EXCHANGE RATE PASS-THROUGH INTO DOMESTIC PRICE INDICATORS: A SECTORAL ANALYSIS OF TURKISH ECONOMY

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ABSTRACT

EXCHANGE RATE PASS-THROUGH INTO DOMESTIC PRICE INDICATORS: A SECTORAL ANALYSIS OF TURKISH ECONOMY

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The question of exchange rate pass-through into domestic inflation is a widely analyzed issue due to its importance as regards to monetary policy, exchange rate policy and in general macroeconomic policy for open economies. Although most of the literature is focused on the exchange rate pass-through at the aggregate level, there are fewer studies that are done at the sectoral level for the Turkish economy. In this study by using a distribution chain of pricing model developed by McCarthy (2000), pass-through of exchange rates and import prices into domestic prices for selected sectors are examined for the Turkish economy. The emprical model estimates a Vector Auto Regression (VAR) to see pass-through dynamics through times and across the selected sectors. This study covers March 2002- December 2010 period; the period of floating

exchange rates. Findings indicate that pass-through has fallen recently in Turkey. Moreover results of the analysis show that external factors explain an important proportion of the variance of domestic prices for the sectors which have a larger import share.

Keywords: Pass-through, Inflation, Exchange rates, Import Prices, VAR

ÖZ

DÖVİZ KURUNUN ENFLASYON GÖSTERGELERİNE GEÇİŞKENLİĞİ:
TÜRKİYE EKONOMİSİNİN SEKTÖREL ANALİZİ

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Döviz kurunun yurtiçi enflasyona geçişkenlik etkisi, dışa açık ekonomilerin para, kur ve genel makro ekonomik politikaları üzerindeki önemi nedeniyle yaygın olarak araştırılan bir konu olmuştur. Literatürde Türkiye ekonomisi için pek çok çalışma genel ekonomi üzerine yoğunlaşmışken, sektörel düzeyde az sayıda çalışma bulunmaktadır. Bu çalışmada, McCarthy'nin bölüşüm zinciri fiyatlaması (2000) kullanılarak, Türkiye ekonomisinde seçilmiş sektörler için döviz kurlarının ve ithal fiyatlarının yurtiçi fiyatlara geçişkenlik etkisi incelenmiştir. Model, sektörel olarak geçişkenlik dinamiklerinin incelenmesi için Vektör Oto Regresyon (VAR) yöntemi kullanılarak tahmin edilmiştir. Çalışma dalgalı kur rejiminin uygulandığı Mart 2002 - Aralık 2010 dönemini kapsamaktadır. Sonuçlar Türkiye'de geçişkenlik etkisinin son dönemde azaldığını göstermektedir. Ayrıca, analiz sonuçları, ithalatta önemli bir pay sahip sektörlerde, dışsal faktörlerin yurtiçi

fiyatlardaki değişimlerin önemli bir kısmını açıkladığını ortaya koymaktadır.

Anahtar Kelimeler: Geçişkenlik, Enflasyon, Döviz Kurları, İthal Fiyatları, VAR

I dedicate this thesis to my family for their support, patience and unconditional love!

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CHAPTER 1

INTRODUCTION

Turkey experienced strong inflationary pressures over the period of 1970s until early 2000s. Especially in 1990s one of the major reasons for macroeconomic instability in Turkey was extremely high inflation rates. Moreover, exchange rate movements were persistent and volatile during this period. From 1965 until 2010, the average inflation rate in Turkey was 39.78 percent reaching an historical high 138.71 percent in May 1980. After the failure of exchange-rate stabilization policy adopted in 2000 due to the 2001 crisis, the Central Bank of the Republic of Turkey (CBRT) adopted Implicit Inflation Targeting Regime (IIT) under a floating exchange rate regime to struggle with high inflation rates

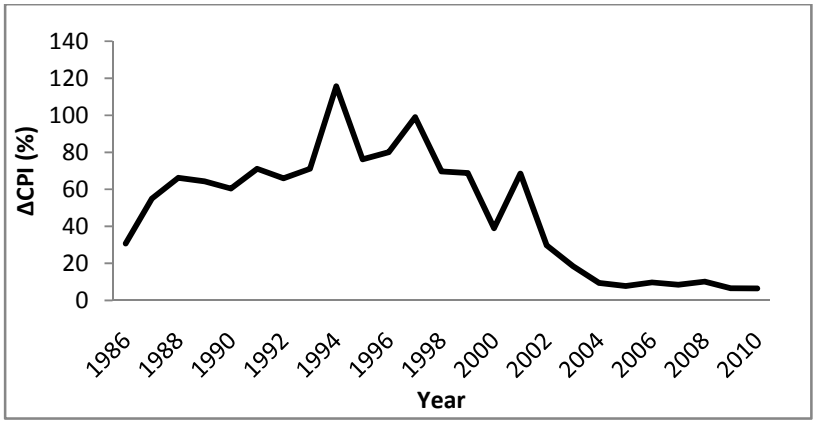

Figure 1. 1. Annual % Change in CPI for the period 1986-2010

in 2002. After the introduction of this regime, inflation rates displayed a downward trend which then reached to one-digit numbers indicating its success (Figure 1.1). In 2006 with the improvement in communication and institutional set up, Full-Fledged Inflation Targeting Regime (FFIT) was introduced to maintain price stability.[1] Average annual inflation decreased to 8.2 percent at the end of 2005 from 80.6 percent at the beginning of 2002 during the IIF period. However, during the period between 2006-2008, year-end annual inflation rates were above the end-year inflation of 2005 and the inflation target for the corresponding year.[2] Fall in inflation was mainly interrupted by the external factors two times. Firstly, in 2006 sudden depreciation of Turkish Lira (TL) against US Dollar (USD) due to financial stress in global markets led to increase in inflation. Secondly, in 2007 and 2008 an increase in import prices especially in oil prices due to external supply-side factors had been major reasons behind the surge of domestic inflation before the global financial crisis erupted. These developments indicate that external shocks even after disinflation still have significant impacts on domestic inflation dynamics. Therefore, the relationship between the inflation and the external factors are studied in this dissertation which constitutes the main motivation of this study.

In this study, we try to determine the effect of the exchange rate and the import price pass-through into the domestic price indicators at the sectoral level. There are several reasons to choose this topic. First of all, investigating the importance of external factors in domestic price indicators is one of the key points for the CBRT in terms of determining monetary policy. Therefore,findings of this study will be beneficial for the policy makers at the micro level. Secondly, although most of the literature focus on the exchange rate pass-through at the aggregate level, there are very few studies that are done at the sectoral level for the Turkish economy. Analyzing the exchange rate pass-through at the sectoral

[1] More detailed information about inflation developments in IIT and FFIT periods are available in Kara (2006).

[2] CBRT determined year-end annual inflation targets as 5, 4 and 4 percent, respectively, from 2006 to 2008.

level is important in determining industrial policies to strengthen the Turkish economy against external shocks. Extensive use of imported inputs, especially in the industry, increases the sensivity of the Turkish economy to the dynamics of import prices. For different sectors which have different structural properties and different levels of import dependency, it is necessary to implement different microeconomic policies to improve the competitiveness of domestic manufacturers. Thus, identifying the sectors with higher exchange rate pass-through have significant policy implications at the micro level. In this regard, this study provides valuable information on the exchange rate and the import price pass-through in Turkey and represents useful findings for the policy makers.

In this study, we use a distribution chain of pricing model as suggested by McCarthy (2000) and investigate pass-through of exchange rates and import prices into domestic price indicators for some selected sectors: clothing, electricity, energy, fuel oil, furniture, machinery, motor vehicles, processed foods, tobacco products and unprocessed foods in Turkey. The model is estimated using a VAR model to see pass-through dynamics through time and across the each sector. Sectors are selected at the 2 and 3 digit level and the VAR model uses import prices, producer and consumer prices as well as the output gap, and exchange rate. The study uses monthly data between March 2002 and December 2010. The pass-through coefficients are calculated using impulse response functions. In addition, variance decomposition is used to represent the significance of exchange rate and import prices for variation in domestic price indicators.

Our results reveal that pass-through of exchange rate and import prices into price indicators have fallen along the distribution chain. However, more specifically, for the fuel oil and unprocessed food, the pass-through of exchange rate into consumer prices is higher and faster than it is for producer prices. On the other hand for the sectors having high import dependency like energy and fuel oil, exchange rate pass-through into producer prices is higher and faster

than it is for aggregate producer prices. In addition, the pass-through of import price and exchange rate shocks into consumer prices is found almost the same. However, import prices have a stronger effect on producer prices than exchange rate for all the sectors.

The outline of this thesis is as follows: Chapter 2 includes the theoretical framework of pass-through and the literature review on pass-through. Determination of the model, methodology and selection of data, its properties constitute Chapter 3 of the study. Chapter 4 covers the empirical results of the estimated model. The results of impulse response functions, variance decomposition for each sector in detail and a brief comparison of results with previous studies are included. Finally, Chapter 5 summarizes the study with concluding remarks.

CHAPTER 2

THE THEORETICAL FRAMEWORK OF PASS-THROUGH

The theoretical relationship between exchange rate and domestic price indicators are explained in this section. As the most commonly known and the simplest definition, the concept of exchange rate pass-through is defined as the extent to which exchange rate changes are transmitted into prices.

Krugman and Obstfeld (2000) state that the degree of pass-through from the exchange rate to import prices is defined as the percentage by which import prices rise when the home currency depreciate by one percent. [3] That the degree of pass-through is 1 indicates a complete pass-through of exchange rate to import prices. However, less than one-to-one response of import price to exchange rate indicates an incomplete exchange rate pass-through. The linkage between foreign and domestic prices is simply explained using the Law of One Price. According to the Law, domestic price (P_d) of a given good is equal to foreign price (P_f) of the good times exchange rate (e) in an efficient market which indicates a market with perfect competition (Eq. 2.1).

$$P_d = eP_f \qquad (2.1)$$

[3] Krugman and Obstfeld (2000). International Economics, Theory and Policy, p. 468.

For a complete exchange rate pass-through, two conditions have to be fulfilled: mark-ups of price over cost and marginal costs have to be constant. However, it is not possible to observe complete pass-through in practice. The reasons behind incomplete pass-through are examined in many studies.

Goldberg and Knetter (1997) suggest that around 60% of exchange rate is transmitted into import prices in the US, which is fairly well-supported and thus, indicates an incomplete pass-through. The main factor behind that the pass-through is not complete can be firms' pricing strategy. Many importing and exporting firms try to keep their prices constant when the exchange rate changes. That is called pricing-to-market (Krugman, 1987). Thus, many firms venture revenue losses to keep their share in the market. Goldberg and Knetter (1997) state that pricing-to-market is more present within competitive industries.

Another factor is size of the economy. The common belief has been that small countries are more affected by currency depreciation or import price shocks on domestic prices than large countries. The explanation of McCarthy for this is that an increase in prices will be negated by a decrease in world prices through lower world demand and pass-through effect gets lower, however, a higher pass-through is observed for small countries since they have almost zero effect on international prices (McCarthy, 2000).

Moreover, the degree of pass-through decreases along the distribution chain (McCarthy, 2000). The main reason for this decrease is the contents of the price indicators. While producer prices include more traded items, consumer prices contain more non-traded ones. In addition, higher tax burden is observed on consumer prices. That indicates that degree of pass-through falls when the number of items affected by external shock is less along the distribution chain.

CHAPTER 3

LITERATURE

Pass-through literature can be classified into various categories. In general, the pass-through literature is examined under two main categories: the first one includes studies on Turkish economy while the second one consists of studies on global basis. Most studies analyze the pass-through to import prices of specific industries or products at the industry level. These studies mostly investigate the pass-through of exchange rate into import prices (Feinberg, 2000) rather than examining the pass-through of import price to domestic inflation indicators. Moreover, this part consists of the studies focusing on pass-through to aggregate price measures (McCarthy, 2000; Campa and Goldberg, 2002). The major difference proposed in this paper is that it provides information for exchange rate and import price pass-through into domestic prices for various products at the sectoral base for Turkey. It is useful to examine the available literature to analyze the exchange rate and import price pass-through into domestic prices. Empirical studies show some variation in terms of the methodology used.

The existing studies tend to use a single-equation version of the pass-through analysis to explain the response of the domestic price indices to changes in the exchange rate. Hampton (2001) aims to identify the impact of import prices on consumer prices in the long-run by using co-integration model for New Zealand. The data covers the period from 1985 to the mid-1990s. The results suggest that

the long-run import price pass-through coefficient is around 0.15, with around half of any deviation from the long-run relationship being corrected in around five months. Moreover, he finds that a 10 percent increase in import prices leads to a 0.5 percent increase in consumer prices

Campa and Goldberg (2002) provide cross-country, time-series, and industry-specific evidence on the pass-through of exchange rates into import prices across twenty five OECD countries. They examine not only aggregate import prices but also five product categories: food, energy, raw materials, manufacturing, and non-manufacturing products by using ordinary least squares after cointegration approach. They find that import prices in local currencies reflect 60 percent of exchange rate fluctuations in the short run and 80 percent over the long run. Moreover, macroeconomic variables play a limited role in explaining cross-country differences in levels of pass-through elasticities. However, for OECD countries, the most important determinants of pass-through changes are microeconomic and related to the industry composition of a country's import bundle. While pass-through elasticities for manufacturing products and food products are generally partial, energy and raw material imports have pass-through elasticities closer to one.

Rincon, Caicedo and Rodriguez (2005) try to analyze the exchange rate pass-through effects on import prices within a sample of manufactured import goods by using Error Correction Model (ECM), fixed and time-varying parameters and Kalman filter techniques. The study uses Colombian monthly data and the period 1995:01-2002:11. The main finding of this paper is that the long-run pass-through elasticities for the industries in the sample change between 0.1 and 0.8 and the short-run ones change between 0.1 and 0.7. In addition, there exists different degrees of pass-through among manufacturing sectors that indicate the significance of using disaggregate data. Furthermore, in the short-run, the pass-through coefficient is higher under the floating exchange rate regime than the one during the semi-fixed exchange rate regime.

There are pass-through studies examining Turkish data using single-equation framework. Alper (2003) investigates the exchange rate pass-through to domestic prices in Turkish economy by using a single equation error-correction mechanism model for the period 1987:01-2003:05. Estimation results show that similar to other emerging countries, the degree of exchange rate past through to domestic prices is high and the pass-through is completed in a very short time span. In addition, the main factors to account for high pass-through are founded that the past currency crises and the high degree of openness of the economy.

The casual direction of pass-through relationship from the exchange rate to domestic price indicators is mostly investigated during the period of currency crises. However, reverse causation, impact of domestic prices on the exchange rate, cannot be ignored. An increase in domestic prices leads to exchange rate depreciation as suggested by a standard monetary model. Single-equation approaches cannot capture this interaction. For this purpose, it is appropriate to use a model which includes both exchange rate and domestic price indicators as endogenous variables.

A VAR approach is useful for determining the endogenous interactions between the exchange rate and domestic price indicators. McCarthy (2000) provides a comprehensive study to determine the impact of exchange rates changes and import prices on the domestic consumer and producer prices for nine industrialized countries. The estimation period runs from 1976:1 through 1998:4 for most countries. The empirical model is a VAR model including a distribution chain of pricing that gives us a chance to see pass-through dynamics through time. In most of the countries analyzed, the exchange rate pass-through to consumer prices is found to be modest. However, import prices have a stronger effect on domestic prices. Moreover, pass-through is larger in countries with a larger import share, more persistent exchange rates and import prices.

There are the pass-through studies on Turkish economy that use models similar to McCarthy (2000). Leigh and Rossi (2002) investigate the impact of exchange rate movements on prices in Turkey by using recursive VAR. The data covers the period from the January 1994 to April 2002. The findings are worth emphasizing. The first finding is that impact of the exchange rate on prices is over after about a year, but mostly in the first four months. The second one is that the pass-through to wholesale price is stronger than the pass-through to consumer prices. This finding does not seem surprising since wholesale prices index contains a larger share of tradable goods than the consumer prices index. The third finding is that estimated pass-through is complete both in the short-run and long-run. However, the results of this study should be considered with caution since the sample period covers both the managed peg regime and the floating exchange rate regime without any consideration given to exchange rate regime change.

Following Leigh and Rossi (2002), Arat (2003) and Arbatlı (2003) also analyze the exchange rate pass-through in Turkey for the pre-2001 data. The findings of Arat (2003) indicate that exchange rate pass-through into inflation takes more time than the Leigh and Rossi (2002) findings. In addition, pass-through into tradable goods is much larger than that into non-tradable goods. Arbatlı (2003) extends the study by utilizing a threshold VAR model to examine asymmetries in the relationship between exchange rate and inflation. It is concluded that the asymmetry is significant and pass-through into prices is lower during significant economic contractions, periods with higher exchange rate depreciation and periods with lower inflation.

Kara and Ögünç (2005) investigate the pass-through from exchange rate and import prices to domestic prices in Turkey by using VAR model based on McCarthy (2000). Pass-through is estimated for two different periods which are before and after the adoption of floating exchange rate regime. They use different type of price measures such as private manufacturing inflation, core

CPI and tradable/non-tradable CPI. They find that pass-through has weakened after the adoption of floating exchange rate regime. Furthermore, they conclude that completion of the pass-through takes more time, and cumulative effects of one-sided shocks on domestic prices can still be sizeable. In other words, exchange rate shocks may still dominate inflation dynamics if they are persistent enough. However, one disadvantage of this study is the limited data for the floating exchange rate regime. They have only three and a half years of observation which is short for the statistical analysis.

In a recent study, Korap (2007) examines the extent to which changes in exchange rates result in changes in Turkish domestic inflation by using McCarthy (2000) framework in a VAR set up. The data includes two different periods; the pre-2003 and post-2003, when the exchange rates were allowed to float. Using monthly data, two impulse-response functions and pass-through coefficients, one for the 1994 April-2002 December period and the other one for the 2003 January- 2006 December period are estimated. The most important finding is that the magnitude of the impact has declined for the post-2003 period by nearly one-half compared to the pre-2003 period during the early stages of the production process reflecting the predominance of the manufacturer price index in determining Turkish inflation rates. In addition, the decline in the exchange rate pass-through to domestic prices coincides with a 25 percent decline in the consumer price inflation after 2003.

Kara and Öğünç (2008) also investigate pass-through recently. They use the same methodology with McCarthy (2000). Apart from other studies on pass-through in Turkey, they discuss import price inflation into price indicators. Moreover, they use a more recent data set with the periods of pre-2001 and post-2001. They give a conclusion that pass-through had decreased after the adoption of inflation targeting (IT) and flexible exchange rate regimes.

Rowland (2004) analyzes the pass-through into aggregate price measures rather than focusing on the pass-through to import prices of different industries. This study includes two different econometric frameworks to study Colombian exchange rate pass-through to import, producer and consumer prices. These frameworks are based on VAR models. An unrestricted VAR model forms the basis for the first framework while the multivariate cointegration model by Johansen (1988) constitutes the second one. They use monthly data from January 1983 up until October 2002. This study concludes that pass-through in Colombia is incomplete. Import prices respond quickly to an exchange rate change with pass-through coefficients of 0.48 after three months and 0.80 after one year while producer prices respond more slowly with a pass-through coefficient of 0.28 after one year. For consumer prices, two frameworks produce different results. The unrestricted VAR framework gives a pass-through coefficient of 0.08 after one year whereas the Johansen framework gives a coefficient of 0.15.

There are also studies considering the two-step approach as an extension of the mark-up pricing framework. Firstly, the pass-through of import prices into producer prices and then, pass-through from producer prices to consumer prices are estimated. After the estimation of two stages, they are combined to calculate the import price pass-through into consumer inflation. Liu and Tsang (2008) examine pass-through effect of global commodity prices on China's inflation. Their results show that in a three-month period, a 10 percent increase in international commodity prices lead to 1.2 percent rise in producer prices and 0.24 percent rise in consumer prices.

In the previous part, studies using aggregate data are discussed. However, there are limited studies examining the exchange rate pass-through at the sectoral base which are more important in evaluating the results in this thesis. Feenstra, Gagnon and Knetter (1993) mostly provide a theoretical relationship for pass-through and market share using a panel data set of automobile exports

from France, Germany, Sweden and the United States to a number of destinations during the period of 1970-1988. The results show that this relationship is nonlinear. The lowest pass-through is observed when the market share of the source country is about 45 percent and the highest is observed when the market share of the source country approaches to 100 percent. Pass-through changes in different exporting and importing countries.

Yang (1997) examines exchange rate pass-through in US manufacturing industries and its cross-sectional variation using import price data for three and four digit SIC industries in the U.S. manufacturing sector. This paper explains an adapted Dixit-Stiglitz model concluding that the reason for pass-through can be increasing marginal cost as well as variable demand elasticity. Moreover, it is observed that the relationship between pass-through and the degree of product differentiation is positive while it is negative for pass-through and the elasticity of marginal cost with respect to output.

Kardasz and Stollery (2001) try to examine the determinants of the pass-through exchange rate fluctuations into both domestic and import prices for thirty-one Canadian manufacturing industries. This study has a two-stage estimation procedure. In the first stage, time series data are used to estimate import and domestic price equations by industry to obtain unbiased pass-through elasticities of both domestic and import goods. The second stage mainly depends on the previous stage and explains the interindustry variation in the estimated elasticities by designing cross-section regressions. The data set includes the period from 1972 to 1989. They find that exchange rate pass-through elasticity for imports increases when the elasticity of substitution between imports and domestic goods.

Kara et al. (2005) aims to demonstrate the variations in the exchange rate pass-through across different exchange rate regimes and characterize the degree and extent of pass-through in Turkey by using Seemingly Unrelated Regressions

(SUR). The monthly data covers the period from the January 1995 to June 2004. They find that the pass-through of exchange rates to domestic prices has declined in the post 2001 period in comparison with the earlier episodes, due to a decline in indexation behavior. Moreover switching to floating exchange rate regime and implementing ambitious disinflation policy contribute to reduction in the pass-through. However, it is observed that the impact of exchange rate on inflation for traded goods is still notable.

CHAPTER 4

MODEL, METHODOLOGY AND DATA

This chapter describes the data, the methodology and develops a model of pricing along a distribution chain as in McCarthy (2000) to examine pass-through effects into inflation indicators. In this regard, Section IV.I discusses the reasons behind the choice of this framework and presents the setup of the proper model to analyze the pass-through effects into price indicators. The other section focuses on the data selection process and the properties of the data.

4.1. Model and Methodology

To examine the exchange rate pass-through into domestic inflation indicators across sectors, pricing along a distribution chain model developed by McCarthy (2000) is used.[4] There are several reasons for choosing this model. The first reason is that pricing along a distribution chain model makes it possible to observe the way the external shocks are transmitted from one stage to the other one. The second one is that the model enables to identify direct and indirect effects of exchange rates and import price shocks on domestic consumer inflation. The third one is that it combines the dynamics through pricing power

[4] The chain structure of Blanchard (1983), Christiano, Eichenbaum, and Evans (1997), and Clark (1999) are taken into consideration as the chain structure of the model.

and changing mark-up rates. As in McCarthy (2000), inflation has some components at all import, producer, and consumer inflation stages at period t.

Expected inflation at that stage based on the available information at the end of period t-1 is called the first component. The second and third components are the impacts of domestic supply and demand shocks on inflation at that stage in period t. The fourth one includes exchange rate shocks effect on inflation at a particular stage. Other components include the effects of shocks which belong to the previous stage in the chain.

McCarthy (2000) indicates that the shocks at each stage comprise an important part of a stage's inflation. Inflation at each stage is better understood by using information of the previous period t-1 with contemporaneous information about domestic supply and demand variables, exchange rates, and inflation at previous stages of the cycle.

Using the assumptions given above, the inflation rates in the sector i in period t at three stages can be given as the following.[5]

$$og_{it} = E_{t-1}(og_{it}) + \varepsilon_{it}^{og} \qquad (3.1)$$

$$\Delta er_{it} = E_{t-1}(\Delta er_{it}) + \alpha_{1i}\varepsilon_{it}^{og} + \varepsilon_{it}^{\Delta er} \qquad (3.2)$$

$$\pi_{it}^{ipi} = E_{t-1}\left(\pi_{it}^{ipi}\right) + \beta_{1i}\varepsilon_{it}^{og} + \beta_{2i}\varepsilon_{it}^{\Delta er} + \varepsilon_{it}^{ipi} \qquad (3.3)$$

$$\pi_{it}^{ppi} = E_{t-1}\left(\pi_{it}^{ppi}\right) + \delta_{1i}\varepsilon_{it}^{og} + \delta_{2i}\varepsilon_{it}^{\Delta er} + \delta_{3i}\varepsilon_{it}^{ipi} + \varepsilon_{it}^{ppi} \qquad (3.4)$$

$$\pi_{it}^{cpi} = E_{t-1}\left(\pi_{it}^{cpi}\right) + \gamma_{1i}\varepsilon_{it}^{og} + \gamma_{2i}\varepsilon_{it}^{\Delta er} + \gamma_{3i}\varepsilon_{it}^{ipi} + \gamma_{54i}\varepsilon_{it}^{ppi} + \varepsilon_{it}^{cpi} \qquad (3.5)$$

[5] The model will be determined for each sector separately (subscript i is used for each coefficient in the equations).

where og_t is the output gap, Δe_t is the first difference of the logarithm of nominal exchange rate. Moreover, ε_{it}^{og} and $\varepsilon_{it}^{\Delta er}$, refer to the demand, and exchange rate shocks; π_{it}^{ipi}, π_{it}^{ppi}, and π_{it}^{cpi} refer to the first difference of the logarithm of import price, PPI and CPI; ε_{it}^{ipi}, ε_{it}^{ppi}, and ε_{it}^{cpi} refer to the import price, PPI, and CPI inflation shocks respectively; and finally $E_{t-1}(\cdot)$ refer to the expectation variable at the end of period t-1.

Eq. 3.1 implies that the dynamics of the output gap in the corresponding sector is used to identify demand shocks. In addition, Eq. 3.2 indicates that the dynamics of exchange rate appreciation are used to identify exchange rate shocks after taking the contemporaneous effects of demand shocks. In addition, Import price shocks are identified from unit value of import after taking the contemporaneous effects of demand and exchange rate shocks (Eq. 3.3). Eqs. 4-5 include the effects of sequential shocks at the various stages of the distribution chain.

As given above, our model does not include supply shock equation. Since the share of oil in import is high, import prices include the information about oil supply shocks implicitly.

As in McCarthy (2000), conditional expectations in Eqs. 3.1-3.5 are assumed to be linear. Under this assumption, the model is estimated using Cholesky decomposition. PPI and CPI inflation affected by the orthogonalized shocks of exchange rate appreciation and import price inflation help determine the effect of these variables on domestic inflation. Moreover, variance decompositions contribute determination of the importance of these external variables on domestic inflation (McCarthy, 2000).

4.2. The Data

The selection of the variables for the pass-through analysis is based on the considerations of the pricing model which depends on McCarthy (2000). The pricing model presents a transmission mechanism by stages along a distribution chain which includes importers, producers and consumers. Therefore, price indicators such as consumer, producer and import prices are included in the model. In addition, Karadaş et al. (2008) focus on the selection of the proper variables which affect the pricing behaviour of the Turkish manufacturing industry. In this study, the demand conditions, exchange rate developments and cost changes are counted as the main three determinants of the monthly price changes of the Turkish firms. Therefore, our model should include the variables related to the demand conditions and exchange rate developments.

To represent the demand shocks into the economy, alternative variables are used in the literature such as gross domestic product (GDP), output gap, industrial production index (IPI) and capacity utilization rate (CUR). However IPI and CUR reflect the conditions of industry which represents only a sub-sector of the economy. In this study, output gap is used to represent demand shocks as it reflects the demand dynamics of the aggregate economy. There are several problems related to the output gap since it is not observed directly. Hence output gap has to be estimated. In this study, output gap is estimated from quarterly national accounts data by using HP Filter technique as presented in Kara et al. (2007b). The estimated quarterly output gap is transformed into monthly data using the methodology developed by Fernandez (1981). Following Fernandez (1981), the monthly changes in the CUR are used to convert the annual output gap data to the quarterly frequency. Thus, the average of monthly output gap at each quarter is equal to the estimated output gap for the corresponding quarter.

The exchange rate variable is chosen as the monthly average of nominal TL to USD rate.[6] This paper uses TL/USD rate instead of other exchange rates since the majority of Turkish imports are carried out in USD terms and USD effects inflation expectations much more than any other currencies. Around 60% of import is in USD currency.[7]

Although McCarthy (2000) includes oil prices in the VAR system, it is not considered in our model as a supply shock indicator. As Kara and Öğünç (2008) state that developments in international oil price do not reflect local markets because of the changes in special consumption taxes. We assume that supply shocks are carried through nominal exchange rates.

The model also includes inflation indicators such as import prices, producer prices and consumer prices. To represent the dynamics of import prices, sectoral unit value import price index in USD terms is used.[8] This shows the influence of import price shocks on inflation. To show the production side, sectoral producer price index (PPI) is chosen.[9] The final chain is generated by the consumer price index.[10] In the literature, both consumer price index (CPI) and core inflation are used to analyze the pass-through of exchange rate. However, core inflation indicators exclude the uncontrolled items such as food, energy etc. reflecting only indirect effects. In this regard, since this thesis aims to investigate both direct and indirect effects of import prices change on CPI at

[6] The source of exchange rate data is CBRT.

[7] According to the data provided by Turkish Statistical Institute (TURKSTAT).

[8] The source of IP is TURKSTAT.

[9] The source of PPI is TURKSTAT.

[10] In this study other factors like tax regulations, behind the movement of prices are ignored.

the sectoral level and since core inflation is not available at the sectoral base, CPI is preferred as the consumer price measure.[11]

The analysis is based on monthly data covering the time period March 2002 to December 2010. The main reason to choose this period is that it corresponds to the IT period and investigation of exchange rate pass-through at the sectoral level will provide important insights to policy makers.

4.2.1. Selection of Sectors

Identifying sectors is crucial in determining industrial policies that will strengthen the Turkish economy against external shocks. In sector selection, simultaneous availability of sectoral data for import, producer and consumer prices is taken into consideration in addition to the weight of the sectors in total imports. The exchange rate pass-through into the domestic inflation indicators is investigated for the following 10 sectors: clothing, electricity, energy, fuel oil, furniture, machinery, motor vehicles, processed foods, tobacco products and unprocessed foods.

To compare sectors with respect to exchange rate and import price pass-through into domestic price indicators, it is necessary to match different price indicators for each sector. This matching allows us to analyze different patterns of price adjustments in different sectors. However, PPI and IP have the same classification type while CPI differs from them in terms of classification type.

PPI and IP are defined at the 2-digit level of International Standard Industrial Classification of All Economic Activities (ISIC) Rev.2 and ISIC Rev.3 respectively while CPI is defined at the 2-digit or 3-digit level of Classification of Individual Consumption According to Purpose (COICP) for each of ten

[11] The source of CPI is TURKSTAT.

sectors.[12] For the clothing sector, clothing excluding footwear in CPI and clothing in IP and PPI are matched. Moreover, for the electricity sector, electricity under housing prices in CPI is selected while electricity in PPI and IP are directly used. The energy prices in CPI are taken from issues of Monthly Price Developments (CBRT) for the corresponding months. On the other hand, crude oil and natural gas prices are chosen as energy prices to represent the dynamics of enegry prices both for IP and PPI. In addition, to investigate the movements of fuel oil prices, fuels and lubricants for personal in transport inflation are chosen as fuel oil inflation indicators in CPI while refined petroleum products are selected as fuel oil inflation indicators for PPI and IP. Furniture and furnishings under furnishings, household equipment and routine maintenance of the house in CPI are matched with the furnishing in PPI and IP. For the machinery sector, household appliances in CPI are paired with electirical machinery in PPI and IP. Motor vehicles under transport main expenditure group of CPI are taken into the model while motor vehicles under manufacturing industry are chosen for PPI and IP. Processed and unprocessed food prices in CPI are taken from issues of Monthly Price Developments (CBRT) for the corresponding months. Additionally, Food and non-alcoholic beverages prices in manufacturing industry are selected to show the processed food prices and agriculture prices are chosen to display the unprocessed food prices in PPI and IP. Finally, for the tobacco sector, tobacco under alcoholic beverages and tobacco in CPI are matched with the tobacco products under manufacturing industry for PPI and IP.

4.2.2. Data Properties

Prior to estimation of the VAR model, the unit root tests for each sector are carried out to assess the degree of integration of each variable. Tables show the results for the level of the logs of each variable and the first difference of them.

[12] For electricity sectors,machinery IP is defined at the 2-digit level of Standard International Trade Classification (SITC) Rev.3.

As it is clear from these tables, variables are found to be non-stationary in levels but stationary in first differences indicating that they are integrated of order 1, I(1). Output gap is, by definition, a stationary variable, I(0).

Table 4. 1. ADF Statistics for Clothing Sector for Testing Unit Root[13]

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	12	-1.178	12	-4.878	11	-3.183	11	-2.724
PPI	0	-1.237	0	-2.475	0	-8.064	0	-8.032
Import Prices	0	-1.035	0	-2.836	0	-11.204	0	-11.157
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 2. ADF Statistics for Electricity Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	1	-1.166	1	-2.915	0	-6.655	0	-6.673
PPI	0	-0.459	0	-2.134	0	-8.745	0	-8.720
Import Prices	0	-3.031	0	-3.226	0	-11.156	0	-11.094
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 3. ADF Statistics for Energy Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	0	-1.835	1	-3.375	0	-7.488	0	-7.541
PPI	0	-2.000	0	-3.745	0	-10.003	0	-9.959
Import Prices	3	-1.651	3	-2.029	2	-4.189	2	-4.256
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 4. ADF Statistics for Fuel Oil Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	1	-1.448	1	-2.822	0	-7.040	0	-7.039
PPI	0	-1.353	0	-2.399	0	-10.126	0	-10.106
Import Prices	1	-1.912	1	-2.643	0	-5.681	0	-5.678
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

[13] The null hypothesis of a unit root was tested using the Augmented Dickey-Fuller which was performed on variables expressed in logarithms. The ADF Statistics presented are significant at 5 percent significance level according to ADF distribution's critical values.

Table 4. 5. ADF Statistics for Furniture Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	0	-3.907	0	-2.542	0	-8.759	0	-9.452
PPI	0	-2.975	0	-1.839	0	-10.648	0	-11.220
Import Prices	1	-0.654	1	-5.060	2	-8.726	2	-8.680
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 6. ADF Statistics for Machinery and Equipment Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	0	-1.708	0	-3.017	0	-10.106	0	-10.122
PPI	1	-2.832	0	-0.942	0	-7.466	0	-8.037
Import Prices	0	-2.344	0	-2.793	0	-12.071	0	-12.015
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 7. ADF Statistics for Motor Vehicles Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	0	-3.579	0	-3.954	0	-9.249	0	-9.310
PPI	1	-3.782	1	-3.994	0	-6.647	0	-7.029
Import Prices	0	-2.960	0	-3.309	0	-11.538	0	-11.663
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 8. ADF Statistics for Processed Food Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	1	-2.485	1	-3.305	0	-6.813	0	-7.187
PPI	1	-2.825	1	-3.395	0	-6.167	0	-6.585
Import Prices	0	-1.358	0	-2.123	0	-10.138	0	-10.085
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 9. ADF Statistics for Tobacco Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	0	-1.685	0	-2.697	0	-9.080	0	-9.153
PPI	1	-3.108	1	-2.458	0	-9.708	0	-10.087
Import Prices	2	-2.254	2	-2.122	2	-12.953	1	-13.075
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 10. ADF Statistics for Unprocessed Food Sector for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	4	-1.498	0	-2.563	3	-6.701	3	-6.681
PPI	0	-1.365	0	-1.893	0	-7.370	0	-7.374
Import Prices	1	-0.426	3	-3.156	0	-6.542	0	-6.542
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

Table 4. 11. ADF Statistics for All Sectors for Testing Unit Root

	ADF				ADF			
Variables	Lags	η_μ	Lags	η_τ	Lags	η_μ	Lags	η_τ
CPI	3	-3.535	1	-3.198	2	-4.998	2	-5.852
PPI	1	-2.185	1	-3.259	0	-6.520	0	-6.724
Import Prices	1	-1.752	3	-3.052	0	-6.224	0	-6.274
Exchange Rate	3	-2.869	3	-2.809	1	-7.844	1	-7.794

There is a discussion about that the variables should be differenced or not although they include a unit root. Sims (1980) and Doan (1992) disagree the idea of difference taking since the possibility of information loss.[14] On the other hand, in most cases, the results of the predictions from non-stationary series might be statistically incorrect (Rosenweigh and Tallman, 1991, s.1-24). This has made us use the variables after taking their first differences.

[14] In this study, the possibility of cointegration among the log levels of the variables is ignored.

CHAPTER 5

RESULTS

This chapter of the study includes the empirical results obtained from the VAR model conducted for each sector. Firstly, the specifications of the model take place. Then, in section V.II, impulse response functions of producer prices and consumer prices to exchange rate and import prices shocks are investigated. After that, variance decomposition is used for representing the significance of exchange rate and import prices for variation in domestic price indicators in section V.III.

5.1. Model Specification

5.1.1. Lag Length Selection

One of the most important things in the specification of VAR models is the determination of the optimal lag length of the VAR. There are several criteria available for helping determine the most appropriate lag length such as Sequential Likelihood Ratio test (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ). While use of too many lags reduces the power of the test to reject the null of a unit root since increases the number of lags necessitates the estimation of additional parameters and a loss of degrees of freedom (Enders 1995), limiting the lag length may lead to model

misspecification. On the other hand, Enders (2004) claims that setting an upper limit while testing for the appropriate lag length is beneficial. This upper limit is $T^{1/3}$, where T is the number of observation.[15] In this case, it corresponds to 5 (Yüncüler, 2009). The majority of these selection criteria suggest the use of a lag of 1 as the optimal lag length for all sectors. Results of the lag selection criteria can be found in **Appendix A.I**.

5.1.2. Residual Tests

To investigate the serial correlation, LM test is used for all sectors that are included in this study. LM test results indicate that there is no autocorrelation in the VAR model of most sectors.[16] Therefore, it can be said that the specification of the VAR with lag length of 1 is sufficient to eliminate auto-correlation problem at 1 percent significance level and there is no need to extend the lag length.[17] In these regards, 1 is selected as the appropriate lag for these sectors. Since the null hypothesis that is the normality of residuals is not rejected at 1 percent significance level for all sectors, normality is also satisfied. However, there exist skewness and kurtosis problems for some sectors.[18] Moreover, the heteroscedasticity is tested. It is found that residuals hold homoscedasticity for most sectors.[19]

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[15] Enders (2004) points out that in case of a suspicion of substantial amount of seasonality, the number of lags could be extended beyond $T^{1/3}$. For our model, only variable that shows seasonality is CPI for clothing and unprocessed food. They are seasonally adjusted.

[16] For the clothing,energy, motor vehicles, processed food and tobacco sectors, there is serial correlation at 5 percent significance level..

[17] See Appendix Table A.I.

[18] Clothing, electricity, energy, fuel oil, machinery, tobacco and unprocessed food sectors have skewness problem. On the other hand, fuel oil, furniture, unprocessed food sectors and aggregate economy have kurtosis problem.

[19] For the machinery sector, normality does not hold.

Although variables included in the models are stationary,[20] there is a need to test stationarity of the residuals in order to get impulse responses. Unit root tests report that all VAR residuals are stationary as expected since the variables are stationary.[21] After proving the stationarity of the VAR system and residuals, it can be possible to investigate the pass-through of exchange rate and import price shocks into the domestic price indicators using impulse response functions. Results of the residual tests can be seen in Appendix A.II.

5.2. Impulse Response Functions of the VAR Model

Impulse responses to the exchange rate and import price shocks are estimated over 24-month horizon. To identify these shocks, the residuals from the VAR models are orthogonalized using a Cholesky decomposition. These shocks are standardized to one percent shock in the exchange rate or import price index to provide a comparative analysis of sensivity to these shocks across sectors. In the function figures, the vertical axis represents a percentage of pass-through which shows the percentage change in the respective price indicator following a one percent shock in the respective variable.[22]

Kara and Öğünç (2008) suggest that the pass-through coefficient is calculated using the ratio of cumulative change in the price level to the cumulative change in the desired variable over the same period. This coefficient helps to understand the predicted price adjustments of the model to an external shock

[20] Variables included in the model are stationary in first differences.

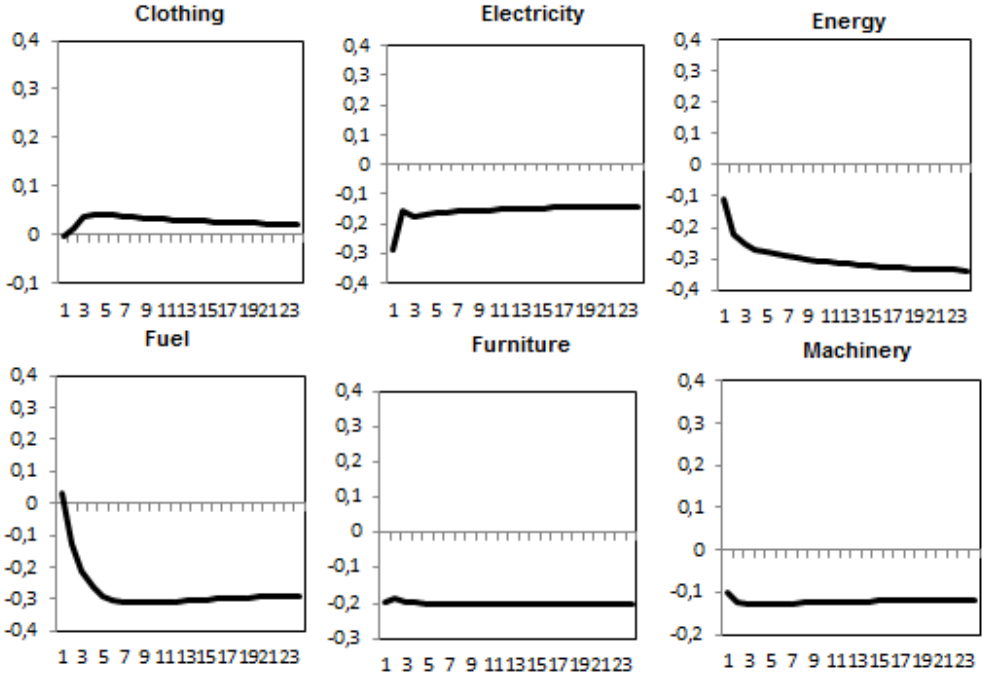
[21] See Appendix Table A.II.

[22] Accumulated impulse responses for all sectors are presented in Appendix IV. In each graph, response to a one standard deviation shock are shown by the solid line while dashed lines refer to two standard error confidence bands of the impulse response functions.

when the interference of other endogenous variables are taken into account (Leigh and Rossi, 2002).[23]

5.2.1. Responses to Exchange Rate Shocks

Figure 5.1-5.3 show the impulse responses of the IP, the PPI, and the CPI to an exchange rate shock in each of the sectors. In other words, these figures presents the estimated pass through into the price indicators to one percent shock in the exchange rate. In this model, the exchange rate shock is estimated given the past values of all endogenous variables and current values of the output gap and the exchange rate.



[23] The formal representation is in following manner: $PT_{t,t+j} = P_{t,t+j}/E_{t,t+j}$, where $P_{t,t+j}$ denotes the cumulative change in the price level and $E_{t,t+j}$ is the cumulative change in the variable whose pass-through will be calculated.

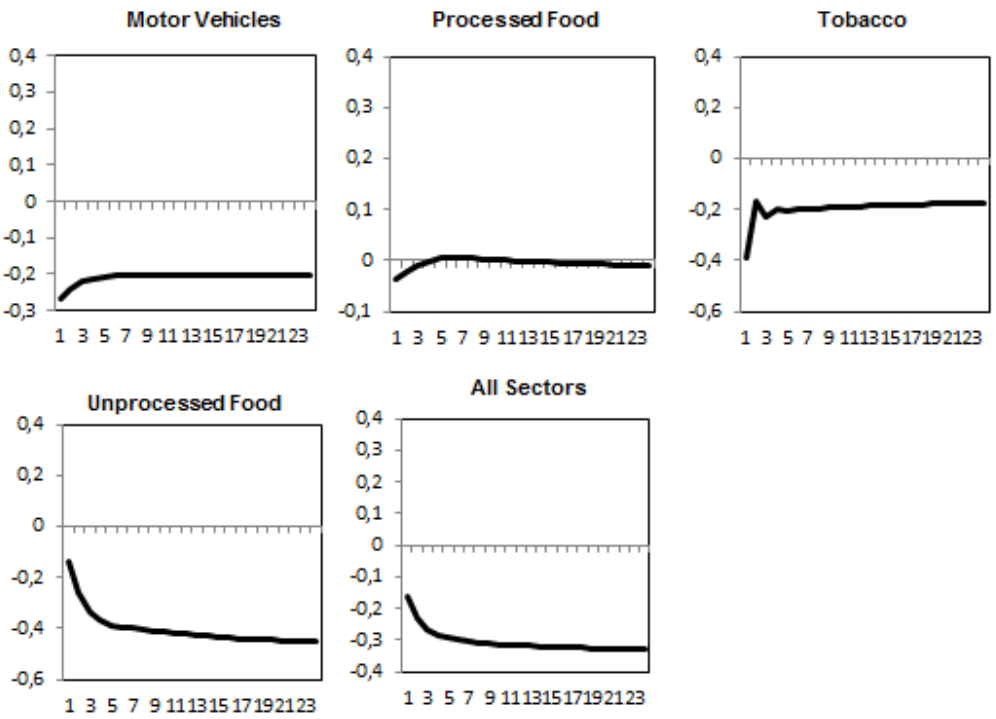


Figure 5. 1. Impulse Response of Import Prices to Exchange Rate Shocks

The initial impact of an exchange rate appreciation on import prices is negative except for clothing and remains so for at least two years in all of the sectors. For the clothing and processed food sectors, the impulse responses are found to be negative. Figure 5.1 presents that the immediate effect of appreciation of exchange rate on import prices is very high for the electricity, motor vehicles and tobacco sectors. Overall the pass-through is particularly large in energy, fuel oil and unprocessed food sectors with the eventual change in import prices exceeding 30 percent. The estimated pass-through coefficient is 45 percent for the unprocessed food sector which has the highest coefficient. On the other hand, the pass-through is surprisingly small in machinery and processed food sectors. For the aggregate import prices, our findings indicate that 88 percent of the exchange rate changes are cumulatively passed-through into the import prices within 9 months and the pass-through coefficient is 32 percent at the end of the first year.

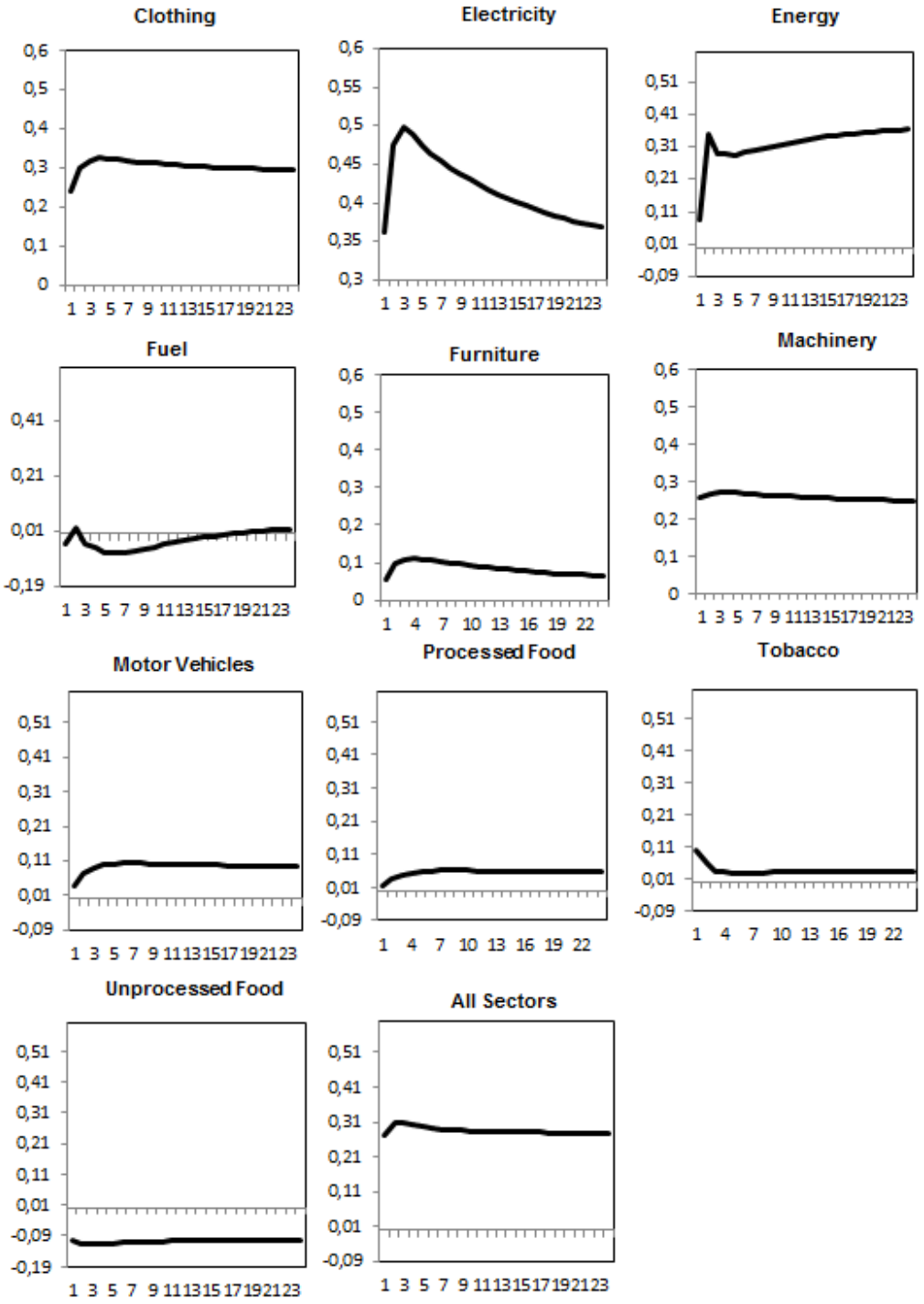
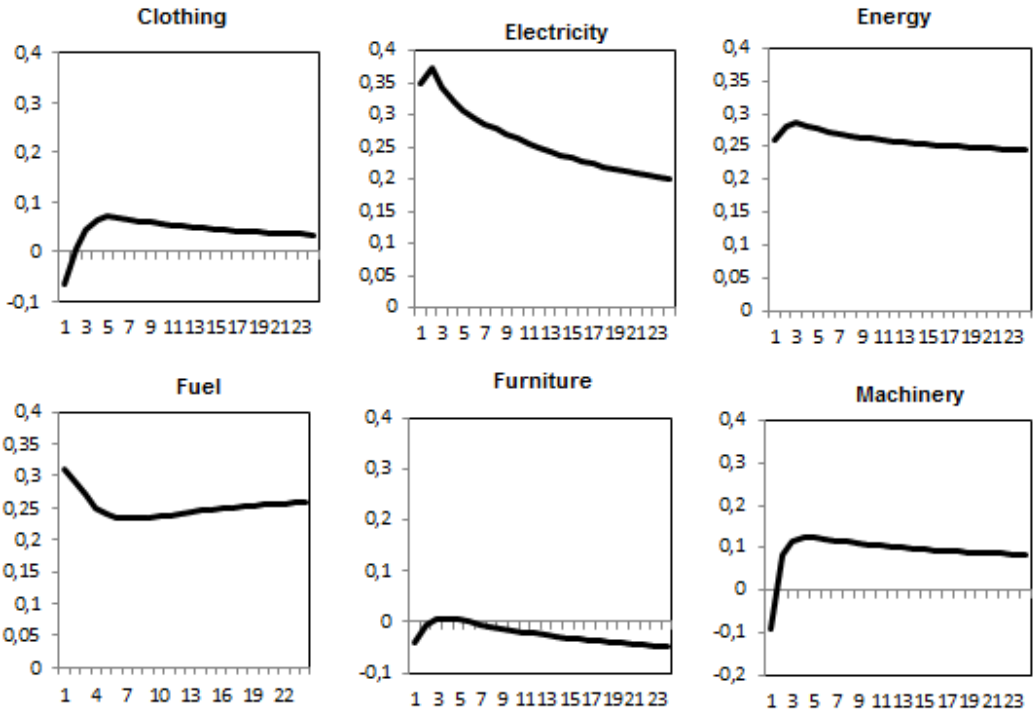


Figure 5. 2. Impulse Response of Producer Prices to Exchange Rate Shocks

The response of producer prices to a one percent increase in the exchange rate is positive as expected in most of the sectors. Figure 5.2 shows that the immediate effect of an increase in the exchange rate on import prices is very low for the fuel oil, furniture, motor vehicles and processed food sectors while it is very high for the clothing, electricity and machinery sectors. The electricity among all sectors that are included in this study has the highest pass-through coefficient. For electricity, the pass-through amounts to around 50 percent after 3 months and starts to decrease thereafter. However, in most sectors the extent of exchange rate pass-through is stable after the initial effect. For the aggregate producer prices, the immediate response is nearly 27 percent and it reaches 30 percent after 3 months (Figure 5.2). In the second year, the change in cumulative pass-through becomes stable.



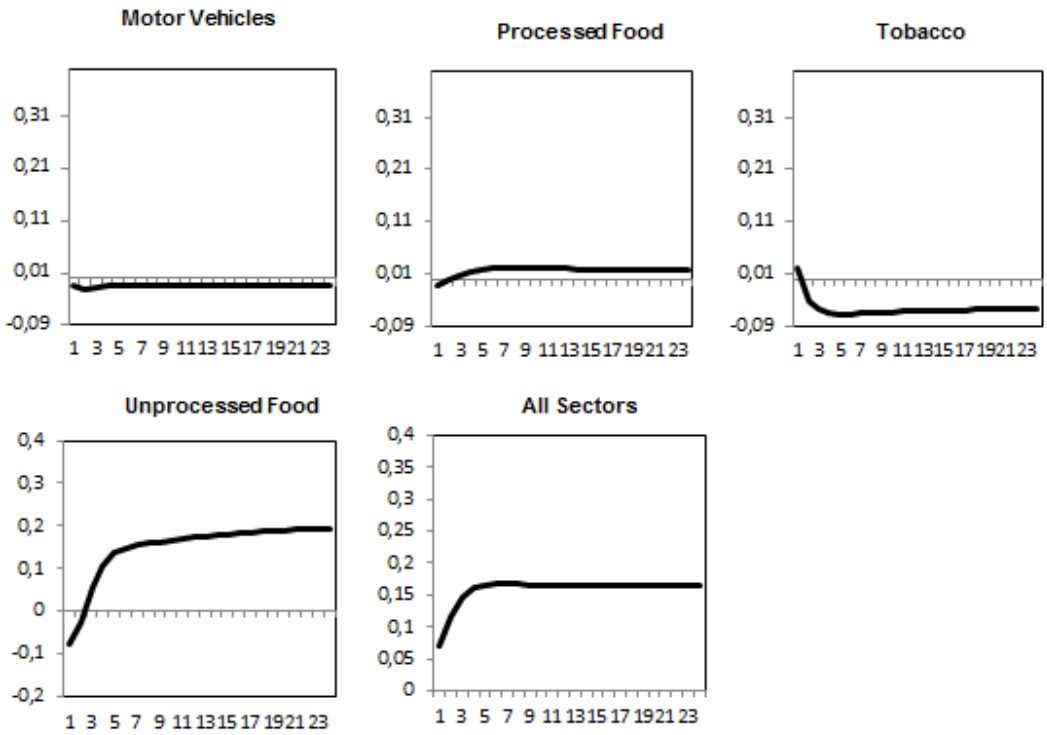
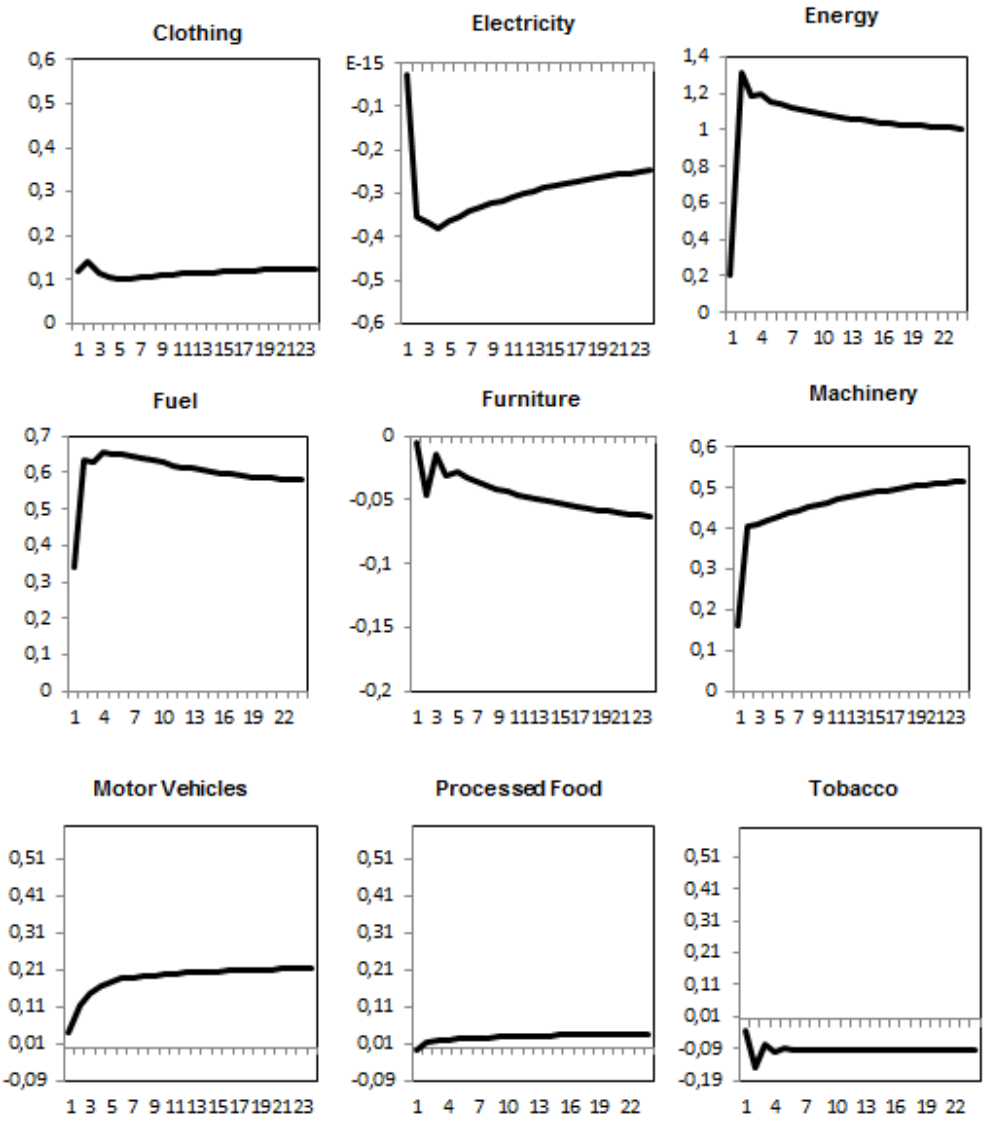


Figure 5. 3. Impulse Response of Consumer Prices to Exchange Rate Shocks

The response of consumer prices to a one percent increase in the exchange rate is positive as expected. The pass-through is particularly large in electricity, energy, fuel oil and unprocessed food sectors with the eventual change in consumer prices exceeding 20 percent. On the other hand, the pass-through is insignificant for the machinery and processed food sectors. In most sectors except electricity, energy, fuel, immediate responses are negative. However pass through tends to increase thereafter. For the aggregate consumer prices, although the immediate effect of exchange rate appreciation on consumer prices is very low, the extent of exchange rate pass-through tends to rise over the first 6 months. The estimated pass-through coefficient is 16 percent at the end of the first year and it becomes negligible in the second year.

5.2.2. Responses to import price shocks

Figure 5.4 and 5.5 show the impulse responses of the PPI and the CPI to an IP shock in each of the sectors respectively. In other words, these figures present the estimated pass through into the price indicators to one percent shock in IP. In this model, the import price shock is estimated given past values of all endogenous variables and current values of the output gap and the exchange rate.



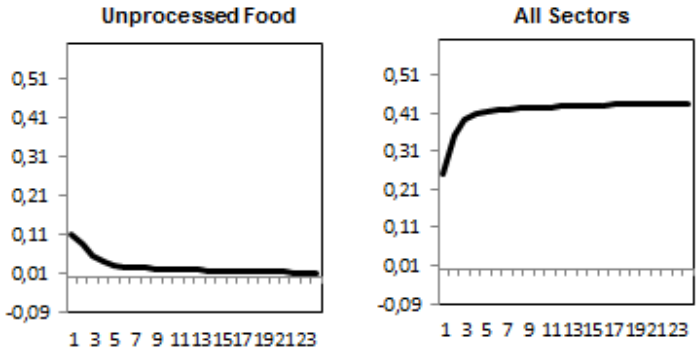
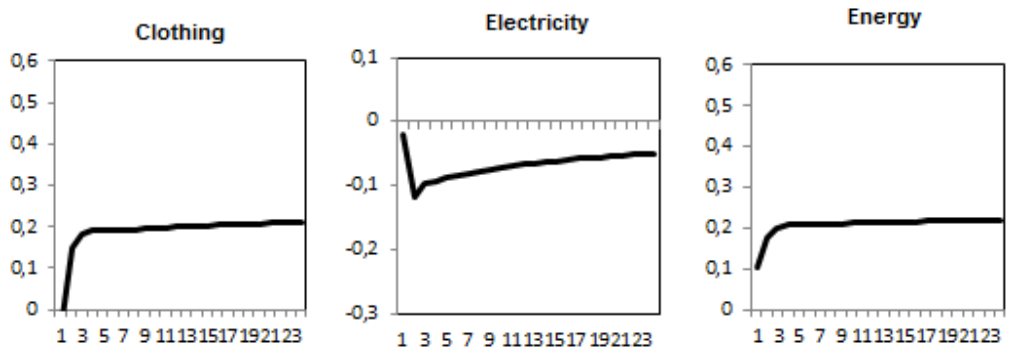


Figure 5. 4. Impulse Response of Producer Prices to Import Shocks

The response of the PPI to an import price shock is usually positive as expected (Figure 5.4). The responses are particularly large in energy, fuel oil and machinery with the pass-through eventually exceeding 100 percent. In contrast, the pass-through is rather small in processed and unprocessed food. In addition, for the unprocessed food sector, the impulse responses die out in a 24-month horizon, indicating the stationary characteristics of the variables used. For the electricity, furniture and tobacco sectors, the responses are negative. This finding might be related to the tax burden on these sectors. For aggregate producer prices, pass-through is 42 percent at the end of the first year and accumulates to 43 percent after 2 years.



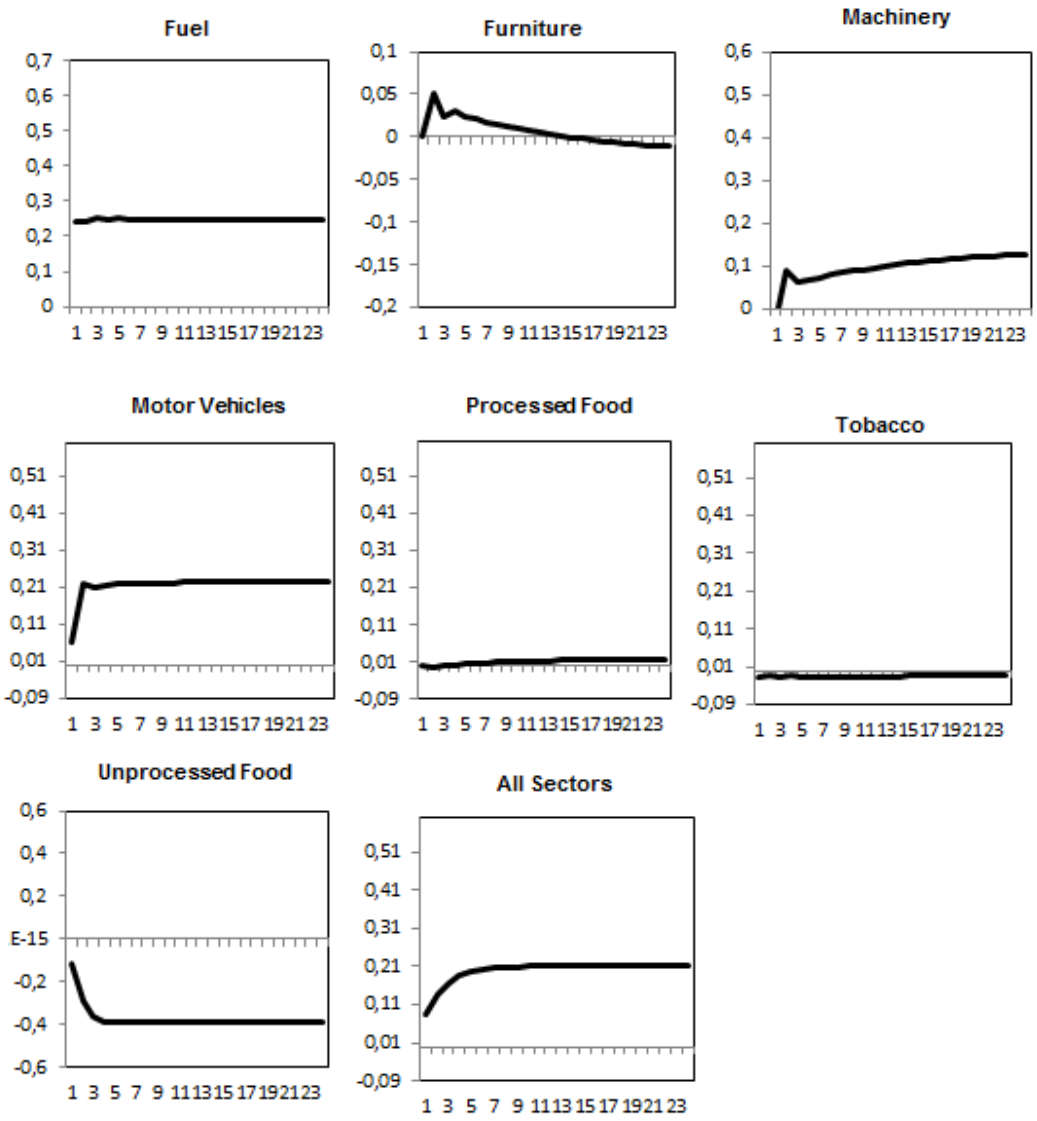


Figure 5. 5. Impulse Response of Consumer Prices to Import Shocks

The response of consumer prices to an import price shock is also positive and usually statistically significant, although smaller than the PPI response (Figure 5.5). In absolute terms, the pass-through is largest in the unprocessed food sector, is quite large in the energy, fuel and motor vehicles sectors and small in the furniture sector. For regulated sectors like tobacco, the sensitivity of consumer prices to import price developments decreases. Therefore, the pass-through coefficient is found statistically insignificant for the tobacco sector.

Furthermore, a number of responses have the wrong (negative) sign, particularly in electricity and unprocessed food. For the aggregate consumer prices, the immediate response is nearly 9 percent and at the end of the first year it becomes 21 percent and (Figure 5.5).

For the aggregate sectors, 96 percent of cumulative exchange rate pass-through into producer prices is realized in a year while 85 percent of cumulative pass-through into consumer prices is completed in a year. The pass-through of exchange rate into producer and consumer prices is complete over the forecast horizon.

The comparative analysis of the pass-through results regarding the responses of aggregate price indicators indicates that the response of producer prices to each shock is higher than the response of consumer prices. This finding confirms the decreasing pass-through of exchange rate and import prices into price indicators along the distribution chain as McCarthy (2000) indicates. However, the pass-through analysis produces alternative results at the sectoral level. More specifically, for the fuel oil and unprocessed food sectors, the pass-through of exchange rate into consumer prices is higher and faster than it is for producer prices. On the other hand, the pass-through of import prices into the consumer prices is higher and faster than that is for producer prices for the clothing sector. These results indicate that price changes in these sectors are directly reflected to the consumers.

Additionally, the responses of price indicators to external shocks for sectors differ from the aggregate economy and other sectors. Although import price pass-through into the producer prices is higher than exchange rate pass-through, exchange rate shocks are passed faster than import price shocks into the producer prices at the aggregate level. However, for the clothing, energy and fuel oil sectors import price pass-through is both higher and faster than exchange rate shocks. In spite of these results, exchange rate shocks into

consumer prices are passed slower than import price shocks into consumer prices for all sectors. Moreover, the pass-through of both shocks into consumer prices is found almost the same.

The pass-through results for the producer prices indicate that firms are more willing to reflect changes in import prices to their prices compared to changes in exchange rate in most sectors. This may be relevant with the import prices comprising a larger share of the production cost of firms than the exchange rate. Moreover, as a financial indicator, more volatile characteristic of the exchange rate compared to import prices may affect pass-through. Greater exchange rate volatility may make importers more conservative in changing prices and more willing to adjust profit margins, thus reducing the pass-through in response to exchange rate shocks.[24] In addition, persistency of shocks may be another reason. If exchange rate shocks are persistent, firms are more likely to change prices in response to changes in the exchange rate. On the other hand, it is found that in Turkey firms are more sensitive to the changes in exchange rate than the change in import prices for fuel oil and unprocessed food sectors.

The pass-through results of external shocks into consumer prices confirm that pass-through of both shocks are almost the same. However, import price shocks have more direct ways to affect consumer prices than the exchange rate. The goods which have a larger share in the consumption basket are directly affected from the changes in the import prices. For the energy and fuel oil sectors, the import price pass-through is relatively high compared to the aggregate economy. On the other hand, although motor vehicles sector has the highest share in imports of Turkey, the exchange rate and import prices pass-through into consumer prices is limited since price of these types of goods are set in foreign currency terms. Level of inventories may play a critical role on the pass-through of the exchange rate as well. If inventories are at high levels, this may reduce

[24] Mann (1986), Wei and Parsley (1995) and Engel and Rogers (1998) have provided some empirical evidence confirming this hypothesis at the sectoral and product level.

the pass-through effect of the exchange rate. For the furniture sector, pass-through of both shocks are found insignificant. That is to say, furniture is a less tradable sector which is mainly affected by domestic developments. Aggregate demand uncertainty may play a role on price changes of this sector.

Our results point clearly that the pass-through dynamics are different for different shocks, thus, inserting exchange rate and import price separately into the model is a critical issue to obtain true pass-through dynamics. Also, looking at the pass-through dynamics at the sectoral level reveals that different sectors have different pass-through dynamics.

Table 5. 1. Pass-Through Coefficients for the Exchange Rate

Sectors	Clothing	Electricity	Energy	Fuel Oil	Furniture	Machinery	Motor Vehicles	Processed Food	Tobacco	Unprocessed Food	All Sectors
Exchange rate pass-through into IP	0.02	-0.14	-0.34	-0.29	-0.20	-0.12	-0.20	-0.01	-0.17	-0.45	-0.33
Exchange rate pass-through into PPI	0.30	0.37	0.36	0.02	0.06	0.25	0.09	0.06	0.03	-0.10	0.28
Exchange rate pass-through into CPI	0.03	0.20	0.25	0.26	-0.05	0.08	-0.02	0.02	-0.06	0.19	0.16

The response of PPI to the exchange rate shocks is higher for the clothing, electricity and energy sectors when compared to aggregate economy at the end of the second year. In terms of CPI, the response gives higer pass-through coefficients fort he electricity, energy, fuel and unprocessed food sectors.

Table 5. 2. Pass-Through Coefficients for the Import Price

Sectors	Clothing	Electricity	Energy	Fuel Oil	Furniture	Machinery	Motor Vehicles	Processed Food	Tobacco	Unprocessed Food	All Sectors
Import price pass-through into PPI	0.12	-0.25	1.01	0.58	-0.06	0.52	0.21	0.04	-0.09	0.01	0.43
Import price pass-through into CPI	0.21	-0.05	0.22	0.25	-0.01	0.13	0.22	0.02	-0.01	-0.40	0.21

When the effect of import price pass-through is evaluated, it is observed that the response of PPI to the exchange rate shocks is greater for the energy, fuel oil and machinery sectors when compared to that of aggregate economy. In addition, the energy, motor vehicles and unprocessed food sectors give the greater pass-through coefficients in terms of the effect of CPI to the exhange rate pass-through when compared to the pass-through coefficient of aggregate economy.

5.3. Variance Decomposition

Although the impulse responses indicate the extent of pass-through to domestic prices, they do not determine the importance of these shocks in domestic price indicators. Therefore to investigate the importance of these factors, variance decomposition of the price variables is examined. Figure 5.6 and 5.7 show the results of the variance decompositions of producer and consumer prices over a forecast horizon of 24 months.

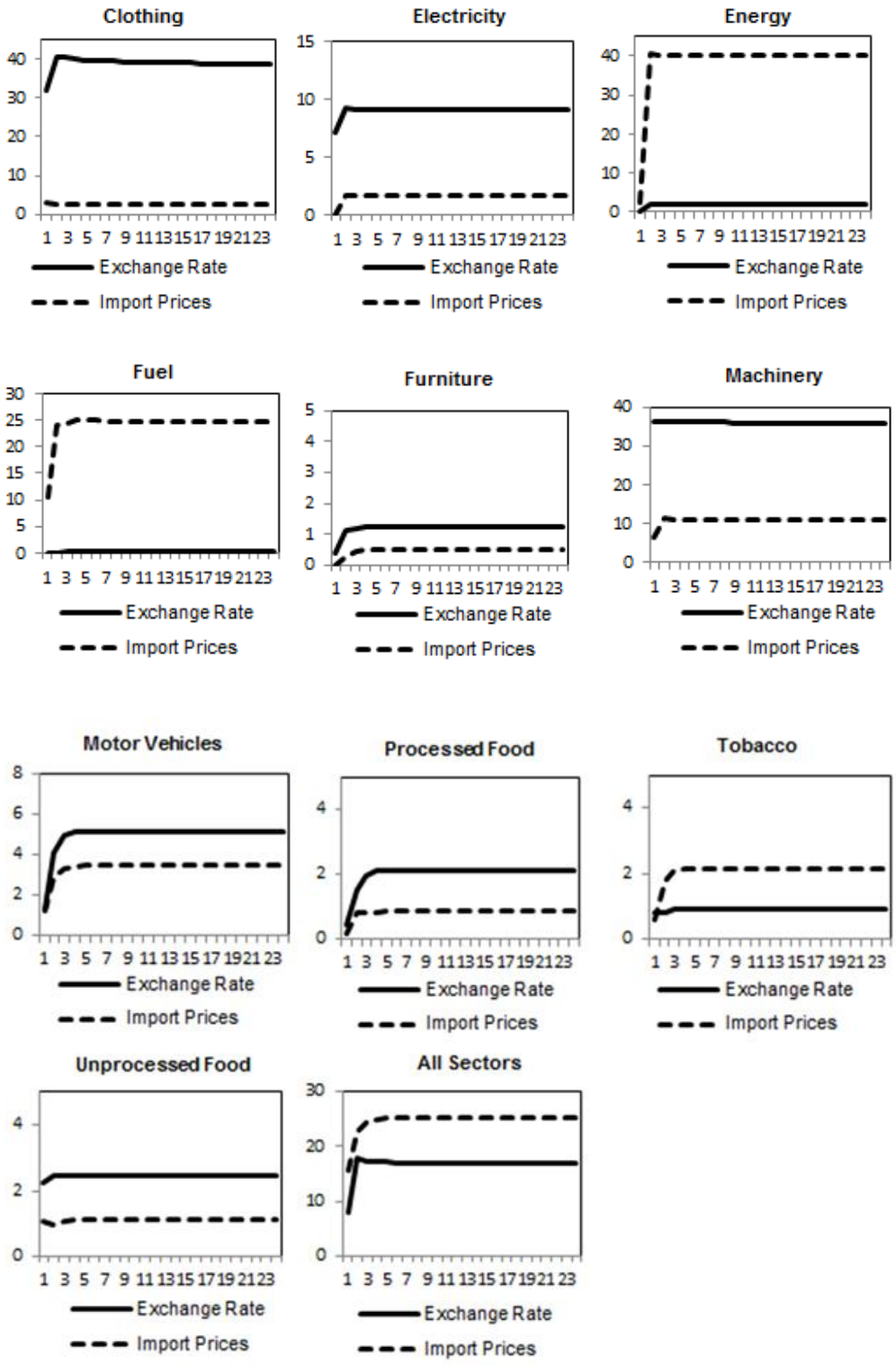
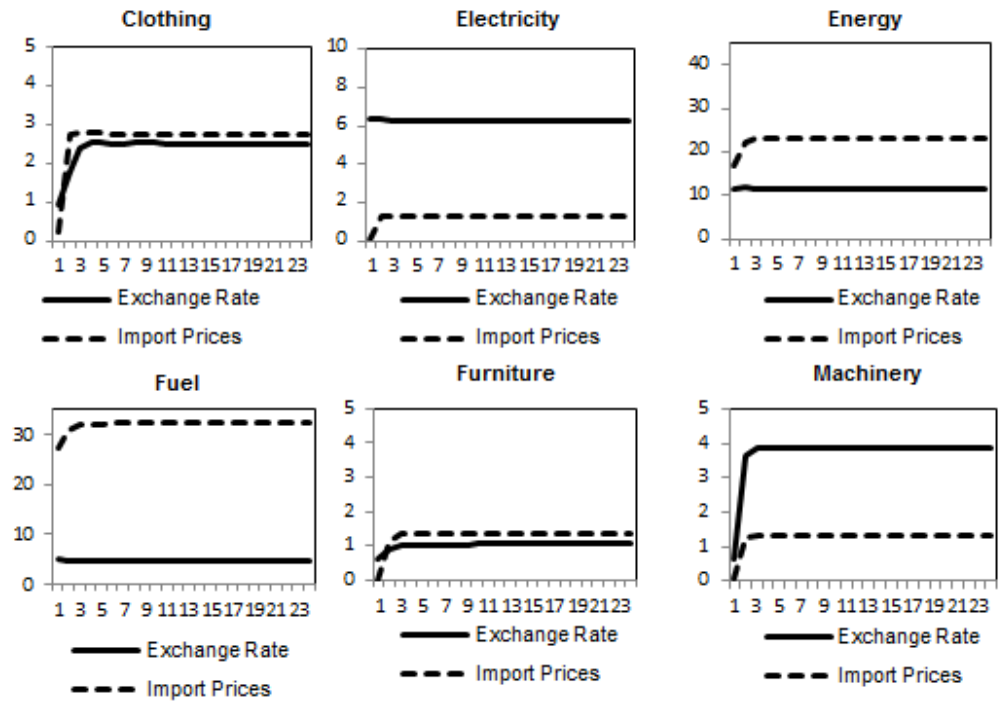


Figure 5. 6. Variance Decomposition of Producer Prices

Import price shocks are more important for the variation of producer prices both in the short-run and long-run. As forecast horizon increases, import prices continue to contribute relatively more to the variation, in addition contributions of both factors are stable after 3 months (Figure 5.6). Initially, attribution of external factors is about 24 percent of the variance and the contribution of both the exchange rate and import prices increase up to 42 percent as the forecast horizon increases. Majority of this contribution comes from import prices both in the short and long run. For producer prices, the percentage of variance explained by the exchange rate and import prices are quite large in many sectors. These shocks explain one-third or more of the variance of PPI (at least for some horizons) in four sectors—clothing, energy, fuel and machinery. Although not negligible, their contributions in the other sectors are more limited. The differences across sectors may be positively correlated with the share of the sector in total imports. In addition, for regulated sectors like tobacco, contribution of these shocks to producer prices is modest.



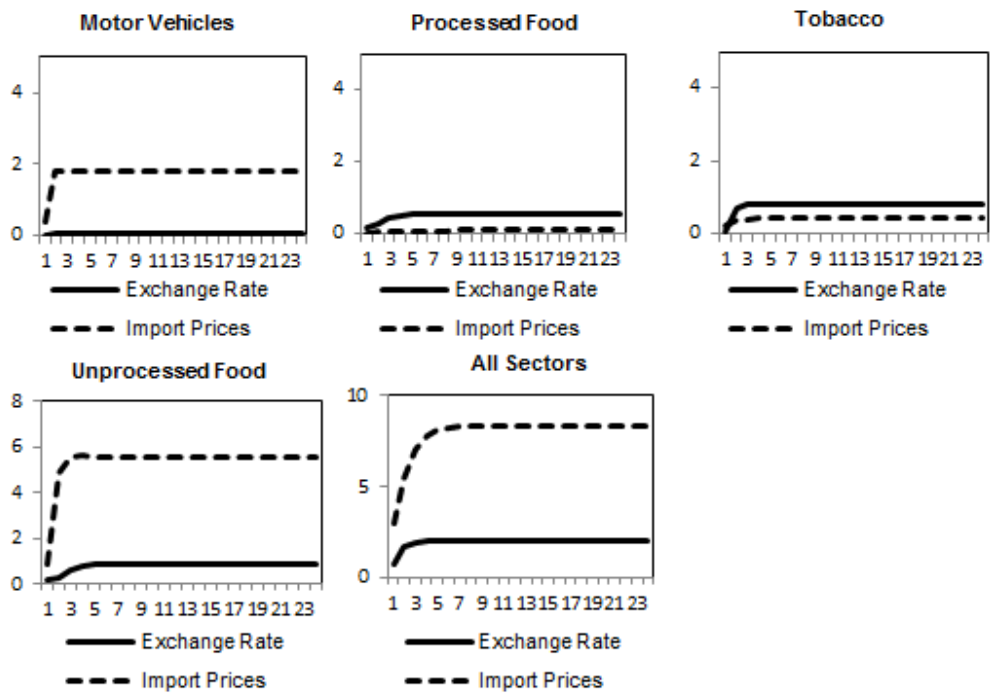


Figure 5. 7. Variance Decomposition of Consumer Prices

Although external shocks are important determinants of consumer prices, the influence of exchange rates and import prices on consumer price variance are less than it is for producer prices. In most of the sectors, these factors explain less than 15 percent of the variance of the consumer prices. Although this percentage tends to increase in the first 6 months, it is stable there after. This percentage is higher for sectors with a larger import share like energy and fuel. On the other hand, for the furniture sector as a less tradable sector, contribution of these shocks is negligible. Moreover, in most of the sectors, import price shocks seem more important to explain the change in consumer prices.

The variance decomposition results indicate that external factors explain an important proportion of the variance of domestic price indicators for the sectors that have a larger import share. Import price shocks are more important for the variation of domestic price indicators compared to the exchange rates shocks. In

addition, the influences of external shocks on the variance of the price indicators decrease along the distribution chain.

5.4. The Comparison of Results with Previous Studies

In this thesis the pass-through of external shocks into price indicators at both aggregate and sectoral level were estimated. Therefore, comparison of the results with previous studies provides a better understanding for the change in pass-through dynamics of Turkey. However there are some differences among studies in terms of the methodology, models used in the analysis and the variables included in the model, etc.

There are some similarities between the results of this study and Leigh and Rossi's (2002). In both studies pass-through into producer prices is found to be more pronounced than the pass-through into consumer prices. However, there are some differences. Leigh and Rossi (2002) investigate the impact of exchange rate movements on prices in Turkey for the period from January 1994 to April 2002. This study analyzes the exchange rate pass-through in Turkey using post-2001 data. While Leigh and Rossi's (2002) results indicate that the exchange rate pass-through is 60 percent and 45 percent for producer and consumer prices, these coefficients are found 28 percent and 16 percent, respectively in this thesis. Therefore the exchange rate pass-through results show that exchange rate pass-through has significantly fallen over time in Turkey in both producer and consumer prices.

Unlike the majority of the studies in the literature, using USD-denominated import prices in the model makes it difficult to compare the import price pass-through. However since Kara and Ögünç (2008) focuses on both exchange rate and import price pass-through, it enables the comparison with the results of this study. Kara and Öğünç (2008) calculated the imported inflation pass-through as 50 percent for manufacturing industry prices and 30 percent for consumer prices

under the IT. However these results are needed to be harmonized to make the comparison. In our study any linear combination of import price and exchange rate pass-through into producer prices takes a value between 28 and 43 percent. On the other hand, this value changes between 16 and 21 percent for consumer prices. These calculated intervals indicate that imported inflation pass-through into both producer and consumer prices in this thesis is found to be lower than Kara and Öğünç (2008) calculations.

CONCLUSION

This paper examines the pass-through of external factors—the exchange rate and import prices—to domestic inflation indicators for several sectors during the period between March 2002 and December 2010. A VAR approach including the distribution chain of pricing model of McCarthy (2000) is used to identify the pass-through coefficients in the model, identification is achieved through a standard Cholesky decomposition. The impulse response functions are used to derive the estimates and the speed of the pass-through. In addition, variance decompositions of producer and consumer prices are utilized to determine the importance of external shocks for domestic inflation at different stages. Furthermore, using the impulse functions that are estimated, pass-through coefficients at the sectoral level are calculated.

Our results reveal that the exchange rate pass-through is 30 percent and 16 percent for aggregate producer and consumer prices, respectively. The corresponding coefficients are found to be 43 percent and 21 percent for the import price shocks. These findings confirm that pass-through of exchange rate and import prices into price indicators decrease along the distribution chain as implied by McCarthy (2000). However, more specifically, for the fuel oil and unprocessed food sectors, the pass-through of exchange rate into consumer prices is higher and faster than it is for producer prices. In addition, the pass-through of import prices into the consumer prices is higher and faster than that is for producer prices for the clothing sector. The reason behind these findings is that these sectors have high shares in the consumption basket. On the other hand for the sectors having high import dependency like energy and fuel oil,

exchange rate pass-through into producer prices is higher and faster than it is for aggregate producer prices. It is also true for the exchange rate pass-through into the consumer prices for the electricity, energy and fuel oil sectors. In addition, the pass-through of both shocks into the consumer prices are found almost the same. However, import prices have a stronger effect on producer prices than the exchange rate. Compared to earlier studies, findings of the current study indicate that pass-through has further fallen in Turkey. This decline in the pass-through may be due to inflation environment of the post IT period and the change in exchange rate dynamics. The variance decomposition results indicate that external factors explain an important proportion of the variance of domestic price indicators for the sectors which have a larger import share. Import price shocks are more important for the variation of domestic price indicators compared to exchange rates shocks.

Although pass-through has declined recently in Turkey, it is still important in determining the behavior of the domestic inflationary process and CBRT has to take these dynamics into account in order to control domestic inflation. Therefore the results of this study are useful as a tool in the inflation analysis. Additionally, findings of the present study provide important information regarding the differences in responses of different sectors to different external shocks which will be useful in industrial policy determination.

This thesis can be extended in several ways. Firstly, it may be interesting to develop this thesis by investigating the impact of external shocks to domestic inflation indicators for the period before the adoption of floating exchange rate regime. This would give a chance to compare pass-through effects between pre-2001 and post-2001 periods and to analyze how the exchange rate pass-through changes over time at the sectoral level. Secondly more sectors at different degree could be included in the model to investigate which items in the consumption basket are more affected. Finally, in the literature there are discussions regarding the non-linear nature of the pass-through dynamics. As

for future reasearch this analysis can be improved by using a nonlinear model instead of a linear VAR.

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APPENDIX

A.1. VAR Lag Length Selection Criteria Tables

1. Clothing Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	898.1105	NA	1.20E-14	-17.8622	-17.732	-17.8095
1	1013.68	217.2709	1.97E-15	-19.6736	-18.89205*	-19.35729*
2	1038.901	44.89253	1.97E-15	-19.678	-18.2452	-19.0981
3	1067.37	47.82810*	1.85e-15*	-19.74739*	-17.6633	-18.9039
4	1086.935	30.91378	2.10E-15	-19.6387	-16.9033	-18.5316
5	1098.546	17.18339	2.83E-15	-19.3709	-15.9842	-18.0003

2. Electricity Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	577.381	NA	2.91E-13	-14.6764	-14.5254	-14.616
1	681.2321	191.7252	3.86e-14*	-16.6983	-15.79183*	-16.33540*
2	699.343	31.11359	4.64E-14	-16.5216	-14.8598	-15.8564
3	732.0749	52.03525	3.88E-14	-16.7199	-14.3027	-15.7522
4	755.3985	34.08838	4.21E-14	-16.6769	-13.5044	-15.4069
5	783.8219	37.89790*	4.11E-14	-16.76466*	-12.8368	-15.1923

3. Energy Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	642.3495	NA	2.00E-12	-12.747	-12.6167	-12.6943
1	786.6116	271.2128	1.85E-13	-15.1322	-14.35068*	-14.81592*
2	807.976	38.02862	1.99E-13	-15.0595	-13.6267	-14.4796
3	838.642	51.51886*	1.80e-13*	-15.17284*	-13.0887	-14.3294
4	861.9446	36.81817	1.89E-13	-15.1389	-12.4035	-14.0318
5	873.8769	17.65974	2.53E-13	-14.8775	-11.4908	-13.5069

4. Fuel Oil Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	623.2113	NA	2.94E-12	-12.3642	-12.234	-12.3115
1	777.0547	289.2257*	2.23e-13*	-14.94109*	-14.15954*	-14.62479*
2	793.2635	28.85162	2.67E-13	-14.7653	-13.3324	-14.1854
3	812.4732	32.27238	3.03E-13	-14.6495	-12.5653	-13.806
4	823.4113	17.28213	4.09E-13	-14.3682	-11.6328	-13.2612
5	836.6691	19.62154	5.32E-13	-14.1334	-10.7467	-12.7627

5. Furniture Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	702.3049	NA	6.04E-13	-13.9461	-13.8158	-13.8934
1	818.6526	218.7337	9.72e-14*	-15.77305*	-14.99150*	-15.45674*
2	837.6734	33.85697	1.10E-13	-15.6535	-14.2206	-15.0736
3	852.6249	25.11855	1.36E-13	-15.4525	-13.3684	-14.609
4	882.0133	46.43372*	1.27E-13	-15.5403	-12.8048	-14.4332
5	900.3385	27.12127	1.49E-13	-15.4068	-12.0201	-14.0361

6. Machinery and Equipment Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	888.4396	NA	1.46E-14	-17.6688	-17.5385	-17.6161
1	1003.71	216.7086*	2.40e-15*	-19.47420*	-18.69265*	-19.15789*
2	1020.31	29.54761	2.85E-15	-19.3062	-17.8734	-18.7263
3	1036.468	27.14617	3.43E-15	-19.1294	-17.0452	-18.2859
4	1055.065	29.38254	3.97E-15	-19.0013	-16.2659	-17.8942
5	1077.359	32.99534	4.32E-15	-18.9472	-15.5605	-17.5765

7. Motor Vehicles Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	846.8991	NA	3.35E-14	-16.838	-16.7077	-16.7853
1	963.5856	219.3708	5.36e-15*	-18.67171*	-17.89016*	-18.35540*
2	983.7698	35.92777	5.92E-15	-18.5754	-17.1426	-17.9955
3	1010.736	45.30316*	5.75E-15	-18.6147	-16.5306	-17.7712
4	1029.347	29.40546	6.65E-15	-18.4869	-15.7515	-17.3799
5	1048.446	28.26612	7.70E-15	-18.3689	-14.9822	-16.9983

8. Processed Food Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	956.0898	NA	3.77E-15	-19.0218	-18.8915	-18.9691
1	1079.681	232.3509	5.25e-16*	-20.99361*	-20.21206*	-20.67731*
2	1103.58	42.54100*	5.39E-16	-20.9716	-19.5388	-20.3917
3	1120.254	28.01231	6.43E-16	-20.8051	-18.721	-19.9616
4	1137.029	26.50472	7.71E-16	-20.6406	-17.9052	-19.5335
5	1160.403	34.59287	8.21E-16	-20.6081	-17.2213	-19.2374

9. Tobacco Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	580.088	NA	6.96E-12	-11.5018	-11.3715	-11.449
1	703.6766	232.3465	9.69E-13	-13.4735	-12.69198*	-13.15722*
2	733.6452	53.34414*	8.81e-13*	-13.57290*	-12.1401	-12.993
3	755.6406	36.95226	9.44E-13	-13.5128	-11.4287	-12.6693
4	776.8089	33.44587	1.04E-12	-13.4362	-10.7008	-12.3291
5	794.9986	26.92076	1.22E-12	-13.3	-9.91325	-11.9293

10. Unprocessed Food Sector

Lag	LogL	LR	FPE	AIC	SC	HQ
0	775.6157	NA	1.39E-13	-15.4123	-15.2821	-15.3596
1	900.1425	234.1104	1.91e-14*	-17.40285*	-16.62130*	-17.08654*
2	916.0248	28.27065	2.30E-14	-17.2205	-15.7877	-16.6406
3	943.5392	46.22405*	2.20E-14	-17.2708	-15.1867	-16.4273
4	963.373	31.33751	2.49E-14	-17.1675	-14.432	-16.0604
5	978.044	21.71303	3.15E-14	-16.9609	-13.5742	-15.5902

11. All Sectors

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1017.101	NA	1.11E-15	-20.242	-20.1118	-20.1893
1	1158.172	265.213	1.09e-16*	-22.56344*	-21.78188*	-22.24713*
2	1175.949	31.64366	1.27E-16	-22.419	-20.9861	-21.8391
3	1204.297	47.62386*	1.20E-16	-22.4859	-20.4018	-21.6425
4	1221.83	27.70298	1.41E-16	-22.3366	-19.6012	-21.2295
5	1231.559	14.39864	1.98E-16	-22.0312	-18.6445	-20.6605

* indicates lag order selected by the criterion

A.2. Residual Tests

A.2.1. Residual Tests of VAR Residuals

1. Clothing Sector

Serial Correlation Test[25]		
Lag	**LM Test**	**Probability**
1	46.7897	0.0052
2	45.9757	0.0065
3	32.2025	0.1522
4	28.6303	0.2797
5	20.0463	0.7444

Normality Test[26]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	-0.1675	0.4855	3.0596	0.9010	0.0158	0.9921
2	0.1527	0.5249	4.8343	0.0413	0.9428	0.6442
3	0.0384	0.8722	2.5024	0.3003	1.0892	0.5801
4	0.0081	0.9728	2.7373	0.6457	0.7103	0.7011
5	2.1789	0.0000	3.8534	0.6800	8.7473	0.0126
Joint		0.0411		0.2268		0.0191

Heteroscedasticity Test[27]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
163.2201	0.2177	325.0117	0.1536

[25] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[26] Null Hypothesis: Residuals are multivariate normal.

[27] Null Hypothesis: There is no heteroscedasticity.

2. Electricity Sector

Serial Correlation Test[28]		
Lag	LM Test	Probability
1	32.3405	0.1484
2	38.2134	0.0441
3	38.6209	0.0402
4	42.9377	0.0142
5	31.6067	0.1697

Normality Test[29]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.1341	0.6201	2.7576	0.6541	0.4464	0.7999
2	0.7529	0.0040	4.7571	0.2035	4.4614	0.1075
3	-0.1757	0.5161	2.6938	0.5715	0.7420	0.6901
4	0.4677	0.0838	2.4722	0.4477	0.2986	0.8613
5	2.1789	0.0000	3.5750	0.5443	7.3262	0.0257
Joint		0.0176		0.1724		0.0113

Heteroscedasticity Test[30]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
142.5589	0.6548	318.667	0.2195

[28] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[29] Null Hypothesis: Residuals are multivariate normal.

[30] Null Hypothesis: There is no heteroscedasticity.

3. Energy Sector

Serial Correlation Test[31]		
Lag	LM Test	Probability
1	40.9366	0.0233
2	47.0347	0.0049
3	38.6304	0.0401
4	30.4506	0.2079
5	25.5930	0.4296

Normality Test[32]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.1352	0.5736	3.0399	0.9338	0.3236	0.8506
2	0.2896	0.3296	4.0837	0.7026	0.9578	0.6195
3	-0.1819	0.5402	5.0642	0.7817	6.2654	0.0436
4	0.3918	0.1029	3.7212	0.1333	4.9140	0.0857
5	0.2591	0.2582	4.6162	0.0430	0.8662	0.6485
Joint		0.0479		0.3465		0.0525

Heteroscedasticity Test[33]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
150.6773	0.4691	287.8475	0.6828

[31] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[32] Null Hypothesis: Residuals are multivariate normal.

[33] Null Hypothesis: There is no heteroscedasticity.

4. Fuel Oil Sector

Serial Correlation Test[34]		
Lag	LM Test	Probability
1	33.2134	0.1258
2	40.8370	0.0239
3	23.6767	0.5381
4	5.5957	1.0000
5	25.8339	0.4165

Normality Test[35]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.3456	0.1502	2.9780	0.9634	2.0727	0.3547
2	0.8655	0.0003	4.9396	0.0001	3.0063	0.2224
3	-0.1392	0.5621	3.2834	0.5553	0.6840	0.7104
4	0.1649	0.4925	3.1834	0.7027	0.6169	0.7346
5	0.2071	0.3885	3.5934	0.2167	2.2694	0.3215
Joint		0.0153		0.0126		0.0578

Heteroscedasticity Test[36]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
142.8171	0.6491	302.9918	0.4408

[34] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[35] Null Hypothesis: Residuals are multivariate normal.

[36] Null Hypothesis: There is no heteroscedasticity.

5. Furniture Sector

Serial Correlation Test[37]		
Lag	LM Test	Probability
1	33.7054	0.1144
2	40.9516	0.0232
3	16.4810	0.8998
4	32.8057	0.1360
5	21.2334	0.6795

Normality Test[38]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.0639	0.7901	3.1940	0.6863	0.2339	0.8896
2	0.2070	0.4795	5.4369	0.9313	47.8122	0.0000
3	-0.7534	0.0017	2.6560	0.5568	0.8453	0.6553
4	0.0973	0.7396	2.7941	0.7251	0.2341	0.8895
5	0.1487	0.5358	4.1085	0.0427	3.2173	0.2002
Joint		0.0688		0.0318		0.0205

Heteroscedasticity Test[39]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
144.6742	0.6074	320.7304	0.1964

[37] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[38] Null Hypothesis: Residuals are multivariate normal.

[39] Null Hypothesis: There is no heteroscedasticity.

6. Machinery and Equipment Sector

Serial Correlation Test[40]		
Lag	LM Test	Probability
1	35.0165	0.0879
2	33.7201	0.1140
3	18.6960	0.8115
4	21.9742	0.6372
5	25.7170	0.4228

Normality Test[41]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.0912	0.7042	2.8869	0.8139	0.1996	0.9050
2	0.6467	0.0078	4.4040	0.2046	3.4342	0.1796
3	0.1294	0.5901	3.0793	0.8689	0.3174	0.8532
4	-0.3854	0.1085	3.7956	0.0977	5.3178	0.0700
5	0.7704	0.0013	5.5623	0.0193	7.2579	0.0265
Joint		0.0000		0.0924		0.0000

Heteroscedasticity Test[42]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
343.8971	0.041	415.9278	0.0000

[40] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[41] Null Hypothesis: Residuals are multivariate normal.

[42] Null Hypothesis: There is no heteroscedasticity.

7. Motor Vehicles Sector

Serial Correlation Test[43]		
Lag	LM Test	Probability
1	45.3224	0.0077
2	42.2113	0.0171
3	34.4280	0.0991
4	27.0495	0.3534
5	25.7889	0.4189

Normality Test[44]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.0561	0.8041	3.1807	0.7069	0.1542	0.9258
2	0.0285	0.9106	3.7535	0.4600	3.0369	0.2190
3	-0.3178	0.1683	2.3919	0.2056	1.8961	0.3875
4	0.7080	0.0032	2.6080	0.0955	6.1416	0.0464
5	1.1051	0.6792	9.5466	0.0000	4.0751	0.1303
Joint		0.8944		0.0532		0.5098

Heteroscedasticity Test[45]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
180.6851	0.0444	307.0738	0.3769

[43] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[44] Null Hypothesis: Residuals are multivariate normal.

[45] Null Hypothesis: There is no heteroscedasticity.

8. Processed Food Sector

Serial Correlation Test[46]		
Lag	LM Test	Probability
1	44.1488	0.0104
2	40.0018	0.0292
3	19.2091	0.7870
4	21.6180	0.6577
5	37.1884	0.0554

Normality Test[47]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.0113	0.9625	3.1091	0.8203	0.6017	0.7402
2	0.3835	0.1628	4.2220	0.0110	1.6619	0.4725
3	-0.2631	0.2733	2.7374	0.5846	1.4990	0.5301
4	0.5723	0.0172	3.2730	0.5698	3.3897	0.1836
5	1.7931	0.0000	3.8521	0.4309	4.1309	0.0917
Joint		0.1695		0.0691		0.0505

Heteroscedasticity Test[48]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
180.6851	0.0444	307.0738	0.3769

[46] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[47] Null Hypothesis: Residuals are multivariate normal.

[48] Null Hypothesis: There is no heteroscedasticity.

9. Tobacco Sector

Serial Correlation Test[49]		
Lag	LM Test	Probability
1	54.0334	0.0007
2	60.1809	0.0001
3	31.0010	0.1890
4	14.5704	0.9509
5	27.5686	0.3281

Normality Test[50]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.0896	0.7092	2.9544	0.9244	0.1481	0.9286
2	0.0308	0.8201	3.4128	0.8662	4.2457	0.0818
3	-0.5271	0.0282	3.7425	0.2164	1.1692	0.1638
4	-0.8183	0.0007	6.0554	0.0496	5.2010	0.0735
5	3.3238	0.0000	18.7281	0.0000	3.4440	0.1063
Joint		0.0341		0.0563		0.0216

Heteroscedasticity Test[51]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
144.9533	0.6011	278.8307	0.8046

[49] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[50] Null Hypothesis: Residuals are multivariate normal.

[51] Null Hypothesis: There is no heteroscedasticity.

10. Unprocessed Food Sector

Serial Correlation Test[52]		
Lag	LM Test	Probability
1	30.4241	0.2088
2	41.1328	0.0222
3	32.8766	0.1342
4	23.1606	0.5682
5	27.2690	0.3426

Normality Test[53]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.0304	0.8993	3.0345	0.9427	0.0212	0.9895
2	1.0877	0.0000	3.0796	0.9603	6.6033	0.0212
3	-0.0394	0.8697	2.8748	0.7943	0.0949	0.9537
4	-0.0087	0.9710	3.9057	0.0594	3.5558	0.1690
5	0.2269	0.3448	2.7499	0.6026	1.1636	0.5589
Joint		0.0007		0.0000		0.0000

Heteroscedasticity Test[54]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
166.5761	0.168	341.0636	0.0513

[52] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[53] Null Hypothesis: Residuals are multivariate normal.

[54] Null Hypothesis: There is no heteroscedasticity.

11. All Sectors

Serial Correlation Test[55]		
Lag	LM Test	Probability
1	27.9377	0.3107
2	34.4380	0.0989
3	34.4877	0.0979
4	21.2558	0.6783
5	20.8794	0.6993

Normality Test[56]						
	Skewness		**Kurtosis**		**Jarque -Bera**	
Component	Value	Probability	Value	Probability	Value	Probability
1	0.2560	0.2866	3.0380	0.9370	1.1419	0.5650
2	0.4189	0.0601	5.3728	0.0000	3.0353	0.1925
3	-0.3898	0.1046	2.5461	0.3447	3.5266	0.1715
4	0.4806	0.0454	3.4860	0.3117	5.0276	0.0810
5	0.3064	0.2021	2.5462	0.3448	2.5198	0.2837
Joint		0.1351		0.0201		0.0213

Heteroscedasticity Test[57]			
No Cross Terms		**With Cross Terms**	
Chi Square	Probability	Chi Square	Probability
1092.7997	0.39	344.5744	0.068

[55] Null Hypothesis: There is no serial correlation at lag order p. Probabilities are from chi-square with 25 degrees of freedom.

[56] Null Hypothesis: Residuals are multivariate normal.

[57] Null Hypothesis: There is no heteroscedasticity.

A.3. Unit Root Test of VAR Residuals[58]

1. Clothing Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-10.4775	0	-10.4472
CPI	1	-8.96159	1	-8.90176
PPI	0	-10.3106	0	-10.2587
Import Prices	0	-9.03672	0	-8.98789
Exchange Rate	3	-8.12428	3	-8.2556

2. Electricity Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	1	-5.1636	0	-9.3101
CPI	1	-7.9480	1	-7.8935
PPI	0	-9.2111	0	-9.1640
Import Prices	0	-8.6305	0	-8.6136
Exchange Rate	0	-9.4200	0	-9.3602

3. Energy Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-11.2204	0	-11.2015
CPI	1	-9.1401	1	-9.1080
PPI	2	-4.7465	0	-4.7880
Import Prices	0	-10.7531	0	-10.6991
Exchange Rate	0	-10.0977	0	-10.0893

4. Fuel Oil Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-10.8640	0	-10.8692
CPI	1	-9.4436	1	-9.4082
PPI	0	-9.6490	0	-9.6386
Import Prices	0	-9.5399	0	-9.4928
Exchange Rate	0	-9.6692	0	-9.6487

[58] The null hypothesis of a unit root was tested using the Augmented Dickey-Fuller which were performed on variables expressed in logarithms. The ADF Statistics presented are significant at 1 percent significance level according to ADF distribution's critical values.

5. Furniture Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-10.3456	0	-10.3242
CPI	1	-9.4408	1	-9.4735
PPI	1	-9.2979	1	-9.2629
Import Prices	0	-9.7818	0	-10.0081
Exchange Rate	0	-9.9607	0	-10.2564

6. Machinery and Equipment Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	1	-5.8063	0	-10.6892
CPI	1	-9.3781	1	-9.3419
PPI	0	-10.0072	0	-9.9563
Import Prices	0	-9.7858	0	-10.2176
Exchange Rate	0	-10.2465	0	-10.2354

7. Motor Vehicles Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-9.7877	0	-9.7499
CPI	1	-8.7590	1	-8.8791
PPI	0	-10.3496	0	-10.3308
Import Prices	0	-10.1628	0	-10.4104
Exchange Rate	0	-10.3008	0	-10.2823

8. Processed Food Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-10.9268	0	-10.9039
CPI	1	-9.2380	1	-9.1644
PPI	0	-10.2769	0	-10.3388
Import Prices	0	-10.3631	0	-10.6823
Exchange Rate	0	-10.2544	0	-10.4018

9. Tobacco Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-9.9200	0	-9.9223
CPI	1	-9.3973	1	-9.3691
PPI	1	-10.0263	1	-10.0681
Import Prices	0	-9.9193	0	-10.3654
Exchange Rate	0	-10.1002	0	-10.1871

10. Unprocessed Food Sector

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-10.6519	0	-10.6097
CPI	1	-9.3609	1	-9.3242
PPI	0	-10.5021	0	-10.5461
Import Prices	0	-10.7663	0	-10.8415
Exchange Rate	0	-10.1691	3	-6.2784

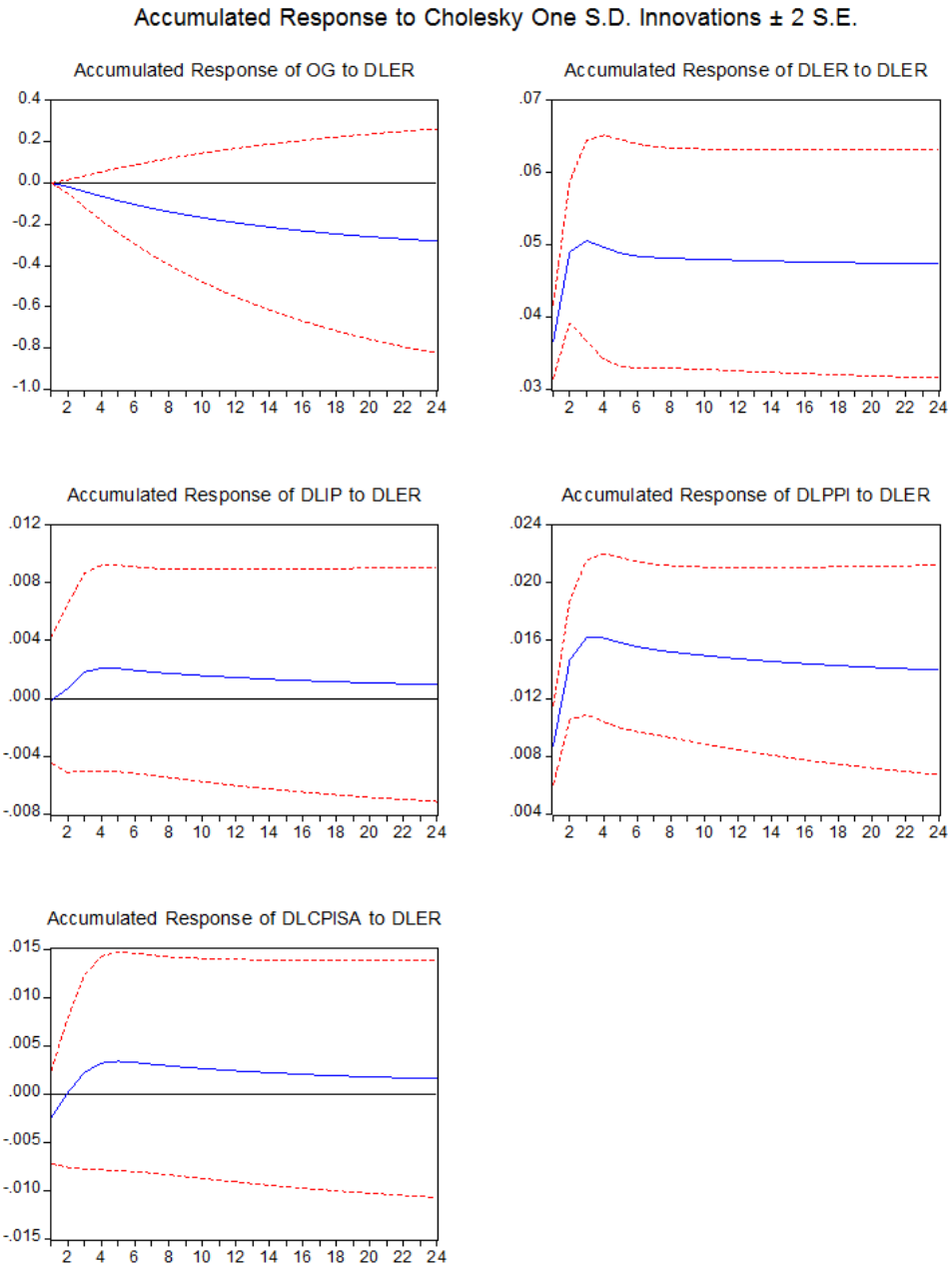
11. All Sectors

	ADF			
Variables	Lags	η_μ	Lags	η_τ
OG	0	-11.1625	0	-11.1664
CPI	1	-9.2496	1	-9.1853
PPI	0	-10.7558	0	-10.7319
Import Prices	0	-9.0663	0	-9.2058
Exchange Rate	11	-4.2142	11	-3.9650

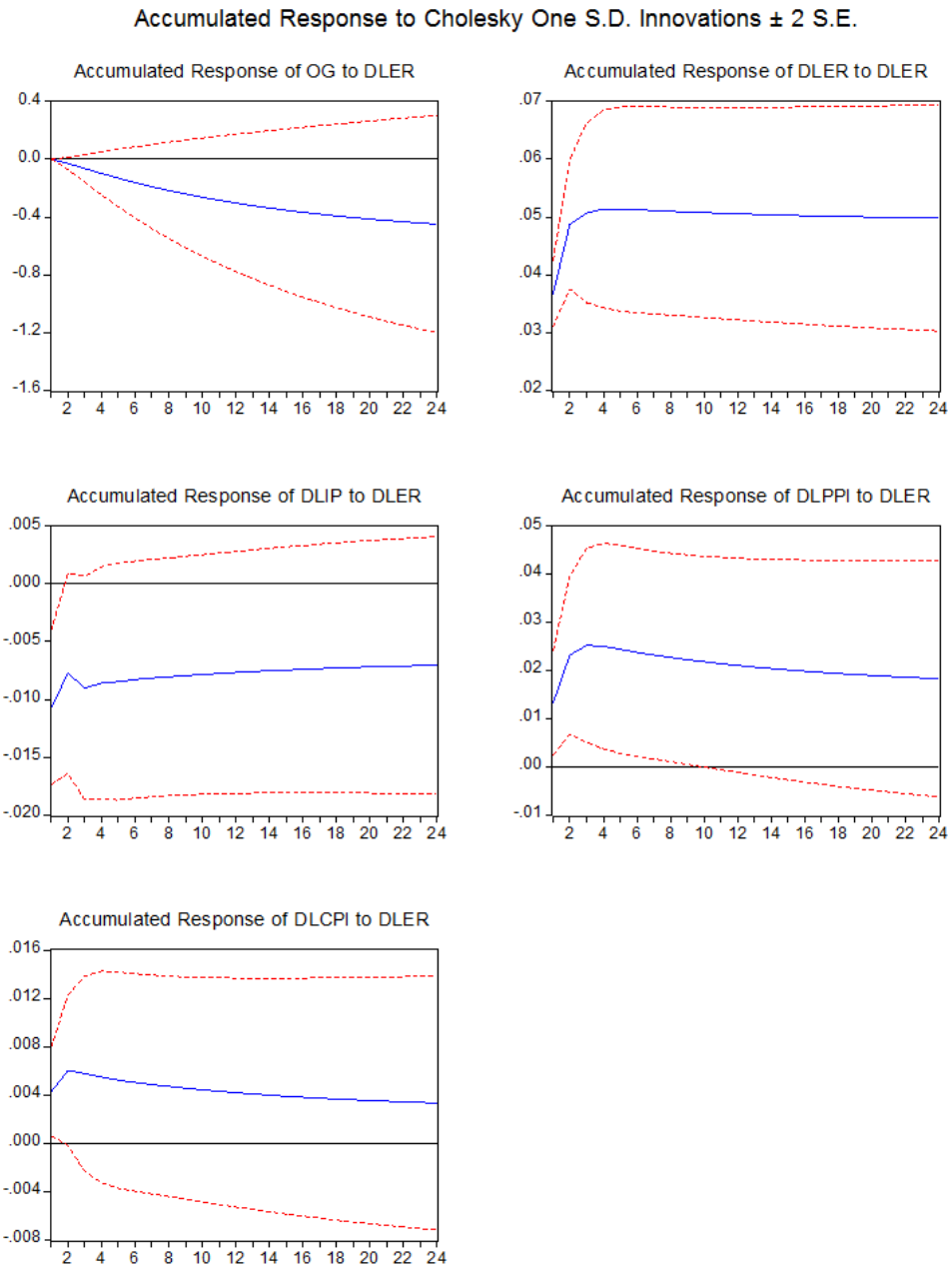
A.4. Responses to Exchange Rate Shocks

A.4.1. Impulse Response of Import Prices to Exchange Rate Shocks for Ten Different Sectors

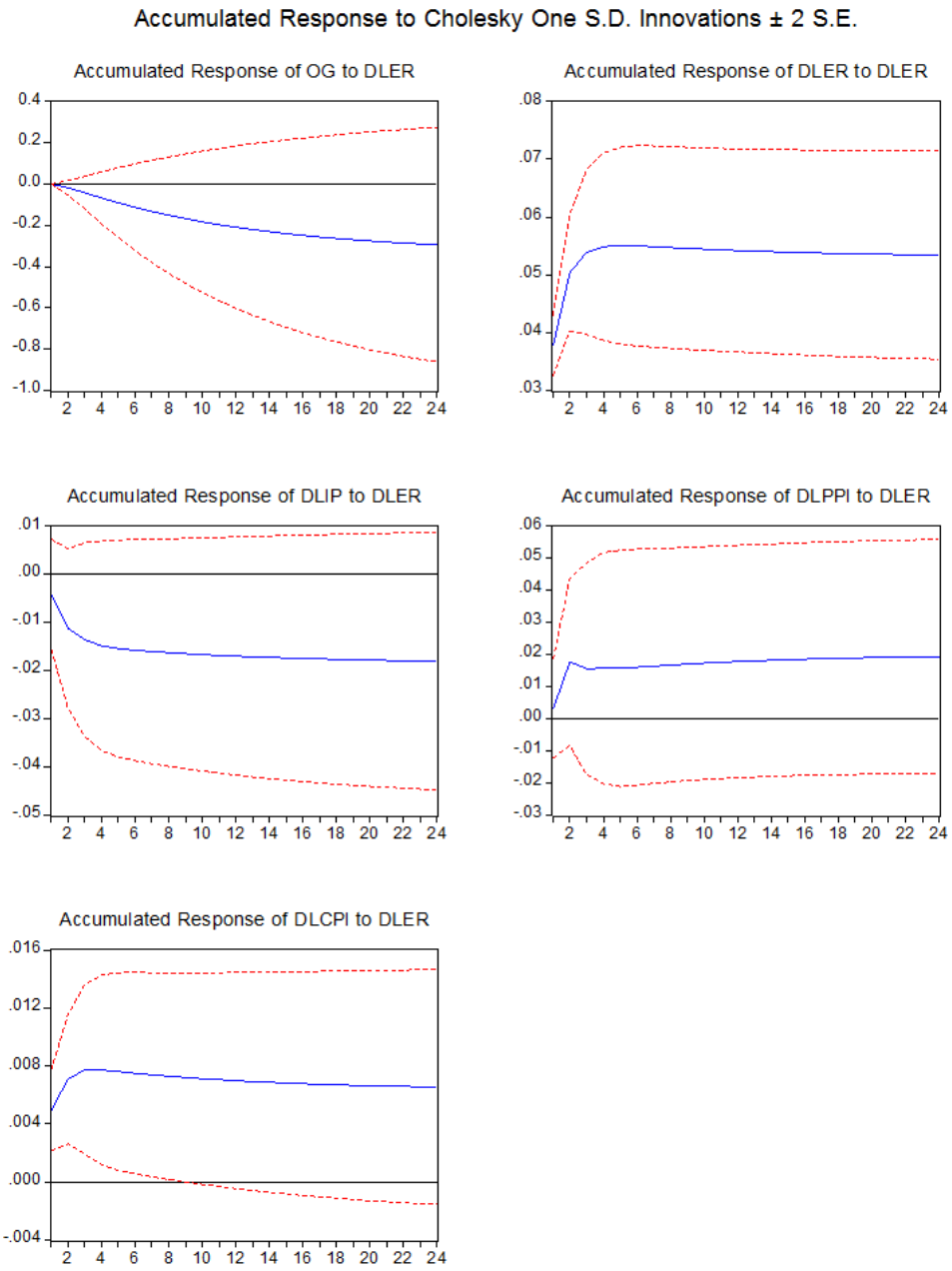
1. Clothing Sector



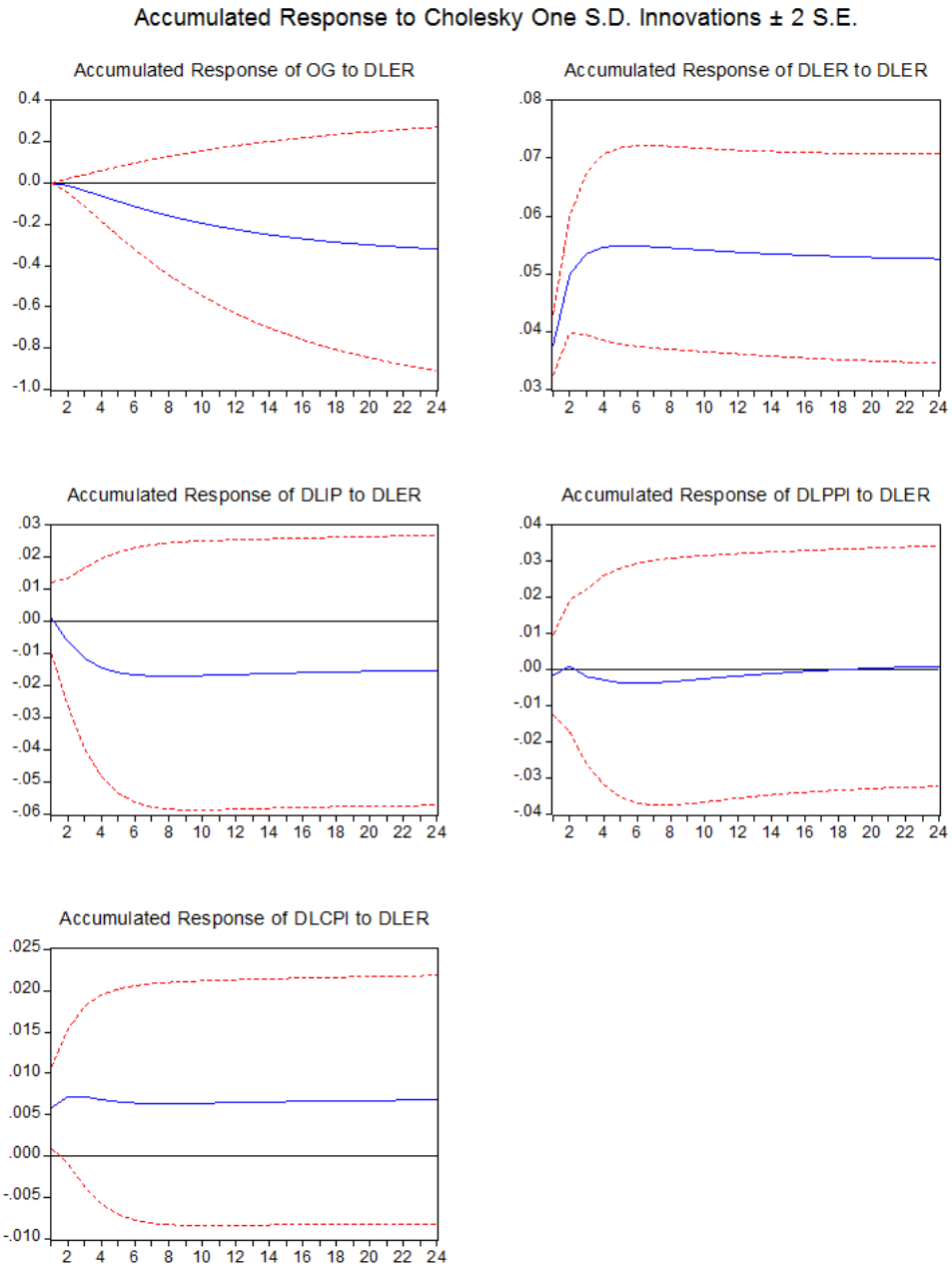
2. Electricity Sector



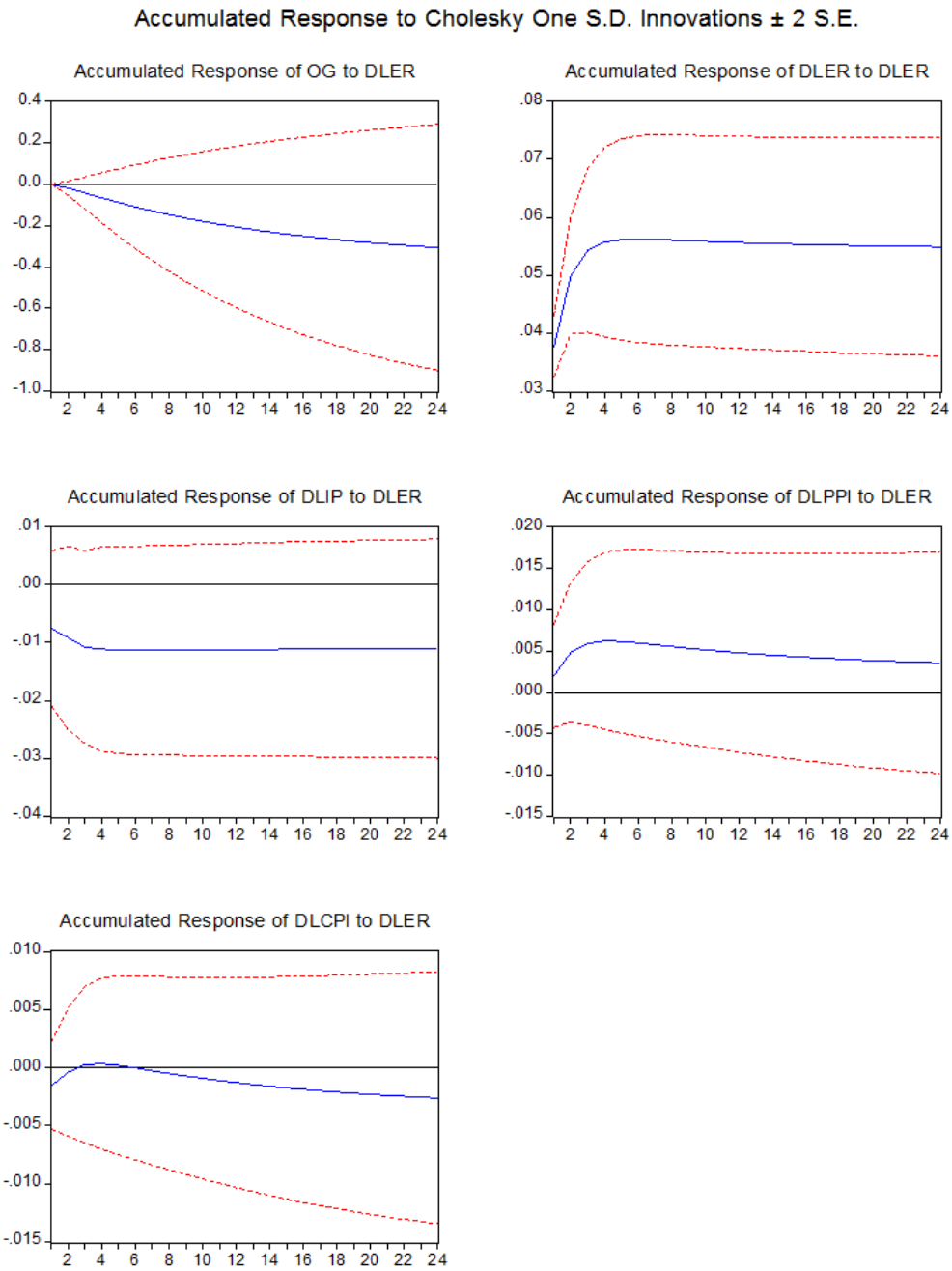
3. Energy Sector



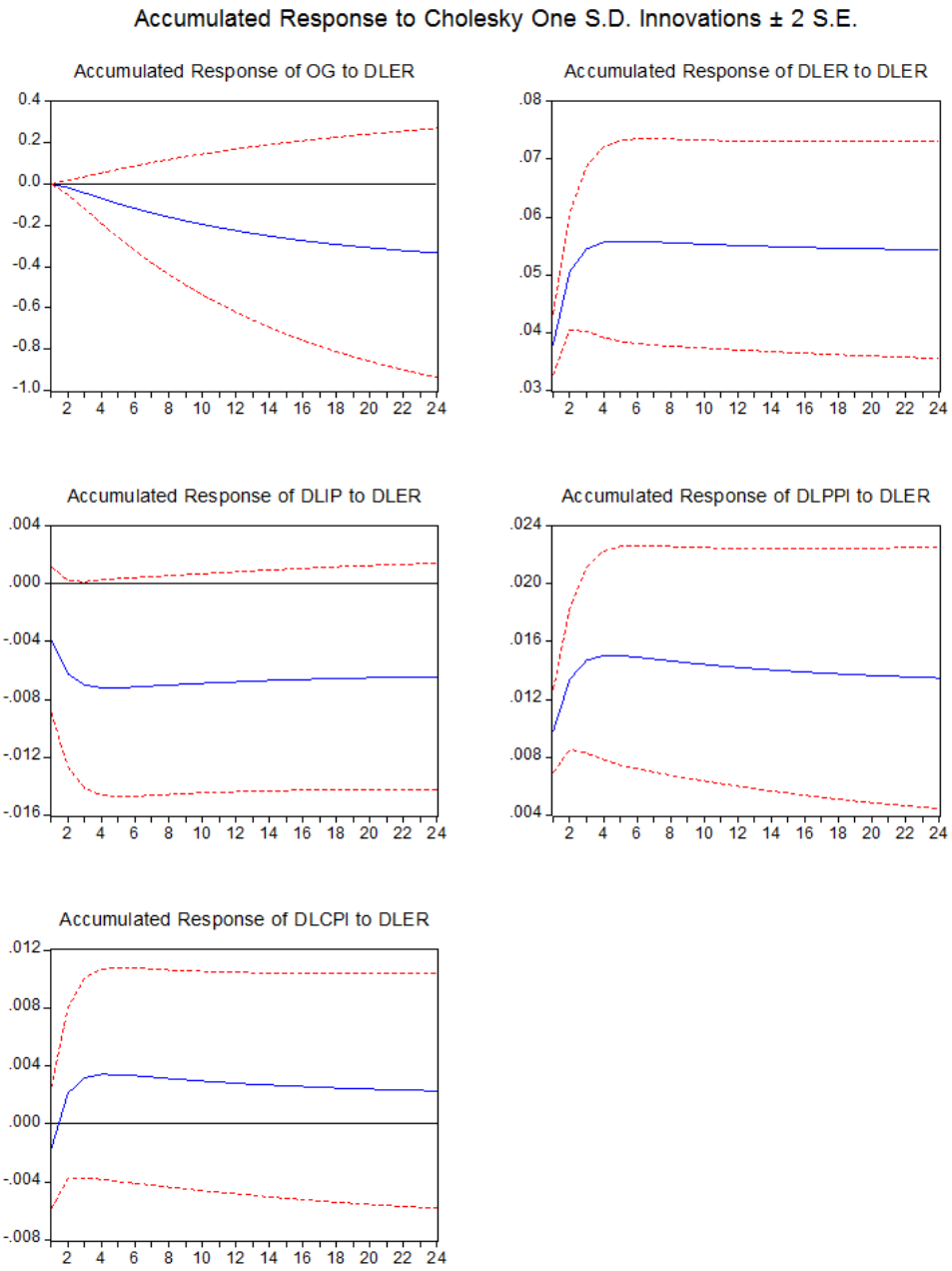
4. Fuel Oil Sector



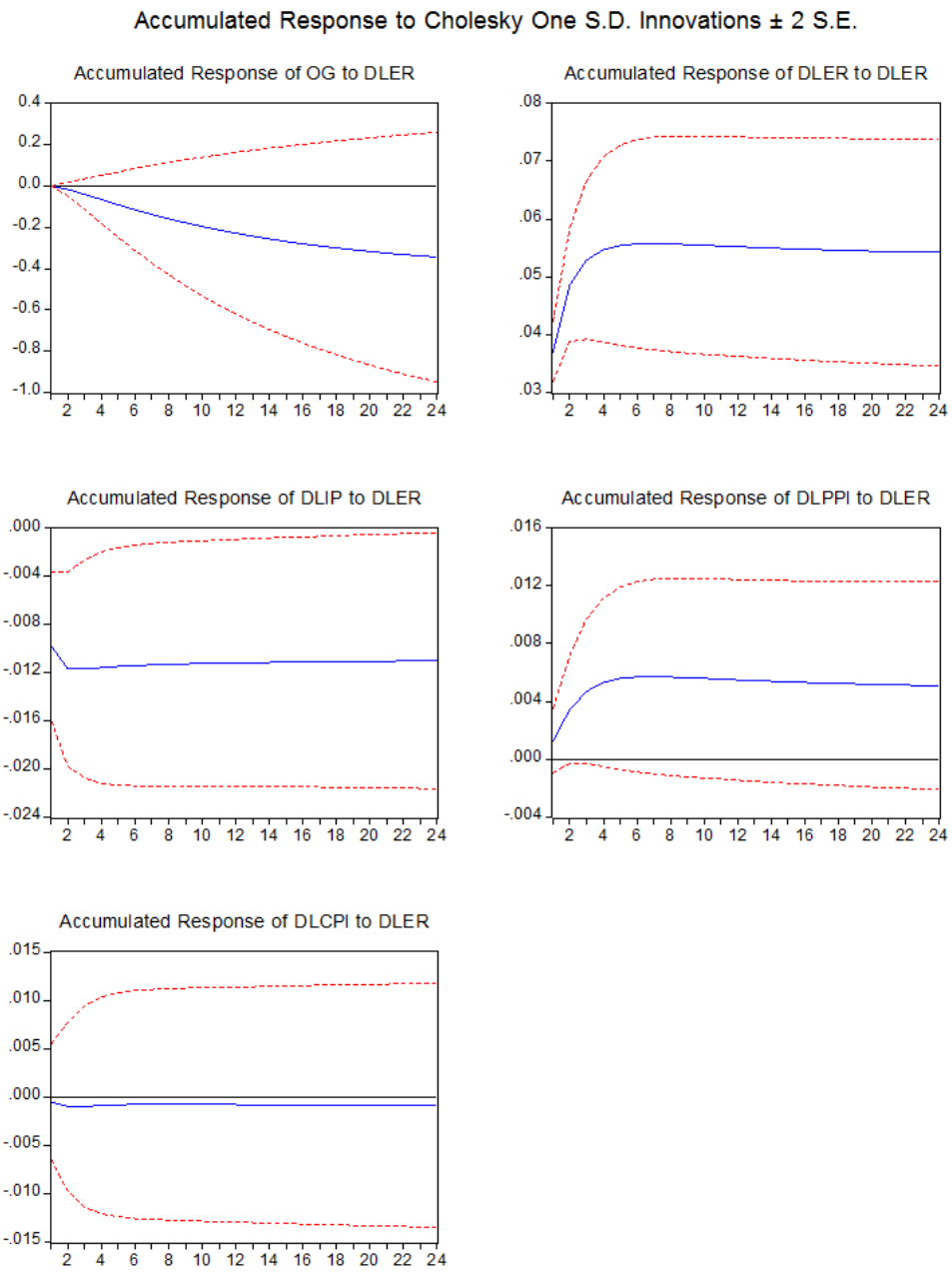
5. Furniture Oil Sector



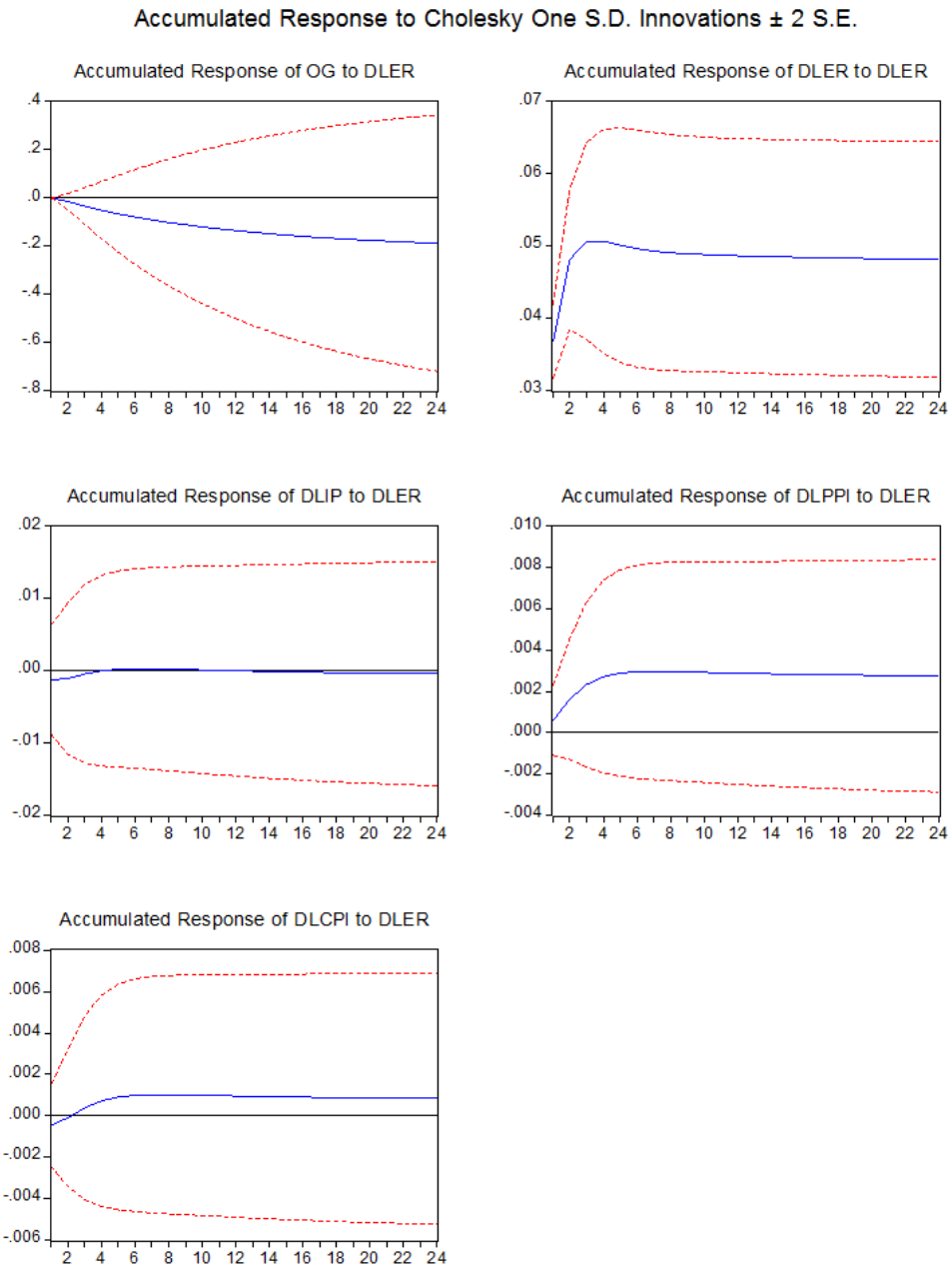
6. Machinery Sector



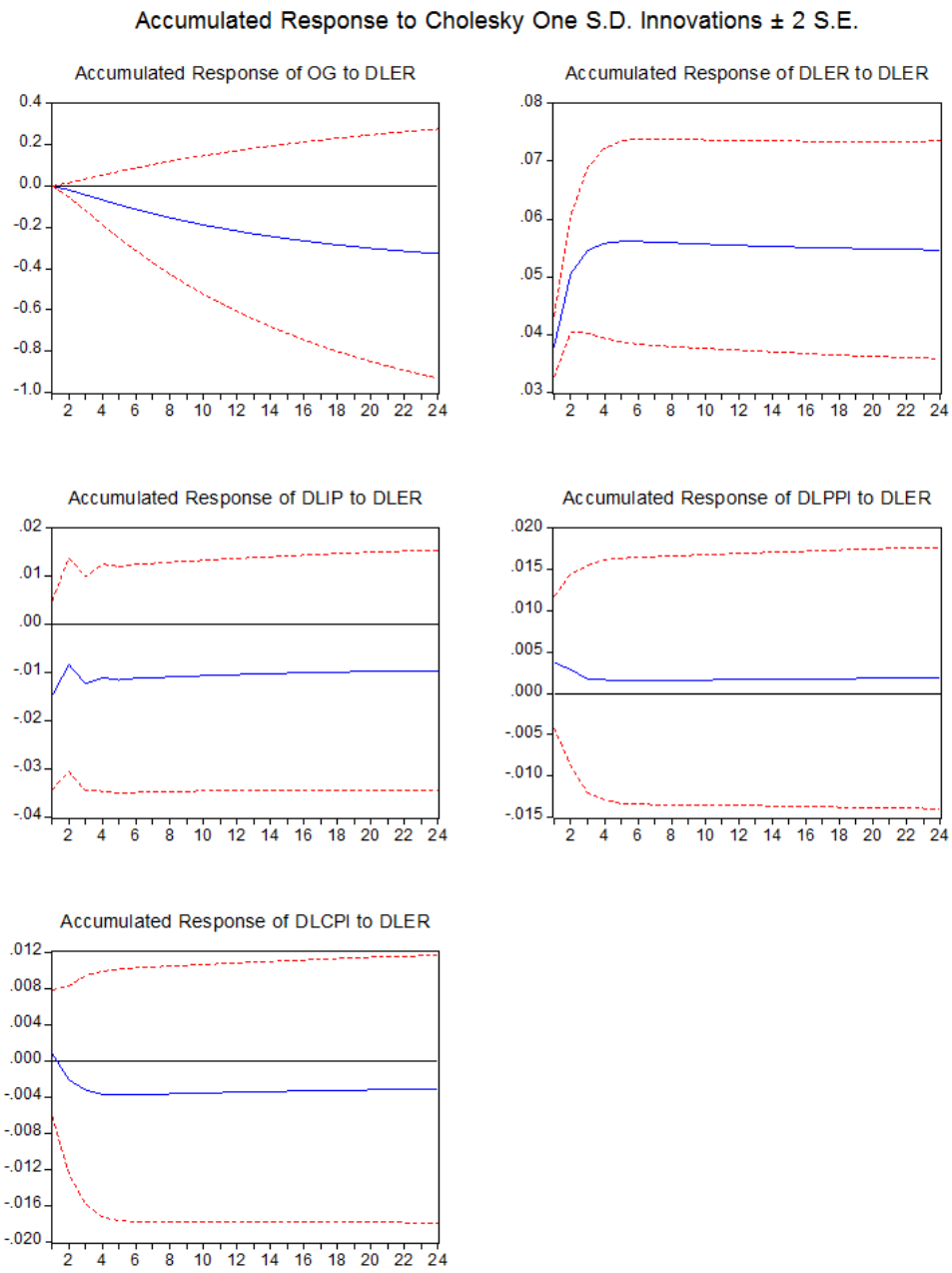
7. Motor Vehicles Sector



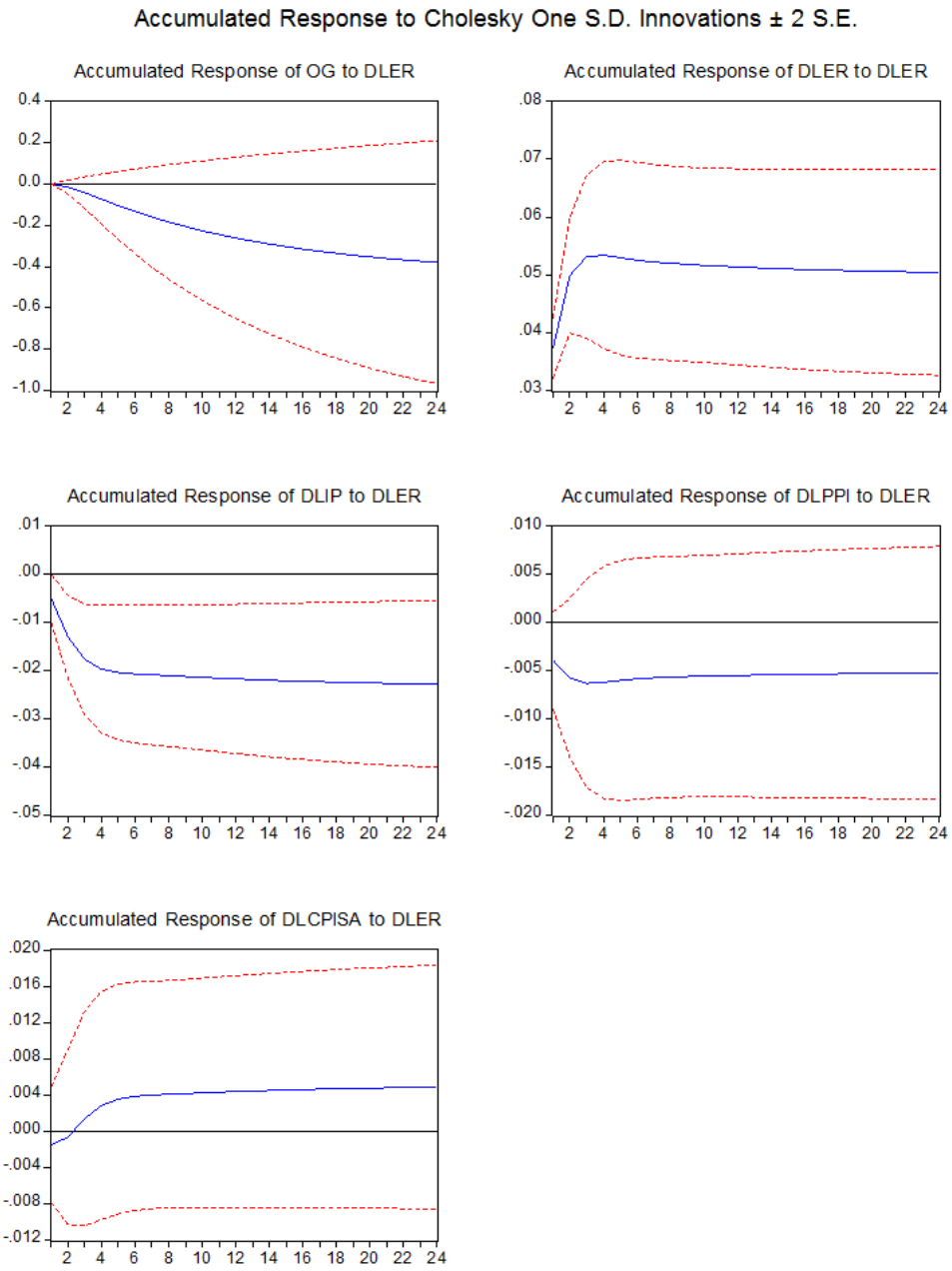
8. Processed Food Sector



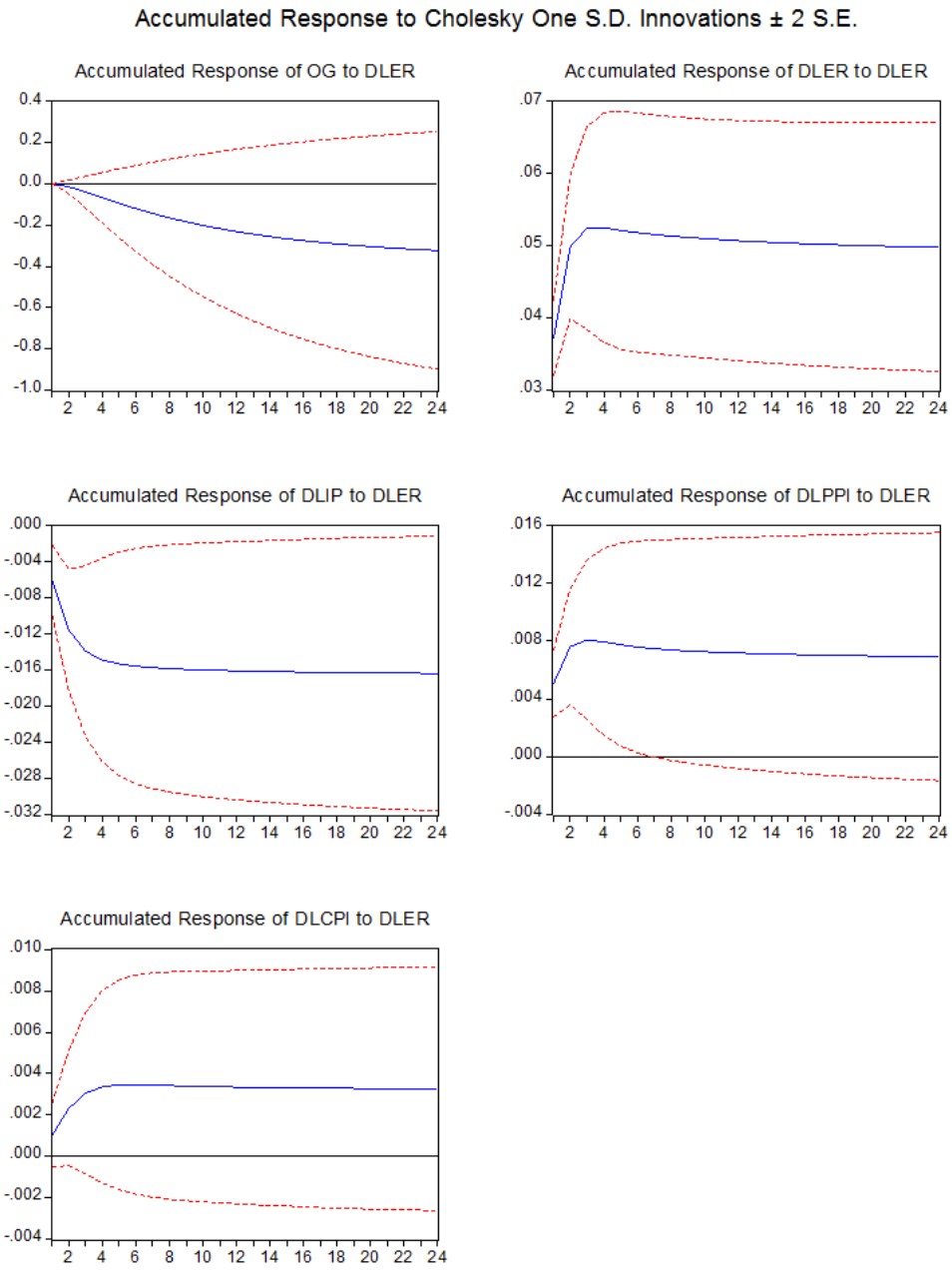
9. Tobacco Sector



10. Unprocessed Food Sector

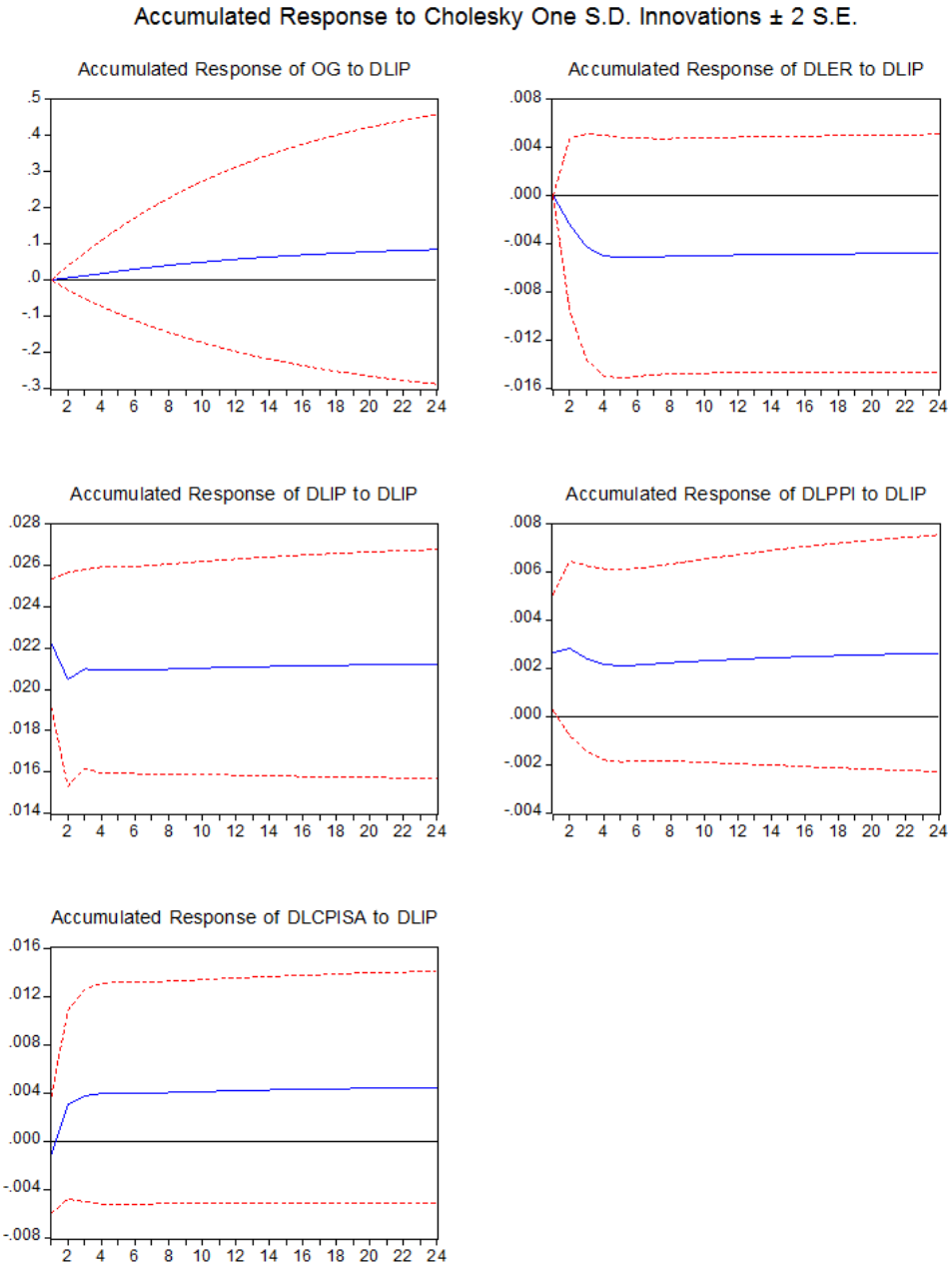


11. All Sector

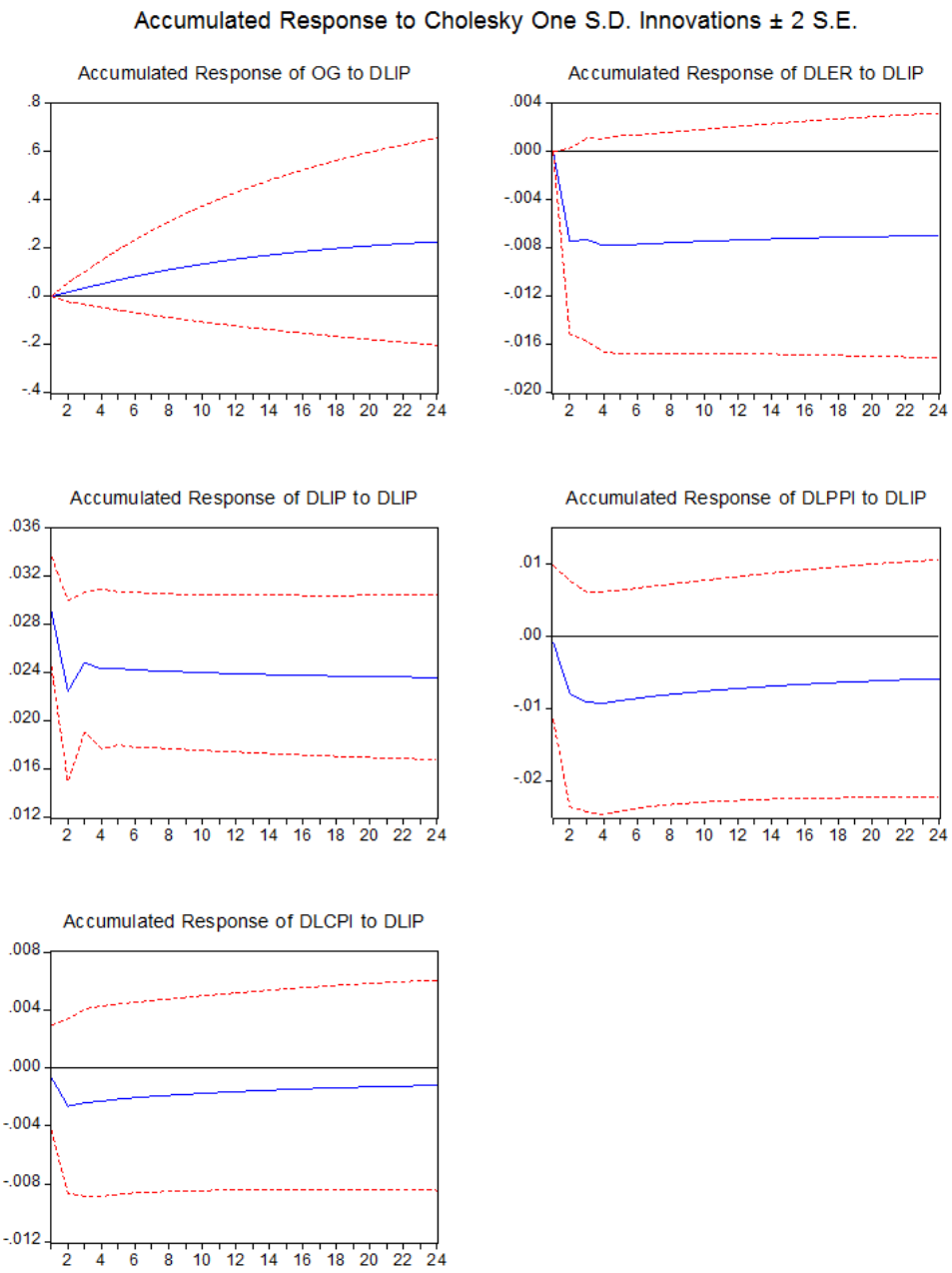


A.4.2. Impulse Response of Import Prices to Import Price Shocks fot Ten Different Sectors

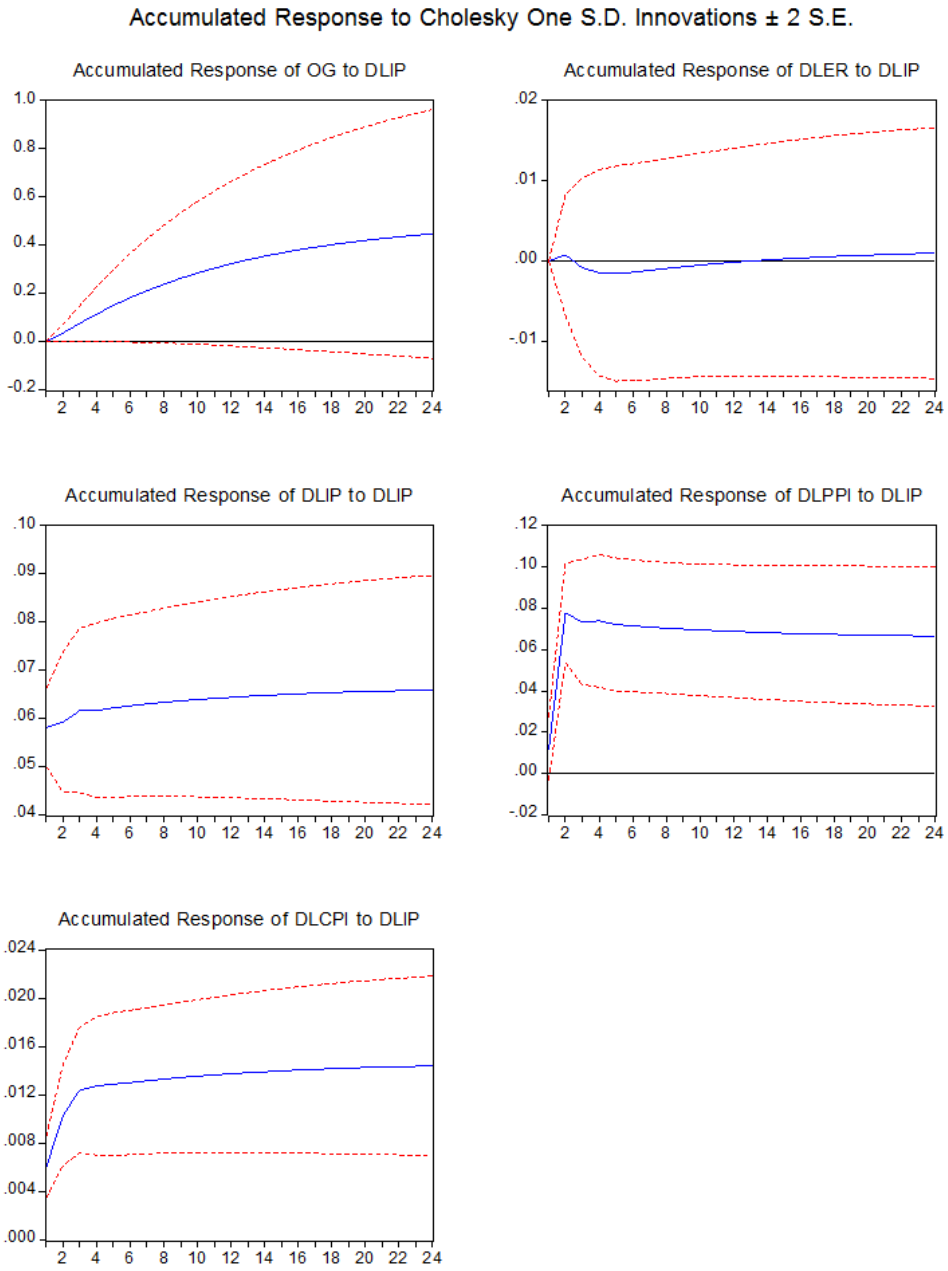
1. Clothing Sector



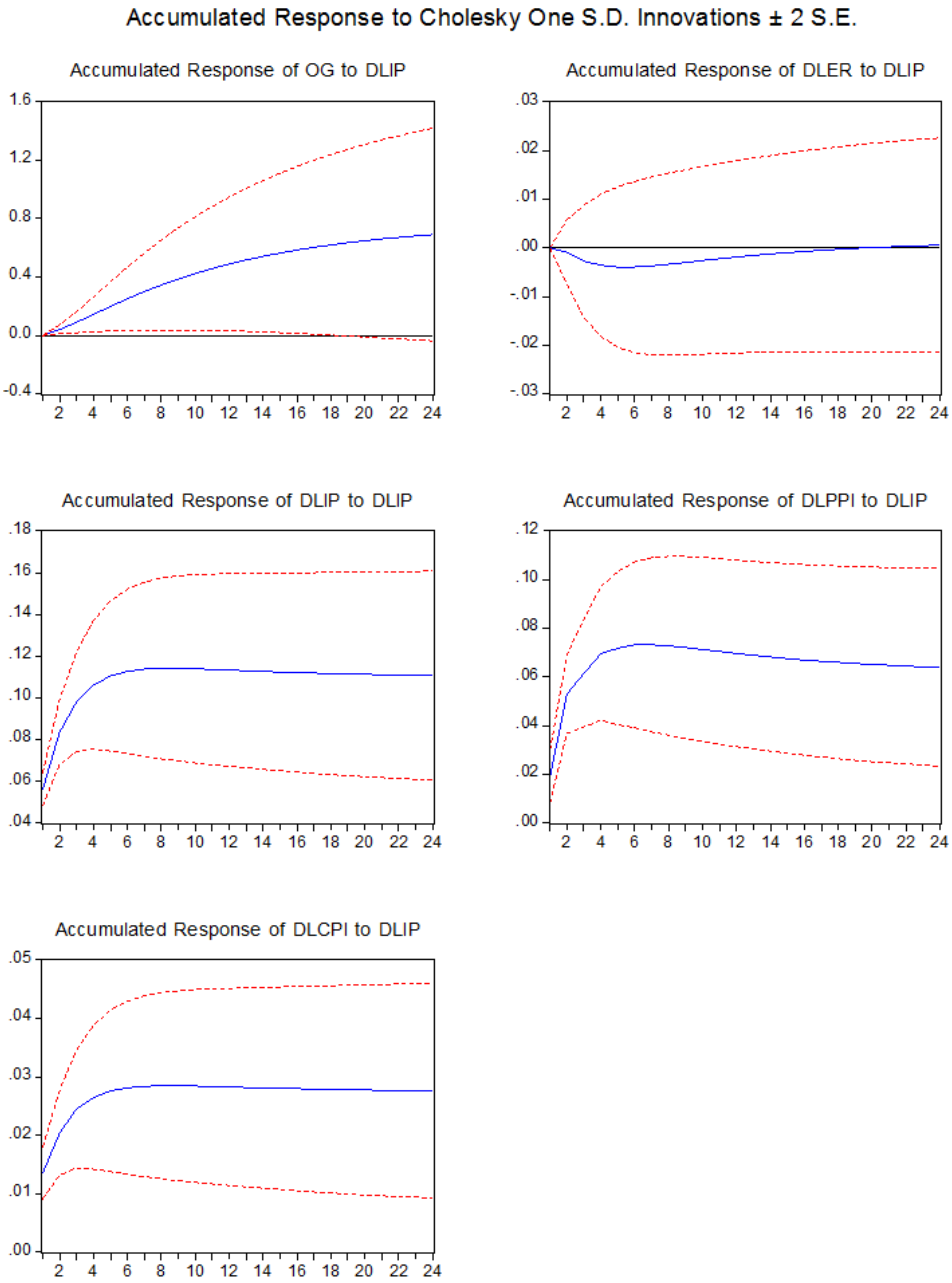
2. Electricity Sector



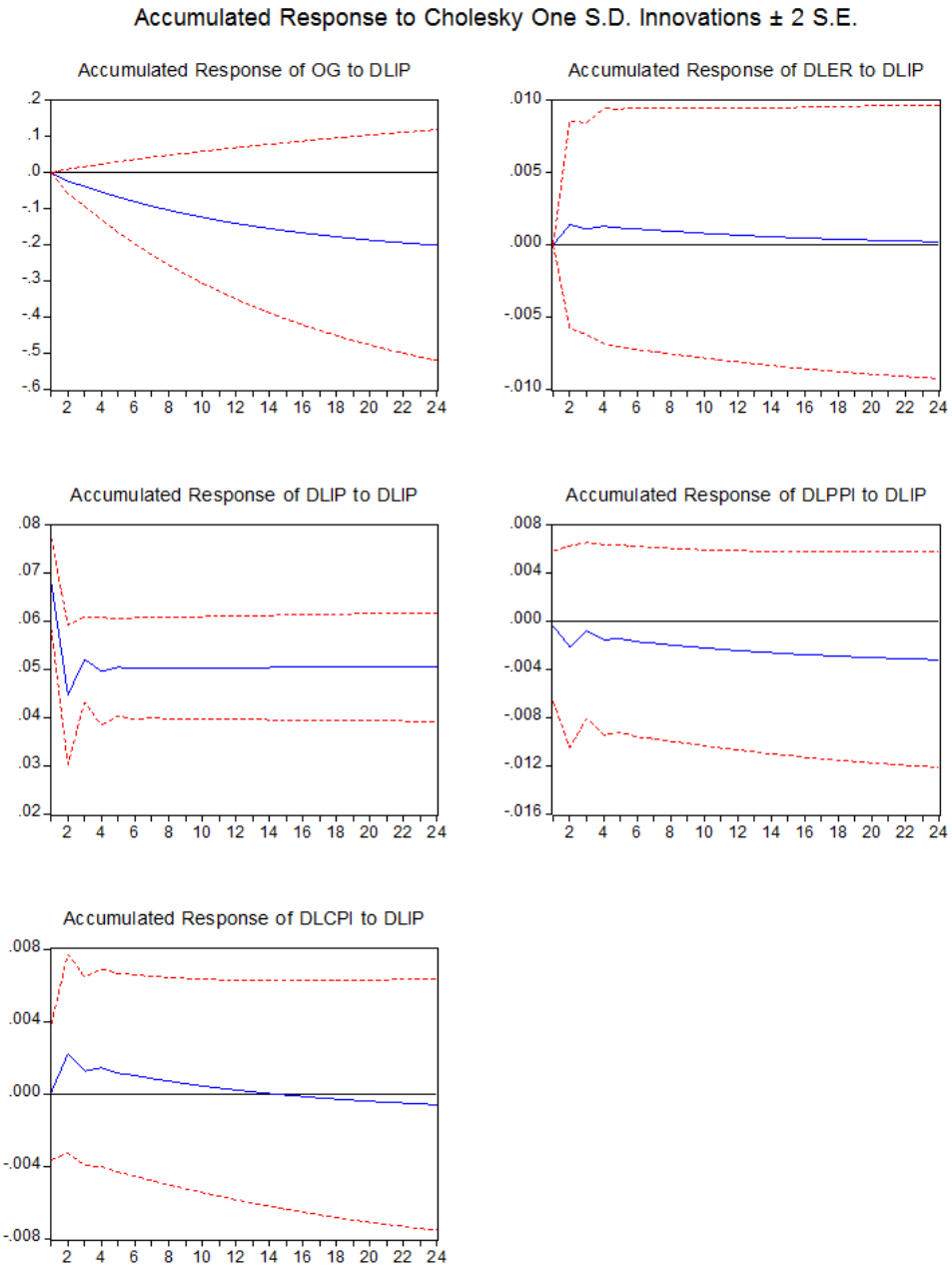
3. Energy sector



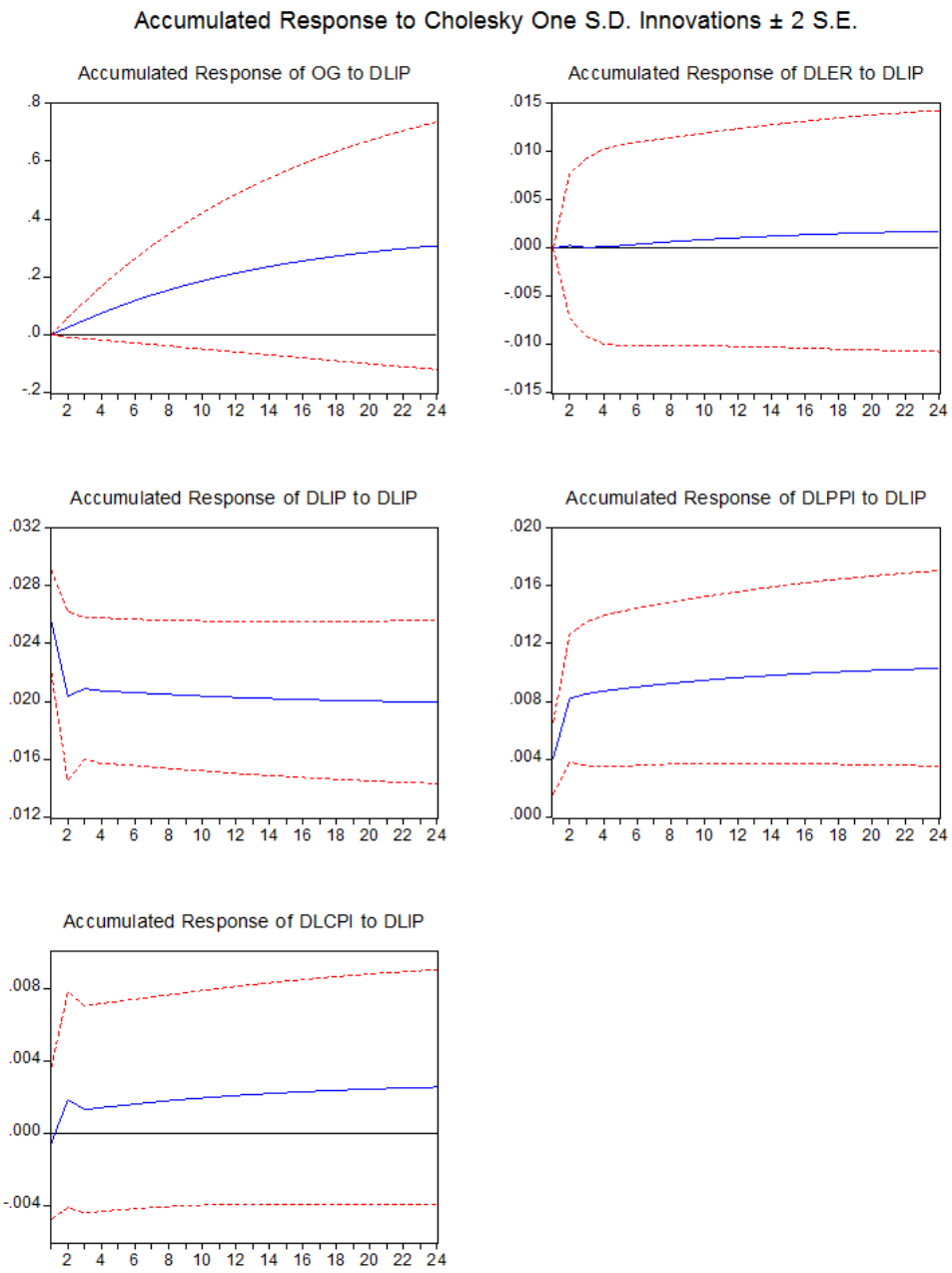
4. Fuel Oil Sector



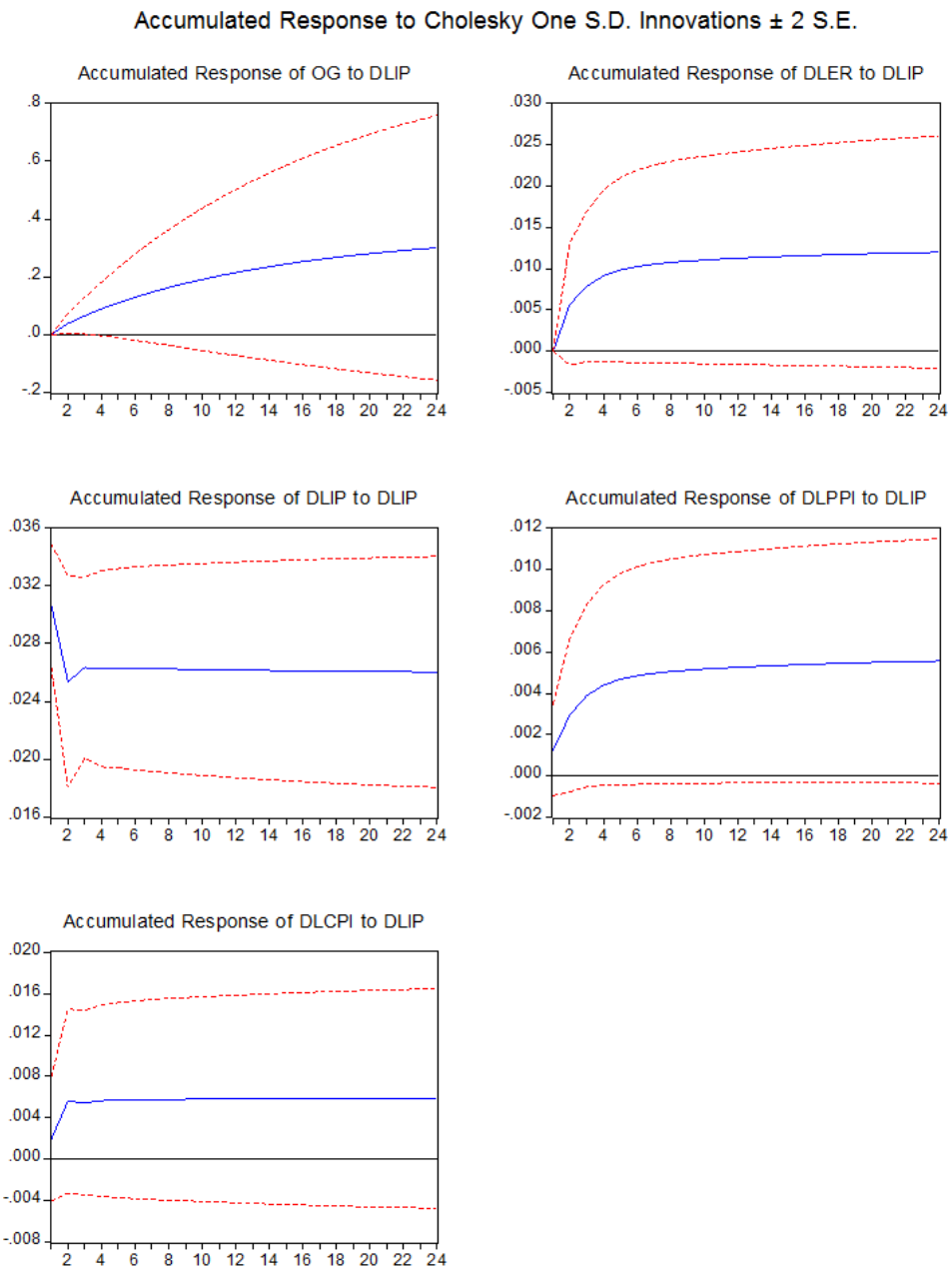
5. Furniture Oil Sector



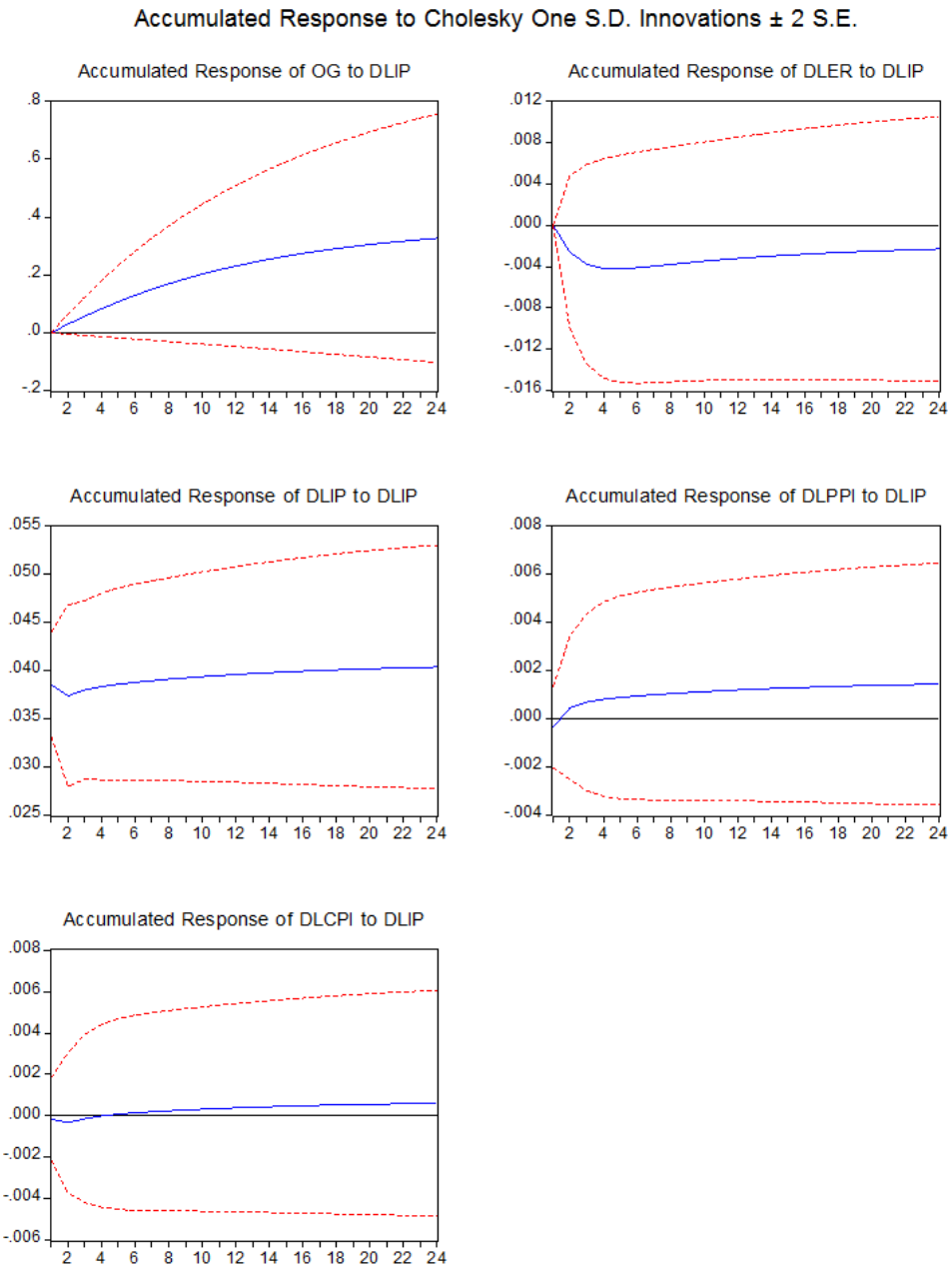
6. Machinery Sector



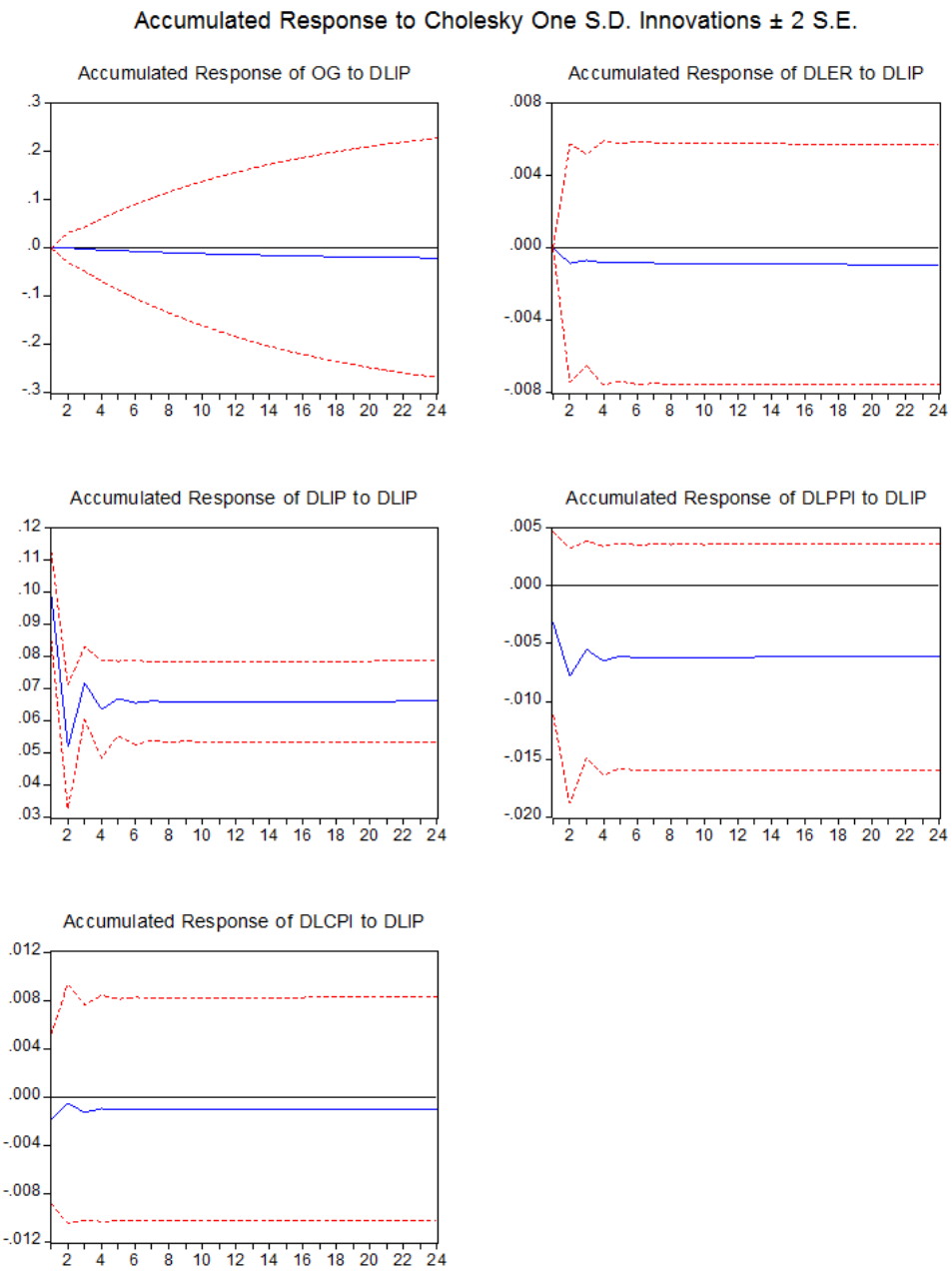
7. Motor Vehicles Sector



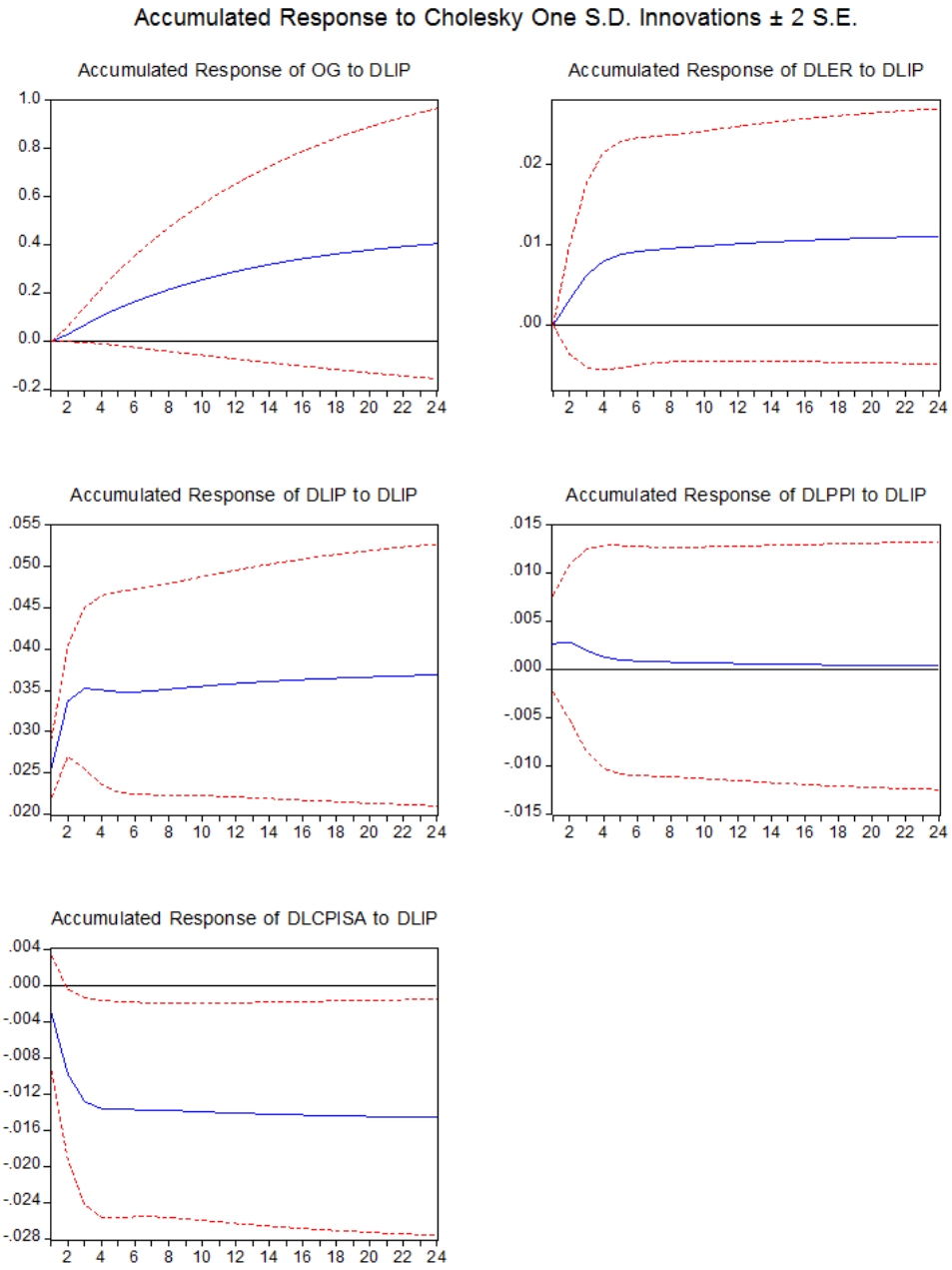
8. Processed Food Sector



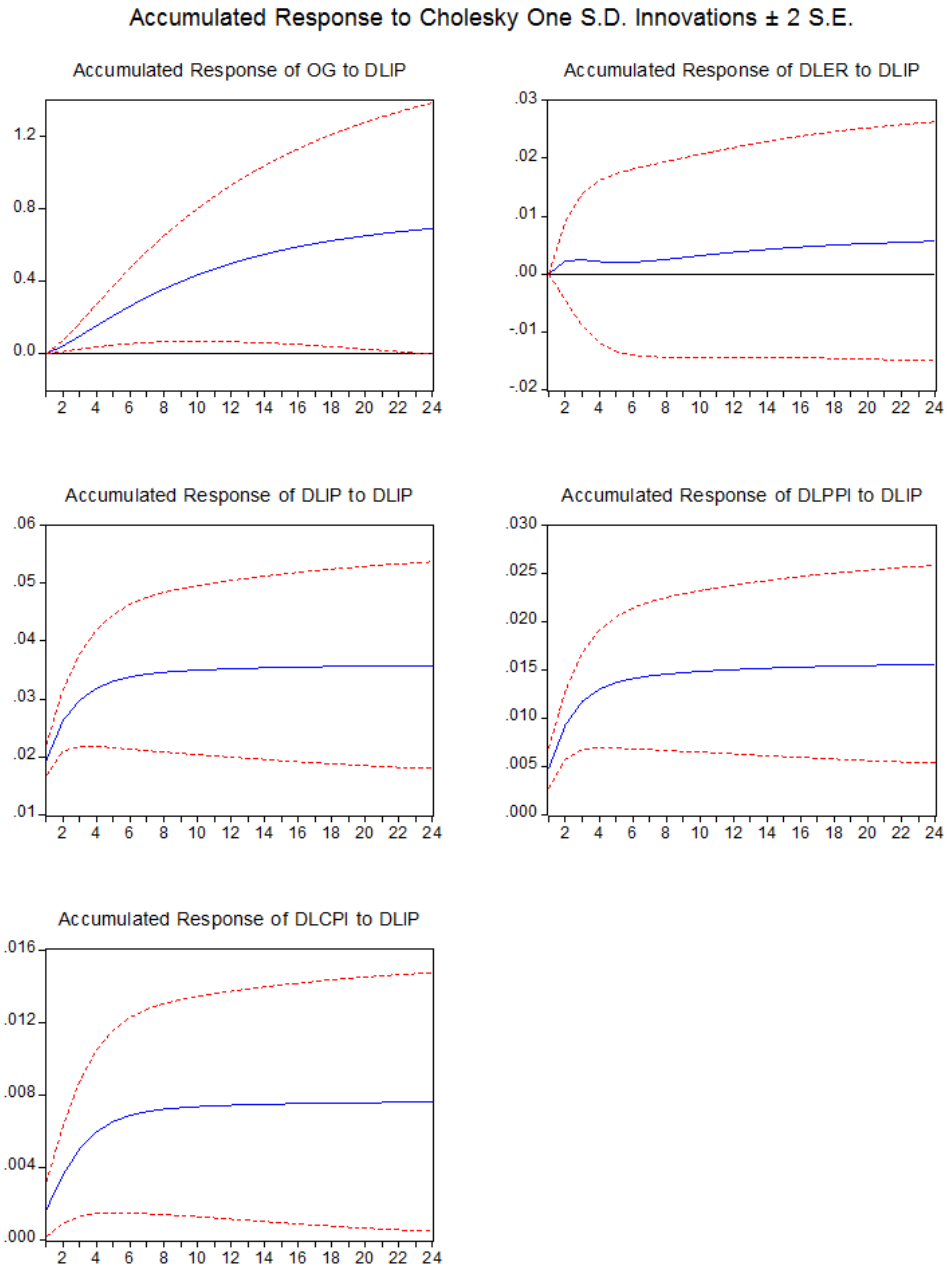
9. Tobacco Sector



10. Unprocessed Food Sector



11. All Sector



TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü	
Sosyal Bilimler Enstitüsü	X
Uygulamalı Matematik Enstitüsü	
Enformatik Enstitüsü	
Deniz Bilimleri Enstitüsü	

YAZARIN

Soyadı : ÖZEN
Adı : Emine Özgü
Bölümü : İktisat

TEZİN ADI (İngilizce) : EXCHANGE RATE PASS-THROUGH INTO DOMESTIC PRICE INDICATORS: A SECTORAL ANALYSIS OF TURKISH ECONOMY

TEZİN TÜRÜ : Yüksek Lisans [X] Doktora [ ]

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. [ ]
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. [ ]
3. Tezimden bir (1) yıl süreyle fotokopi alınamaz. [X]

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: