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## Pass-Through of External Shocks to Inflation in Sri Lanka

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**IMF Working Paper**

Asia and Pacific Department

**Pass-Through of External Shocks to Inflation in Sri Lanka**

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**Abstract**

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This paper investigates pass-through of external shocks (exchange rate, oil price, and import price shocks) to inflation in Sri Lanka. The analysis is based on a vector autoregression (VAR) model that incorporates a distribution chain of pricing. The paper finds low and incomplete pass-through of external shocks to consumer inflation, reflecting a combination of factors including the existence of administered prices, high content of food in the consumption basket, and low persistence and volatility of the exchange rate. External shocks explain about 25 percent of the variation in consumer price inflation, reflecting room for domestic policies in controlling inflation.

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## I. INTRODUCTION

**A recent sharp increase in inflation in Sri Lanka has raised questions on the sources of this increase.** According to one inflation indicator<sup>2</sup>, inflation rose from about 7 percent to 19 percent between the beginning of 2006 and the end of 2007. A number of shocks, both external and domestic, have contributed to this increase including rising international oil prices, demand pressures, and adjustments in administered prices. On the external shocks, the exchange rate has long been viewed in monetary literature as an important channel of monetary transmission. The importance of the exchange rate warrants an assessment of the extent to which it affects domestic inflation and implications of its pass-through on the effectiveness of domestic monetary policy in containing inflation. The theoretical and empirical literature has also identified many other channels through which inflation can be affected including the credit channel, the asset price channel, and through inflation expectations and wages (for example, Christiano, Eichenbaum, and Evans (1998); Ramaswamy and Sloek (1997); and Mishkin (2001)). This paper focuses on the exchange rate channel, the effect of oil prices (as they feed through the exchange rate), and that of import prices on inflation in Sri Lanka.

**The paper determines the extent to which external shocks (exchange rate, oil, and import prices) have an impact on inflation in Sri Lanka and whether they explain much of the variation in inflation.** The empirical approach used in this paper is a VAR model that incorporates a distribution chain of pricing to trace the effects of external shocks on Sri Lanka inflation. From this model, pass through coefficients are determined and used to assess the extent to which the external shocks affect inflation. Variance decompositions are used to assess the extent to which external shock explain the variation in inflation. Published work assessing pass-through of external shocks using the VAR modeling framework on Sri Lanka is, to the best of my knowledge, currently not available and this paper aims, therefore, to be a useful contribution.

**The paper finds incomplete pass-through of external shocks to domestic price inflation in Sri Lanka.** Pass-through to consumer prices is about 10 percent during the first month and rises gradually to a maximum of about 40 percent in four months. Pass-through of oil price shocks is much smaller and even negative, rising from about 2 percent during the first month to about 6 percent in four months. Pass-through of import prices rises from about 4 percent in the first month to about 28 percent in three months. The presence of administered prices in Sri Lanka helps to partly explain low and incomplete pass-through. External shocks appear to explain about 25 percent of the variation in consumer prices and about 32 percent of the

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<sup>2</sup> Sri Lanka has several price indicators including a new Colombo Consumer Price Index (CCPIN) covering Colombo and surrounding areas; and a Sri Lanka Consumer Price Index (SLCPI) with broader geographical coverage.

variation in core inflation, suggesting that other shocks that are likely more domestic in nature explain most of the variation in inflation in Sri Lanka.

**The paper is organized as follows:** Section II provides a brief summary of pass-through literature and of other country findings. Section III provides some stylized facts on prices and the exchange rate in Sri Lanka. Section IV describes the VAR modeling framework used to assess pass-through, and provides and analyzes the model's results. Section V concludes.

## II. LITERATURE REVIEW

**There has been an increasing interest in the literature over the past two decades on using VARs as a tool for analyzing different channels of transmission of macroeconomic shocks.** The interest in VARs for macroeconomic analysis began with Sims (1980) who used a recursive VAR to analyze the interest rate channel of monetary transmission. He included interest rates, money, the price level and output to analyze the relationship between monetary policy and real economic activity on monthly data for the United States covering 1974 to 1978. Since then, a number of other studies have used the VAR modeling framework in analyzing different channels of transmission.

**There is a large body of empirical literature examining pass-through of external shocks to prices and results vary. Here are some of the findings:**

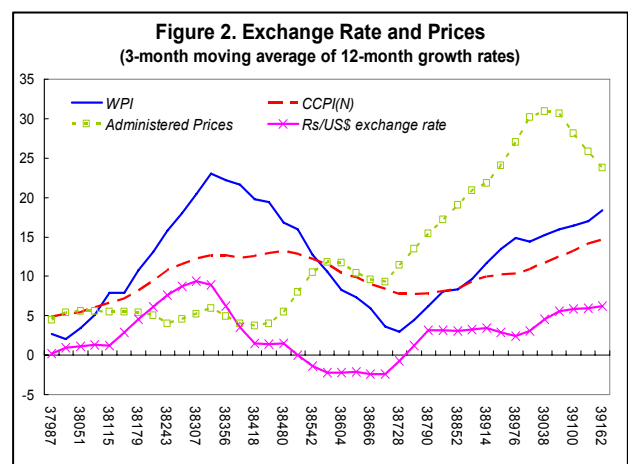
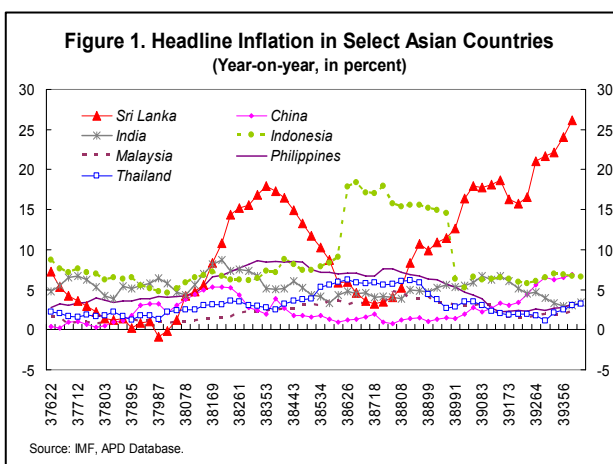
- In a number of studies, a less than one to one transmission of external shocks to inflation is found, implying that prices tend to adjust less than fully to exchange rate shocks (Goldberg and Knetter, 1997). McCarthy (2000) uses the recursive VAR modeling framework to examine the impact of exchange rates and import prices on domestic producer and consumer prices in selected industrialized countries with quarterly data from 1976 to 1998. McCarthy finds that exchange rates have a modest effect on domestic price inflation while import prices have a stronger effect over the post-Bretton Woods era. McCarthy found pass-through to be larger in countries with a large import share and more persistent exchange rates and import prices. Using a recursive VAR to examine exchange rate pass-through in Croatia in the context of strict exchange rate targeting, Billmeier and Bonato (2004) find low exchange rate pass-through partly reflecting administered and controlled prices, and low variability of the exchange rate. Also, in a survey of pass-through to import prices, Goldberg and Knetter (1997) find that price levels adjust less than fully to exchange rate shocks. Dornbusch (1987) and Krugman (1987) find a less than one to one transmission and explain that this is due to imperfect competition or pricing-to-market behavior.
- High pass-through has tended to be associated with high import shares, persistent and less volatile exchange rates, less volatile GDP, and low competitiveness (McCarthy, 2000).

- Some studies have found pass-through to decline as shocks move down the distribution chain. In a study on Turkey, Leigh and Rossi (2002) find that pass-through to wholesale prices is more pronounced relative to pass-through to consumer prices. They also find that the impact of the exchange rate on prices is over after about a year, but is most felt in the first four months.
- Some studies have found pass-through to be correlated with the degree of openness (McCarthy, 2000). In a study on Brazil, Belaisch (2003) finds low exchange rate pass-through and partly attributes this finding to Brazil's low degree of openness given the sum of exports and imports at only 30 percent of GDP.

**A stepping off point for this study is a paper by Lueth and Ruiz-Arranz (2006) that assesses the impact of oil prices more generally in South Asian economies.** The present study extends the work by Lueth and Ruiz-Arranz (2006) on several fronts. Firstly, the present study not only assesses the impact of oil prices but that of the exchange rate and import prices as well. Secondly, the present study assesses the effects of external shocks on inflation at different stages of the distribution chain. Thirdly, the present study is specific to Sri Lanka and therefore allows for an assessment of more country-specific effects of external shocks on inflation while covering a longer time period. Fourthly, the methodology allows for an assessment of the magnitudes and the lags of the impact of external shocks on inflation at each stage of the distribution chain, which is important information for policy makers in setting policies and in determining how and when to react if need be. Finally, the study sheds light on the importance of various shocks in explaining variation in inflation.

### III. INFLATION AND THE EXCHANGE RATE IN SRI LANKA

**Since late 2006, Sri Lanka's inflation has increased sharply relative to other economies in the region (Figure 1).** The sharp increase in inflation compared to other countries in Asia points out that increases in oil prices in the recent past (a common shock to most economies in the region) cannot explain most of the increase in inflation in Sri Lanka.



**The recent depreciation of the Sri Lanka rupee partly reflects rising inflation.** Since late 2005, the rupee gradually depreciated (Figure 2), partly reflecting a decline in export growth and increase in import growth. However, the rupee remained stable in the second half of 2006—during a period when inflation was rising sharply, the trade balance deteriorating, and gross reserves (in months of imports) falling—due to heavy intervention by the Central Bank of Sri Lanka (CBSL). The rupee further depreciated from January 2007 onwards as intervention eased. The section that follows will shed more light on the relationship between the exchange rate and inflation in Sri Lanka.

#### IV. A MODEL OF PASS-THROUGH AND METHODOLOGY

**This paper uses the VAR modeling framework to examine pass-through of oil price and exchange rate fluctuations to consumer inflation in Sri Lanka.** The modeling approach draws on McCarthy (2000) by using recursive Cholesky orthogonalization to identify primitive shocks in the VAR.

**The framework is a model of pricing along a distribution chain.** Inflation at each stage—import, wholesale and consumer—is comprised of six components. The first component is that expected inflation at each stage is based on information available at period  $t-1$ . The second component is the effects of domestic “supply” shocks to inflation. The third component is the effects of domestic “demand” shocks to inflation. The fourth component is the effect of exchange rate shocks on inflation at each stage. The fifth is the effect of shocks to inflation at previous stages of the chain. Lastly is the effect of shocks of that stage of the distribution chain. In the model, import price inflation affects consumer price inflation both directly and indirectly through its effects on wholesale prices. There is no contemporaneous feedback in the model, meaning that consumer price inflation affects import and wholesale price inflation only through its effect on expected inflation in future periods.

**The model contains seven variables, with some indicating specific types of shocks.** The variables included are oil price inflation ( $\pi^{oil}$ ) to proxy international supply shocks; the output gap ( $y_{gap}$ ) to proxy a demand shock; a change in the nominal exchange rate ( $\Delta e$ ) to proxy an exchange rate shock; import price inflation ( $\pi^{MP}$ ); wholesale price inflation ( $\pi^{WPI}$ ), consumer price inflation ( $\pi^{CCPIN}$ ); and broad money ( $\Delta m$ ) to allow for the effects of monetary policy. Monetary policy may react to exchange rate fluctuations and may also eventually affect the exchange rate and inflation. Monetary policy also reflects the reaction of the private sector to inflation. Given the nature of the monetary policy framework in Sri Lanka (a reserve money targeting framework with indicative targets on broad money as well), broad money is used here instead of policy interest rates. The CBSL uses open market operations (OMO) more often than adjusting policy interest rates. Recently, policy interest rates have not moved much yet the CBSL has been more active in the money market through OMO. Broad money, therefore, should be a good indicator of the stance of monetary policy as it captures underlying demand pressures. Therefore, putting broad money last in the distribution chain



assumes a monetary policy reaction function. Other orderings of the distribution chain are tested and discussed later below.

**Shocks in the VAR system are identified in accordance with a recursive VAR specification in the following manner:**

$$\pi_{it}^{oil} = E_{t-1}(\pi_{it}^{oil}) + \varepsilon_{it}^s \quad (1)$$

$$ygap_{it} = E_{t-1}(ygap_{it}) + a_1 \varepsilon_{it}^s + \varepsilon_{it}^d \quad (2)$$

$$\Delta e_{it} = E_{t-1}(\Delta e_{it}) + c_1 \varepsilon_{it}^s + c_2 \varepsilon_{it}^d + \varepsilon_{it}^e \quad (3)$$

$$\pi_{it}^{MP} = E_{t-1}(\pi_{it}^{MP}) + d_1 \varepsilon_{it}^s + d_2 \varepsilon_{it}^d + d_3 \varepsilon_{it}^e + \varepsilon_{it}^{MP} \quad (4)$$

$$\pi_{it}^{WPI} = E_{t-1}(\pi_{it}^{WPI}) + e_1 \varepsilon_{it}^s + e_2 \varepsilon_{it}^d + e_3 \varepsilon_{it}^e + e_4 \varepsilon_{it}^{MP} + \varepsilon_{it}^{WPI} \quad (5)$$

$$\pi_{it}^{CCPIN} = E_{t-1}(\pi_{it}^{CCPIN}) + g_1 \varepsilon_{it}^s + g_2 \varepsilon_{it}^d + g_3 \varepsilon_{it}^e + g_4 \varepsilon_{it}^{MP} + g_5 \varepsilon_{it}^{WPI} + \varepsilon_{it}^{CCPIN} \quad (6)$$

$$\Delta m_{it} = E_{t-1}(\Delta m_{it}) + h_1 \varepsilon_{it}^s + h_2 \varepsilon_{it}^d + h_3 \varepsilon_{it}^e + h_4 \varepsilon_{it}^{MP} + h_5 \varepsilon_{it}^{WPI} + h_6 \varepsilon_{it}^{CCPIN} + \varepsilon_{it}^m \quad (7)$$

where  $\varepsilon_{it}^s$ ,  $\varepsilon_{it}^d$ , and  $\varepsilon_{it}^e$  are the supply, demand, and exchange rate shocks respectively;  $\varepsilon_{it}^{MP}$ ,  $\varepsilon_{it}^{WPI}$ , and  $\varepsilon_{it}^{CCPIN}$  are the import price, wholesale price, and consumer price inflation shocks; and  $E_{t-1}(\bullet)$  is the expectation of a variable based on information set at the end of period t-1.

The shocks are assumed serially uncorrelated as well as uncorrelated with one another within a period.

### A. Data Issues and Transformation of Variables

**The investigation of pass-through covers the period 2003m1 to 2007m7 of monthly data.** The sample period is determined by the availability of data for the variables being examined. For example, the CCPIN series only begins in 2003, largely determining the starting point for model estimation. Raw oil price data—an index of the average of the spot U.K. Brent, Dubai, and West Texas Intermediate—is taken from the IMF *International Financial Statistics* (IFS) database. The output gap variable is derived from monthly industrial production data. The output gap is expressed as actual industrial production (in logs) minus potential industrial production, where potential is derived from actual industrial production (in logs) using the Hodrick Prescott (HP) filter. The exchange rate is expressed as Sri Lankan rupees per U.S. dollar and an increase represents a depreciation of the Sri Lankan rupee. The other variables are taken from The IMF IFS, the CEIC, Sri Lanka's Department of Census and Statistics, and the Central Bank of Sri Lanka (CBSL) databases.

**Appropriate transformations of the variables and tests are performed:**

- Variables are expressed in log terms on which unit root tests are performed. All variables are found to be integrated of the order one, except the output gap variable that is found to be integrated of the order zero (Table 1).
- Given the order of integration of the variables, cointegration is tested with the output gap entering as an exogenous variable. Variables are found not to be cointegrated.
- The VAR uses a stationary transformation of the variables. All the variables enter in first differences, except the output gap variable that enters in levels given its order of integration.

Table 1 . Unit Root Tests		
Variable	ADF Statistic	Order of Integration
Oil price	-7.432904*	I(1)
Output gap	-6.422854*	I(0)
Exchange rate	-6.332869*	I(1)
Import prices	-9.892428*	I(1)
Wholesale prices	-7.808793*	I(1)
Colombo consumer price inflation (New)	-5.684348*	I(1)
Broad money	-5.646375*	I(1)

Note: Unit root tests were performed on variables expressed as logs, except the output gap variable. The lag length was chosen to minimize the Akaike Information Criterion and it is zero for each variable except broad money (six lags). A (\*) denotes significance at 0.05 level according to the Augmented Dickey Fuller distribution's critical values.

## B. VAR Model Specification

**An attempt is made at selecting an adequate VAR model that meets model specification issues as close as possible.** The VAR model selected tries to balance two extremes in VAR modeling: avoiding model over-fitting by limiting the length of lags included in the VAR given the short sample; and minimizing model misspecification by not selecting too small a lag length. Standard lag length selection criteria are used to select the number of lags of the VAR: the sequential modified likelihood ratio (LR) test, the Akaike information Criterion (AIC), the Final Prediction Error (FPE), the Hannan-Quinn Information Criterion (HQ), and the Bayesian Information Criterion (BIC). All these criteria select zero lags (Table 2). However, in order to make sure that lags with significant information content are not excluded from the VAR, Wald tests are performed (Table 3). Wald tests show that two lags are jointly significant for all the equations in the VAR system. The VAR was, therefore, estimated with two lags.

Residual tests of the VAR are performed. A visual inspection of the residuals reveals that there are no major outliers. Multivariate serial correlation of the residuals is tested to determine if the residuals are stationary. A residual serial correlation Lagrange Multiplier

(LM) test reveals that the null hypothesis of no serial correlation at lag order 2 cannot be rejected (Table 4).

Lag	LogL	LR	FPE	AIC	BIC	HQ
0	926.6618	NA*	2.49e-25*	-36.78647*	-36.51879*	-36.68454*
1	964.2460	63.1415	4.01E-25	-36.3298	-34.1884	-35.5144
2	1010.5050	64.7624	5.02E-25	-36.2202	-32.2050	-34.6912
3	1044.8980	38.5201	1.24E-24	-35.6359	-29.7469	-33.3933
4	1093.0830	40.4755	2.58E-24	-35.6033	-27.8405	-32.6472

Note: The \* indicates lag order selected by the criterion. LR is the sequential modified LR test statistic (each test at 5% level); FPE is the final prediction error; AIC is the Akaike information criterion; SC is the Schwarz information criterion; HQ is the Hannan-Quinn information criterion.

	D(LOIL)	YGAP	D(LE)	D(LMP)	D(LWPI)	D(LCCPIN)	D(LM)	Joint
Lag 1	5.249337 [0.629565]	6.645331 [0.466717]	13.33688 [0.064314]	13.71365 [0.056515]	6.73853 [0.456602]	6.299455 [0.505251]	10.10412 [0.182750]	82.58309 [0.001904]
Lag 2	5.686572 [0.576785]	7.966009 [0.335601]	25.81862 [0.000543]	4.785189 [0.686159]	1.024919 [0.994416]	7.284988 [0.399822]	2.512851 [0.926126]	70.09547 [0.025597]
Lag 3	3.128216 [0.872893]	2.401821 [0.934307]	6.755808 [0.454740]	11.6633 [0.112190]	7.711343 [0.358734]	1.898694 [0.965234]	4.489883 [0.721935]	46.5627 [0.572491]
df	7	7	7	7	7	7	7	49

Note: The numbers are Chi-squared test statistics for lag exclusion; the numbers in parentheses are p-values.

Lags	LM-Stat	Prob
1	31.46246	0.9757
2	41.37715	0.7721
3	42.73531	0.7237
4	29.27955	0.9886
5	58.29207	0.1707

Note: Probabilities are from chi-square with 36 df. The null hypothesis is no serial correlation at lag order h.

### C. VAR Model Results and Analysis

**Impulse response functions help determine the extent to which a shock that hits one variable affects other variables in the VAR system.** Appendix II shows the estimated orthogonalized impulse response functions for wholesale and consumer prices to a one standard deviation innovation in the exchange rate, oil prices and import prices. The impulse response functions reveal the following results:

- A positive exchange rate shock (a depreciation of the Sri Lanka rupee) has an immediate and a positive effect on both wholesale and consumer prices with the maximum effect occurring in the second month of the shock on wholesale prices and between the second and the third month on consumer prices. The impact of the exchange rate shock seems to fall and die out more quickly in wholesale prices than on consumer prices. The impact of the exchange rate shock on consumer prices turns to negative after four months, partly reflecting the adjustment process by consumers in the domestic economy to the shock.
- Oil price shocks are ambiguous and appear to have an immediate (an effect during the first month, which is the month of the shock) and a negative impact on prices. This finding is explored further when pass-through coefficients are explored below.
- An import price shock has an immediate and positive impact on wholesale and consumer prices in Sri Lanka. The shock has a maximum effect during the first month of the shock on wholesale prices and during the second month of the shock on consumer prices. The shocks lasts for about seven to eight months in both wholesale and consumer prices.

**Estimates of cumulative pass-through coefficients are derived from impulse response functions.** Pass-through coefficients show the model's predicted adjustment of prices (both wholesale and consumer prices in this case) to a shock (both oil price and exchange rate in turn) after accounting for disturbances of the other endogenous variables in the model. For the exchange rate, for example, pass-through coefficients are obtained by dividing the cumulative impulse responses of each price index after  $j$  months by the cumulative response of the exchange rate to the exchange rate shock after  $j$  months. The same is done for oil price pass-through coefficients. Pass-through coefficients reveal the following results (Appendix III):

- Exchange rate pass-through to wholesale prices is more pronounced compared to pass-through to consumer prices. Pass-through is positive to both wholesale and consumer prices. Pass-through to consumer prices rises from about 8 percent in the first month of the shock to about 40 percent in six month while pass-through to wholesale prices rises from about 20 percent in the first month of the shock to about 49 percent in six months. The bulk of pass-through to both consumer and wholesale

prices occurs in the first four months of the shock. The smaller pass through to consumer prices compared to wholesale prices reflects that the impact of the exchange rate shock gets smaller as one moves down the distribution chain. About 40 percent of the depreciation is reflected in consumer prices after 10 months of the shock.

- Pass-through of oil price shocks to prices is rather small and negative. The finding of a limited impact of oil prices on inflation in Sri Lanka is not unique to this paper and is similar to that of Lueth and Arranz (2006) in a study on the oil price impact in South Asia. This is partly because of implicit and explicit oil subsidies that contain the impact of oil prices on inflation. The oil price shock, however, has a positive impact on administered prices. Administered prices contain high weights of kerosene and electricity, which relies a lot on thermal power in Sri Lanka. An analysis of the impact of external shocks on administered prices is provided below.
- Pass-through of import price shocks to prices is positive and more pronounced on wholesale prices than on consumer prices. About 19 percent of the shock in import prices is reflected in consumer prices after 10 months.

**Variance decompositions help assess the importance of external shocks in explaining wholesale price and consumer price inflation over the sample period.** External shocks appear to account for about 25 percent (6 percent from oil, 10 percent from the exchange rate, and 11 percent from import prices) of the variation in consumer price inflation. On wholesale prices, external shocks explain about 22 percent (5 percent from oil, 6 percent from the exchange rate, and 11 percent from import prices) of the variation. Other main variation in consumer price inflation is explained by wholesale price inflation (about 11 percent) and broad money (about 10 percent). The output gap explains about 6 percent of the variation in inflation.

**Low exchange rate and oil price pass-through could be the result of the following factors:**

- *Government subsidies.* In Sri Lanka, oil subsidies have long curtailed the impact of oil prices and the exchange rate on consumer prices. These were, however, eliminated recently in the government's budget and administered prices were correspondingly increased slowly between 2006 and 2007 to help bring about full pass-through of oil prices to consumer prices. Inflation therefore rose from about 7 percent at the beginning of 2006 to about 19 percent at the end of 2007. The oil price impact was, however, amongst a number of other factors that resulted in an increase in inflation including expansionary fiscal policy and monetary policy that is not tight enough.

- *Food prices.* Food prices carry the largest weight (about 47 percent) on the CCPIN in Sri Lanka and they are subject to erratic weather conditions that have an impact on food supplies and prices.
- *Low volatility of the exchange rate.* Exchange rate volatility in Sri Lanka, as measured by the variance of residuals from the exchange rate equation, is low. Low volatility in Sri Lanka's exchange rate, even as the economy is hit by major international shocks and inflation diverging from that of trading partners, could also underlie low pass-through.
- *Low persistence of the exchange rate.* The response of the exchange rate to its own shock at long horizons could be used as a measure of exchange rate persistence (McCarthy (2000)). In Sri Lanka, exchange rate persistence is low given that the response of the exchange rate to the shock on itself dies out in about six to eight months, whereas in economies with high persistence, a similar shock dies out after a much longer period (at least after two years).

**Low and incomplete exchange rate and oil price pass-through is not unique to Sri Lanka.** Low pass-through is typical in economies with oil subsidies and administered prices. For example, Mwase (2006) finds that a 10 percent depreciation is associated with a 0.05 percent increase in inflation after about two-quarters in Tanzania, partly due to the presence of administered prices amongst other factors. Other examples of low pass-through include Bhundia (2002) who finds low exchange rate pass-through to inflation (about 12 percent) in South Africa partly due to frictions in price-setting behavior (under imperfect competition). Also, in a study of a wide range of countries, Eichenbaum and Rebelo (2002) find that substitution by consumers away from imports to lower quality local goods accounts for incomplete pass-through.

**Low and incomplete exchange rate pass-through has implications on the extent to which domestic policies are effective in influencing inflation.** High Sri Lanka inflation therefore partly reflects the policy environment. In a study on growth in Sri Lanka, Duma (2007) finds that the output gap is positive in the recent past, indicating that the economy has been operating above its current potential, therefore resulting in inflationary pressures. Though monetary policy tightened somewhat between 2006 and 2007, it has been largely insufficient to contain inflation as the fiscal policy stance has also been rather loose with fiscal deficits at 7 percent and above in the recent past.

#### **D. Sensitivity Analysis and Alternative Specifications**

**In order to determine the robustness of the results, different Cholesky orderings of the variables were tested.** Two alternative orderings were experimented with based on other possible alternative channels through which the macroeconomic variables could interact and the results are robust to different orderings:

- The first alternative Cholesky ordering places import prices before the exchange rate and the output gap. In this ordering, oil prices enter first as the most exogenous shock, followed by import prices, the exchange rate, the output gap, wholesale prices, consumer prices, and lastly, broad money. This ordering assumes a contemporaneous impact of import prices on the exchange rate. Impulse response functions are presented in Appendix V. This ordering did not result in a change in the findings presented above.
- The second alternative Cholesky ordering involved placing the broad money variable after the output gap variable. The variables are ordered in the following manner: oil prices, the exchange rate, the output gap, broad money, import prices, wholesale prices, and consumer price inflation. Impulse response functions are presented in Appendix VI. This ordering did not result in a change in the findings presented above.

**Given the importance of administered prices in Sri Lanka, a separate VAR with administered price inflation in place of CPI inflation was also estimated.** The specification reveals that pass-through of oil price shock to administered prices is largely positive, compared to negative pass-through to consumer prices. Oil pass-through rises from about 2 percent during the second month to about 7 percent in seven months. Oil pass-through is slightly larger to administered prices compared to consumer prices. Exchange rate pass-through, however, is negative. The results (Appendix VII) suggest that administered prices do distort the impact of oil price shocks to inflation. Another notable finding is that import prices explain more variation in administered prices than in consumer prices possibly reflecting that the Sri Lankan authorities adjust administered prices more in line with changes in import prices in general.

**In order to further disentangle variation in inflation, a core inflation indicator was assessed.** Another VAR model including Sri Lanka core inflation in place of consumer inflation was estimated. Sri Lanka core inflation is an inflation indicator published by the Department of Census and Statistics (DCS). As defined by the DCS, core inflation excludes items covered under the Consumer Protection Act (wheat, milk powder, and gas); transportation; telecommunications and post office; and items whose pricing is influenced by government intervention (administered prices). Given low pass-through of external shocks to inflation, exploring a model with a core inflation indicator could help shed light on the extent to which administered prices play an important role in the variation of inflation in Sri Lanka. The following results emerged:

- Exchange rate pass-through is higher to core inflation than to general consumer price inflation (assessed earlier). Pass-through to core inflation is 18 percent in the month of the shock and rises to 62 percent in four months. This compares with exchange rate pass-through to general consumer prices of 8 percent in the first months to 41 percent in four months.

- Oil price pass-through to core inflation is also negative but slightly higher compared to that on general consumer prices.
- The exchange rate and oil prices explain slightly more variation in core price inflation than general price inflation. Together, external shocks (exchange rate, oil price, and import price shocks) explain about 28 percent of the variation in core inflation. About 50 percent of the variation in core inflation is still not explained by the variables in the model leading to the conclusion that there may be other factors influencing inflation in Sri Lanka. An assessment of these factors could be the subject of further investigation beyond this study.

## V. CONCLUSION

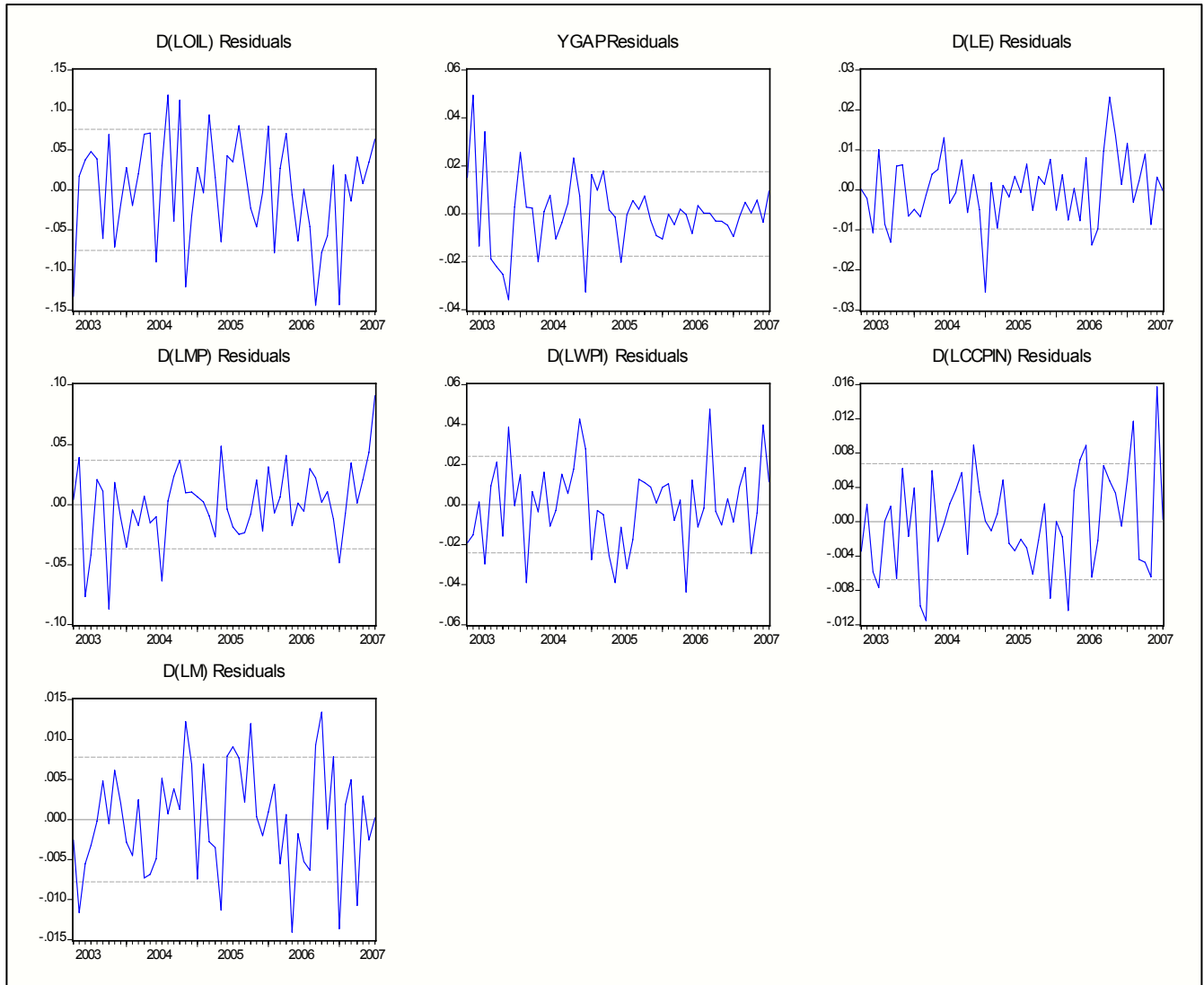
### **This paper finds incomplete pass-through of external shocks to inflation in Sri Lanka.**

Using impulse response functions and variance decompositions derived from a recursive VAR model, the paper finds that pass-through to consumer prices rises from about 10 percent in the first month of the shock to about 40 percent in six months. The bulk of pass-through occurs in the first four months of the shock. Pass-through of external shocks to wholesale prices is more pronounced compared to pass-through to consumer prices implying that the impact of external shocks declines as one moves down the distribution chain. Also, the impact of the oil price shock on prices is rather small and negative, partly reflecting implicit and explicit oil subsidies that contain the impact of oil prices on inflation. In a parallel model, the study finds that pass-through of oil price shocks is slightly larger on administered prices compared to consumer prices.

**Given low pass-through of external shocks and that external shocks explain a small percentage of the variation in inflation, domestic shocks likely play a more significant role on inflation in Sri Lanka.** With external shock not playing a major role in influencing domestic inflation, domestic policies can be very important in containing inflation.

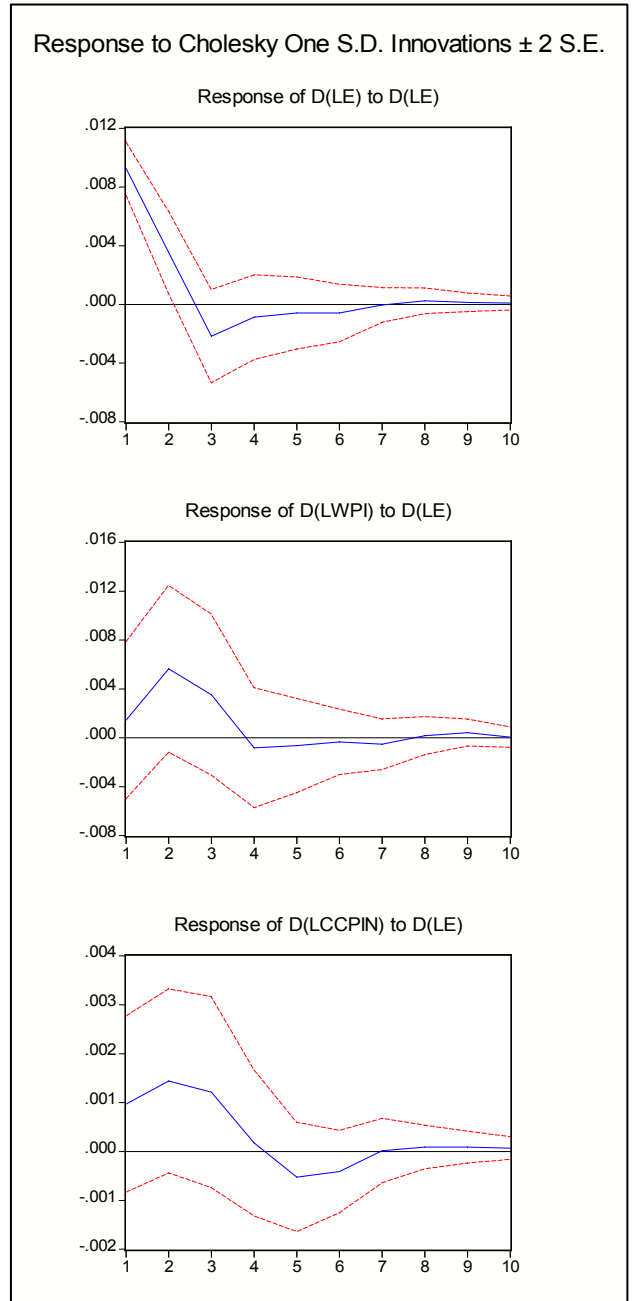
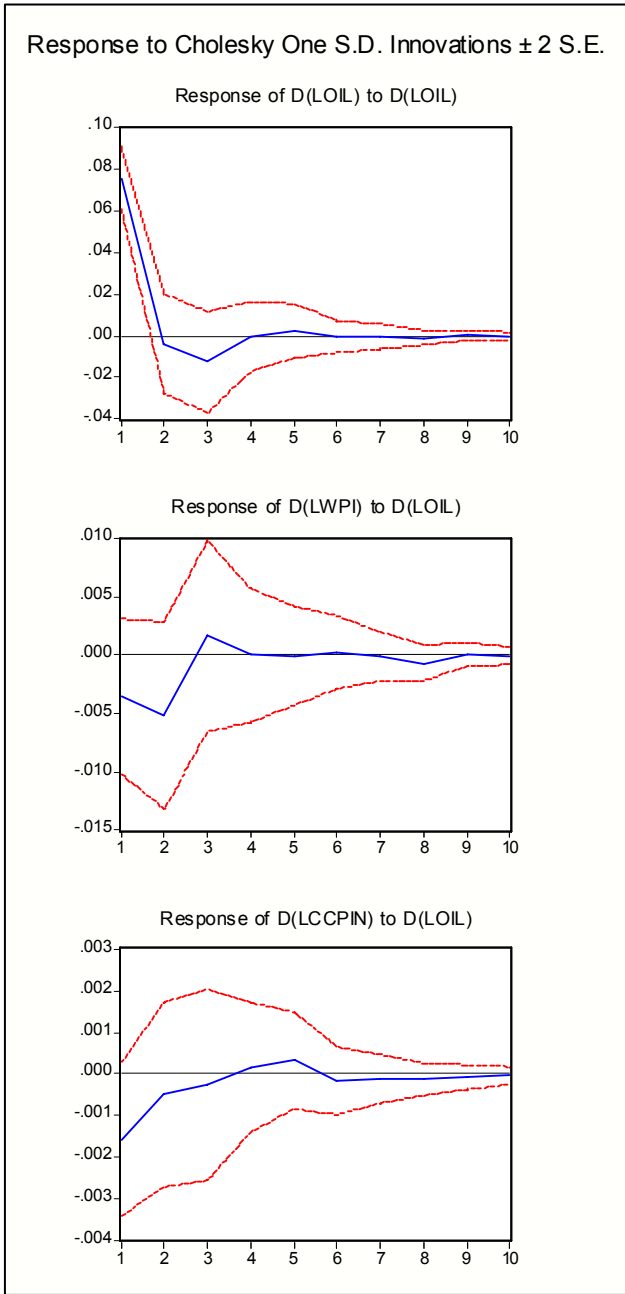


### Appendix I. VAR Residuals<sup>3</sup>

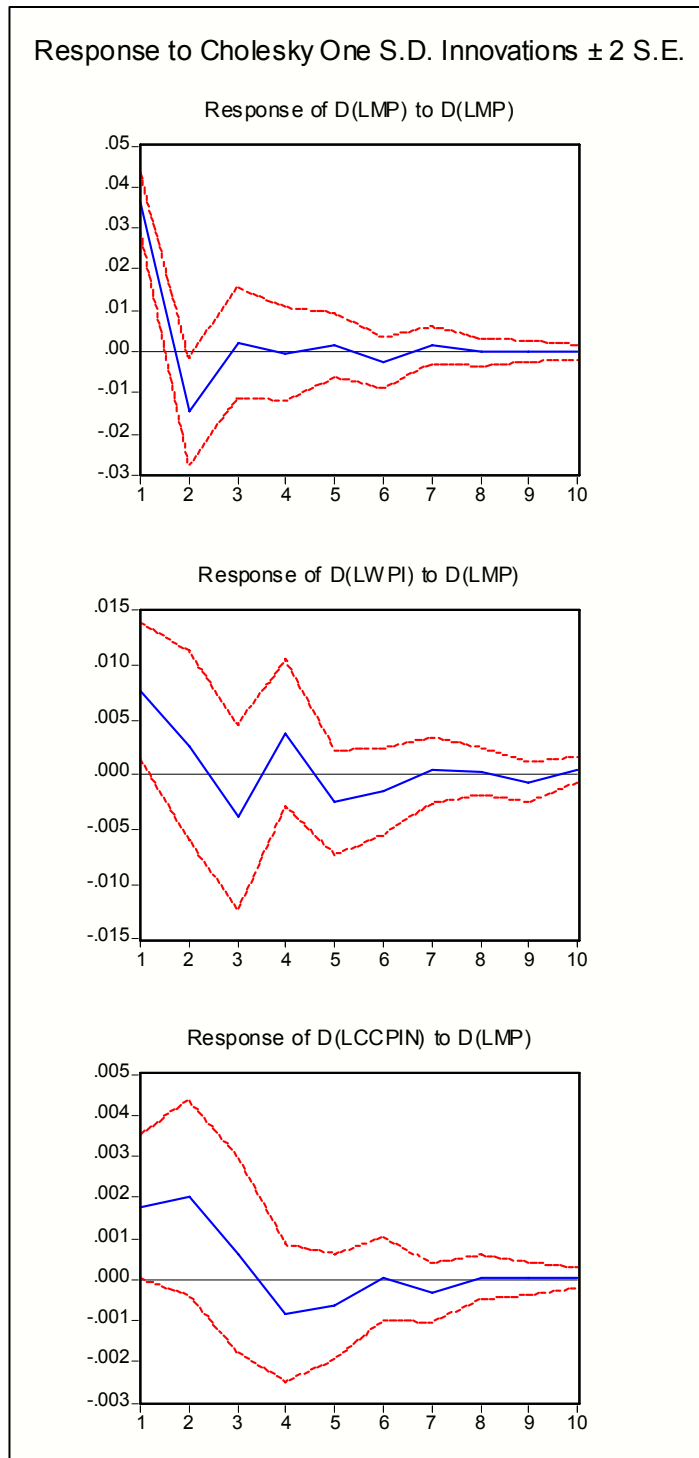


<sup>3</sup> The variable names in the charts from here onwards, “D” refers to the first difference operator, and the first “L” refers to the log. Therefore D(LOIL) is the first difference of the log of oil, YGAP is the output gap, D(LE) is the first difference of the log of the exchange rate, D(LMP) is the first difference of the log of import prices, D(LWPI) is the first difference of the log of wholesale prices, D(LCCPIN) is the first difference of the log of consumer prices, D(LM) is the first difference of the log of broad money.

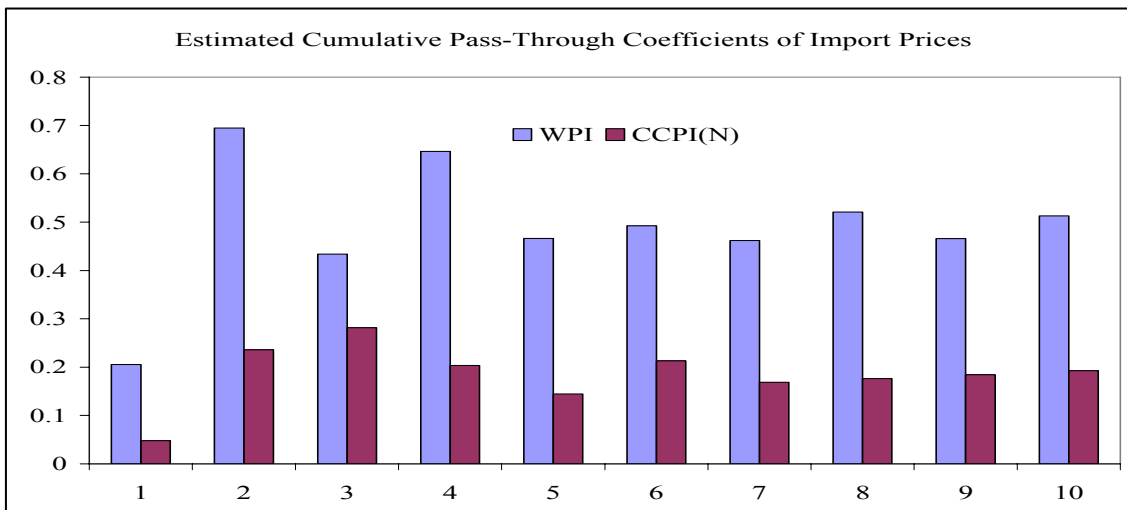
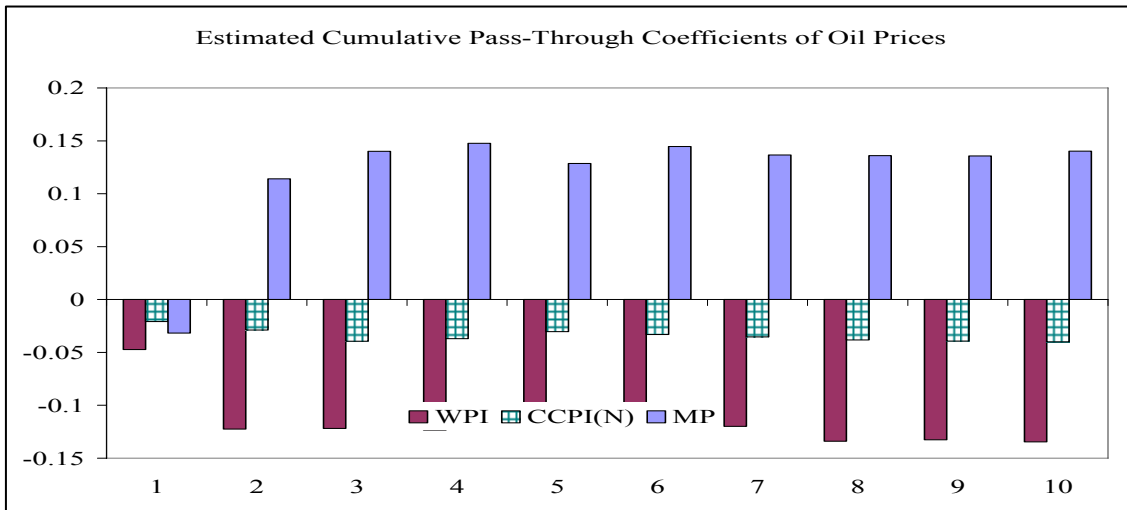
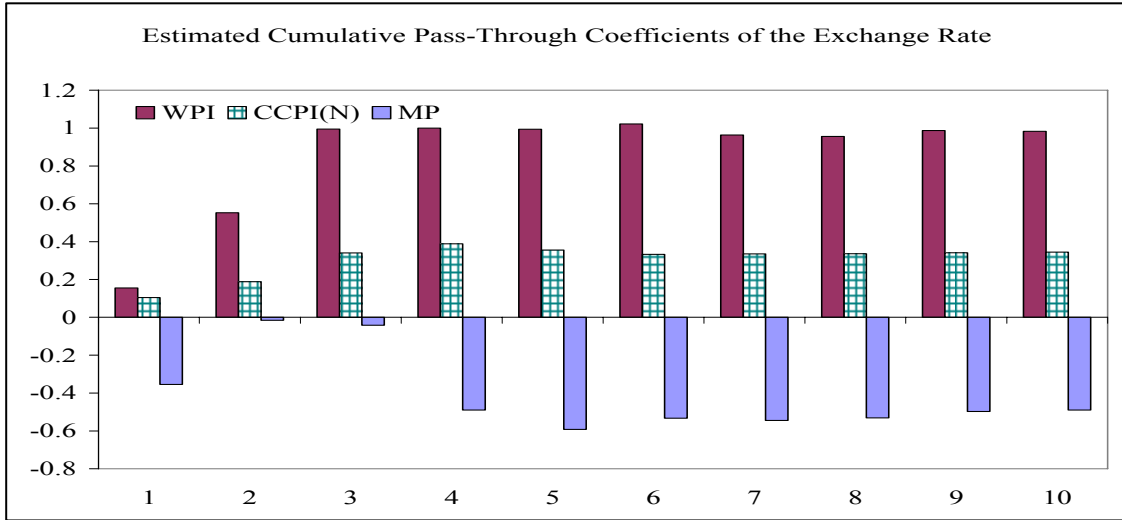
### Appendix II. Impulse Response Functions<sup>4</sup>



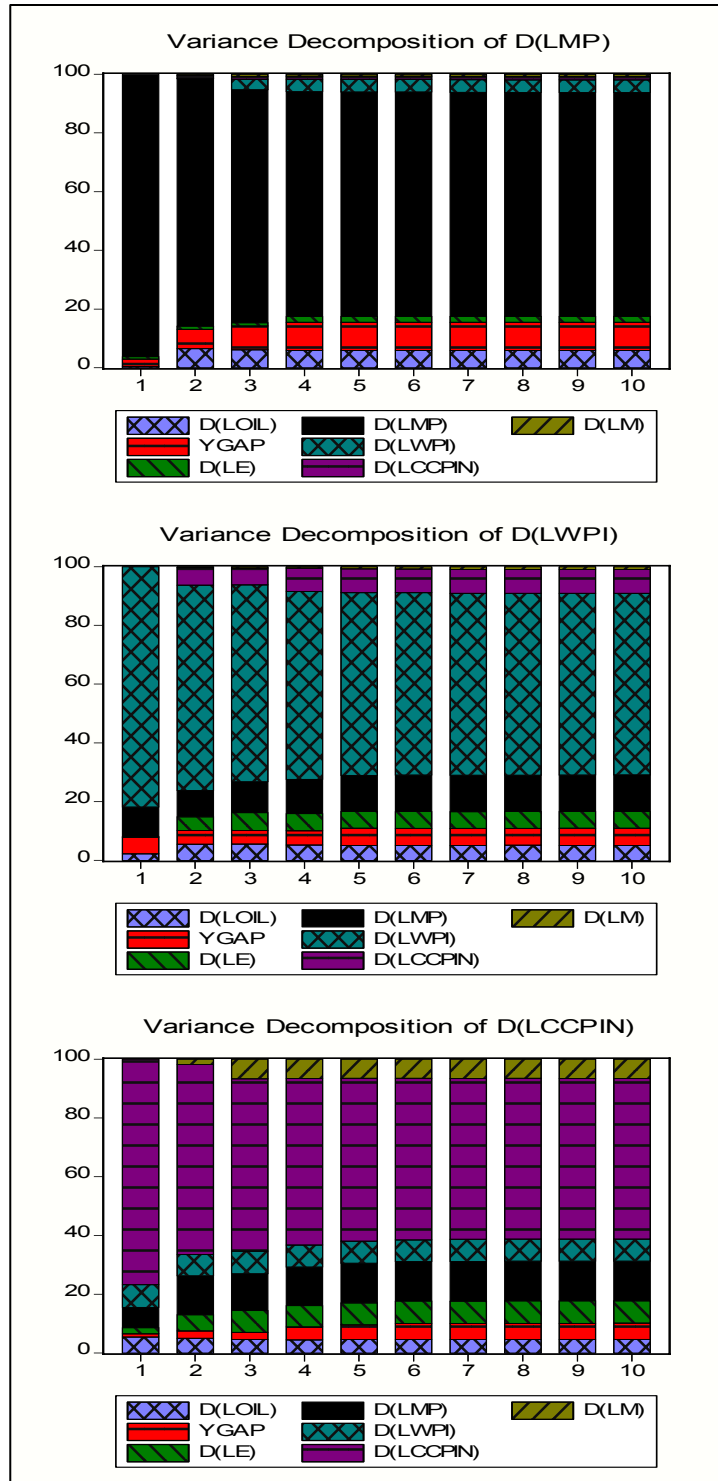
<sup>4</sup> The dotted lines are standard error bands.

**Appendix II. Impulse Response Functions (concluded)**

**Appendix III. Estimated Cumulative Pass-Through Coefficients**

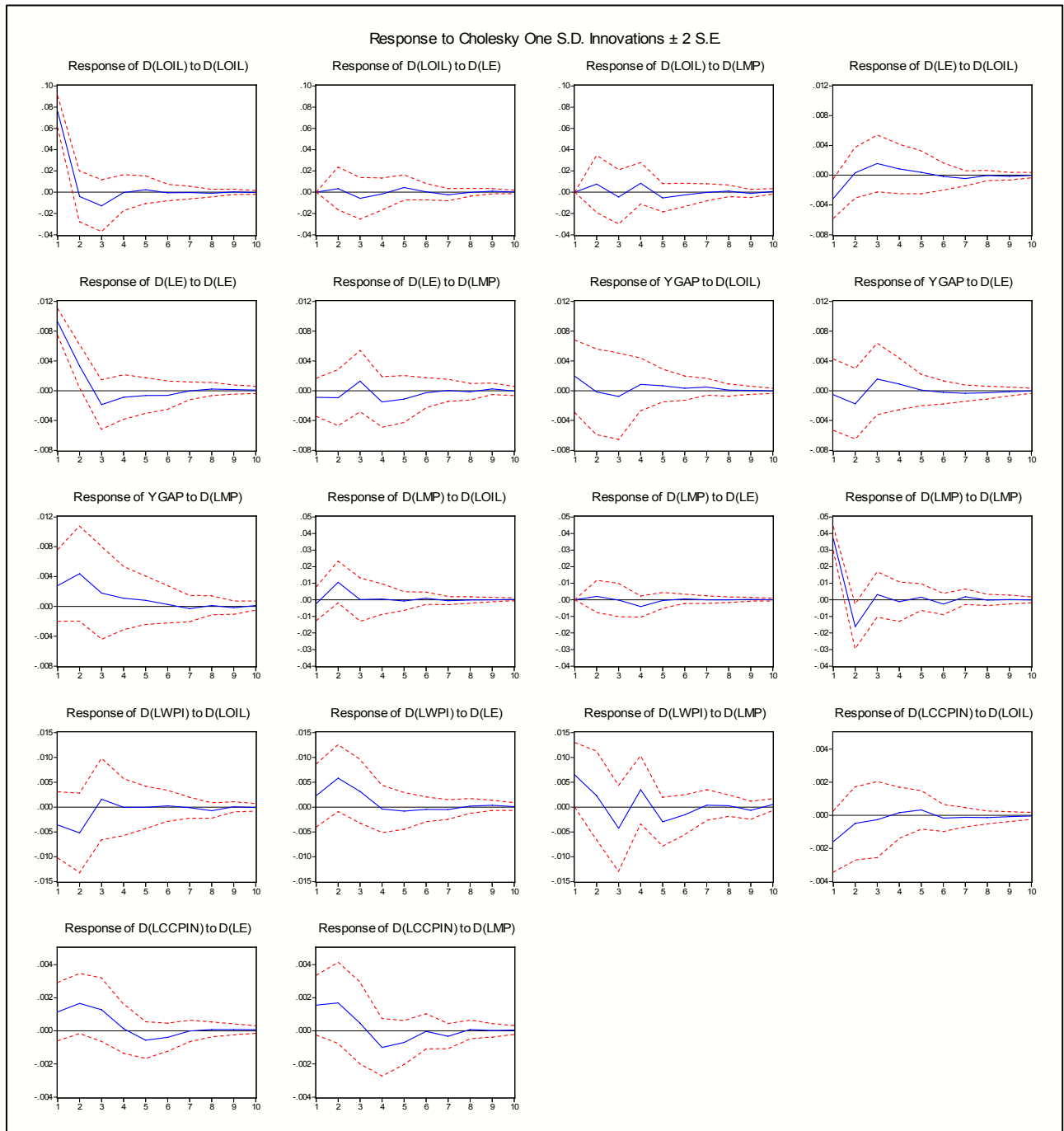


**Appendix IV. Variance Decompositions<sup>5</sup>**



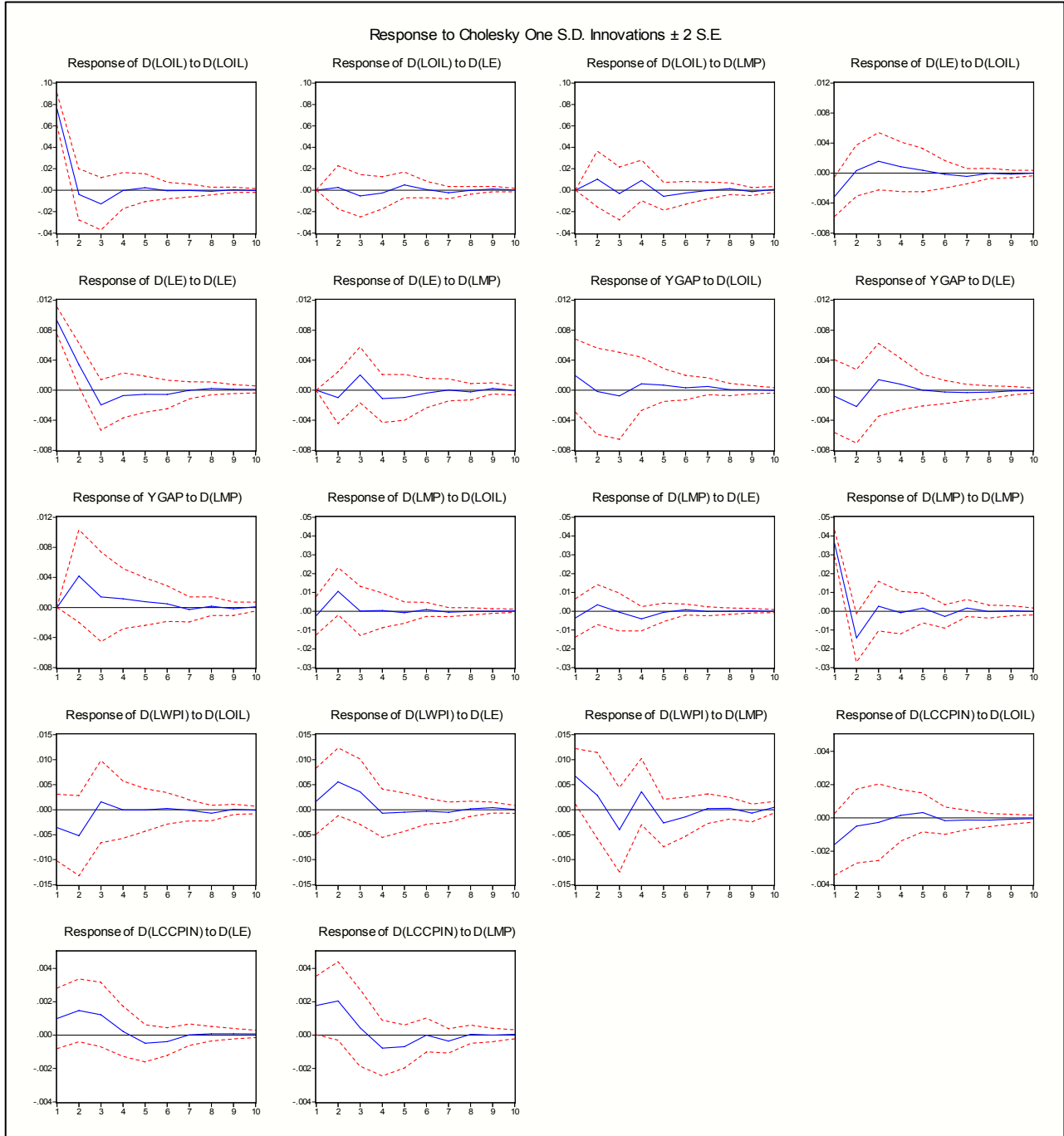
<sup>5</sup> In the charts, D is the first difference operator and L represents a log.

### Appendix V. Sensitivity Analysis—Cholesky Ordering A<sup>6</sup>



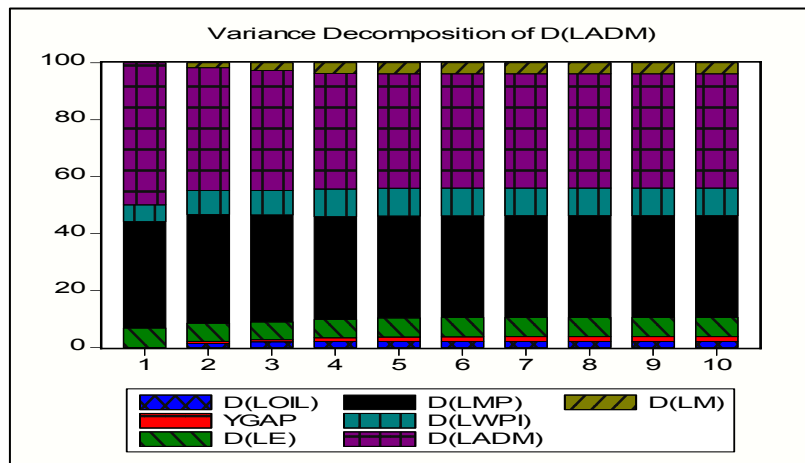
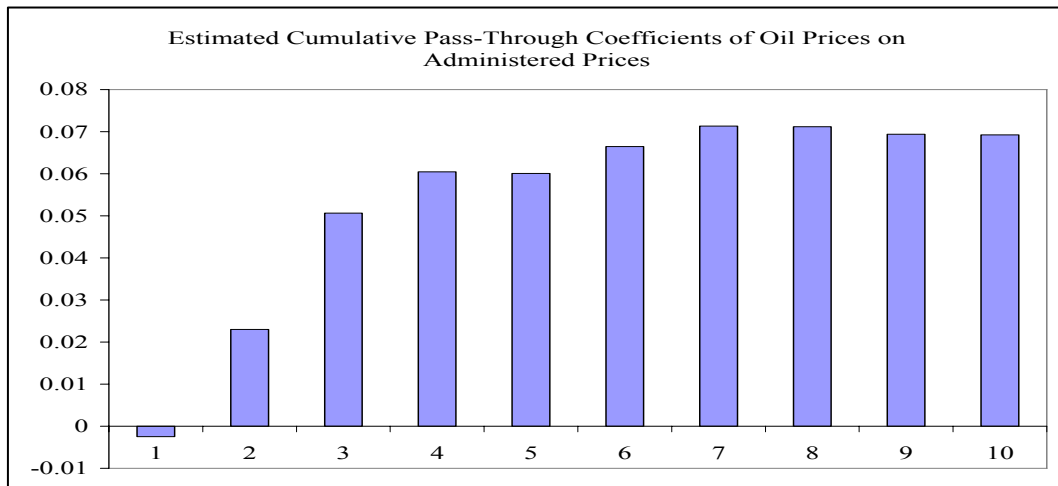
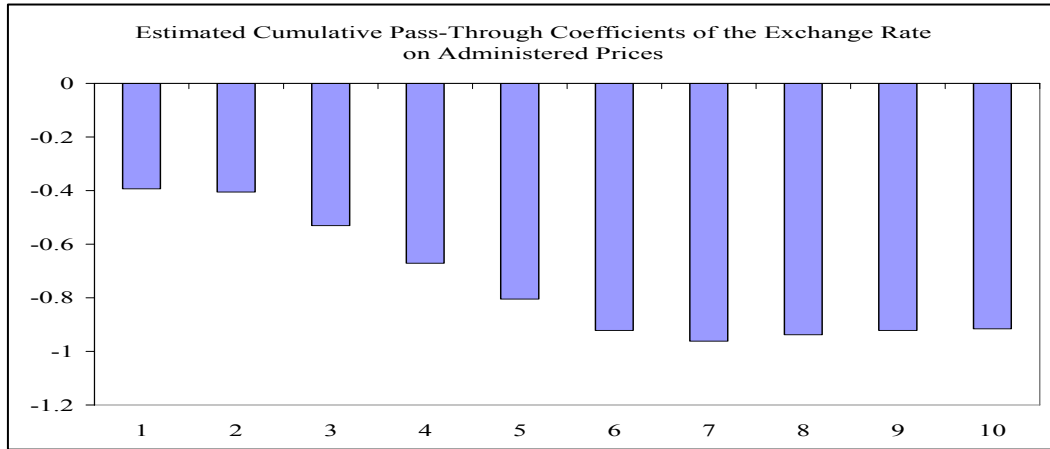
<sup>6</sup> The dotted lines are standard error bands.

## Appendix VI. Sensitivity Analysis—Cholesky Ordering B<sup>7</sup>



<sup>7</sup> The dotted lines are standard error bands.

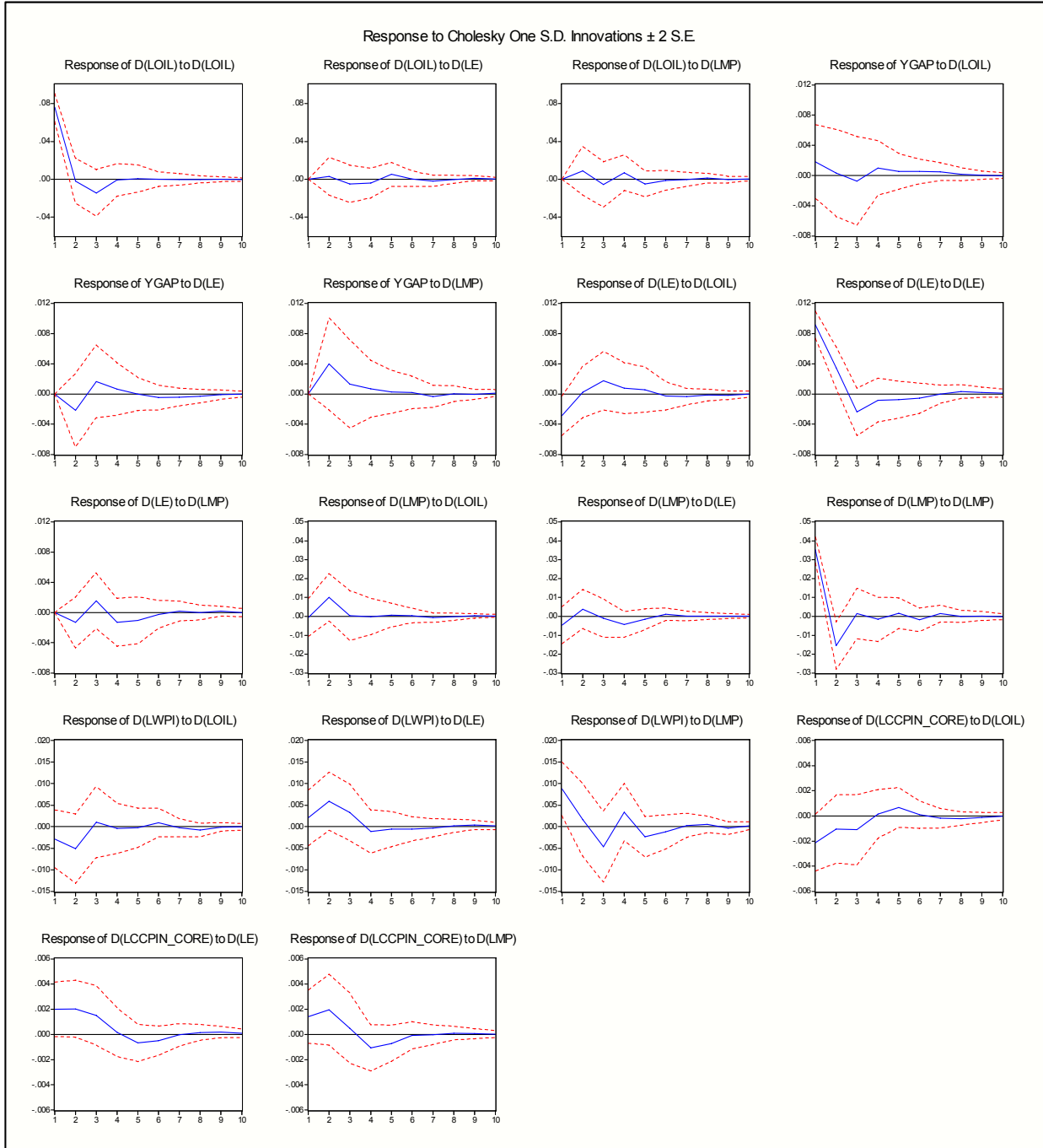
### Appendix VII. Administered Prices VAR Results<sup>8</sup>



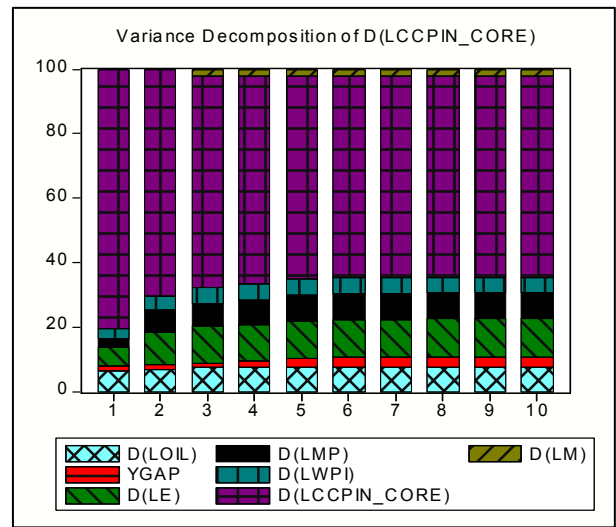
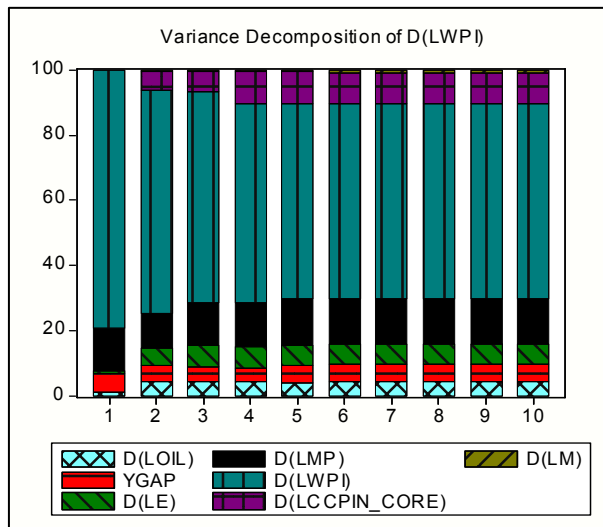
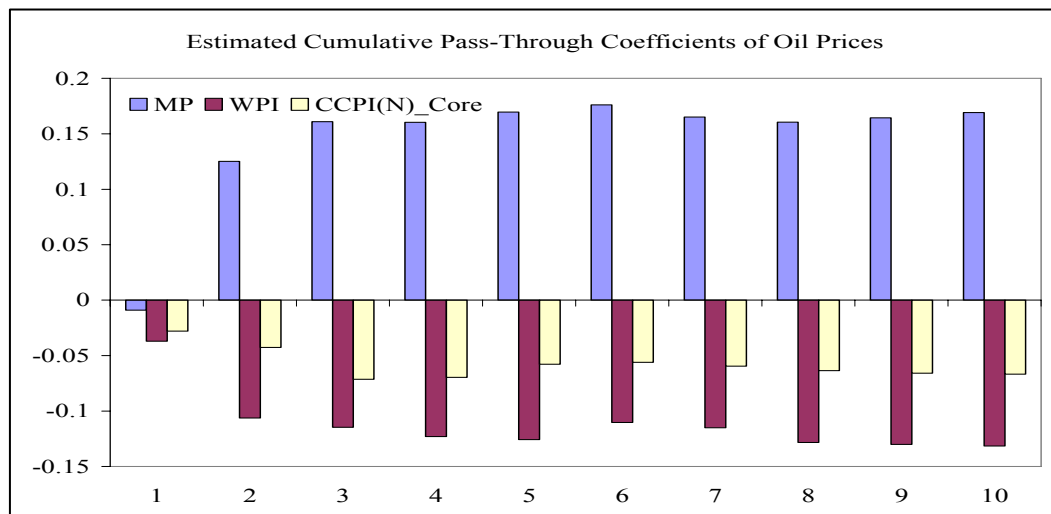
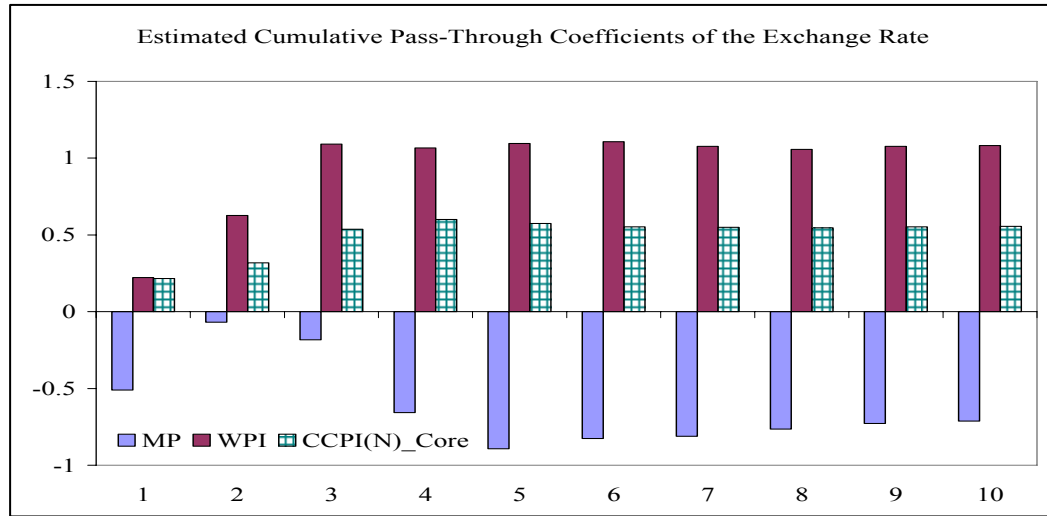
<sup>8</sup> In the variance decomposition graph, D (LADM) refers to the first difference of the log of administered prices. The administered price variable was found to be stationary in first differences and not in levels. Given data limitations, the model with administered prices was estimated with data up to 2007m3.



**Appendix VIII. Core Inflation VAR Results—Impulse Responses**



### Appendix IX. Core Inflation VAR Results—Pass-Through and Variance Decompositions



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