard regression models that simply establishes an association between variables the **Granger Causality Test** goes further to establish the direction of the causality, whether uni or bidirectional. This presents a powerful forecasting tool that enables past values of one time series variable to forecast future values of another time series variable.

To assess the validity, and thus ensure that the model is a **Best Linear Unbiased Estimator (BLUE)**, it is critical to further test the statistical characteristics of the VAR model, by conducting residual tests for **Residual Autocorrelation** (using the *Serial Correlation LM Test*), **Normality** (using the *Normality Test*) and **Heteroscedasticity** (using the *Heteroscedasticity Test*)**.**

CHAPTER 4

Results & Discussion

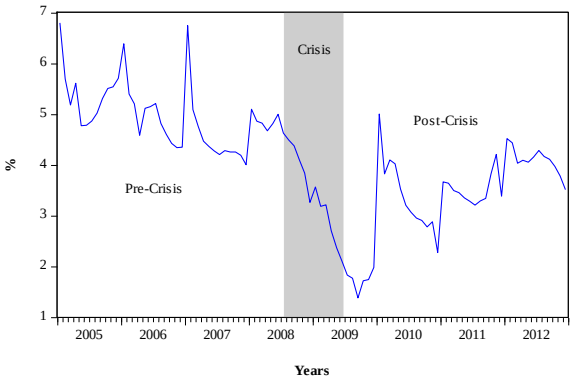
4.1 Trend Analysis of Performance Variables

The following figures shows the monthly trend of the selected variables over the 8-year period 2005-2012, thus covering the period before (Jan 2005 – Jun 2008), during (Jul 2008 – Jun 2009) and after (Jul 2009 – Dec 2012) the crisis *(full data sets used in the analyses are detailed in Appendix 2).*

4.1.1 Banking Sector Factors

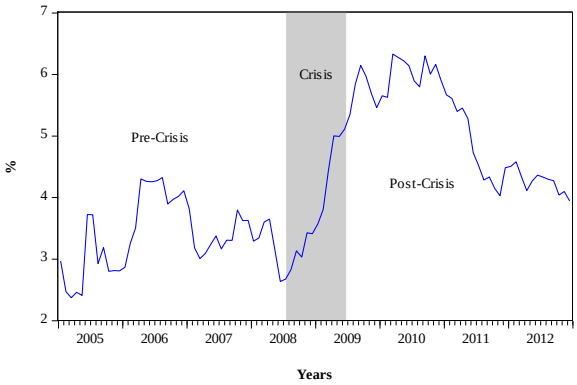
Figure 3: Banking Sector Variables

i) Return on Assets (ROA)



Earnings generally showed a downward trend from 7% in 2005 and dipping significantly to a low of 1.2% during the 2008-9, the period of the crisis. It recovered in 2010, and continued on its downward trend to end at 3.5% at the end of 2012.

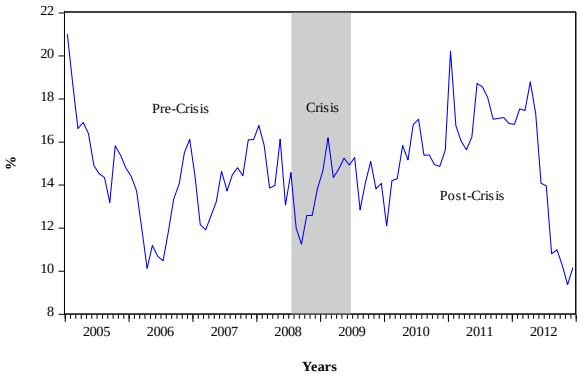
ii) Non-Performing Loans (NPLs)



The graph shows a general upward increase, from a low of 2.3% during 2005 and increasing sharply to a high of 6.3% during, and just post, the crisis period. It then fell steadily during the period 2011-12 to end at 4% at the end of 2012.

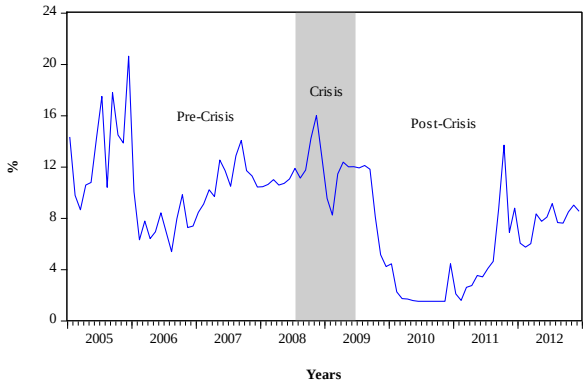
Figure 3: Banking Sector Variables (Cont.)

i) Foreign Assets Investments



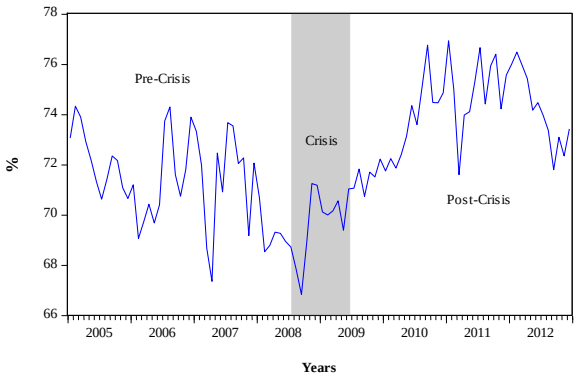
Investment in foreign assets sharply fell from 20% in 2005 to 10% in 2006, before increasing to 18% at the beginning of 2011 and sharply falling to a low of 9.3% at the end of 2012. Investment during the crisis period fell to a low of 11%.

ii) Inter-Bank Lending Rates (IBLR)



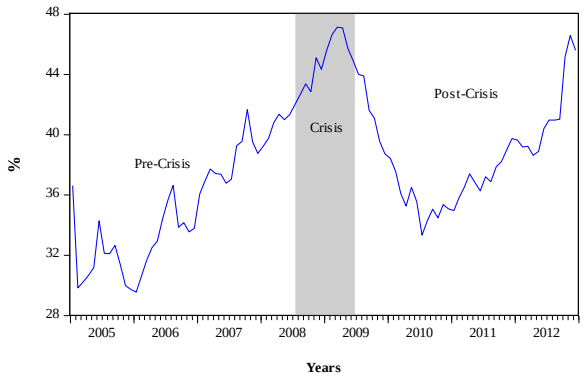
Inter Bank Interest Rates were at a lowest of 1.4% in the immediate post crisis period of 2010. This from an average of 12% in the preceding period.

iii) Liquidity



Liquidity in terms of total deposits fell to the lowest, at 66% of assets, during the crisis period, indicating the effect that it had on liquidity in the market. The post crisis period showed an increase in liquidity, hitting a highest of 76.9% during 2010 and ending at 73% in 2012.

iv) Credit to Private Sector

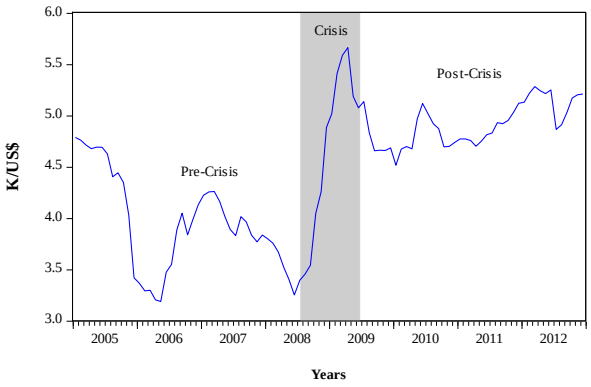


Private sector lending increased steadily from a low of 29.5% in 2006 to a high of 47% during the crisis. This however dropped during the immediate post crisis period to 34%, before increasing and ending back up at 46% in 2012.

4.1.2 Macro-Economic Factors

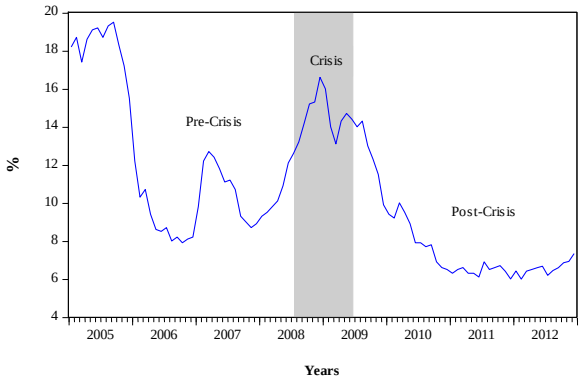
Figure 4: Macro-Economic Variables

i) Foreign Exchange Rate



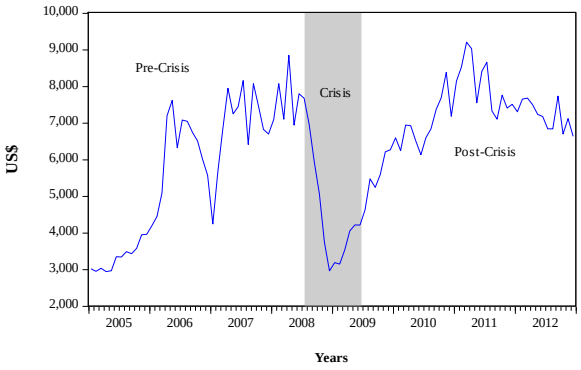
The graph shows a sharp increase in the exchange rate during the crisis period, from a low of K3.20 to a high of K5.60 to one dollar, within a few months. This only fell slightly during the post crisis period, ending at K5.20 in 2012.

ii) Inflation



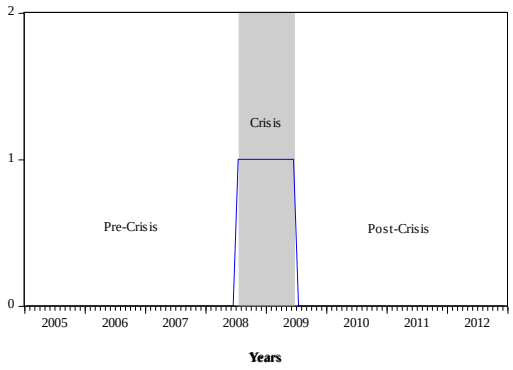
Inflation increased sharply over the crisis period, from a low of 8.5% to a high of 16% at the peak of the crisis. This fell steadily during the post-crisis period, to close at 7% in 2012.

iii) Copper Prices



The price of Copper was lowest during the crisis, from a high of US$ 9,000 to US$ 3,000 per tonne from the onset of the crisis, indicating the significant effect it had on the country's main commodity export.

iv) CRISIS Dummy Variable



The spike corresponds to the crisis period in Zambia - July 2008 to June 2009

4.2 Descriptive Statistics

The table below gives a summary of some descriptive statistics of the variables before (Pre-Crisis), during (Crisis), and after (Post-Crisis) the crisis:

Table 8: Variables - Descriptive Statistics

Variable	Period	Statistic			
		Mean	Max.	Min.	Std. Dev.
1. Return on Assets (ROA - %)	*Pre-Crisis*	5.0	6.8	4.0	0.7
	Crisis	3.5	4.6	2.1	0.8
	Post-Crisis	3.4	5.0	1.4	0.9
2. Non-Performing Loans (NPLs - %)	*Pre-Crisis*	3.4	4.3	2.4	0.6
	Crisis	3.8	5.1	2.7	0.9
	Post-Crisis	5.1	6.3	3.9	0.8
3. Foreign Assets (FA - %)	*Pre-Crisis*	14.4	21.0	10.1	2.2
	Crisis	13.9	16.2	11.2	1.5
	Post-Crisis	15.3	20.2	9.4	2.5
4. Inter-Bank Lending Rates (IBLR - %)	*Pre-Crisis*	10.7	20.6	5.4	3.2
	Crisis	11.9	16.0	8.2	2.0
	Post-Crisis	5.5	13.7	1.5	3.5
5. Liquidity (LQD - %)	*Pre-Crisis*	71.3	74.3	67.3	1.8
	Crisis	69.6	71.2	66.8	1.4
	Post-Crisis	73.9	76.9	70.7	1.8
6. Credit to Private Sector (PRV - %)	*Pre-Crisis*	35.2	41.6	29.5	3.8
	Crisis	44.8	47.1	42.0	1.8
	Post-Crisis	38.5	46.6	33.3	3.2
7. Foreign Exchange Rate (FOREX – K/US$)	*Pre-Crisis*	4.0	4.8	3.2	0.5
	Crisis	4.6	5.7	3.4	0.8
	Post-Crisis	4.9	5.3	4.5	0.2
8. Inflation Rate (INFL - %)	*Pre-Crisis*	12.3	19.5	7.9	4.1
	Crisis	14.5	16.6	12.6	1.2
	Post-Crisis	7.8	14.3	6.0	2.2
9. Copper Prices (CU – US$)	*Pre-Crisis*	5,770	8,840	2,933	1,857
	Crisis	4,546	7,665	2,953	1,544
	Post-Crisis	7,131	9,196	4,617	973

The above table clearly shows that there is an evident change in each of the variables, as indicated by the means in the each of the periods before, during and after the crisis. This

therefore suggests that the crisis may have had a measurable impact on the performance of the sector as a whole.

Non-Performing Loans (NPLs) showed the largest adverse movement between the pre- and post-crisis periods, increasing by 52%. The Return on Assets (ROA) also showed an adverse movement, decreasing by 32% between the same periods. Other significant adverse movements can be seen in Copper Prices (CU), which fell by 21% in the period before and during the crisis, hitting a minimum of US$ 2,933 per tonne and maximum of US$ 8,840 during the same period. The post-crisis period, however showed a recovery in the copper prices, to an average of US$ 7,131 per tonne.

Liquidity (LQD), as measured by total deposits, and Foreign Asset investments (FA), only fell slightly during the crisis, by 2% and 3% respectively, before increasing by 4% and 6% respectively, during the post crisis period.

The Inter-Bank Lending Rates (IBLR) and Inflation (INFL), adversely increased by 11% and 17% respectively during the pre- and crisis periods, before showing a favorable decrease of 48% and 36% respectively, during the post-crisis period. This significant decrease is presumably due to government's efforts, in trying to stimulate economic activities by reducing inflation and interest rates. This is evidenced further by the increase in Private Sector lending (PRV), by 27% during the pre- and crisis periods, which is an important indicator for investment, and hence economic growth.

The Foreign Exchange Rate (FOREX) increased from an average of K4.00 per US$ to K4.90 per US$, between the pre- and post- crisis periods, indicating a currency depreciation rate of 24% during the period.

4.3 Econometric Modelling

4.3.1 Stationarity Test

As alluded to in the Methodology, *stationarity* of the time series data is critical if any meaningful conclusions are to be drawn from any estimated regression models of the variables. Although observation of the graphical time series data suggests that all the selected variables are *non-stationary*, confirmatory results using the **Augmented Dickey-Fuller (ADF) test,** to test for the presence or absence of *Unit Roots*, are shown in the Table 9.

It is clear from Table 9 that the null hypothesis of no unit roots for all the variables are rejected at their first difference, as their probability values are less than 5%. Thus the variables are stationary and integrated of the same order I(1). The test, however, further reveals that the FA, IBLR and LQD variables are stationary, at both level and first difference. All other variables are non-stationary in their level form, and only become stationary after first differencing.

The ADF results are generally in line with the graphical analysis, thus confirming that the variables are stationary and integrated of the same order I(1), and may be used for further analysis.

Table 9: ADF Test Summary Results

Variable	Test Level	Model	No. of Lags	ADF Test Statistic	Critical Level			Prob.	Order of Integration
					1%	5%	10%		
1. Return on Assets (ROA)	Level	Constant	1	-2.466	-3.501	-2.893	-2.583	0.127	
		Trend + Const.	0	-3.696	-4.058	-3.458	-3.155	0.027	I(0)
		None	1	-1.127	-2.590	-1.944	-1.614	0.235	
	1st Diff.	Constant	0	-12.887	-3.501	-2.893	-2.583	0.000	I(1)
		Trend + Const.	0	-12.843	-4.059	-3.458	-3.155	0.000	I(1)
		None	0	-12.925	-2.590	-1.944	-1.614	0.000	I(1)
2. Non-Performing Loans (NPLs)	Level	Constant	1	-1.974	-3.501	-2.893	-2.583	0.298	
		Trend + Const.	1	-1.636	-4.059	-3.458	-3.155	0.771	
		None	0	-0.094	-2.590	-1.944	-1.615	0.649	
	1st Diff.	Constant	0	-8.670	-3.501	-2.893	-2.583	0.000	I(1)
		Trend + Const.	0	-8.738	-4.059	-3.458	-3.155	0.000	I(1)
		None	0	-8.697	-2.590	-1.944	-1.614	0.000	I(1)
3. Foreign Assets (FA)	Level	Constant	0	-3.514	-3.501	-2.892	-2.583	0.010	I(0)
		Trend + Const.	0	-3.591	-4.058	-3.458	-3.155	0.036	I(0)
		None	0	-1.289	-2.590	-1.944	-1.615	0.181	
	1st Diff.	Constant	0	-10.829	-3.501	-2.893	-2.583	0.000	I(1)
		Trend + Const.	0	-10.769	-4.059	-3.458	-3.155	0.000	I(1)
		None	0	-10.835	-2.590	-1.944	-1.614	0.000	I(1)
4. Inter-Bank Lending Rates (IBLR)	Level	Constant	0	-3.180	-3.501	-2.892	-2.583	0.024	I(0)
		Trend + Const.	0	-3.467	-4.058	-3.458	-3.155	0.049	I(0)
		None	0	-1.567	-2.590	-1.944	-1.615	0.110	
	1st Diff.	Constant	1	-9.512	-3.502	-2.893	-2.584	0.000	I(1)
		Trend + Const.	1	-9.457	-4.060	-3.459	-3.155	0.000	I(1)
		None	1	-9.565	-2.590	-1.944	-1.614	0.000	I(1)
5. Liquidity (LQD)	Level	Constant	0	-3.185	-3.501	-2.892	-2.583	0.024	I(0)
		Trend + Const.	0	-3.860	-4.058	-3.458	-3.155	0.018	I(0)
		None	0	-0.073	-2.590	-1.944	-1.615	0.656	
	1st Diff.	Constant	1	-9.162	-3.502	-2.893	-2.584	0.000	I(1)
		Trend + Const.	1	-9.133	-4.060	-3.459	-3.155	0.000	I(1)
		None	1	-9.212	-2.590	-1.944	-1.614	0.000	I(1)

Table 9: ADF Test Summary Results (Cont.)

Variable	Test Level	Model	No. of Lags	ADF Test Statistic	Critical Level			Prob.	Order of Integration
					1%	5%	10%		
6. Credit to Private Sector (PRV)	Level	Constant	0	-0.954	-3.501	-2.892	-2.583	0.767	
		Trend + Const.	0	-1.584	-4.058	-3.458	-3.155	0.792	
		None	0	0.572	-2.590	-1.944	-1.615	0.838	
	1st Diff.	Constant	0	-10.753	-3.501	-2.893	-2.583	0.000	I(1)
		Trend + Const.	0	-10.623	-4.059	-3.458	-3.155	0.000	I(1)
		None	0	-10.628	-2.590	-1.944	-1.614	0.000	I(1)
7. Foreign Exchange Rate (FOREX)	Level	Constant	1	-1.773	-3.501	-2.893	-2.583	0.392	
		Trend + Const.	2	-3.472	-4.060	-3.459	-3.155	0.048	I(0)
		None	1	-0.055	-2.590	-1.944	-1.614	0.662	
	1st Diff.	Constant	0	-6.650	-3.501	-2.893	-2.583	0.000	I(1)
		Trend + Const.	0	-6.676	-4.059	-3.458	-3.155	0.000	I(1)
		None	0	-6.682	-2.590	-1.944	-1.614	0.000	I(1)
8. Inflation Rate (INFL)	Level	Constant	1	-2.280	-3.501	-2.893	-2.583	0.181	
		Trend + Const.	1	-2.372	-4.059	-3.458	-3.155	0.392	
		None	1	-1.646	-2.590	-1.944	-1.614	0.094	
	1st Diff.	Constant	0	-6.154	-3.501	-2.893	-2.583	0.000	I(1)
		Trend + Const.	0	-6.188	-4.059	-3.458	-3.155	0.000	I(1)
		None	0	-6.093	-2.590	-1.944	-1.614	0.000	I(1)
9. Copper Prices (CU)	Level	Constant	0	-2.549	-3.501	-2.892	-2.583	0.107	
		Trend + Const.	0	-2.601	-4.058	-3.458	-3.155	0.281	
		None	0	-0.181	-2.590	-1.944	-1.615	0.618	
	1st Diff.	Constant	0	-11.579	-3.501	-2.893	-2.583	0.000	I(1)
		Trend + Const.	0	-11.587	-4.059	-3.458	-3.155	0.000	I(1)
		None	0	-11.600	-2.590	-1.944	-1.614	0.000	I(1)

4.3.2 Cointegration Test

Cointegration implies that the variables exhibit similar stochastic trends, and therefore have a long-run association. Testing for cointegration is a critical step, as it determines the appropriate regression model to apply. Using the Johansen's co integration approach, the choice of the *lag length*, which is used in both the cointegration analysis and regression model, is determined using several information criteria, as shown in Table 10 below. Although there is no specified information criterion to apply, several literatures does suggest the use of the Schwarz (SC) and Akaike information criterion (AIC). It may however, be more prudent to take the most common lag amongst the various criteria, which in this case is a lag length of one (1) or alternatively, one that produces the best model in terms of diagnostic tests

Table 10: Lag-order Selection Criterion

Lag	Criteria					
	LogL	LR	FPE	AIC	SC	HQ
0	-1068.161	NA	0.246	24.137	24.637	24.339
1	-449.517	1086.063	1.61e-06*	12.189	14.939*	13.298*
2	-393.119	87.731	0.000	12.736	17.736	14.752
3	-335.170	78.553	0.000	13.248	20.498	16.172
4	-226.769	125.263	0.000	12.639	22.139	16.470
5	-126.352	95.954	0.000	12.208	23.957	16.946
6	11.320	104.019*	0.000	10.948*	24.947	16.594

The **Johansen's Cointegration Test** derives two (2) likelihood estimators for ranking the number of cointegrating equations (CEs) in the model, the *Trace* and *Maximum Eigen Value* Tests. The results of the 2 tests are presented in Table 11 below.

Table 11: Unrestricted Cointegration Rank Tests

Hypothesized No. of CE(s)	Eigenvalue	Trace Test		Maximum Eigen Value Test	
		Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None *	0.489	212.530	197.371	63.161	58.434
At most 1	0.356	149.369	159.530	41.368	52.363
At most 2	0.298	108.001	125.615	33.319	46.231
At most 3	0.232	74.682	95.754	24.862	40.078
At most 4	0.210	49.820	69.819	22.127	33.877
At most 5	0.179	27.693	47.856	18.503	27.584
At most 6	0.078	9.190	29.797	7.603	21.132
At most 7	0.016	1.587	15.495	1.513	14.265
At most 8	0.001	0.075	3.841	0.075	3.841

Both the Trace and Max-eigenvalue test indicates 1 cointegrating equation(s) at the 0.05 level

From the above table, results of both the *Trace* and *Maximum Eigen Value Tests* reject the null hypothesis of no CEs at the 5% level of significance, implying that the model has at most one (1) CE, with a lag length of one (1).

Having established that the variables are cointegrated, we can proceed to estimate the **Vector Error Correction Model (VECM)**, which is the appropriate regression model.

4.3.3 Estimating the Vector Error Correction Model (VECM)

The presence of cointegration between variables suggests that there is a long run association amongst the variables, indicating therefore that the **Vector Error Correction Model (VECM)** is the most appropriate regression model to apply. The main feature of the *VECM* is its ability to correct, through the error correction term, for any disequilibrium caused by shocks to the system, which may occur from time to time. This makes it appropriate as it takes into account both the long and short run dynamics of the system.

In estimating the VECM, the econometric software package **Eviews** is used. The software is ideal as it analyses data sets, interprets results, and draws conclusions in a user-friendly manner. The detailed steps involved in estimating the VECM, using Eviews and the 'Dummy' variable (CRISIS), are given and illustrated by the Eviews screen-shots in *Appendix 3*.

The system equation of the VECM, incorporating the error correction term, and accompanying table of coefficients, with corresponding t-statistic values, is given below *(full outcome of the VECM is detailed in Appendix 3)*:

VECM System Equation:

D(ROA) = C(1)*(ROA(-1) + 0.012*FA(-1) - 0.187*IBLR(-1) + 0.274*INFL(-1) - 3.056*LNCU(-1) - 13.907*LNFOREX(-1) + 1.069*LQD(-1) + 0.756*NPL(-1) + 0.481*PRV(-1) - 56.903) + C(2)*D(ROA(-1)) + C(3)*D(FA(-1)) + C(4)*D(IBLR(-1)) + C(5)*D(INFL(-1)) + C(6)*D(LNCU(-1)) + C(7)*D(LNFOREX(-1)) + C(8)*D(LQD(-1)) + C(9)*D(NPL(-1)) + C(10)*D(PRV(-1)) + C(11) + C(12)*CRISIS

	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
C(1)	-0.084643	0.049748	-1.701416	0.0927
C(2)	-0.233334	0.103837	-2.247131	0.0273
C(3)	0.018013	0.044486	0.404905	0.6866
C(4)	0.038145	0.025500	1.495853	0.1385
C(5)	-0.146555	0.079333	-1.847334	0.0683
C(6)	-0.262512	0.540791	-0.485423	0.6287
C(7)	0.385389	1.669766	0.230804	0.8180
C(8)	0.116297	0.046284	2.512669	0.0139
C(9)	-0.168175	0.208422	-0.806900	0.4221
C(10)	-0.007262	0.048068	-0.151073	0.8803
C(11)	-0.016902	0.062037	-0.272443	0.7860
C(12)	-0.166314	0.184947	-0.899248	0.3712

R-squared	0.253006	Mean dependent var	-0.02318
Adjusted R-squared	0.152799	S.D. dependent var	0.582565
S.E. of regression	0.536214	Akaike info criterion	1.710176
Sum squared resid	23.57706	Schwarz criterion	2.034851
Log likelihood	-68.3783	Hannan-Quinn criter.	1.841321
F-statistic	2.524845	Durbin-Watson stat	2.029269
Prob(F-statistic)	0.008569		

The VECM table above indicates the coefficients, and their significance, at the 5% level of significance. The t-statistic and its associated probability (p-value), tests the hypothesis that the coefficient of the independent variable has a significant influence, or not, on the dependent variable, ROA. It therefore tests the hypothesis:

$H_0 : Coefficient = 0$, for no significant influence on the dependent variable, and

$H_1 : Coefficient \neq 0$, for a significant influence on the dependent variable.

In this case a p-value of less 5% indicates that the independent variable is significant explaining the dependent variable.

The coefficient C(1), for the error correction term [(ROA(-1) + 0.012*FA(-1) - 0.187*IBLR(-1) + 0.274*INFL(-1) - 3.056*LNCU(-1) - 13.907*LNFOREX(-1) + 1.069*LQD(-1) + 0.756*NPL(-1) + 0.481*PRV(-1) - 56.903)] determines the speed of adjustment towards long run equilibrium. Any deviation from the long run equilibrium of the model is corrected by this error correction term, implying that the coefficient C(1) must be negative, and have a significant influence on the dependent variable ROA, for this to occur. Although C(1) is negative (-0.084643), which is desirable, its p-value is greater than 5% suggesting that it has no significant influence on the ROA. This implies that there is no long run influence on the dependent variable, ROA, from the selected independent variables.

The table further indicates that of all the selected independent variables in the model, only the coefficient of the liquidity (LQD) variable was found to be significant, with a p-value of 1.39%. The coefficient therefore suggests that a 1% increase in the liquidity rate, as measured by the bank deposits to total asset ratio, results in an increase in the ROA, of about 0.12%. This is consistent with economic theory which, as already alluded to in the literature review, underscores the importance of bank deposits in liquidity creation and transformation, and hence its effect on the banking sector's profitability, as measured by the ROA.

With regards to the effect of the crisis on the ROA, the coefficient of the CRISIS dummy variable is negative, and the p-value greater than 5%, suggesting that although its effect was negative, it had very little influence on the sector's profitability. This is generally consistent with the empirical findings of the other selected African countries in this study.

Regression Diagnostics

The model is based on certain assumptions, therefore it is necessary to carry out diagnostic tests to assess its validity, and hence robustness of the model, in making inferences about the variables and their associations. From the VECM table above, the R-squared (Coefficient of

determination), which indicates the proportion of the independent variables that influences the dependent variable ROA, is considered low at 0.25.

The F-statistic, on the other-hand, appears to be significant with a p-value of less than 5%, which strengthens the validity of the model. The F Statistic is a measure of the joint significance of the independent variables, in the overall model, in influencing the dependent variable. This means that, although, the independent variables may individually be insignificant in influencing the dependent variable, jointly they are significant.

The table below gives a summary of further key residual diagnostic checks, done on the model:

Table 12: Residual Diagnostic Checks

Test	Test Statistic	Prob. (P-Value)	Decision
i) Serial Correlation LM Test	Obs*R-Square = 0.312	0.86	Do not reject
ii) Heteroscedasticity Test	Obs*R-Square = 18.051	0.52	Do not reject
iii) Normality Test	Jarque-Bera = 517.31	0.00	Reject

i) ***Serial Correlation.*** May be referred to as *autocorrelation*, and measures the effect of the given time series variable with itself, over various time intervals. The test statistic is the observed R-squared which tests the null hypothesis for no serial correlation. From the above table the p-value is greater than 5%, therefore we cannot reject the null hypothesis and conclude that there is no serial correlation in the model. This is a desirable feature of the model.

ii) ***Heteroscedasticity.*** Refers to time series residual data with unequal variances over time. The test statistic is again, the observed R-squared which tests the null hypothesis for no heteroscedasticity. From the above table, the p-value is greater than 5% therefore we cannot reject the null hypothesis and conclude that there is no heteroscedasticity in the model. This is a desirable feature of the model.

iii) ***Normality.*** Refers to the feature of time series residual data being normally distributed. The test statistic is the *Jarque-Bera* , which tests the null hypothesis for normality. From the above table, the p-value is less than 5%, therefore we reject the null hypothesis and conclude that the residuals are not normally distributed.

Following these diagnostic checks, it may be concluded that the model is sufficiently robust to be able to make meaningful inferences about the selected independent variables, and their association with the dependent variable, ROA. Although the model's residuals are not normally distributed, other test features of the model, such as the absence of *serial correlation* and *heteroscedasticity* are sufficient enough to validate it.

4.3.4 Granger Causality Tests

The *Granger Causality Test*, as already alluded to, goes further to establish the direction of the short-run causality, and not simply an association between variables. Estimation results for granger causality between the selected variables is summarized in Table 13 below *(full results of the tests are detailed in Appendix 4)*:

Table 13: Granger Causality Test Results - ROA as Dependent Variable

	Null Hypothesis:	F-Statistic	Prob.	Conclusion
i)	LNFOREX does not Granger Cause ROA	4.32204	0.0404	**Causality**
	ROA does not Granger Cause LNFOREX	0.55639	0.4576	No causality
ii)	NPL does not Granger Cause ROA	3.70143	0.0575	No causality
	ROA does not Granger Cause NPL	7.21212	0.0086	**Causality**
iii)	PRV does not Granger Cause ROA	8.40946	0.0047	**Causality**
	ROA does not Granger Cause PRV	0.02202	0.8824	No causality
iv)	CRISIS does not Granger Cause ROA	4.45435	0.0375	**Causality**
	ROA does not Granger Cause CRISIS	2.21393	0.1402	No causality
v)	CRISIS does not Granger Cause LNCU	7.86918	0.0061	**Causality**
	LNCU does not Granger Cause CRISIS	0.37855	0.5399	No causality
vi)	NPL does not Granger Cause FA	4.21477	0.0429	**Causality**
	FA does not Granger Cause NPL	0.68362	0.4105	No causality
vii)	PRV does not Granger Cause LNFOREX	6.22918	0.0143	**Causality**
	LNFOREX does not Granger Cause PRV	1.65275	0.2018	No causality
viii)	CRISIS does not Granger Cause LNFOREX	11.1343	0.0012	**Causality**
	LNFOREX does not Granger Cause CRISIS	4.0305	0.0476	No causality

Table 13: Granger Causality Test Results - ROA as Dependent Variable (Cont.)

	Null Hypothesis:	F-Statistic	Prob.	Conclusion
ix)	INFL does not Granger Cause IBLR	4.07464	0.0464	**Causality**
	IBLR does not Granger Cause INFL	0.10611	0.7454	No causality
x)	LQD does not Granger Cause IBLR	2.5146	0.1162	No causality
	IBLR does not Granger Cause LQD	4.35056	0.0398	**Causality**
xi)	NPL does not Granger Cause IBLR	17.4787	7.00E-05	**Causality**
	IBLR does not Granger Cause NPL	0.54016	0.4642	No causality
xii)	PRV does not Granger Cause INFL	3.7871	0.0547	No causality
	INFL does not Granger Cause PRV	4.01779	0.048	**Causality**
xiii)	NPL does not Granger Cause LQD	6.03631	0.0159	**Causality**
	LQD does not Granger Cause NPL	3.74002	0.0562	No causality
xiv)	CRISIS does not Granger Cause NPL	5.71783	0.0188	**Causality**
	NPL does not Granger Cause CRISIS	3.84423	0.0529	No causality

From the above table, the following conclusions can be made about the direction of the short-run causality amongst the variables in the model:

i) FOREX granger causes ROA, unidirectional, at the 5% level of significance, meaning that in the short-run, movements in the foreign exchange rate has a significant effect on the banking sector's profitability, ROA.

ii) ROA granger causes NPL, unidirectional, at the 5% level of significance, meaning that in the short-run, movements in the sector's profitability has a significant effect on the level of non-performing loans.

iii) PRV granger causes ROA, unidirectional, at the 5% level of significance, meaning that in the short-run, lending to the private sector has a significant effect on the banking sector's profitability, ROA.

iv) CRISIS granger causes ROA unidirectional, at the 5% level of significance, meaning that the CRISIS had a significant effect on the banking sector's profitability, ROA.

v) CRISIS granger causes LNCU unidirectional, at the 5% level of significance, meaning that the CRISIS had a significant effect on the Copper Prices.

vi) NPL granger causes FA, unidirectional, at the 5% level of significance, meaning that in the short-run, the level non-performing loans has a significant effect on the banking sector's investment in foreign assets.

vii) PRV granger causes LNFOREX, unidirectional, at the 5% level of significance, meaning that in the short-run, lending to the private sector has a significant effect on the currency foreign exchange rate.

viii) CRISIS granger causes LNFOREX unidirectional, at the 5% level of significance, meaning that the CRISIS had a significant effect on the currency foreign exchange rate.

ix) INFL granger causes IBLR, unidirectional, at the 5% level of significance, meaning that in the short-run, the rate of inflation has a significant effect on the banking sector's inter-bank lending rates.

x) IBLR granger causes LQD, unidirectional, at the 5% level of significance, meaning that in the short-run, the banking sector's inter-bank lending rates has a significant effect on the sector's liquidity in terms of level of deposits.

xi) NPL granger causes IBLR, unidirectional, at the 5% level of significance, meaning that in the short-run, the level of non-performing loans has a significant effect on the banking sector's inter-bank lending rates.

xii) INFL granger causes PRV, unidirectional, at the 5% level of significance, meaning that in the short-run, the rate of inflation has a significant effect on the banking sector's lending to the private sector.

xiii) NPL granger causes LQD, unidirectional, at the 5% level of significance, meaning that in the short-run, the level of non-performing loans has a significant effect on the sector's liquidity in terms of level of deposits.

xiv) CRISIS granger causes NPL unidirectional, at the 5% level of significance, meaning that the CRISIS had a significant effect on the level of non-performing loans in the sector.

Granger Causality with NPL Dependent Variable

It is evident from the above VEC Model that, where the ROA is the dependent variable, NPLs have a significant short-run effect on a number of the selected independent variables (FA, IBLR and LQD). Re–running the VEC Model, using the NPL as the dependent variable therefore yields the following results for Granger Causality *(Full results of the VECM and Granger Causality Tests are detailed in Appendix 5 & 6)*:

Table 14: Granger Causality Test Results – NPL as Dependent Variable

	Null Hypothesis:	F-Statistic	Prob.	Conclusion
i)	IBLR does not Granger Cause NPL	2.691	0.0366	**Causality**
	NPL does not Granger Cause IBLR	6.49994	0.0001	**Causality**
ii)	INFL does not Granger Cause NPL	2.62511	0.0403	**Causality**
	NPL does not Granger Cause INFL	1.56808	0.1905	No causality

Table 14: Granger Causality Test Results – NPL as Dependent Variable (Cont.)

	Null Hypothesis:	F-Statistic	Prob.	Conclusion
iii)	LQD does not Granger Cause NPL	2.0347	0.097	No causality
	NPL does not Granger Cause LQD	2.5636	0.0442	**Causality**
iv)	PRV does not Granger Cause NPL	0.91175	0.4611	No causality
	NPL does not Granger Cause PRV	4.55071	0.0023	**Causality**
v)	LQD does not Granger Cause LNCU	1.96899	0.1068	No causality
	LNCU does not Granger Cause LQD	7.13471	5.00E-05	**Causality**
vi)	INFL does not Granger Cause IBLR	4.55001	0.0023	**Causality**
	IBLR does not Granger Cause INFL	0.14294	0.9656	No causality

i) IBLR granger causes NPL, and vice-versa, at the 5% level of significance, meaning that in the short-run, the banking sector's inter-bank lending rates have a significant effect on the level of non-performing loans, and vice-versa.

ii) INFL granger causes NPL, unidirectional, at the 5% level of significance, meaning that in the short-run, the rate of inflation has a significant effect on the level of non-performing loans.

iii) NPL granger causes LQD, unidirectional, at the 5% level of significance, meaning that in the short-run, the level of non-performing loans has a significant effect on the sector's liquidity in terms of level of deposits.

iv) NPL granger causes PRV, unidirectional, at the 5% level of significance, meaning that in the short-run, the level of non-performing loans has a significant effect on the banking sector's lending to the private sector.

v) LNCU granger causes LQD, unidirectional, at the 5% level of significance, meaning that in the short-run, the copper price has a significant effect on the sector's liquidity in terms of level of deposits.

vi) INFL granger causes IBLR, unidirectional, at the 5% level of significance, meaning that in the short-run, the rate of inflation has a significant effect on the banking sector's inter-bank lending rates.

With NPL as the dependent variable, the results clearly show that the banking sector's inter-bank lending rates and the rate of inflation, both have a significant effect on the sector's level of non-performing loans (NPLs).

4.4 Chapter Summary

A *monthly trend analysis* of the selected variables over the 8-year period 2005-2012, covering the period before (Jan 2005 – Jun 2008), during (Jul 2008 – Jun 2009) and after (Jul 2009 – Dec 2012) the crisis, clearly shows the adverse impact the crisis had on both the banking sector and macro-economic performance indicators. This is confirmed by the descriptive statistics clearly shows that there is an evident change in each of the variables, as indicated by the means in the each of the periods before, during and after the crisis.

Although the *monthly trend analysis* suggests that all the selected variables are *non-stationary*, results using the **Augmented Dickey-Fuller (ADF) test,** to test for the presence or absence of *Unit Roots,* confirm that the variables, after first differencing, are stationary and integrated of the same order I(1), and may be used for further analysis. To determine the appropriate regression model to apply, the variables were tested for *cointegration* using the **Johansen's Cointegration Test,** which revealed that they were cointegrated. This implies that there is a long run association between the variables, and the appropriate regression model is the **Vector Error Correction Model (VECM).**

In estimating the system equation of the VECM, the econometric software package **Eviews** is used. The equation incorporates the error correction term which corrects any deviation from the long run equilibrium of the model. It further suggests that there is no long run influence on the dependent variable, ROA, from the selected independent variables. Of the independent variables, only the liquidity (LQD) variable was found to have a significant effect on the ROA. The crisis therefore had very little influence on the sector's profitability.

To establish the direction of the short-run causality between the variables, the **Granger Causality Test** was applied. From the results, the variables CRISIS, FOREX and PRV granger causes ROA, and NPLs granger causes FA, IBLR and LQD. Further, INFL and IBLR granger causes NPLs.

CHAPTER 5

Conclusions & Recommendations

5.1 Summary and Discussion

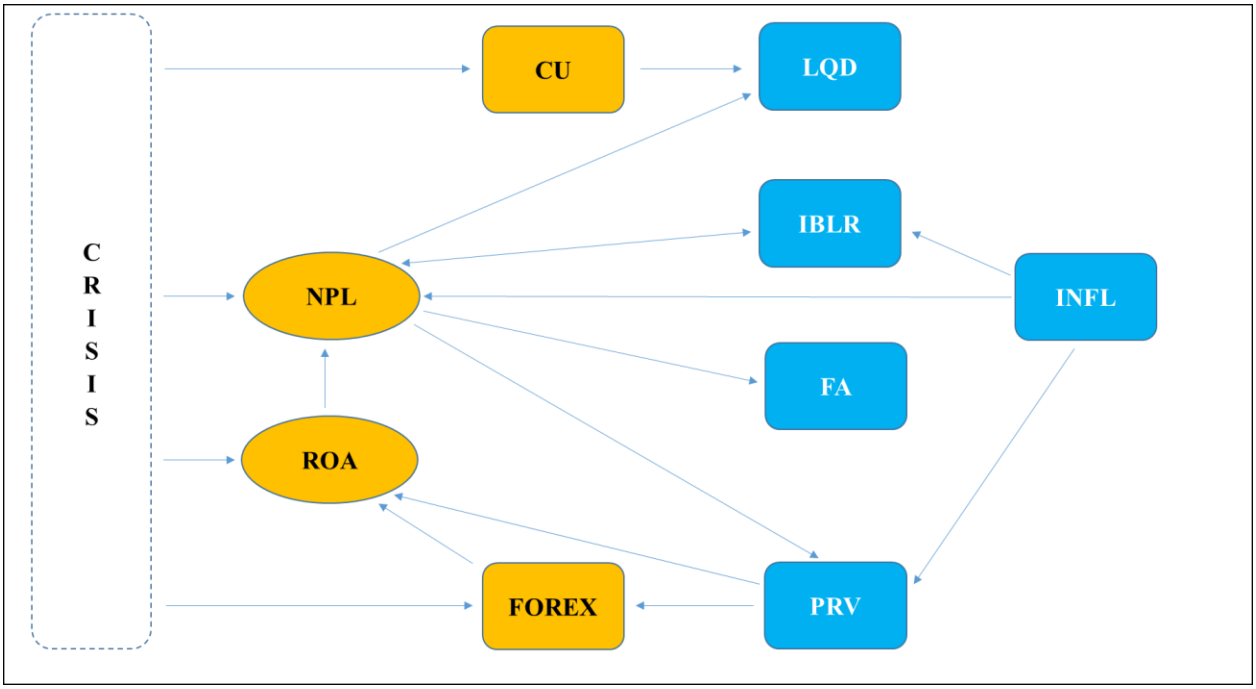
Prior to the financial crisis of 2008, the Zambian banking sector was characterized by low financial intermediation, with a large section of the population, having limited, or no access to affordable financial services. The high operational costs within the sector, as a comprehensive survey highlighted in 2004, has made banking services very costly, relative to the moderate lending and depository services offered. The relatively undeveloped financial markets also meant that investments in the sector were limited only to government securities, thus not only crowding out the private sector credit, but also making it more vulnerable to adverse changes in the financial markets. In addition, the weak coordination between government monetary and fiscal policy has further exacerbated the high service costs within the sector.

Based on the literature review and analysis of data, over an eight (8) year period covering the periods before, during, and after the crisis, the chapter aims to draw conclusions and highlight the possible policy implications that would give policy decision makers, and regulators, with relevant tools to better understand the key factors that affect the performance, in terms of costs and profitability, of the Zambian banking sector, especially in times of global external shocks.

Time series variables from selected sub-Saharan countries, with similar ownership structure as Zambia's banking sector, were used to estimate a *Vector Auto-Regressive (VAR)* model to define the relationship between the dependent and independent variables. An exogenous 'dummy' variable was included in the model to simulate the effects of the crisis over the chosen time period. The profitability, as measured by the *Return on Assets (ROA)*, and the level on *Non-Performing Loans (NPLs)*, were the dependent variables, and therefore, both used as measures of the performance of the sector. To establish the direction of the causality amongst the variables, whether uni or bidirectional, *Granger Causality* tests were further carried out on the variables

The schematic figure below summaries the results of the relationships amongst the selected variables, and provides the basis for any policy recommendations.

Figure 5: Schematic Representation Granger Causality Tests



The above figure clearly shows that the crisis had a direct and significant effect on the four (4) variables;

i) Profitability (ROA);
ii) Level of Non-Performing Loans (NPLs);
iii) Foreign exchange rate (LNFOREX); and
iv) Price of Copper (LNCU).

These results would suggest that during times of crisis, policy makers and regulators should focus their attention on these key variables, as they in turn have a direct and significant effect on the other identified variables within the banking system. If not properly managed therefore, the direct effects on these variables would potentially destabilize the whole banking system.

Following the crisis, the policy stance of the government was to adopt a tighter monetary policy, focused mainly on stabilizing the foreign exchange rate. According to the BoZ Governor, the Central bank became a net seller of foreign exchange to banks, in an effort to dampen excessive volatility in the exchange rate (Fundanga, 2009). Other key measures adopted included tightening the supervisory guidelines and enhancing the information flows with the banks and major business entities. This was in an effort to better understand, and plan for, their expected foreign exchange requirements at any one time.

5.2 Policy Implications

As alluded to, the *Monetary Policy* was the main tool adopted by government to counter the effects of the crisis. From Figure 5 above, in addition to the direct effects of the crisis, the banks' profitability (ROA) was directly influenced by the foreign exchange rate and the level of private sector lending. This would appear to support the move by the BoZ to focus on the stabilization of the foreign exchange rate during the crisis. Clearly the depreciation of the Kwacha by 24% during the wake of the crisis justifies the approach by government, which can be seen, from Figure 4, to bear fruit by its slight appreciation and stabilization in the few months into the crisis. The predominately foreign ownership structure of the sector may also explain the direct effect of the foreign exchange rate on the sectors' profitability.

Private sector lending has a direct influence on the foreign exchange rate as shown in Figure 5 above. Therefore, the increase in private sector lending during the crisis was one way of countering the sharp depreciation of the kwacha, and supports the BoZ's approach to encouraging the banking sector to provide more credit to the private sector.

With regards to the level of NPLs, these have a direct bearing on the lending to the private sector and as Figure 4 shows, were relatively stable prior to the crisis, but drastically increased during the crisis period. Clearly the NPLs were under direct pressure, not only from the effects of the crisis, but also the inflation and inter-bank interest rates, as evidenced from Figure 5 above.

The effectiveness of monetary policy at the time may also have been questionable. The policy was more focused on influencing monetary aggregates, and hence liquidity, as a means of managing inflation. With hindsight, a monetary policy based on inflation targeting, may have been more effective in managing inflation, and hence the level of NPLs. Further, a lower inflation rate would favorably influence the inter-bank lending rates (IBLR), and in turn, the liquidity.

While liquidity, as measured by deposits, fell sharply during the crisis, the fall could not directly be attributed to the crisis, as the Figure 5 clearly shows. It could however be indirectly attributed to the combined effect of the sharp fall in copper prices (CU); increased NPLs and inter-bank lending rates (IBLR), as evidenced from the trend analyses of each of the variables. Clearly any reduction in the level of NPLs, interest rates and inflation would have eased the pressure on the liquidity situation and allowed the banking system to perform its role of liquidity creation and transformation more cost efficiently.

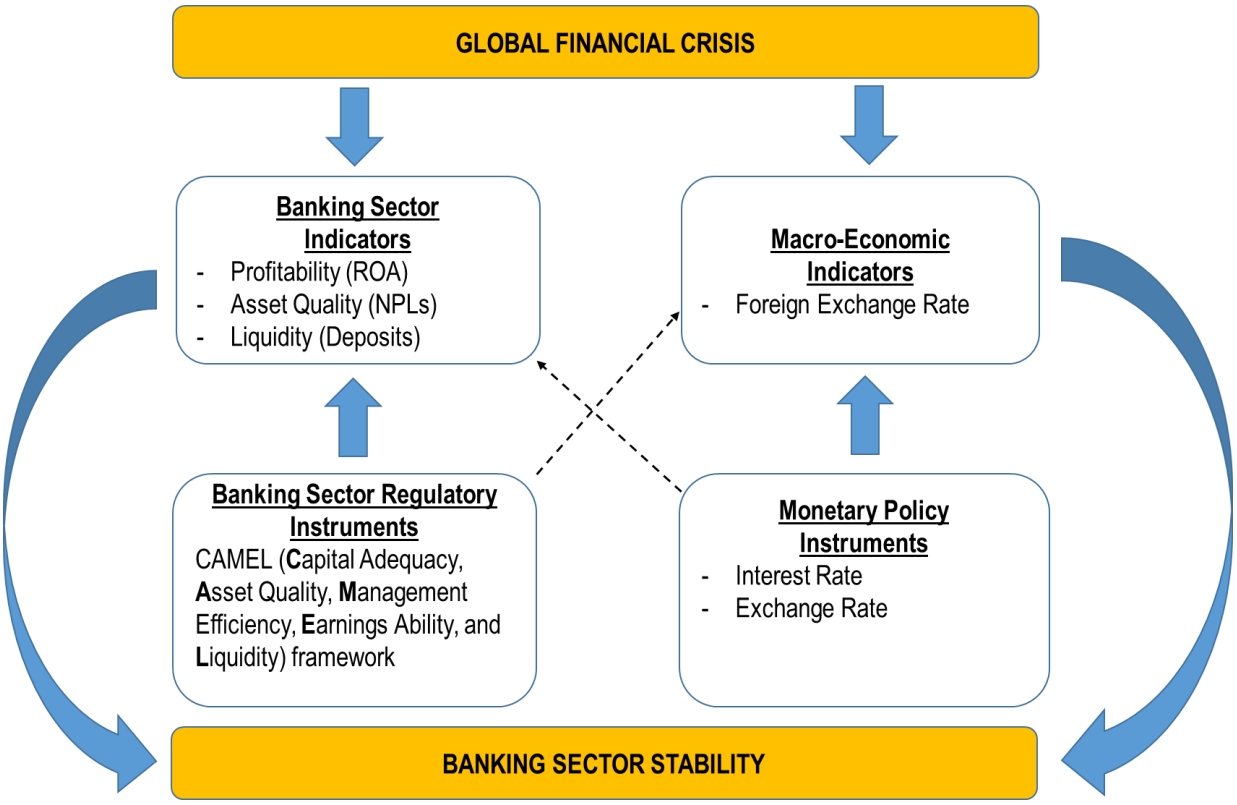
In addition, and although not included in the model, various literature has shown capital adequacy to be an important determinant of liquidity, with some suggesting a trade-off between the benefits of financial stability, through stronger capital requirements, and greater liquidity creation (Horváth, Seidler, & Weill, 2014). This is within the framework of the various BASEL accords and as earlier alluded to, at the time of the crisis, the Zambian banking sector was still operating under BASEL I. Despite this, however, the sector was resilient during the crisis, not

only suggesting strong banking regulation and supervision, but also the possible influence of the predominately foreign owned banks within the sector, which may have contributed to the adoption of good governance and best international banking practices from their headquarter counterparts.

5.3 Proposed Action Framework

The proposed framework provides a basis that would aid policy decision-makers, and regulators, in addressing macroeconomic and bank performance challenges, in times of global external shocks. This is given in Figure 6 below:

Figure 6: Proposed Action Framework



The framework suggests that to ensure stability of the Banking Sector during a crisis, the identified indicators need to be managed using both the *Banking Sector Regulatory* and *Monetary Policy Instruments.*

Within the Banking sector, the critical indicators relate to Profitability (as measured by ROA); Assets Quality (as measured by NPLs); and Liquidity (as measured by deposit levels). During times of a crisis regulators may use the CAMEL (Capital Adequacy, Asset Quality, Management Efficiency, Earnings Ability, and Liquidity) Framework to ensure that the identified critical indicators are kept within certain limits. Application of the framework will also have an impact on the identified foreign exchange macro-economic indicator.

The framework further indicates that the critical macro-economic indicator is the Foreign Exchange Rate. The appropriate Monetary Policy Instrument to use is the Central Bank's Policy Rate, which sets the basis for interest rates in the sector. In addition, the Central Bank may influence the foreign exchange rate directly through its actions in buying and/or selling foreign currency on the market. This however should be done within certain limits as it may expose the sector and economy to other adverse effects. Like the banking regulatory instruments, application of the monetary policy instruments will also have an impact on the identified Banking Sector indicators.

5.4 Conclusion and Recommendations

Overall, the crisis had a limited impact on the sector's profitability, but a more adverse effect on the asset quality, as measured by the level of NPLs. This had implications for both the sector and the economy as a whole. It is recommended therefore, that authorities initially focus their attention on addressing these factors, by countering their negative effects.

Firstly, regulation and supervision should engage in strong monitoring of banks' credit appraisal processes and institute a more robust risk-management environment. This would help reduce credit and default risk, thereby lowering the levels of NPLs, and ensuring that liquidity in the sector is strengthened, with a high quality asset base.

Secondly, the change in the monetary policy regime, from one which was anchored on a monetary aggregate measure during the crisis, to the current one, which anchors on a policy rate, gives the BoZ more leverage to influence liquidity through the inter-bank lending rate. This however, should not mean that it abandons the key principals of the old regime, but rather use it in tandem with the new one, especially in times of a crisis when liquidity is a challenge.

Thirdly, efforts should be made on strengthening the cooperation between the BoZ, as the monetary authority, and the Government, through the Ministry of Finance, as the fiscal authority. This would further strengthen the broader liquidity framework, through a more coordinated debt management policy, which has implications for the cost efficiency of the banking sector, and hence the economy.

Finally, much as the use of macro prudential policy and regulations are appropriate instruments in stabilizing and sustaining the sector, their excessive use may act as an entry barrier to competition, thereby limiting the number of players in the sector and making it more concentrated. As the sector is already predominantly owned by a few large and foreign banks, any such regulations may simply add to this level of concentration, and therefore, making it more cost inefficient in the long run.

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APPENDIX 1: International Banks and Branch/Subsidiary Locations in Africa

Bank (Country)	Angola	Burundi	Benin	Botswana	Burkina Faso	Cameroon	Cape Verde	Central Afr. Rep.	Chad	Comoros	Congo, Rep. of	Côte d'Ivoire	Congo DR	Djibouti	Eq. Guinea	Ethiopia	Gabon	Gambia	Ghana	Guinea	Guinea-Bissau	Kenya	Lesotho
Belgolaise (Belgium)		✓										✓	✓						✓				
Financial Bank (Benin)			✓																				
Finabank (Botswana)									✓													✓	
Afriland First (Cameroon)											✓	✓			✓								
FOTSO (Cameroon)						✓						✓											
Cofipa (Côte d'Ivoire)						✓		✓	✓		✓	✓											
BNP Paribas (France)					✓			✓	✓	✓		✓		✓			✓			✓			
Calyon (France)			✓			✓					✓	✓		✓			✓						
SGB (France)					✓	✓			✓			✓			✓				✓	✓			
BGFI (Gabon)											✓				✓		✓						
First International (Gambia)												✓						✓					
Novobanco (Germany)	✓																		✓				
Intl. Commercial (Ghana)																			✓	✓			
Kenya Commercial (Kenya)																						✓	
BSIC (Libya)			✓		✓				✓														
Ecobank (Mali)			✓	✓	✓	✓	✓					✓							✓	✓			
Capricorn I H (Namibia)																							
Guaranty Trust (Nigeria)																		✓	✓				
Intercontinental (Nigeria)																							
Millennium BCP (Portugal)	✓																						
Bank of Africa (Togo)			✓		✓							✓										✓	
Absa (South Africa)	✓																		✓			✓	✓
Stanbic (South Africa)				✓									✓					✓				✓	
Barclays (United Kingdom)				✓															✓			✓	
Stanchart (United Kingdom)				✓		✓						✓						✓	✓			✓	
Citi (United States)						✓						✓	✓						✓			✓	

Bank (Country)	Liberia	Madagascar	Malawi	Mali	Mauritania	Mauritius	Mozambique	Namibia	Niger	Nigeria	Rwanda	São Tome	Senegal	Seychelles	Sierra Leone	South Africa	Sudan	Swaziland	Tanzania	Togo	Uganda	Zambia	Zimbabwe
Belgolaise (Belgium)					✓				✓	✓	✓								✓	✓	✓		
Financial Bank (Benin)																							
Finabank (Botswana)											✓												
Afriland First (Cameroon)												✓											
FOTSO (Cameroon)												✓											
Cofipa (Côte d'Ivoire)																			✓				
BNP Paribas (France)		✓		✓									✓										
Calyon (France)		✓											✓			✓							
SGB (France)		✓											✓										
BGFI (Gabon)																							
First International (Gambia)	✓														✓								
Novobanco (Germany)							✓																
Intl. Commercial (Ghana)																							
Kenya Commercial (Kenya)																							
BSIC (Libya)				✓					✓				✓				✓						
Ecobank (Mali)	✓			✓					✓				✓							✓			
Capricorn I H (Namibia)								✓		✓													
Guaranty Trust (Nigeria)										✓					✓								
Intercontinental (Nigeria)										✓													
Millennium BCP (Portugal)							✓																
Bank of Africa (Togo)				✓			✓		✓				✓										
Absa (South Africa)						✓	✓									✓			✓				
Stanbic (South Africa)		✓	✓					✓		✓						✓		✓	✓		✓	✓	✓
Barclays (United Kingdom)		✓								✓						✓			✓		✓	✓	✓
Stanchart (United Kingdom)										✓						✓			✓		✓	✓	✓
Citi (United States)										✓			✓			✓			✓		✓	✓	

APPENDIX 2: Variables Data Set

Year/ Month	NPL (%)	FA (%)	ROA (%)	IBLR (%)	LQD (%)	PRV (%)	FOREX (K/US$)	INFL (%)	CU (US$)
Jan-05	2.96	20.98	6.80	14.30	73.05	36.59	4.79	18.20	3,008.55
Feb-05	2.46	18.71	5.69	9.75	74.32	29.80	4.76	18.70	2,942.43
Mar-05	2.36	16.61	5.18	8.62	73.88	30.19	4.71	17.40	3,023.36
Apr-05	2.45	16.88	5.61	10.55	72.90	30.63	4.68	18.60	2,932.80
May-05	2.40	16.36	4.77	10.75	72.15	31.15	4.69	19.10	2,955.83
Jun-05	3.71	14.88	4.78	14.23	71.31	34.24	4.69	19.20	3,340.61
Jul-05	3.71	14.50	4.86	17.46	70.61	32.09	4.62	18.70	3,331.12
Aug-05	2.92	14.33	5.02	10.38	71.40	32.07	4.40	19.30	3,478.63
Sep-05	3.18	13.17	5.31	17.76	72.33	32.62	4.44	19.50	3,422.18
Oct-05	2.79	15.79	5.51	14.45	72.15	31.36	4.35	18.30	3,568.63
Nov-05	2.81	15.36	5.54	13.83	71.07	29.95	4.03	17.20	3,938.24
Dec-05	2.80	14.78	5.71	20.60	70.64	29.70	3.42	15.50	3,951.28
Jan-06	2.86	14.39	6.39	10.03	71.19	29.52	3.36	12.20	4,187.24
Feb-06	3.25	13.72	5.39	6.28	69.05	30.57	3.29	10.30	4,435.61
Mar-06	3.50	11.93	5.20	7.74	69.71	31.64	3.29	10.70	5,079.94
Apr-06	4.29	10.11	4.58	6.38	70.41	32.46	3.20	9.40	7,189.03
May-06	4.25	11.16	5.11	6.90	69.66	32.90	3.18	8.60	7,608.70
Jun-06	4.25	10.66	5.15	8.38	70.39	34.38	3.47	8.50	6,314.54
Jul-06	4.27	10.46	5.21	6.88	73.72	35.61	3.55	8.70	7,070.32
Aug-06	4.32	11.82	4.81	5.35	74.29	36.61	3.88	8.00	7,037.31
Sep-06	3.89	13.33	4.60	7.92	71.59	33.82	4.05	8.20	6,731.02
Oct-06	3.96	14.02	4.42	9.80	70.73	34.12	3.84	7.90	6,498.85
Nov-06	4.01	15.49	4.34	7.24	71.79	33.52	3.98	8.10	5,996.55
Dec-06	4.10	16.10	4.35	7.36	73.88	33.75	4.13	8.20	5,559.30

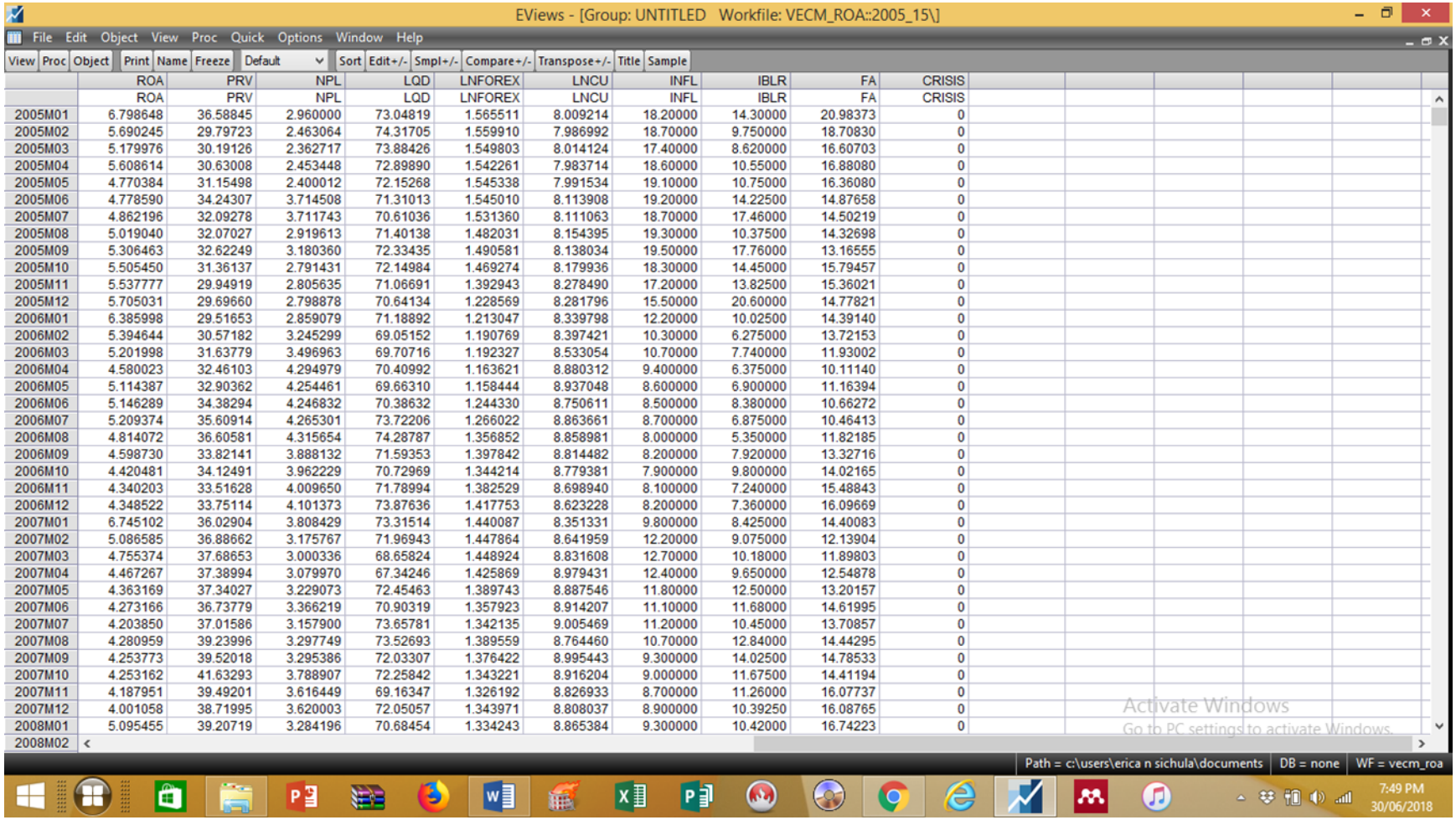
Year/ Month	NPL (%)	FA (%)	ROA (%)	IBLR (%)	LQD (%)	PRV (%)	FOREX (K/US$)	INFL (%)	CU (US$)
Jan-07	3.81	14.40	6.75	8.43	73.32	36.03	4.22	9.80	4,235.81
Feb-07	3.18	12.14	5.09	9.08	71.97	36.89	4.25	12.20	5,664.42
Mar-07	3.00	11.90	4.76	10.18	68.66	37.69	4.26	12.70	6,847.29
Apr-07	3.08	12.55	4.47	9.65	67.34	37.39	4.16	12.40	7,938.12
May-07	3.23	13.20	4.36	12.50	72.45	37.34	4.01	11.80	7,241.22
Jun-07	3.37	14.62	4.27	11.68	70.90	36.74	3.89	11.10	7,436.88
Jul-07	3.16	13.71	4.20	10.45	73.66	37.02	3.83	11.20	8,147.52
Aug-07	3.30	14.44	4.28	12.84	73.53	39.24	4.01	10.70	6,402.60
Sep-07	3.30	14.79	4.25	14.03	72.03	39.52	3.96	9.30	8,066.24
Oct-07	3.79	14.41	4.25	11.68	72.26	41.63	3.83	9.00	7,451.75
Nov-07	3.62	16.08	4.19	11.26	69.16	39.49	3.77	8.70	6,815.35
Dec-07	3.62	16.09	4.00	10.39	72.05	38.72	3.83	8.90	6,687.78
Jan-08	3.28	16.74	5.10	10.42	70.68	39.21	3.80	9.30	7,082.52
Feb-08	3.34	15.82	4.86	10.60	68.52	39.73	3.75	9.50	8,063.67
Mar-08	3.59	13.84	4.82	10.98	68.77	40.76	3.67	9.80	7,095.46
Apr-08	3.64	13.95	4.67	10.55	69.30	41.33	3.52	10.10	8,840.04
May-08	3.13	16.10	4.81	10.68	69.25	40.96	3.40	10.90	6,934.10
Jun-08	2.63	13.05	5.00	11.03	68.93	41.30	3.25	12.10	7,788.56
Jul-08	2.67	14.55	4.63	11.85	68.71	41.97	3.39	12.60	7,665.00
Aug-08	2.82	11.97	4.49	11.10	67.84	42.63	3.45	13.20	6,950.11
Sep-08	3.13	11.23	4.37	11.73	66.82	43.34	3.54	14.20	5,915.01
Oct-08	3.02	12.56	4.10	14.18	68.85	42.83	4.04	15.20	5,053.54
Nov-08	3.42	12.57	3.83	15.98	71.24	45.07	4.26	15.30	3,733.09
Dec-08	3.40	13.82	3.26	12.80	71.17	44.30	4.88	16.60	2,953.24

Year/ Month	NPL (%)	FA (%)	ROA (%)	IBLR (%)	LQD (%)	PRV (%)	FOREX (K/US$)	INFL (%)	CU (US$)
Jan-09	3.56	14.62	3.56	9.51	70.10	45.59	5.02	16.00	3,178.87
Feb-09	3.80	16.17	3.18	8.21	69.99	46.62	5.41	14.00	3,137.94
Mar-09	4.44	14.33	3.21	11.42	70.14	47.11	5.58	13.10	3,519.74
Apr-09	4.99	14.72	2.70	12.34	70.55	47.06	5.66	14.30	4,041.31
May-09	4.98	15.22	2.36	11.97	69.38	45.68	5.19	14.70	4,208.39
Jun-09	5.10	14.91	2.10	11.99	71.02	44.87	5.07	14.40	4,201.26
Jul-09	5.34	15.25	1.83	11.89	71.05	43.97	5.13	14.00	4,617.04
Aug-09	5.83	12.83	1.76	12.08	71.81	43.87	4.83	14.30	5,467.35
Sep-09	6.14	14.07	1.38	11.78	70.72	41.59	4.65	13.00	5,234.57
Oct-09	5.96	15.07	1.71	8.06	71.69	41.06	4.66	12.30	5,582.21
Nov-09	5.68	13.81	1.74	5.11	71.50	39.52	4.66	11.50	6,203.48
Dec-09	5.45	14.05	1.98	4.19	72.21	38.69	4.68	9.90	6,257.71
Jan-10	5.64	12.08	5.00	4.41	71.74	38.40	4.51	9.40	6,587.67
Feb-10	5.62	14.18	3.82	2.22	72.23	37.54	4.67	9.20	6,233.10
Mar-10	6.32	14.27	4.10	1.70	71.85	36.05	4.70	10.00	6,932.23
Apr-10	6.27	15.81	4.02	1.67	72.38	35.23	4.67	9.50	6,917.70
May-10	6.21	15.14	3.52	1.55	73.12	36.47	4.97	8.90	6,494.98
Jun-10	6.13	16.78	3.20	1.49	74.34	35.52	5.12	7.90	6,126.21
Jul-10	5.89	17.03	3.06	1.49	73.58	33.30	5.02	7.90	6,591.53
Aug-10	5.79	15.36	2.95	1.49	75.11	34.25	4.92	7.70	6,829.44
Sep-10	6.29	15.38	2.90	1.49	76.75	35.03	4.87	7.80	7,359.37
Oct-10	6.00	14.92	2.78	1.49	74.47	34.45	4.69	6.90	7,678.04
Nov-10	6.16	14.85	2.88	1.49	74.45	35.32	4.70	6.60	8,374.50
Dec-10	5.90	15.60	2.27	4.42	74.85	35.04	4.74	6.50	7,175.35

Year/ Month	NPL (%)	FA (%)	ROA (%)	IBLR (%)	LQD (%)	PRV (%)	FOREX (K/US$)	INFL (%)	CU (US$)
Jan-11	5.66	20.20	3.66	2.07	76.92	34.93	4.77	6.30	8,134.67
Feb-11	5.60	16.73	3.64	1.55	74.97	35.79	4.77	6.50	8,525.26
Mar-11	5.39	16.02	3.49	2.57	71.59	36.48	4.76	6.60	9,196.08
Apr-11	5.45	15.62	3.45	2.71	73.96	37.38	4.70	6.30	9,021.52
May-11	5.27	16.20	3.35	3.50	74.10	36.79	4.75	6.30	7,540.82
Jun-11	4.72	18.70	3.28	3.39	75.28	36.24	4.81	6.10	8,400.22
Jul-11	4.51	18.54	3.21	4.05	76.65	37.18	4.83	6.90	8,648.49
Aug-11	4.28	18.04	3.29	4.59	74.40	36.85	4.93	6.50	7,319.66
Sep-11	4.33	17.04	3.34	8.76	75.92	37.84	4.92	6.60	7,096.08
Oct-11	4.14	17.07	3.82	13.67	76.39	38.18	4.95	6.70	7,749.57
Nov-11	4.02	17.11	4.21	6.86	74.21	38.96	5.03	6.40	7,398.35
Dec-11	4.48	16.83	3.38	8.76	75.55	39.71	5.12	6.00	7,500.88
Jan-12	4.50	16.80	4.52	6.01	75.99	39.61	5.13	6.42	7,297.75
Feb-12	4.57	17.52	4.43	5.72	76.47	39.15	5.22	5.99	7,641.83
Mar-12	4.33	17.44	4.03	5.98	75.95	39.20	5.28	6.41	7,672.01
Apr-12	4.10	18.77	4.09	8.31	75.42	38.60	5.24	6.50	7,493.89
May-12	4.26	17.29	4.05	7.72	74.16	38.87	5.21	6.59	7,226.73
Jun-12	4.36	14.06	4.15	8.06	74.46	40.37	5.25	6.67	7,166.01
Jul-12	4.33	13.93	4.28	9.11	73.96	40.95	4.86	6.19	6,832.02
Aug-12	4.29	10.79	4.16	7.62	73.35	40.93	4.91	6.44	6,830.56
Sep-12	4.27	10.97	4.11	7.58	71.79	40.99	5.03	6.59	7,727.62
Oct-12	4.03	10.24	3.97	8.45	73.08	45.13	5.17	6.85	6,686.60
Nov-12	4.09	9.35	3.78	8.99	72.33	46.55	5.20	6.93	7,110.94
Dec-12	3.94	10.14	3.51	8.50	73.41	45.58	5.21	7.33	6,623.98

APPENDIX 3: Steps in Estimating the Vector Error Correction Model (VECM)

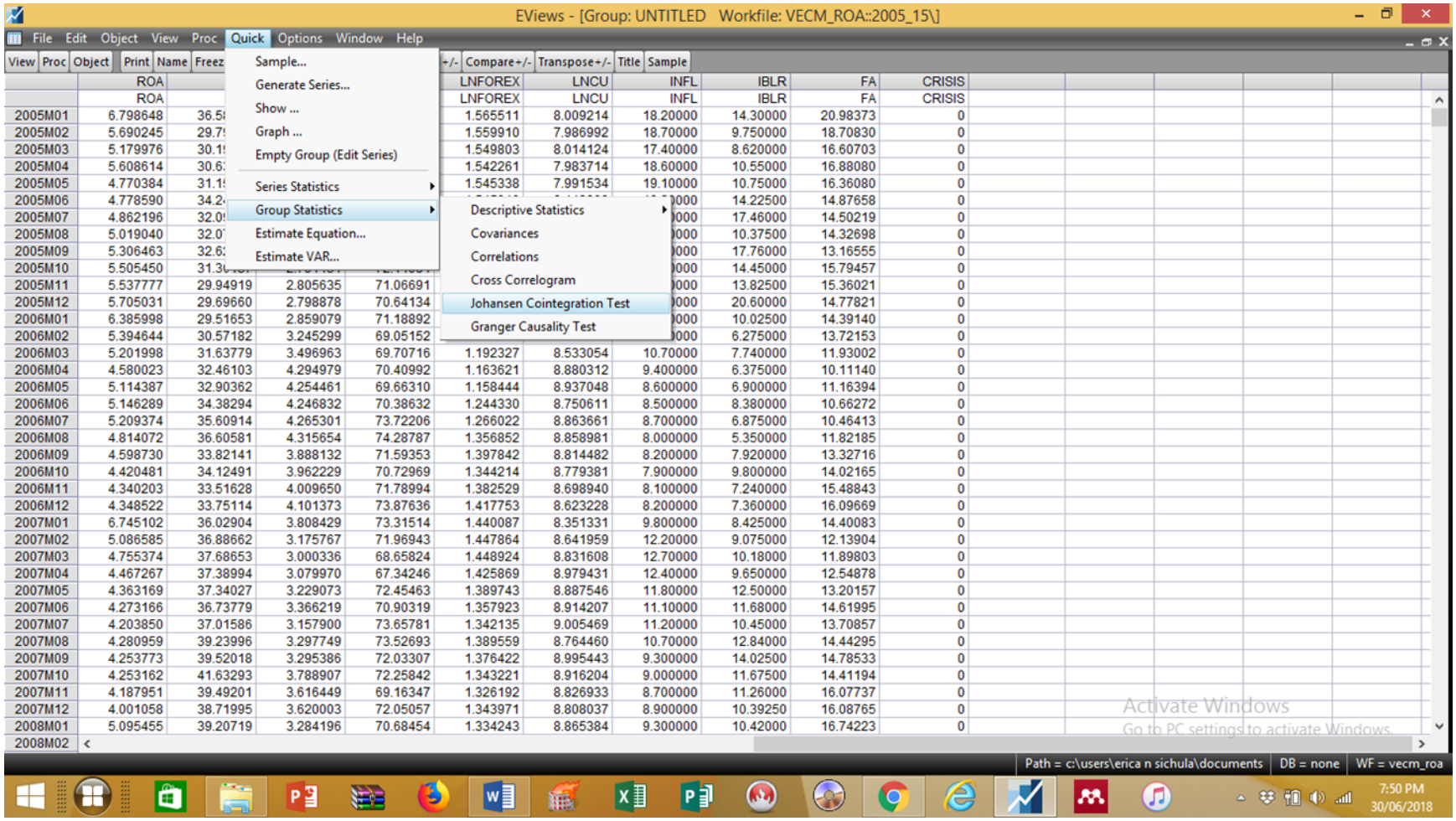
STEP 1. Open variables as group which includes the dummy variable (CRISIS).



	ROA	PRV	NPL	LQD	LNFOREX	LNCU	INFL	IBLR	FA	CRISIS
	ROA	PRV	NPL	LQD	LNFOREX	LNCU	INFL	IBLR	FA	CRISIS
2005M01	6.798648	36.58845	2.960000	73.04819	1.565511	8.009214	18.20000	14.30000	20.98373	0
2005M02	5.690245	29.79723	2.463064	74.31705	1.559910	7.986992	18.70000	9.750000	18.70830	0
2005M03	5.179976	30.19126	2.362717	73.88426	1.549803	8.014124	17.40000	8.620000	16.60703	0
2005M04	5.608614	30.63008	2.453448	72.89890	1.542261	7.983714	18.60000	10.55000	16.88080	0
2005M05	4.770384	31.15498	2.400012	72.15268	1.545338	7.991534	19.10000	10.75000	16.36080	0
2005M06	4.778590	34.24307	3.714508	71.31013	1.545010	8.113908	19.20000	14.22500	14.87658	0
2005M07	4.862196	32.09278	3.711743	70.61036	1.531360	8.111063	18.70000	17.46000	14.50219	0
2005M08	5.019040	32.07027	2.919613	71.40138	1.482031	8.154395	19.30000	10.37500	14.32698	0
2005M09	5.306463	32.62249	3.180360	72.33435	1.490581	8.138034	19.50000	17.76000	13.16555	0
2005M10	5.505450	31.36137	2.791431	72.14984	1.469274	8.179936	18.30000	14.45000	15.79457	0
2005M11	5.537777	29.94919	2.805635	71.06691	1.392943	8.278490	17.20000	13.82500	15.36021	0
2005M12	5.705031	29.69660	2.798878	70.64134	1.228569	8.281796	15.50000	20.60000	14.77821	0
2006M01	6.385998	29.51653	2.859079	71.18892	1.213047	8.339798	12.20000	10.02500	14.39140	0
2006M02	5.394644	30.57182	3.245299	69.05152	1.190769	8.397421	10.30000	6.275000	13.72153	0
2006M03	5.201998	31.63779	3.496963	69.70716	1.192327	8.533054	10.70000	7.740000	11.93002	0
2006M04	4.580023	32.46103	4.294979	70.40992	1.163621	8.880312	9.400000	6.375000	10.11140	0
2006M05	5.114387	32.90362	4.254461	69.66310	1.158444	8.937048	8.600000	6.900000	11.16394	0
2006M06	5.146289	34.38294	4.246832	70.38632	1.244330	8.750611	8.500000	8.380000	10.66272	0
2006M07	5.209374	35.60914	4.265301	73.72206	1.266022	8.863661	8.700000	6.875000	10.46413	0
2006M08	4.814072	36.60581	4.315654	74.28787	1.356852	8.858981	8.000000	5.350000	11.82185	0
2006M09	4.598730	33.82141	3.888132	71.59353	1.397842	8.814482	8.200000	7.920000	13.32716	0
2006M10	4.420481	34.12491	3.962229	70.72969	1.344214	8.779381	7.900000	9.800000	14.02165	0
2006M11	4.340203	33.51628	4.009650	71.78994	1.382529	8.698940	8.100000	7.240000	15.48843	0
2006M12	4.348522	33.75114	4.101373	73.87636	1.417753	8.623228	8.200000	7.360000	16.09669	0
2007M01	6.745102	36.02904	3.808429	73.31514	1.440087	8.351331	9.800000	8.425000	14.40083	0
2007M02	5.086585	36.88662	3.175767	71.96943	1.447864	8.641959	12.20000	9.075000	12.13904	0
2007M03	4.755374	37.68653	3.000336	68.65824	1.448924	8.831608	12.70000	10.18000	11.89803	0
2007M04	4.467267	37.38994	3.079970	67.34246	1.425869	8.979431	12.40000	9.650000	12.54878	0
2007M05	4.363169	37.34027	3.229073	72.45463	1.389743	8.887546	11.80000	12.50000	13.20157	0
2007M06	4.273166	36.73779	3.366219	70.90319	1.357923	8.914207	11.10000	11.68000	14.61995	0
2007M07	4.203850	37.01586	3.157900	73.65781	1.342135	9.005469	11.20000	10.45000	13.70857	0
2007M08	4.280959	39.23996	3.297749	73.52693	1.389559	8.764460	10.70000	12.84000	14.44295	0
2007M09	4.253773	39.52018	3.295386	72.03307	1.376422	8.995443	9.300000	14.02500	14.78533	0
2007M10	4.253162	41.63293	3.788907	72.25842	1.343221	8.916204	9.000000	11.67500	14.41194	0
2007M11	4.187951	39.49201	3.616449	69.16347	1.326192	8.826933	8.700000	11.26000	16.07737	0
2007M12	4.001058	38.71995	3.620003	72.05057	1.343971	8.808037	8.900000	10.39250	16.08765	0
2008M01	5.095455	39.20719	3.284196	70.68454	1.334243	8.865384	9.300000	10.42000	16.74223	0
2008M02										

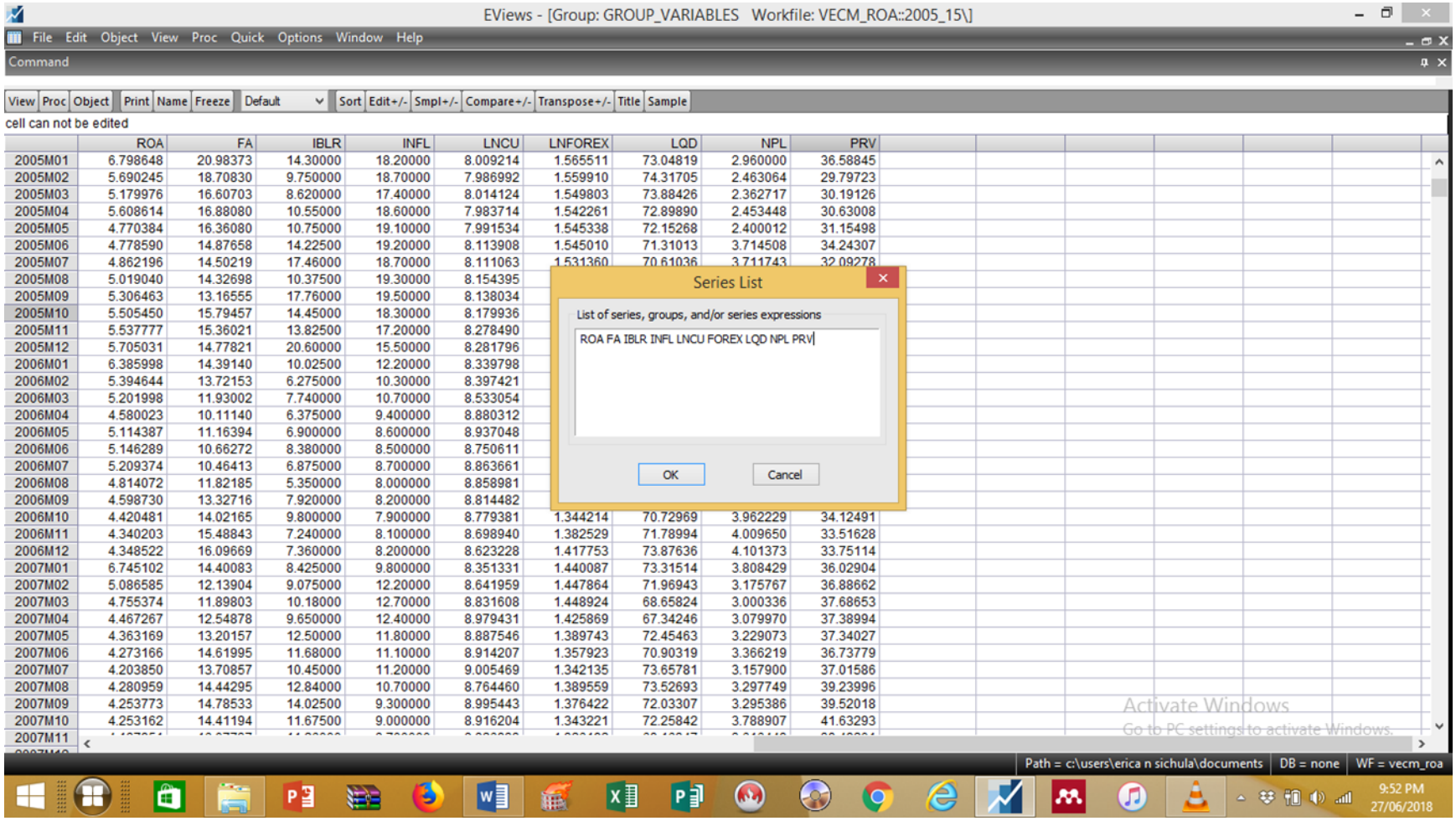
Note that the Dummy varible is zero (0) for the entire period, except during the period of the crisis which is set at one (1). The one(1) and zero(0) therefore indicates the presence (1) or absence (0) of the Crisis.

STEP 2. Perform the Joahansen Co-integration Test to determine wheather varaiables are co-integrated



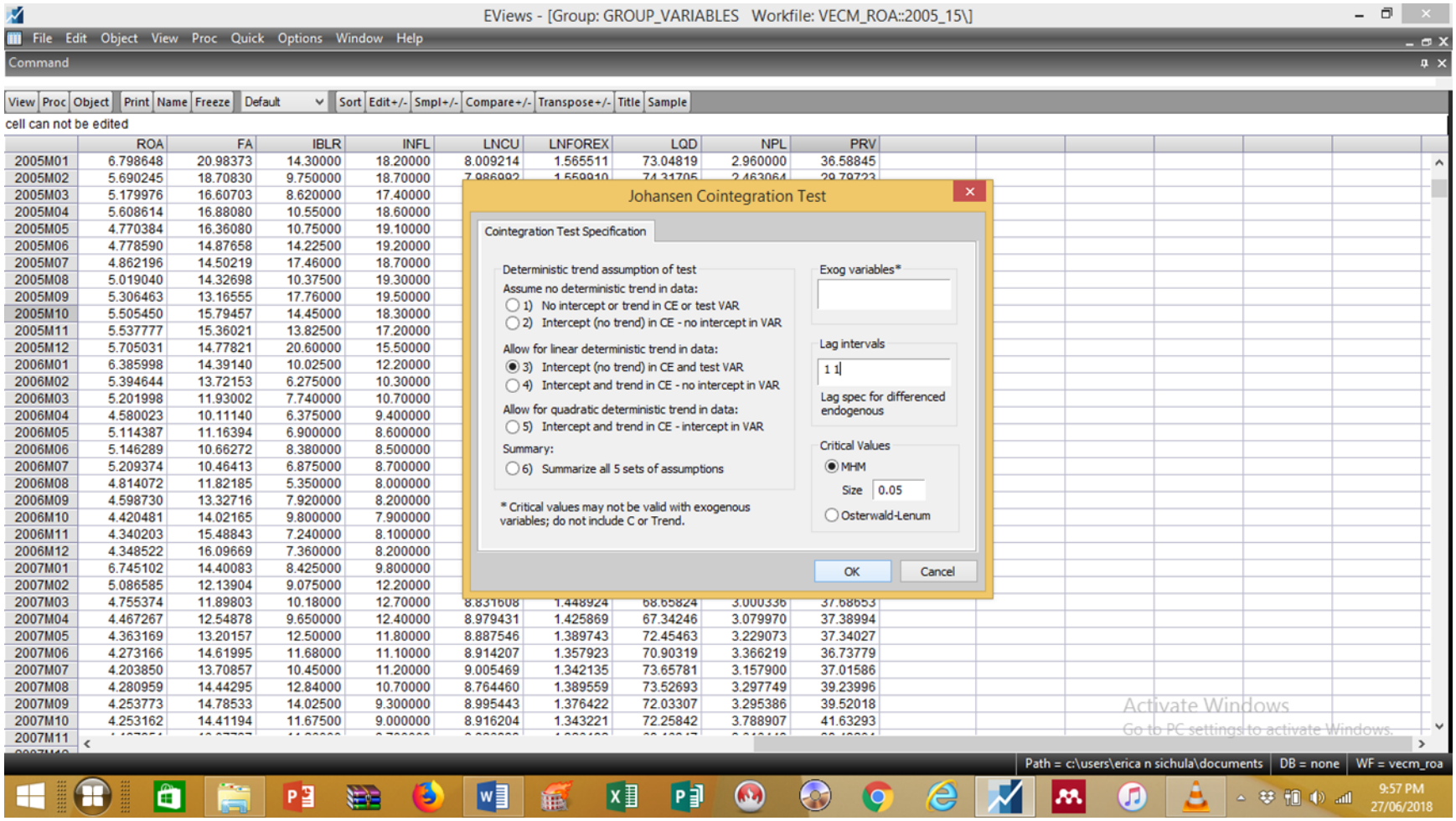
	ROA				LNFOREX	LNCU	INFL	IBLR	FA	CRISIS
	ROA				LNFOREX	LNCU	INFL	IBLR	FA	CRISIS
2005M01	6.798648	36.5			1.565511	8.009214	18.20000	14.30000	20.98373	0
2005M02	5.690245	29.7			1.559910	7.986992	18.70000	9.750000	18.70830	0
2005M03	5.179976	30.1			1.549803	8.014124	17.40000	8.620000	16.60703	0
2005M04	5.608614	30.6			1.542261	7.983714	18.60000	10.55000	16.88080	0
2005M05	4.770384	31.1			1.545338	7.991534	19.10000	10.75000	16.36080	0
2005M06	4.778590	34.2					000	14.22500	14.87658	0
2005M07	4.862196	32.0					000	17.46000	14.50219	0
2005M08	5.019040	32.0					000	10.37500	14.32698	0
2005M09	5.306463	32.6					000	17.76000	13.16555	0
2005M10	5.505450	31.3					000	14.45000	15.79457	0
2005M11	5.537777	29.94919	2.805635	71.06691			000	13.82500	15.36021	0
2005M12	5.705031	29.69660	2.798878	70.64134			000	20.60000	14.77821	0
2006M01	6.385998	29.51653	2.859079	71.18892			000	10.02500	14.39140	0
2006M02	5.394644	30.57182	3.245299	69.05152			000	6.275000	13.72153	0
2006M03	5.201998	31.63779	3.496963	69.70716	1.192327	8.533054	10.70000	7.740000	11.93002	0
2006M04	4.580023	32.46103	4.294979	70.40992	1.163621	8.880312	9.400000	6.375000	10.11140	0
2006M05	5.114387	32.90362	4.254461	69.66310	1.158444	8.937048	8.600000	6.900000	11.16394	0
2006M06	5.146289	34.38294	4.246832	70.38632	1.244330	8.750611	8.500000	8.380000	10.66272	0
2006M07	5.209374	35.60914	4.265301	73.72206	1.266022	8.863661	8.700000	6.875000	10.46413	0
2006M08	4.814072	36.60581	4.315654	74.28787	1.356852	8.858981	8.000000	5.350000	11.82185	0
2006M09	4.598730	33.82141	3.888132	71.59353	1.397842	8.814482	8.200000	7.920000	13.32716	0
2006M10	4.420481	34.12491	3.962229	70.72969	1.344214	8.779381	7.900000	9.800000	14.02165	0
2006M11	4.340203	33.51628	4.009650	71.78994	1.382529	8.698940	8.100000	7.240000	15.48843	0
2006M12	4.348522	33.75114	4.101373	73.87636	1.417753	8.623228	8.200000	7.360000	16.09669	0
2007M01	6.745102	36.02904	3.808429	73.31514	1.440087	8.351331	9.800000	8.425000	14.40083	0
2007M02	5.086585	36.88662	3.175767	71.96943	1.447864	8.641959	12.20000	9.075000	12.13904	0
2007M03	4.755374	37.68653	3.000336	68.65824	1.448924	8.831608	12.70000	10.18000	11.89803	0
2007M04	4.467267	37.38994	3.079970	67.34246	1.425869	8.979431	12.40000	9.650000	12.54878	0
2007M05	4.363169	37.34027	3.229073	72.45463	1.389743	8.887546	11.80000	12.50000	13.20157	0
2007M06	4.273166	36.73779	3.366219	70.90319	1.357923	8.914207	11.10000	11.68000	14.61995	0
2007M07	4.203850	37.01586	3.157900	73.65781	1.342135	9.005469	11.20000	10.45000	13.70857	0
2007M08	4.280959	39.23996	3.297749	73.52693	1.389559	8.764460	10.70000	12.84000	14.44295	0
2007M09	4.253773	39.52018	3.295386	72.03307	1.376422	8.995443	9.300000	14.02500	14.78533	0
2007M10	4.253162	41.63293	3.788907	72.25842	1.343221	8.916204	9.000000	11.67500	14.41194	0
2007M11	4.187951	39.49201	3.616449	69.16347	1.326192	8.826933	8.700000	11.26000	16.07737	0
2007M12	4.001058	38.71995	3.620003	72.05057	1.343971	8.808037	8.900000	10.39250	16.08765	0
2008M01	5.095455	39.20719	3.284196	70.68454	1.334243	8.865384	9.300000	10.42000	16.74223	0
2008M02										

STEP 2 (Cont.)



	ROA	FA	IBLR	INFL	LNCU	LNFOREX	LQD	NPL	PRV
2005M01	6.798648	20.98373	14.30000	18.20000	8.009214	1.565511	73.04819	2.960000	36.58845
2005M02	5.690245	18.70830	9.750000	18.70000	7.986992	1.559910	74.31705	2.463064	29.79723
2005M03	5.179976	16.60703	8.620000	17.40000	8.014124	1.549803	73.88426	2.362717	30.19126
2005M04	5.608614	16.88080	10.55000	18.60000	7.983714	1.542261	72.89890	2.453448	30.63008
2005M05	4.770384	16.36080	10.75000	19.10000	7.991534	1.545338	72.15268	2.400012	31.15498
2005M06	4.778590	14.87658	14.22500	19.20000	8.113908	1.545010	71.31013	3.714508	34.24307
2005M07	4.862196	14.50219	17.46000	18.70000	8.111063	1.531360	70.61036	3.711743	32.09278
2005M08	5.019040	14.32698	10.37500	19.30000	8.154395				
2005M09	5.306463	13.16555	17.76000	19.50000	8.138034				
2005M10	5.505450	15.79457	14.45000	18.30000	8.179936				
2005M11	5.537777	15.36021	13.82500	17.20000	8.278490				
2005M12	5.705031	14.77821	20.60000	15.50000	8.281796				
2006M01	6.385998	14.39140	10.02500	12.20000	8.339798				
2006M02	5.394644	13.72153	6.275000	10.30000	8.397421				
2006M03	5.201998	11.93002	7.740000	10.70000	8.533054				
2006M04	4.580023	10.11140	6.375000	9.400000	8.880312				
2006M05	5.114387	11.16394	6.900000	8.600000	8.937048				
2006M06	5.146289	10.66272	8.380000	8.500000	8.750611				
2006M07	5.209374	10.46413	6.875000	8.700000	8.863661				
2006M08	4.814072	11.82185	5.350000	8.000000	8.858981				
2006M09	4.598730	13.32716	7.920000	8.200000	8.814482				
2006M10	4.420481	14.02165	9.800000	7.900000	8.779381	1.344214	70.72969	3.962229	34.12491
2006M11	4.340203	15.48843	7.240000	8.100000	8.698940	1.382529	71.78994	4.009650	33.51628
2006M12	4.348522	16.09669	7.360000	8.200000	8.623228	1.417753	73.87636	4.101373	33.75114
2007M01	6.745102	14.40083	8.425000	9.800000	8.351331	1.440087	73.31514	3.808429	36.02904
2007M02	5.086585	12.13904	9.075000	12.20000	8.641959	1.447864	71.96943	3.175767	36.88662
2007M03	4.755374	11.89803	10.18000	12.70000	8.831608	1.448924	68.65824	3.000336	37.68653
2007M04	4.467267	12.54878	9.650000	12.40000	8.979431	1.425869	67.34246	3.079970	37.38994
2007M05	4.363169	13.20157	12.50000	11.80000	8.887546	1.389743	72.45463	3.229073	37.34027
2007M06	4.273166	14.61995	11.68000	11.10000	8.914207	1.357923	70.90319	3.366219	36.73779
2007M07	4.203850	13.70857	10.45000	11.20000	9.005469	1.342135	73.65781	3.157900	37.01586
2007M08	4.280959	14.44295	12.84000	10.70000	8.764460	1.389559	73.52693	3.297749	39.23996
2007M09	4.253773	14.78533	14.02500	9.300000	8.995443	1.376422	72.03307	3.295386	39.52018
2007M10	4.253162	14.41194	11.67500	9.000000	8.916204	1.343221	72.25842	3.788907	41.63293
2007M11									

STEP 2 (Cont.)



	ROA	FA	IBLR	INFL	LNCU	LNFOREX	LQD	NPL	PRV
2005M01	6.798648	20.98373	14.30000	18.20000	8.009214	1.565511	73.04819	2.960000	36.58845
2005M02	5.690245	18.70830	9.750000	18.70000	7.986992	1.559910	74.31705	2.463064	29.79723
2005M03	5.179976	16.60703	8.620000	17.40000					
2005M04	5.608614	16.88080	10.55000	18.60000					
2005M05	4.770384	16.36080	10.75000	19.10000					
2005M06	4.778590	14.87658	14.22500	19.20000					
2005M07	4.862196	14.50219	17.46000	18.70000					
2005M08	5.019040	14.32698	10.37500	19.30000					
2005M09	5.306463	13.16555	17.76000	19.50000					
2005M10	5.505450	15.79457	14.45000	18.30000					
2005M11	5.537777	15.36021	13.82500	17.20000					
2005M12	5.705031	14.77821	20.60000	15.50000					
2006M01	6.385998	14.39140	10.02500	12.20000					
2006M02	5.394644	13.72153	6.275000	10.30000					
2006M03	5.201998	11.93002	7.740000	10.70000					
2006M04	4.580023	10.11140	6.375000	9.400000					
2006M05	5.114387	11.16394	6.900000	8.600000					
2006M06	5.146289	10.66272	8.380000	8.500000					
2006M07	5.209374	10.46413	6.875000	8.700000					
2006M08	4.814072	11.82185	5.350000	8.000000					
2006M09	4.598730	13.32716	7.920000	8.200000					
2006M10	4.420481	14.02165	9.800000	7.900000					
2006M11	4.340203	15.48843	7.240000	8.100000					
2006M12	4.348522	16.09669	7.360000	8.200000					
2007M01	6.745102	14.40083	8.425000	9.800000					
2007M02	5.086585	12.13904	9.075000	12.20000					
2007M03	4.755374	11.89803	10.18000	12.70000	8.831608	1.448924	68.65824	3.000336	37.68653
2007M04	4.467267	12.54878	9.650000	12.40000	8.979431	1.425869	67.34246	3.079970	37.38994
2007M05	4.363169	13.20157	12.50000	11.80000	8.887546	1.389743	72.45463	3.229073	37.34027
2007M06	4.273166	14.61995	11.68000	11.10000	8.914207	1.357923	70.90319	3.366219	36.73779
2007M07	4.203850	13.70857	10.45000	11.20000	9.005469	1.342135	73.65781	3.157900	37.01586
2007M08	4.280959	14.44295	12.84000	10.70000	8.764460	1.389559	73.52693	3.297749	39.23996
2007M09	4.253773	14.78533	14.02500	9.300000	8.995443	1.376422	72.03307	3.295386	39.52018
2007M10	4.253162	14.41194	11.67500	9.000000	8.916204	1.343221	72.25842	3.788907	41.63293
2007M11									

STEP 2 (Cont.)

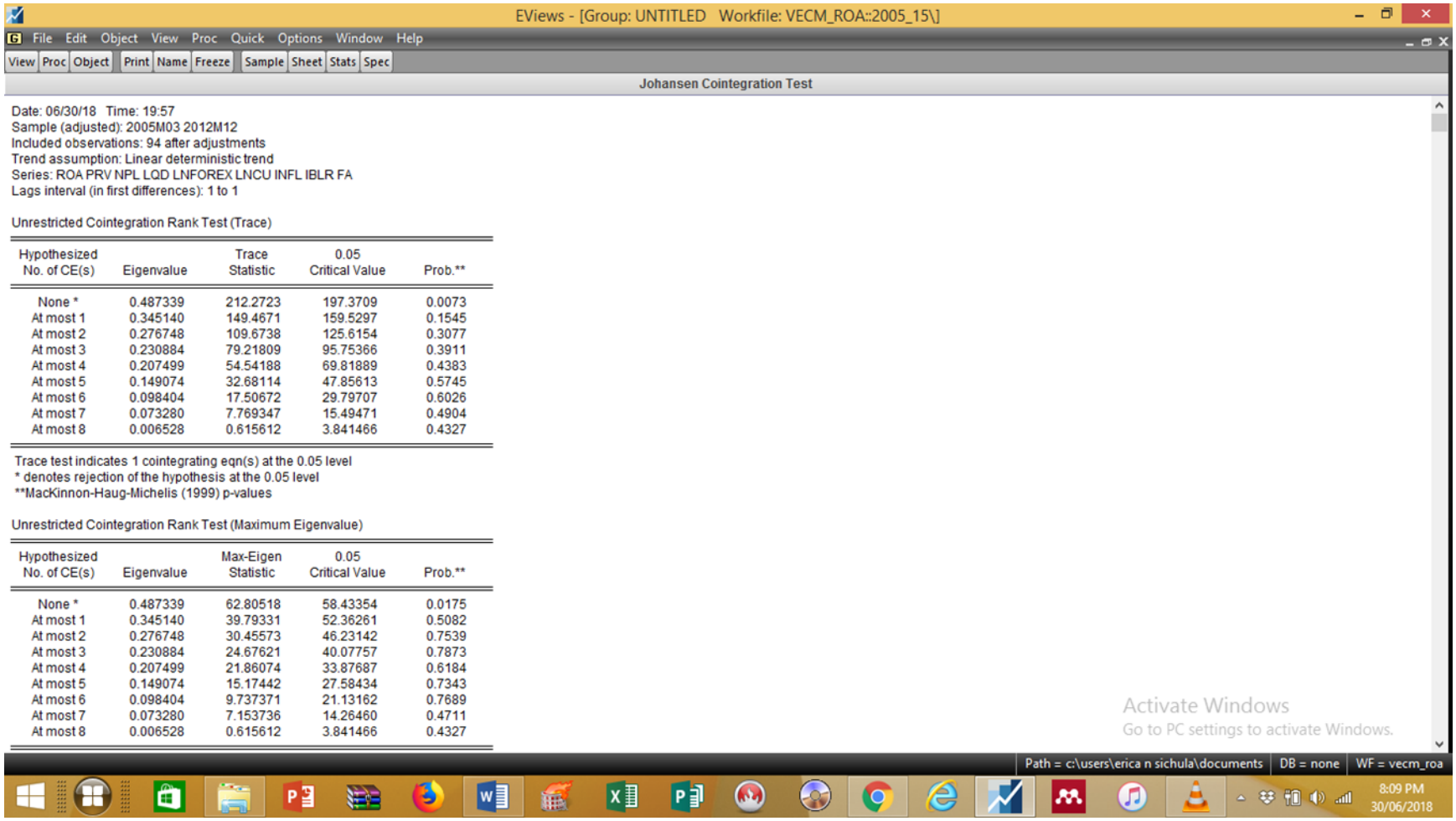
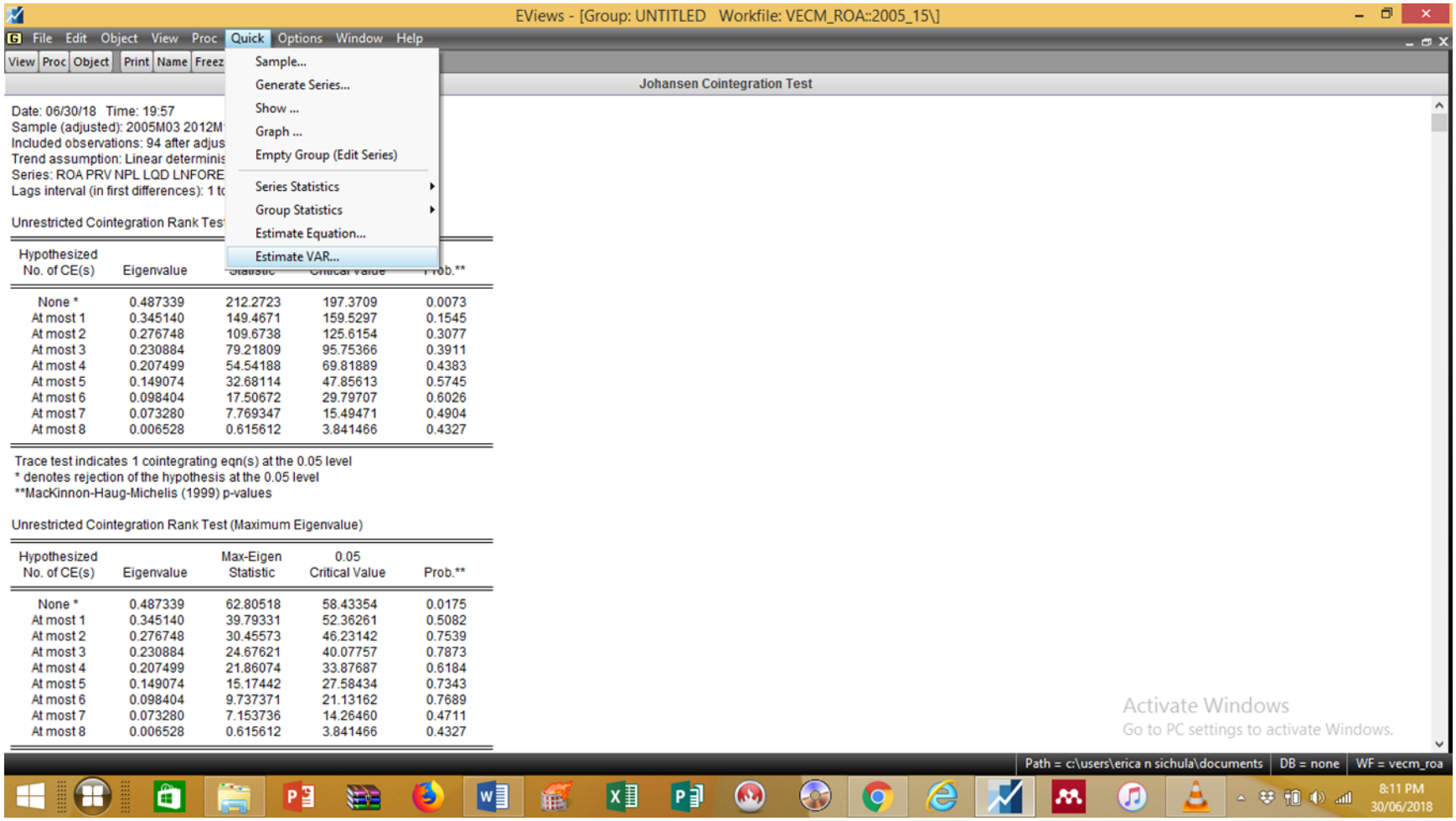
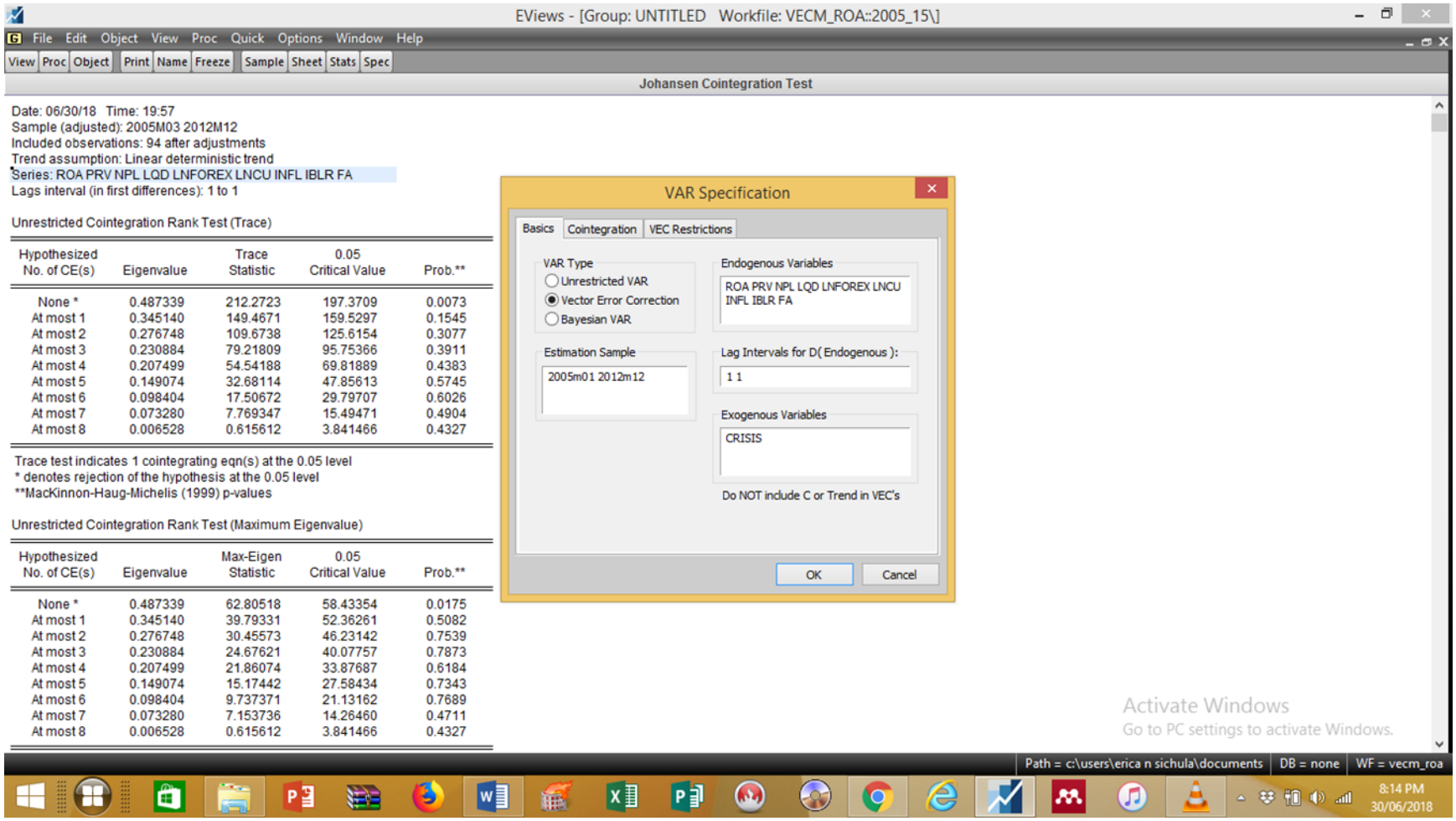


Table indicates at most one (1) co-integrated equation at the 5% level indicating that the variables are co-integrated, and therefore have a long-run association.

STEP 3. Estimate the VECM equation



STEP 3 (Cont.)


EViews - [Group: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freeze Sample Sheet Stats Spec
Johansen Cointegration Test
Date: 06/30/18 Time: 19:57
Sample (adjusted): 2005M03 2012M12
Included observations: 94 after adjustments
Trend assumption: Linear deterministic trend
Series: ROA PRV NPL LQD LNFOREX LNCU INFL IBLR FA
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)
Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.**
None * 0.487339 212.2723 197.3709 0.0073
At most 1 0.345140 149.4671 159.5297 0.1545
At most 2 0.276748 109.6738 125.6154 0.3077
At most 3 0.230884 79.21809 95.75366 0.3911
At most 4 0.207499 54.54188 69.81889 0.4383
At most 5 0.149074 32.68114 47.85613 0.5745
At most 6 0.098404 17.50672 29.79707 0.6026
At most 7 0.073280 7.769347 15.49471 0.4904
At most 8 0.006528 0.615612 3.841466 0.4327
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)
Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.**
None * 0.487339 62.80518 58.43354 0.0175
At most 1 0.345140 39.79331 52.36261 0.5082
At most 2 0.276748 30.45573 46.23142 0.7539
At most 3 0.230884 24.67621 40.07757 0.7873
At most 4 0.207499 21.86074 33.87687 0.6184
At most 5 0.149074 15.17442 27.58434 0.7343
At most 6 0.098404 9.737371 21.13162 0.7689
At most 7 0.073280 7.153736 14.26460 0.4711
At most 8 0.006528 0.615612 3.841466 0.4327
VAR Specification
Basics Cointegration VEC Restrictions
VAR Type
Unrestricted VAR
Vector Error Correction
Bayesian VAR
Endogenous Variables
ROA PRV NPL LQD LNFOREX LNCU INFL IBLR FA
Estimation Sample
2005m01 2012m12
Lag Intervals for D(Endogenous):
1 1
Exogenous Variables
CRISIS
Do NOT include C or Trend in VEC's
OK
Cancel
Activate Windows
Go to PC settings to activate Windows.
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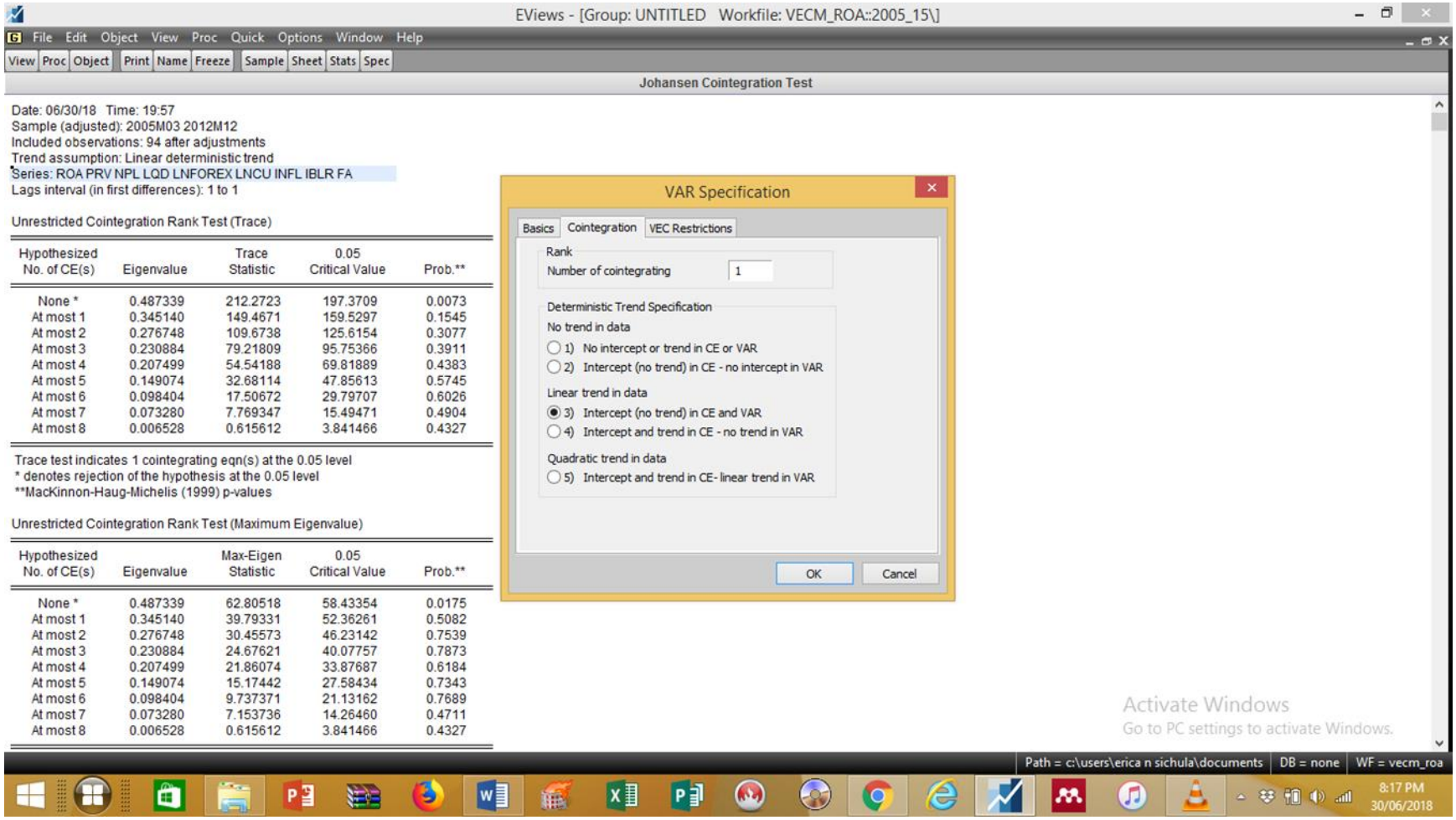
8:14 PM
30/06/2018

STEP 3 (Cont.)


EViews - [Group: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freeze Sample Sheet Stats Spec
Johansen Cointegration Test
Date: 06/30/18 Time: 19:57
Sample (adjusted): 2005M03 2012M12
Included observations: 94 after adjustments
Trend assumption: Linear deterministic trend
Series: ROA PRV NPL LQD LNFOREX LNCU INFL IBLR FA
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)
Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.**
None * 0.487339 212.2723 197.3709 0.0073
At most 1 0.345140 149.4671 159.5297 0.1545
At most 2 0.276748 109.6738 125.6154 0.3077
At most 3 0.230884 79.21809 95.75366 0.3911
At most 4 0.207499 54.54188 69.81889 0.4383
At most 5 0.149074 32.68114 47.85613 0.5745
At most 6 0.098404 17.50672 29.79707 0.6026
At most 7 0.073280 7.769347 15.49471 0.4904
At most 8 0.006528 0.615612 3.841466 0.4327
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)
Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.**
None * 0.487339 62.80518 58.43354 0.0175
At most 1 0.345140 39.79331 52.36261 0.5082
At most 2 0.276748 30.45573 46.23142 0.7539
At most 3 0.230884 24.67621 40.07757 0.7873
At most 4 0.207499 21.86074 33.87687 0.6184
At most 5 0.149074 15.17442 27.58434 0.7343
At most 6 0.098404 9.737371 21.13162 0.7689
At most 7 0.073280 7.153736 14.26460 0.4711
At most 8 0.006528 0.615612 3.841466 0.4327
VAR Specification
Basics Cointegration VEC Restrictions
Rank
Number of cointegrating 1
Deterministic Trend Specification
No trend in data
1) No intercept or trend in CE or VAR
2) Intercept (no trend) in CE - no intercept in VAR
Linear trend in data
3) Intercept (no trend) in CE and VAR
4) Intercept and trend in CE - no trend in VAR
Quadratic trend in data
5) Intercept and trend in CE- linear trend in VAR
OK
Cancel
Activate Windows
Go to PC settings to activate Windows.
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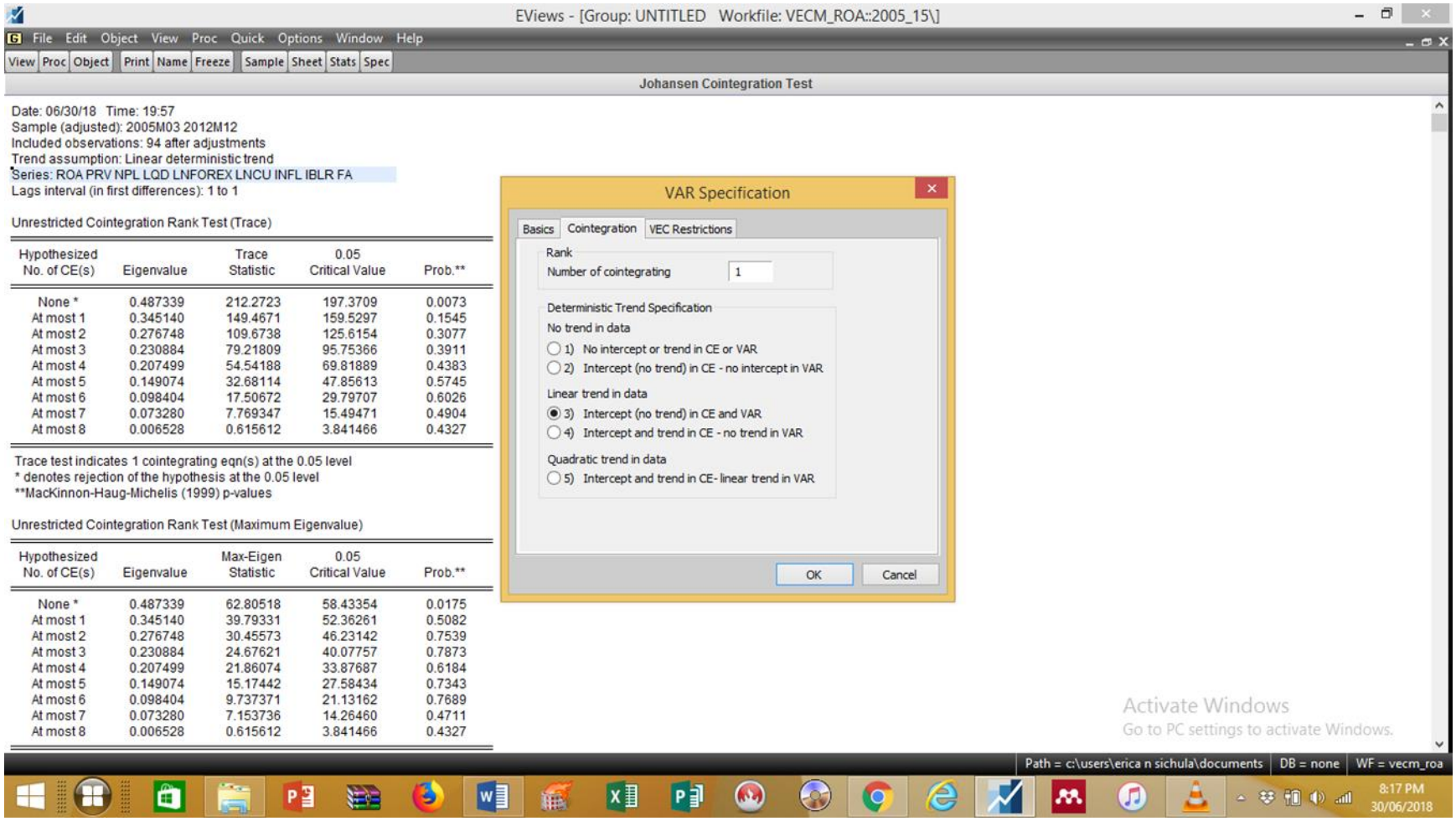
WF = vecm_roa
8:17 PM
30/06/2018

STEP 3 (Cont.)


EViews - [Group: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freeze Sample Sheet Stats Spec
Johansen Cointegration Test
Date: 06/30/18 Time: 19:57
Sample (adjusted): 2005M03 2012M12
Included observations: 94 after adjustments
Trend assumption: Linear deterministic trend
Series: ROA PRV NPL LQD LNFOREX LNCU INFL IBLR FA
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)
Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.**
None * 0.487339 212.2723 197.3709 0.0073
At most 1 0.345140 149.4671 159.5297 0.1545
At most 2 0.276748 109.6738 125.6154 0.3077
At most 3 0.230884 79.21809 95.75366 0.3911
At most 4 0.207499 54.54188 69.81889 0.4383
At most 5 0.149074 32.68114 47.85613 0.5745
At most 6 0.098404 17.50672 29.79707 0.6026
At most 7 0.073280 7.769347 15.49471 0.4904
At most 8 0.006528 0.615612 3.841466 0.4327
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)
Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.**
None * 0.487339 62.80518 58.43354 0.0175
At most 1 0.345140 39.79331 52.36261 0.5082
At most 2 0.276748 30.45573 46.23142 0.7539
At most 3 0.230884 24.67621 40.07757 0.7873
At most 4 0.207499 21.86074 33.87687 0.6184
At most 5 0.149074 15.17442 27.58434 0.7343
At most 6 0.098404 9.737371 21.13162 0.7689
At most 7 0.073280 7.153736 14.26460 0.4711
At most 8 0.006528 0.615612 3.841466 0.4327
VAR Specification
Basics Cointegration VEC Restrictions
Rank
Number of cointegrating 1
Deterministic Trend Specification
No trend in data
1) No intercept or trend in CE or VAR
2) Intercept (no trend) in CE - no intercept in VAR
Linear trend in data
3) Intercept (no trend) in CE and VAR
4) Intercept and trend in CE - no trend in VAR
Quadratic trend in data
5) Intercept and trend in CE- linear trend in VAR
OK
Cancel
Activate Windows
Go to PC settings to activate Windows.
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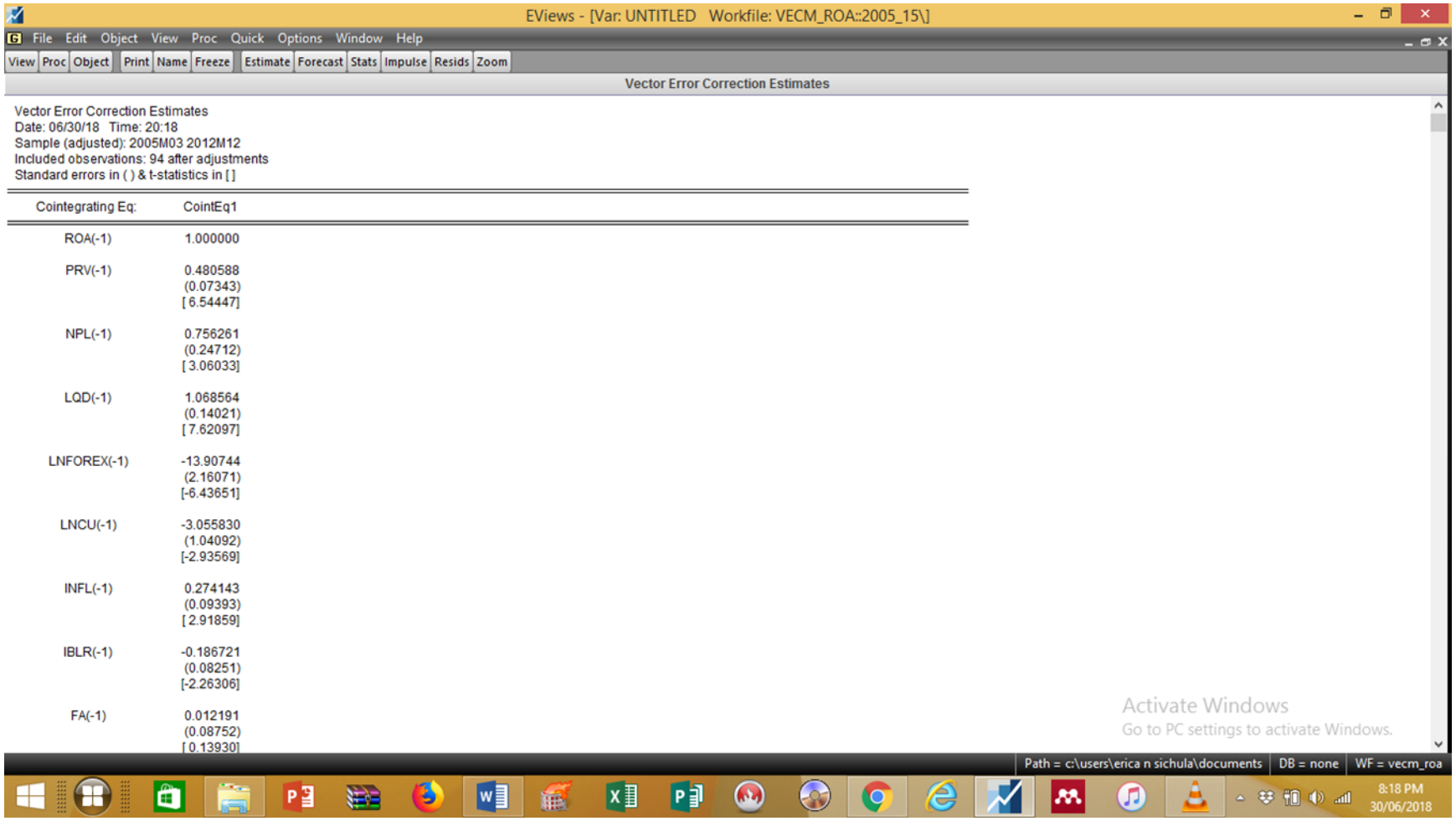
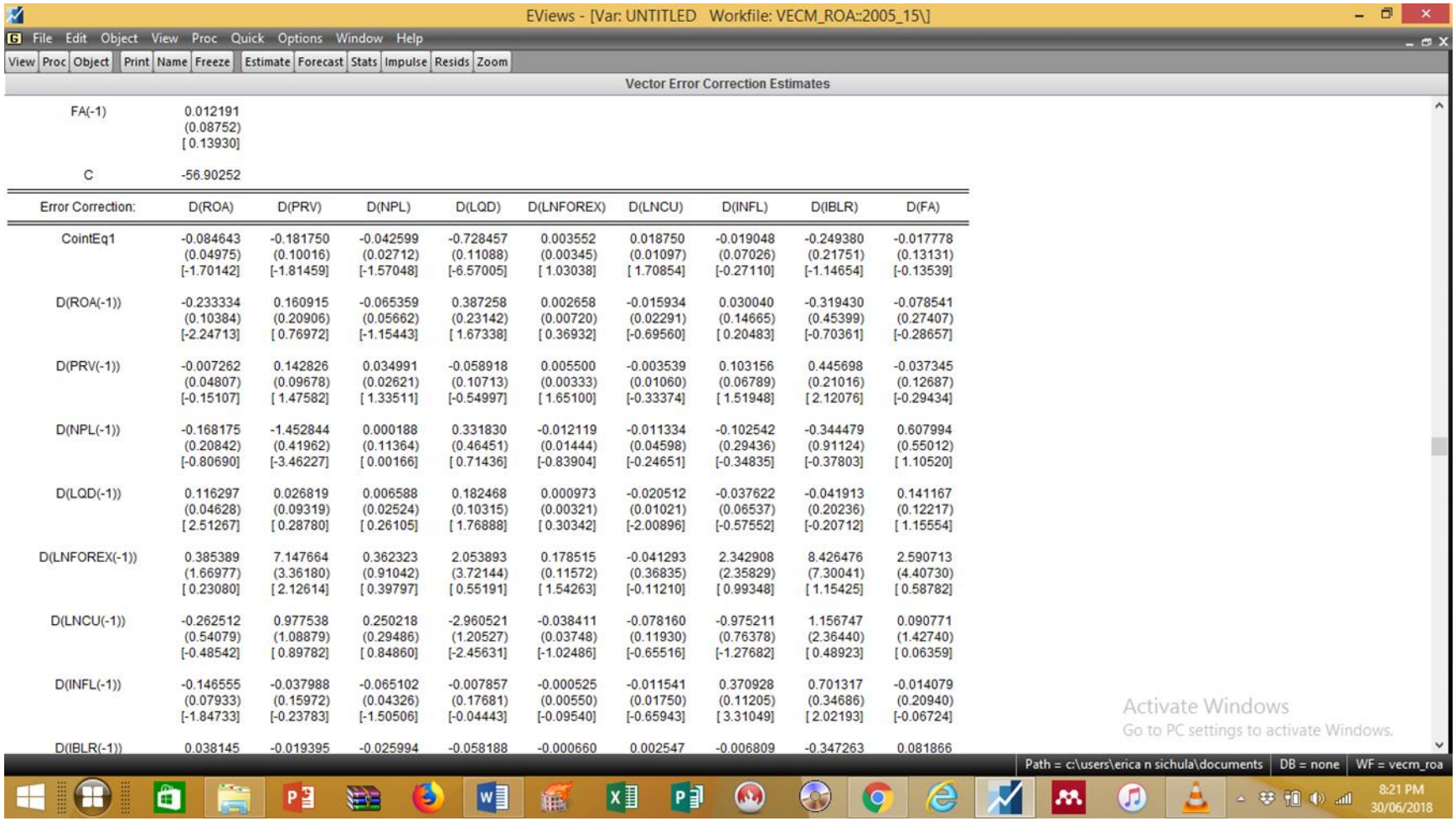
WF = vecm_roa
8:17 PM
30/06/2018

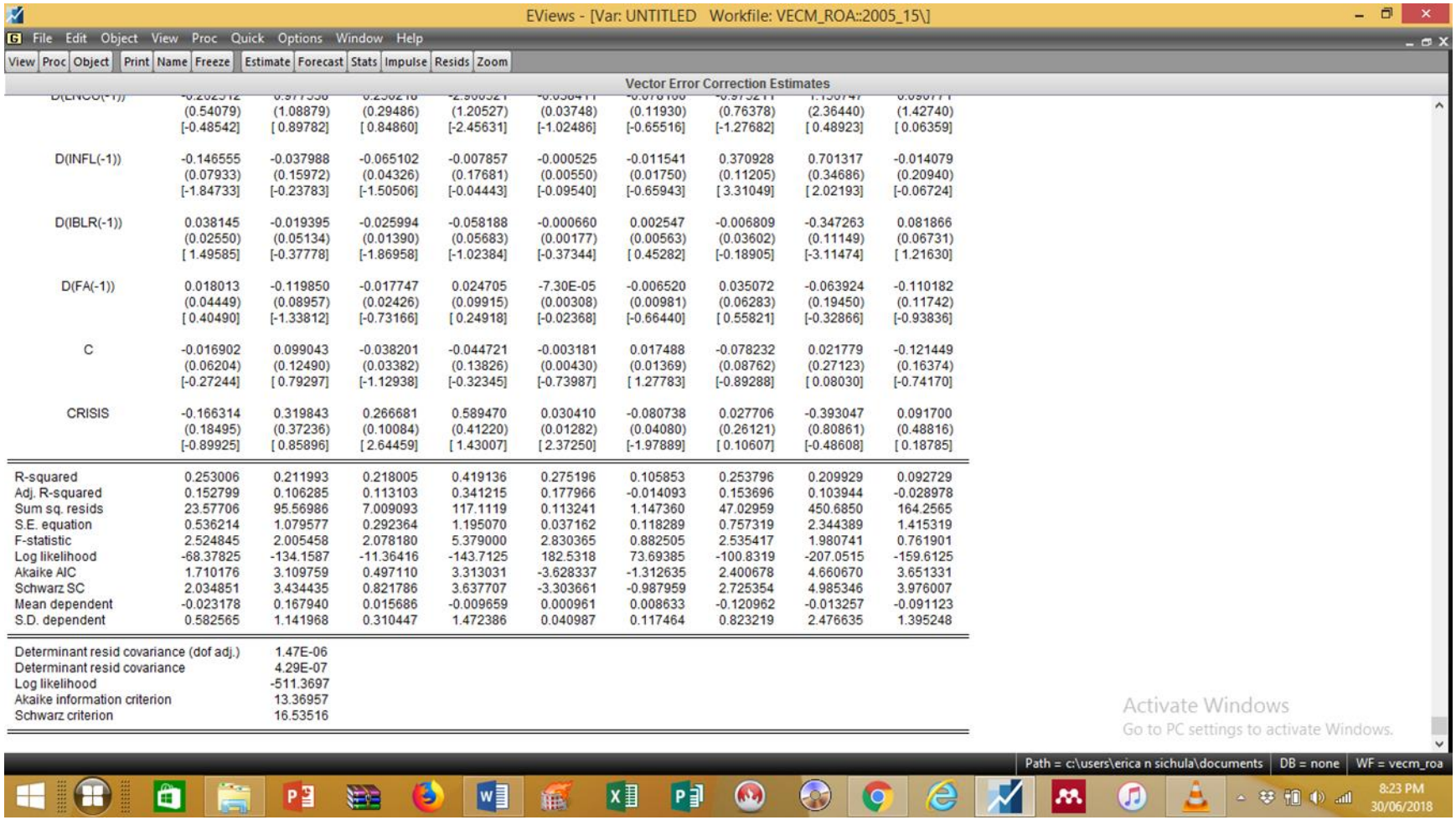
STEP 3 (Cont.)


EViews - [Var: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freeze Estimate Forecast Stats Impulse Resids Zoom
Vector Error Correction Estimates
Vector Error Correction Estimates
Date: 06/30/18 Time: 20:18
Sample (adjusted): 2005M03 2012M12
Included observations: 94 after adjustments
Standard errors in ( ) & t-statistics in [ ]
Cointegrating Eq: CointEq1
ROA(-1) 1.000000
PRV(-1) 0.480588
(0.07343)
[6.54447]
NPL(-1) 0.756261
(0.24712)
[3.06033]
LQD(-1) 1.068564
(0.14021)
[7.62097]
LNFOREX(-1) -13.90744
(2.16071)
[-6.43651]
LNCU(-1) -3.055830
(1.04092)
[-2.93569]
INFL(-1) 0.274143
(0.09393)
[2.91859]
IBLR(-1) -0.186721
(0.08251)
[-2.26306]
FA(-1) 0.012191
(0.08752)
[0.13930]
Activate Windows
Go to PC settings to activate Windows.
Path = c:\users\erica n sichula\documents
DB = none
WF = vecm_roa
8:18 PM
30/06/2018



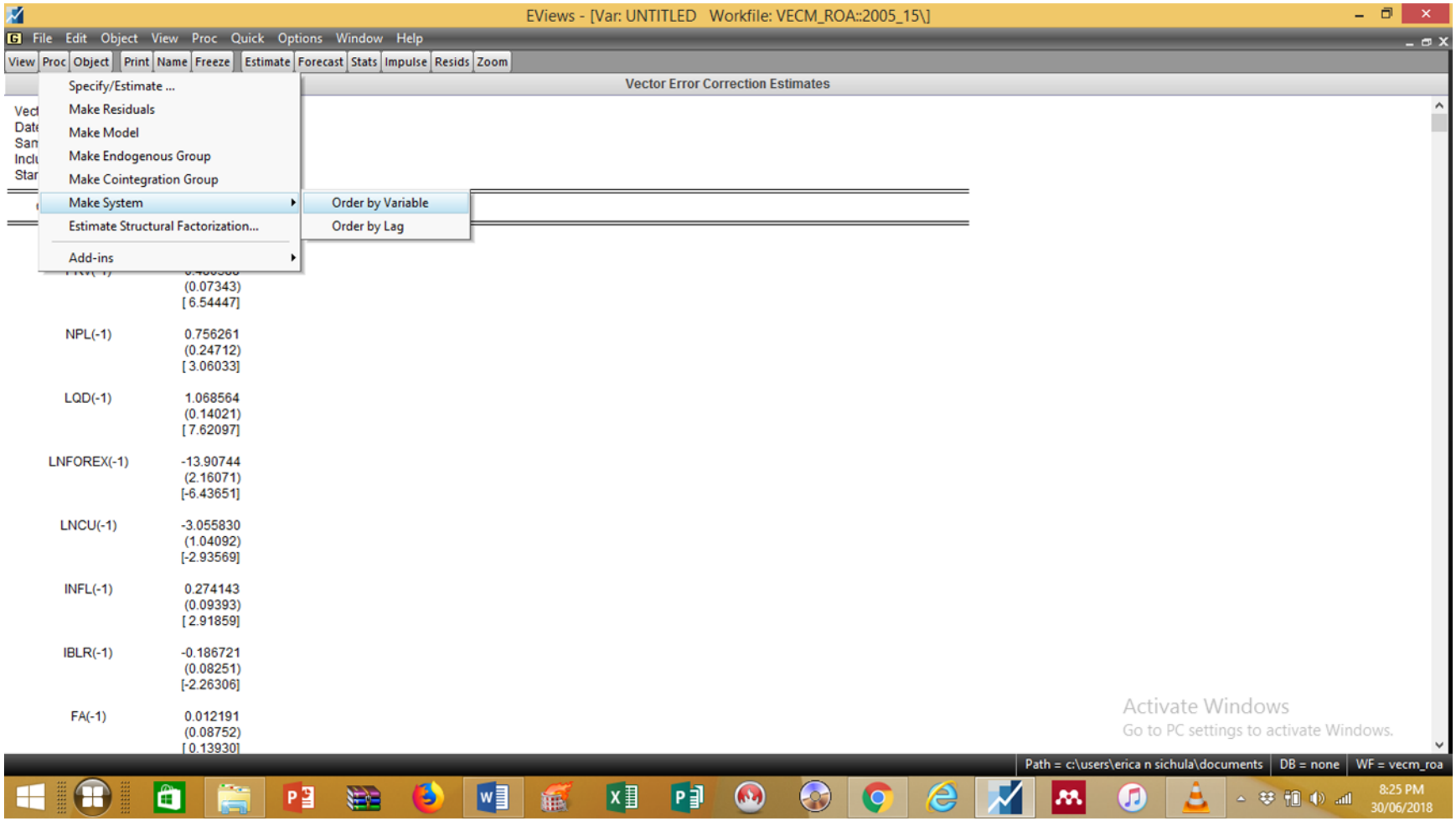
FA(-1)	0.012191								
	(0.08752)								
	[0.13930]								
C	-56.90252								

Error Correction:	D(ROA)	D(PRV)	D(NPL)	D(LQD)	D(LNFOREX)	D(LNCU)	D(INFL)	D(IBLR)	D(FA)
CointEq1	-0.084643	-0.181750	-0.042599	-0.728457	0.003552	0.018750	-0.019048	-0.249380	-0.017778
	(0.04975)	(0.10016)	(0.02712)	(0.11088)	(0.00345)	(0.01097)	(0.07026)	(0.21751)	(0.13131)
	[-1.70142]	[-1.81459]	[-1.57048]	[-6.57005]	[1.03038]	[1.70854]	[-0.27110]	[-1.14654]	[-0.13539]
D(ROA(-1))	-0.233334	0.160915	-0.065359	0.387258	0.002658	-0.015934	0.030040	-0.319430	-0.078541
	(0.10384)	(0.20906)	(0.05662)	(0.23142)	(0.00720)	(0.02291)	(0.14665)	(0.45399)	(0.27407)
	[-2.24713]	[0.76972]	[-1.15443]	[1.67338]	[0.36932]	[-0.69560]	[0.20483]	[-0.70361]	[-0.28657]
D(PRV(-1))	-0.007262	0.142826	0.034991	-0.058918	0.005500	-0.003539	0.103156	0.445698	-0.037345
	(0.04807)	(0.09678)	(0.02621)	(0.10713)	(0.00333)	(0.01060)	(0.06789)	(0.21016)	(0.12687)
	[-0.15107]	[1.47582]	[1.33511]	[-0.54997]	[1.65100]	[-0.33374]	[1.51948]	[2.12076]	[-0.29434]
D(NPL(-1))	-0.168175	-1.452844	0.000188	0.331830	-0.012119	-0.011334	-0.102542	-0.344479	0.607994
	(0.20842)	(0.41962)	(0.11364)	(0.46451)	(0.01444)	(0.04598)	(0.29436)	(0.91124)	(0.55012)
	[-0.80690]	[-3.46227]	[0.00166]	[0.71436]	[-0.83904]	[-0.24651]	[-0.34835]	[-0.37803]	[1.10520]
D(LQD(-1))	0.116297	0.026819	0.006588	0.182468	0.000973	-0.020512	-0.037622	-0.041913	0.141167
	(0.04628)	(0.09319)	(0.02524)	(0.10315)	(0.00321)	(0.01021)	(0.06537)	(0.20236)	(0.12217)
	[2.51267]	[0.28780]	[0.26105]	[1.76888]	[0.30342]	[-2.00896]	[-0.57552]	[-0.20712]	[1.15554]
D(LNFOREX(-1))	0.385389	7.147664	0.362323	2.053893	0.178515	-0.041293	2.342908	8.426476	2.590713
	(1.66977)	(3.36180)	(0.91042)	(3.72144)	(0.11572)	(0.36835)	(2.35829)	(7.30041)	(4.40730)
	[0.23080]	[2.12614]	[0.39797]	[0.55191]	[1.54263]	[-0.11210]	[0.99348]	[1.15425]	[0.58782]
D(LNCU(-1))	-0.262512	0.977538	0.250218	-2.960521	-0.038411	-0.078160	-0.975211	1.156747	0.090771
	(0.54079)	(1.08879)	(0.29486)	(1.20527)	(0.03748)	(0.11930)	(0.76378)	(2.36440)	(1.42740)
	[-0.48542]	[0.89782]	[0.84860]	[-2.45631]	[-1.02486]	[-0.65516]	[-1.27682]	[0.48923]	[0.06359]
D(INFL(-1))	-0.146555	-0.037988	-0.065102	-0.007857	-0.000525	-0.011541	0.370928	0.701317	-0.014079
	(0.07933)	(0.15972)	(0.04326)	(0.17681)	(0.00550)	(0.01750)	(0.11205)	(0.34686)	(0.20940)
	[-1.84733]	[-0.23783]	[-1.50506]	[-0.04443]	[-0.09540]	[-0.65943]	[3.31049]	[2.02193]	[-0.06724]
D(IBLR(-1))	0.038145	-0.019395	-0.025994	-0.058188	-0.000660	0.002547	-0.006809	-0.347263	0.081866

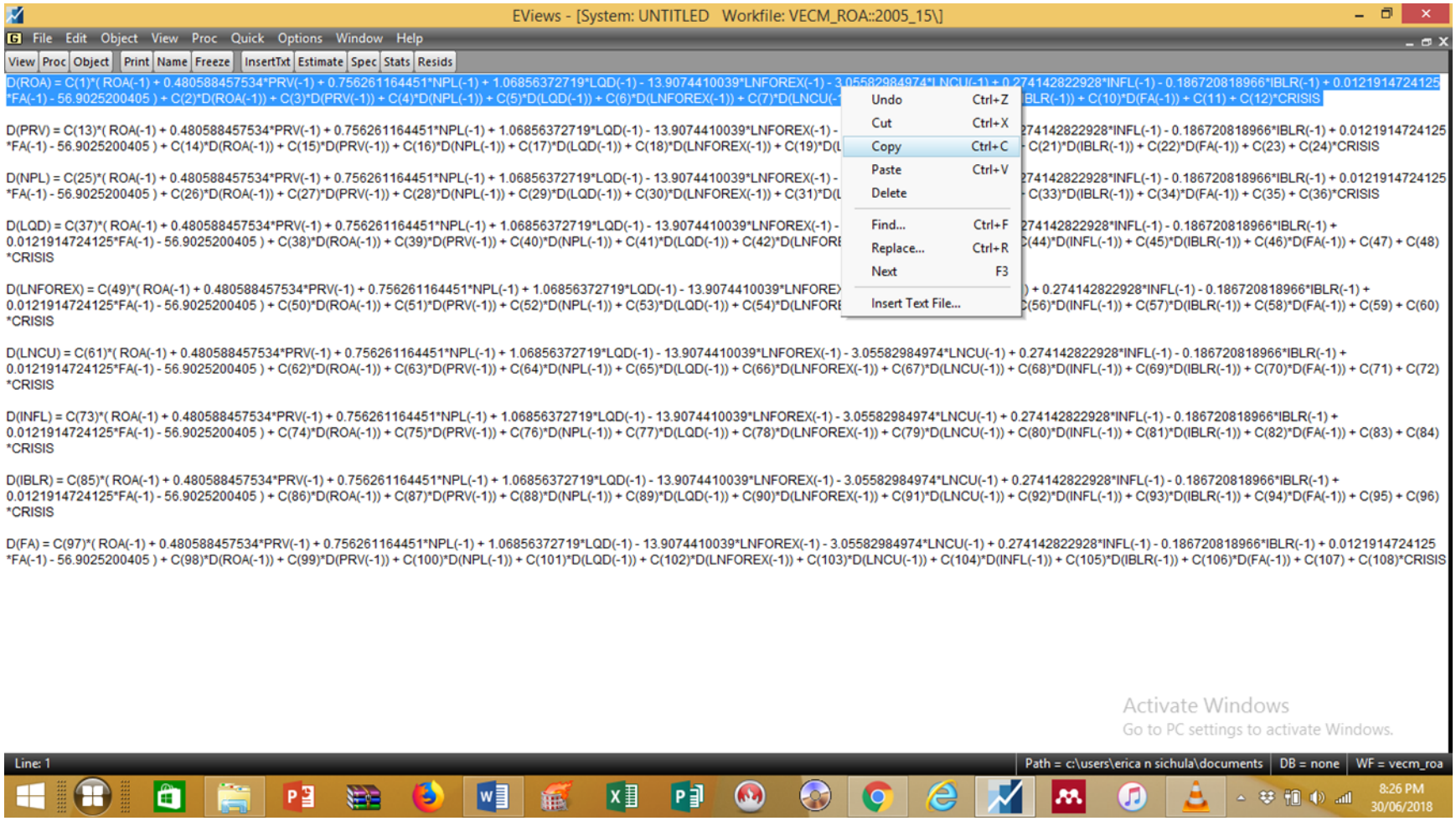


This is the full VECM showing the coefficients of the cointegrating equation and the error correction model with a lag 1.

STEP 4. The model gives the coefficient, standard error, and the T statistic value only, but not the p-value of the variables, which is a critical value in deciding to reject or accept the null hypothesis. This step therefore is to determine the p-values of the model.



STEP 4 (Cont.)


EViews - [System: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freeze InsertTxt Estimate Spec Stats Resids
D(ROA) = C(1)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125 *FA(-1) - 56.9025200405) + C(2)*D(ROA(-1)) + C(3)*D(PRV(-1)) + C(4)*D(NPL(-1)) + C(5)*D(LQD(-1)) + C(6)*D(LNFOREX(-1)) + C(7)*D(LNCU(-1)) + C(10)*D(FA(-1)) + C(11) + C(12)*CRISIS
D(PRV) = C(13)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125 *FA(-1) - 56.9025200405) + C(14)*D(ROA(-1)) + C(15)*D(PRV(-1)) + C(16)*D(NPL(-1)) + C(17)*D(LQD(-1)) + C(18)*D(LNFOREX(-1)) + C(19)*D(LNCU(-1)) + C(21)*D(IBLR(-1)) + C(22)*D(FA(-1)) + C(23) + C(24)*CRISIS
D(NPL) = C(25)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125 *FA(-1) - 56.9025200405) + C(26)*D(ROA(-1)) + C(27)*D(PRV(-1)) + C(28)*D(NPL(-1)) + C(29)*D(LQD(-1)) + C(30)*D(LNFOREX(-1)) + C(31)*D(LNCU(-1)) + C(33)*D(IBLR(-1)) + C(34)*D(FA(-1)) + C(35) + C(36)*CRISIS
D(LQD) = C(37)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(38)*D(ROA(-1)) + C(39)*D(PRV(-1)) + C(40)*D(NPL(-1)) + C(41)*D(LQD(-1)) + C(42)*D(LNFOREX(-1)) + C(44)*D(INFL(-1)) + C(45)*D(IBLR(-1)) + C(46)*D(FA(-1)) + C(47) + C(48) *CRISIS
D(LNFOREX) = C(49)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(50)*D(ROA(-1)) + C(51)*D(PRV(-1)) + C(52)*D(NPL(-1)) + C(53)*D(LQD(-1)) + C(54)*D(LNFOREX(-1)) + C(56)*D(INFL(-1)) + C(57)*D(IBLR(-1)) + C(58)*D(FA(-1)) + C(59) + C(60) *CRISIS
D(LNCU) = C(61)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(62)*D(ROA(-1)) + C(63)*D(PRV(-1)) + C(64)*D(NPL(-1)) + C(65)*D(LQD(-1)) + C(66)*D(LNFOREX(-1)) + C(67)*D(LNCU(-1)) + C(68)*D(INFL(-1)) + C(69)*D(IBLR(-1)) + C(70)*D(FA(-1)) + C(71) + C(72) *CRISIS
D(INFL) = C(73)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(74)*D(ROA(-1)) + C(75)*D(PRV(-1)) + C(76)*D(NPL(-1)) + C(77)*D(LQD(-1)) + C(78)*D(LNFOREX(-1)) + C(79)*D(LNCU(-1)) + C(80)*D(INFL(-1)) + C(81)*D(IBLR(-1)) + C(82)*D(FA(-1)) + C(83) + C(84) *CRISIS
D(IBLR) = C(85)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(86)*D(ROA(-1)) + C(87)*D(PRV(-1)) + C(88)*D(NPL(-1)) + C(89)*D(LQD(-1)) + C(90)*D(LNFOREX(-1)) + C(91)*D(LNCU(-1)) + C(92)*D(INFL(-1)) + C(93)*D(IBLR(-1)) + C(94)*D(FA(-1)) + C(95) + C(96) *CRISIS
D(FA) = C(97)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125 *FA(-1) - 56.9025200405) + C(98)*D(ROA(-1)) + C(99)*D(PRV(-1)) + C(100)*D(NPL(-1)) + C(101)*D(LQD(-1)) + C(102)*D(LNFOREX(-1)) + C(103)*D(LNCU(-1)) + C(104)*D(INFL(-1)) + C(105)*D(IBLR(-1)) + C(106)*D(FA(-1)) + C(107) + C(108)*CRISIS
Undo Ctrl+Z
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Delete
Find... Ctrl+F
Replace... Ctrl+R
Next F3
Insert Text File...
Activate Windows
Go to PC settings to activate Windows.
Line: 1
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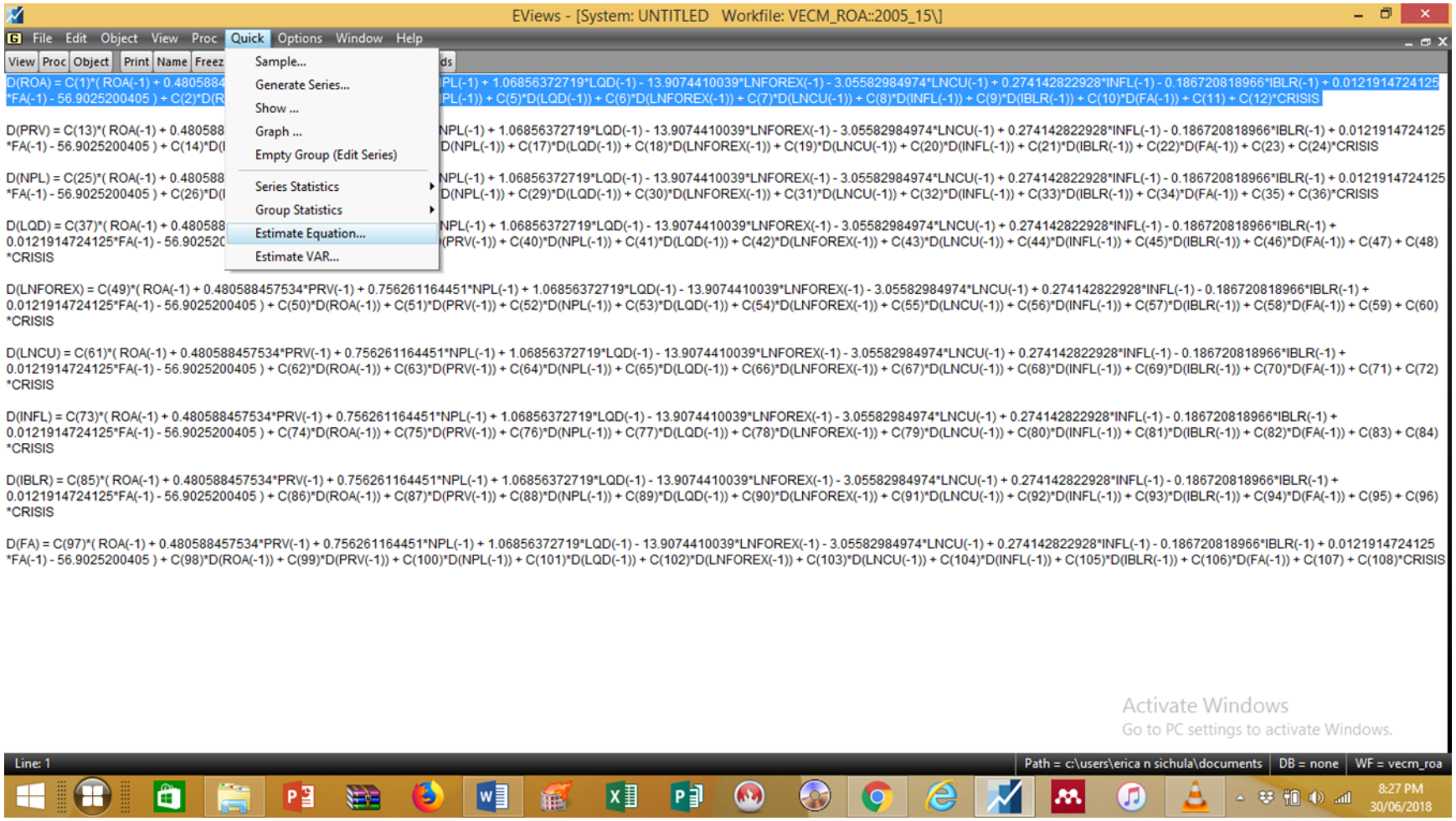
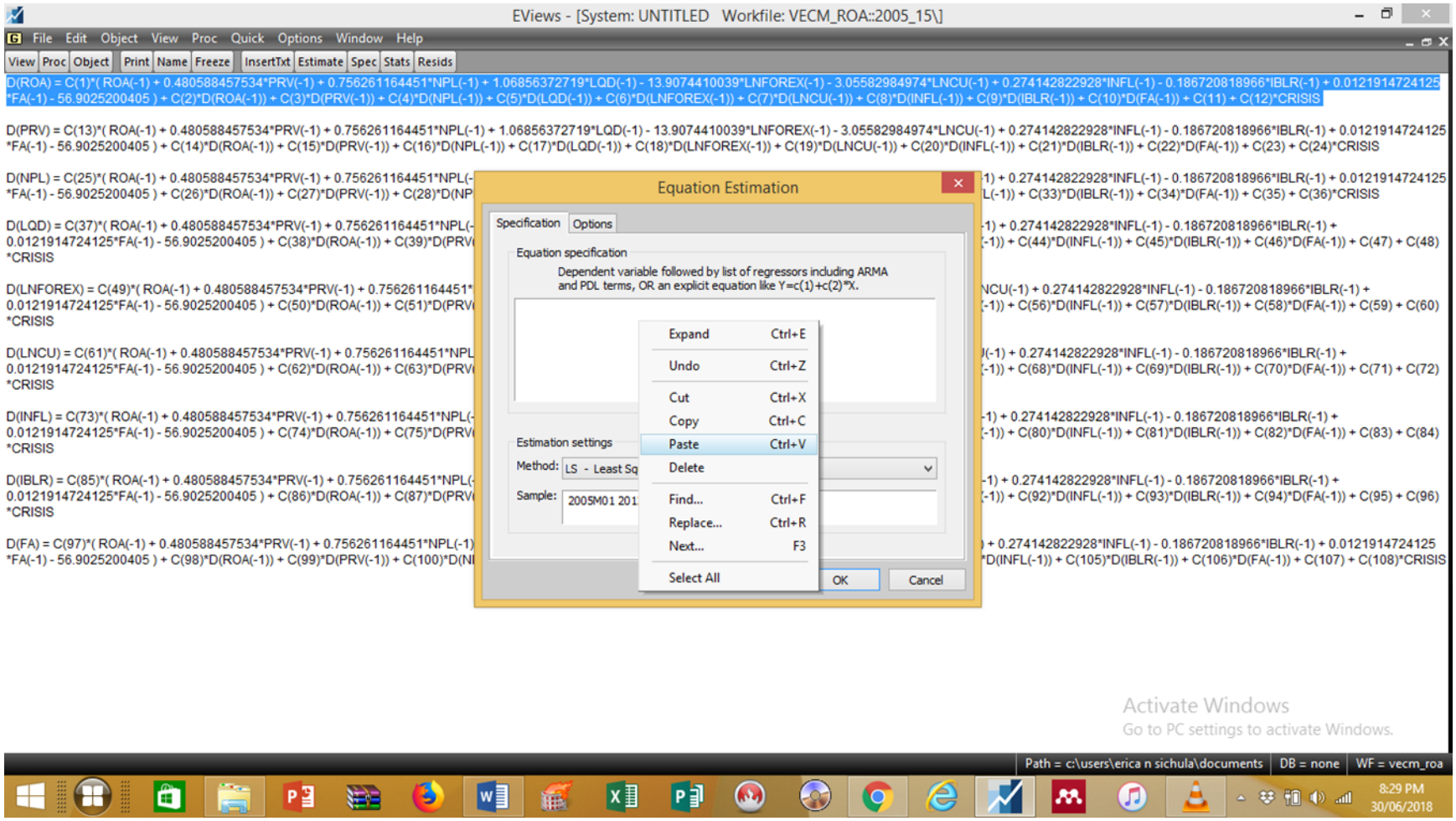
DB = none
WF = vecm_roa
8:26 PM
30/06/2018

STEP 4 (Cont.)


EViews - [System: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freez
Sample...
Generate Series...
Show ...
Graph ...
Empty Group (Edit Series)
Series Statistics
Group Statistics
Estimate Equation...
Estimate VAR...
D(ROA) = C(1)*(ROA(-1) + 0.480588
D(PRV) = C(13)*(ROA(-1) + 0.480588
D(NPL) = C(25)*(ROA(-1) + 0.480588
D(LQD) = C(37)*(ROA(-1) + 0.480588
D(LNFOREX) = C(49)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(50)*D(ROA(-1)) + C(51)*D(PRV(-1)) + C(52)*D(NPL(-1)) + C(53)*D(LQD(-1)) + C(54)*D(LNFOREX(-1)) + C(55)*D(LNCU(-1)) + C(56)*D(INFL(-1)) + C(57)*D(IBLR(-1)) + C(58)*D(FA(-1)) + C(59) + C(60)*CRISIS
D(LNCU) = C(61)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(62)*D(ROA(-1)) + C(63)*D(PRV(-1)) + C(64)*D(NPL(-1)) + C(65)*D(LQD(-1)) + C(66)*D(LNFOREX(-1)) + C(67)*D(LNCU(-1)) + C(68)*D(INFL(-1)) + C(69)*D(IBLR(-1)) + C(70)*D(FA(-1)) + C(71) + C(72)*CRISIS
D(INFL) = C(73)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(74)*D(ROA(-1)) + C(75)*D(PRV(-1)) + C(76)*D(NPL(-1)) + C(77)*D(LQD(-1)) + C(78)*D(LNFOREX(-1)) + C(79)*D(LNCU(-1)) + C(80)*D(INFL(-1)) + C(81)*D(IBLR(-1)) + C(82)*D(FA(-1)) + C(83) + C(84)*CRISIS
D(IBLR) = C(85)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(86)*D(ROA(-1)) + C(87)*D(PRV(-1)) + C(88)*D(NPL(-1)) + C(89)*D(LQD(-1)) + C(90)*D(LNFOREX(-1)) + C(91)*D(LNCU(-1)) + C(92)*D(INFL(-1)) + C(93)*D(IBLR(-1)) + C(94)*D(FA(-1)) + C(95) + C(96)*CRISIS
D(FA) = C(97)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(98)*D(ROA(-1)) + C(99)*D(PRV(-1)) + C(100)*D(NPL(-1)) + C(101)*D(LQD(-1)) + C(102)*D(LNFOREX(-1)) + C(103)*D(LNCU(-1)) + C(104)*D(INFL(-1)) + C(105)*D(IBLR(-1)) + C(106)*D(FA(-1)) + C(107) + C(108)*CRISIS
Activate Windows
Go to PC settings to activate Windows.
Line: 1
Path = c:\users\erica n sichula\documents
DB = none
WF = vecm_roa
8:27 PM
30/06/2018

STEP 4 (Cont.)


EViews - [System: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freeze InsertTxt Estimate Spec Stats Resids
D(ROA) = C(1)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125 *FA(-1) - 56.9025200405) + C(2)*D(ROA(-1)) + C(3)*D(PRV(-1)) + C(4)*D(NPL(-1)) + C(5)*D(LQD(-1)) + C(6)*D(LNFOREX(-1)) + C(7)*D(LNCU(-1)) + C(8)*D(INFL(-1)) + C(9)*D(IBLR(-1)) + C(10)*D(FA(-1)) + C(11) + C(12)*CRISIS
D(PRV) = C(13)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125 *FA(-1) - 56.9025200405) + C(14)*D(ROA(-1)) + C(15)*D(PRV(-1)) + C(16)*D(NPL(-1)) + C(17)*D(LQD(-1)) + C(18)*D(LNFOREX(-1)) + C(19)*D(LNCU(-1)) + C(20)*D(INFL(-1)) + C(21)*D(IBLR(-1)) + C(22)*D(FA(-1)) + C(23) + C(24)*CRISIS
D(NPL) = C(25)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-
*FA(-1) - 56.9025200405) + C(26)*D(ROA(-1)) + C(27)*D(PRV(-1)) + C(28)*D(NP
D(LQD) = C(37)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-
0.0121914724125*FA(-1) - 56.9025200405) + C(38)*D(ROA(-1)) + C(39)*D(PRV
*CRISIS
D(LNFOREX) = C(49)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*
0.0121914724125*FA(-1) - 56.9025200405) + C(50)*D(ROA(-1)) + C(51)*D(PRV
*CRISIS
D(LNCU) = C(61)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL
0.0121914724125*FA(-1) - 56.9025200405) + C(62)*D(ROA(-1)) + C(63)*D(PRV
*CRISIS
D(INFL) = C(73)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-
0.0121914724125*FA(-1) - 56.9025200405) + C(74)*D(ROA(-1)) + C(75)*D(PRV
*CRISIS
D(IBLR) = C(85)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-
0.0121914724125*FA(-1) - 56.9025200405) + C(86)*D(ROA(-1)) + C(87)*D(PRV
*CRISIS
D(FA) = C(97)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1)
*FA(-1) - 56.9025200405) + C(98)*D(ROA(-1)) + C(99)*D(PRV(-1)) + C(100)*D(NI
Equation Estimation
Specification Options
Equation specification
Dependent variable followed by list of regressors including ARMA and PDL terms, OR an explicit equation like Y=c(1)+c(2)*X.
Estimation settings
Method: LS - Least Sq
Sample: 2005M01 201
Expand Ctrl+E
Undo Ctrl+Z
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Delete
Find... Ctrl+F
Replace... Ctrl+R
Next... F3
Select All
OK
Cancel
Activate Windows
Go to PC settings to activate Windows.
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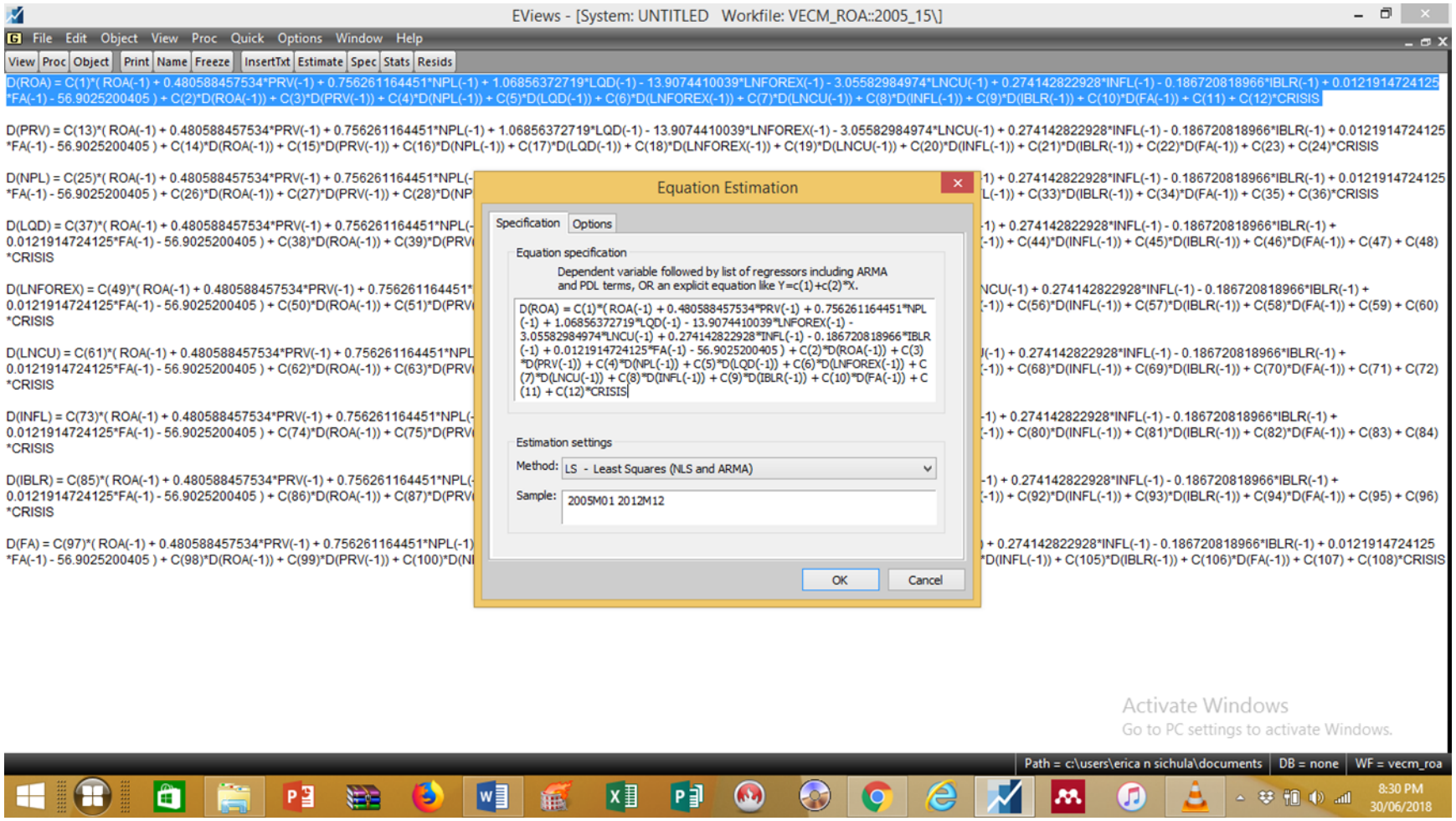
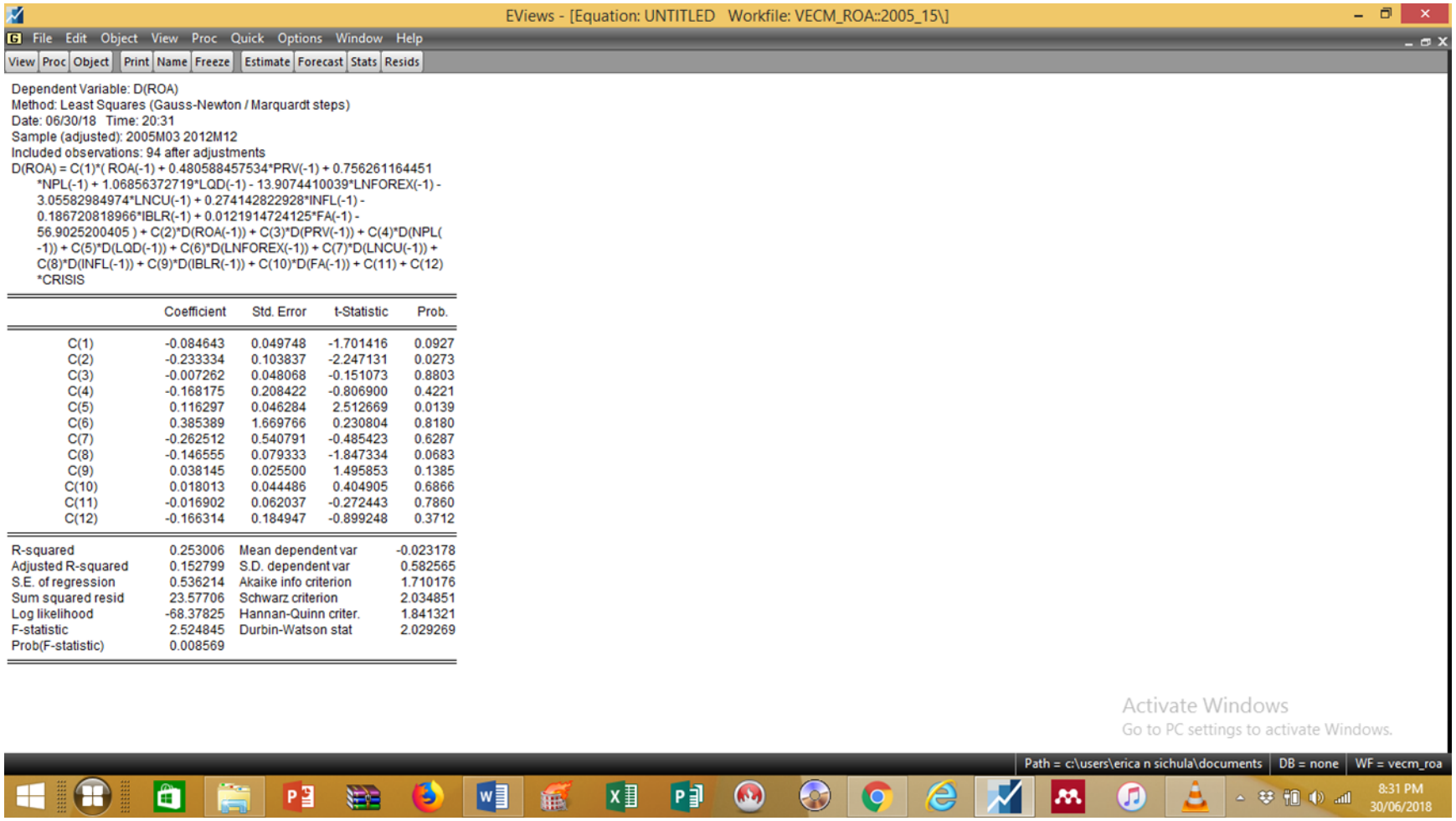
DB = none
WF = vecm_roa
8:29 PM
30/06/2018

STEP 4 (Cont.)


EViews - [System: UNTITLED Workfile: VECM_ROA::2005_15\]
File Edit Object View Proc Quick Options Window Help
View Proc Object Print Name Freeze InsertTxt Estimate Spec Stats Resids
D(ROA) = C(1)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(2)*D(ROA(-1)) + C(3)*D(PRV(-1)) + C(4)*D(NPL(-1)) + C(5)*D(LQD(-1)) + C(6)*D(LNFOREX(-1)) + C(7)*D(LNCU(-1)) + C(8)*D(INFL(-1)) + C(9)*D(IBLR(-1)) + C(10)*D(FA(-1)) + C(11) + C(12)*CRISIS
Equation Estimation
Specification Options
Equation specification
Dependent variable followed by list of regressors including ARMA and PDL terms, OR an explicit equation like Y=c(1)+c(2)*X.
D(ROA) = C(1)*(ROA(-1) + 0.480588457534*PRV(-1) + 0.756261164451*NPL(-1) + 1.06856372719*LQD(-1) - 13.9074410039*LNFOREX(-1) - 3.05582984974*LNCU(-1) + 0.274142822928*INFL(-1) - 0.186720818966*IBLR(-1) + 0.0121914724125*FA(-1) - 56.9025200405) + C(2)*D(ROA(-1)) + C(3)*D(PRV(-1)) + C(4)*D(NPL(-1)) + C(5)*D(LQD(-1)) + C(6)*D(LNFOREX(-1)) + C(7)*D(LNCU(-1)) + C(8)*D(INFL(-1)) + C(9)*D(IBLR(-1)) + C(10)*D(FA(-1)) + C(11) + C(12)*CRISIS
Estimation settings
Method: LS - Least Squares (NLS and ARMA)
Sample: 2005M01 2012M12
OK
Cancel
Activate Windows
Go to PC settings to activate Windows.
Path = c:\users\erica n sichula\documents
DB = none
WF = vecm_roa
8:30 PM
30/06/2018

STEP 4 (Cont.)



This is the error correction system model equation which include the probability (p) values of the variables.

APPENDIX 4: Granger Causality Test Results – ROA as Dependent Variable

Null Hypothesis:	F-Statistic	Prob.	Conclusion
LNCU does not Granger Cause ROA	0.24848	0.6193	No causality
ROA does not Granger Cause LNCU	0.12992	0.7193	No causality
FA does not Granger Cause ROA	0.10436	0.7474	No causality
ROA does not Granger Cause FA	3.78188	0.0549	No causality
LNFOREX does not Granger Cause ROA	4.32204	0.0404	**Causality**
ROA does not Granger Cause LNFOREX	0.55639	0.4576	No causality
IBLR does not Granger Cause ROA	0.65885	0.4191	No causality
ROA does not Granger Cause IBLR	0.6973	0.4059	No causality
INFL does not Granger Cause ROA	0.10706	0.7443	No causality
ROA does not Granger Cause INFL	2.29337	0.1334	No causality
LQD does not Granger Cause ROA	0.27878	0.5988	No causality
ROA does not Granger Cause LQD	3.26437	0.0741	No causality
NPL does not Granger Cause ROA	3.70143	0.0575	No causality
ROA does not Granger Cause NPL	7.21212	0.0086	**Causality**
PRV does not Granger Cause ROA	8.40946	0.0047	**Causality**
ROA does not Granger Cause PRV	0.02202	0.8824	No causality
CRISIS does not Granger Cause ROA	4.45435	0.0375	**Causality**
ROA does not Granger Cause CRISIS	2.21393	0.1402	No causality
FA does not Granger Cause LNCU	0.10427	0.7475	No causality
LNCU does not Granger Cause FA	1.1342	0.2897	No causality
LNFOREX does not Granger Cause LNCU	0.24346	0.6229	No causality
LNCU does not Granger Cause LNFOREX	0.37332	0.5427	No causality
IBLR does not Granger Cause LNCU	3.09037	0.0821	No causality
LNCU does not Granger Cause IBLR	0.442	0.5078	No causality

(Cont.)

Null Hypothesis:	F-Statistic	Prob.	Conclusion
INFL does not Granger Cause LNCU	7.90461	0.006	**Causality**
LNCU does not Granger Cause INFL	0.24417	0.6224	No causality
LQD does not Granger Cause LNCU	0.91901	0.3402	No causality
LNCU does not Granger Cause LQD	1.72572	0.1922	No causality
NPL does not Granger Cause LNCU	2.50022	0.1173	No causality
LNCU does not Granger Cause NPL	2.32508	0.1307	No causality
PRV does not Granger Cause LNCU	0.88553	0.3492	No causality
LNCU does not Granger Cause PRV	3.0655	0.0833	No causality
CRISIS does not Granger Cause LNCU	7.86918	0.0061	**Causality**
LNCU does not Granger Cause CRISIS	0.37855	0.5399	No causality
LNFOREX does not Granger Cause FA	1.6107	0.2076	No causality
FA does not Granger Cause LNFOREX	3.15351	0.0791	No causality
IBLR does not Granger Cause FA	0.4543	0.502	No causality
FA does not Granger Cause IBLR	0.34383	0.5591	No causality
INFL does not Granger Cause FA	0.40449	0.5264	No causality
FA does not Granger Cause INFL	0.10978	0.7411	No causality
LQD does not Granger Cause FA	3.74987	0.0559	No causality
FA does not Granger Cause LQD	0.8924	0.3473	No causality
NPL does not Granger Cause FA	4.21477	0.0429	**Causality**
FA does not Granger Cause NPL	0.68362	0.4105	No causality
PRV does not Granger Cause FA	0.07435	0.7857	No causality
FA does not Granger Cause PRV	2.63745	0.1078	No causality
CRISIS does not Granger Cause FA	0.00112	0.9734	No causality
FA does not Granger Cause CRISIS	0.84016	0.3617	No causality
IBLR does not Granger Cause LNFOREX	2.98812	0.0872	No causality
LNFOREX does not Granger Cause IBLR	0.05046	0.8228	No causality

(Cont.)

Null Hypothesis:	F-Statistic	Prob.	Conclusion
INFL does not Granger Cause LNFOREX	1.95881	0.165	No causality
LNFOREX does not Granger Cause INFL	0.00489	0.9444	No causality
LQD does not Granger Cause LNFOREX	0.19825	0.6572	No causality
LNFOREX does not Granger Cause LQD	3.42656	0.0674	No causality
NPL does not Granger Cause LNFOREX	0.68132	0.4113	No causality
LNFOREX does not Granger Cause NPL	0.59038	0.4442	No causality
PRV does not Granger Cause LNFOREX	6.22918	0.0143	**Causality**
LNFOREX does not Granger Cause PRV	1.65275	0.2018	No causality
CRISIS does not Granger Cause LNFOREX	11.1343	0.0012	**Causality**
LNFOREX does not Granger Cause CRISIS	4.0305	0.0476	No causality
INFL does not Granger Cause IBLR	4.07464	0.0464	**Causality**
IBLR does not Granger Cause INFL	0.10611	0.7454	No causality
LQD does not Granger Cause IBLR	2.5146	0.1162	No causality
IBLR does not Granger Cause LQD	4.35056	0.0398	**Causality**
NPL does not Granger Cause IBLR	17.4787	7.00E-05	**Causality**
IBLR does not Granger Cause NPL	0.54016	0.4642	No causality
PRV does not Granger Cause IBLR	0.27058	0.6042	No causality
IBLR does not Granger Cause PRV	0.64325	0.4246	No causality
CRISIS does not Granger Cause IBLR	1.23226	0.2699	No causality
IBLR does not Granger Cause CRISIS	0.25737	0.6131	No causality
LQD does not Granger Cause INFL	1.27989	0.2609	No causality
INFL does not Granger Cause LQD	3.72744	0.0566	No causality
NPL does not Granger Cause INFL	3.78849	0.0547	No causality
INFL does not Granger Cause NPL	1.24746	0.2669	No causality

(Cont.)

Null Hypothesis:	F-Statistic	Prob.	Conclusion
PRV does not Granger Cause INFL	3.7871	0.0547	No causality
INFL does not Granger Cause PRV	4.01779	0.048	**Causality**
CRISIS does not Granger Cause INFL	3.34564	0.0706	No causality
INFL does not Granger Cause CRISIS	0.15382	0.6958	No causality
NPL does not Granger Cause LQD	6.03631	0.0159	**Causality**
LQD does not Granger Cause NPL	3.74002	0.0562	No causality
PRV does not Granger Cause LQD	0.3967	0.5304	No causality
LQD does not Granger Cause PRV	0.37679	0.5408	No causality
CRISIS does not Granger Cause LQD	0.85261	0.3582	No causality
LQD does not Granger Cause CRISIS	3.01062	0.0861	No causality
PRV does not Granger Cause NPL	0.9239	0.339	No causality
NPL does not Granger Cause PRV	2.97708	0.0878	No causality
CRISIS does not Granger Cause NPL	5.71783	0.0188	**Causality**
NPL does not Granger Cause CRISIS	3.84423	0.0529	No causality
CRISIS does not Granger Cause PRV	0.9256	0.3385	No causality
PRV does not Granger Cause CRISIS	0.79185	0.3759	No causality

APPENDIX 5: VEC Model - NPL as Dependent Variable

Lag Selection Criteria:

Lag	Criteria					
	LogL	LR	FPE	AIC	SC	HQ
0	-614.4108	NA	8.79E-06	13.89914	14.39579*	14.09951*
1	-532.2019	144.5432	8.65e-06*	13.87257*	16.60416	14.9746
2	-487.413	69.89032	2.03E-05	14.66842	19.63495	16.67211
3	-409.0383	106.7963	2.47E-05	14.72612	21.92759	17.63146
4	-305.5078	120.5959*	2.00E-05	14.23094	23.66736	18.03795

VECM System Equation:

D(NPL) = C(1)*(NPL(-1) + 0.184405161341*FA(-1) + 0.189771647236*IBLR(-1) - 0.0210882689889*INFL(-1) - 0.00447765678212*LNCU(-1) + 3.59149362775*LNFOREX(-1) - 0.313363480115*LQD(-1) -0.019881687002*PRV(-1) + 0.645453886093*ROA(-1) +7.15267456178) + C(2)*D(NPL(-1)) + C(3)*D(NPL(-2)) + C(4)*D(NPL(-3)) + C(5)*D(NPL(-4)) + C(6)*D(FA(-1)) + C(7)*D(FA(-2)) + C(8)*D(FA(-3)) + C(9)*D(FA(-4)) + C(10)*D(IBLR(-1)) + C(11)*D(IBLR(-2)) + C(12) *D(IBLR(-3)) + C(13)*D(IBLR(-4)) + C(14)*D(INFL(-1)) + C(15)*D(INFL(-2)) + C(16)*D(INFL(-3)) + C(17)*D(INFL(-4)) + C(18)*D(LNCU(-1)) + C(19)*D(LNCU(-2)) + C(20)*D(LNCU(-3)) + C(21)*D(LNCU(-4)) + C(22)*D(LNFOREX(-1)) + C(23)*D(LNFOREX(-2)) + C(24)*D(LNFOREX(-3)) + C(25)*D(LNFOREX(-4)) + C(26)*D(LQD(-1)) + C(27)*D(LQD(-2)) + C(28)*D(LQD(-3)) + C(29)*D(LQD(-4)) + C(30)*D(PRV(-1)) + C(31)*D(PRV(-2)) + C(32)*D(PRV(-3)) + C(33)*D(PRV(-4)) + C(34)*D(ROA(-1)) + C(35)*D(ROA(-2)) + C(36)*D(ROA(-3)) + C(37)*D(ROA(-4)) + C(38) + C(39)*CRISIS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.0257	0.095291	-0.269651	0.7885
C(2)	0.111698	0.17714	0.630561	0.5311
C(3)	0.050617	0.146599	0.345279	0.7313
C(4)	-0.25116	0.160277	-1.567044	0.1232
C(5)	0.093928	0.154736	0.607022	0.5465
C(6)	0.032811	0.031011	1.058035	0.2949
C(7)	0.022506	0.028706	0.784036	0.4366
C(8)	-0.05152	0.027919	-1.845482	0.0707
C(9)	-0.02922	0.024966	-1.170215	0.2472
C(10)	-0.02218	0.020292	-1.092946	0.2795
C(11)	0.008832	0.019674	0.448914	0.6554

C(12)	-0.00874	0.018129	-0.481964	0.6319
C(13)	0.003013	0.016951	0.177769	0.8596
C(14)	-0.04027	0.050704	-0.794223	0.4307
C(15)	0.027746	0.055958	0.495842	0.6221
C(16)	-0.13634	0.051088	-2.668736	0.0101
C(17)	0.064986	0.05628	1.154698	0.2535
C(18)	0.559242	0.334565	1.67155	0.1006
C(19)	0.079985	0.325917	0.245416	0.8071
C(20)	0.348641	0.32732	1.065138	0.2917
C(21)	-0.53106	0.377668	-1.406155	0.1656
C(22)	0.783796	1.078734	0.726589	0.4707
C(23)	-0.46888	1.09693	-0.427451	0.6708
C(24)	1.384246	1.039431	1.331735	0.1888
C(25)	-0.18498	1.011812	-0.182823	0.8556
C(26)	-0.03576	0.03508	-1.019378	0.3127
C(27)	-0.0611	0.031612	-1.932909	0.0587
C(28)	0.00686	0.031279	0.21931	0.8273
C(29)	0.001616	0.025877	0.06244	0.9505
C(30)	0.04977	0.040837	1.218744	0.2284
C(31)	-0.06333	0.040418	-1.566818	0.1232
C(32)	-0.04718	0.04589	-1.028024	0.3087
C(33)	-0.06436	0.035698	-1.802816	0.0772
C(34)	-0.05167	0.077282	-0.668643	0.5067
C(35)	0.001011	0.079217	0.012759	0.9899
C(36)	0.006952	0.074287	0.093582	0.9258
C(37)	-0.14398	0.064156	-2.244184	0.0291
C(38)	-0.03391	0.036851	-0.920253	0.3617
C(39)	0.26311	0.116846	2.251769	0.0286

R-squared	0.591146	Mean dependent var	0.016896
Adjusted R-squared	0.292368	S.D. dependent var	0.315156
S.E. of regression	0.265112	Akaike info criterion	0.480197
Sum squared resid	3.654782	Schwarz criterion	1.556279
Log likelihood	17.15105	Hannan-Quinn criter.	0.914329
F-statistic	1.978545	Durbin-Watson stat	1.918539
Prob(F-statistic)	0.011238		

Residual Diagnostic Checks

Test	Test Statistic	Prob. (P-Value)	Decision
i) Serial Correlation LM Test	Obs*R-Square = 8.621	0.07	Do not reject
ii) Heteroscedasticity Test	Obs*R-Square = 54.107	0.19	Do not reject
iii) Normality Test	Jarque-Bera = 0.630	0.73	Do not reject

APPENDIX 6: Granger Causality Test Results - NPL as Dependent Variable

Null Hypothesis:	F-Statistic	Prob.	Conclusion
LNCU does not Granger Cause NPL	2.1567	0.081	No causality
NPL does not Granger Cause LNCU	1.62726	0.1751	No causality
FA does not Granger Cause NPL	0.1622	0.9569	No causality
NPL does not Granger Cause FA	1.19824	0.3178	No causality
LNFOREX does not Granger Cause NPL	0.45306	0.7699	No causality
NPL does not Granger Cause LNFOREX	0.95596	0.4362	No causality
IBLR does not Granger Cause NPL	2.691	0.0366	**Causality**
NPL does not Granger Cause IBLR	6.49994	0.0001	**Causality**
INFL does not Granger Cause NPL	2.62511	0.0403	**Causality**
NPL does not Granger Cause INFL	1.56808	0.1905	No causality
LQD does not Granger Cause NPL	2.0347	0.097	No causality
NPL does not Granger Cause LQD	2.5636	0.0442	**Causality**
PRV does not Granger Cause NPL	0.91175	0.4611	No causality
NPL does not Granger Cause PRV	4.55071	0.0023	**Causality**
ROA does not Granger Cause NPL	2.12999	0.0843	No causality
NPL does not Granger Cause ROA	0.64876	0.6293	No causality
CRISIS does not Granger Cause NPL	2.37221	0.0589	No causality
NPL does not Granger Cause CRISIS	1.05716	0.383	No causality
FA does not Granger Cause LNCU	1.03707	0.3931	No causality
LNCU does not Granger Cause FA	0.35925	0.8369	No causality
LNFOREX does not Granger Cause LNCU	0.82657	0.512	No causality
LNCU does not Granger Cause LNFOREX	1.89621	0.1188	No causality
IBLR does not Granger Cause LNCU	2.68091	0.0371	**Causality**
LNCU does not Granger Cause IBLR	0.14176	0.9661	No causality

(Cont.)

Null Hypothesis:	F-Statistic	Prob.	Conclusion
INFL does not Granger Cause LNCU	3.74604	0.0075	**Causality**
LNCU does not Granger Cause INFL	1.3082	0.2737	No causality
LQD does not Granger Cause LNCU	1.96899	0.1068	No causality
LNCU does not Granger Cause LQD	7.13471	5.00E-05	**Causality**
PRV does not Granger Cause LNCU	0.32676	0.8593	No causality
LNCU does not Granger Cause PRV	1.59578	0.1831	No causality
ROA does not Granger Cause LNCU	1.78476	0.1396	No causality
LNCU does not Granger Cause ROA	0.26544	0.8994	No causality
CRISIS does not Granger Cause LNCU	2.25098	0.0705	No causality
LNCU does not Granger Cause CRISIS	1.15887	0.335	No causality
LNFOREX does not Granger Cause FA	0.71796	0.582	No causality
FA does not Granger Cause LNFOREX	0.25917	0.9033	No causality
IBLR does not Granger Cause FA	1.68148	0.162	No causality
FA does not Granger Cause IBLR	0.50711	0.7306	No causality
INFL does not Granger Cause FA	0.16459	0.9557	No causality
FA does not Granger Cause INFL	0.51027	0.7283	No causality
LQD does not Granger Cause FA	1.73862	0.1492	No causality
FA does not Granger Cause LQD	1.30539	0.2748	No causality
PRV does not Granger Cause FA	0.27659	0.8923	No causality
FA does not Granger Cause PRV	0.07473	0.9897	No causality
ROA does not Granger Cause FA	0.98165	0.4222	No causality
FA does not Granger Cause ROA	0.47213	0.756	No causality
CRISIS does not Granger Cause FA	0.32677	0.8593	No causality
FA does not Granger Cause CRISIS	0.6661	0.6173	No causality
IBLR does not Granger Cause LNFOREX	0.72113	0.5799	No causality
LNFOREX does not Granger Cause IBLR	0.6685	0.6157	No causality

(Cont.)

Null Hypothesis:	F-Statistic	Prob.	Conclusion
INFL does not Granger Cause LNFOREX	0.8874	0.4753	No causality
LNFOREX does not Granger Cause INFL	1.49961	0.2098	No causality
LQD does not Granger Cause LNFOREX	0.47154	0.7565	No causality
LNFOREX does not Granger Cause LQD	0.78049	0.541	No causality
PRV does not Granger Cause LNFOREX	1.93999	0.1114	No causality
LNFOREX does not Granger Cause PRV	1.83224	0.1304	No causality
ROA does not Granger Cause LNFOREX	1.19353	0.3198	No causality
LNFOREX does not Granger Cause ROA	0.98126	0.4224	No causality
CRISIS does not Granger Cause LNFOREX	1.08882	0.3675	No causality
LNFOREX does not Granger Cause CRISIS	2.03639	0.0967	No causality
INFL does not Granger Cause IBLR	4.55001	0.0023	**Causality**
IBLR does not Granger Cause INFL	0.14294	0.9656	No causality
LQD does not Granger Cause IBLR	0.86506	0.4885	No causality
IBLR does not Granger Cause LQD	1.84304	0.1283	No causality
PRV does not Granger Cause IBLR	1.95895	0.1084	No causality
IBLR does not Granger Cause PRV	0.09485	0.9838	No causality
ROA does not Granger Cause IBLR	1.34768	0.2593	No causality
IBLR does not Granger Cause ROA	0.86572	0.4881	No causality
CRISIS does not Granger Cause IBLR	0.92887	0.4513	No causality
IBLR does not Granger Cause CRISIS	0.13998	0.9669	No causality
LQD does not Granger Cause INFL	1.57469	0.1887	No causality
INFL does not Granger Cause LQD	1.06153	0.3808	No causality
PRV does not Granger Cause INFL	0.91495	0.4593	No causality
INFL does not Granger Cause PRV	0.98835	0.4186	No causality
ROA does not Granger Cause INFL	1.39993	0.2412	No causality
INFL does not Granger Cause ROA	0.85892	0.4922	No causality

(Cont.)

Null Hypothesis:	F-Statistic	Prob.	Conclusion
CRISIS does not Granger Cause INFL	1.43222	0.2306	No causality
INFL does not Granger Cause CRISIS	0.82879	0.5106	No causality
PRV does not Granger Cause LQD	1.40074	0.2409	No causality
LQD does not Granger Cause PRV	1.06964	0.3768	No causality
ROA does not Granger Cause LQD	2.18261	0.078	No causality
LQD does not Granger Cause ROA	1.16869	0.3306	No causality
CRISIS does not Granger Cause LQD	0.37834	0.8235	No causality
LQD does not Granger Cause CRISIS	1.06153	0.3808	No causality
ROA does not Granger Cause PRV	1.24888	0.2968	No causality
PRV does not Granger Cause ROA	2.24598	0.071	No causality
CRISIS does not Granger Cause PRV	0.79873	0.5294	No causality
PRV does not Granger Cause CRISIS	0.48915	0.7437	No causality
CRISIS does not Granger Cause ROA	2.42496	0.0544	No causality
ROA does not Granger Cause CRISIS	0.43628	0.782	No causality