EXCHANGE RATE PASS-THROUGH IN KYRGYZSTAN

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ABSTRACT

This paper investigates the degree of exchange rate pass-through into domestic prices for Kyrgyzstan from January 2000 to July 2019. The study employed impulse response function and variance decomposition obtained from the vector autoregression model. This study aims to investigate the effect of exchange rate changes on the domestic price level in Kyrgyzstan. The impulse response functions and variance decomposition results present a high and long-lasting impact from changes in exchange rates to producer and consumer prices. The results confirm an incomplete exchange rate pass-through, indicating that the purchasing power parity theory does not hold regarding the price level in the context of Kyrgyzstan.

Keywords: Exchange rate, Pass-through, Consumer price index, Producer price index, Vector autoregressive, Impulse response, Variance decomposition

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ABBREVIATIONS

ADF test – Augmented Dickey-Fuller test

AIC – Akaike information criterion

CPI – Consumer Price Index

ERPT – Exchange rate pass-through

GDP – Gross Domestic Product

HP filter – Hodrick-Prescott filter

IMF – International Monetary Fund

IMP – Import Price Index

IRF – Impulse Response Function

NBKR – National Bank of the Kyrgyz Republic

NEER – Nominal Effective Exchange Rate

PPI – Producer Price Index

VAR – Vector Autoregression

INTRODUCTION

The growing globalization, the deepening of integration processes, and the increasingly close interconnection and interdependence of national economies are the most critical factors in today's world economy. Under these conditions, the role of the exchange rate as an instrument of effective monetary policy in the state. Through the impact on the exchange rate level and its dynamics, the state seeks to solve its main macroeconomic problems. At the same time, in a modern open economy, the choice of economic policy instruments and, in general, its effectiveness largely depends on the exchange rate regime used.

Changes in the exchange rate usually have an immediate effect on the level of domestic prices due to changes in the prices of imported goods in the national currency. This impact initially proceeds through two channels: through direct changes in the prices of imported final goods and services and changes in the prices of goods and services produced domestically, the production costs of which include the costs of imported components.

The effect of changes in the exchange rate on domestic prices in an open economy is called exchange rate pass-through (ERPT). On a macroeconomic level, ERPT directly affects inflation since it is closely linked to the monetary policy of a country. On a microeconomic level, the degree of pass-through determines how firms and households are affected by external shacks (Berner, 2010).

According to the theory, the exchange rate pass-through measures the percentage change in domestic prices of goods resulting from one percentage change in the exchange rate. If one percentage change in the exchange rate causes one percentage change in domestic goods prices, then pass-through is called complete (Goldberg and Knetter, 1996). The ERPT called incomplete or partially complete if there is less than one-to-one change. Different empirical and economic studies tried to understand the degree of ERPT and concluded that

complete ERPT never occurs. At the same time, incomplete pass-through is related to factors such as trade barriers, transaction, transport costs, the market power of the firm, and lack of complete substitution between domestic and foreign products (Kotil, 2020).

A low ERPT may stimulate low inflation rates because depreciation of the domestic currency will not create inflationary pressures to increase import prices; vice versa, high ERPT may lead to a high inflation rate through appreciation of the currency and make import cheaper (Krugman, 2004).

Based on the previous studies, this master paper examines degree of ERPT into domestic price level in Kyrgyzstan. Consequently, the degree of ERPT has important implications for the considering of monetary policy to prohibit the inflationary as well as trade implications of an exchange rate shock. Based on the data of Kyrgyzstan, it will be investigated how dependent the relationship is under unrestricted Vector Autoregressive Model (VAR) specification.

This paper is divided into the following sections: in Chapter 1 the historical development of Kyrgyzstan's monetary and exchange rate policy is presented; Chapter 2 summarizes the theoretical and empirical literature; in Chapter 3 the econometric model is given; and in Chapter 4 concluding remarks and policy recommendations are presented.

CHAPTER 1. Overview of Monetary and Exchange Rate Policy in Kyrgyzstan.

Exchange rate policy is one of the determinants of monetary policy, and its regulation is one of the tasks of the National Bank of Kyrgyzstan. Since the introduction of national currency on May 13, 1993 the National Bank of Kyrgyzstan follows a floating exchange rate, in which rates of foreign currencies to som are composed based on the relation of demand and supply on the internal exchange rate market. This regime adaptation to the changes in world markets and internal macroeconomic situation.

The National Bank determines the official rates of 43 foreign currencies to som. Out of these, 39 are selected weekly. The remaining four (US dollar, euro, Russian ruble, and Kazakh tenge) are updating daily. The exchange rate of the US dollar to som is determined by calculating the weighted average rate of purchase-sale transactions of non-cash dollars concluded on the interbank foreign exchange market over a certain period through the automated trading system of the NBKR. The rates of other foreign currencies to som are calculated using cross-rates to a dollar.

According to the legislation of the Kyrgyz Republic, the financial liability must be expressed and settled in the national currency. After joining the International Monetary Fund (IMF) in May 1992 and assuming the obligations under Clause VIII of the IMF Agreement, "Kyrgyzstan has to refrain from imposing restrictions upon currency rate in payments and transfers on current international transactions, as well as from discriminating currency regimes or multiple currency rate practices without the consent of the IMF" (Kalikova & Associates, 2020, p1).

In Kyrgyzstan, the currency exchange is almost non-existent due to the limited restrictions upon (Kalikova & Associates, 2020):

- Transfer of foreign currency across borders;

- Currency import and export (on condition of its declaring at customs points);
- National and foreign currency exchange transactions;
- Purchase and sale of foreign currency by residents and non-residents at duly licensed banks and exchange offices;
- One-time cash transactions of exchanging national and foreign currency;
- Current payments, operating revenues, and cross-border transfer of capital.

While implementing its monetary and exchange rate policies, Kyrgyzstan has overcome the following stages:

- The period from 1993 till 2000 years was characterized by the depreciation of currency from 4 som till 49 som per US dollar due to the high inflation rates, lack of money in circulation, transition from a planned economy to a market economy, and unavailability of loans (NBKR data, 2000).
- The period from 2001 till 2007 years characterized by an appreciation of the national currency from 48 till 35 soms per dollar due to the growing inflow of remittances from labor migrants (NBKR data, 2007).
- The period from 2008 till 2010 consequently impacted the exchange rate market by the depreciation of som due to the global financial crisis; significant weakening of the Russian ruble; devaluation of Kazakh tenge; and Kyrgyz Revolution in 2008 and 2010. This was caused by a decline in growth in remittances and an increase in the import of fuel and lubricants (Tsoi, 2014).
- The depreciation of som to dollar characterizes the period from 2011 till 2013. An increase in remittances over the past few years had compensated the pressure on the exchange rate of the national currency from growing imports.
- The period from 2014 till 2016: Kyrgyz som achieved its minimum compared to the US dollar. The main reason for this drop is geopolitical problems after the Russian annexation of Crimea in 2014 and the following sanctions from Western countries.

– The period from 2016 till 2018: Kyrgyz som reached its average value (70 som per one dollar) and demonstrated stability and low fluctuations about other currencies for almost two years.

– The period from 2018 till now is accomplished by a dramatic drop in the national currency value due to the riots and change of the presidential power. And due to the global pandemic, Kyrgyz som is now at its minimum, reaching 84 som per US dollar (NBKR, 2021).

Similar to the world practice, the primary tool of the NBKR for stabilizing the situation on the domestic foreign exchange market is currency interventions, which are used to maintain a balance of supply and demand on foreign currency. If necessary, the NBKR can also use a sufficiently large set of instruments to regulate the volume of money supply in the country. Combining the floating exchange rate policy approach with the set of tools on maintaining currency stability caused an absence of significant national currency devaluations during the independent period, while several devaluations took place in neighboring Kazakhstan and Russia.

According to theoretical aspects of economic sciences, for an import-dependent country (Kyrgyzstan), whose domestic production is replaced mainly by imports, strengthening the national currency can positively affect. For instance, for the population, imported goods become cheaper and more accessible. Thus, maintaining the national currency to a certain extent can affect the reduction in inflation. But this relationship occurs only in the case of invariance of other conditions.

CHAPTER 2. Theoretical Framework - Insights into the Relationship

2.1Economic Theory Overview

One of the essential places in a debate over the optimal monetary policy is whether there is a relationship between nominal exchange rate changes and prices. If the relationship exists, what is the degree of correlation? This correlation between exchange rate and prices has received the name "exchange rate pass-through" in the economic theory.

Substantially, ERPT is a percentage change in domestic prices caused by a change in the exchange rate. ERPT is partial or incomplete if the domestic prices raise less than one percent to a one percent change in the exchange rate.

The benchmark of the theory of ERPT is *Purchasing Power Parity* states that the pass-through of exchange rate on domestic prices ought to be complete, which means that one percentage (%) change in exchange rate leads to 1 percentage (%) change in prices of imported goods. (Marazzi, Sheets, Vigfusson, 2005).

Moreover, the *law of one price* implies that the prices of traded goods in different geographical areas should be equal, i.e.:

$$P_i^m = EP_i^{m*}$$

where:

P_i^m – the import price in domestic currency on good i

E – nominal exchange rate KGS/foreign currency

P_i^{w*} – the price in foreign currency on the world market.

But these theoretical models are based on perfect competition and the absence of transaction costs assumptions (Adolfson, 1997).

The theoretical dependence of exchange rate and prices of imported goods states that the appreciation of domestic currency to international currency makes domestic goods more expensive while import more cheaper (Krugman, 2004).

According to the *law of one price*, the change in exchange rate serves as a cause for the rise of prices or the imported goods, but the degree of ERPT depends on domestic and foreign market structures, monetary and exchange rate policies. The more stable a country's monetary policy and the lower its inflation rate, the lower the extent of ERPT will be (Mishkin, 2008). This in turn helps to maintain low inflation and makes monetary policy more effective.

2.2Theoretical Literature Overview

The pass-through problem was first described by Stephen Magee (1973) in explaining the impact of currency depreciation. After that, the effect has been widely used in the economic literature. Given its essential economic application, economists began trying to estimate the extent of ERPT and analyze the determinations of ERPT. More recently pass-through effect played a central role over the appropriate monetary policies and exchange rate regime. The implication of monetary policy plays a specific role in the macroeconomic stability, international transmission of shocks, and significant imbalance in trade and global capital flow (Campa and Goldberg, 2002). Most scholars predicted the high dependency of ERPT on monetary policy. In equilibrium, countries with low exchange rate variability or stable monetary policy would have low ERPT and choose their currency for transaction invoicing (Devereux and Engel, 2001). Countries have high ERPT with the high volatility of money, while countries with low volatility of money growth will have relatively low rates of ERPT.

The degree of ERPT behavior has important implications on economic policy. If ERPT is low, then any exchange rate-based adjustments to improve the trade balance for

economies may be less effective, as nominal exchange rate changes do not transform into real exchange rate changes. Conversely, if the pass-through effect is high, the consumers will shift to domestically produced goods from imported and have a more significant impact on the trade balance. Furthermore, understanding ERPT at the industry level gives insight into international market power in that industry (Devereux and Yetman, 2002). In general, ERPT is higher if the home market is monopolistic or if the foreign market is competitive.

According to its definition, the ERPT generally significantly affects import prices than on a nation's consumer price index (CPI). This is because the latter includes non-tradable goods that are less responsive to exchange rate changes. It has been argued that if the export is set in the currency of the importing nation, known as local-currency pricing (LCP), then exchange rate changes have little effect on the destination market import prices, which leads to low ERPT. On the other hand, if exporters are set in the exporters' currency, referred to as producer-currency pricing (PCP). Exchange rate changes have a greater effect on prices in the importing nation, leading to a higher pass-through (Devereux and Engel, 2001). Campa and Goldberg (2005) provided cross-country and time-series analyses of ERPT into import prices of 23 OECD countries. They found the incomplete ERPT in the short run rejecting both PCP and LCP. While in the long run the ERPT is close to zero and PCP is more used for many types of imported goods (Campa and Goldberg, 2005).

Several empirical and theoretical studies provided evidence across countries and industries. They found inflation in emerging economies generally displaying greater sensitivity to exchange rate developments than in high-income countries (McCarthy, 1999, Schmidt-Hebbel and Tapia, 2002). At the same time, Taylor (2000) investigated benefits and downsides mostly the same while using monetary policy roles both in emerging and developed countries. But market policies of ERPT recommended for advanced economies might include several deviations, the pass-through rates are significantly influenced by policy

choices, the credibility of central banks, and other factors that affect inflation expectations (Taylor, 2000). Bussiere and Peltonen (2008) presented that the degree of ERPT to import and export prices are broadly comparable between emerging markets and advanced economies. And when currency and global crisis episodes are controlled, the ERPT tends to be higher among EMEs. It can be explained by the fact that EMEs usually price their import in the international currency, whereases advanced economies set import prices in their currency.

Various theoretical arguments found a positive relationship between average inflation and a level of ERPT. Choudhri and Hakura (2001) tested the hypothesis that a low inflationary environment leads to lower ERPT. A significant increase in consumer price inflation in EMEs is associated with large depreciation of the currency. ERPT tends to increase with the size of depreciation (Ha, and Stocker, 2019).

2.3Empirical Literature Overview

The empirical studies on ERPT can be divided into two main groups. The first group of studies uses the VAR methodology introduced by McCarthy (1999), while others used single-equation methodology as in Campa and Goldberg (2002) studies.

Jonathan McCarthy (2000) adopts the VAR approach for a comprehensive study of the impact of ERPT and import prices on domestic Producer Price Index (PPI) and Consumer Price Index (CPI) for nine industrial countries for the period of 1976-1998. His model consideration of impulse responses in VAR analysis indicates that import prices to exchange rate changes are greater than PPI while insignificant for CPI. His findings show that pass-through is higher in countries with large import share, proving the positive correlation between pass-through and openness of the country.

Jonas Stultz (2000), analyzing the effect of ERPT and different price shocks in Switzerland using the VAR model, shows that ERPT is significant, though incomplete to

import prices, but only moderate to consumer prices. This analysis reveals that the pass-through effect decreased in the 1990s, before previous decades, and a decrease was more in consumer prices than in import prices. The reason for a decline in pass-through coincided with a shift of Switzerland's economy to a stable inflationary environment.

Ito, Sasaki, Sato (2005), using VAR analysis, test the degree of ERPT into both aggregate import prices and CPI for eight East Asian countries from 1996 through 2004. They found that the estimates of ERPT into import prices are high and significant for four economies such as Hong Kong (49%), Indonesia (100%), Japan (99%), and Thailand (166%). The estimates of the other three economies (Korea, Singapore, and Taiwan) are insignificant. It was also found that the degree of ERPT into CPI is relatively lower than import prices, ranging from 13 percent in Korea to 57 percent in Indonesia. Moreover, to test the performance of inflation in the aftermath of the Asian currency and VAR analysis. Their analysis shows that crisis-hit countries experienced a higher degree of ERPT to import prices, while it had a lower degree on CPI. The lower impact of ERPT on CPI, as discussed above, can be the reason for the following factors: import goods are just components of the CPI; the prices of non-tradable policy have a more significant contribution to increase in the CPI.

Chan (2008) and Barhoumi (2006) examine some emerging and developing economies. The main results are as following, the exchange rate pass-through is higher for import prices than for consumer prices; in Asia, pass-trough to CPI is found to be low even after significantly long time series.

Ca'Zorzi, Hahn, and Sanchez (2007), using three alternative VAR models examined the degree ERPT to import and consumer prices in twelve emerging markets in Asia, Latin America, Central, and Eastern Europe, confirmed that the ERPT has a quicker response on import price than on consumer prices and that ERPT is always higher in emerging countries than in developed countries.

Various studies have shown that the pass-through effect had decreased in recent years (Taylor, 2000; Choudhri and Hakura, 2001). They relate the pass-through reduction to the lower inflation environment of the last decade that prevents firms from increasing prices. Edwards and Pinto (2005) argue that this decrease was caused by credibility gains of monetary authorities under Inflation Targeting. Campa and Goldberg (2002) see this movement through the change in the composition of the import goods in the consumer bundle. Thus, the larger the share of imported goods that make up the CPI basket, the greater the exchange rate pass-through effect on domestic prices.

Gulnara Moldasheva (2013) conducted the cointegration analyzes of ERPT into import prices for Central Asia countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan over the period 1995-2012. The result showed that ERPT extended beyond one for Kazakhstan and Kyrgyzstan, while for Tajikistan and Turkmenistan ERPT is indicated as incomplete. As for Uzbekistan, ERPT is equal to zero.

The IMF's country report (Article IV) for Kyrgyzstan (2009) should be mentioned in this part since it investigates the drivers of inflation in the country using the VAR model. This report doesn't study ERPT in particular but helps to understand how prices react to the changes in the exchange rate. The report uses the same variable in this paper: international food price index, real GDP, the price for services, headline CPI, M2, and the som/dollar exchange rate. The results suggest that a shock to broad money, international food prices, the som/dollar exchange rate, and service prices are significant (IMF report, Article IV, 2009).

It can be concluded from the analyzed literature that the degree of the ERPT is statistically significant but different across countries and industries. The impact of the ERPT is higher for import goods and the long run, rather than for CPI and short run. Finally, the vast majority of the literature suggests that many countries and industries have experienced a general decline of the exchange rate pass-through over the last decades. Although all of these

studies examine various countries using different time series and methodology, they all appear to support the ERPT hypothesis's overall support. Different results for a country stem primary from the use of different metrologies, model specifications and variable selections rather than from the use different time period studies. In addition, there might be an aggregation problem of prices of goods that should be included. The choice of price aggregate has a potentially large impact on results.

CHAPTER 3: Empirical Investigation of Exchange Rate Pass-Through

3.1Methodology

The theoretical part of the research shows no complete implication of the theory in real economic situations, simply because of the bunch of assumptions pointed out in the literature review. It is important to obtain empirical results to overcome the political and economic implementation ERTP in Kyrgyzstan. The VAR model is used in this paper, which examines the pass-through effect on the exchange rate of the domestic prices in Kyrgyzstan. The VAR model is a multidimensional time series model in which all variables included in the model are defined by their own and other variables with lag values (Kotil, 2020)

The VAR approach used to estimate ERPT in Kyrgyzstan is the following:

$$Y_t = \alpha_0 + \alpha_i \sum Y_{t-1} + \varepsilon_t$$

where Y_t donates six vectors of CPI, PPI, M2, output gap of real GDP, NEER and ImpPr. The matrix with CPI, PPI, M2, output gap of real GDP, NEER, and ImpPr in the right-hand side of the equation shows all the lagged values of independent variables (repressors). α_0 is an intercept, α_I is a coefficient of matrix 6 x 6, ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

The model described above has been borrowed from researches on ERPT conducted by McCarthy (2000) and Taylor (2007). Both studies used VAR as the most accurate and applicable method to estimate the level of pass-through. Since the individual coefficient in the estimated VAR model is often difficult to interpret, the practitioners of this technique often use the so-called impulse response function. The impulse response function traces out the response of the dependent variable in the VAR system to shocks in the error terms and

traces out the impact of such shocks for several periods in the future (Blanchard, Oliver, and Danny Quah, 2010).

3.2 Data Description

The empirical analysis is planned to be conducted using quarterly data, which provides a reasonable sample size to study the exchange rate-import goods' price dynamics in the post 2000 period. The applied data was derived from the bulletins of the National Bank of Kyrgyz Republic and the National Statistic Committee. The period covered is January 2000 to December 2019. The choice of the length of the period was constrained by the availability of data, which is sufficient for the applied model and bears statistically significant confidence in the specified model. All variables were normalized, having the base year 2000, seasonally adjusted and turned into a logarithm.

- **Import Price (ImpPr)** is presented in the unit value index of import in som. Data was taken from NBKR converted to the national currency;
- **Consumer Price Index (CPI**) represents changes in the price level of the market basket of consumer goods and services. CPI is considered the most widely used measure of inflation. Data was taken from NBKR and converted to the deflator with a base period of January 2000. The deflator was multiplied by 100, giving us real CPI where the first period of times-series variable is the base;
- **Producer Price Index (PPI)** is a weighted index of prices measured at the producer level. Data was taken from NBKR converted to the deflator with a base period of January 2000.
- **Output gap (gap)** is a measurement of the difference between the actual output of an economy and its potential output. Potential output refers to the maximum amount of goods and services an economy can produce under given circumstances. The variable was obtained by coveting nominal GDP to real GDP by CPI deflator (base

period – January 2000). To obtain the GDP output gap HP filter was applied. Presented in Figure 1 (Appendix A).

- **Exchange Rate (NEER)** represents the nominal effective exchange rate of the US dollar to som. An increase in NEER is corresponding with a depreciation of the domestic currency.
- **Monetary aggregate (M2)** represents the monetary base. Money supply reflects inflation processes due to excess shortage of money on the market.

3.3Test for Stationarity - Unit Root Test

The VAR approach is used in this study to examine the pass-through effect on the exchange rate of domestic prices in Kyrgyzstan. Firstly, each variable was investigated for stationarity by unit root test. A time-series data is stationary (does not have unit root) if its probability distribution does not change over time. Otherwise, data is nonstationary (has unit root) (Stock, 2012, p. 578). Table I and Figure 3 from Appendix A show the result of the Augmented Dickey-Fuller (ADF) test. According to the test CPI, PPI, Output Gap are stationary at the level, while NEER, M2, and ImpPr are first different. The number of lags was automatically chosen to two by Akaike information criteria (Table II, Appendix A)

3.4Granger - Causality Test

A Granger causality test was performed to explore the causality relationship between variables. Specially to find out the relationship between NEER and CPI, PPI. Granger causality test checks for predicting variables based on causal relations between NEER and lagged variables in the VAR model. The Granger causality results are presented in Table III of Appendix A. The results of the test show the causality relationship between NEER and ImpPr. But NEER doesn't granger cause CPI and PPI.

3.5Impulse Response Function

Impulse response function (IRF) shows responses of PPI, CPI, and ImpPr to the shocks in NEER. Firstly, exogenous "white noise" ε impacts NEER, and then this shock is transmitted to the CPI, PPI, and ImpPr. More generally, IRF represents the impulse response of one variable to one standard deviation shock in the exchange rate. The IRF results are presented in Figure 3 (Appendix A). The vertical axes give the approximate percentage change in CPI, PPI, and ImpPr in response to one percent shock in NEER. In response to shock on the NEER (in the form of appreciation), the PPI exhibits a continuous increase until the third period, reaching its maximum by approximately 7.5%. The plot seems to suggest that the shock to the NEER does contemporaneously affect the PPI in Kyrgyzstan.

The response of CPI for one standard deviation shock in NEER is lower than for PPI. Results indicate that CPI reaches its maximum in the second period by approximately 5%. After the second period, CPI declines, being negative in the fourth period and afterward. After eights period, it reaches its steady state. ImpPr reacts against one unit shock in NEER in a negative way in the second period. In general, the analysis of the IRF suggests a significant and long-lasting effect from changes in NEER to PPI, CPI, and ImpPr in Kyrgyzstan.

The nature of the Kyrgyz economy might interpret obtained results and the monetary and exchange rate policy conducted by the NBKR after the dissolution of Soviet Union trade patterns in Kyrgyzstan changed considerably. The country opened its borders to a wide range of goods, and key trade activities shifted towards China, Russia, the EU, and Turkey. A big share of Kyrgyz's economy occupied re-export, and the appearance of such markets like Dordoi was quite logical. From this perspective, it might be concluded that a big share of goods has import origins and consequently was bought in foreign currency. On the other hand, the value of the US dollar (and other foreign currencies as well) is not fixed by the

NBKR. In this regard, appreciation of the US dollar has immediate and quite significant (comparing to other countries) response on domestic prices in Kyrgyzstan.

3.6Variance Decomposition

This study uses Cholesky variance over ten quarters. According to Taylor (2000), to reinforce the result of ERPT, it is necessary to analyze variance decomposition of domestic prices, apart from the impulse response.

The results in the CPI variance Table IV (Appendix A) show that NEER is an excellent factor to determine the variance of CPI among macroeconomic factors. Three quarters after the NEER shocks explains nearly 5 percent of CPI variance. The seventh period after the NEER shocks explains almost eight percent of CPI variance or 8 percent of the inflation in fluctuation explained by NEER. The results of PPI show that NEER shocks explain approximately five percent over the ten quarters. The same results are obtained for ImpPr, where NEER shocks explain nearly six percent for the long-run and short-run.

Several reasons can be cited from the extensive theoretical literature on ERPT to explain the incomplete pass-through and failure of PPP theory in Kyrgyzstan. The key reason is that the incomplete ERPT can be associated with the low share of traded goods in the CPI baskets for Kyrgyzstan. Kyrgyzstan is relatively small, and the share of imported goods in Kyrgyzstan's GDP is quite large.

CHAPTER 4. Conclusion and Policy Recommendations

This research estimated ERPT in Kyrgyzstan. By applying the VAR model, ERPT for consumer, producer, and import prices were studied. The estimation process strictly went in line with the econometric approach, implying that several adjustments and tests should be conducted before running VAR regression, particularly IRF and variance decomposition tests.

Results from IRFs and variance decomposition tests suggest that ERPT in Kyrgyzstan is incomplete. However, comparing with average values among other countries, it is slightly higher. The effect of ERPT is more significant for consumer goods. The higher value of ERPT for CPI can be explained by the fact that the basket of consumer goods includes much more imported items. At the same time, producer goods being produced locally are less dependent on exchange rate fluctuations. According to IRF, depreciation of som leads to the rapid rise of inflation during the second.

Several reasons might explain such an immediate ERPT effect. Firstly, a big share of import goods on the domestic market contributes to higher inflation on the exchange rate. Secondly, there is a high level of dollarization on the financial market, with an average of 60% of credits and deposits in foreign currency.

Finally, the approach and findings of this paper might be useful for understanding how inflation corresponds to the fluctuations in the exchange rate and to the partial determination of inflation drivers in Kyrgyzstan.

The exchange rate is one of the most important macroeconomic variables, especially in those economies that have adopted flexible exchange rate regimes and highly dependent on international trade. It affects inflation, exports, imports, and other economic activates. But the recent financial and economic crises in several economies, especially in Kyrgyzstan, and their effect on the global prices of some goods and increasing globalization, necessitates more

research on the extent to which pass-through may have changed in recent years. A model that incorporates time variation in some of its parameters is desirable for such an examination. Furthermore, an additional investigation is required to consider whether macroeconomic actors or microeconomic factors impact the change in exchange rate pass-through across countries and industries. These results would be essential for big sectors or local trades and monetary authorities to control inflation effectively.

For the policy implication, two scenarios can be considered. The first one is optimistic that based on the assumption that the government would strengthen the domestic currency (KGS), by stimulating economic development (Increasing government spending and investments, attracting foreign direct investments, stimulating the production). This scenario would cause increasing in GDP and a strengthening of the domestic currency (KGS), all other things being equal. The second scenario is not as optimistic as the first one. It is assumed that the government would artificially strengthen the domestic currency by using a tight monetary policy (stimulating deflation). This could result decreasing in the GDP level and, in the long run, could stimulate inflation. As a result, there might be a risk of entering the economic stagnation, all other things being equal.

As for the current situation in Kyrgyzstan, it is more likely that it would get increasing in import prices and the inflation rate soon. The reason for this is the political instability and global pandemic, which causes a decrease in the investment attractiveness of the country (this decreases the GDP growth and leads KGS to become weaker), the shift of import's supply curve to the left (this usually leads to increasing of the prices and decreasing quantity imported). All this factor makes us conclude that even if the government would stimulate Kyrgyzstan's economic development, it would be hard to stabilize the economic situation in the near future, and it is more likely that Kyrgyzstan will face high inflation.

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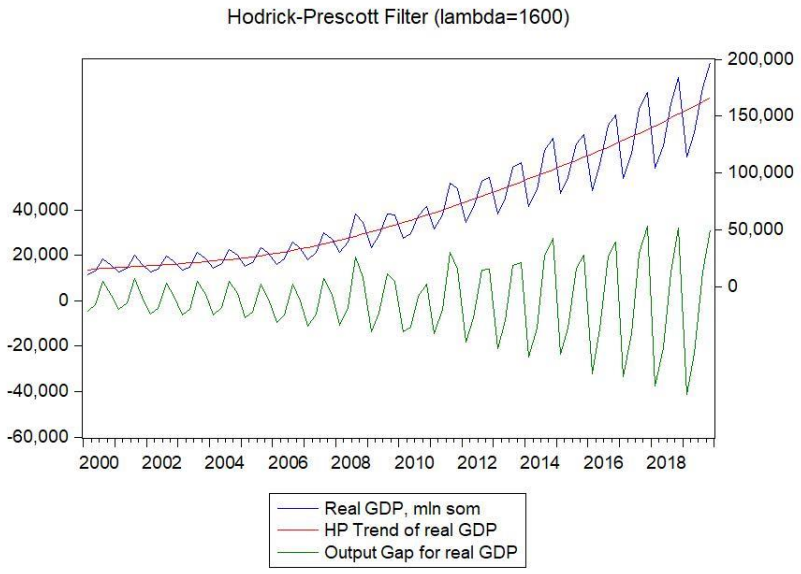
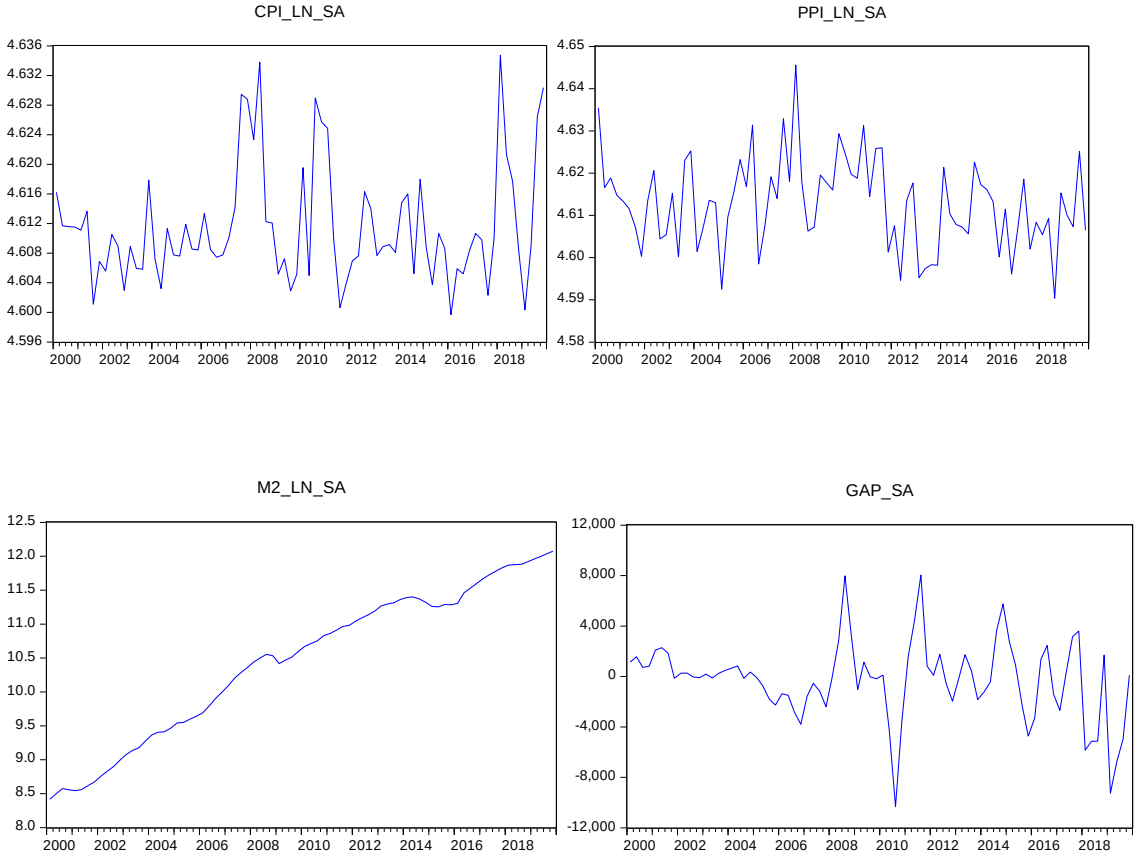
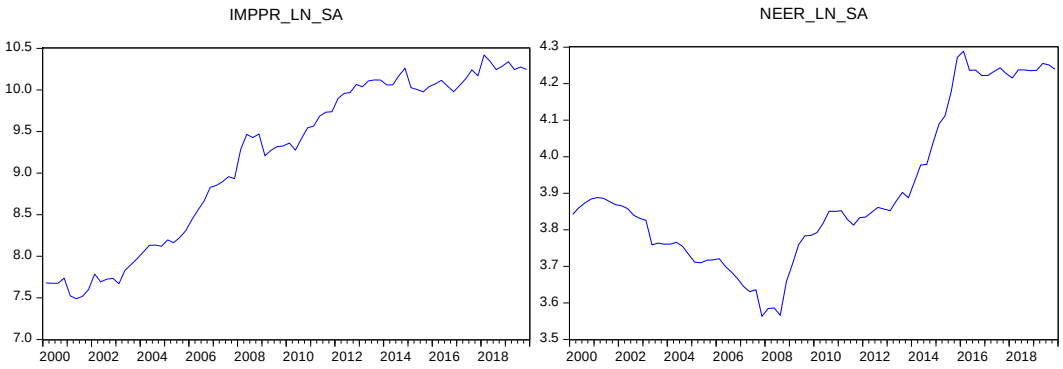
Appendix A

A Figure 1 Output Gap for Real GDP

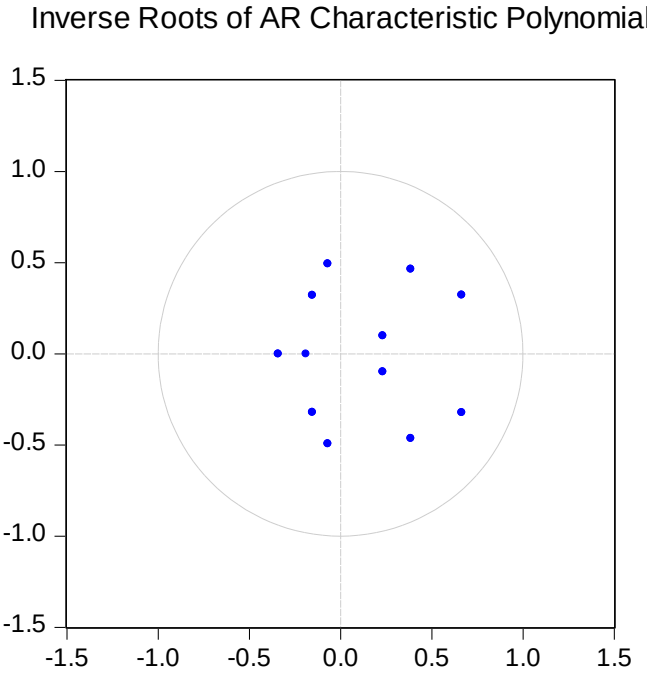


A Figure 2 Graphical representation of the data

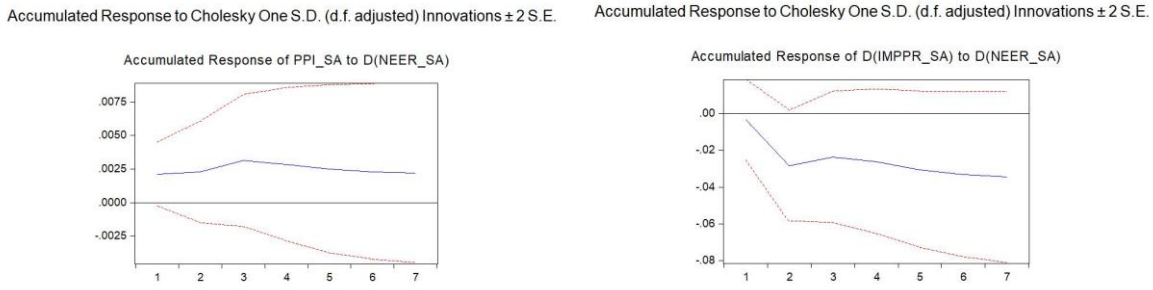




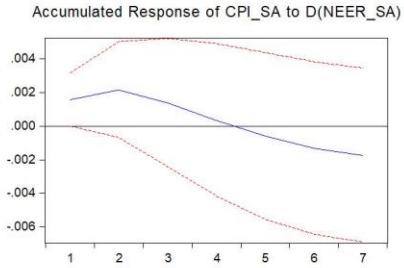
A Figure 3 Inverse Roots of AR



A Figure 3 Impulse Response of CPI, PPI, and IM to one S.D. increase in exchange rate



Accumulated Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.



A Table I Unit Root Test

	ADF (level)		
Variable	t-statistic	5% CV	Outcome
gap_sa	-5.603689	-2.899115	Stationary data
neer_ln_sa	-0.091224	-2.899115	Nonstationary data
m2_ln_sa	-1.23852	-2.899115	Nonstationary data
cpi_ln_sa	-5.047277	-2.898623	Stationary data
ppi_ln_sa	-7.34852	-2.898623	Stationary data
imppr_ln_sa	-1.094596	-2.898623	Nonstationary data

	ADF (1st difference)		
Variable	t-statistic	5% CV	Outcome
gap_sa	-8.658954	-2.900137	Stationary data
neer_ln_sa	-3.043402	-2.900137	Stationary data
m2_ln_sa	-4.953089	-2.899115	Stationary data
cpi_ln_sa	-11.16686	-2.899115	Stationary data
ppi_ln_sa	-10.14061	-2.899619	Stationary data
imppr_ln_sa	-8.830323	-2.899115	Stationary data

A Table II Lag Structure

VAR Lag Order Selection Criteria
Endogenous variables: D(NEER_SA) PPI_SA CPI_SA GAP_SA D(IMPPR_SA) D(M2_SA)
Exogenous variables: C
Date: 28/06/21 Time: 23:04
Sample: 2000Q1 2019Q4
Included observations: 75

Lag	LogL	LR	FPE	AIC	SC	HQ
0	180.4762	NA	3.84e-10	-4.652697	-4.467298*	-4.578670
1	244.3357	115.7986*	1.83e-10*	-5.098117	-4.097825	-4.877424*
2	269.1794	41.07492	2.51e-10	-5.395618*	-2.687929	-4.135755
3	290.0311	31.13856	3.94e-10	-4.694163	-1.171581	-3.287634
4	318.1489	37.49040	5.33e-10	-4.483971	0.151006	-2.633276

A Table III Granger Causality Test

Pairwise Granger Causality Tests
Date: 06/02/21 Time: 15:52
Sample: 2000Q1 2019Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
GAP_SA does not Granger Cause CPI_LN_SA	78	2.45628	0.0928
CPI_LN_SA does not Granger Cause GAP_SA		1.95048	0.1495
D(IMPPR_LN_SA) does not Granger Cause CPI_LN_SA	77	0.52904	0.5914
CPI_LN_SA does not Granger Cause D(IMPPR_LN_SA)		0.32518	0.7235
D(M2_LN_SA) does not Granger Cause CPI_LN_SA	77	1.28244	0.2836
CPI_LN_SA does not Granger Cause D(M2_LN_SA)		1.19669	0.3081
D(NEER_LN_SA) does not Granger Cause CPI_LN_SA	77	1.29451	0.2803
CPI_LN_SA does not Granger Cause D(NEER_LN_SA)		1.81903	0.1696
PPI_LN_SA does not Granger Cause CPI_LN_SA	78	2.14061	0.1249
CPI_LN_SA does not Granger Cause PPI_LN_SA		0.60545	0.5485
D(IMPPR_LN_SA) does not Granger Cause GAP_SA	77	1.60802	0.2074
GAP_SA does not Granger Cause D(IMPPR_LN_SA)		1.05054	0.3550
D(M2_LN_SA) does not Granger Cause GAP_SA	77	0.55443	0.5768
GAP_SA does not Granger Cause D(M2_LN_SA)		3.51496	0.0350
D(NEER_LN_SA) does not Granger Cause GAP_SA	77	1.93241	0.1522
GAP_SA does not Granger Cause D(NEER_LN_SA)		3.05049	0.0535
PPI_LN_SA does not Granger Cause GAP_SA	78	2.43292	0.0949
GAP_SA does not Granger Cause PPI_LN_SA		1.47922	0.2346
D(M2_LN_SA) does not Granger Cause D(IMPPR_LN_SA)	77	3.13944	0.0493
D(IMPPR_LN_SA) does not Granger Cause D(M2_LN_SA)		0.71213	0.4940
D(NEER_LN_SA) does not Granger Cause D(IMPPR_LN_SA)	77	4.05585	0.0214
D(IMPPR_LN_SA) does not Granger Cause D(NEER_LN_SA)		0.94863	0.3921
PPI_LN_SA does not Granger Cause D(IMPPR_LN_SA)	77	2.01357	0.1410
D(IMPPR_LN_SA) does not Granger Cause PPI_LN_SA		0.75946	0.4716
D(NEER_LN_SA) does not Granger Cause D(M2_LN_SA)	77	3.95219	0.0235
D(M2_LN_SA) does not Granger Cause D(NEER_LN_SA)		3.86936	0.0253
PPI_LN_SA does not Granger Cause D(M2_LN_SA)	77	1.13063	0.3285
D(M2_LN_SA) does not Granger Cause PPI_LN_SA		0.17174	0.8425
PPI_LN_SA does not Granger Cause D(NEER_LN_SA)	77	0.72271	0.4889
D(NEER_LN_SA) does not Granger Cause PPI_LN_SA		0.11363	0.8927

A Table IV Variance Decomposition Results

Variance Decomposition of PPI_SA:

Period	S.E.	D(NEER_SA)	PPI_SA	CPI_SA	GAP_SA	D(IMPPR_SA)	D(M2_SA)
1	0.025730	4.050152	95.94985	0.000000	0.000000	0.000000	0.000000
2	0.026509	3.794136	92.60183	1.021718	1.489443	0.115511	0.977359
3	0.028278	4.170403	89.42357	0.971031	1.659331	2.646357	1.129303
4	0.029864	4.216562	89.06552	0.967409	1.850413	2.698135	1.201962
5	0.030493	4.295073	88.88890	1.044781	1.868682	2.702077	1.200489
6	0.030780	4.326435	88.78645	1.114631	1.866031	2.706381	1.200070
7	0.030921	4.333337	88.73326	1.155957	1.869366	2.705977	1.202107
8	0.030989	4.332714	88.72061	1.164983	1.872513	2.707160	1.202016
9	0.031029	4.334060	88.71589	1.166513	1.873916	2.707455	1.202163
10	0.031058	4.335907	88.71300	1.166474	1.874853	2.707370	1.202400

Variance Decomposition of CPI:

Period	S.E.	D(NEER_SA)	PPI_SA	CPI_SA	GAP_SA	D(IMPPR_SA)	D(M2_SA)
1	0.010598	4.917205	2.711752	92.37104	0.000000	0.000000	0.000000
2	0.010973	4.376682	8.421750	83.22387	3.035212	0.914203	0.028284
3	0.011294	4.872146	7.837001	78.37505	7.920119	0.914283	0.081399
4	0.011318	6.095268	7.455055	74.62491	10.02378	1.123937	0.677053
5	0.011329	7.121335	7.252223	72.80889	10.63938	1.090909	1.087260
6	0.011338	7.630393	7.169141	72.22081	10.65765	1.080661	1.241350
7	0.011342	7.754657	7.149935	72.16388	10.55175	1.084282	1.295496
8	0.011343	7.746265	7.141667	72.21675	10.50564	1.084981	1.304702
9	0.011343	7.734318	7.137107	72.22058	10.51928	1.086070	1.302645
10	0.011343	7.742609	7.132864	72.18292	10.55043	1.086062	1.305114

Variance Decomposition of D(IMPPR_SA):

Period	S.E.	D(NEER_SA)	PPI_SA	CPI_SA	GAP_SA	D(IMPPR_SA)	D(M2_SA)
1	0.007066	0.140316	1.821503	2.454534	0.045330	95.53832	0.000000
2	0.007977	6.223104	3.173139	3.238993	0.954198	86.11087	0.299700
3	0.008307	6.084327	6.620556	3.162974	1.438785	81.96429	0.729067
4	0.008519	6.006862	6.665789	3.514360	2.756846	80.17569	0.880458
5	0.008661	6.095034	6.576960	4.118553	3.100920	79.14571	0.962826
6	0.008762	6.128364	6.570268	4.467251	3.087467	78.75992	0.986734
7	0.008816	6.128833	6.590579	4.620870	3.115813	78.55911	0.984793
8	0.008837	6.121591	6.596566	4.656701	3.166461	78.47304	0.985639
9	0.008844	6.128548	6.593722	4.655514	3.199320	78.43415	0.988750
10	0.008848	6.141618	6.591991	4.657903	3.211424	78.40515	0.991910

Cholesky Ordering: D(NEER_SA) PPI_SA CPI_SA GAP_SA D(IMPPR_SA) D(M2_SA)

A Table V Vector Autoregressive Model

Vector Autoregression Estimates
Date: 06/02/21 Time: 16:45
Sample (adjusted): 2000Q4 2019Q4
Included observations: 77 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	D(NEER_SA)	PPI_SA	CPI_SA	GAP_SA	D(IMPPR_SA)	D(M2_SA)
D(NEER_SA(-1))	0.232900	-0.051010	-0.027269	-18876.39	-0.968509	-0.585529
	(0.13844)	(0.05702)	(0.03802)	(13417.4)	(0.51105)	(0.16684)
	[1.68233]	[-0.89453]	[-0.71725]	[-1.40686]	[-1.89513]	[-3.50955]
D(NEER_SA(-2))	-0.056338	0.011943	-0.041393	23209.34	0.251339	0.161872
	(0.14759)	(0.06079)	(0.04053)	(14304.2)	(0.54483)	(0.17787)
	[-0.38173]	[0.19646]	[-1.02125]	[1.62256]	[0.46132]	[0.91008]
PPI SA(-1)	-0.286995	0.193417	0.169701	-24822.40	1.516254	1.138834
	(0.31512)	(0.12980)	(0.08654)	(30541.2)	(1.16328)	(0.37976)
	[-0.91075]	[1.49010]	[1.96095]	[-0.81275]	[1.30343]	[2.99879]
PPI_SA(-2)	0.046484	0.139452	-0.085779	47584.60	1.437440	0.118576
	(0.34405)	(0.14172)	(0.09448)	(33344.8)	(1.27006)	(0.41463)
	[0.13511]	[0.98402]	[-0.90787]	[1.42705]	[1.13179]	[0.28598]
CPI_SA(-1)	-0.207555	0.107940	0.364529	48906.71	-1.342978	-1.076617
	(0.47618)	(0.19614)	(0.13077)	(46150.8)	(1.75783)	(0.57386)
	[-0.43588]	[0.55031]	[2.78754]	[1.05972]	[-0.76400]	[-1.87609]
CPI_SA(-2)	0.936709	-0.062386	-0.033926	-5793.539	1.072292	-1.111250
	(0.49308)	(0.20311)	(0.13541)	(47789.2)	(1.82023)	(0.59423)
	[1.89970]	[-0.30716]	[-0.25054]	[-0.12123]	[0.58910]	[-1.87005]
GAP_SA(-1)	-3.03E-08	-5.32E-07	-5.77E-07	0.677902	-4.20E-06	-3.96E-06
	(1.2E-06)	(5.1E-07)	(3.4E-07)	(0.11934)	(4.5E-06)	(1.5E-06)
	[-0.02462]	[-1.04854]	[-1.70674]	[5.68040]	[-0.92380]	[-2.66591]
GAP SA(-2)	2.17E-06	9.16E-08	-1.40E-07	-0.260346	-2.50E-07	-7.23E-07
	(1.3E-06)	(5.5E-07)	(3.7E-07)	(0.13005)	(5.0E-06)	(1.6E-06)
	[1.61744]	[0.16569]	[-0.38049]	[-2.00183]	[-0.05056]	[-0.44707]
D(IMPPR_SA(-1))	-0.003369	0.000281	-0.007683	8606.840	-0.144490	-0.013965
	(0.03546)	(0.01461)	(0.00974)	(3437.19)	(0.13092)	(0.04274)
	[-0.09501]	[0.01926]	[-0.78890]	[2.50404]	[-1.10366]	[-0.32676]
D(IMPPR_SA(-2))	-0.023381	-0.016798	0.008059	1340.898	-0.113088	0.061583
	(0.03632)	(0.01496)	(0.00997)	(3520.09)	(0.13408)	(0.04377)
	[-0.64374]	[-1.12282]	[0.80793]	[0.38093]	[-0.84347]	[1.40695]
D(M2_SA(-1))	-0.011120	-0.043399	-0.005367	-20323.56	0.220761	0.259912
	(0.12045)	(0.04962)	(0.03308)	(11674.0)	(0.44465)	(0.14516)
	[-0.09232]	[-0.87471]	[-0.16224]	[-1.74092]	[0.49648]	[1.79051]
D(M2_SA(-2))	-0.171368	0.029362	0.008196	3979.256	0.214155	-0.031323
	(0.10479)	(0.04316)	(0.02878)	(10155.8)	(0.38682)	(0.12628)
	[-1.63541]	[0.68026]	[0.28480]	[0.39182]	[0.55363]	[-0.24804]
C	-2.238943	2.868125	2.699849	-303593.1	-12.35133	4.322675
	(2.52528)	(1.04019)	(0.69351)	(244749.)	(9.32217)	(3.04332)
	[-0.88661]	[2.75731]	[3.89304]	[-1.24043]	[-1.32494]	[1.42038]
R-squared	0.298252	0.127313	0.353833	0.472646	0.196359	0.533712
Adj. R-squared	0.166675	-0.036316	0.232676	0.373768	0.045677	0.446283
Sum sq. resids	0.042370	0.007189	0.003195	3.98E+08	0.577392	0.061537
S.E. equation	0.025730	0.010598	0.007066	2493.725	0.094983	0.031008
F-statistic	2.266741	0.778057	2.920464	4.780059	1.303132	6.104529
Log likelihood	179.6892	247.9841	279.1997	-704.3968	79.12375	165.3210
Akaike AIC	-4.329589	-6.103484	-6.914278	18.63368	-1.717500	-3.956389
Schwarz SC	-3.933882	-5.707777	-6.518571	19.02939	-1.321793	-3.560682
Mean dependent	0.004756	4.612316	4.611449	-355.7070	0.033356	0.045463
S.D. dependent	0.028186	0.010411	0.008067	3151.235	0.097229	0.041671

Determinant resid covariance (dof adj.)	1.04E-10
Determinant resid covariance	3.43E-11
Log likelihood	272.1003
Akaike information criterion	-5.041567
Schwarz criterion	-2.667322
Number of coefficients	78