REAL EXCHANGE RATE DETERMINANTS IN TRANSITION ECONOMIES:

DO MACROECONOMIC FUNDAMENTALS AND POLITICAL RISK PLAY A ROLE?

by

VAHÉ HEBOYAN

(Under the Direction of Lewell F. Gunter)

ABSTRACT

The real exchange rate being the most important relative price in international economics plays a critical role in determining the competitiveness, resource allocation, the direction of international trade, and the economic growth and development in a particular country. Political factors are often cited in the theoretical literature as potential determinants of foreign exchange volatility. However, these factors are seldom captured in empirical exchange rate models, especially in transition and developing countries.

Armenia witnessed an impressive economic growth during its transition from the Soviet centrally planned to the market economy. By mid-2000s, Armenia was able to achieve a sustained economic growth, which was accompanied by drastic appreciation of Armenia's national currency by 46% between 2003 and 2007. Rapid appreciation triggered alarms and gave rise to speculative theories of government manipulation to pocket hard currency and benefit government-connected importers. Central Bank denied all wrongdoing and insisted that drastic increases in dollar remittances and economic growth were major cause. Thus, scientifically robust explanations are timely and crucial to avoid further speculation and manipulations for political gains.

This study utilizes multiple econometric estimation approaches (VAR, VECM and ARDL) to analyze real exchange rate dynamics in relation to economic fundamentals. We then incorporate

several political risk indicators in the analysis to see if they improve the overall performance of the real exchange rate models and inquire if changes in the political climate have affected the real exchange rate in Armenia. Finally, we evaluate the out-of-sample forecasting power of these models to (1) make an inference on the overall effectiveness of these models to forecast real exchange rate in a transition country; (2) examine if accounting for the political climate and investment risk helps to improve the forecasting power; and (3) see if any of these models perform better than the simple random walk as argued in Meese and Rogoff (1983a).

Results provide strong indications that the real exchange rate dynamics over the study period were driven by economic developments and weigh against the claim that the government and the Central Bank directly manipulated the exchange rate. Evaluation of alternative estimation approaches based on their out-of-sample forecasting performance provide a strong support for a more recent bounds testing and ARDL estimation approaches over the traditional VAR and VECM in out-of-sample forecasting performance. Furthermore, results indicate that the ARDL models (both, with and without political risk) perform slightly better in out-of-sample forecasting as compared to the random walk. Our findings empirically confirm the theoretical findings of Pesaran and Shin (1998) and Pesaran *et al.* (2001) for this analysis.

Even though the initial analysis showed that the political risk indicators are often correlated with the main political and economic events in Armenia, our results suggest very weak or no effect of the political risk factors on Armenia's real exchange rate. This suggests a minor role for political risk in the decisions of major foreign investors in Armenia, which may in part be explained by a different investment decision-making rationale for Diaspora represented investors.

INDEX WORDS: real exchange rate, cointegration, bounds testing, ARDL modeling, political risk, Armenia, VAR, VECM, random walk, transition economy

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by

VAHÉ HEBOYAN

B.S., Armenian Agricultural Academy, Armenia, 1999

M.S., The University of Georgia, 2001

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VAHÉ HEBOYAN

Major Professor: Lewell F. Gunter

Committee: William D. Lastrapes
James E. Epperson

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
August 2011

To my Family

In living memory of my grandfather Khachatur (Bulo) Sahakyan

Նվիրում եմ իմ ընտանիքին

Ի հիշատակ իմ պապի՝ Խաչատուր (Բուլո) Սահակյանի

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This journey has come to an end and another chapter is closing in my life. It was an extraordinary experience and I look forward to the new professional challenges ahead.

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CHAPTER 1

INTRODUCTION

1.1 Motivation

Economic problems associated with exchange rate dynamics have become a major area of interest in macroeconomic research. Determination of the *right* exchange rate has been a key objective for international investors, multinational corporations, and scientists (Rosenberg, 2003). Equally, the choice/adoption of the right exchange rate regime was on the agenda during 1980s and 1990s transition process from centrally planned to market oriented economy in the countries of the former Soviet Union (FSU) and Central and Eastern Europe (CEE). Several scientists have blamed economic crises in the developing world as being directly or indirectly caused by inappropriate exchange rate policies in those countries[1]. Understanding of exchange rate behavior, underlying determinants, equilibrium path, exchange rate misalignment, and the impact on the overall economic performance and competitiveness have always been of great importance in the exchange rate literature (Edwards, 1989; Égert*, et al.*, 2006).

The real exchange rate (RER) is the most important relative price in international finance and plays a crucial role in determining the competitive position of a country in the global market. RER overvaluation is singled out as the most important factor responsible for weak economic performance (Naja, 1998). It directly impacts inflation and outputs in every economy and is most important for the young and fragile economies in transition.

[1] Edwards (1989) refers to the 1980s debt crisis (Cline, 1983), failed experiments with free market policies in the Southern Cone (Corbo*, et al.*, 1986), and the disappointing performance of Africa's agricultural sector (World Bank, 1984).

Productivity growth, increases in real wages, liberalization of capital accounts, increased foreign direct investments (FDI), and private remittances put an upward pressure on the real exchange rates. In recent years major changes in exchange rate movements have been observed among many transition economies of the former Soviet Union (FSU) and Central and Eastern Europe (CEE), which raised the issue of whether this trend reflects adjustment towards equilibrium due to an initial undervaluation, or whether it corresponds to an equilibrium appreciation. As a result, supported with increased availability of data points and quality, exchange rate research focusing on developing and transition economies has witnessed unprecedented growth (Égert*, et al.*, 2006).

Appreciation of exchange rates has very important macroeconomic consequences. It may alter international competitiveness of the country, may affect inflation, output and FDI significantly, and may also signal a currency crisis (Dibooglu and Kutan, 2001). However, undervaluation of the currency may also have negative economic consequences. For example, it may lead to higher inflation and price instability due to dramatic growth in exports. Thus, understanding the exchange rate dynamics and determinants, adopting the *right* exchange rate policy, and getting the exchange rate *right* becomes crucial for the overall success of the economy during the transition and in the long run (Égert*, et al.*, 2006).

Fueled by large volume of remittances from abroad and liberal market and economic reforms that promoted investor confidence and boosted exports, Armenia was quick to recover from economic decline experienced by all transition countries of the FSU and CEE in early 1990s (World Bank, 2010). By mid-2000s, Armenia was able to achieve an impressive economic growth that earned her the title of *The Caucasian Tiger* (Mitra, et al., 2007).

During the transition period, Armenia's exchange rate has seen major developments. With respect to US dollar, Euro, and Russian Ruble, it exhibited significant depreciation during late 1990s

and early 2000s, rapid appreciation during the mid-2000s, and sharp depreciation during the late-2000s amid global economic slowdown (Figure 1.1).

The Central Bank of Armenia (CBA), prominent economists, businessmen, and politicians offered their own interpretation of the causes of the exchange rate movements, in many cases causing further controversies on the matter. CBA has backed an official government view that the exchange rate movements are directly linked to (1) the significant changes in the remittances[2] regularly sent home by hundreds of thousands of Armenians working abroad, (2) volatile international commodity and raw material markets, and (3) continuously changing value of the US dollar in international currency markets. In contrast, some politicians and economists critical of government policies argue that the authorities have engineered the dramatic changes to pocket part of the hard currency and to benefit import and domestic businesses either controlled or owned by government officials.

Whatever the cause is, drastic movements in the exchange rate have generated negative reactions from affected businesses and the hundreds of thousands of Armenian families that rely heavily on remittances from abroad and others who are affected by the depreciating national currency. Contradicting arguments and statements continue to dominate public and private discussions in Armenia. Thus, scientifically robust explanations are timely and crucial to avoid further speculation and accusations around monetary developments in Armenia.

Furthermore, exchange rate economists have long argued and debated over the right exchange rate determination model and a consensus has yet to be reached. The former Federal Reserve Chairman, Alan Greenspan, is quoted (US Senate, 2002) saying that despite considerable investment in exchange rate determination research at the Federal Reserve, no consistent approach

[2] The World Bank estimates that foreign remittances have accounted for 20 percent of Armenia's GDP on average during early to mid-2000s (Mitra*, et al.*, 2007, p. 501).

has been produced that helps to consistently explain and predict exchange rates not only here in the US but also abroad.

Research has evolved through the last half century developing new and more complex theoretical approaches and more robust estimation techniques for modeling exchange rate volatility. However, in their seminal article Meese and Rogoff (1983a) and later Meese (1990) demonstrated that none of these models out-perform the random walk model in out-of-sample forecasting. These findings still stand and keep the economic community focused on the quest for better exchange rate model.

The literature has argued that the omission of political factors may in part be the reason for the lack of forecasting power[3]. However, the empirical exchange rate determination literature on newly emerging and transition economies has been largely silent about political risk factors which have largely been omitted when explaining the exchange rate dynamics in these economies. Thus, it is warranted to examine the role of political risk factors in determining the real exchange rate in a transition economy with an aim to potentially improve the out-of-sample performance of the model.

1.2 Objectives

This dissertation investigates exchange rate dynamics in post-Soviet transition economies with a primary focus on Armenia. It does not intend to be a review or critique of exchange rate theory, modeling methods, approaches, and techniques. A consensus on the validity and significance of those is yet to be reached among economists. This study's overall objective is to survey, adapt, and extend empirical models from monetary and financial economics to the benefit of understanding and practical modeling of exchange rate dynamics and behavior in these economies. Specific objectives of this study are to:

[3] More on this topic is discussed in Chapter 4.1.

(a) identify the modeling approach that better suits the small sample properties of our study based on the evaluation of the out-of-sample forecasting power of various estimation approaches.

(b) investigate the role of macroeconomic fundamentals on the real exchange rate dynamics in Armenia with an objective to determine if the real exchange rate developments were induced by changes in the fundamentals or, as some have suggested, were results of manipulations to favor business interests strategically connected to the political establishment and country's leadership; and

(c) assess the potential of improving the out-of-sample forecasting performance of the real exchange rates model by accounting for the changes in the political climate and investment risk.

1.3 Structure of the Dissertation

Chapter 2 discusses the developments in Armenia's economy since its independence from the Soviet Union and developments in its foreign exchange market. Chapter 3 discusses the theoretical modeling approaches used in this study and provides a rationale for adopting Edwards' (1989) open economy real exchange rate model. Chapter 4 uses various modeling approaches to investigate the real exchange rate dynamics in relation to the economic fundamentals and political climate/risk. The study concludes with a summary, policy implications, and suggestions for future research in Chapter 5.

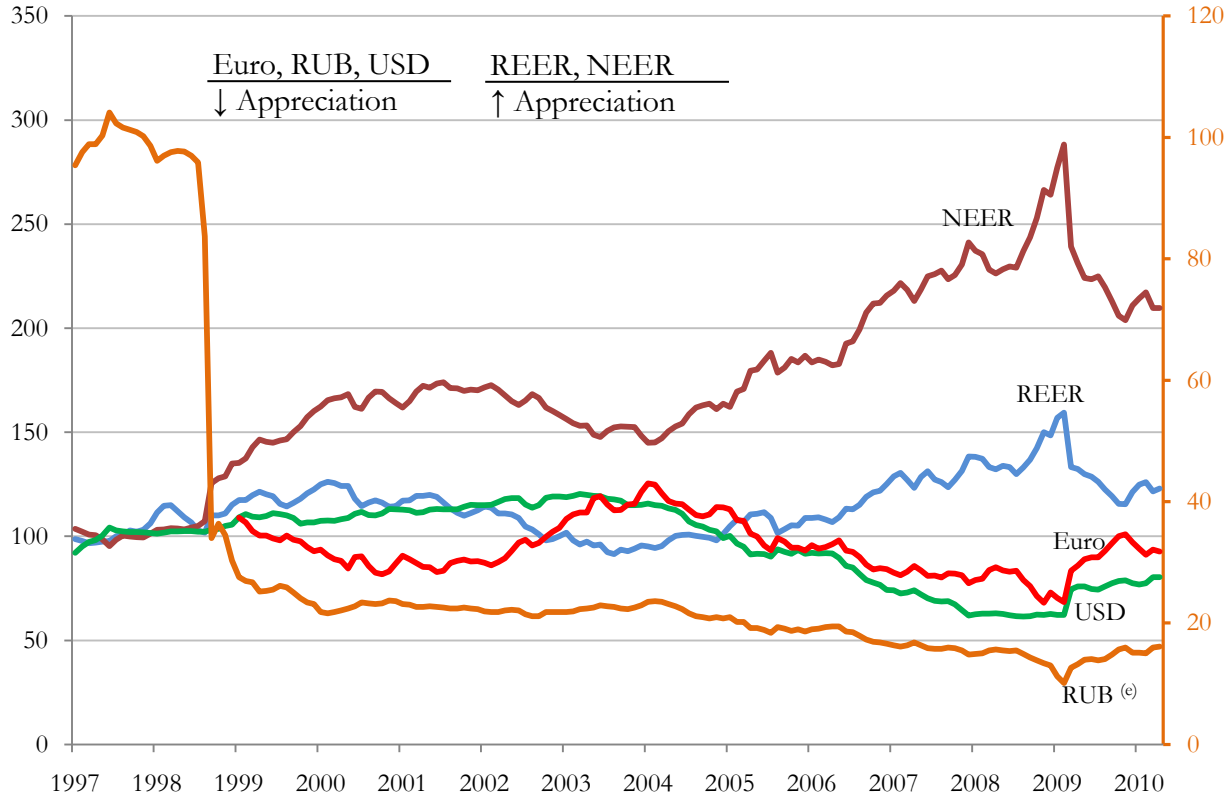


Figure 1.1. Effective[(a)] and Select Bilateral Exchange Rates, Armenia, 1997=100[b], 1997-2010
Source: CBA (2010); EDRC (2010)

Note:

(a) Effective exchange rates by 11 partner-countries, excluding humanitarian aid, natural gas, petroleum and diamonds, 2003-2007 weights, 1997 = 100.
(b) Base year for Euro is 1999 (1999=100).
(c) REER = Real Effective Exchange Rate
(d) NEER =Nominal Effective Exchange Rate
(e) RUB = Russian Rubble (right axis)
(f) USD = U.S. Dollar

CHAPTER 2

STATE OF THE ECONOMY IN TRANSITION:

ACHIEVEMENTS AND CHALLENGES

"Armenia was the California of Soviet high technology, the Italy of Soviet shoe manufacturing, the France of Soviet-made cognac"
- National Geographic (Viviano, 2004)

2.1 Soviet Legacy and the Path to Market Economy

The Republic of Armenia is a land-locked country situated on the south-eastern edge of Europe – in the Caucasus. For over 70 years Armenia was part of the former Soviet Union and its centrally planned economy. Armenia's transition to modern democracy and market economy started after the collapse of the Soviet Union in 1991. During the early transition (1991-93) Armenia's GDP fell by nearly 60 percent, living standards plummeted, and real wages declined to about 6 percent of their 1991 level. In the aftermath, over 700,000 people (20%)[4] became unemployed and poverty spread all over the country hitting the urban areas the hardest due to the lack of access to agricultural land and means of basic food production (World Bank, 1993; 1996).

Armenia started to show signs of macroeconomic stabilization with the introduction of the national currency in 1994, tightening of monetary policies, significant reductions in lending and subsidies to the private sector, prioritization of public expenditures, and improvements in tax collection. As a result, Armenia was able to stabilize and gradually lower its fiscal deficit from 48 percent of GDP in 1993 to 16.5 percent in 1994 and to 9.9 percent in 1995. Inflation also stabilized, averaging just 2 percent per month in 1995 compared to 46 percent a month in the first quarter of

[4] Total population in Armenia in 1993 was 3.4 million (World Bank, 2007) .

1994. Since early 1994, the nominal exchange rate also showed signs of stabilization further reinforcing confidence in the national currency – *the Dram*.

External developments have played a significant role in supporting and enhancing Armenia's economic reforms, facilitating its recovery, and, most importantly, improving foreign investor confidence and attracting FDIs. Increasing political and civil stability in Georgia and, most importantly, the 1994 cease-fire between Armenia and Azerbaijan brought relative stability in the region and accelerated reforms. Additionally, rapidly growing trade with Iran and development of export markets in the Middle East and Asia (via transportation links through Iran) further contributed towards easing economic isolation and boosted economic activity.

A crucial and unique factor in Armenia's quest for independent statehood and economic development was its Diaspora[5]. Following the 1988 earthquake and independence from the Soviet Union, the Armenian Diaspora has been instrumental in providing vital economic and political support for rebuilding earthquake-torn communities and substantially easing the transition process. Representatives of the Diaspora were the first to invest in Armenia at the time when conventional investors were still examining Armenia's investment risk and rating. By the mid-1990s Armenia was able to stabilize its internal and external imbalances and embark onto a journey towards economic recovery and development that would later earn her the nickname of *The Caucasian Tiger* by the World Bank.

2.2 The Quest for Growth

Armenia started implementing its major economic reforms early in 1991-94 by liberalizing prices, removing price controls and subsidies, starting privatization of land and state-owned

[5] Definition for "Diaspora" in the Merriam-Webster Online Dictionary (www.merriam-webster.com) reads: (a) *the movement, migration, or scattering of a people away from an established or ancestral homeland* and (b) *people settled far from their ancestral homelands*.

enterprises, and setting up policies to promote foreign trade and foreign exchange. During 1995-97, most of earlier polices were sustained, capital accounts were liberalized, privatization of large-scale state assets started, tax and customs regulations and laws were substantially reformed, and new targeted reforms were initiated for banking, telecommunications, and water sectors. The next phase of major economic reforms was implemented during late 1990s and early 2000s. These were designed to complete privatization, significantly improve taxation, customs administration, advance competition, develop infrastructures and telecommunications, and regulate banking, financial, and energy sectors. A discussion of major economic reforms in Armenia is provided in Gelbard *et al.* (2005).

As of 2009, Armenia's progress towards a market economy, as measured by the EBRD transition indicators, has been average compared to that of the rest of transition countries in the FSU and CEE (EBRD, 2009). Armenia has advanced in fully privatizing land and state-owned assets and liberalizing prices and trade. However, the *de facto* progress has been far from desired. Freinkman (2001) argued that Armenia's business culture evolved by establishing close links and financial interests between businesses and the government ministers and policymakers, which resulted in the establishment of a non-competitive business environment and barriers for entry thus limiting small and medium business from successfully competing and growing independently from political and business "elite".

Armenia's economy registered double digit economic growth during 2002-2007 averaging 13.1% of real GDP growth per year (World Bank, 2010). Mitra, *et al.* (2007) explain such impressive growth largely by private sector productivity gains as a result of improved macroeconomic stability, expanded role of private markets, limited public sector, and instituted important measures targeting free price formation, liberal trade, private ownership of assets, and industrial restructuring.

Armenia's per capita GDP has more than quadrupled since the start of the transition. However, significant dram appreciation during the same period (Figure 1.1) has weakened external competitiveness, reduced purchasing power, and caused significant harm to the large segments of the population that heavily rely on foreign-currency denominated remittances[6] and savings (IMF, 2006).

Economic growth in Armenia has been primarily driven by gains in total factor productivity (TFP) that reflects efficiency gains from macroeconomic stabilization, structural changes, and improved utilization of resource. Gelbard, *et al.* (2005, p. 26) estimated that Armenia's TFP grew at an average rate of 5.3% and 8.4% per year during 1998-2000 and 2001-2004, respectively. Moreover, Mitra, *et al.* (2007) show that Armenia achieved higher growth in labor productivity compared to the GDP growth - narrowing the gap with the industrialized countries, which still remains substantial. Armenia was able to stabilize and lower inflation, averaging 3.7% annually during 1998-2009, by reducing fiscal and quasi-fiscal deficits.

Armenia's economic growth has been, in part, export-led. Armenia liberalized its trade and exchange rate regimes at the very beginning of the transition period; however significant setbacks in early transition years due to economic and geopolitical developments in the post-Soviet territories, reduced demand in traditional export markets. In real terms, exports grew, on average, 20% per year during 1999-2005. However, staring in 2006, despite export expansion in nominal terms, in the midst of rapid appreciation of the national currency export value in real terms started to decline (World Bank, 2010). Armenia's export market diversification remains very low. A small number of countries, Belgium, Iran, Georgia, Germany, Russia, and United Stated, have accounted for the bulk of Armenia's exports[7]. Such concentration creates potential vulnerability to geo-political and

[6] Primarily transfers from Russia and United States.
[7] Detail statistics is available from EDRC at http://edrc.am/project.html?cat_id=70.

country-specific economic developments as well as bilateral exchange rate dynamics that may significantly alter Armenia's exports.

In summary, Armenia's economic fundamentals remain fragile and strongly correlated with external developments. Its dependency on few export markets, growth dominance of remittance-financed construction sector, export exposure volatility in world commodity markets, closed borders, and unhealthy entrepreneurial business environment signal a need for the next round of comprehensive and fundamental reforms aimed at eliminating monopolistic and oligopolistic business practices and creating fair competition and unconstrained entry for small, medium, and new businesses.

2.3 Developments in the Foreign Exchange Market

On November 22, 1993, Armenia introduced its national currency, the Dram, at a rate of 200 Soviet rubles per dram. Armenia has no exchange restrictions on international transactions except for restrictions maintained for security reasons (IMF, 2006, p. 34; 2009b).

Armenia adopted an implicit inflation targeting monetary policy in 2006 (IMF, 2009b, p. 40) and the CBA has been committed to maintaining its inflation target. Even though IMF classifies Armenia's exchange rate system as "*a managed float without a predetermined path*", since 2003 CBA has been actively engaged in foreign exchange interventions to smooth exchange rate volatility due to increasing capital inflows and accommodate for its inflation targeting policy (IMF, 2009b). CBA's current year-end inflation target is 4±1.5% (IMF, 2009a, p. 6).

As Figure 1.1 shows, Armenia's exchange rate experienced initial depreciation that peaked during 2002-2003 and started to appreciate as Armenia's economy showed signs of strong economic growth. Between March 2003 and September 2007, the Armenian Dram has appreciated by 43, 28, and 26 percent in nominal terms against U.S. dollar, Euro, and Russian Ruble, respectively. Almost

immediately, such rapid appreciation has triggered alarms in various parts of the society some accusing the CBA and government in exchange rate manipulations.

The CBA strongly denied all wrongdoing and currency manipulation and insisted that drastic increases in the dollar remittances were the major cause of such changes. According to the CBA, dollar value of remittances jumped by 50 percent to $760 million in 2004. Compared to the monetary base of Armenia's small economy, about $268 million in circulation, the large amounts of remittances may indeed cause such major fluctuations in the currency exchange market.

To the contrary, critics question the credibility of the official statistics on the remittances. In particular, Eduard Aghajanov, a leading economist and the former head of the National Statistical Service (NSS) has argued that "Armenians living in Russia or the United States could not have gotten 50 percent wealthier within a year" (Danielyan, 2005).

Claims against government manipulation have become stronger due to the fact that virtually no imported products became cheaper due to the appreciation. Mr. Nasibian of the Converse Bank believes that "*the main reason for that is a very small number of importers. Each of them seems to have monopolized a particular field, making disproportionate profits*" (Danielyan, 2005). In opposition, the government and the importers claim that the price increases in the world markets offset the potential for decline in the prices for imported goods. An International Monetary Fund review (2007) has concluded that further action is needed in Armenia "*to look for ways to reduce monopolistic practices in the import business, with a view to increasing the pass-through of exchange rate changes to domestic prices.*"

The Armenian export industry has also raised alarms regarding continuing appreciation of the dram. Since late 2006, many exporters have articulated for more intervention from the CBA in the currency exchange market. Despite these calls for intervention, the CBA continued to hold to its primary objective of inflation targeting and believes that appreciation creates unique opportunity for

local businesses to boost their competitiveness through acquiring new foreign technologies (Emerging Markets Monitor, 2006).

In early 2009, as a result of the global economic crisis, the CBA had to frequently intervene into the foreign exchange market by selling large amounts of U.S. dollars every day to stabilize exchange rate in the market (IMF, 2009b). The policy proved to be unsustainable and on March 3, 2009, the CBA announced a major monetary policy move by returning to the floating exchange rate policy (CBA, 2009). As a result, AMD depreciated by over 21% (Figure 1.1) against the U.S. dollar, Euro, and Russian Ruble immediately on March 3, 2009 (CBA, 2009). This, along with declining local and foreign demand for domestic goods, created a confidence gap in the local currency and amid the economic crisis, dollarization grew. Since then, AMD continued to depreciate at a steady rate in part due to improved market confidence and balanced daily currency flows and intervention in the foreign exchange market has been limited to rebuilding reserves and smoothing excess volatility without targeting a particular exchange rate level or path (IMF, 2009b).

During the growth years Armenia experienced a significant appreciation of the national currency and de-dollarization due to CBA interventions to keep the exchange rate in a very tight band out of concern for financial instability and increased confidence in the local currency. However, in the aftermath of the crisis Armenian Dram started to depreciate as a result of declining supply of foreign currency due to falling exports, remittances, and FDI.

The global financial crisis has underlined the dependence of Armenia's economic growth on remittance-financed construction sector. A World Bank report has concluded that "*the growth model based on non-tradable sector, with financing from abroad (remittances) is not sustainable. To sustain fast growth in the future, the economy needs to become more diversified through a substantial improvement in competitiveness*" (Oomes, 2009).

Furthermore, the World Bank and IMF have underlined the existence of oligopolistic and monopolistic forces in the Armenian market that create further distortions and limit Armenia's growth potential. To ensure sustained economic growth for the future, the World Bank and IMF authorities have strongly advised the Armenian government to facilitate progress towards competitive and fair market competition in the country (Meloyan, 2009; World Bank, 2009).

CHAPTER 3

THEORETICAL FOUNDATIONS OF REAL EXCHANGE RATE DETERMINATION

"We at the Federal Reserve have spent an inordinate amount of time trying to find models which would successfully project exchange rates, not only ours, but everyone else's. It is not the most profitable investment we have made in research time. Indeed, it is really remarkable how difficult it is to forecast."

Alan Greenspan
Remarks Before U.S. Senate
Semi-Annual Monetary Policy Report
Washington D.C., July 16, 2002

3.1 Introduction

The **real exchange rate** is the most important relative price in international finance and plays a crucial role in determining the external competitiveness of a country in the global market. It directly impacts inflation and outputs in every economy and is most important for the young and fragile economies in transition. A very important concept related to the real exchange rate, is real exchange rate misalignment. It has been established that much of economic success in the successful developing countries are due to successful exchange rate policies that maintained the real exchange rate at the "appropriate" level. Thus, the behavior of the real exchange rate is a key component in macroeconomic policy evaluation and design.

Evidence from Latin America, Asia, and Africa provide support for the strong link between RER policies and economic performance. Economists have argued that while unstable RER has suppressed export growth in Latin America, their stability has assured economic growth in East

Asia. Additionally, RER misalignment hindered development of the agricultural sector and caused domestic food shortages in many African nations (Domaç and Shabsigh, 1999).

An important issue in transition economies is the effect of the real exchange rate policies on the output. Literature identifies two primary channels of real exchange rate impact on the output. First, real exchange rate affects the international price competitiveness of the country through both demand and supply. For the former, it influences the output levels by altering relative prices. For the letter, it impacts the costs of production through impact on the prices of imported inputs. Through the second channel the real exchange rate policy affects the inflation process, and as Papazoglu (2001) notes, "to the extent that the exchange rate policy has contributed to lower inflation in these countries it has indirectly caused higher economic growth (p. 58)".

Eichengreen (2008) notes that the literature on export-led growth assigns a prominent role for the real exchange rate in keeping prices of exportables high enough to achieve a shift of production resources towards the manufacturing of exportable goods. This process will induce an economic growth while productivity in manufacturing productivity is higher than in the agricultural sector. For example, Japan, Hong Kong, Singapore, South Korea, Taiwan, and China have had success with this model that has reinforced the role of the real exchange rate policy in shaping economic growth. However, Eichengreen observes, there are costs and risks associated with keeping the real exchange rate low for long. Since such policy entails accumulation of vast international reserves, the adjustment ultimately will induce costly and disruptive inflation. Moreover, such policy may tension relations with other countries. The tensions caused between China and major trading partners due to its exchange rate policy are classical example of such policy repercussions.

From another narrative, the real exchange rate volatility discourages trade and investments; both are important components of economic growth. Eichengreen (2008) suggests that the implications of the RER volatility on the financial stability and economic growth will depend upon

the depth and development country's financial sector and the presence and absence of relevant hedging institutions. It should, however, be noted that transition economies are characterized with the lack of or insufficiency of such financial development and availability and reach to hedging instruments, especially in their early to mid-term development period.

The concern of the impact of the real exchange rate on competitiveness and growth is high in developing and transition countries and an important question is whether the real exchange rate can be used as a policy tool for promoting an economic growth. Keynes' famous dictum states that policies affecting the real exchange rate even in the intermediate run may have a significant imprint on growth. Eichengreen (2008) argues that any shock to the financial markets that adds to the volatility of the nominal exchange rate and thereby to the real exchange rate is transitory and monetary policy cannot be used to sustain the long-run real exchange rate at a particular level. However, Eichengreen notes, even though real exchange rate by itself cannot sustain an economic growth, one can think of it as a facilitating factor where an appropriate real exchange rate policy may play a key enabling role for countries seeking to capitalize on opportunities for growth.

In the last few decades with the emergence of a significant number of less developed and developing countries in the aftermath of the collapse of the Soviet Union and the Soviet Bloc, the real exchange rate has became part of the policy discussions on improving economic stability and performance in these countries. Empirical evidence from East Asia, Africa, and Latin America has been cited in support of the strong link between RER and economic performance (Cottani*, et al.*, 1990).

The impact of exchange rate appreciation on the domestic economy and competitiveness has become apparent since 2003 when Armenia's national currency, the dram, started to experience significant appreciation (Figure 1.1) that continued until the beginning of 2009 when the wave of the global economic crisis hit Armenia. Since 2003, many Armenian export businesses started to raise

alarms regarding continuing appreciation of the dram. Calls for intervention intensified in late 2006 when several exporters articulated for more intervention from the CBA in the currency exchange market.

As Armenia moves towards building a more stable market-based economy, policymakers are faced with the key challenge of balancing economic liberalization efforts and the upward pressure it puts on the real exchange rate induced by large inflows of capital. In these circumstances, the policymakers are to choose between (a) tightening the fiscal policies and intervening in the currency market to counter the pressure or (b) leaving the policy as it and facing the risk of increased and unsustainable current account deficits. Thus, understanding the dynamics and determinants of the real exchange rate becomes of high importance both for the academic community and policymakers.

3.2 Behavioral Equilibrium Exchange Rate Approach

Most of the findings of empirical research done when the majority of the world economies adopted floating exchange rate regimes after the end of the Bretton Woods agreement were refuted in the early 1980s; a trend that continues through the present day. The most powerful results were produced by the works of Meese and Rogoff (1983a; b) in which they studied the predictive abilities of several exchange rate models and their key findings concluded that none of the existing structural exchange rate models could reliably out-predict the random walk model in the short and medium-run, even when models are strengthened with additional observations. Frankel and Rose (1995) underscore that since Meese and Rogoff published their works, "*the simple random walk model of the exchange rate has become the standard benchmark for empirical exchange rate performance, no matter how uninteresting it is per se*" (p. 1691).

Since the emergence of the newly independent economies in the early 1990s and creation of national currencies, empirical research on exchange rates in transition and developing countries has

commenced. This created a new challenge in exchange rate economics as empirical research on exchange rates in the post-Bretton Woods era primarily focused on the industrialized countries. Thus, the choice of the *correct* approach applicable to emerging economies has become the objective of the economists dealing with these economies.

All PPP based models make an implicit assumption about the existence of competitive markets and terms of trade, which creates major obstacles in validating the PPP. Ghlijian (2006) argues that even if long-run prices for tradable goods are similar across countries, the prices for non-tradable goods may not be constant since there exists variability in labor and capital markets across countries, and in growing number of emerging economies it is practically impossible to prove that competitive markets exist. There seems to be a widely accepted consensus that the PPP theory is not applicable to exchange rate determination for these emerging economies.

Apergis (2003) used data for 1993-96 to study the PPP hypothesis for the foreign exchange market in Armenia. His results show that the PPP does not hold in both short and long-run horizons. Additionally, he argues that "*the Armenian economy has been dominated by real shocks, a piece of evidence that justifies, according to the Balassa-Samuelson effect, why PPP does not hold in the long-run* (p. 91)"

Due to the lack of the consistency in results on PPP ability to explain fluctuations in the foreign exchange rates, many economists tried to improve the PPP-based models to increase their explanatory power. Some of the new approaches, known as the monetary approaches, focused on explaining short-run movements in nominal exchange rates rather than the desirable properties of the medium-term equilibrium real exchange rates. The major advance in exchange rate determination modeling in the post-World War I era was made in early 1960s. The new theoretical foundations began with the Mundell-Fleming model which extending the IS-LM model to the case of an open economy. However the dominant model in the 1970s was the flexible-price monetary model, which gave way to the sticky-price or overshooting model pioneered by Dornbusch (1976).

The portfolio balance models were developed in the same time and the general equilibrium model followed later (Sarno and Taylor, 2002).

The quest for estimating equilibrium real exchange rates has become a key objective for not only academicians and researchers but also for the policymakers tasked to (1) understand the current standing of the exchange rate relative to its equilibrium long-term value; (2) examine the efficiency and cost of a particular fixed exchange rate regime and the need for subsequent adjustment; and (3) determine the best policy response by understanding the implications that various macroeconomic shocks have on the value of the exchange rate (Driver and Westaway, 2005).

Despite major breakthroughs in the exchange rate literature and estimation techniques, consensus has yet to be reached over the *correct* definition of the equilibrium exchange rate. This creates a wide variation of estimates for the same set of fundamentals depending upon the choice of the equilibrium concept. Thus, no single model or approach is expected to answer all policy questions.

The Consultative Group on Exchange Rate Issues (CGER) at the IMF has recommended three complimentary approaches to the exchange rate assessment:

1. The **Macroeconomic balance approach** (MB) is based on the estimation of (i) the equilibrium relationship between the current account and economic fundamentals, (ii) the equilibrium current account or "the norm", and (iii) the real exchange rate adjustment that is needed to close the gap between the current account and its norm.
2. The **External Sustainability approach** (ES) focuses on the relations between the sustainability of country's external stock position and its current account and trade balance and the real exchange rate.
3. The **Equilibrium Real Exchange Rate** (ERER) approach is the most common methodology used to understand the dynamics and determinants of real exchange rates

in developing countries (Di Bella*, et al.*, 2007). It involves three steps: (i) an econometric estimation of the equilibrium relationship between the real exchange rate and economic fundamentals, (ii) computation of the equilibrium level of the real exchange rate based on the current values of the fundamental variables, and (iii) calculation of the real exchange rate misalignment from the equilibrium level.

Bussière, *et al.* (2010) suggest that "*the CGER methodologies constitute a very good starting point for further research on equilibrium real exchange rates. While the large empirical uncertainties allow for an important role for judgment, the estimated equilibrium real exchange rate measures still provide information to policy makers and may provide a framework for the technical discussions underpinning key decisions* (p. 8)."

Takagi, *et al.* (2007) summarize two main classes of recent empirical exchange rate models that estimate equilibrium real exchange rate value in relation to the set of economic fundamentals. The **first** class of models is based on the notion of internal and external balance and the **second** class estimates a reduced form ERER regression. The most notable models in the first category are the fundamental equilibrium exchange rate (FEER) and its close variant desired equilibrium exchange rate (DEER) models. The second category includes the behavioral equilibrium exchange rate (BEER) and its close alternative permanent equilibrium exchange rate (PEER) models. Thorough and comprehensive overviews of major modeling approaches to equilibrium exchange rates are provided by Takagi, *et al.* (2007), Égert, *et al.* (2006), Di Bella, *et al.* (2007), and Driver and Westaway (2005) among others. The latter provide a summary of the main approaches to equilibrium exchange rate estimation and an overview of their theoretical and statistical assumptions, relevant time horizon, and estimation methods.

Clark and MacDonald (1999) characterize FEER approach as normative since it calculates the equilibrium exchange rate that is consistent with the "ideal" level of economic fundamentals. Methodological comparison of FEERs and BEERs suggests that the FEERs "*embody a theory of*

exchange rate determination that provides predictions about the future evolution of the exchange rate", whereas "*the BEER denotes a modeling strategy that attempts to explain the actual behavior of the exchange rate in terms of relevant economic variables* (p. 5)."

The BEER models and their variations examine the sources of capital account changes in an attempt to understand underlying factors affecting the capital account and subsequently the "behavior" of the exchange rate itself. This is most applicable to the developing and transition countries that are characterized by substantial variations in short-term economic fundamentals. For this very reason, economists at the IMF and policymakers in many developing and transition countries have used the BEER approach to model exchange rate behavior and understand the impact of economic fundamentals (Takagi*, et al.*, 2007)[8].

Takagi *et al.* (2007) conclude: "*Among the equilibrium exchange rate models that were reviewed, the BEER and its variants appear to be the most frequently employed by the IMF staff, particularly for the currencies of emerging market economies. A test of long-run cointegration between the real effective exchange rate and a selected set of fundamentals is usually carried out to estimate the equilibrium exchange rate and the degree of misalignment. In some cases, an error correction term is added to explain the short-term deviation of the exchange rate from its equilibrium value.*"

The BEER approach to real exchange rate determination has been extensively used in recent years; including Clark and MacDonald (1999), Maeso–Fernandez, *et al.* (2002; 2004), Iimi (2006), Chobanov and Sorsa (2004), Hinnosaar, *et al.* (2005), Iossifov and Loukoianova (2004), Babetskii and Égert (2005), and Chudik and Mongardini (2007).

The seminal works of Edwards (1989; 1994) were the first attempts of building an equilibrium real exchange rate model for developing countries to estimate the relationship between exchange rates and the underlying economic fundamentals. More specifically, based on Edwards'

[8] Takagi, *et al.* (2007, Annex A3.1), and Égert, *et al.* (2006, Table 7) compile major empirical applications of various equilibrium exchange rate models for advanced, emerging, and less developed economies.

framework, Khan and Ostry (1991) study the response of the ERER to the real shocks in developing countries. Using panel data, they estimate ERER elasticities for trade shocks and commercial policies. Elbadawi (1994) applies the simplified version of the model to estimating ERER for Chile, Ghana, and India. Faruqee (1995) and Mongardini (1998) examine the ERER in Egypt, De Broeck and Sløk (2001) extend the model to the transition economies of the CEE and Baltic countries, Lane and Milesi-Farretti (2001) for Ireland, MacDonald and Ricci (2003) for South Africa, and Chudik and Mongardini (2007) for Sub-Saharan African countries in a single-country and panel framework.

3.3 Edwards' Real Exchange Rate Model

Edwards' model is an intertemporal general equilibrium model of a small open economy with both tradable and non-tradable goods. The unique ERER is attained when the economy achieves its internal and external balance. The model's internal balance is achieved when all markets for non-tradable goods are cleared (static equilibrium). External balance is achieved when the net present value of the future current accounts is non-negative at the given level of exogenous long-run capital inflows (dynamic equilibrium). A formal summary of the model is provided in Edwards (1988; 1989; 1994).

The basic structure of Edwards' real exchange rate model is:

$$\begin{aligned}\Delta \log e_t = \theta\left(\log e_t^* - \log e_{t-1}\right) - \lambda\left(Z_t - Z_t^*\right) + \\ + \varphi\left(\log S_t - \log S_{t-1}\right) - \psi\left(PMPR_t - PMPR_{t-1}\right)\end{aligned} \tag{3.2}$$

where, e is the actual real exchange rate, e^* is the equilibrium real exchange rate (in turn a function of fundamentals), Z_t is an index of macroeconomic policies (e.g. the rate of growth of domestic credit), Z_t^* is the sustainable level of macroeconomic policies (e.g. the rate of increase of demand for domestic money), S_t is the nominal exchange rate, $PMPR$ is the spread in the parallel

market for foreign exchange, and θ, λ, ψ, and φ are positive parameters that capture the most important dynamic aspects of the adjustment process.

Equation (3.2) clearly illustrates that the real exchange rate is moving due to four forces. *First*, the actual real exchange rate will tend to independently correct existing misalignment through the partial adjustment term $\theta\left(\log e_t^* - \log e_{t-1}\right)$. The speed of the adjustment is determined by the parameter θ. The larger is the parameter faster will be the speed at which the real exchange rate misalignment will be corrected. The *second* term that determines real exchange rate movements is given by the term for macroeconomic policies, $-\lambda\left(\mathbf{Z}_t - \mathbf{Z}_t^*\right)$. If these policies (e.g. monetary, fiscal) are "inconsistent" with the exchange rate regime then the real exchange rate will be over- or under-valued, *ceteris paribus*. In this context, inconsistent means that in order to maintain the macro equilibrium it is necessary that macro policies (monetary, fiscal) be consistent with the chosen exchange rate regime or policies. The *third* element of the equation is the change in the nominal exchange rate (i.e. nominal depreciation) represented by $\varphi\left(\log S_t - \log S_{t-1}\right)$. Nominal depreciation will in the short-run cause the real exchange rate to depreciate. The magnitude will depend on the parameter φ. The *fourth* element refers to the changes in the parallel market premium. An increase in the term will cause a real exchange rate appreciation.

The structural equation for the ERER can be written as:

$$\log e_t^* = \beta_0 + \beta_i (FUND)_t + \varepsilon_t \qquad (3.3)$$

where, *FUND* represents a set of macroeconomic fundamental variables that are assumed to have a determining effect on the ERER. The choice of the fundamentals varies from one country to another.

Theoretical literature pioneered by Edwards (1989; 1994) lists (1) tariffs, (2) terms-of-trade disturbances, (3) capital flows, (4) exchange controls, (5) government expenditures, and (6)

technological progress as the fundamental determinants of real exchange rates. However, data availability and reliability create challenges for empirically estimating the theoretical model. Instead, Edwards (2007) and other studies either exclude some of these variables or use proxies as an alternative.

After substituting (3.3) into (3.2), and for convenience and generalization using a single notation of macroeconomic policy variables, say *POLICY*, equation (3.4) is obtained that could be estimated using conventional methods.

$$\begin{aligned}\Delta \log e_t = \gamma_0 + \sum_{i=1}^{n} \gamma_i \left(FUND_i\right)_t - \theta \log e_{t-1} - \sum_{j=1}^{m} \lambda_j \left(POLICY_j\right)_t \\ + \phi NOMDEV_t - \psi \left(PMPR_t - PMPR_{t-1}\right) + \varepsilon_t\end{aligned} \tag{3.4}$$

In (3.4), *NOMDEV* stands for nominal depreciation and γ's are combinations of β's and θ and n and m are the number of fundamental and policy variables, respectively. A thorough description and derivation is provided in Edwards (1989).

CHAPTER 4

EMPIRICAL MODELING OF REAL EXCHANGE RATES IN TRANSITION ECONOMIES

4.1 Politics, Political Stability, and Exchange Rates

In their seminal works Meese and Rogoff (1983a) and later Meese (1990) overturned the apparent successes in exchange rate modeling formed during the second half of the twentieth century. They showed that no existing structural exchange rate model could out-perform the simple random walk model out-of-sample. These results still stand as witnessed by the quote from former Federal Reserve Chairman Alan Greenspan at the beginning of the previous chapter.

The scientific literature, since then, has argued that the failure of exchange rate models to out-perform the random walk model in out-of-sample forecasting could be, in part, due to the omission of political risks in empirical exchange rate modeling. The link between exchange rates and politics had been articulated as far back as in 1923 by Keynes (1923) who underscored the influence of politics on exchange rates. Our contemporaries, Blomberg and Hess (1997) have argued that political events do affect exchange rates and the poor out-of-sample performance of existing structural models as found in Meese and Rogoff (1983a) is in part due to the omission of political risk factors. They demonstrated that their model, which accounts for the political variables, out-performs the random walk in out-of-sample forecasting.

Cermeño, *et al.* (2010) studied the relationship between elections and exchange rates for a panel of nine Latin American countries and confirmed that real depreciation intensifies after elections. This result suggests a strong link between political factors and exchange rate volatility.

Krugman (1985) and Bovenberg (1989) argued that the political risk plays a key role in international investors' decision to lend to a particular country. Siokis and Kapopoulos (2003) examined the role of political environment in better explaining exchange rate movements. Their results suggest that indeed the exchange rate in Greece is impacted by the domestic political developments. Similarly, Cosset and Rianderie (1985), Frieden and Stein (2001), Schamis and Way (2003), Gärtner (1986), and Mei and Guo (2004) have shown that political factors are important in predicting exchange rates.

To account for changes in the political environment in modeling exchange rates, this study includes political risk indicators developed by the International Country Risk Guide, *ICRG* (International Country Risk Guide, 2011). The dual objective of including these factors are to (1) test if the political risk, hence investment risk, proxied by the ICRG indicators, influenced the dynamics of real exchange rate, and (2) test if the accounting for the political risk helps to improve out-of-sample performance of the real exchange rate model.

The ICRG's political risk rating assesses the political stability of the countries covered by ICRG on a comparable basis. An increase in the measure indicates improvement in the respective political environment, hence (a) positive impact on foreign investor confidence and willingness to invest in the reporting economy and (b) overall improved economic activity and faith in the government and its policies. ICRG rates political risk using 12 weighted variables covering both political and social attributes as briefly described in Table 4.1.

Figure 4.1 illustrates the dynamics in the political risk series and a timeline of the major political events in the country. All twelve components are also summed to establish a single political risk rating of the country. Panel (a) illustrates the aggregated political risk rating and panels (b) - (m) illustrate individual indicators.

The link between the major political events in the country and compiled ICRG indicators is evident. Almost every parliamentary and presidential election during the illustrated period has had a

negative impact on the risk indicators. It is explained by the fact that since 1998 all such elections in the country have been described by the domestic and international observers as falling short of free and fair elections. Anecdotal evidence cites significant violation of people's right to vote as well as multiple incidents of vote rigging, ballot stuffing, etc.

Another major event was the assassination of the county's Prime Minister and Speaker of the Parliament. They were the *de-facto* leaders in the country. Furthermore, though political adversaries in the past, they have established a political tandem and were gearing up for the new parliamentary and presidential elections in a unity and were at large expected to win both. In addition, the Prime Minister, Vazgen Sarkisyan, was highly regarded politician with political will and reputation in the country as well as outside its borders. As can be seen from the graphs, the event had a significant negative effect on almost all indicators since it created a political bubble and chaos in the country, hence increasing the political risk.

In January 2001, Armenia joined the Council of Europe (CE), which, as can be seen from data, improved most of its political risk indicators mainly due to the fact that membership at CE came with significant obligations towards ensuring more transparent economy as well as conformity with international standards and regulations, especially in the investment-related activities.

The latest major event started in the fall of 2007 when the former President of the country, Levon Ter-Petrosyan (LTP), after a decade long silence since he was forced to resign in February 1998, declare his return to the politics and intention to run in next year's Presidential elections. This event significantly altered the political landscape as LTP represented the single serious challenge to the incumbent authorities. It also galvanized the opposition base, which *de-facto* did not exist till then. Elections held in February 19, 2008 were described by major international organizations and observing groups as unfair and full of irregularities. Almost no major country, including US, has officially recognized the results and congratulated the current President, Serj Sarkisyan. As a result,

LTP and his followers contested the results and staged massive demonstrations which culminated in the early morning of March 2, when the sitting President ordered the use of lethal force to disperse peaceful demonstrators. As a result, several people were killed, hundreds jailed, and LTP put under *de-facto* house arrest. The impact of these events is clearly evident from the ICRG data. The situation started to stabilize when the opposition, led by LTP, ruled out the use of force and instead they adopted a strategy to peacefully force political change in the country. As a result, as can be seen from the graphs, the situations started to gradually stabilize and "improve" due to reduced uncertainty.

4.2 Edwards' Estimation Approach

Theoretical literature pioneered by Edwards (1989) lists (1) tariffs, (2) terms-of-trade disturbances, (3) capital flows, (4) exchange controls, (5) government expenditures, and (6) technological progress as the fundamentals determinants of real exchange rates in equation 3.4. However, data availability and reliability create challenges for empirically estimating the theoretical model. Instead, Edwards (1989) and other studies either exclude these variables or use proxies as an alternative.

Edwards (1989) estimates equation (3.4) by ordinary least squares (OLS) and instrumental variables (IV) techniques employing both bilateral and multilateral exchange rates. However, Edwards admits that choosing instruments in the IV estimation was not trivial. Since equation (3.4) includes a lagged dependent variable, lagged endogenous variables are not adequate instruments. Thus, by eliminating lagged dependent variables, only instruments poorly correlated with the endogenous variables were left. In addition, the author notes, estimation of equation (3.4) requires the series to be stationary, which rarely holds in macroeconomic time series and as can be seen from

unit root tests in the next sections, the null hypothesis of unit root is not always rejected for the series used in this study. Hence, adoption of an alternative estimation approach is warranted.

4.3 Data

To analyze the real exchange rate dynamics and its determinants for Armenia, we adopt Edwards' equilibrium real exchange rate approach and model the real exchange rate as a function of economic fundamentals, macroeconomic policy variables, and nominal devaluation. In addition, we add political risk variable to account for the dynamics in the country's political risk rating perceived primarily by foreign investors as a measure of investment risk.

Based on data availability and reliability, we model Armenia's real exchange rate as a function of openness of trade (*open*), net foreign assets (*nfa*), productivity (*prod*), government expenditures (*gov*), remittances (*remit*), rate of growth of domestic credit (*dcre*), and nominal devaluation (*nomdev*). Additionally, ICRG indicators are used as a measure of political risk (*risk*).

Data are not available for *remit* series before 2004:1 and a structural break is present[9] during the pre- and post 2004:1 period, which corresponds to the period when Armenia started to register consistent double-digit GDP growth[10] and a significant increase in FDI inflows[11]. Monthly data for 2004-2009 are used in the estimations and monthly observations for 2010 were preserved for out-of-sample forecasting. Table 4.2 provides summary statistics for series used in this study. For estimation, the series are transformed into natural logarithms where applicable. Detailed variable descriptions, construction methods, and sources are described below.

[9] A Chow test rejects the null hypothesis of no structural break.
[10] Average real GDP growth was 8.9% during 1998-2003 and 11.6% during 2004-2009.
[11] FDI inflow annual average was $124.8 million during 1998-2003 and $514.9 million during 2004-2009.

- *REER* is the **real effective exchange rate**. It is a multilateral CPI based real effective exchange rate obtained from the International Financial Statistics (IFS) of IMF (IMF, 2011). The REER for country *j* is calculated by

$$REER_j = \frac{P_j E_j}{\exp\left(\sum_k w_k \ln P_k E_k\right)} \times 100 \qquad (4.1)$$

where

  - *P* is the price index;
  - *E* is the nominal exchange rate defined as units of foreign currency per one unit of domestic currency;
  - *k* represents the index of trading partner countries (k=1,2,3,…,n);
  - w_k is the weight that domestic country *j* assigns to foreign partner *k*.

  Thus, an increase (decrease) in *REER* represents appreciation (depreciation).

- *OPEN* is a proxy for **severity of trade restrictions** and is calculated as country's trade turnover (exports plus imports) as a share of GDP. Trade data is obtained from IMF IFS and GDP is obtained from Armenia's National Statistical Service (NSS) (NSS, 2011).
- *NFA* is country's **net foreign assets** as a share of GDP and is a proxy for country's net external position. NFA data is obtained from IMF IFS (IFS line 31N…ZK…). It is the sum of foreign assets held by monetary authorities and deposit money banks, less their foreign liabilities.
- *PROD* is the **productivity** measure. Real per capita GDP is used as a proxy. GDP is obtained from NSS, GDP deflator and population is obtained from IMF's World Economic Outlook (WEO) (IMF, 2010).
- *GOV* measures **government consumption expenditures** as a share of GDP. It is obtained from NSS. The government consumption biased toward non-tradables creates

higher demand for non-tradables (relative to the tradable sector) increasing relative prices of non-tradable goods. Hence, the real exchange rate should appreciate. However, government consumption is biased toward the tradables an increase should cause the real exchange rate to depreciate.

- *REMIT* is the non-commercial **money transfers** from abroad that include non-repayable transfers of individuals that are used for current needs as well as salary sent to and received from abroad. The empirical literature is inconclusive on the sign of the remittances. These transfers are intended for spending on tradables as well as non-tradables. Remittances will cause *REER* appreciation if it increases the demand for non-tradables. However, if remittances are used to increase the supply of non-tradables, REER would depreciate (Weber and Yang, 2011). Our expectation is that remittances inflows will have a significant income effect for Armenia due to the widespread poverty and household reliance on these transfers for daily needs. Therefore, a positive sign is expected.
- *DCRE* is a **macroeconomic policy** measure suggested by Edwards (1989, p. 137) (Weber and Yang, 2011). It is the rate of growth of domestic credit. Domestic credit is obtained from IMF IFS (IFS line 32...ZK…) and includes gross credit from the financial system to households, nonprofit institutions serving households, nonfinancial corporations, state and local governments, and social security funds.
- *NOMDEV* is the **nominal devaluation**; i.e. one period change in the nominal exchange rate. An increase (decrease) indicates appreciation (depreciation). Nominal effective exchange rate (*NEER*) from IMF IFS is used.

4.4 Vector Autoregression Analysis

When the nature of the exogeneity of the regressors is not clear, a natural analytical alternative is to treat each regressor symmetrically (Enders, 2010). Sims (1980) proposed the use of **vector autoregressions** (VARs) as an alternative to analyze evolution and interdependencies between macroeconomic time series.

The VAR has become a standard workhorse in exploring the dynamics in macroeconomic and financial time series and provides powerful tools for describing data and generating reliable multivariate benchmark forecasts. The two essential features of the VAR analysis are the **impulse response functions** (IRF) and **forecast error variance decompositions** (FEVD) that illustrate the underlying dynamics within the empirical model. VAR's popularity is due to economists' inability to reach a consensus on the true structure of the underlying economic model and VAR's ability of revealing the dynamic behavior of the series without imposing theoretical restrictions (Keating, 1992; Stock and Watson, 2001).

Sims (1980, pp. 14-15) argues that:

> "… *most of the restrictions on existing models are false, and the models are nominally over-identified… For this reason alone it appears worthwhile to investigate the possibility of building large models in a style which does not tend to accumulate restriction so haphazardly… It should be feasible to estimate large-scale macromodels as unrestricted reduced forms, treating all variables as endogenous."*

Another issue is whether the series in the VAR model need to be **stationary**. According to Enders (2010, p.303); Sims (1980), Sims, Stock, and Watson (1990), and Doan (2000) recommend against differencing[12] *even if the variables contain a unit root*. The formers argue that the objective of

[12] To achieve stationarity.

VAR framework is to determine the interrelationships among the series, *not* to determine the parameter estimates. The latter, referencing Fuller (1976, Theorem 8.5.1) argues that:

> "*Differencing produces no gain in asymptotic efficiency in an autoregression, even if the variables contain a unit root. In a VAR, differencing throws information away (for instance, a simple VAR on differences cannot capture a co-integrating relationship), while it produces almost no gain" (p. 283).*"

The opposite view is that the form of variables in the VAR should follow the true data generating process (DGP). Hence, the issue of stationarity is of upmost importance. Since determination of interrelationships among time series is of interest in our study, we proceed with the simple VAR framework without imposing the stationarity restriction and estimating the models in levels. In the next section, we will follow the majority view of ensuring the adopted framework(s) satisfy respective condition(s).

The p^{th}-order multivariate VAR, denoted as VAR(p), in the *standard* form is an n-equation, n-variable linear model where each variable is explained by p of its own lagged values and p lagged values of remaining $n-1$ variables (Enders, 2010; Hamilton, 1994).

To estimate the evolution and interrelationships among real exchange rate and macroeconomic fundamentals for Armenia, a nine-variable VAR model is specified. Following Sims (1980), Sims, Stock, and Watson (1990), and Doan (2000), as discussed earlier, the VAR is estimated in levels. A VAR of the following variables is specified: real effective exchange rate (*reer*) discussed in the previous section, severity of trade restrictions proxied by openness of trade (*open*), net foreign assets (*nfa*), macroeconomic policy variable (*dcre*), productivity proxied by real per capita GDP (*prod*), government expenditures (*gov*), remittances (*remit*), nominal devaluation (*nomdev*), and political risk (*risk*).

The p is selected through the `varsoc` lag-length selection analysis in Stata. Table 4.3 reports the results. All, but SBC, select a VAR(4) model and SBC selects a VAR(1) model. The former is selected since Lütkepohl (Lütkepohl, 2005, p. 150) shows that "*AIC and FPE asymptotically overestimate the true order with positive probability and underestimate the true order with probability zero.*" However, they also state that:

> "*Paulsen & Tjøstheim* (1985, p. 224) *argued that the limiting probability for overestimating the order declines with increasing dimension K and is negligible for* $K \geq 5$. *In other words, asymptotically AIC and FPE choose the correct order almost with probability one if the underlying multiple time series has large dimension K.*"[13]

VAR estimates

VAR estimation results are reported in Table 4.4. Results indicate that the past realizations of openness of trade (*open*, 4th lag), net foreign assets (*nfa*, 1st lag), growth of domestic credit (*dcre*, lags1-3), remittances (*remit*, lags 1-2), nominal exchange rate (*nomdev*, 1st lag), and political risk (*politic*, 4th lag) were statistically significant in explaining the path of the real exchange rate (*reer*). All variables have the expected sign, except for the nominal devaluation, which is negative and significant only at the 1st lag. One reason for the negative sign might be that if, for example, in the immediate time horizon the nominal depreciation is accompanied with a higher degree of inflation, then, according to equation (4.1), the real exchange rate will appreciate, *ceteris paribus*. Similar effects are registered in other countries, namely a simultaneous depreciation in NEER and appreciation in REER has been registered during 2000-2007 in Egypt, Iraq, Qatar, United Arab Emirates, and Yemen (United Nations, 2007). However, the long-run effect of *nomdev* is expected to be positive.

[13] K is the dimension of the time series.

For a process to be covariance-stationary, the consequences of any given ε_t must converge to zero. Lütkepohl (2005, pp. 14-15) and Hamilton (1994, p. 259) show that if all eigenvalues lie inside the unit circle, then the VAR is covariance-stationary. Results of the stability test indicate that all the eigenvalues of the companion matrix are inside the unit circle. Hence, the VAR satisfies the eigenvalue stability condition.

Analysis also suggests that the model satisfies residual normality and serial auto-correlation assumptions. The null hypothesis of normally distributed disturbances is rejected only for one of the equations at 5%. However, a visual inspection of the distribution of residuals against the normal distribution, confirms that the residuals are approximately normally distributed (see Figure A1 in the appendix).

Granger Causality

In the VAR framework, Granger Causality tests can be used to test whether the lags of one variable enter into equation of another variable. A variable *x* is said to Granger-cause a variable *y* if lag values of *x* are useful for predicting *y*. The Wald test is used to investigate Granger-causality among VAR series. The test is due to Granger (1969) and the idea is that if *x* does not improve the forecasting performance of *y*, then *x* does not Granger-Cause *y*.

Results, presented in Table 4.5, suggest that all variables, except productivity (*prod*), government consumption (*gov*), and political risk (*politic*), Granger-cause the real exchange rate (*reer*). The opposite causality direction is also true, except the real exchange rate does Granger-cause productivity. Hence, the test suggests no casual relationship of any kind between (a) real exchange rate and (b) government consumption and political risk.

However, political risk does Granger-cause the nominal level of the exchange rate (through *nomdev*), which may be explained that when the political environment worsens (i.e. *politic* declines),

initially (positive coefficient on *L_.politic* in Table 4.4) uncertainty forces people to convert savings into foreign currency and increase demand for it, thus depreciating the domestic currency (decreasing *nomdev*). However, as time goes on and people get accustomed to the new situation they start selling accumulated excess foreign currency to finance consumption, thus appreciating (negative coefficient on *L4.politic* in Table 4.4) the domestic currency (increased *nomdev*).

From the other side, when the political environment improves (*politic* increases), initially people start selling the excess foreign currency that was accumulated during hard times, thus appreciating the domestic currency. However, as time goes on, people's increased consumption will increase circulation of the domestic currency (and also increase demand for imports), hence causing it to depreciate.

Examination of the causality between political risk and rest of series, suggests that country's political risk rating Granger-causes openness of trade (*open*), growth of domestic credit (*dcre*) and level of remittances (*remit*). For example, the improved political risk is likely to results in improved domestic employment opportunities through increased economic activity (due to local and foreign investment). Remittances that are sent by not-immediate family members should be expected to decline as a result of improved economic activity as well.

Impulse Reaction Functions

Lütkepohl (2005) suggests that the Granger-causality may not necessarily tell the complete story about the interactions between series and, hence, in the applied work the *response* of one variable to the *impulse* in another variable in the system is of importance. The impulse reaction function (IRF) identifies the effect of an exogenous shock or innovation in one of the variables on some or all of the other variables in the system.

Impulse responses of the real exchange rate to the exogenous shocks in own and other series in the VAR model over 48 periods (months) are plotted in Figure 4.2. Results of the impulse reaction analysis shows that all of the series in the system have only transitory effect on the real exchange rate since all shocks die out eventually. However, the path of most of the shocks is long and lasts about 40 months (*prod, gov, remit, nomdev, politic*). Macroeconomic policy proxy, growth of domestic credit (*dcre*), has the shortest transitory impact and dies out after 10 periods. Severity of trade restrictions (*open*) and net foreign assets (*nfa*) have a transitory impact of about 20 and 30 periods, respectively. A summary of findings is as follows.

1. Our results show that the effect of a positive shock to *open* increases *reer* which peaks at about the 10^{th} period and gradually fades-off. Maeso-Fernandez *et al.* (2004) indicate that the effect of **trade openness** (*open*) has been ambiguous in the empirical literature with majority of empirical evidence favoring a negative impact on the real exchange rate. However, they further argue: "*On the one hand, the more open to trade a country is, the less it relies on protection and distortions to its external accounts: hence increasing openness should enhance the country's economic performance and lead to an appreciation of the real exchange rate* (p. 25)."
2. A positive **net foreign asset** *(nfa)* shock, say through reduced foreign liabilities, results in capital outflows which reduce demand for domestic currency, thus causing it to depreciate. The impulse reaction from Figure 4.2 suggests that initially real exchange rate depreciates, however, after a short period the impact fades-away.
3. A positive shock to **domestic credit** (*dcre*) initially depreciates the real exchange rate due to increased supply of domestic currency, which lasts only a few periods. Afterwards, the *reer* briefly appreciates as a result of increased economic activity

(increased domestic demand and prices). The impact converges towards zero at about 10th period.

4. The **productivity** (*prod*) shock on the *reer* becomes noticeable at the 5th period and remains positive for an extended period (about 40 periods). The effect is consistent with the theoretical prediction implying that economic growth increases the prices of nontradables and therefore causing the *reer* to appreciate.
5. Results from Figure 4.2 indicate a slight negative impact of a shock in the **government spending** (*gov*) on the *reer*. Theory predicts, and majority of surveyed literature confirms, a positive effect on the *reer* when the government consumption is biased towards nontradables. However, the statistically insignificant VAR estimates might be the reason for such negative effect.
6. A shock to the remittances (*remit*) causes an immediate *reer* appreciation that slowly disappears after about forty periods. This effect is consistent with the expectation since the *remit* represent the private transfers to households in Armenia from abroad and is primarily used for increasing consumption, thus increasing the domestic prices and causing *reer* to appreciate (see equation 4.1).
7. Figure 4.2 also shows that a positive shock in the **nominal devaluation** (*nomdev*) will depreciate the *reer*. As discussed earlier, if the nominal appreciation is accompanied with a lower degree of inflation, then, according to equation (4.1), the real exchange rate will depreciate, *ceteris paribus*.
8. Finally, our results from the VAR model indicate that as a response to a positive shock to the **political** environment (*politic*), *reer* depreciates. The effect starts to fade-off after about eight months. Improved political environment, hence reduced political risk, is expected to have a positive long-term effect on the *reer* since

improved political environment is expected to facilitate economic activity and, most importantly, foreign investments into the country, which should appreciate the *reer*.

Out-of-sample Dynamic Forecasting

Multistep-ahead dynamic forecasts for the level of series computed by iterating forward the reduced form VAR is plotted in Figure 4.3 and Table 4.6 lists observed and forecasted values for the level of REER along with upper and lower bounds and standard error. Results indicate that model provides good forecast for initial four months only. Starting with the 5th month, the observed and forecasted values diverge significantly such that the observed *reer* lies outside of the upper bound of the forecast. Figure 4.3 also indicates that the model performs poorly in forecasting the *prod*, *remit*, and *nomdev*. However, it does seem to perform well in forecasting the *open* and *dcre*.

4.5 Vector Error Correction Analysis

The analysis and corresponding inferences in the previous section were based on the argument by Sims (1980), Sims, Stock, and Watson (1990), and Doan (2000) that the condition of stationarity of the series is irrelevant for the purposes of VAR analysis that seeks to determine the interrelationships among series. The other side of the debate argues for ensuring that the model follow the true data generating process.

Time series are said to be **stationary** if its probability distribution is stable over time. Wooldridge (2003) defines a stochastic process $\{x_t : t = 1,2,...\}$ to be stationary if for every collection of time indices $1 \le t_1 < t_2 < ... < t_m$, the joint distribution of $(x_{t1}, x_{t2}, ..., x_{tm})$ is the same as the joint distribution of $(x_{t1+h}, x_{t2+h}, ..., x_{tm+h})$ for all integers $h \ge 1$ (p. 361). This implies that the stochastic properties of x_t for all t are the same and invariant with respect to time. Even more,

stationarity requires that the joint distribution of (x_1, x_2) be the same as the joint distribution for (x_t, x_{t+1}) for any $t \geq 1$. Thus, a stochastic process that is non stationary is said to be a **nonstationary process**. Nevertheless, stationarity imposes no restriction on the nature of correlation between series.

In the macroeconomic research involving time series the researcher is constantly reminded of the possibility of nonstationary processes. Even more, the empirical research has shown that most macroeconomic series, such as income, money, and prices, can all be characterized as nonstationary $I(1)$ variables (Enders, 2004; Kennedy, 1998).

Following Elliot, *et al.* (1996), Baek and Koo (2009), and Fosu and Magnus (2006), a univariate Dickey-Fuller generalized least squares (ADF-GLS) test for an autoregressive unit root is applied. ADF-GLS optimizes the power of the standard augmented Dickey-Fuller (ADF) test by detrending. It has also been shown that ADF-GLS performs substantially better in small samples compared to other alternatives. Test results fail to reject the null hypothesis of a unit root for all series at the level, except for *nomdev* and *dcre*[14]. However, the null hypothesis is rejected after first differencing, indicating stationary of the series at first differences.

Stationary series are said to be *cointegrated of order zero*. If series are nonstationary and they become stationary after differencing each series *n* times then series are said to be *integrated of order n.* The term *cointegration* is due to the fact that for a series of variables to be cointegrated, each variable must be integrated of the same order. Engle and Granger (1987) and Enders (2010) provide an in-depth illustration of the concepts of cointegration and **error correction**.

Two principal approaches have emerged in testing for the existence of a cointegrating vector. The first, popularized by Engle and Granger (1987) and Phillips and Ouliaris (1990) uses two-step residual-based procedure for testing the null of no cointegration. The second approach due

[14] By construction, *nomdev* and *dcre* are 1st differences.

to Johansen (1991; 1995) uses the system-based reduced rank regression approach. Other approaches offered by Park (1990), Shin (1994), and Stock and Watson (1988) have also been considered in the literature.

Test for Cointegration

Prior to proceeding with the cointegration test, the lag order is selected following the approach discussed and used in the previous section. Results, reported in Table 4.7, indicate that lag length of four is most appropriate.

The presence of cointegration among series is tested using Johansen's trace test (1988). The test results, reported in Table 4.8, indicate of the existence of four cointegrating equations. Kim (2006, p. 43), referencing Johansen and Juselius (1990, p. 192), suggest that: "*the first cointegrating vector – which is associated with largest root of Φ(1) – is of special significance in that it is the 'most correlated with the stationary part of the model'* ". Therefore, we proceed with the vector error correction model (VECM) analysis using the first cointegrating vector. The results indicate a strong support for the following cointegrating long-run equilibrium relationship[15]:

$$reer = 1.2796 - 0.1970\,prod + 0.1129\,gov + 0.3942\,remit + 0.3123\,nomdev + 0.0248\,politic \quad (4.2)$$

The adjustment coefficient (*error correction term*), α_1 (Table 4.9), is equal to -0.4817 and is statistically significant at 1%. It implies that 48% of the difference between the real exchange rate and its equilibrium value is corrected in each time period. The **long run coefficients,** reported in equation 4.2, are significant at 1% except for *prod* and *gov* that are significant at 5%.

The sign on *prod* is negative, which contradicts the Balassa-Samuelson hypothesis that suggests that the higher productivity of tradable goods relative to that of the nontradables will

[15] Values for *open* and *dcre* were indistinguishable from zero; 5.55e-17 and -2.22e-17, respectively; *reer* is normalized to 1 and *nfa* was dropped due to Johansen's normalization restrictions.

increase the price for nontradables and therefore appreciate the real exchange rate. Edwards (1989, p. 48) finds similar evidence for a number of developing countries and notes that (1) the real growth may not be a good proxy for technological progress and (2) if the supply effects of the technological progress more than offsets the demand (income) effects, this can induce nontradables' price decline, implying a real exchange rate depreciation. For the latter effect, governed by the Rybczynski principle (Rybczynski, 1955, p. 340), if a shift of human resources towards nontradables takes place as a result of increased productivity in the tradables sector, it will lead to worsening of the terms of trade, or the relative price, of nontradables, hence, inducing a real exchange rate depreciation. The coefficient magnitude implies that a 10 percent increase in the real income will generate 1.3 percent real exchange rate depreciation.

The positive sign on the *gov* is indicates that a government consumption biased towards nontradables increases the prices for nontradables and, therefore, inducing a real exchange rate appreciation. A 10 percent increase in the government consumption will cause the *reer* to appreciate by 1.1 percent.

The sign on the *remit* is positive and consistent with our expectation implying that through the income effect increased remittances generate higher demand for nontradables increasing their pricess and inducing a real exchange rate appreciation. Bourdet and Falck (2006) found a positive effect of workers' remittances on the equilibrium real exchange rate in Cape Verde during 1980–2000; Saadi-Sedik and Petri (2006) found similar results for Jordan over 1964–2005.

The positive sign on the *nomdev* is also expected and about 30 percent change in the nominal exchange rate is passed into the real exchange rate. This result implies that the nominal devaluation may be an important policy tool for correcting real exchange rate disequilibrium. However, its effectiveness as a policy tool will depend upon the magnitude of nominal devaluation required and

country's ability to carry such intervention. For example to restore equilibrium after 10 percent *reer* overvaluation in Armenia, 32 percent nominal devaluation will be required.

The positive sign on the political risk, *politic*, implies that improved political environment (increased *politic*) induces a *reer* appreciation, even though the magnitude is relatively small. It is according to the general expectation as, in the long-run, an improved political environment will facilitate real growth through increased foreign investments, technological progress, and increased domestic economic activity. As a result, prices for the nontradables should rise as a response to the increased demand causing the real exchange rate to appreciate.

The coefficients describing the **short-run dynamics** in the VECM model are reported in Table 4.9 along with the model fit parameters. The inference after VECM requires that the cointegrating equations be stationary and that the number of cointegrating equations be correctly specified. Following the earlier approach, results of the stability test indicate that the model satisfies the eigenvalue stability condition and the number of cointegrating equations is correctly specified.

Tests do not reject the null hypothesis of no serial autocorrelation at the lag order. The null hypothesis of normally distributed disturbances is rejected at the 5%. However, a visual inspection of the distribution of residuals against the normal distribution, confirms that the residuals are approximately normally distributed (see Figure A2 for plotted residuals).

Impulse Reaction Functions

Impulse responses of the real exchange rate to the exogenous shocks in own and other series in the VECM over 60 periods (months) are plotted on Figure 4.4. Results indicate that innovations (shocks) to *prod*, *nomdev*, and *gov* are transitory and die out over time. Meanwhile, innovations to remaining series converge to a new asymptote over time indicating that the orthogonalized innovations to these series have a permanent effect on the *reer* in Armenia. As was expected, a

positive shock to *politic*, which improves the overall political environment in the country, will have a permanent positive impact on the real exchange rate (appreciation) through long-term positive effect on the economic activity.

Policy Implications

The results have important **policy implications.** Policymakers and monetary authorities can benefit greatly from the knowledge of the nature of these innovation impacts. Knowing if a shock to the particular macroeconomic variable has a transitory or permanent impact can assist them better responding to potential adverse impacts on the economy and designing appropriate policy interventions to mitigate the undesired impacts. For example, Figure 4.4 suggests that reducing trade restrictions (i.e. increase in *open*) is going to have a permanent positive effect on the real exchange rate (appreciation). Similarly, positive shocks to *dcre* (increased domestic credit) and *remit* (increased inflow of remittances) will induce a permanent *reer* appreciation. Contrary, a positive shock to the *nfa* will put a permanent downward pressure on the *reer* (depreciation).

As a policy tool, governments in countries experiencing real economic growth may counter (balance) *reer* appreciation induced in the aftermath of economic growth by increasing servicing their foreign debt (i.e. a positive shock to *nfa*) which will induce a depreciating effect that may partially or completely balance the effects of the former.

Out-of-sample Dynamic Forecasting

Dynamic forecasts for the series computed by iterating forward the VECM is plotted in Figure 4.5 and Table 4.10 lists observed and forecasted values for the level of REER along with upper and lower bounds and standard error.

Results indicate a much improved forecast ability over the previous VAR model. VECM forecast RMSE is half of that from the VAR model (0.1062 and 0.2123 respectively). Similar to the forecasts from the VAR, VECM dynamic forecasts are almost identical to the observed values for the first 4 periods. However, divergence in the later periods remains within the 95% confidence bounds, compared to the VAR forecasts where the observed *reer* lies outside of the upper bound of the forecast (see Figure 4.3). The model performs well in forecasting *open*, *nfa*, *dcre*, *prod*, *remit*, and *nomdev*. In contrast, the VAR performed well only in forecasting *open* and *dcre*.

4.6 ARDL and Bounds Testing Approach to Cointegration

In the recent decade a growing body of macroeconomic empirical literature has opted for alternative approaches to estimation of the dynamic relationships between macroeconomic and financial time series. This is especially true for developing and transition countries, which are characterized by shorter time series. The previous cointegration approaches were focused on $I(1)$ processes and involve a certain degree of pre-testing that increases the degree of uncertainty in testing for the existence of level relationships between time series. Moreover, the traditional econometric cointegration approaches, such as Johansen's, require the series to be integrated to the same order, thus introducing a further degree of uncertainty into the analysis of level relationships especially in a transition country setting.

Gregory and Hansen (1996) conclude that "*the standard tests for cointegration are not appropriate, since they presume that the cointegrating vector is time-invariant under the alternative hypothesis* (p. 100)" and that if there exists a cointegration, the standard ADF test may not reject the null, thus wrongly concluding that there is no long-run relationship. Gregory, *et al.* (1996) have found that the power of standard ADF test decreases sharply when a structural break is present. Structural breaks occur with

technological progress, economic crises, changes in people's preferences, policy or regime shifts, and institutional developments, which are very typical to developing and transition economies.

Nieh and Wang (2005) applied six unit root tests[16] to test the stationarity in macroeconomic fundamentals and found inconclusive results (p. 61). The mixed unit root test results suggest that the macroeconomic fundamentals used in their model were inconclusive of being either *I*(1) or *I*(0). Additionally, in a short-time series, which is typical for transition and developing economies, the determination of variables' order of integration becomes uncertain due to poor performance of unit root tests for small samples (Chobanov and Sorsa, 2004; Chudik and Mongardini, 2007).

This study adopts the **bounds testing approach** developed by Pesaran, *et al.* (2001) to test for the existence of the cointegrating vector and the **Autoregressive Distributed Lag (ARDL)** modeling approach proposed by Pesaran and Shin (1998) for estimating the long-run coefficients.

Pesaran, *et al.* (2001) developed a new approach for testing for the existence of level relationship between variables irrespective of whether the underlying variables are stationary, integrated to the order of one, or a mixture of the two. This approach has been shown to be successful and superior to the traditional Johansen cointegration test in a small sample (Chudik and Mongardini, 2007).

The ARDL modeling approach was proposed by Pesaran and Shin (1998) and adapted by many for macroeconomic empirical research. Pesaran and Shin have re-examined the conventional ARDL approach for estimating the long-run coefficients when the order of integration in the underlying variables is one. Monte Carlo experiments were conducted to examine the small sample properties of the estimators. Since the "true" orders of integration in the ARDL(p, m) model are rarely known a priori, the cointegration vector were first estimated using either the Akaike Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC, also known as Bayesian

[16] Namely, ADF, DF-GLS, ERS, NP, PP, KPSS

Information Criterion, BIC) and then the long-run coefficients were estimated using the ARDL model selected in the first step.

Pesaran and Shin (1998) showed that "*The Monte Carlo results point strongly in favor of the two-step estimation procedure, and this strategy seems to work even when the model under consideration has endogenous regressors, irrespective of whether the regressors are I(1) or I(0)* (p. 374)." Furthermore, the authors conclude that their proposed ARDL approach avoids the pre-testing problem in cointegration analysis of long-run relationships typical to conventional methods. This approach has become a standard workhorse in the exchange rate research at IMF and Central Banks around the world as witnessed by the growing number of exchange rate studies using the bounds testing and ARDL approaches. A comprehensive list of empirical literature using the ARDL and bounds testing approaches to analyze the real exchange rate dynamics in transition economies is provided in Nieh and Wang (2005). Over the last few years several working papers using this approach to explore real exchange dynamics in Armenia have been developed at IMF (Al Shehabi and Ding, 2008; Oomes*, et al.*, *forthcoming;* Oomes*, et al.*, 2009; Weber and Yang, 2011). However, no peer-reviewed study has been identified in the literature.

The benefits of the ARDL and bounds testing approach, as discussed, for example, in Brussière *et al.* (2010), Pesaran and Shin (1998), Fosu and Magnus (2006), Roudet, *et al.* (2007), Chudik and Mongardini (2007), and Mongardini (1998) can be summarized as follows:

a) The bounds testing approach is relatively simple as compared to other conventional tests and once the cointegrating vector and the lag order have been identified, the model can be estimated by the ordinary least squares (OLS);

b) This approach does not require pre-testing of the variables for the existence of unit-roots and thus minimizes the potential of uncertainty and it is applicable irrespective if the regressors in the model are purely $I(0)$ or $I(1)$;

c) The test is more efficient in small samples and compared to the VAR, as in Johansen's methodology, the ARDL is represented by a single equation model that reduces the number of parameters to be estimated and improves efficiency in small samples; and

d) As implied earlier, Pesaran and Shin (1998) demonstrate that the approach is adequate *even when the model under consideration has endogenous regressors*.

Following Pesaran, *et al* (2001), Frait *et al.* (2008) and Fosu and Magnus (2006), a general ARDL(p_y,p_{xn}) model for a dependent variable *y* and independent variables *x* with only deterministic parameter being intercept c_0 can be written as:

$$y_t = c_0 + \sum_{i=1}^{p_y} \alpha_i y_{t-i} + \sum_{j=1}^{n} \sum_{i=1}^{p_x} \beta_{ji} x_{j,t-i} + \varepsilon_t \tag{4.3}$$

where, p_y, p_x are the orders of lags for dependent and independent variables, respectively, and *n* refers to the number of regressors. The corresponding error-correction is represented as:

$$\Delta y_t = c_0 + \pi_{yy} y_{t-1} + \sum_{j=1}^{n} \pi_{yx,j} x_{j,t-1} + \sum_{i=1}^{p_y-1} \theta_i \Delta y_{t-i} + \sum_{j=1}^{n} \sum_{i=0}^{p_x-1} \psi_{ji} \Delta x_{j,t-i} + \varepsilon_t \tag{4.4}$$

The bounds tests proposed by Pesaran, *et al.* (Pesaran*, et al.*, 2001) uses Wald or *F*-statistics to tests for the existence of the level relationship. The joint null hypothesis of no cointegration is:

$$H_0 : \pi_{yy} = 0 \cap \left\{ \pi_{yx,j} = 0,\ j = 1, 2, ..., n \right\} \tag{4.5}$$

against the alternative hypothesis of a long-run equilibrium relationship that at least one of the π_{yy} *and* $\pi_{yx,j}$ is not equal zero. The econometric estimation consists of four main steps.

It should be noted that bounds testing will not be applicable in the presence of *I*(2) processes. Thus, in the **first step**, series are tested to ensure selected variables are either *I*(0) or *I*(1) and not *I*(2). Following Elliot, *et al.* (1996), Baek and Koo (2009), and Fosu and Magnus (2006), a univariate Dickey-Fuller generalized least squares (ADF-GLS) test for an autoregressive unit root is applied. ADF-GLS optimizes the power of the standard augmented Dickey-Fuller (ADF) test by

detrending. It has been shown that ADF-GLS performs substantially better in small samples when an unknown mean and trend is present.

In the **second step** (4.4) is estimated by OLS to test for the existence of the cointegrating vector. Wald (*W*) or *F*-statistics are computed for the joint significance of the parameters of the lagged levels of variables in (4.5). Two asymptotic critical value bounds[17], upper and lower, provide a test for cointegration. Three possible outcomes are:

(a) If the statistics is higher than the upper value then the null is rejected in favor of the existence of the cointegrating vector of a long-run equilibrium relationship among variables.

(b) If the statistics is lower than the lower bound value then the null of no cointegration cannot be rejected.

(c) If the statistics falls between the upper and lower bounds then the results are inconclusive.

In the **third step**, once the cointegrating vector is identified, long-run parameters in the conditional ARDL(p_y,p_{xn}) model in (4.3) are estimated. At this stage, the lag orders are selected using the Schwarz Bayesian Criterion (SBC). Pesaran and Shin (1998) argue that "*S*[B]*C is a consistent model-selection criterion, while AIC [Akaike Information Criterion] is not*".

In the **fourth step**, the short-run dynamic parameters are obtained by estimating the error correction model associated with the long-run estimates:

$$\Delta y_t = \alpha + \sum_{i=1}^{p_y-1} \theta_i \Delta y_{t-i} + \sum_{j=1}^{n} \sum_{i=0}^{p_x-1} \psi_{ji} \Delta x_{j,t-i} + \upsilon ecm_{t-1} + \varepsilon_t \qquad (4.6)$$

where, θ_i and ψ_{ji} are the short-run parameters of the model's convergence towards the equilibrium and υ is the speed of adjustment. Results are reported in Table A3 in the appendix.

[17] Estimations and critical value bounds are computed in Microfit 5.01 by stochastic simulations using 20,000 replications.

Unit root tests

Before proceeding with the bounds tests and estimation of the long-run parameters, variables are tested for the order of integration. This is done to ensure that the series are not *I*(2) stationary as to avoid spurious results. Results of the unit root tests, indicate that all the series are either *I*(0) or *I*(1) as required for the bounds testing.

In the next step, the same set of variables used in the previous two approaches is used. In addition to the aggregate political risk rating indicator, *politic*, individual risk variables described in Table 4.1 and Figure 4.1 are interchangeably used to investigate the role of each individual indicator. Indicators for the corruption, military's involvement in the political and economic life of the country, religious tensions, law and order, ethnic tensions, and the quality of bureaucracy are omitted from the analysis since their values did not change during the study time.

A general empirical model of real exchange rate determination for Armenia can be written:

$$\begin{aligned} reer_t = {} & \gamma_o + \gamma_1 open_t + \gamma_2 nfa_t + \gamma_3 prod_t + \gamma_4 gov_t \\ & + \gamma_5 remit_t + \lambda_i dcre_t + \phi nomdev_t + \eta risk_t + \varepsilon_t \end{aligned} \tag{4.7}$$

where, variables are in natural logarithms where applicable and *risk* represents the political risk component.

A total of eight models were analyzed; one base model without any political risk variable, second model with the aggregated political risk rating (*politic*), and six other models with individual political risk indicators (*democr*, *secon*, *extconf*, *intconf*, *invest*, and *govstab*)[18].

Estimation of the cointegration vector

Positive outcomes in Step 1 enable one to proceed with the tests for the presence of long-run relationships in equations (4.7) using the error correction specification in equation 4.4. The

[18] Table 4.1 provides a detailed description of these indicators.

maximum lag structure is restricted to 4 months. All explanatory variables are allowed to vary up to the maximum lag. The ARDL lag structure is selected by the SBC criterion. Table 4.11 reports the results of the bounds test for existence of the level relationships among variables in equation 4.7. Reported in Table 4.11 for each model are the ARDL lag structure, the *F*-statistics for testing the joint null hypothesis of no cointegration (equation 4.5), and results from diagnostics tests.

Results indicate that the calculated *F*-statistics for all models is above the critical value of the upper bound at 5% level. Hence, the null hypothesis of no cointegration is rejected for all cases. This indicates the existence of a long-run cointegrating relationship among the variables of the selected lag order. It should be noted that the chosen lag structure is stable across all specifications.

Diagnostics tests for serial autocorrelation, functional form, normality of residuals, and heteroskedasticity for all estimated models are reported in the bottom of Table 4.11. Results indicate of no serious problem in all models. Only in one model the null of normally distributed residuals is rejected at 5%. However, a visual inspection of the residual distribution against the normal distribution confirms that the residuals are approximately normally distributed.

Estimation of the long-run parameters

Once the existence of the long-run cointegrating vector is established in step 2, long-run parameters in equations 4.7 are estimated for corresponding ARDL specifications from Table 4.11 using the specification in equation 4.3. Long run parameter estimates and corresponding equilibrium error correction coefficient (*ecm*) are reported in Table 4.12.

The **error correction** coefficient (*ecm*) that determines the speed of adjustment to the long-run equilibrium is highly significant across all models considered and has the expected negative sign, thus confirming the significance of the cointegration procedure (i.e. existence of stable long-run relationship). It also suggests that the deviation from the long-run equilibrium path is corrected by

about 10% each month implying a convergence towards equilibrium within a year. The half-life[19] to correct 50% of over or undervaluation is computed to be approximately 6 months (Table A1). This may be an indication of an existence of stickiness in the economy. Anecdotal evidence suggests of an existence of oligopolistic and monopolistic structures in major trading commodities and a joint statement by the World Bank and IMF further reinforce this argument (Meloyan, 2009; World Bank, 2009).

The signs of the long-run coefficients are similar to the ones from the VECM except for *prod*, which is statistically insignificant in the ARDL model (Table 4.12). However, the models differ in magnitude of the coefficients. The VECM reports larger coefficients than the ARDL, except for the coefficient on *nomdev*. Coefficient magnitudes of various ARDL models (A-H in Table 4.12) are generally consistent and statistically significant except for *prod* and *gov*.

Among the **political risk** indicators, coefficients of the democracy (*democr*) and external conflicts (*extconf*) indicators are statistically significant and have a positive sign and similar magnitudes implying that as the country becomes more democratic and improves external relations it facilitates economic growth, and, therefore, induces *reer* appreciation through the income effect. Our findings are important for the policymakers and country's leadership in a sense that it informs them that economic and political reforms will put an upward pressure on the *reer* in a long-run. Therefore, when designing macroeconomic and monetary policies they should take into consideration the potential effect of the improved political environment.

The analysis of Figure 4.1 that plots the political risk indicators against the timeline of major political developments in Armenia, show that these indicators are often correlated with the main political and economic events in Armenia. However, our results, suggest very weak to no effect of

[19] The number of periods (T) to clear α percent of an exogenous shock through natural adjustment is computed as: $T = \frac{\ln(1-\alpha)}{\ln(1-|\upsilon_{ecm}|)}$, where υ_{ecm} is the error correction coefficient (1994, p. 110). Half-life corresponds to α=0.5.

the political risk factors on Armenia's real exchange rate. This suggests a minor role for political risk in the decisions of major foreign investors in Armenia. One explanation of low impact of political risk maybe due to the relative importance of the Armenian Diaspora in Armenia's FDI and economic activity. A study by Hergnyan and Makaryan (2006) provides some evidence that suggests that Diaspora investors overwhelmingly are willing to accept an ethic identity discount and factors other than conventional business decision-making concepts played a more important role in their investment decisions. A more comprehensive discussion on this subject is provided in Appendix B.

The **openness of trade** (*open*) is statistically significant and positive across all equations. Similar positive relationship was found in the previous two methods as well. From one side, if we consider openness as an indicator of trade liberalization, improvement in openness should lead to a real exchange rate depreciation as a result of lower tariffs on imports or taxes on exports. However, Maeso-Fernandez *et al.* (2004) and Bakardzhieva *et al.* (2010) argue that increasing openness should enhance country's economic activity and supply capacity which leads to an improvements in the trade balance and induces a *reer* appreciation. Results indicate that for every 10 percent increase in *open* the *reer* will appreciate by about 2 percent.

The **net foreign asset** (*nfa*) position of a country reflects the indebtedness of that country. For example, a decrease in *nfa*, say as a result of increased foreign liabilities (capital inflows) will increase the demand for domestic currency causing *reer* to appreciate. However, the relationship is theoretically ambiguous. Most studies on advanced economies found a positive relationship, whereas studies on transition economies and former Soviet economies found a negative *nfa* - *reer* relationship. For example, Al Shehabi and Ding (2008) found negative relationship between *nfa* and *reer* for Armenia and Georgia, Oomes *et al.* (*forthcoming*) find a negative relationship for Armenia, and Burgess *et al.* (2003) found negative relationship for the Baltic States (Latvia, Lithuania, and Estonia). The latter argues that countries with large liabilities, which is the typical profile of most transition

economies including Armenia, eventually need to run large trade surpluses to service them, which may ultimately require real exchange rate depreciation. (p.37). Burgess *et al.* (2003) also argue that studies that find a positive relationship between *nfa* and *reer* tend to be based on longer time series, typically 20-30 years. Additionally, Babetskii and Égert (2005) find a negative relationship for the Czech Republic. They argue that:

> "*In the event that a transition economy has low initial endowment with foreign assets and if domestic savings are not enough to finance growth, then the economy needs foreign capital mirrored in accumulating foreign liabilities. Therefore, an increase in foreign liabilities* [i.e. negative NFA growth] *might go along with domestic currency appreciation, in the mid- to long-term horizon. However, once the level of net foreign liabilities reach their long-term steady state level, the domestic economy has to start transferring interest payments and repaying its debt to non-residents. So, any additional increase in foreign liabilities would lead to a depreciation of the real exchange rate so that the domestic economy remains capable of servicing debt* (p. 241)."

The expansionary **macroeconomic policy** proxy, *dcre* (rate of growth of domestic credit), is statistically significant and negative across all models. Results imply that the growth of domestic credit in Armenia induces *reer* deprecation due to increased supply of domestic currency. A 10 percent increase in the domestic credit growth induces about 40 percent *reer* depreciation in Armenia.

Results also show that **remittances** (*remit*) have a statistically significant and positive impact on RER in Armenia. This agrees with the earlier findings (from VECM) that increased remittances generate higher demand for nontradables, thus increasing prices and putting an upward pressure on the *reer*. A 10 percent increase in the *remit* results in 1.5-2 percent *reer* appreciation.

Nominal devaluation (*nomdev*) is highly significant across all models and has a positive sign. The magnitude of the coefficient is comparable of that reported in previous studies and results from the VECM. For example, Bahmani-Oskooee and Miteza (2002) estimate it to generally be over 0.50 for 19 less developed countries. Whereas, Mongardini (1998) estimates it to be 0.35 for Egypt. For Armenia, the coefficient is about 0.45 indicating that a 10 percent increase in nominal devaluation[20] is associated with 4.5 percent depreciation of the real exchange rate in Armenia.

Results indicate that nominal devaluation may be a tool for affecting the real exchange rate, however its effectiveness will depend on the magnitude of nominal devaluation required and country's ability to carry such interventions. For example, for 10 percent *reer* depreciation, about 22% nominal devaluation will be required. As mentioned earlier, since 2003 the Central Bank of Armenia has been actively engaged in foreign exchange interventions to smooth exchange rate volatility due to increasing capital inflows and to accommodate its inflation targeting policy. However, Armenian authorities have announced a return to floating exchange rate on March 3, 2009 (more in Section 2.3) as the prior policy requiring substantial interventions proved to be unsustainable during the recent economic crisis.

Out-of-sample Dynamic Forecasting

Dynamic forecast from the ARDL model are reported in Table 4.13 and graphically illustrated in Figure 4.6. Results indicate that the 12-period dynamic forecasts from the ARDL model are very close to the observed values and their forecasting power, as measured by the forecast RMSE, is significantly superior of the VAR and VECM[21]. However, there is no noticeable difference between the base model and the models with the political risk variables implying that contrary to the expectation, accounting for the political risk did not add to the forecasting power of the model.

[20] An increase in *nomdev* means nominal appreciation.
[21] RMSE(VAR) = 0.2123 and RMSE(VECM) = 0.1062

4.7 Examining the out-of-sample forecasting power of VAR, VECM, ARDL and the simple random walk models

John Maynard Keynes (1923) stressed the idea that politics greatly influence exchange rates. The New York Times (Friedman, 1994) quoted a senior Clinton advisor saying that "*The value of dollar on any given day is like a global referendum on all of the policies of the Clinton administration combined*". Moreover, Meese and Rogoff (1983a) successfully argued that none of the structural exchange rate models could beat the simple random walk model in out-of-sample forecasting. Consequently, omission of political risk factors in the exchange rate models was suggested as a possible reason for the poor performance of such models.

The evaluation of the out-of-sample forecasting power of the models estimated here (VAR, VECM, ARDL base, ARDL with political risk) were based on the root mean sum squared error (RSME) criteria similar to the one used by Meese and Rogoff (1983a). Tables 4.6, 4.10, 4.13 and 4.14 report forecasts and corresponding summary statistics for the level of REER based on the VAR, VECM, ARDL, and random walk regressions, respectively.

Our tests indicate that ARDL models perform better in out-of-sample forecasts than the VAR and VECM models, and the ARDL base-model performs as well as the ARDL models with political risk indicators. The latter suggests no significant improvement in forecasting power due to inclusion of political risk as suggested by the literature. Results also indicate that the ARDL models (both with and without political risk) perform slightly better than the random walk.

Table 4.1. International Country Risk Guide Political Risk Components

Political Risk Component	Max points	Description
Government Stability (*govstab*)	12	Assesses government's ability to carry out its declared program(s) and its ability to stay in office.
Socioeconomic Conditions (*secon*)	12	Assesses the socioeconomic pressures in the society that could constrain government action or fuel social dissatisfaction.
Investment Profile (*invest*)	12	Assesses factors affecting the risk to investment that are not covered by other political, economic and financial risk components.
Internal Conflict (*intconf*)	12	Assesses political violence in the country and its actual or potential impact on governance. The highest rating is given to those countries where there is no armed or civil opposition to the government and the government does not indulge in arbitrary violence, direct or indirect, against its own people. The lowest rating is given to a country embroiled in an on-going civil war.
External Conflict (*extconf*)	12	Assesses the risk to the incumbent government from foreign action, ranging from non-violent external pressure (diplomatic pressures, withholding of aid, trade restrictions, territorial disputes, sanctions, etc) to violent external pressure (cross-border conflicts to all-out war). External conflicts can adversely affect foreign business in many ways, ranging from restrictions on operations, to trade and investment sanctions, to distortions in the allocation of economic resources, to violent change in the structure of society.
Corruption (*corrupt*)	6	Assesses corruption within the political system. It is a threat to foreign investment because it distorts the economic and financial environment; it reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than merit; and introduces an inherent instability into the political process. The most common form of corruption faced by business is financial corruption in the form of demands for special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection, or loans. Such corruption can make it difficult to conduct business effectively, and in some cases my force the withdrawal or withholding of an investment.
Military in Politics (*military*)	6	The military is not elected by anyone. Therefore, its involvement in politics, even at a marginal level, is a reduction of democratic accountability. In the short-run a military regime may provide a new stability and thus reduce business risks. However, in the longer-run the risk will almost certainly rise, partly because the system of governance will be become corrupt and partly because the continuation of such a government is likely to create an armed opposition.

Table 4.1. ***continued***

Religion in Politics (*relig*)	6	Religious tensions may stem from the domination of society and/or governance by a single religious group that seeks to replace civil law by religious law and to exclude other religions from the political and/or social process. The risk involved in these situations range from inexperienced people imposing inappropriate policies through civil dissent to civil war.
Law and Order (*law*)	6	Assesses the strength and impartiality of the legal system and the observance of the law.
Ethnic Tensions (*ethnic*)	6	Assesses of the degree of tension within a country due to racial, nationality, or language divisions. Lower ratings are given to countries where racial and nationality tensions are high because opposing groups are intolerant and unwilling to compromise. Higher ratings are given to countries where tensions are minimal, even though such differences may still exist.
Democratic Accountability (*democr*)	6	Assesses the responsiveness government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one.
Bureaucracy Quality (*bureau*)	4	Measures the institutional strength and quality of the bureaucracy. It tends to minimize revisions of policy when governments change. Therefore, high points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services.
Political Risk Rating (*politic*)	100	Is an aggregate measure and is obtained from the sum of above twelve indicators. It defines country's overall political risk rating.

Source: International Country Risk Guide (2011)

Table 4.2. Summary Statistics

Variable	Mean	Standard Deviation	Min	Max
reer	4.74	0.11	4.52	5.07
open	-6.63	0.44	-7.40	-4.01
nfa	1.29	1.40	0.36	15.37
prod	10.58	0.66	9.03	11.70
dcre	0.02	0.07	-0.44	0.14
gov	-1.54	0.40	-2.29	0.22
remit	11.06	0.52	9.71	12.03
nomdev	0.10	0.55	-3.29	3.38
politic	59.03	2.15	53.00	62.50
democr	3.19	0.74	2.00	4.00
secon	4.04	0.74	3.00	5.00
extconf	7.39	0.40	6.50	8.50
intconf	8.84	0.90	7.00	10.00
invest	7.31	1.64	4.00	8.50
govstab	8.56	1.08	6.50	11.00

Table 4.3. Lag-order selection for the VAR model

Sample: 2004m5 2009m12
Number of obs = 68

lag	LL	LR	df	p	FPE	AIC	HQC	SBC
0	-57.79				5.80E-11	1.9645	2.0809	2.2583
1	316.42	748.43	81	0.0000	1.10E-14	-6.6594	-5.4954	-3.72181*
2	437.43	242.01	81	0.0000	3.70E-15	-7.8361	-5.6246	-2.2547
3	571.96	269.07	81	0.0000	1.10E-15	-9.4106	-6.1515	-1.1854
4	702.78	261.64*	81	0.0000	5.0e-16*	-10.8759*	-6.56929*	-0.0069

Endogenous: reer open nfa dcre prod gov remit nomdev politic
Exogenous: *constant*

FPE : Final Prediction Error Criterion
AIC : Akaike's Information Criterion
HQIC : Hannan and Quinn Criterion
SBC : Schwarz Bayesian Criterion
An ' * ' indicates the optimal lag.

Table 4.4. VAR results

variable	*equation*								
	reer	**open**	**nfa**	**dcre**	**prod**	**gov**	**remit**	**nomdev**	**politic**
L.reer	2.221***	1.130	7.130**	-1.964***	-1.906**	-0.260	-4.57***	22.08***	0.088
	(8.173)	(0.893)	(2.089)	(-3.229)	(-1.986)	(-0.134)	(-2.604)	(4.297)	(0.014)
L2.reer	-1.731***	0.192	-1.181	-0.142	1.714	-2.059	9.356***	-25.09***	4.100
	(-4.292)	(0.102)	(-0.233)	(-0.157)	(1.203)	(-0.716)	(3.594)	(-3.289)	(0.450)
L3.reer	0.279	0.166	3.681	0.459	-0.186	6.039**	-1.483	3.047	-13.350
	(0.704)	(0.090)	(0.739)	(0.516)	(-0.133)	(2.135)	(-0.579)	(0.406)	(-1.489)
L4.reer	-0.193	0.199	-5.721	1.035*	1.008	-3.755*	-1.216	-7.410	10.463*
	(-0.689)	(0.153)	(-1.630)	(1.653)	(1.021)	(-1.883)	(-0.674)	(-1.402)	(1.656)
L.open	0.046	0.207	-0.323	0.242***	-0.159	0.316	0.344*	0.888*	-1.084*
	(1.626)	(1.574)	(-0.913)	(3.833)	(-1.598)	(1.570)	(1.890)	(1.665)	(-1.700)
L2.open	0.017	0.083	0.292	0.114	-0.202*	0.727***	-0.162	0.091	1.957***
	(0.535)	(0.561)	(0.735)	(1.615)	(-1.810)	(3.221)	(-0.792)	(0.152)	(2.736)
L3.open	0.031	-0.082	0.266	0.204***	-0.120	-0.026	-0.272	0.510	0.883
	(0.904)	(-0.515)	(0.616)	(2.651)	(-0.991)	(-0.105)	(-1.228)	(0.785)	(1.137)
L4.open	0.078**	-0.62***	-1.004**	0.121*	-0.025	-0.002	-0.58***	1.948***	0.061
	(2.388)	(-4.091)	(-2.453)	(1.659)	(-0.220)	(-0.010)	(-2.768)	(3.161)	(0.082)
L.nfa	-0.026**	0.104*	0.512***	-0.019	-0.031	0.074	0.066	-0.473*	0.289
	(-1.987)	(1.702)	(3.109)	(-0.652)	(-0.667)	(0.790)	(0.782)	(-1.906)	(0.976)
L2.nfa	0.005	-0.22***	-0.41***	-0.021	0.184***	-0.43***	0.302***	0.270	-0.75***
	(0.416)	(-4.014)	(-2.740)	(-0.786)	(4.423)	(-5.126)	(3.956)	(1.207)	(-2.825)
L3.nfa	-0.020	0.563***	1.298***	-0.007	-0.024	0.311**	-0.178	-0.221	-0.285
	(-1.140)	(6.914)	(5.910)	(-0.178)	(-0.393)	(2.496)	(-1.578)	(-0.668)	(-0.721)
L4.nfa	0.001	-0.142**	-0.52***	0.008	0.039	-0.150	0.146	-0.392	1.137***
	(0.044)	(-1.999)	(-2.705)	(0.227)	(0.735)	(-1.381)	(1.483)	(-1.364)	(3.305)
L.dcre	-0.113**	0.581**	1.231*	-0.169	0.002	-0.004	0.307	-2.435**	-1.480
	(-2.205)	(2.441)	(1.917)	(-1.473)	(0.010)	(-0.011)	(0.930)	(-2.518)	(-1.280)
L2.dcre	-0.118***	-0.100	-0.167	-0.252***	0.287*	-0.314	0.692**	-2.042**	-2.79***
	(-2.810)	(-0.508)	(-0.317)	(-2.676)	(1.930)	(-1.045)	(2.547)	(-2.567)	(-2.932)
L3.dcre	-0.086*	0.651***	1.361**	-0.236**	0.061	-0.091	0.458	-1.381	-3.49***
	(-1.935)	(3.131)	(2.428)	(-2.365)	(0.384)	(-0.287)	(1.590)	(-1.636)	(-3.466)
L4.dcre	-0.017	0.274*	-0.176	0.211***	0.086	-0.132	0.217	-0.438	-0.517
	(-0.473)	(1.659)	(-0.394)	(2.649)	(0.686)	(-0.519)	(0.945)	(-0.652)	(-0.645)
L.prod	-0.001	-2.61***	-5.19***	0.179**	1.070***	-1.06***	1.964***	0.513	-0.322
	(-0.040)	(-15.930)	(-11.759)	(2.267)	(8.609)	(-4.235)	(8.646)	(0.772)	(-0.405)
L2.prod	-0.072	3.871***	9.341***	0.268	-0.639**	1.922***	-1.44***	-1.295	-3.266*
	(-0.868)	(10.076)	(9.015)	(1.452)	(-2.192)	(3.265)	(-2.704)	(-0.830)	(-1.751)
L3.prod	0.019	-2.10***	-4.01***	0.140	0.043	-0.491	-0.552	-0.477	6.334***
	(0.199)	(-4.783)	(-3.385)	(0.661)	(0.130)	(-0.731)	(-0.907)	(-0.268)	(2.974)
L4.prod	0.047	0.095	0.053	-0.028	-0.115	0.195	-0.220	0.020	0.222
	(1.402)	(0.601)	(0.125)	(-0.370)	(-0.965)	(0.809)	(-1.009)	(0.031)	(0.290)

Table 4.4. (*continued*)

variable	*equation*								
	reer	**open**	**nfa**	**dcre**	**prod**	**gov**	**remit**	**nomdev**	**politic**
L.gov	-0.016	-0.136	0.340	-0.127***	-0.007	-0.245*	-0.328**	-0.135	-0.757*
	(-0.782)	(-1.443)	(1.339)	(-2.811)	(-0.098)	(-1.696)	(-2.510)	(-0.354)	(-1.655)
L2.gov	-0.018	0.126*	-0.056	0.053	0.066	0.060	-0.070	-0.424	-1.86***
	(-1.097)	(1.648)	(-0.271)	(1.434)	(1.149)	(0.515)	(-0.663)	(-1.369)	(-5.024)
L3.gov	-0.012	-0.024	-0.87***	0.003	0.010	0.288**	-0.013	-0.458	0.156
	(-0.613)	(-0.275)	(-3.651)	(0.077)	(0.148)	(2.126)	(-0.107)	(-1.277)	(0.364)
L4.gov	-0.020	-0.056	-0.010	-0.067	0.091	0.030	0.092	-0.518	1.174***
	(-1.030)	(-0.613)	(-0.039)	(-1.513)	(1.301)	(0.213)	(0.722)	(-1.389)	(2.632)
L.remit	0.056***	0.015	0.239	-0.166***	0.145**	-0.46***	0.061	0.581	0.382
	(3.002)	(0.171)	(1.019)	(-3.969)	(2.193)	(-3.479)	(0.509)	(1.643)	(0.904)
L2.remit	0.051**	0.184*	0.072	-0.230***	-0.039	-0.225	0.115	1.349***	-0.715
	(2.319)	(1.777)	(0.257)	(-4.638)	(-0.494)	(-1.424)	(0.806)	(3.215)	(-1.425)
L3.remit	-0.035	0.047	-0.618**	0.043	0.192**	0.127	0.514***	-0.304	-0.785
	(-1.441)	(0.418)	(-2.049)	(0.805)	(2.258)	(0.744)	(3.317)	(-0.670)	(-1.446)
L4.remit	0.023	0.063	-0.87***	0.067	0.022	0.118	0.133	0.698	-0.744
	(0.943)	(0.544)	(-2.784)	(1.215)	(0.253)	(0.666)	(0.831)	(1.489)	(-1.328)
L.nomdev	-0.085***	-0.076	-0.365**	0.113***	0.119**	-0.068	0.191**	-1.512***	-0.106
	(-6.040)	(-1.161)	(-2.057)	(3.585)	(2.389)	(-0.677)	(2.096)	(-5.661)	(-0.332)
L2.nomdev	0.018	-0.032	-0.188	0.053	-0.004	0.034	-0.31***	-0.027	-0.190
	(1.135)	(-0.446)	(-0.969)	(1.532)	(-0.068)	(0.304)	(-3.118)	(-0.093)	(-0.544)
L3.nomdev	-0.005	-0.055	-0.404**	0.090***	0.036	-0.271**	-0.101	-0.261	0.395
	(-0.332)	(-0.775)	(-2.124)	(2.653)	(0.672)	(-2.510)	(-1.037)	(-0.910)	(1.155)
L4.nomdev	0.008	-0.08***	-0.21***	-0.044***	-0.034	-0.046	-0.027	0.177	-0.113
	(1.382)	(-2.842)	(-2.739)	(-3.277)	(-1.592)	(-1.069)	(-0.700)	(1.559)	(-0.829)
L.politic	0.003	0.039*	0.030	0.022**	-0.020	0.055	-0.067**	0.103	0.746***
	(0.643)	(1.699)	(0.482)	(1.988)	(-1.138)	(1.576)	(-2.096)	(1.106)	(6.695)
L2.politic	0.003	-0.045	-0.012	-0.018	0.022	-0.071	-0.000	-0.033	0.372**
	(0.459)	(-1.492)	(-0.145)	(-1.247)	(0.979)	(-1.537)	(-0.004)	(-0.267)	(2.548)
L3.politic	0.002	-0.07***	-0.078	0.012	-0.009	0.006	0.044	0.085	-0.082
	(0.366)	(-2.704)	(-1.077)	(0.950)	(-0.435)	(0.159)	(1.178)	(0.787)	(-0.629)
L4.politic	-0.007*	0.049**	0.010	0.002	-0.003	0.018	-0.018	-0.180**	-0.172*
	(-1.651)	(2.371)	(0.173)	(0.244)	(-0.219)	(0.574)	(-0.618)	(-2.137)	(-1.704)
constant	2.077***	-11.5***	-10.732*	3.160***	-2.205	3.959	-8.283**	46.26***	-0.678
	(4.064)	(-4.813)	(-1.673)	(2.762)	(-1.222)	(1.086)	(-2.512)	(4.788)	(-0.059)
RMSE	0.0244	0.1134	0.3057	0.0545	0.0860	0.1737	0.1572	0.4604	0.5504
R-square	0.9814	0.9566	0.9357	0.7997	0.9784	0.8928	0.946	0.7327	0.9217
chi2	3597.35	1499.22	990.03	271.51	3081.00	566.15	1192.37	186.35	800.60
P>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

note: *** *p-value*<0.01, ** *p-value*<0.05, * *p-value*<0.1. *t*-values are given in parentheses.

Table 4.5. Granger causality Wald tests (H_0: no Granger causation)

	H_0:				
x	***does not Granger-cause***	***y***	χ^2	**Prob > χ^2**	**Decision[(a)]**
open	→	reer	7.863	0.0970	Reject
nfa	→	reer	9.971	0.0410	Reject
dcre	→	reer	9.745	0.0450	Reject
prod	→	reer	3.470	0.4820	Do not reject
gov	→	reer	5.868	0.2090	Do not reject
remit	→	reer	22.684	0.0000	Reject
nomdev	→	reer	42.839	0.0000	Reject
politic	→	reer	6.379	0.1730	Do not reject
ALL	→	reer	187.600	0.0000	Reject
reer	→	open	18.051	0.0010	Reject
reer	→	nfa	14.643	0.0060	Reject
reer	→	dcre	22.946	0.0000	Reject
reer	→	prod	11.997	0.0170	Reject
reer	→	gov	5.807	0.2140	Do not reject
reer	→	remit	27.360	0.0000	Reject
reer	→	nomdev	50.701	0.0000	Reject
reer	→	politic	4.278	0.3700	Do not reject
politic	→	open	21.023	0.0000	Reject
politic	→	nfa	4.453	0.3480	Do not reject
politic	→	dcre	12.016	0.0170	Reject
politic	→	prod	2.151	0.7080	Do not reject
politic	→	gov	2.884	0.5770	Do not reject
politic	→	remit	10.157	0.0380	Reject
politic	→	nomdev	9.105	0.0590	Reject

[(a)] At 10% significant level

Table 4.6. Out-of-sample Dynamic Forecasts from the VAR for the Level of REER

	observed	forecast	lower bound	upper bound	standard error
2010M1	4.8247	4.8109	4.7709	4.8510	0.0204
2010M2	4.8352	4.8174	4.7587	4.8761	0.0300
2010M3	4.7997	4.7589	4.6830	4.8347	0.0387
2010M4	4.8108	4.7321	4.6451	4.8192	0.0444
2010M5	4.8830	4.7086	4.6067	4.8105	0.0520
2010M6	4.9260	4.6846	4.5639	4.8054	0.0616
2010M7	4.9102	4.6683	4.5412	4.7953	0.0648
2010M8	4.9103	4.6478	4.5191	4.7765	0.0656
2010M9	4.9050	4.6332	4.5046	4.7617	0.0656
2010M10	4.8850	4.6267	4.4993	4.7541	0.0650
2010M11	4.9042	4.6184	4.4920	4.7447	0.0645
2010M12	4.9328	4.6258	4.5003	4.7514	0.0641

RMSE of forecast = 0.2123

Table 4.7. Lag-order selection for the VECM model

Selection order criteria
Sample: 2004m5 2009m12
Number of obs =
68

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-57.79				5.80E-11	1.9645	2.0809	2.2583
1	316.42	748.43	81	0.0000	1.10E-14	-6.6594	-5.4954	-3.7218 *
2	437.43	242.01	81	0.0000	3.70E-15	-7.8361	-5.6246	-2.2547
3	571.96	269.07	81	0.0000	1.10E-15	-9.4106	-6.1515	-1.1854
4	702.78	261.64*	81	0.0000	5.0e-16 *	-10.8759 *	-6.5693 *	-0.0069

Endogenous: reer open nfa dcre prod gov remit nomdev politic
Exogenous: constant

FPE : Final Prediction Error Criterion
AIC : Akaike's Information Criterion
HQIC : Hannan and Quinn Criterion
SBC : Schwarz Bayesian Criterion
An ' * ' indicates the optimal lag.

Table 4.8. Cointegration Trace Test

maximum rank	Parameters	LL	eigenvalue	trace statistic	5% critical value
0	252	519.5297	.	366.5046	192.8900
1	269	576.7298	0.8141	252.1044	156.0000
2	284	618.2316	0.7050	169.1008	124.2400
3	297	645.0190	0.5452	115.5261	94.1500
4	308	670.0364	0.5209	65.4912 *	68.5200
5	317	684.4607	0.3457	36.6426	47.2100
6	324	695.3815	0.2747	14.8010	29.6800
7	329	699.4223	0.1121	6.7193	15.4100
8	332	701.5565	0.0608	2.4510	3.7600
9	333	702.7820	0.0354		

An ' * ' indicates the selected rank.

Table 4.9. VECM Results

	reer	open	nfa	dcre	prod	gov	remit	nomdev	politic
α_1	-0.482***	1.263**	4.325***	-0.688***	0.547	-0.544	1.402*	-8.89***	-1.487
	(-4.044)	(2.188)	(2.980)	(-2.625)	(1.375)	(-0.633)	(1.729)	(-3.892)	(-0.543)
α_2	0.266***	-1.104**	-1.412	0.594***	-0.497*	0.485	-0.886	5.53***	3.944*
	(2.949)	(-2.530)	(-1.287)	(2.997)	(-1.653)	(0.747)	(-1.445)	(3.198)	(1.905)
α_3	-0.064***	0.171**	0.066	-0.057	0.16***	-0.190	0.195*	-1.39***	-0.359
	(-3.785)	(2.083)	(0.320)	(-1.532)	(2.880)	(-1.560)	(1.694)	(-4.271)	(-0.924)
α_4	-0.337**	1.918**	3.313*	-1.31***	0.496	-0.258	1.289	-6.27**	-9.11**
	(-2.064)	(2.427)	(1.666)	(-3.635)	(0.910)	(-0.219)	(1.160)	(-2.001)	(-2.429)
LD.reer	1.597***	-0.686	4.369	-1.395	-2.361*	0.786	-6.55**	28.1***	-2.854
	(4.108)	(-0.364)	(0.923)	(-1.631)	(-1.820)	(0.280)	(-2.476)	(3.763)	(-0.319)
L2D.reer	-0.318	-1.099	3.557	-1.249	-0.793	-0.502	3.719	-0.748	-1.608
	(-0.829)	(-0.591)	(0.761)	(-1.479)	(-0.619)	(-0.181)	(1.425)	(-0.102)	(-0.182)
L3D.reer	-0.070	-1.284	7.799*	-1.010	-0.994	4.855*	0.750	1.388	-17.13*
	(-0.180)	(-0.685)	(1.653)	(-1.186)	(-0.769)	(1.739)	(0.285)	(0.187)	(-1.925)
LD.open	-0.186**	0.490	0.889	-0.340*	0.341	-0.272	1.310**	-3.86**	-4.22**
	(-2.153)	(1.171)	(0.845)	(-1.791)	(1.183)	(-0.436)	(2.228)	(-2.330)	(-2.123)
L2D.open	-0.143**	0.652**	1.006	-0.253*	0.141	0.296	1.071**	-3.20**	-1.700
	(-2.088)	(1.961)	(1.203)	(-1.672)	(0.613)	(0.598)	(2.292)	(-2.430)	(-1.077)
L3D.open	-0.094**	0.593***	1.115*	-0.089	0.016	0.079	0.645**	-2.29**	-0.444
	(-1.970)	(2.578)	(1.925)	(-0.854)	(0.103)	(0.230)	(1.996)	(-2.507)	(-0.406)
LD.nfa	0.034	-0.076	-0.477*	0.038	-0.2***	0.265*	-0.173	0.805**	0.436
	(1.614)	(-0.751)	(-1.866)	(0.821)	(-2.759)	(1.749)	(-1.211)	(2.001)	(0.904)
L2D.nfa	0.035*	-0.322***	-0.844***	0.012	-0.009	-0.170	0.101	0.971**	-0.480
	(1.729)	(-3.301)	(-3.434)	(0.274)	(-0.137)	(-1.167)	(0.738)	(2.509)	(-1.036)
L3D.nfa	0.015	0.242**	0.472*	0.002	-0.034	0.122	-0.115	0.747*	-0.810*
	(0.730)	(2.442)	(1.894)	(0.053)	(-0.500)	(0.828)	(-0.827)	(1.903)	(-1.723)
LD.dcre	0.202*	-1.329**	-1.731	0.159	-0.504	0.223	-1.273	3.372	6.820**
	(1.707)	(-2.317)	(-1.200)	(0.611)	(-1.274)	(0.261)	(-1.580)	(1.483)	(2.506)
L2D.dcre	0.079	-1.304***	-1.585	-0.045	-0.198	0.053	-0.603	1.231	3.722*
	(0.899)	(-3.069)	(-1.482)	(-0.232)	(-0.675)	(0.084)	(-1.011)	(0.731)	(1.846)
L3D.dcre	0.005	-0.443*	-0.005	-0.235**	-0.117	0.024	-0.184	0.156	0.310
	(0.102)	(-1.844)	(-0.009)	(-2.155)	(-0.707)	(0.066)	(-0.544)	(0.164)	(0.272)
LD.prod	-0.087	-2.210***	-5.034***	-0.281	0.638**	-1.411**	2.37***	-0.225	-5.3***
	(-1.084)	(-5.707)	(-5.168)	(-1.596)	(2.392)	(-2.448)	(4.351)	(-0.147)	(-2.893)
L2D.prod	-0.093	1.978***	4.080***	-0.039	0.002	0.097	0.681	-0.074	-7.51**
	(-0.725)	(3.195)	(2.620)	(-0.137)	(0.004)	(0.106)	(0.782)	(-0.030)	(-2.558)
L3D.prod	-0.078	-0.303	-0.052	0.012	0.083	-0.251	0.134	-0.688	-0.864
	(-1.626)	(-1.311)	(-0.089)	(0.115)	(0.521)	(-0.728)	(0.413)	(-0.751)	(-0.787)

Table 4.9. (continued)

	reer	open	nfa	dcre	prod	gov	remit	nomdev	politic
LD.gov	0.031	-0.308*	0.776*	-0.065	-0.233*	-0.8***	-0.446*	0.951	-0.157
	(0.842)	(-1.748)	(1.748)	(-0.809)	(-1.914)	(-3.149)	(-1.799)	(1.361)	(-0.187)
L2D.gov	0.006	-0.141	0.849*	0.020	-0.150	-0.59**	-0.397	0.404	-2.08**
	(0.161)	(-0.729)	(1.751)	(0.229)	(-1.130)	(-2.049)	(-1.465)	(0.529)	(-2.271)
L3D.gov	0.007	-0.044	0.008	0.052	-0.110	-0.116	-0.205	0.225	-1.51**
	(0.247)	(-0.320)	(0.024)	(0.827)	(-1.161)	(-0.562)	(-1.058)	(0.411)	(-2.308)
LD.remit	0.021	-0.067	1.239**	0.054	-0.121	-0.131	-0.832**	-0.483	3.421***
	(0.411)	(-0.277)	(2.022)	(0.492)	(-0.718)	(-0.362)	(-2.430)	(-0.500)	(2.959)
L2D.remit	0.058	0.092	1.347**	-0.141	-0.168	-0.253	-0.587*	0.594	2.536**
	(1.274)	(0.415)	(2.420)	(-1.400)	(-1.102)	(-0.769)	(-1.887)	(0.678)	(2.415)
L3D.remit	-0.005	0.034	0.857**	-0.073	0.004	-0.065	-0.082	-0.321	1.142
	(-0.152)	(0.194)	(1.971)	(-0.930)	(0.032)	(-0.251)	(-0.338)	(-0.469)	(1.392)
LD.nomdev	-0.055**	-0.027	0.945***	-0.115*	-0.023	0.239	0.254	-0.655	-0.985
	(-2.048)	(-0.210)	(2.900)	(-1.955)	(-0.261)	(1.238)	(1.393)	(-1.277)	(-1.602)
L2D.nomdev	-0.017	0.040	0.676***	-0.065	-0.015	0.247*	-0.027	-0.238	-0.712
	(-0.828)	(0.399)	(2.676)	(-1.424)	(-0.214)	(1.650)	(-0.192)	(-0.598)	(-1.493)
L3D.nomdev	-0.009	0.066*	0.200**	0.035**	0.029	-0.009	-0.041	-0.183	0.063
	(-1.052)	(1.689)	(2.033)	(1.973)	(1.064)	(-0.158)	(-0.739)	(-1.180)	(0.336)
LD.politic	0.001	0.073**	0.095	0.009	-0.012	0.049	-0.032	0.103	-0.145
	(0.110)	(2.135)	(1.111)	(0.553)	(-0.496)	(0.976)	(-0.663)	(0.765)	(-0.901)
L2D.politic	0.002	0.011	0.083	-0.013	0.011	-0.016	-0.031	0.027	0.192
	(0.322)	(0.370)	(1.107)	(-0.932)	(0.516)	(-0.372)	(-0.739)	(0.229)	(1.356)
L3D.politic	0.002	-0.070**	0.010	0.001	0.000	-0.005	0.016	0.072	0.075
	(0.350)	(-2.322)	(0.129)	(0.066)	(0.019)	(-0.119)	(0.372)	(0.604)	(0.527)
constant	-0.001	0.021	-0.005	-0.005	0.029**	0.033	0.017	0.003	0.005
	(-0.175)	(1.155)	(-0.108)	(-0.660)	(2.329)	(1.205)	(0.661)	(0.038)	(0.053)
RMSE	0.0242	0.1170	0.2943	0.0532	0.0806	0.1742	0.1644	0.4636	0.5552
R-sq	0.7232	0.9328	0.9235	0.8960	0.9198	0.8192	0.8376	0.8196	0.6072
chi2	88.8351	471.7126	410.2726	292.9074	389.7229	154.0811	175.4051	154.4600	52.5672
P>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0124

note: *** p<0.01, ** p<0.05, * p<0.1. *t*-values are given in parentheses.

Table 4.10. Out-of-sample Dynamic Forecasts from VECM for the Level of REER

period	observed	forecast	lower bound	upper bound	standard error
2010M1	4.8247	4.8301	4.7814	4.8788	0.0249
2010M2	4.8352	4.8564	4.7805	4.9323	0.0387
2010M3	4.7997	4.8169	4.7131	4.9207	0.0530
2010M4	4.8108	4.8096	4.6825	4.9367	0.0648
2010M5	4.8830	4.8017	4.6544	4.9491	0.0752
2010M6	4.9260	4.7862	4.6219	4.9506	0.0839
2010M7	4.9102	4.7751	4.5978	4.9523	0.0904
2010M8	4.9103	4.7681	4.5770	4.9591	0.0975
2010M9	4.9050	4.7669	4.5631	4.9708	0.1040
2010M10	4.8850	4.7706	4.5544	4.9868	0.1103
2010M11	4.9042	4.7715	4.5443	4.9986	0.1159
2010M12	4.9328	4.7905	4.5540	5.0270	0.1207

RMSE of forecast = 0.1062

Table 4.11. Bounds test for existence of long-run equilibrium level relationship among variables in the ARDL model

Models	base model	w/ *politic*	w/ *democr*	w/ *secon*	w/ *extconf*	w/ *intconf*	w/ *invest*	w/ *govstab*
SBC Lags[a]	1,0,0,4,0,0,1,0	1,0,0,4,0,0,1,0,0	1,0,0,4,0,0,1,0,0	1,0,0,4,0,0,1,0,0	1,0,0,4,0,0,1,0,0	1,0,0,4,0,0,1,0,0	1,0,0,4,0,0,1,0,0	1,0,0,4,0,0,1,0,0
F-statistic[b]	5.3873	5.4681	5.9354	5.3843	5.5496	5.3504	5.5719	5.3247
95% Lower Bound	2.6411	2.7983	2.7833	2.7239	2.7550	2.8613	3.0100	2.8426
95% Upper Bound	3.9160	4.1021	4.2013	4.0820	4.1313	4.1062	4.1707	4.0638
Diagnostic Tests[c]								
A: Serial Correlation	F(12,42) = 0.5020 [.902]	F(12,41) = 0.5243 [.886]	F(12,41) = 0.8994 [.555]	F(12,41) = 0.4969 [.905]	F(12,41) = 0.6468 [.790]	F(12,41) = 0.4883 [.910]	F(12,41) = 0.4963 [.905]	F(12,41) = 0.6063 [.824]
B: Functional Form	F(1,53) = 0.6251 [.433]	F(1,52) = 0.6726 [.416]	F(1,52) = 0.0314 [.860]	F(1,52) = 0.7934 [.377]	F(1,52) = 0.0706 [.792]	F(1,52) = 0.6064 [.440]	F(1,52) = 0.5321 [.469]	F(1,52) = 0.281 [.598]
C: Normality	$\chi^2(2)$ = 3.6873 [.158]	$\chi^2(2)$ = 1.3138 [.518]	$\chi^2(2)$ = 3.4970 [.174]	$\chi^2(2)$ = 3.6858 [.158]	$\chi^2(2)$ = 2.5877 [.274]	$\chi^2(2)$ = 3.3124 [.191]	$\chi^2(2)$ = 2.5190 [.284]	$\chi^2(2)$ = 7.069 [.029]
D: Heteroscedasticity	F(1,66) = 0.3518 [.555]	F(1,66) = 0.8557 [.358]	F(1,66) = 0.8662 [.355]	F(1,66) = 0.3540 [.554]	F(1,66) = 0.6599 [.420]	F(1,66) = 0.4066 [.526]	F(1,66) = 0.5266 [.471]	F(1,66) = 0.542 [.464]

(a) Lag order for the dependent variable first, then independent variables.

(b) If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20,000 replications.

(c) *p*-values are given in square brackets

A: Lagrange multiplier test of residual serial correlation

B: Ramsey's RESET test using the square of the fitted values

C: Based on a test of skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values

Table 4.12. Estimated Long-Run Coefficients using the ARDL Approach

Model	A	C	B	D	E	F	G	H
OPEN	0.1891*	0.1928**	0.2246***	0.1891*	0.2357**	0.1880*	0.1797*	0.2015*
	(1.8366)	(2.0239)	(2.6800)	(1.8209)	(2.3101)	(1.8201)	(1.8196)	(1.9185)
NFA	-0.0749*	-0.0790**	-0.1181***	-0.0750*	-0.1182***	-0.0739*	-0.0723*	-0.0908**
	(-1.9489)	(-2.2201)	(-3.5155)	(-1.9312)	(-2.7904)	(-1.8912)	(-1.9700)	(-2.1433)
PROD	0.1558	0.1436	0.0574	0.1536	0.0771	0.1574	0.1525	0.1526
	(1.1663)	(1.1669)	(0.5357)	(1.0669)	(0.5942)	(1.1721)	(1.2065)	(1.1307)
DCRE	-0.3794**	-0.3805**	-0.4078***	-0.3778**	-0.4357**	-0.3752**	-0.3550**	-0.3908**
	(-2.1784)	(-2.3603)	(-2.8569)	(-2.1015)	(-2.4901)	(-2.131)	(-2.1165)	(-2.2003)
GOV	0.0079	0.0059	0.0453	0.0070	0.0337	0.0054	-0.0008	0.0268
	(0.1217)	(0.0984)	(0.8704)	(0.1023)	(0.5384)	(0.0808)	(-0.0125)	(0.3949)
REMIT	0.1618*	0.1396*	0.1999***	0.1625*	0.2101**	0.1574*	0.1300	0.1853**
	(1.8431)	(1.6774)	(2.8023)	(1.8021)	(2.4062)	(1.7055)	(1.3232)	(2.0128)
NOMDEV	0.4617***	0.4300***	0.3892***	0.4616***	0.4553***	0.4584***	0.4366***	0.4627***
	(4.4548)	(4.6379)	(5.1593)	(4.4153)	(4.5979)	(4.3595)	(4.2946)	(4.4024)
politic		0.0143						
		(1.3985)						
democr			0.0795***					
			(2.9102)					
secon				-0.0021				
				(-0.0413)				
extconf					0.0729*			
					(1.9512)			
intconf						0.0039		
						(0.1569)		
invest							0.0630	
							(0.6233)	
govstab								-0.0316
								(-0.8978)
ecm	-0.0986***	-0.1058***	-0.1148***	-0.0987***	-0.0989***	-0.0994***	-0.1047***	-0.0976***
	(-4.9395)	(-5.1571)	(-5.8523)	(-4.8855)	(-5.1091)	(-4.7965)	(-4.6341)	(-4.8724)
constant	2.6395**	2.1926*	3.4471***	2.6627**	2.8437**	2.6210**	2.4280**	2.8219**
	(2.2798)	(1.9043)	(3.7466)	(2.0582)	(2.5683)	(2.2455)	(2.0853)	(2.4045)

t-values are given in parenthesis
* significant at 10%
** significant at 5%
*** significant at 1%

Table 4.13. Out-of-sample Dynamic Forecasts from ARDL for the Level of REER

	Model	**base model**		**w/ *politic***		**w/ *democr***		**w/ *secon***		**w/ *extconf***		**w/ *intconf***		**w/ *invest***		**w/ *govstab***	
obs.	Observed	fcast	error	fcast	error	fcast	error	fcast	error	fcast	error	fcast	error	fcast	error	fcast	error
2010M1	4.825	4.837	-0.012	4.838	-0.014	4.837	-0.012	4.836	-0.012	4.841	-0.016	4.837	-0.012	4.838	-0.013	4.837	-0.012
2010M2	4.835	4.844	-0.009	4.848	-0.013	4.840	-0.005	4.844	-0.009	4.853	-0.018	4.844	-0.009	4.847	-0.011	4.844	-0.009
2010M3	4.800	4.812	-0.012	4.819	-0.020	4.808	-0.008	4.812	-0.012	4.828	-0.028	4.813	-0.013	4.816	-0.016	4.813	-0.013
2010M4	4.811	4.824	-0.014	4.834	-0.023	4.822	-0.011	4.824	-0.013	4.848	-0.037	4.825	-0.014	4.828	-0.017	4.825	-0.014
2010M5	4.883	4.889	-0.006	4.899	-0.016	4.887	-0.004	4.889	-0.006	4.919	-0.036	4.890	-0.007	4.894	-0.011	4.890	-0.007
2010M6	4.926	4.919	0.007	4.929	-0.003	4.916	0.010	4.919	0.007	4.956	-0.030	4.920	0.006	4.924	0.002	4.920	0.006
2010M7	4.910	4.900	0.010	4.910	0.000	4.899	0.012	4.899	0.011	4.945	-0.034	4.901	0.010	4.904	0.006	4.901	0.010
2010M8	4.910	4.888	0.022	4.898	0.013	4.885	0.025	4.888	0.023	4.937	-0.027	4.889	0.021	4.892	0.019	4.889	0.021
2010M9	4.905	4.896	0.009	4.905	0.000	4.895	0.010	4.896	0.009	4.951	-0.046	4.897	0.008	4.900	0.005	4.897	0.008
2010M10	4.885	4.875	0.010	4.883	0.002	4.874	0.011	4.874	0.011	4.935	-0.049	4.875	0.010	4.877	0.008	4.875	0.010
2010M11	4.904	4.891	0.013	4.899	0.005	4.893	0.011	4.890	0.014	4.952	-0.048	4.892	0.013	4.894	0.010	4.892	0.013
2010M12	4.933	4.907	0.026	4.914	0.019	4.910	0.023	4.906	0.027	4.969	-0.036	4.907	0.025	4.909	0.024	4.907	0.025

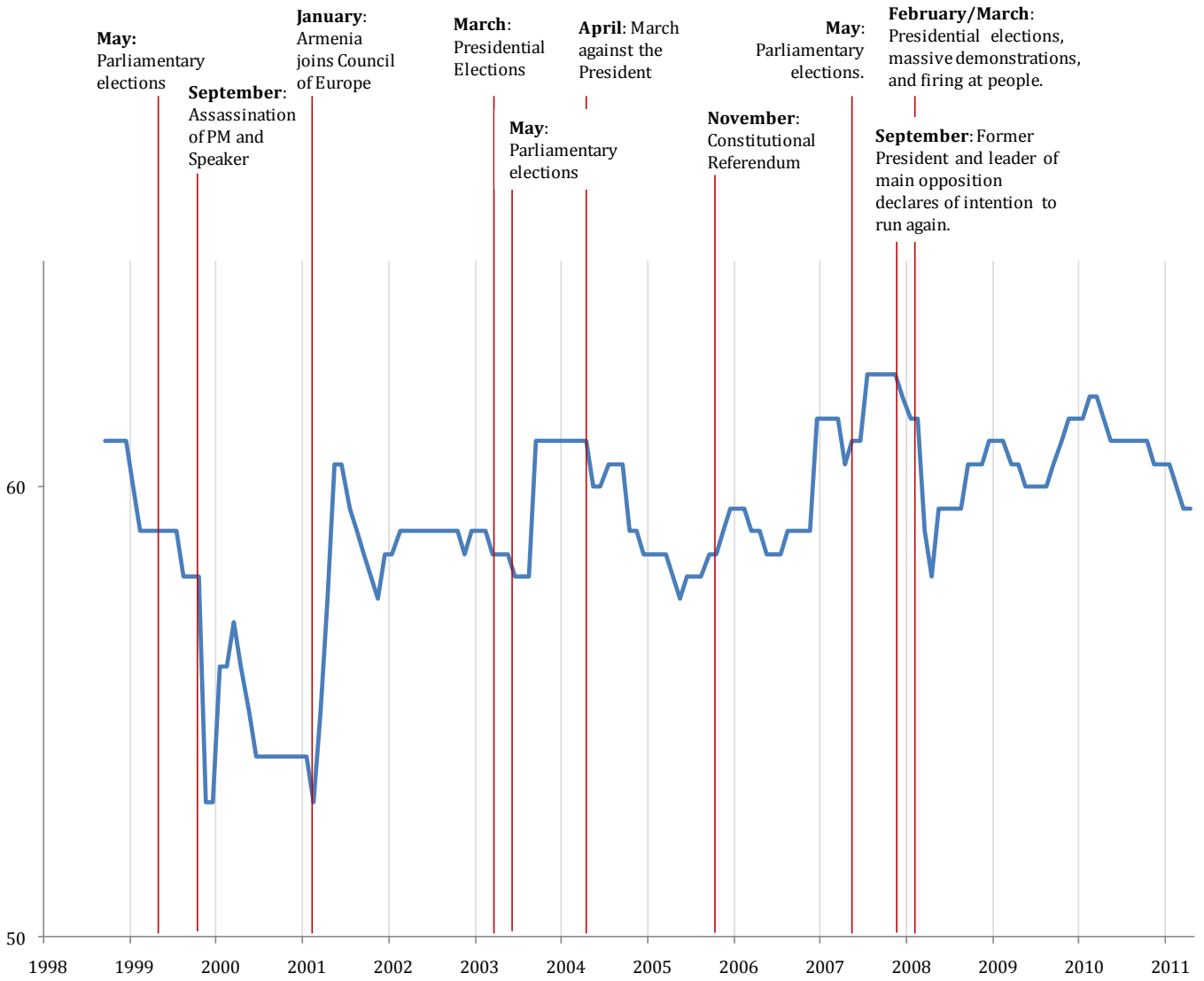
Summary Statistics for Residuals and Forecast Errors

	in sample	out-of-sample	in sample	out-of-sample	in sample	out-of-sample	in sample	out-of-sample	in sample	out-of-sample	in sample	out-of-sample	in sample	out-of-sample	in sample	out-of-sample
Mean	0.000	0.004	0.000	-0.004	0.000	0.005	0.000	0.004	0.000	-0.034	0.000	0.003	0.000	0.001	0.000	0.003
Mean Absolute	0.006	0.013	0.006	0.011	0.006	0.012	0.006	0.013	0.006	0.034	0.006	0.012	0.006	0.012	0.006	0.012
Mean Sum Squares	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Root Mean Sum Squares	0.009	0.014	0.008	0.013	0.008	0.013	0.009	0.014	0.008	0.035	0.009	0.014	0.009	0.013	0.009	0.014

Table 4.14. Out-of-sample Forecasts from Random Walk model for the Level of REER

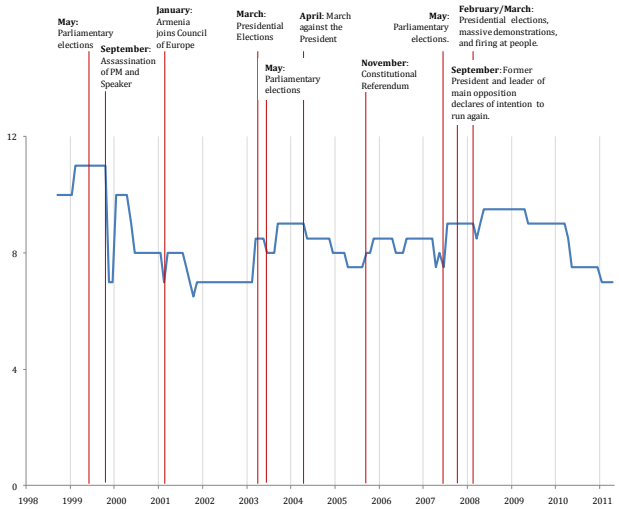
period	observed	forecast	error
2010M1	4.8247	4.7983	-0.0264
2010M2	4.8352	4.8253	-0.0099
2010M3	4.7997	4.8353	0.0356
2010M4	4.8108	4.8015	-0.0093
2010M5	4.8830	4.8121	-0.0709
2010M6	4.9260	4.8807	-0.0453
2010M7	4.9102	4.9216	0.0114
2010M8	4.9103	4.9066	-0.0037
2010M9	4.9050	4.9067	0.0017
2010M10	4.8850	4.9017	0.0167
2010M11	4.9042	4.8827	-0.0215
2010M12	4.9328	4.9009	-0.0319

RMSE of forecast = 0.0305

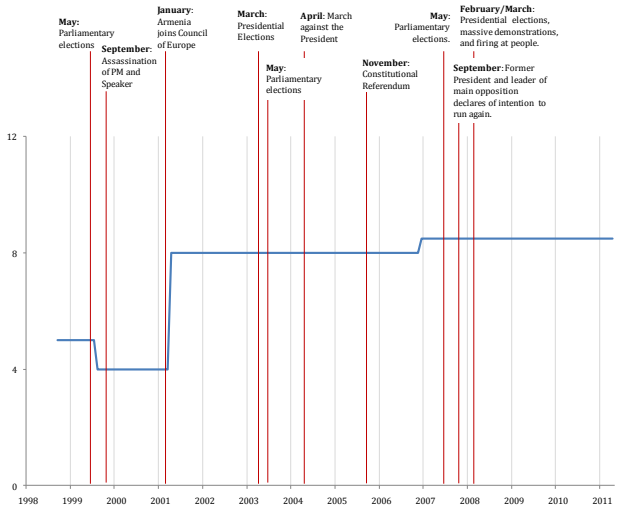


(a) political risk

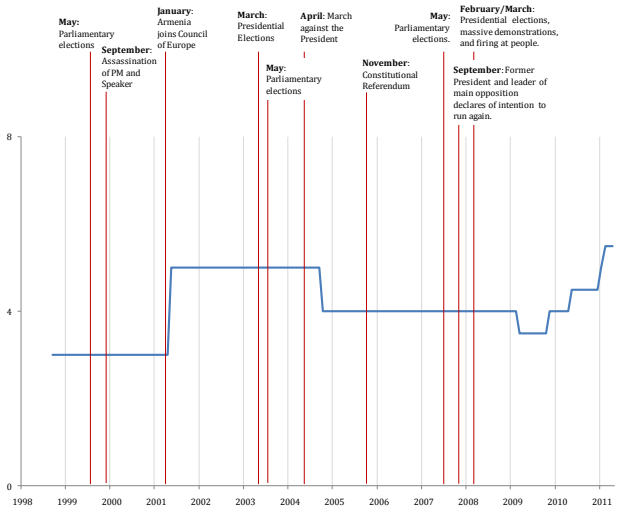
Figure 4.1. Political Risk Indicators.
Source: International Country Risk Guide (2011)



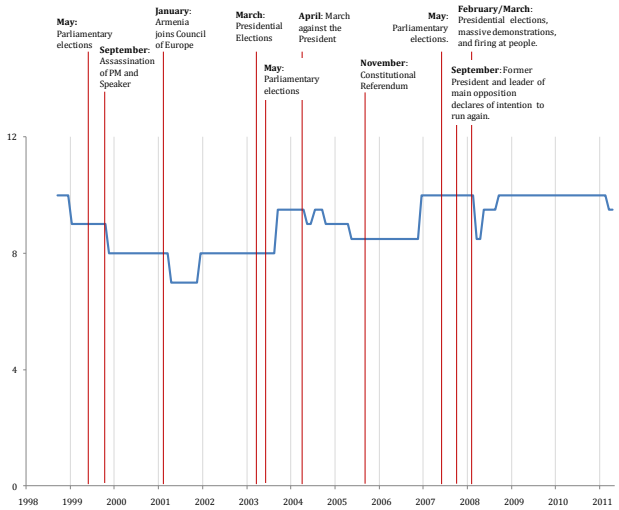
(b) government stability



(c) investment profile

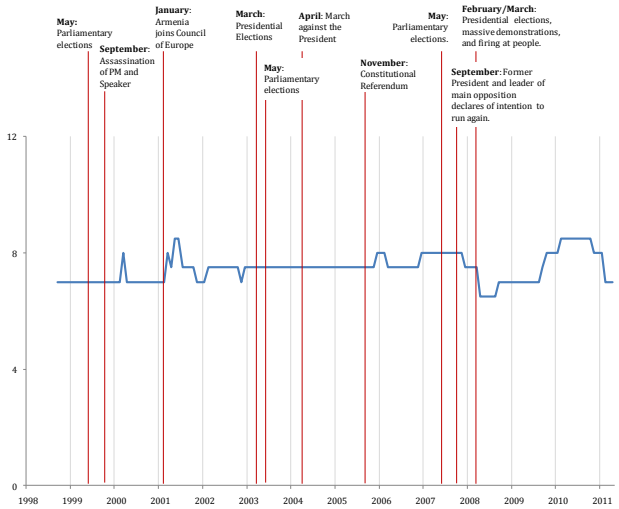


(d) socio-economic situation

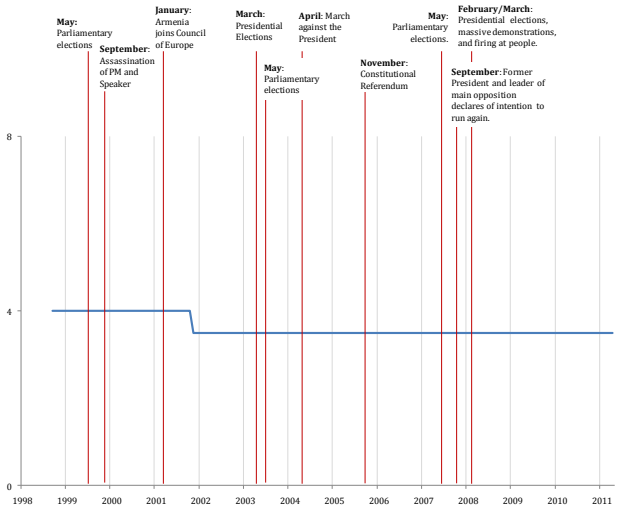


(e) internal conflicts

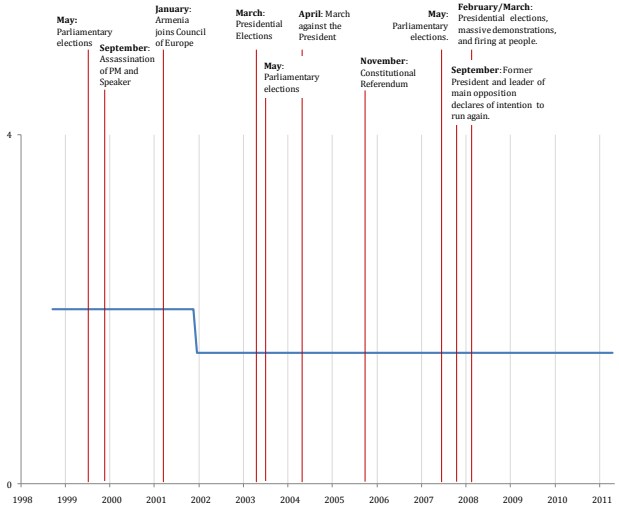
Figure 4.1 (*continued*). Political Risk Indicators.



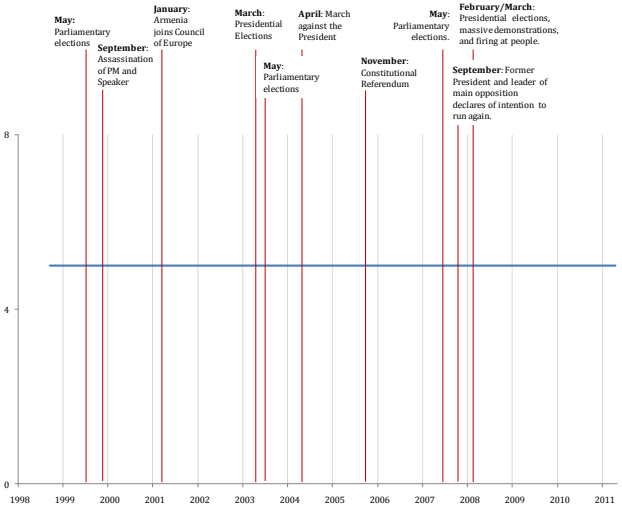
(f) external conflicts



(g) military in politics

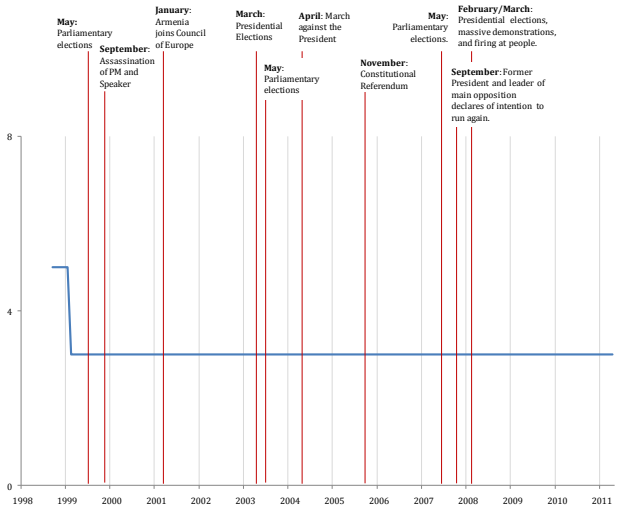


(h) corruption

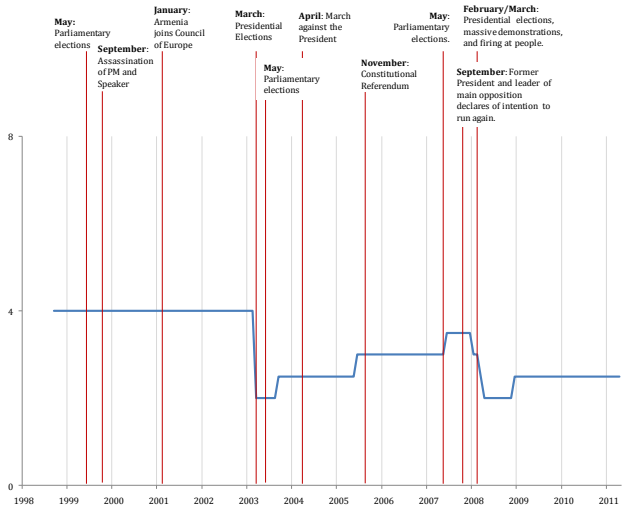


(i) religious tensions

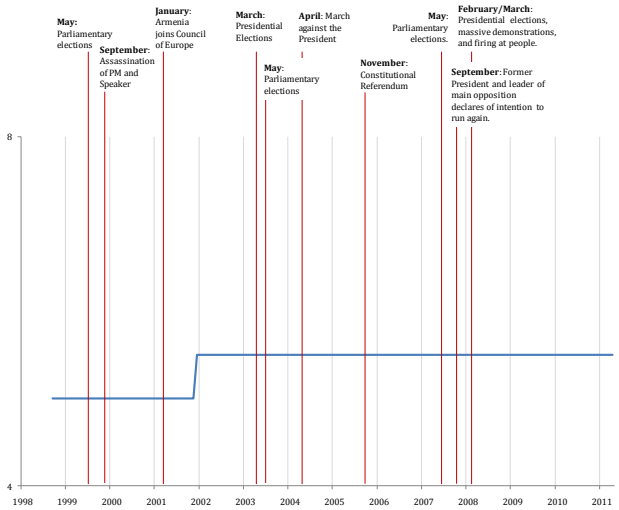
Figure 4.1 (*continued*). Political Risk Indicators.



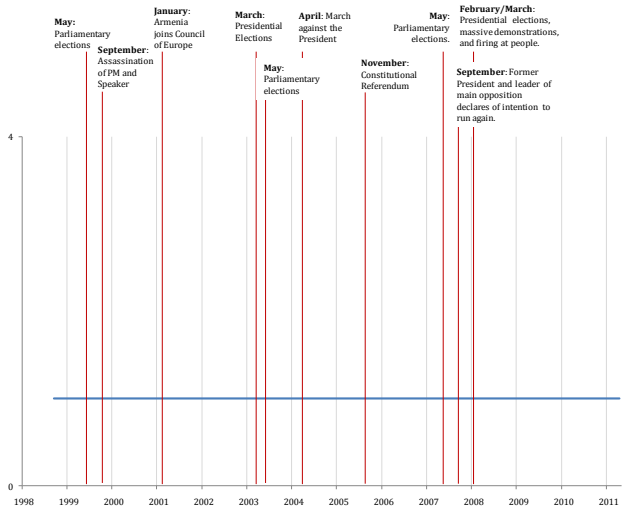
(j) law and order



(k) democratic accountability



(l) ethnic tensions



(m) bureaucracy quality

Figure 4.1 (*continued*). Political Risk Indicators.

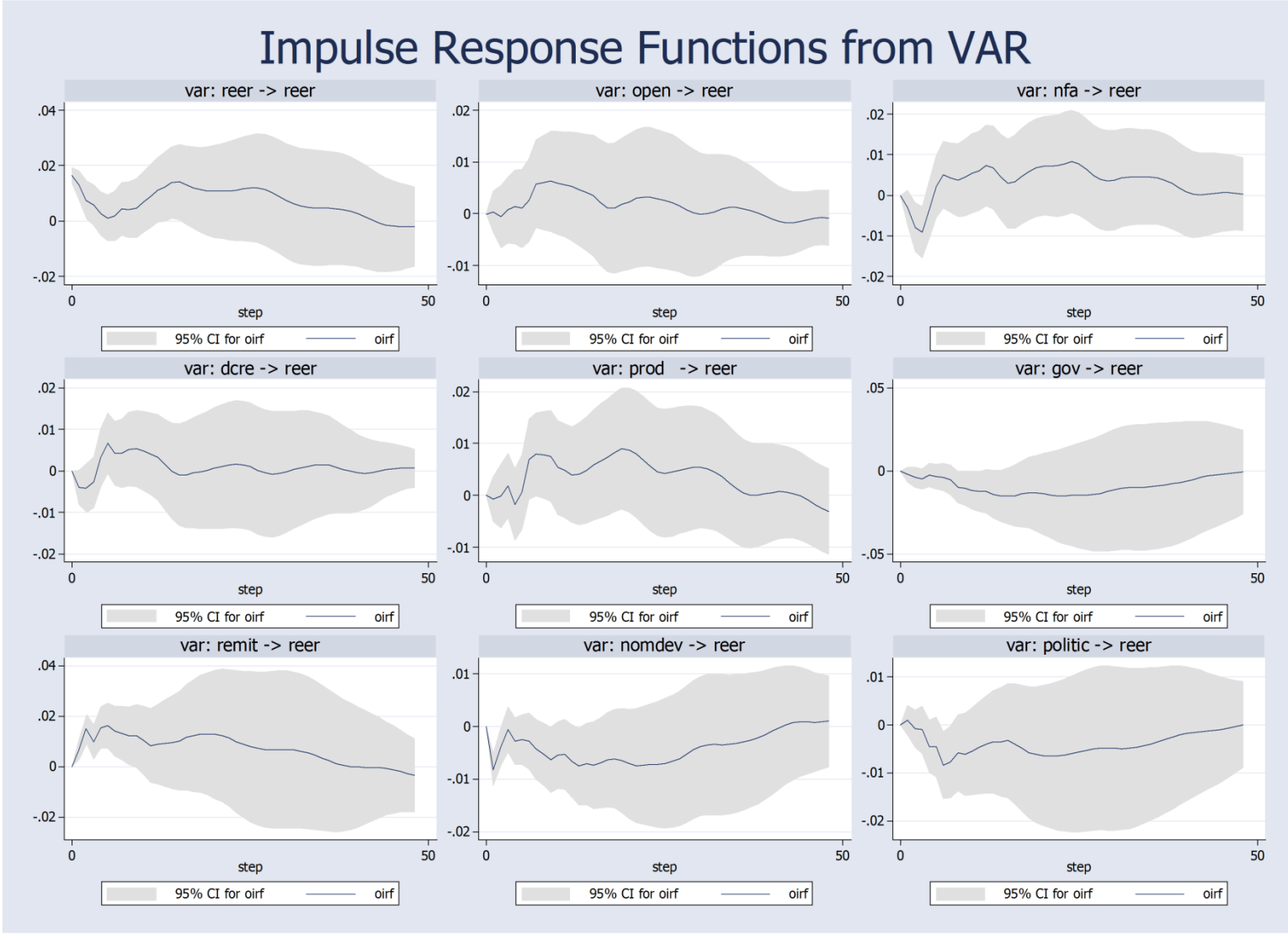


Figure 4.2. Impulse Responses from the VAR model on the real exchange rate (*reer*)
Note: graphs are represented as: *impulse* -> *response*

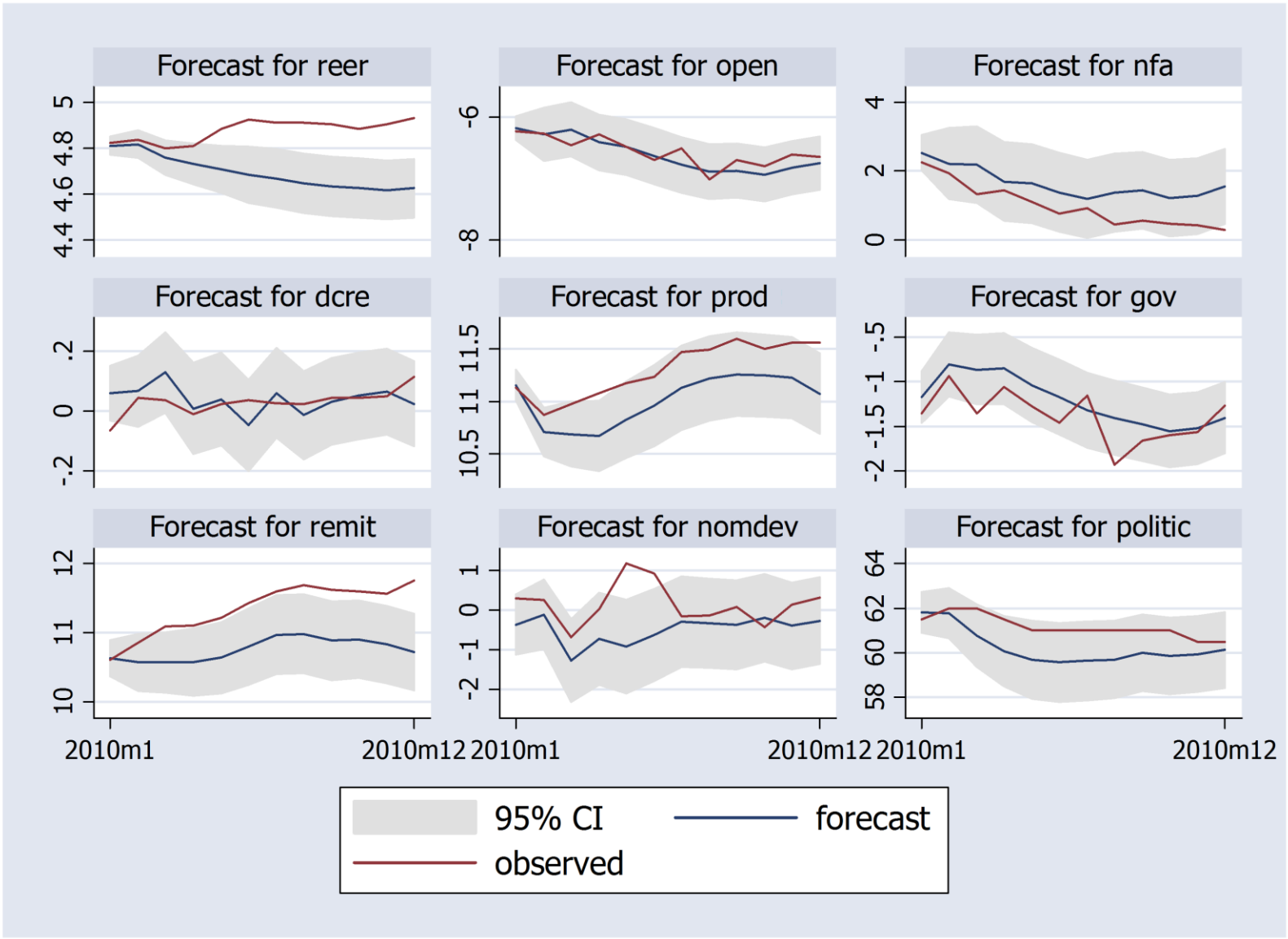


Figure 4.3. Out-of-sample Dynamic Forecasting from the VAR model, 2010:1-2010:12

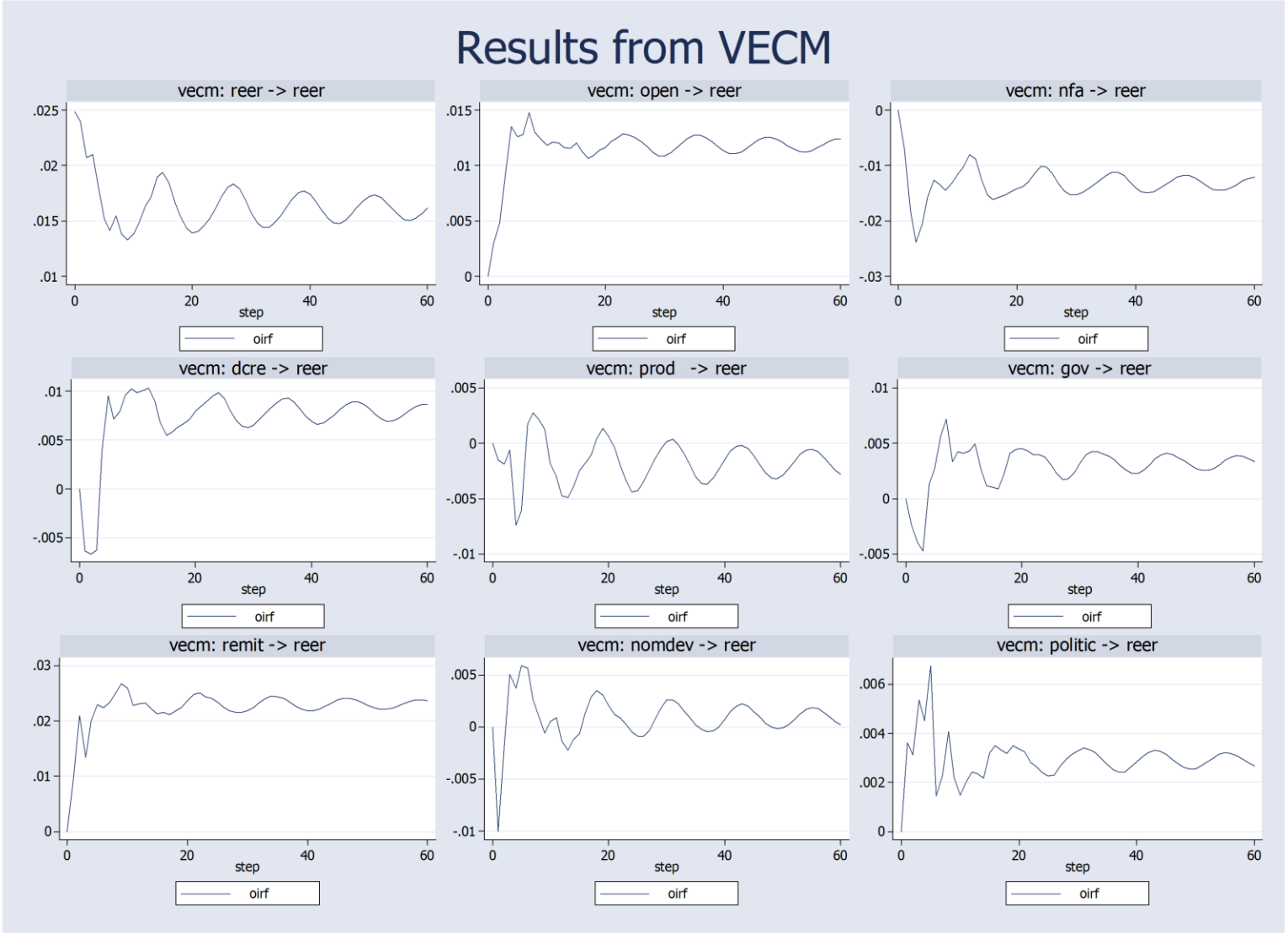


Figure 4.4. Impulse Responses from the VECM on the real exchange rate (*reer*)
Note: graphs are represented as: *impulse* -> *response*

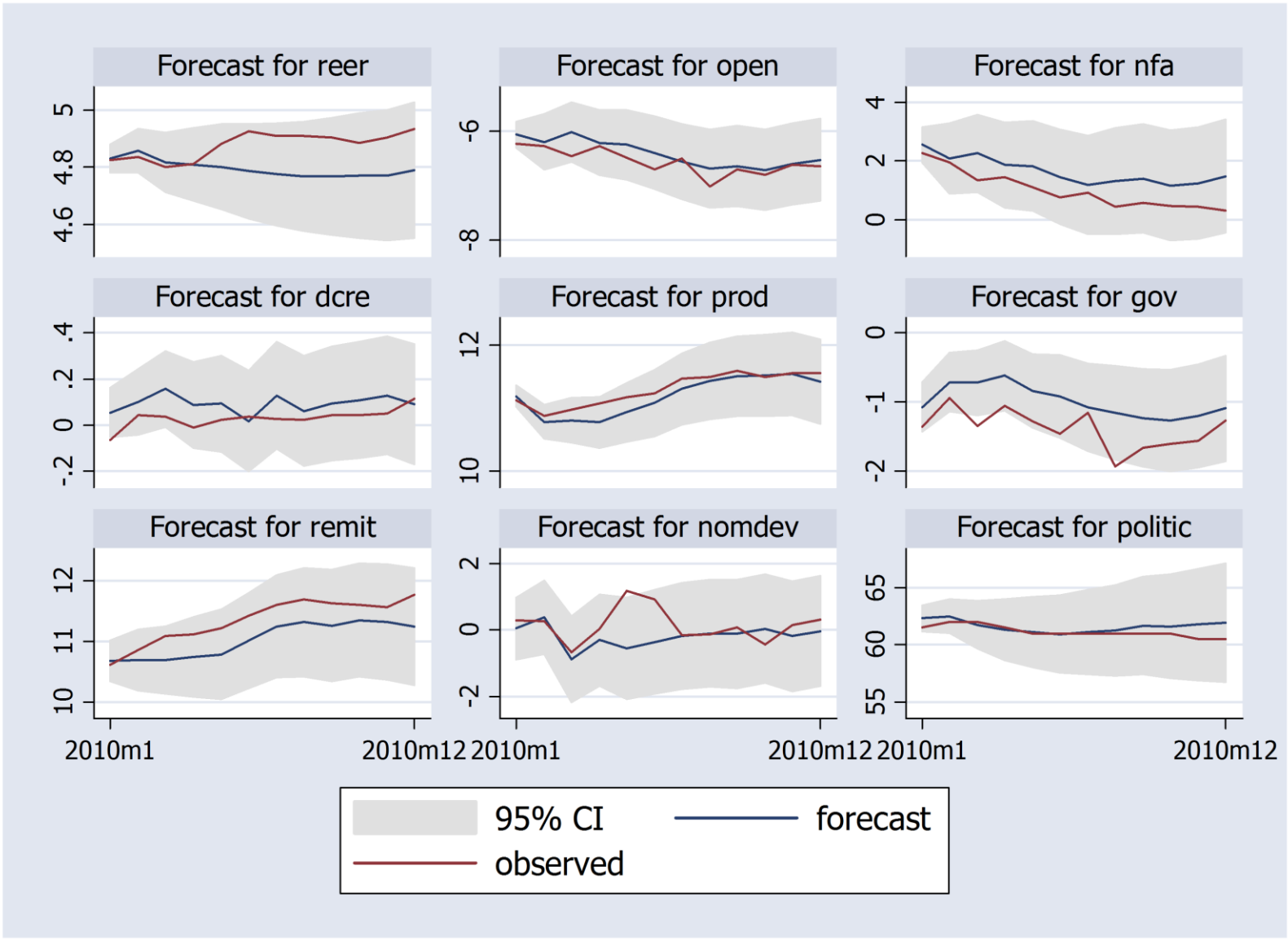
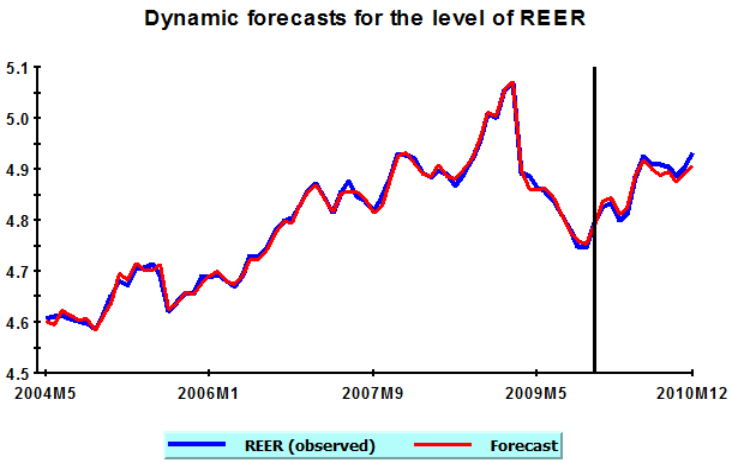
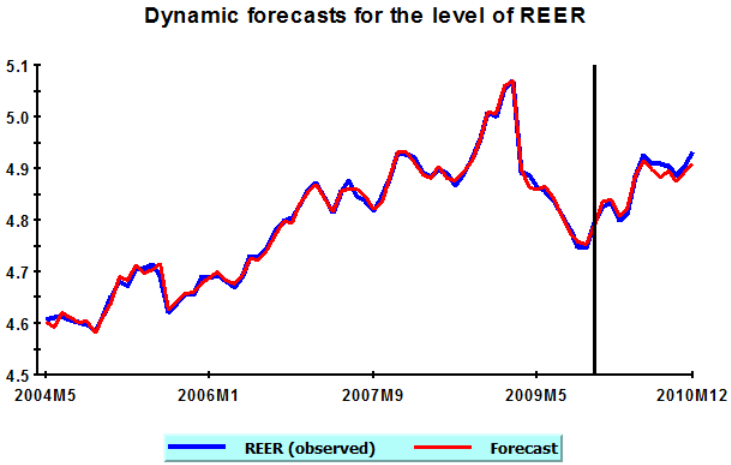


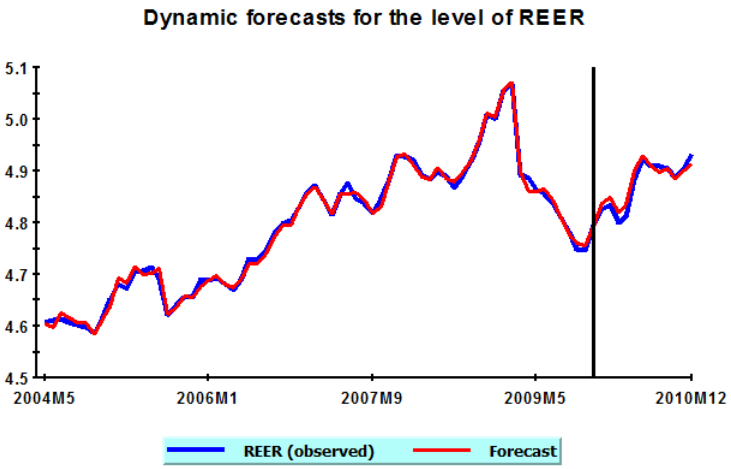
Figure 4.5. Out-of-sample Dynamic Forecasting from the VECM, 2010:1-2010:12



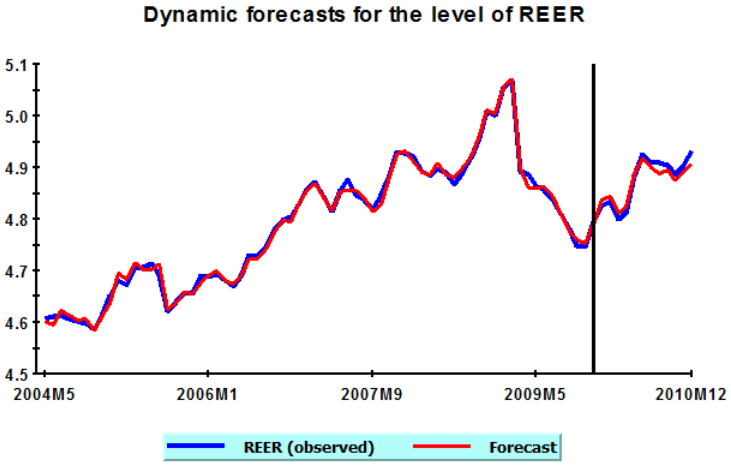
(a) base model, no political risk



(b) democratic accountability

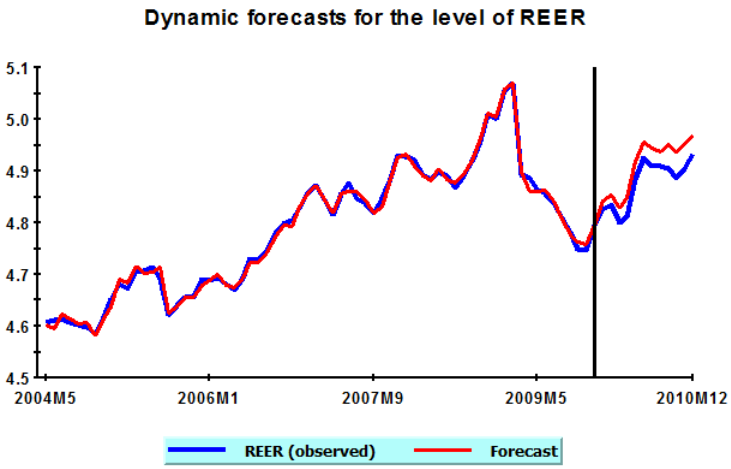


(c) political risk rating

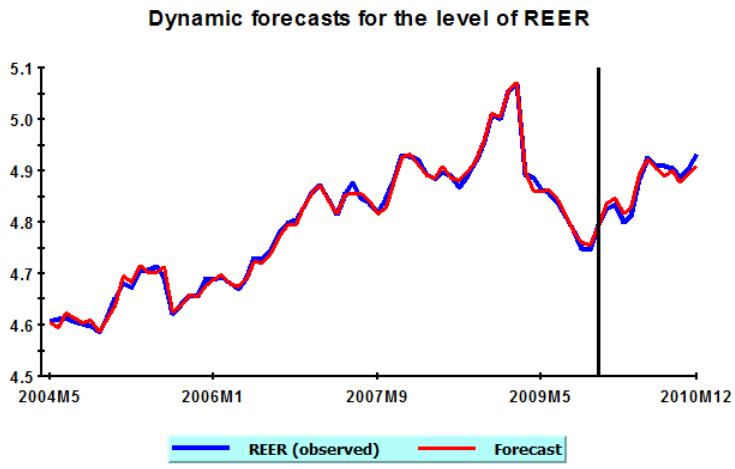


(d) socio-economic conditions

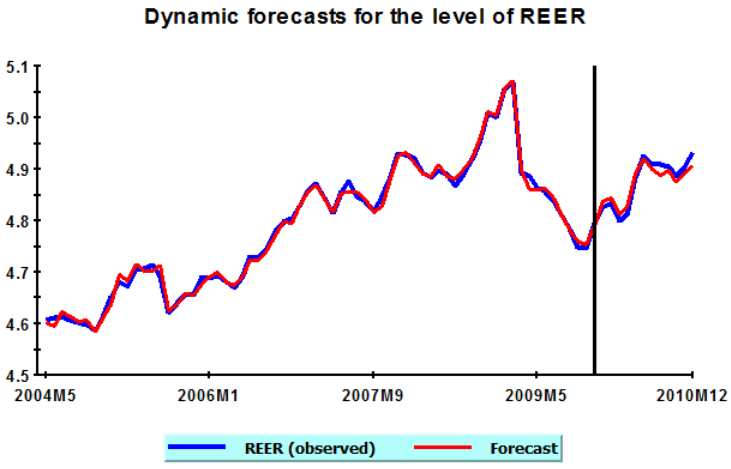
Figure 4.6. Dynamics forecasts for the level of REER from ARDL



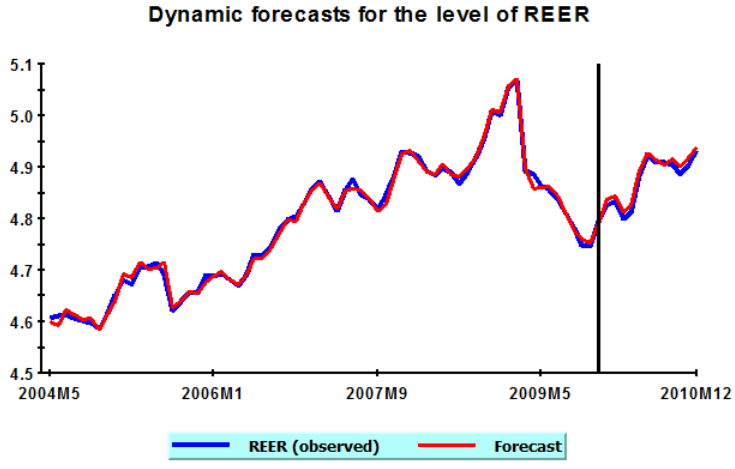
(e) external conflicts



(g) investment profile



(f) internal conflicts



(g) government stability

Figure 4.6 (*continued*). Dynamics forecasts for the level of REER from ARDL

Figure 4.7. Forecasts for the level of REER from Random Walk Model

CHAPTER 5

SUMMARY AND CONCLUSIONS

5.1 Summary and Conclusions

The motivation for this research was based on the personal observation of rapid developments in the currency exchange market in Armenia which gave a rise to speculative theories used for political purposes by government opponents and loyalists. Government opponents accused the government and the Central Bank of Armenia (CBA) of intentional manipulation of exchange rates through foreign exchange interventions to benefit government connected import businesses. The CBA and government officials denied any wrongdoing and argued that economic growth, massive remittances, and the weakening dollar were the causes for the rapid appreciation that had occurred.

The real exchange rate is an important relative price that significantly impacts the long-run development and growth of the economy and social welfare. An increased understanding of exchange rate determinants and impacts should be quite useful in evaluating macroeconomic and monetary policies and anticipating their short and long run impacts.

The development of models that can successfully predict future exchange rates has become one of the major objectives of macro and monetary economists worldwide. All past developments in exchange rate modeling and estimation were undermined by Meese and Rogoff's (1983a; b) seminal articles in the early 1980's that showed that none of these models were able to out-perform the simple random walk model in out-of-sample forecasting. Alan Greenspan, the former Chairman of the Federal Reserve, concluded in a 2002 speech that after much investment in exchange rate

research, a consensus was yet to be reached over the *right* exchange rate determination model (US Senate, 2002).

Several studies have attributed the poor performance of structural exchange rate models in part to the omission of political risk factors that describe the political climate for foreign investors and other economic agents. Economists have found strong links between the political environment and exchange rate dynamics - an idea articulated as far back as in 1923 by Keynes. However, the exchange rate literature on developing and transition countries remains silent on this relationship.

This study utilizes multiple econometric estimation approaches (VAR, VECM and ARDL) to analyze real exchange rate dynamics in relation to economic fundamentals. We then incorporate several political risk indicators in the analysis to see if they improve the overall performance of the real exchange rate models and inquire if changes in the political climate have affected the real exchange rate in Armenia. Finally, we evaluate the out-of-sample forecasting power of these models to (1) make an inference on the overall effectiveness of these models to forecast real exchange rate in a transition country; (2) examine if accounting for the political climate and investment risk helps to improve the forecasting power; and (3) see if any of these models perform better than the simple random walk as argued in Meese and Rogoff (1983a).

The **value of this study** is threefold. **First**, the results provide interested parties with a practical understanding of the role of different macroeconomic and political factors in Armenia's real exchange rate dynamics. The findings provide strong indications that the real exchange rate dynamics over the study period were driven by economic developments as implied by the economically expected and statistically significant macroeconomic and financial variables in the models and the explanatory power of the models. The results weigh against the claim that the government and the Central Bank directly manipulated the exchange rate because observed real

exchange rates are well explained by changes in macroeconomic conditions in the Armenian economy.

Second, the empirical exchange rate literature has used various estimation approaches to assess the real exchange rate relationship to economic fundamentals. Economic research on transition and developing countries is greatly challenged by the short time spans of data available for these economies. Traditional estimation and testing approaches are often sensitive to sample size and new approaches to cointegration testing and parameter estimation that were theoretically shown to perform better for small samples have been proposed.

This study evaluated alternative estimation approaches based on their out-of-sample forecasting performance. The traditional VAR and VECM approaches are evaluated against the more recent bounds testing and ARDL approach. Moreover, to test the standing of these approaches relative to the Meese and Rogoff (1983a) critique, these estimators were also evaluated against the simple random walk model using the root mean sum squared error (RSME) criteria similar to the one used by Meese and Rogoff (1983a).

Results provide a strong support for ARDL over the VAR and VECM in out-of-sample forecasting performance. Furthermore, results indicate that the ARDL models (both, with and without political risk) perform slightly better in out-of-sample forecasting as compared to the random walk. Our findings empirically confirm the theoretical findings of Pesaran and Shin (1998) and Pesaran *et al.* (2001) for this analysis.

Third, this study contributes to the limited literature on the relationship between risk associated with a country's political environment and exchange rates. Existing studies primarily focus on industrialized and Latin American developing countries. Therefore, this study makes timely contribution by adding results from a country with different economic and geo-political endowments. Figure 4.1 shows that the political risk indicators are often correlated with the main

political events in Armenia. However, our results, suggest very weak or no effect of the political risk factors on Armenia's real exchange rate. This suggests a minor role for political risk in the decisions of major foreign investors in Armenia.

It is possible that the small impact of political risk on the exchange rate may be related to the strong importance of Diaspora in the Armenian economy. Additional research (see discussion in Appendix B) suggests that the investment decision-making motivation and triggering factors of Armenian Diaspora representatives are significantly different from those of conventional investors. Ethnic identity and in-country contacts play an important role in Diaspora investment decisions and this may serve to reduce the impact of changes in the political climate on foreign investments in Armenia and the Armenian exchange rate. Further research is needed to examine this relationship in greater detail.

5.2 Policy Implications

Results from this study find strong evidence of permanent effects of various macroeconomic variables on the real exchange rate. For example, a 10% reduction in trade restrictions and 10% growth in the inflow of remittances each generate approximately 2% real exchange rate appreciation. To the contrary, 10% positive changes to the net foreign assets and domestic credit growth will induce permanent real exchange rate depreciation by approximately 1 and 4 percent, respectively.

Policymakers and monetary authorities should take the natures and magnitudes of these relationships into account when designing monetary and/or macroeconomic policies to facilitate real long-term economic growth.

When assessing macroeconomic dynamics in the economy, a major challenge is posed by the multi-directional impact of changes in various endogenous components of the economy. Our results outline the potential reaction of the real exchange rate in response to shocks in economic

fundamentals. Understanding these relationships helps policymakers anticipate real exchange rate effects from policy changes that are not directed at the exchange rate as well as the multiple effects of policies that are directed at the exchange rate. Thus, from a policy perspective, knowing how any changes in the economic fundamentals will affect real exchange rate will allow policymakers to better weigh policy alternatives.

The implications of the political risk variables are a little different since they are exogenous; however, the concern about broad effects still exists. Political reform will affect many things beside the exchange rate that must also be considered when considering it as a policy tool. For example, these additional effects would weigh against intentionally increasing political risk to try and weaken the domestic currency even when there is a desire to devalue it.

Results also indicate that nominal devaluation can be a valuable tool for affecting the real exchange rate, however its effectiveness will depend on the magnitude of the nominal devaluation and country's ability to finance sustained interventions.

As Armenia's economy starts its recovery, it becomes crucial to support its growth and competitiveness through a long-term balanced macroeconomic strategy and policies that will largely be based on economic and market principles. Limiting interventions in the currency market will allow for market based adjustments. Even though interventions to smooth large foreign currency inflows may be needed, it should not be a substitute for a long-term macroeconomic stability. As IMF reports, even though interventions are warranted to smooth excess volatility, CBA's recent response has been asymmetric with "*decisions tilted toward preventing depreciation, motivated in part by concerns for the rapid pass-through of the exchange rate to inflation"* (IMF, 2009a)".

Furthermore, the former IMF Country Director to Armenia, Dr. Nienke Oomes, has identified (personal communication) the vulnerability of Armenia's currency market to a single large transaction, either by an individual or an organization, as a source of major short-term movements

in the currency market. In the absence of proper information about exchange rates, this may trigger an alarm in the society if the one-time short-term effect is perceived as a permanent shock. Hence, policies designed to mitigate/limit the impact of such single transactions and maintain macroeconomic and monetary stability may be warranted.

5.3 Suggestions for Future Research

Results of the study also suggest directions for possible extensions of this research. One logical extension of this work would expand the research to other countries to further explore the robustness and generalizability of our modeling approach and choice of indicators. Another logical continuation of the work is to examine the potential misalignment of the real exchange rate from its long-run equilibrium path.

Another area of extension could examine the impact (*pass-through*) of exchange rate volatility on import and export prices with an aim to explore the responsiveness of specific commodities to exchange rate movements and investigate anecdotal evidence of monopolistic and oligopolistic market structures in the transition economies, especially in the import markets.

Finally, extending the research to countries with differing levels of Diaspora involvement in its economy would help in better understanding the roles of Diaspora and political risk in exchange rate determination.

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APPENDIX

Table A1. Error Correction Representation of the Selected ARDL Model

Regressor	A	C	B	D	E	F	G	H
dOPEN	0.0186*	0.0204*	0.0258**	0.0187*	0.0233**	0.0187*	0.0188*	0.0197*
	(1.7019)	(1.8625)	(2.4325)	(1.6865)	(2.1484)	(1.6896)	(1.7067)	(1.7829)
dNFA	-0.0074*	-0.0084*	-0.0136***	-0.0074*	-0.0117**	-0.0073*	-0.0076*	-0.0089*
	(-1.7397)	(-1.9549)	(-2.9833)	(-1.7218)	(-2.5425)	(-1.7094)	(-1.7681)	(-1.951)
dPROD	-0.0264**	-0.0248*	-0.0339***	-0.0265*	-0.0309**	-0.026*	-0.0254*	-0.0283*
	(-2.0063)	(-1.8935)	(-2.6804)	(-1.9249)	(-2.3923)	(-1.9247)	(-1.9087)	(-2.1222)
dPROD1	-0.0052	-0.0048	-0.0069	-0.0052	-0.0044	-0.0053	-0.0058	-0.0074
	(-0.5804)	(-0.5378)	(-0.8092)	(-0.5708)	(-0.4973)	(-0.5811)	(-0.6362)	(-0.7913)
dPROD2	0.0019	0.0015	0.0066	0.0019	0.0061	0.0016	0.0017	0.0032
	(0.2007)	(0.1604)	(0.7369)	(0.2025)	(0.6566)	(0.169)	(0.1836)	(0.3408)
dPROD3	-0.0526***	-0.0528***	-0.052***	-0.0525***	-0.0502***	-0.0527***	-0.052***	-0.0524***
	(-5.8813)	(-5.9477)	(-6.1802)	(-5.7585)	(-5.7446)	(-5.8226)	(-5.7591)	(-5.8491)
dDCRE	-0.0374**	-0.0402**	-0.0468***	-0.0373**	-0.0431***	-0.0373**	-0.0372**	-0.0381**
	(-2.3575)	(-2.5332)	(-3.0637)	(-2.2791)	(-2.7583)	(-2.3252)	(-2.3286)	(-2.3967)
dGOV	0.0008	0.0006	0.0052	0.0007	0.0033	0.0005	-0.0001	0.0026
	(0.1207)	(0.0978)	(0.8295)	(0.1017)	(0.5221)	(0.0804)	(-0.0125)	(0.3862)
dREMIT	-0.0051	-0.0057	-0.0059	-0.0051	-0.0059	-0.0051	-0.0063	-0.0054
	(-0.8242)	(-0.9223)	(-1.0068)	(-0.8152)	(-0.9837)	(-0.8208)	(-0.9577)	(-0.8669)
dNOMDEV	0.0455***	0.0455***	0.0447***	0.0455***	0.045***	0.0455***	0.0457***	0.0451***
	(19.154)	(19.282)	(19.8207)	(18.6489)	(19.4372)	(18.9389)	(18.9317)	(18.6917)
dPOLITIC		0.0015						
		(1.351)						
dDEMOCR			0.0091***					
			(2.8416)					
dSECON				-0.0002				
				(-0.0413)				
dEXTCONF					0.0072**			
					(2.1049)			
dINTCONF						0.0004		
						(0.1558)		
dINVEST							0.0066	
							(0.5911)	
dGOVSTAB								-0.0031
								(-0.9232)
ecm(-1)	-0.0986***	-0.1058***	-0.1148***	-0.0987***	-0.0989***	-0.0994***	-0.1047***	-0.0976***
	(-4.9395)	(-5.1571)	(-5.8523)	(-4.8855)	(-5.1091)	(-4.7965)	(-4.6341)	(-4.8724)
half life (*months*)	6.68	6.20	5.68	6.67	6.66	6.62	6.27	6.75
R-squared	0.9337	0.9359	0.9425	0.9337	0.9388	0.9337	0.9341	0.9347
R-bar-squared	0.9177	0.9190	0.9273	0.9162	0.9226	0.9162	0.9167	0.9175
F-stat	69.1113	64.4722	72.3250	62.1810	67.7462	62.2093	62.6178	63.2497
SER	0.0096	0.0095	0.0090	0.0097	0.0093	0.0097	0.0097	0.0096
RSS	0.0050	0.0048	0.0043	0.0050	0.0046	0.0050	0.0050	0.0049
DW-stat	1.9309	2.0142	2.1398	1.9305	2.0814	1.9351	1.9298	1.9134

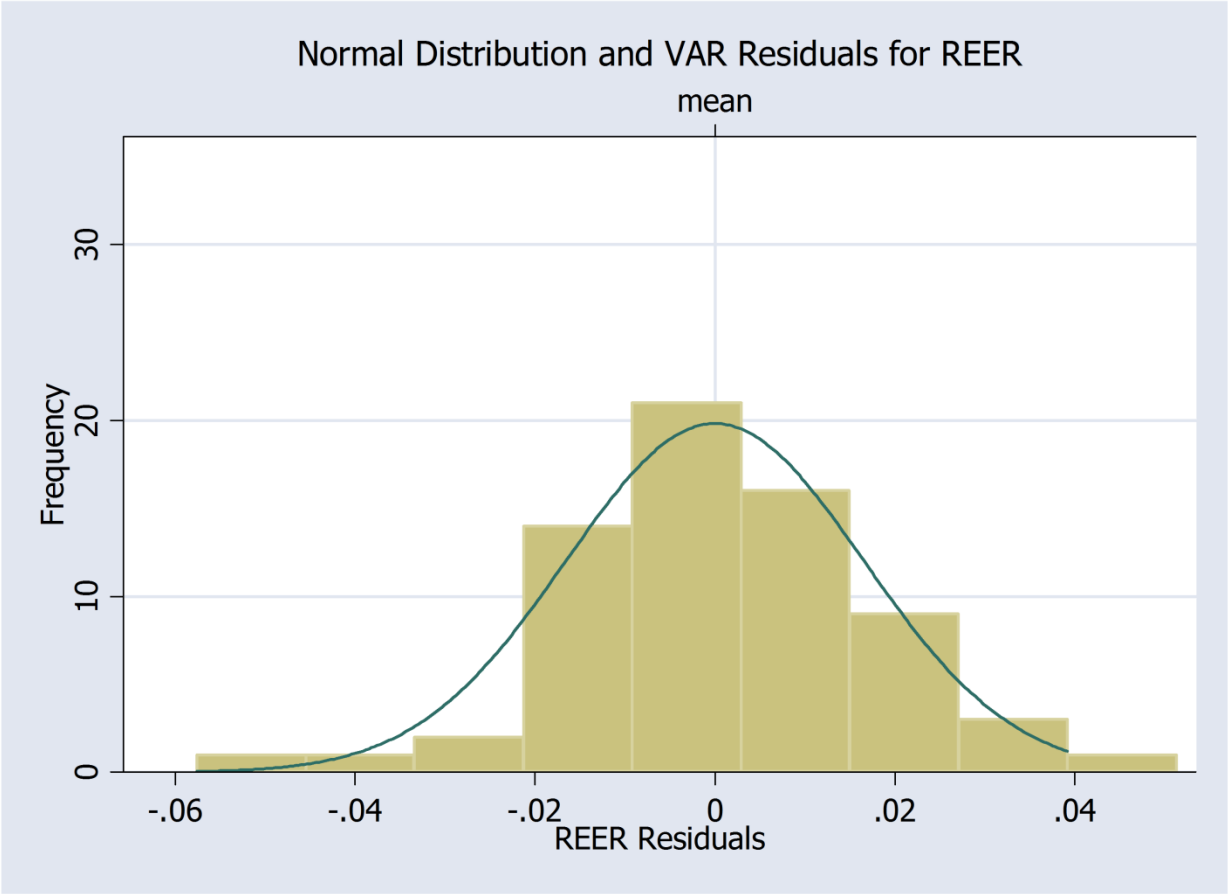


Figure A1. Distribution of residuals from VAR model, equation *reer.*

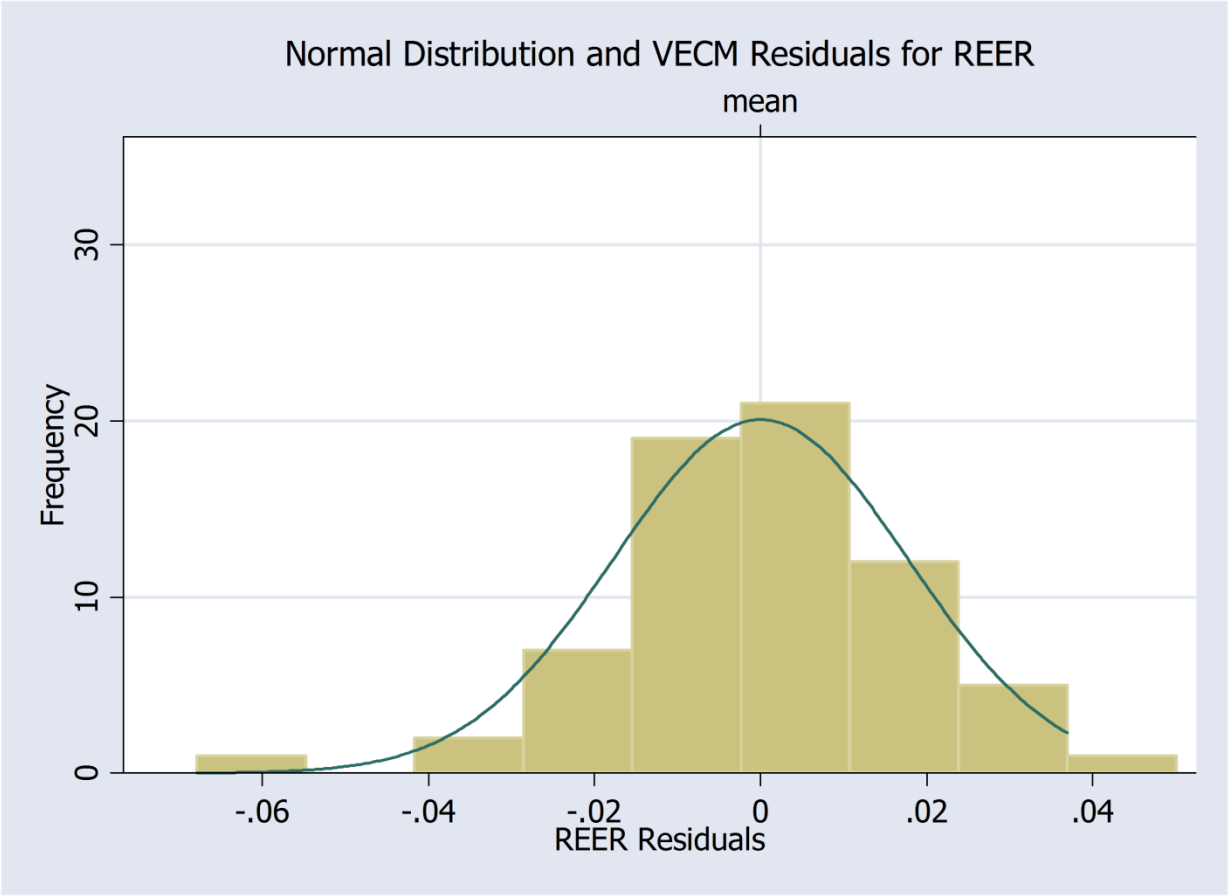


Figure A2. Distribution of residuals from VECM, equation *reer.*

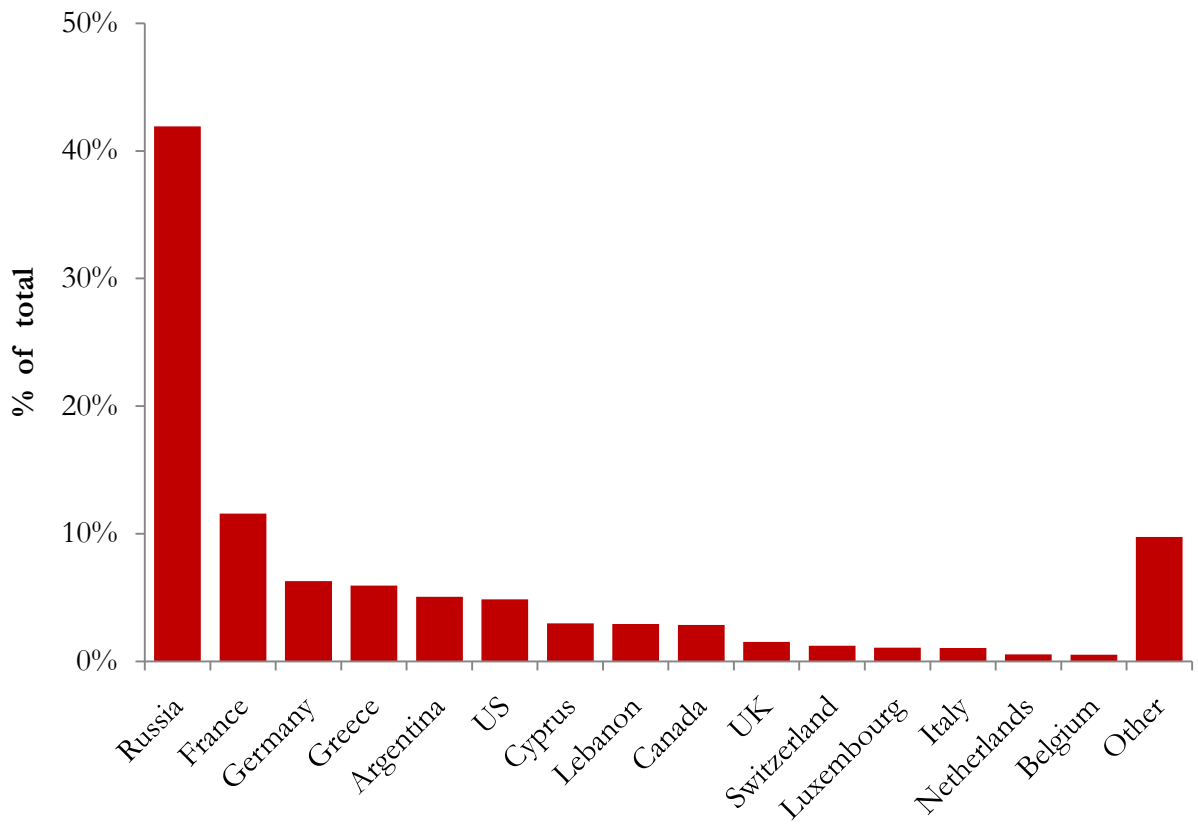
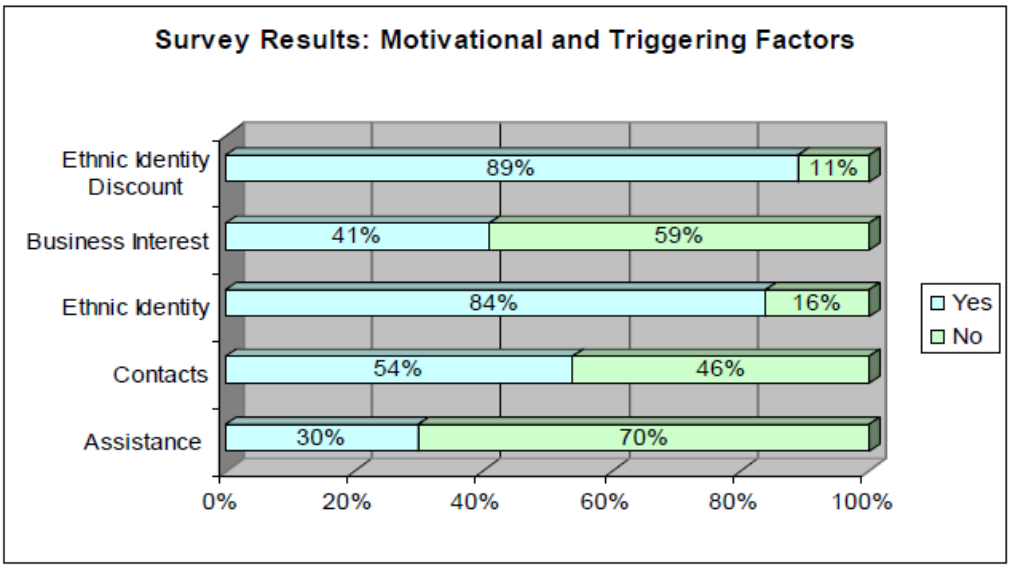


Figure A3. Foreign Direct Investments in Armenia by Country of Origin

Source: Armenian Economic Association (2011)

Survey Results



Assistance (Technical assistance, outsourced contract opportunities for local companies, export assistance prior to investment as a key triggering factor; Yes=Assistance influenced, No=influence)
Contacts (Frequent visits, family/friends contacts prior to investment as a key triggering factor; Yes= Contacts affected investor's decision, No=Contacts did not affect)
Identity (Ethnic identity affiliation (being Armenian) as a key motivational factor affected the investment decision, Yes=Factor affected investor's decision, No= Factor did not affect)
Business Interest (Business interest as a key motivational factor affected the investment decision, Yes= Factor influenced the investment decision, No= Factor did not affect)
Discount (Willingness to accept an "ethnic identity discount", Yes= Willingness to accept the "discount", No= No "discount")

Figure A4. Motivational and Triggering Factors for Diaspora Investment

Source: Hergnyan and Makaryan (2006)

Appendix B

A note on the motivational and triggering factors for investment decision making by the Armenian Diaspora

While not directly intuitive from our model, Armenian FDI data show a strong concentration of FDI sources in Russia[22]; 42 percent in average during 1998-2010 (Figure A3). FDI from Russia are twofold: (1) Armenian Diaspora in Russia is a major source of investments and Armenia's strategic economic, political, and military alliance and partnership with Russia provides a different rationale for Russia-originating FDI in Armenia (both private and state). The former may suggest that the ethnic identity triumphs the investment risks (as seen below) and the latter may imply that the multidimensional strategic alliance with Russia provides Kremlin-backed investment guarantees that, in essence, eliminate any investment risk due to political instability.

Hergnyan and Makaryan (2006) reported that the Diaspora-led FDI in Armenia during 1998-2004 accounted for in average 25% of the total FDI during that time period (it is 43% when excluding large, usually single donor funded infrastructure FDI). The authors also surveyed about 150 investors from 15 countries on motivational and triggering factors of investing in Armenia (Figure A4). Their results show that:

1. 84% of surveyed investors indicate that the ethnic identity (i.e. being Armenian) was the key motivational factor that affected their investment decision.
2. 89% are willing to accept an "*ethnic identity discount*".

[22] Russia has the largest Armenian Diaspora in the world; approximately 2 million Armenians live in Russia, compared to 2.5-3 million Armenians living in Armenia.

3. 54% reported that their in-country contacts (frequent visits, family and friends) were a key triggering factor.
4. Meanwhile, only 30% reported business assistance prior to investing being a key triggering factor. Also, business interest as a key motivational factor affecting investment decision was an important factor for only 41 percent of investors.

The above results suggest of an existence of non-conventional investment decision-making mechanism among major foreign investors in Armenia, where national identity was/is more important in their investment decision than traditional business-related concepts, such as investment risk and political stability. From these perspectives, not finding political risk indicators statistically significant and/or meaningful is not surprising. Even though, a further examination of this phenomenon is warranted in a multicounty framework.