Terms of Trade and the Sri Lankan Economy: A Sign-Restricted Var Approach

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Abstract

The deteriorating terms of trade in the past two decades has been a concern for the policy-makers of Sri Lanka. The recent literature has argued that the effect of the terms of trade shocks on an economy depends on the characteristics of the underlying shock. Using a sign restricted VAR model, this paper examines the effect of external shocks that cause terms of trade fluctuations on the Sri Lankan economy. Three external shocks, viz., world demand shocks, world supply shocks and globalization shocks are considered in this study. The world demand shocks do not have a significant long-term effect on Sri Lanka's real output, but the negative world supply shocks are contractionary. Conversely, positive globalization shocks increase domestic output permanently. Both positive world demand shocks and globalization shocks are inflationary while negative world supply shocks increase domestic prices initially but reduce the prices after two quarters. World demand shocks have largely contributed to the fluctuations in trade balance in Sri Lanka since 2007, whereas the importance of globalization shocks on the imports, exports and trade balance has increased since 2010. Further, the contribution from globalization shocks to the variance in domestic output and price levels has increased since 2007.

Keywords: Terms of Trade; Small Open Economy; External Shocks
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1. Introduction

The terms of trade of a country is one of the crucial relative prices in macroeconomics (Cashin et al. 2004). Recurrent and substantial volatility in terms of trade is widely viewed as a key source of macroeconomic fluctuations, particularly in less-developed economies. Developing countries are more prone to terms of trade fluctuations as they generally export primary

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commodities and are unable to influence world market prices significantly. The Harberger-Laursen-Metzler hypothesis suggests that a deterioration of terms of trade will negatively affect the trade balance and reduce the real income of a country. However, Jääskelä and Smith (2013) argue that the effect of terms of trade shocks on a domestic economy depends on the nature of the underlying external shock that triggers the terms of trade fluctuation. The downward trend in the net-barter terms of trade and the widening trade deficit in Sri Lanka over the past two decades have been concerns for the country's policy-makers. What are the sources of terms of trade fluctuations in Sri Lanka? Do all terms of trade shocks have a similar impact on domestic macroeconomic variables? How do the Sri Lankan variables respond to the shocks that cause terms of trade fluctuations? Using a sign-restricted VAR model, this essay attempts to answer these questions by investigating the effects on the Sri Lankan economy from external shocks that cause terms of trade movements.

The net-barter terms of trade is the ratio between export prices and import prices of a country. Being a small open economy, Sri Lanka is unable to influence the prices of both its imports and exports and hence the terms of trade of the country is determined exogenously. Sri Lanka is potentially vulnerable to terms of trade fluctuations for a number of reasons. First, a considerable portion of Sri Lankan exports consists of less-value-added products. With the economic reforms introduced in 1977, Sri Lanka partly diversified its exports sector from the traditional agricultural commodities to labour-intensive manufacturing goods. Yet, 25 per cent of the country's exports during the 2010-2014 period consisted of agricultural commodities. Second, the country's exports are concentrated in a few goods. When the 2010-2014 period is considered, textile and garments, tea and industrial rubber products accounted for 41, 15 and 8 per cent of the country's exports, respectively. Therefore, fluctuations in tea and rubber prices in the world market have a considerable impact on the country's terms of trade and the exports sector. Third, Sri Lanka relies on imports for its intermediate and capital goods. Within the 2010-2014 period, intermediate goods and capital goods accounted for 60 and 22 per cent of the country's imports, respectively. During the same time period, on average 24 per cent of the country's imports were fuel products. Therefore, prices of oil and fertilizers in the global market have a notable impact on the country's production and as well as on domestic prices.

As depicted in Figure 1, the terms of trade of Sri Lanka has gradually declined during the past two decades. Although imports and exports have grown substantially over time, both imports and exports as a percentage of GDP have declined. Nevertheless, the trade deficit as a

percentage of GDP has increased, particularly since 2010, raising concerns among the country's economists and policy-makers. On the other hand, Sri Lanka has recorded an impressive annual average growth rate of 6.75 per cent during the 2005-2014 period despite the deteriorating terms of trade and widening trade deficit. Therefore, it is worthwhile investigating the effect of the terms of trade movements on the Sri Lankan economy.

Harberger (1950) and Laursen and Metzler (1959) were some of the first to investigate the link between terms of trade shocks and the macroeconomy. They assert that a deterioration in the terms of trade would decrease the real income (or raise the real expenditure for a given level of real income) of a country leading to reduced savings (and a worsening of the current account) through consumption smoothing behaviour. This hypothesis is well-known as the Harberger-Laursen-Metzler effect. Otto (2003) finds strong evidence to support the Harberger-Laursen-Metzler hypothesis. This concept is further extended by Obstfeld (1982) and Kent and Cashin (2003), who suggest that the duration or persistence of terms of trade shocks is pivotal in determining their effect on an economy. They suggest that an unanticipated and permanent deterioration in terms of trade would lower the real income of a country permanently, leading to a permanent reduction in consumption without disrupting the country's savings plan or the current account balance. On the other hand, if the unanticipated terms of trade deterioration is more transitory in nature, real income, current account, consumption and savings would behave as predicted by the Harberger-Laursen-Metzler hypothesis.

In his seminal essay, Mendoza (1995) examines the relationship between the terms of trade and macroeconomic fluctuations in small open economies. He observes the movements in terms of trade and macro-variables and compares them with the predictions of a theoretical model. Mendoza (1995) asserts that a large fraction of the variance in output and exchange rate fluctuations can be explained by terms of trade shocks. Kose (2002) extends Mendoza (1995)'s work by developing a model that better captures the characteristics of developing countries, such as large trade deficit, higher debt-to-GDP ratio and large non-traded goods sector in the economy, and reports similar findings. Numerous other studies have shown that terms of trade volatility accounts for a large fraction in the variance of output, output growth, current account, consumption, and public and private savings in developing economies (Easterly et al., 1993, Agénor et al., 2000).

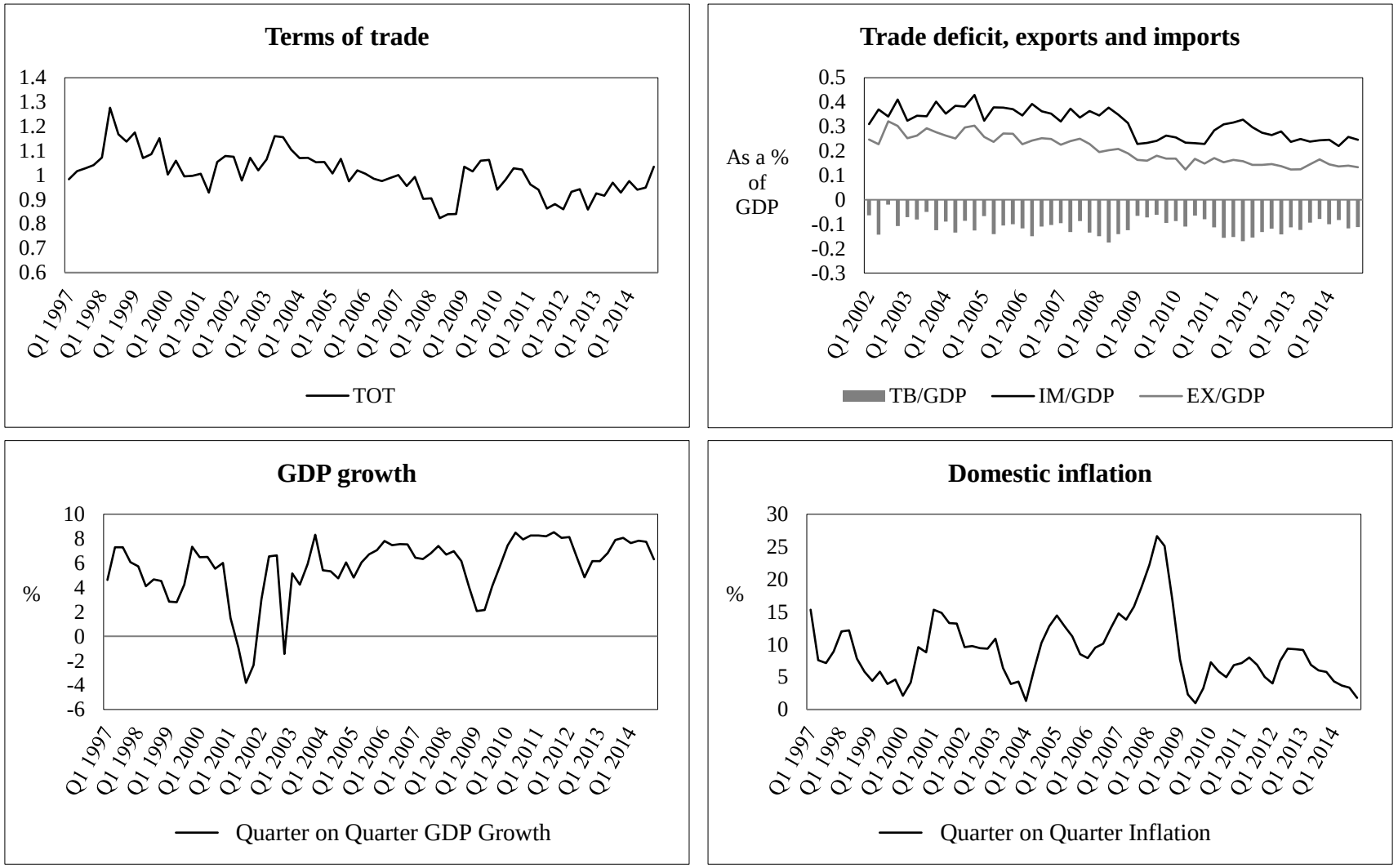


Figure 1. Selected Macroeconomic Variables of Sri Lanka

Several studies have shown that the impact of terms of trade shocks on macroeconomic variables is influenced by the structural characteristics of the domestic economy. Applying a semi-structural VAR model to a panel of 88 countries, Loayza and Raddatz (2007) investigate how the domestic structural characteristics related to product and factor market flexibility and openness influence the effect of terms of trade shocks on aggregate output. They find that great trade openness magnifies the effect of terms of trade shock on output, while financial openness reduces the impact. Further, the flexibility of labour markets dampens the negative effect of terms of trade shocks and ease of firm-entry magnifies the positive effects. Broda and Tille (2003) show that the countries with flexible exchange rate regimes are less vulnerable to terms of trade shocks than the countries with fixed exchange rate regimes. Broda (2004) also asserts that the output, price and exchange rate responses of a country to a terms of trade shock significantly differ across different exchange rate regimes. These studies indicate that the effect of terms of trade shocks on an economy is by and large country specific depending on the country's structural characteristics. Therefore, modelling the Sri Lankan economy separately is essential to better understand the effect of terms of trade shocks on the Sri Lankan economy.

In the more recent literature it has been argued that the response of macro-variables to the fluctuations in certain external variables depends on the characteristics of the underlying shock. For example, the effects of oil price fluctuations on the US and European economies highly depend on the nature of the shock (Kilian, 2009, Peersman and Van Robays, 2009 and Melolinna, 2012). As Kilian (2009) points out, the approach of modelling the oil price shocks as uncorrelated shocks to the rest of the foreign variables in a VAR model is fundamentally incorrect. This is because the oil prices are determined endogenously rather than exogenously within global markets depending on the underlying shocks, such as aggregate demand shocks and supply shocks. Therefore, it is essential to specify these underlying shocks in the VAR model to properly investigate the effect of oil price fluctuations on the domestic economy. Mangadi and Sheen (2016) suggest that the same idea can be applied to the terms of trade shocks as well. Even though the terms of trade is exogenous for a small open economy, this variable will be determined endogenously within the global market. If the underlying shocks that cause terms of trade fluctuations are not specified in the VAR model, the reverse causality coming from other global variables to the terms of trade may not be captured. Therefore, Jääskelä and Smith (2013) and Karagedikli and Price (2012) assume that the export and import

prices, which are influenced by various external shocks, would affect the Australian and New Zealand economies directly as well as through the terms of trade.

Jääskelä and Smith (2013) posit that the export and import prices (and in turn, the terms of trade) of Australia are affected by world demand shocks, commodity-specific shocks and globalization shocks. Their 'world sector' consists of three variables, i.e., export and import prices of Australia, and world output. World demand shock is common to both export and import prices and is associated with the global business cycle. In contrast, commodity-specific shocks are limited to export prices and may or may not have an effect on import prices. The third shock considered by Jääskelä and Smith (2013), i.e., globalization shock, allows export and import prices to move in opposite directions. This shock captures the effect of the entry of large emerging economies to global markets, which leads to an increase in export prices and world output and a decrease in import prices. On the other hand, Karagedikli and Price (2012) incorporate world output, the commodity factor, world prices, export prices and import prices of New Zealand as global variables. They assume that the terms of trade of New Zealand is affected by the world demand, world supply and globalization shocks. They specify world supply shocks as a decrease in world output and an increase in commodity factor and export prices.

There are very few studies that have been conducted with regard to the terms of trade of Sri Lanka or its effect on the domestic economy. Athukorala (2000) investigates the impact of export product diversification in Sri Lanka on the terms of trade of the country. He asserts that product diversification from traditional primary agricultural commodities to labour-intensive manufacturing goods has improved the net-barter terms of trade and income terms of trade of Sri Lanka. However, Athukorala (2000) does not focus on the effect of terms of trade movements on the macro-variables of the domestic economy. Therefore, this essay attempts to fill the gap in the existing literature and investigates the impact of external shocks that trigger terms of trade fluctuations on Sri Lankan macroeconomic variables.

This essay considers three external shocks that cause terms of trade movements, namely, world demand shocks, world supply shocks and globalization shocks. The results of this study show that positive world demand and negative world supply shocks instantaneously deteriorate Sri Lanka's terms of trade, but the terms of trade improves after two quarters in response to a world supply shock. Conversely, globalization shocks improve the terms of trade of the country

temporarily. This is because, the entry of the emerging markets to the global trading systems drives the export prices high through increased demand and causes a downward pressure on import prices through cheap, manufactured goods. However, the terms of trade will marginally decline relative to the original level after three quarters under a globalization shock and will revert to the initial level after 10-12 quarters. Positive world demand shocks do not have a long-term significant impact on domestic output and negative world supply shocks are contractionary. Positive globalization shocks increase domestic output permanently. Both positive world demand shocks and globalization shocks are inflationary and increase domestic price levels permanently. On the other hand, world supply shocks increase domestic prices initially but reduce the price level after two quarters. The external shocks account for 39 per cent of the variation in output and price levels in Sri Lanka.

The remainder of the essay is structured as follows. Section 2 explains the baseline-VAR model, data and the sign restrictions pertaining to the three external shocks. The results of the baseline model, including impulse responses, forecast error variance decomposition and historical decomposition are discussed in Section 3. Further, the model is re-estimated with the trade balance, exports and imports variables and the findings are explained in Section 4. The checks for robustness of the results of baseline-VAR model are discussed in Section 5. The final section of the essay summarizes the overall findings highlighting the importance of modelling the terms of trade of a small open economy as an endogenous variable within the global economy.

2. Methodology

Following Jääskelä and Smith (2013) and Karagedikli and Price (2012), a sign-restricted VAR model is used to identify the external shocks that trigger the terms of trade fluctuations in the Sri Lankan economy. The terms of trade is determined within the global markets due to the relative movements of export and import prices. Hence, the model is specified to include import and export prices separately, instead of incorporating the terms of trade as a single variable.

2.1 Baseline VAR model

The baseline structural VAR model can be expressed as

$$\begin{bmatrix} w_t \\ d_t \end{bmatrix} = \beta x_t + \sum_{i=1}^{p} A_i \begin{bmatrix} w_{t-i} \\ d_{t-i} \end{bmatrix} + B \begin{bmatrix} \varepsilon_t^w \\ \varepsilon_t^d \end{bmatrix} \quad (1)$$

where w_t and d_t are the vectors of endogenous world and domestic variables respectively; x_t is a vector of exogenous variables; β is the coefficient matrix of exogenous variables; A_i is the lag coefficient matrix; B is the contemporaneous impact matrix of the vectors of mutually uncorrelated world (ε_t^w) and domestic (ε_t^d) disturbances with a variance-covariance matrix of Ω . The variance-covariance matrix has the dimensions of $(m * m)$ and m is the number of endogenous variables in the VAR model. Since structural shocks are orthogonal,

$$E\left(\begin{bmatrix}\varepsilon_t^w \\ \varepsilon_t^d\end{bmatrix}\begin{bmatrix}\varepsilon_t^w \\ \varepsilon_t^d\end{bmatrix}'\right) = \Omega_\varepsilon = I \tag{2}$$

where I is an identity matrix.

Following Jääskelä and Smith (2013), the world-block of the VAR model consists of three variables: $w_t' = (expr_t, impr_t, y_t^*)$ where $expr$ is the real export prices; $impr$ is the real import prices and y_t^w is the level of trade-weighted output of Sri Lanka's major trading partners. There are four variables in the domestic block: $d_t' = (y_t, cpi_t, int_t, reer_t)$ where y_t is the domestic output level; cpi_t is the domestic consumer price index; int_t is the domestic short-term interest rate; and $reer_t$ is the real effective exchange rate of Sri Lanka. A full description of the data and their sources is given in Appendix A. As Sri Lanka is a small open economy, the lag coefficients of the domestic variables on the foreign variable equations of the VAR model are restricted to zero. The lag structure of the model is summarized in Table 1.

Table 1. Lag structure of the model

Dependent Variable	Independent Variable						
	$expr$	$impr$	y^*	y	cpi	int	$reer$
$expr$	*	*	*				
$impr$	*	*	*				
y_t^*	*	*	*				
y_t	*	*	*	*	*	*	*
cpi	*	*	*	*	*	*	*
int	*	*	*	*	*	*	*
$reer$	*	*	*	*	*	*	*

Note: * indicates lags of the independent variable appear in the dependent variable equation

The Hannan–Quinn Information Criterion (HQIC) and Schwarz-Bayesian Information Criterion select 1 lag as the optimal lag length. However, two lags are chosen for the model to allow adequate model dynamics. The Seemingly Unrelated Regression Equation (SURE) estimation technique is used to estimate this baseline near-VAR model.

The sample used for the estimation runs from 1997Q1 to 2014Q4. The start date of the sample is restricted by the commencement date of the compilation of quarterly unit price indices of exports and imports of Sri Lanka. Further, a dummy variable, gfc, is used to capture the period of global financial crisis and the resultant economic down-turn in the world economy. Accordingly, $gfc = 1$ from 2007Q4 to 2009Q2.

All variables, except for the interest rate, are expressed in natural logarithm. The Augmented Dicky-Fuller, Phillip-Peron and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests indicate that all variables other than interest rate are *I(1)* variables. The domestic interest rate is a *I(0)* variable as per the Augmented Dicky-Fuller and KPSS tests. The Johansen test for cointegration suggests that variables are cointegrated. Therefore, variables are left in non-stationary form and the VAR model is estimated in levels to avoid potential inconsistency in the parameter estimates caused by the imposition of incorrect co-integrating restrictions (Sims et al. 1990). The VAR stability test indicates that all Eigen values are less than one and the base-line VAR model is stable.

2.2. From reduced-form VAR model to sign-restricted VAR

The reduced-form of the baseline VAR model can be written as

$$\begin{bmatrix} w_t \\ d_t \end{bmatrix} = \beta x_t + \sum_{i=1}^{p} A_i \begin{bmatrix} w_{t-i} \\ d_{t-i} \end{bmatrix} + \begin{bmatrix} e_t^w \\ e_t^d \end{bmatrix} \quad (3)$$

where e_t^w and e_t^d are the reduced-form residuals of the world and domestic variables. Further,

$$\begin{bmatrix} e_t^w \\ e_t^d \end{bmatrix} = B \begin{bmatrix} \varepsilon_t^w \\ \varepsilon_t^d \end{bmatrix} \quad (4)$$

The equation (4) can be re-written as

$$E \begin{bmatrix} e_t^w \\ e_t^d \end{bmatrix} \begin{bmatrix} e_t^w \\ e_t^d \end{bmatrix}' = BE \left(\begin{bmatrix} \varepsilon_t^w \\ \varepsilon_t^d \end{bmatrix} \begin{bmatrix} \varepsilon_t^w \\ \varepsilon_t^d \end{bmatrix}' \right) B' \quad (5)$$

By combining (2) and (5)

$$\Omega_e = BB' \quad (6)$$

where Ω_e is the variance-covariance matrix of the reduced form VAR.

Since Ω_e can be obtained through the reduced-form VAR model, the structural shocks, ε_t^w and ε_t^d, can be identified by finding the B matrix and applying it to equation (4). The identification of structural shocks is generally achieved by placing restrictions on the parameters of the VAR model. However, the sign-restrictions approach, which places restrictions on the direction of the movement of variables (over a given time horizon) in response to different types of shocks, is becoming an increasingly popular method of structural shock identification. This approach has been used by Faust (1998), Canova and De Nicoló (2002), Uhlig (2005) and Mountford and Uhlig (2009).

Given the restrictions on the direction of impulse responses, the sign restrictions technique searches a B vector over the space of possible impulse vectors that would satisfy the equation (6). Therefore, B is not a lower-triangular matrix under the sign restriction approach as in the Cholesky decomposition. However, the Cholesky decomposition is used as an intermediate step to extract B in the sign restriction approach. Assume P is a lower triangular matrix that satisfies $\Omega_e = PP'$. An orthogonal matrix D that yields $B = PD$ and meets $\Omega_e = BB'$ is selected. The sign restriction procedure adopted in this study consists of the following steps:

1) Generate a draw for the VAR coefficients and covariance matrix using SUR Gibbs procedure.
2) Compute a Cholesky factor and the response to it.
3) Generate a random unit vector D in m –space.
4) Weight the impulse responses from step (2) by D to get the responses to the chosen impulse vector.
5) If the impulse response meets the restrictions, save them.
6) Repeat steps (3)-(5) for 10,000 for each main draw.
7) Repeat steps (1)-(6) until 10,000 admissible structural models have been accepted.
8) Using all the admissible structural models, calculate the median values, 16 and 84 percentile values for each response over each time horizon.

Fry and Pagan (2011) criticize the practice of using median response as a measure of central tendency since it mixes the responses of different admissible structural models. Instead, they propose to select a single model (median target) that provides impulse responses that are closest to the median responses across all variables. In this essay, the process of selecting the median

target model is similar to the technique proposed by Fry and Pagan (2011). However, this essay uses the inter-quartile range to rescale the responses instead of the standard deviation. The inter-quartile range is a more robust estimator, since the distribution of responses can sometimes be fat-tailed (Doan, 2015).

2.3. Identification of Shocks

The sign-restriction scheme used in this essay is given in Table 2 below. Although there are seven variables in the model, only three shocks have been identified using sign restrictions. The rest of the shocks are identified using orthogonal Cholesky factorization. The identified shocks are specified in terms of their effect on the variables in the world block while their effects on the domestic variables are left unrestricted. Although sign restrictions can be applied to multiple quarters, sign restrictions are applied only to one quarter in the baseline sign restricted VAR model.

Following Jääskelä and Smith (2013) and Karagedikli and Price (2012), the world demand shock is specified to capture the movements in export and import prices due to the changes in aggregate demand in the world. Therefore, a positive world demand shock is represented by an increase in export prices ($expr$), import prices ($impr$) and the world output (y_t^*).

Table 2. Sign Restrictions

	$expr$	$impr$	y_t^*	Domestic Variables
World demand shock	+	+	+	NA
World supply shock	+	+	-	NA
Globalization shock	+	-	+	NA

The world supply shock may be thought of as an idiosyncratic shock to import and exports prices ($impr$ and $expr$) and the world output (y_t^*) due to supply-side disturbances. For example, this could represent an oil supply-side shock. An unanticipated negative shock to the world oil production can affect world output negatively while raising general price levels in the world. As a result, both the import and export prices for the Sri Lankan economy can increase simultaneously.

As described by Jääskelä and Smith (2013) and Karagedikli and Price (2012), the globalization shock is specified to capture the integration of large emerging market economies such as India and China into the global trading system. A positive globalization shock should increase the world output (y_t^*) and raise export prices ($expr$) due to increased demand for domestic goods in the global market. Simultaneously, import prices ($impr$) should decline due to the downward pressure on the prices of manufactured goods through increased supply. Unlike in 'world demand' shock (in which only aggregate demand in the world changes) and in 'world supply' shock (in which only aggregate supply in the world changes), both aggregate demand and supply in the world change simultaneously under a globalization shock, driving imports and exports prices for Sri Lanka in the opposite direction.

3. Results of the Baseline Model

A Bayesian approach, which captures both sampling and model uncertainty, is used for estimation and inferences. The median, 84th and 16th per centiles of the impulse responses are shown using 10,000 successful draws from the posterior. The direction of the response in the first quarter corresponds to the sign restrictions summarized in Table 2, but no restrictions are imposed on the magnitude of these responses. In addition, the impulse response graphs also illustrate the median target response, which is the impulse response of the model that is closest to the median across all variables (Fry and Pagan, 2007).

3.1 Impulse Responses

3.1.1 Effects on the World Economy

Figures 2, 3 and 4 depict the impulse responses of export prices, import prices and world output to a positive world demand shock, a negative world supply shock and a positive globalization shock, respectively. They also show the impulse responses of the implied terms of trade variable that is constructed from the responses of export and import prices, by dividing the export price by import price.

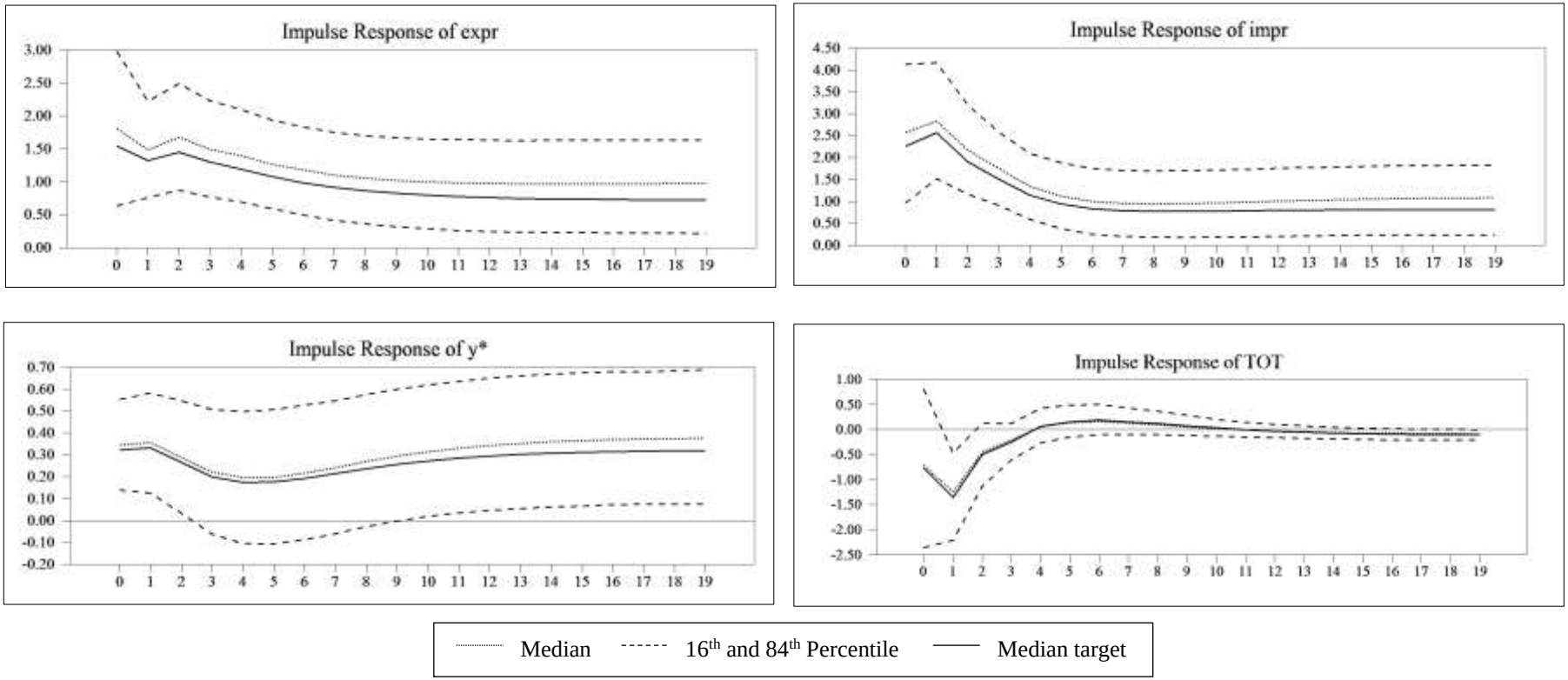
With a positive world demand shock, import prices rise by 2.5 per cent instantaneously while export prices increase only by 1.5 per cent. As a result, the terms of trade for the Sri Lankan economy deteriorate immediately by around 0.5-1.0 per cent due to a world demand shock. A larger portion of Sri Lanka's exports earnings is derived from the textiles and garments industry and generally these apparel exports have sticky prices due to multi-year contracts. Further, the

agricultural commodities exported by Sri Lanka are less value-added products. Hence, prices for these goods may not increase as much as the prices of intermediate and capital goods imported into the country during a world demand shock.

The effect on the terms of trade due to a world demand shock is more transitory in nature with the terms of trade reverting to the original level within 4 quarters. This finding is different from the results for the Australian economy described by Jääskelä and Smith (2013), who showed a permanent increase in Australia's terms of trade due to a positive world demand shock. World output permanently increases by approximately 0.25 per cent due to a positive world demand shock.

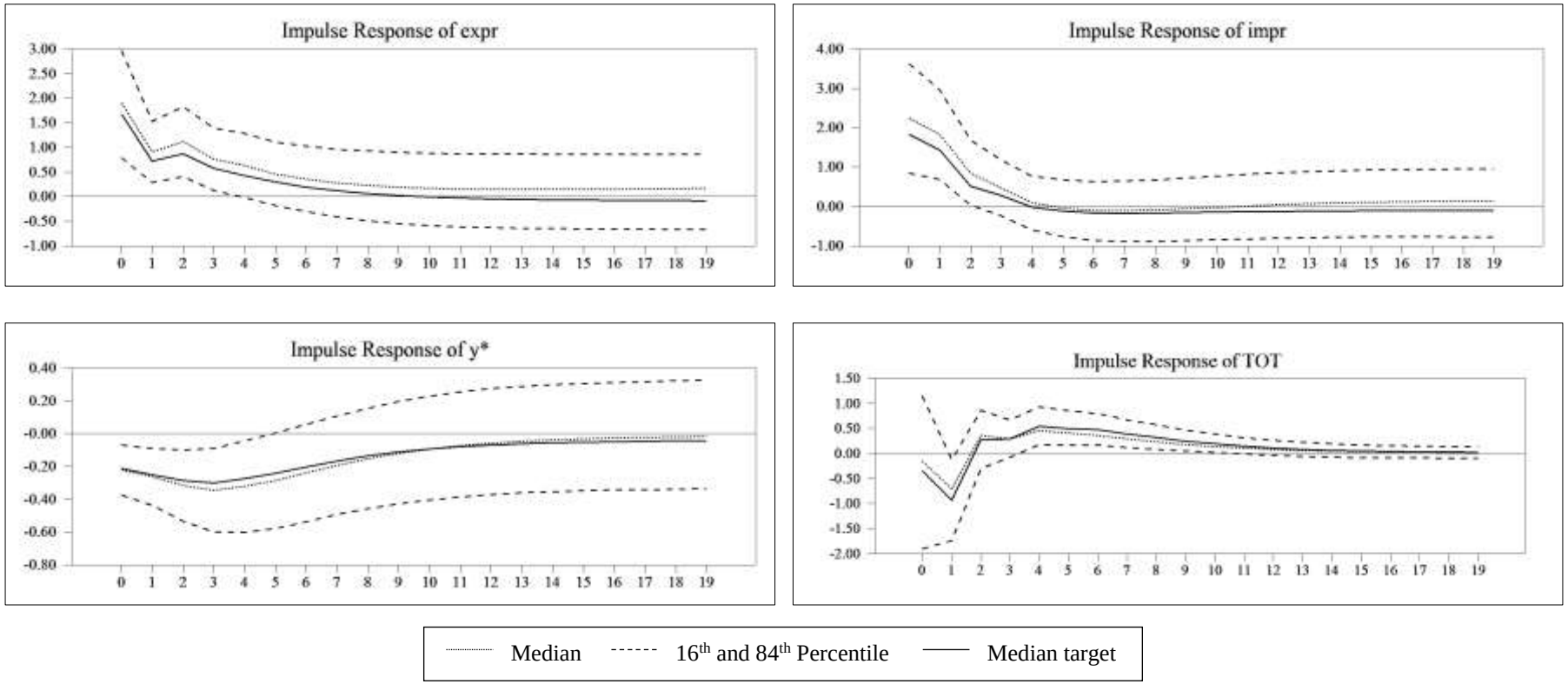
Import prices rise instantaneously by 2.0 per cent in response to a negative world supply shock but within three quarters prices declines more than the original level. On the other hand, export prices increase by approximately 1.5 per cent instantaneously. Consequently, the terms of trade of Sri Lanka deteriorates instantaneously by circa 0.5 per cent due to a world supply shock but after two quarters the negative effect reverses and terms of trade improves marginally until 10-12 quarters. World output declines by 0.3-0.4 per cent in response to a world supply shock, but recovers within 6 quarters.

Import prices decline for a very short period in response to a positive globalization shock but subsequently rise to a higher level than the original level permanently. The export prices also increase by about 1.0 per cent permanently due to a globalization shock. The impact response of the terms of trade to a globalization shock is positive and approximately 2.5-3.0 per cent in magnitude, which gradually recedes within three quarters to a level marginally lower than the initial level. The terms of trade reverts back to the original level only after 10-12 quarters. This result is in contrast to the findings for the Australian economy, where globalization shocks improve Australia's terms of trade permanently (Jääskelä and Smith, 2013). Impulse response function indicates that world output increases permanently by 0.75-1.0 per cent in response to a globalization shock.



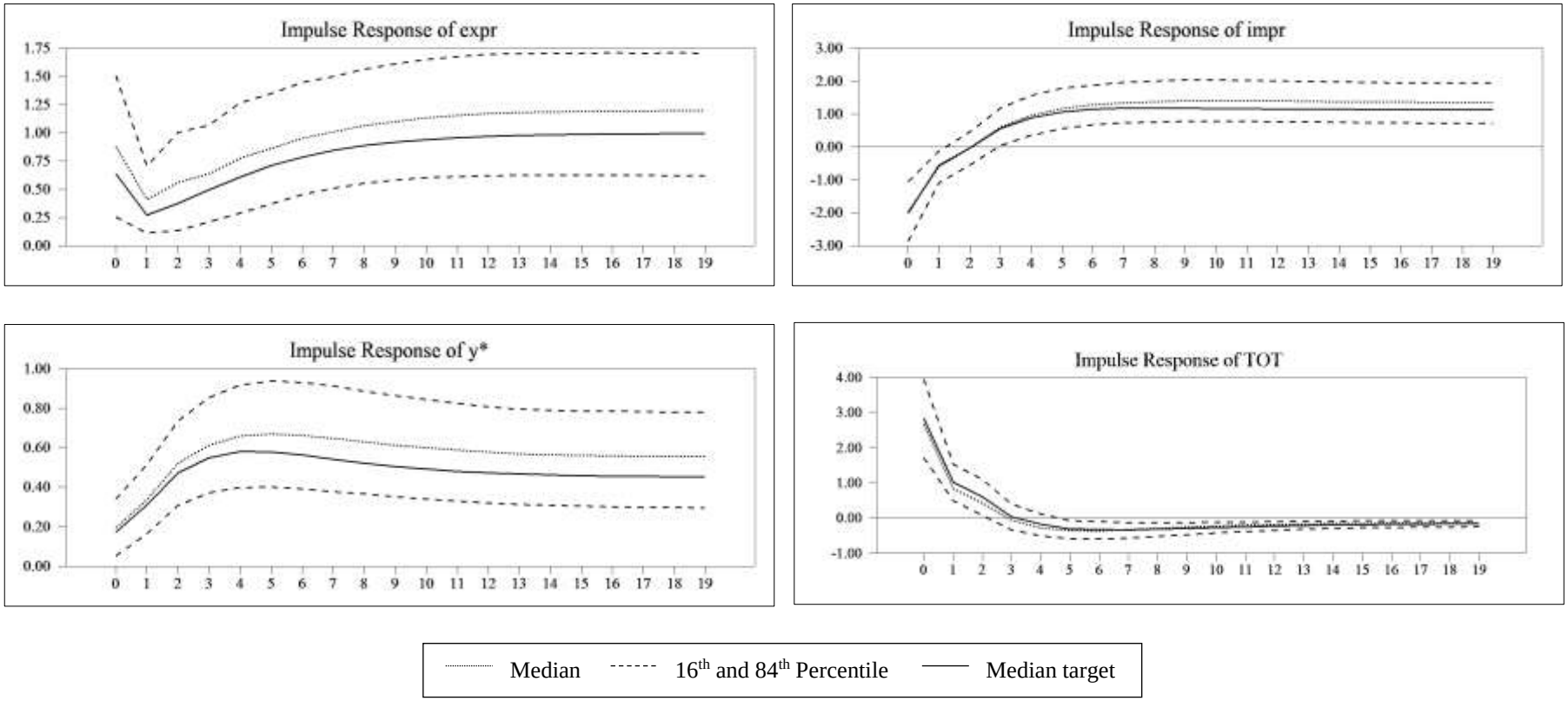
Note: Impulse responses of all variables are multiplied by 100 to obtain percentage increase.

Figure 2. Impulse Responses of Foreign Variables to a Positive World Demand Shock



Note: Impulse responses of all variables are multiplied by 100 to obtain percentage increase.

Figure 3 Impulse Responses of Foreign Variables to a Negative World Supply Shock



Note: Impulse responses of all variables are multiplied by 100 to obtain percentage increase.

Figure 4. Impulse Responses of Foreign Variables to a Positive Globalization Shock

3.1.2 Effects of World Demand Shocks on the Domestic Economy

Figure 5 shows the impulse response of domestic variables to a positive world demand shock. As mentioned earlier, the terms of trade of Sri Lanka deteriorates immediately after the world demand shock but recovers to the original level within four quarters. As per the median target measure, the real output of Sri Lanka declines only for one quarter but recovers quickly. The deterioration of the terms of trade affects the real GDP of a country through its negative effect on production. Even if the weakened terms of trade negatively affect real GDP instantaneously, increasing foreign demand under a world demand shock will counteract this negative effect leading to no significant change in real GDP after the first quarter.

Positive world demand shocks increase the domestic price level quickly and permanently through increased import prices. The median target indicates that the domestic interest rate decreases marginally, which is not sufficient enough to prevent initial real exchange rate appreciation. The real exchange rate appreciates by approximately 1.5 per cent during the first two quarters. However, the real exchange rate gradually depreciates over time and reaches the original level within 12 quarters. With the increasing domestic price levels, the short-term interest rate in Sri Lanka is increased marginally by the Central Bank.

3.1.3 Effects of World Supply Shocks on the Domestic Economy

The impulse responses of domestic variables to a negative world supply shock are depicted in Figure 6. The terms of trade of Sri Lanka deteriorates for two quarters due to a world supply shock, but quickly improves thereafter. The median target indicates that domestic output declines in response to a world supply shock and does not recover fully even after six quarters. This is in contrast to a world demand shock, where domestic output quickly recovers within a quarter. Under a positive world demand shock, the increasing world output offset the negative effect of weakened terms of trade. But the foreign output also declines during a negative world supply shock, which leads to reduced demand for domestic goods and lower domestic output. Even though the terms of trade improve after two quarters, the negative effect coming from the lower foreign output persists. Hence, domestic output does not reach the previous level even after 6 quarters. Therefore, negative world supply shocks have a relatively long-term effect on domestic output compared to world demand shocks.

While the terms of trade deteriorates initially due to a negative world supply shock, the domestic price level increases marginally. However, the domestic price level declines

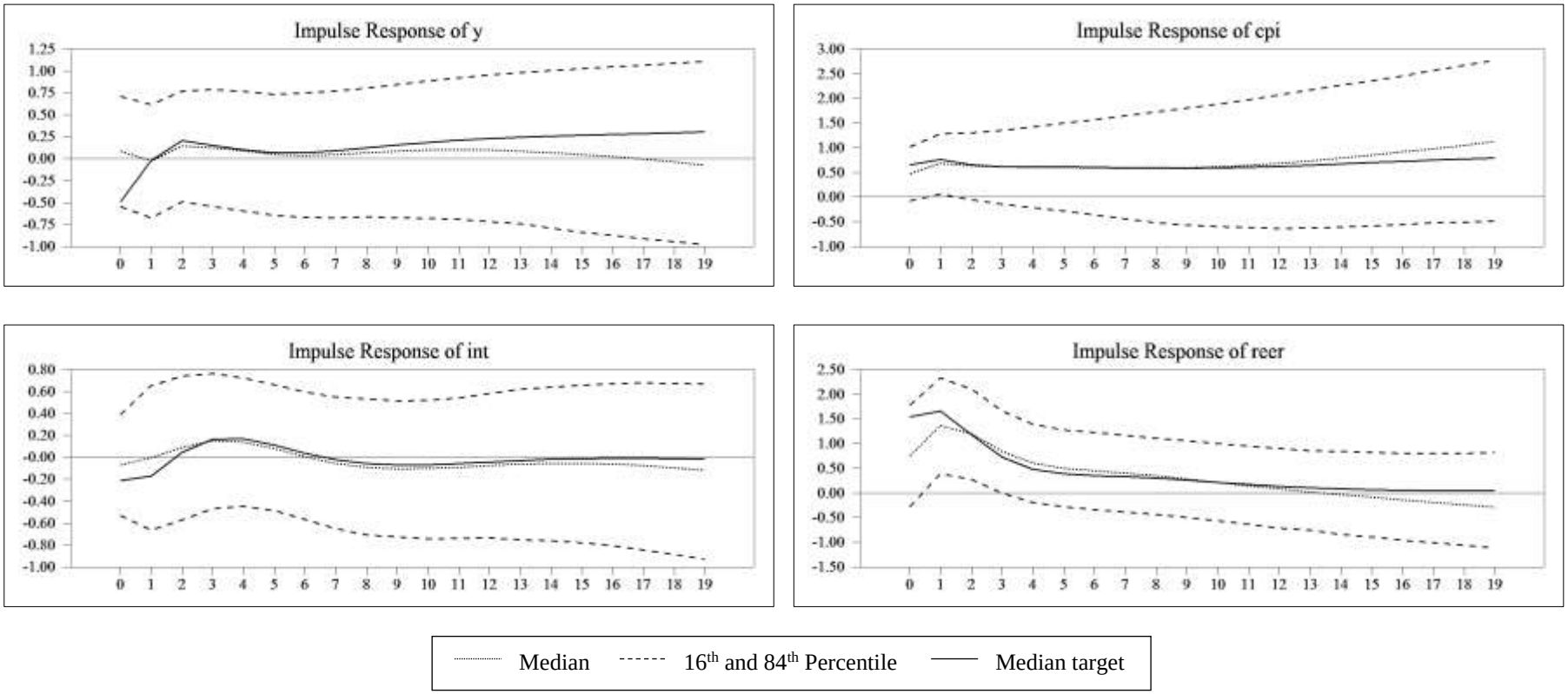
marginally with the improved terms of trade after two quarters. The domestic interest rate is gradually reduced to boost the domestic economy and the peak effect is observed in the sixth quarter. The real exchange rate appreciates instantaneously in response to a world supply shock though this appreciation is marginal. However, the real exchange rate gradually depreciates over time with the reduction in the domestic interest rate.

3.1.4. Effects of Globalization Shocks on the Domestic Economy

Figure 7 illustrates the impulse responses of the Sri Lankan variables to a positive globalization shock. The terms of trade of Sri Lanka improves instantaneously in response to a globalization shock but reverts back to a level marginally lower than the original level within three quarters. The median target measure indicates that domestic output increases by 0.25-0.5 per cent permanently in response to a positive globalization shock. The improvement in terms of trade and the increased world output positively affect the real GDP of Sri Lanka.

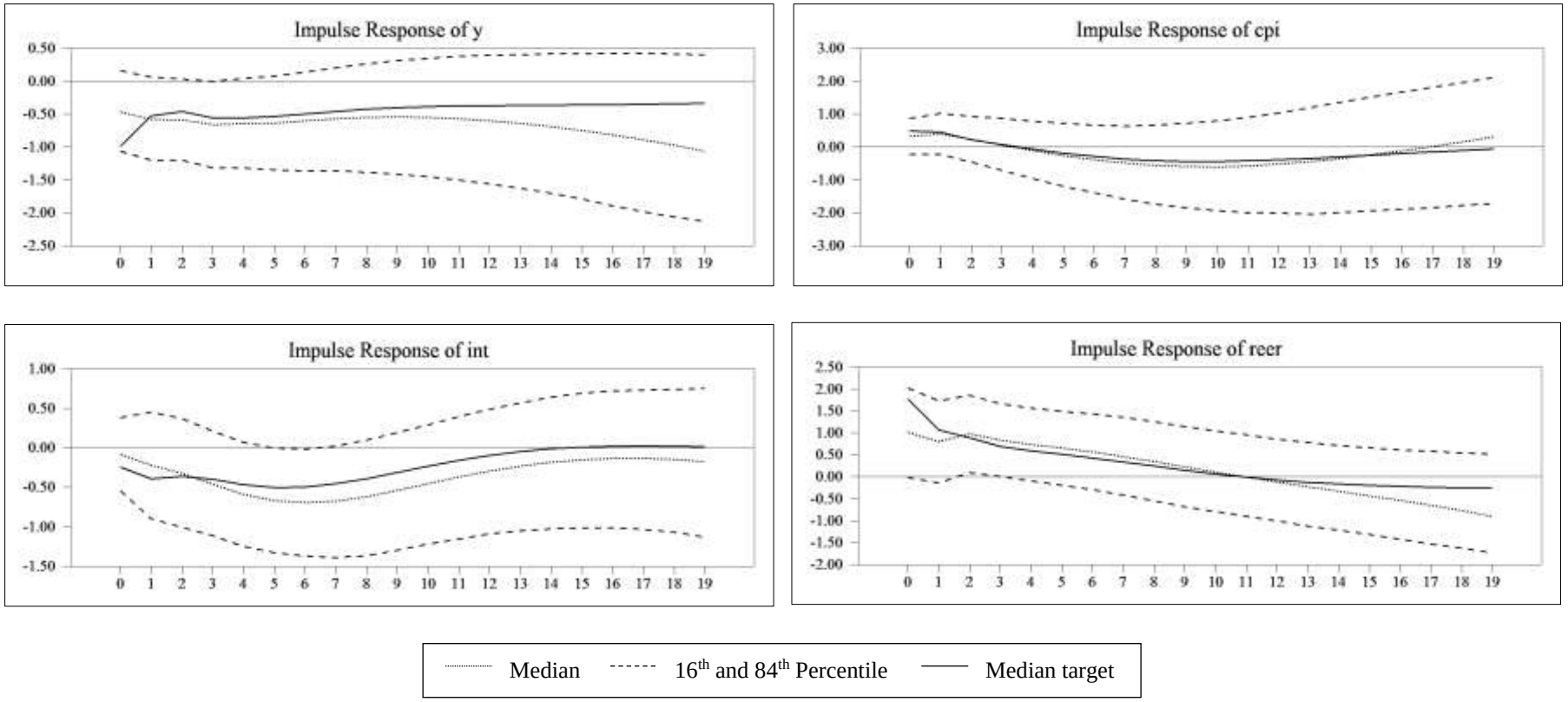
Positive globalization shocks are clearly inflationary and raise the domestic price level gradually. The increase in domestic prices is circa 1.0 per cent by the 12^{th} quarter. The Central Bank of Sri Lanka raises the domestic interest rate gradually to curb inflation. The maximum effect on the domestic interest rate is around 25 basis points and is observed in six to seven quarters after the globalization shock. As per the median target, the real exchange rate appreciates marginally instantaneously but depreciates more than the original state within two quarters. This is in contrast to a positive world demand shock, where real exchange rate appreciates considerably in the impact period and subsequently depreciates gradually over a relatively longer period.

In summary, both the positive world demand and negative world supply shocks deteriorate Sri Lanka's terms of trade instantaneously. However, the effects of the two shocks on the domestic variables are significantly different from each other. Therefore, not all negative terms of trade shocks faced by the Sri Lankan economy negatively affect domestic output. The positive globalization shocks improve the country's terms of trade for a shorter period. Both world demand and globalization shocks are inflationary, though the impact of globalization shock on the domestic prices is more prominent. Further, the Central Bank of Sri Lanka responds differently to the three shocks. Initially, the bank reduces the domestic interest rate under all three shocks but this decrease is not sufficient to prevent the initial real exchange rate appreciation. The Central Bank reduces the domestic interest rate further under a world supply



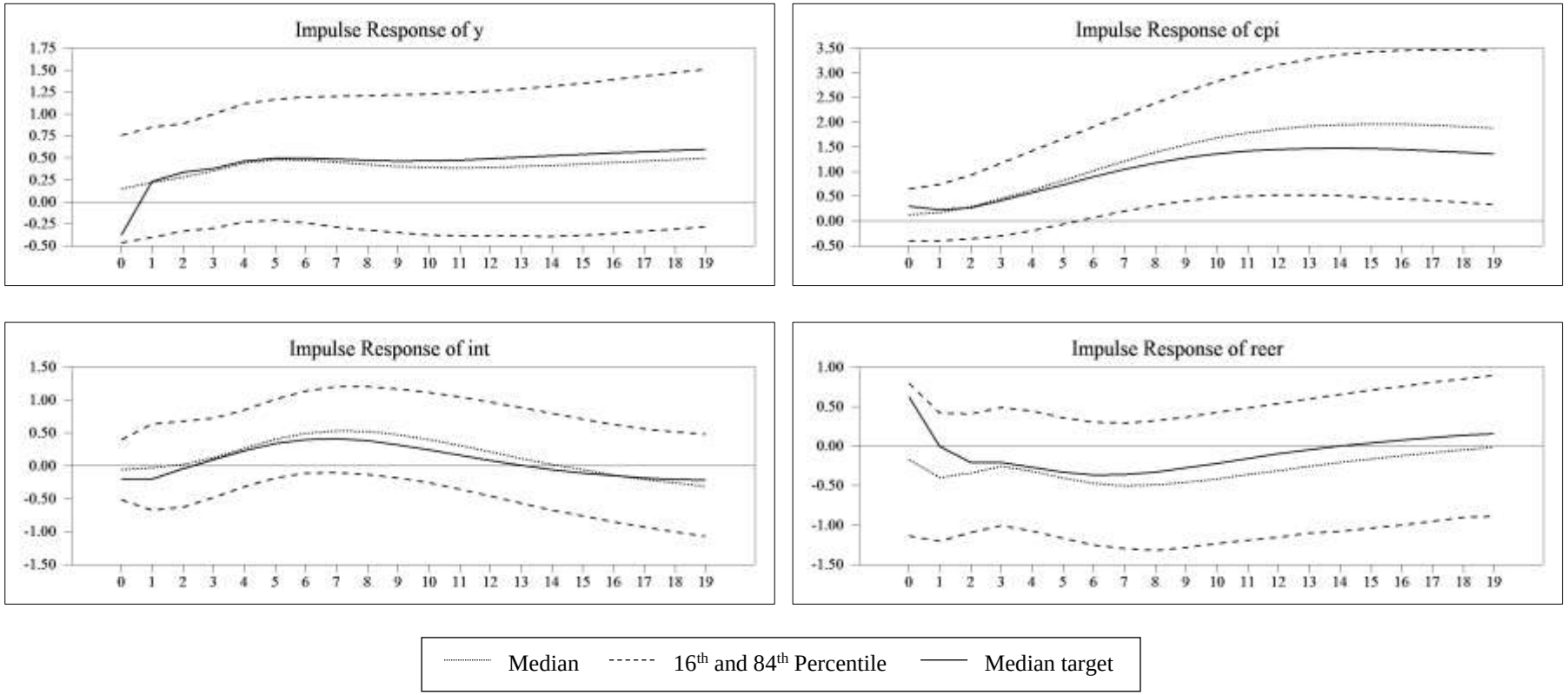
Note: Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

Figure 5. Impulse Responses of Domestic Variables to a Positive World Demand shock



Note: Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

Figure 6 Impulse Responses of Domestic Variables to a Negative World Supply shock



Note: Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

Figure 7 Impulse Responses of Domestic Variables to a Positive Globalization Shock

shock to prevent output contraction. On the other hand, the Central Bank of Sri Lanka increases the domestic interest rate after two quarters to curb the increasing inflation under world demand and globalization shocks. The increase in domestic interest rate is much higher under a positive globalization shock compared to a positive world demand shock.

3.2 Forecast Error Variance Decomposition

The impulse responses indicate how each variable in the model would behave in response to a particular shock. On the other hand, the error variance decomposition shows how important each shock is in explaining the fluctuations in the variables in the model. Table 3 summarizes the estimates of the average fraction of variance in domestic variables attributable to the three foreign shocks.

Table 3. Forecast error variance decomposition

Variable	Time horizon	Source of Disturbance		
		World demand shock	World supply shock	Globalization shock
y	1-4	12 (6,21)	13 (7,23)	12 (6,22)
	5-8	13 (8,20)	14 (9,21)	13 (8,20)
	9-12	13 (8,20)	14 (9,21)	13 (8,20)
cpi	1-4	14 (6,26)	13 (6,24)	10 (5,19)
	5-8	14 (8,22)	14 (8,21)	12 (7,18)
	9-12	14 (8,21)	14 (8,21)	13 (8,19)
int	1-4	11 (5,23)	11 (5,24)	11 (5,24)
	5-8	13 (7,21)	13 (8,21)	12 (7,20)
	9-12	13 (8,20)	14 (9,20)	13 (8,19)
$reer$	1-4	15 (8,23)	13 (7,21)	12 (7,20)
	5-8	15 (9,22)	13 (8,19)	13 (8,19)
	9-12	14 (9,21)	13 (8,19)	13 (8,19)

Note: Figures in parenthesis are the 16^{th} and 84^{th} per centile values, respectively

The error variance decomposition indicates all three external shocks are equally important for the variance in domestic output. On average, 39 per cent of the variation in domestic output is explained by foreign shocks. The world demand and world supply shocks are marginally more important than the globalization shocks for the variation in domestic price levels. The foreign shocks contributed to 39 per cent of the fluctuations in domestic prices.

The interest rate is less affected by the external shocks during the first year with only 33 per cent of the variance in the interest rate explained by the three foreign shocks. However, their effect increases over time, and by the third year, external shocks account for 40 per cent of the fluctuations in the domestic interest rate. The world demand shocks are marginally more important for the variance in the real exchange rate compared to the other two foreign shocks. On average, 40 per cent of the fluctuations in the real exchange rate can be attributed to the external shocks.

The fraction of variance of the domestic output and price levels explained by the foreign shocks is considerably higher for the Sri Lankan economy in comparison to the findings of Jääskelä and Smith (2013) and Karagedikli and Price (2012) for the Australian and New Zealand economies. Jääskelä and Smith (2013) assert that the foreign shocks underlying the terms of trade movement account for 29 per cent of variation in the output and 27 per cent of variation in domestic inflation in Australia. According to Karagedikli and Price (2012), 20 per cent of the variation in New Zealand output, and 30 per cent of CPI is explained by the foreign shocks.

On the other hand, foreign shocks contribute to 76 per cent of the variation in the real exchange rate of Australia (Jääskelä and Smith, 2013). The same figure is 40 per cent for the New Zealand economy. Jääskelä and Smith (2013) assert that the floating exchange rate regime insulates the Australian economy from the external shocks, which can be explained by the lower fraction of variance of the output and inflation and higher fraction of variance of the real exchange rate attributable to the foreign shocks. The same explanation could be applied to the New Zealand economy as well.

However, external shocks underlying the terms of trade fluctuations explain more-or- less an equal fraction of the variance of domestic output, the price level and real exchange rate of Sri Lanka. Sri Lanka adopted a managed floating exchange rate regime during the sample period and, as a result, domestic output and the price level were more vulnerable to foreign shocks.

Therefore, compared to the free-floating exchange rate regime in Australia and New Zealand, the managed floating exchange rate regime in Sri Lanka has been less efficient in insulating the domestic economy from external shocks.

Jääskelä and Smith (2013) suggest that world demand and commodity specific shocks are more important for the Australian economy than globalization shocks. Further, the error variance decomposition shown by Karagedikli and Price (2012) indicate that world demand shocks are more important for the variation in domestic interest rate and exchange rate than the other shocks, though all three shocks are more or less equally important in explaining New Zealand's output and inflation. This study shows that all three external shocks play an equally important role in explaining the fluctuations in Sri Lankan macroeconomic variables.

3.3 Historical Decomposition

The forecast error variance decomposition only shows the overall effect of foreign shocks on domestic macroeconomic variables. Even if the overall impact of a particular shock is smaller, its effect may be more significant during certain sub-periods. The historical decomposition technique evaluates the importance of different external shocks within specific time periods by attributing the error variance of the domestic variables to each structural shock. Figure 8 illustrates the accumulated effect of each external shock on the domestic variables using historical decomposition for the 2004 to 2014 period.

3.3.1. Foreign Variables

Foreign output has declined during the mid-2008 to mid-2009 period due to negative world demand shocks and this period coincides with the economic slow-down in most countries around the world due to the global financial crisis. However, globalization shocks have positively contributed to foreign output during the mid-2008 to 2013 period.

Between 2007 and mid-2009 world demand shocks have significantly contributed to the fluctuations in both export and import prices in Sri Lanka. Both import prices and export prices increased considerably from 2007 to the first quarter of 2008 due to increased world demand. However, world commodity prices, including petroleum prices, sharply declined in the second half of 2008 to the first half of 2009 due to the dampened global demand caused by the global financial crisis. As a result, both import prices and export prices of Sri Lanka have declined

during this period. Globalization shocks have positively affected export and import prices since mid-2008.

3.3.2. Domestic Variables

Since 2007, the effect of globalization shocks on the domestic output has been more prominent. World demand shocks also positively contributed to domestic output variance since 2010. The foreign output variable consists of output of major trading partners of Sri Lanka, including India and Chin, which have shown remarkable growth despite the economic slow-down in advanced economies during this period. Therefore, the economic growth of emerging markets has positively contributed to the growth in Sri Lanka's output since 2007.

Forecast error variance for the full sample period suggests that world demand and world supply shocks are marginally more important than globalization shocks for domestic price levels. However, globalization shocks have contributed more to the increase in domestic price levels since 2007. On the other hand, the accumulated effect of world supply shocks on the domestic CPI has been considerable during the 2007 to 2011 period. The sharp increase in global oil prices in 2007 had a considerable long-term effect on domestic prices. All three shocks contributed equally to the rise in domestic interest rates in 2007 while demand shocks had a more prominent effect than the other two foreign shocks on the real exchange rate of Sri Lanka since 2006.

4. External Shocks and Trade

Neither Jääskelä and Smith (2013) nor Karagedikli and Price (2012) have considered the effect of terms of trade movements on the trade balance. However, exports and imports and the trade balance of a country are the first variables to be affected by terms of trade fluctuations. Therefore, the baseline model of this essay is extended by including additional trade variables to the model.

First, the model is re-estimated with the trade balance in the domestic sector, so that $w_t' = (expr_t, impr_t, y_t^*)$ and $d_t' = (tb_t, y_t, cpi_t, int_t, reer_t)$, where tb is the trade balance. Trade balance is defined as the exports to imports ratio and is converted into natural logarithms. The Augmented Dicky-Fuller, Phillip Peron and KPSS tests suggest that tb is a *I(1)* variable. Eigen values confirm that the model is stable. Second, the model is re-estimated with exports and

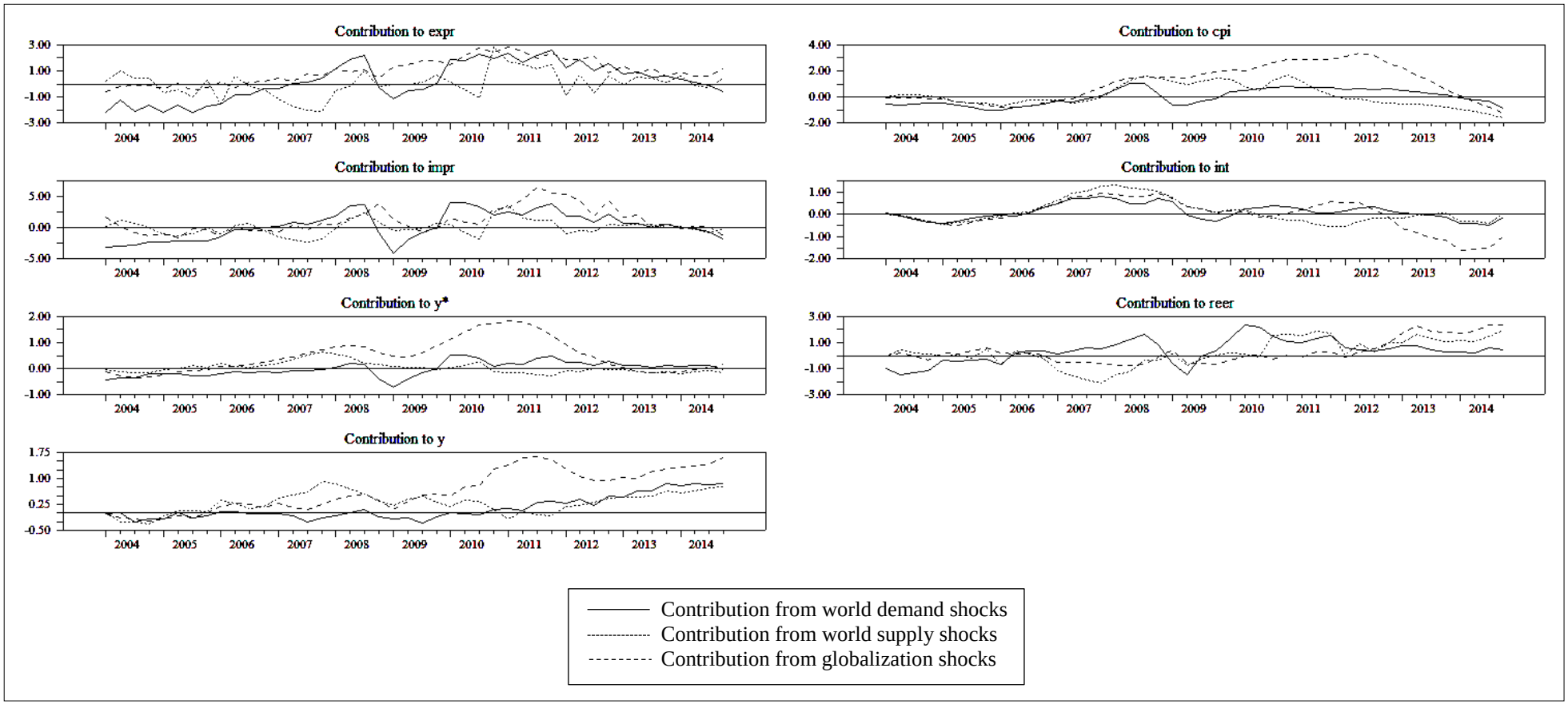


Figure 8. Historical Decomposition (Baseline Model)

imports variables in the domestic sector instead of the trade balance. Accordingly, $w_t' = (expr_t, impr_t, y_t^*)$ and $d_t' = (ex_t, im_t, y_t, cpi_t, int_t, reer_t)$ where ex is the total exports and im is the total imports of Sri Lanka. Both variables are in natural logarithms and are *I(1)* variables. The model meets stability conditions.

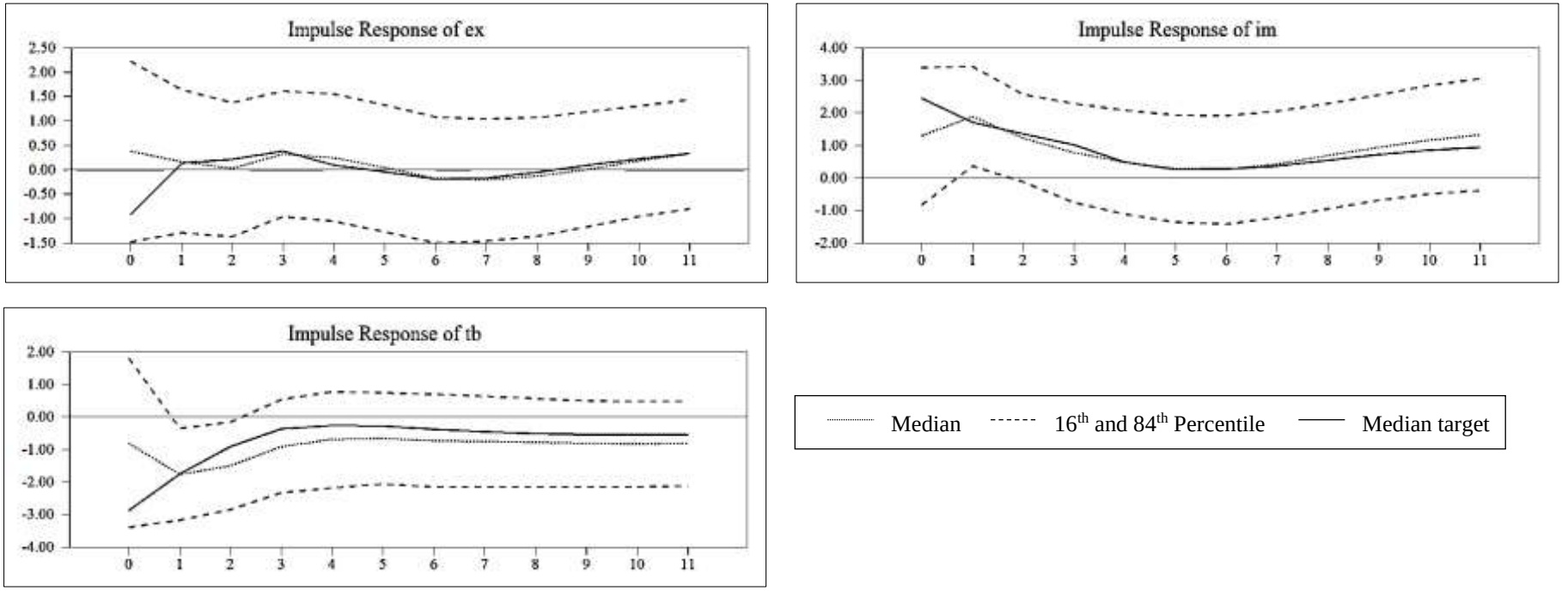
4.1. Impulse Responses

Impulse responses of all other variables in the two extended models are very similar to the baseline model and hence will not be repeatedly shown in the essay. Instead, impulse responses of trade balance, exports and imports to three external shocks are presented in Figures 9, 10 and 11 below.

As depicted in Figure 2 in Section 3, the terms of trade of Sri Lanka deteriorates in response to a positive world demand shock with import prices increasing more than export prices. The world demand for Sri Lankan exports seems to be more price elastic than the domestic demand for imports. As per the median target measure, Sri Lanka's exports marginally decline due to a world demand shock instantaneously. On the other hand, demand for imported goods in Sri Lanka is relatively less price elastic, which results in an approximately 2.5 per cent increase in the total value of imports. Although the exports sector of Sri Lanka recovers within a quarter, the cost of imports reaches the original level only after four quarters. As a result the trade balance worsens for about three quarters in response to a world demand shock.

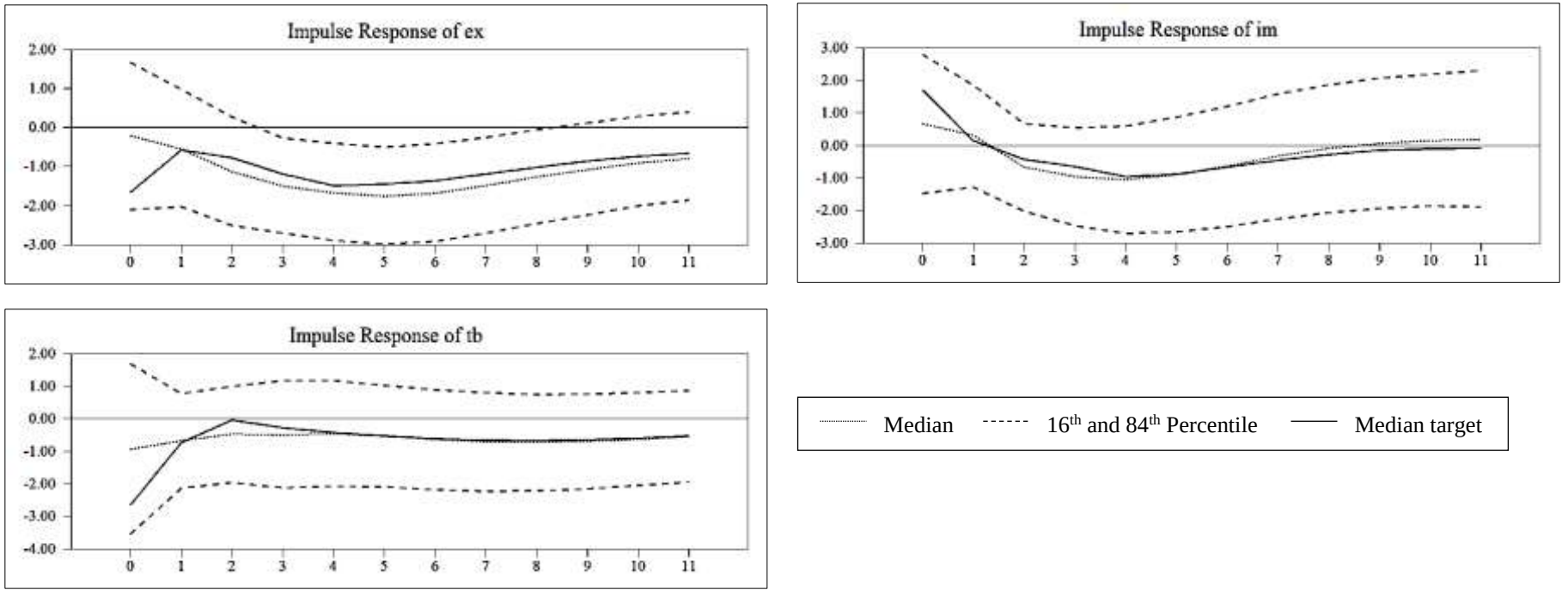
A negative world supply shock also results in an instantaneous terms of trade deterioration. The decline in the output of major trading partners due to a world supply shock results in a significant 1 per cent decrease in the export sector of Sri Lanka for a considerably longer period. On the other hand, the total value of imports also declines after one quarter, which will reach the original level only after eight quarters. Therefore, the trade balance worsens initially but recovers rapidly.

As Figure 4 illustrates, the terms of trade of Sri Lanka improves for a period of three quarters in response to a positive globalization shock. As per the median target, the exports earnings decline while import costs remains the same in the impact quarter, leading to a worsening of trade balance. However, trade balance recovers rapidly with the gradual increase in the country's exports. Unlike in the world demand shock, both the imports and exports of Sri



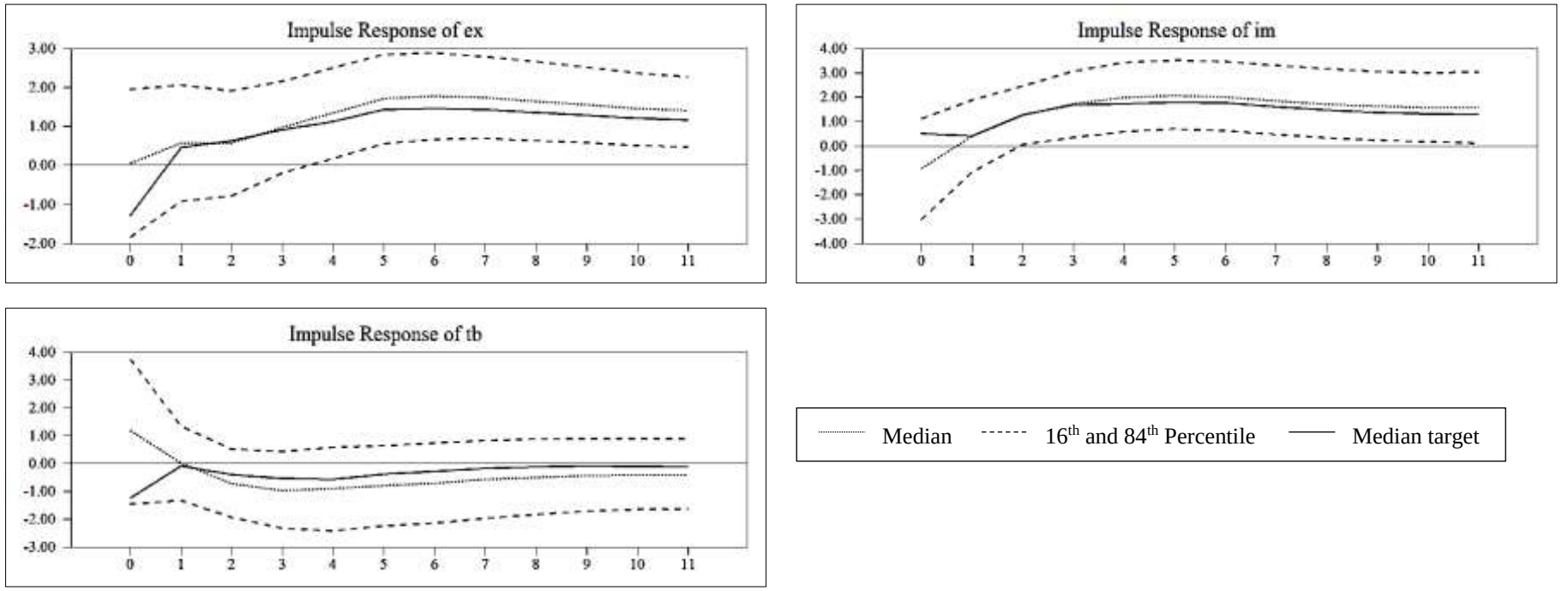
Note: Impulse responses of all variables are multiplied by 100 to obtain percentage increase.

Figure 9. Impulse Responses of the Trade Related Variables to a Positive World Demand Shock



Note: Impulse responses of all variables are multiplied by 100 to obtain percentage increase.

Figure 10. Impulse Responses of the Trade Related Variables to a World Supply Shock



Note: Impulse responses of all variables are multiplied by 100 to obtain percentage increase.

Figure 11. Impulse Responses of the Trade Related Variables to a Globalization Shock

Lanka permanently increase by 1 per cent due to a globalization shock.

Figure 12 shows the historical decomposition of the trade balance, exports and imports of Sri Lanka. The trade balance notably improved during the second half of 2008 but subsequently deteriorated till 2013. The main contributor to this movement was the world demand shocks. World demand declined substantially in the 2008-2009 period due to the global financial crisis, leading to a sharp decline in petroleum prices. Consequently, import costs declined considerably during this period. Although the export sector was negatively affected due to reduced demand for Sri Lankan goods from the global markets, the decline in import prices out-weighed this negative effect leading to an improvement in the trade balance of Sri Lanka in late 2008. However, with the gradual recovery of import prices, the negative demand shocks arising from advanced economies have worsened the trade balance since the mid-2009. On the other hand, globalization shocks have increased both imports and exports particularly since 2010. Yet, the increase in imports is higher than the increase in exports leading to a further deterioration in trade balance since 2010.

5. Robustness check

The results in Sections 3 are based on a baseline VAR model with two lags and sign restrictions holding for one quarter. In order to check the robustness of the results in Section 3, the VAR model was fitted with alternative lag lengths (i), and periods in which sign restrictions are imposed (k). Figure D.1 to Figure D.12 in Appendix D show the impulse responses of world and domestic variables when $i = 1, i = 2, i = 3$ and $i = 4$, respectively. Each graph represents how the impulse responses would behave when $k = 1, k = 2, k = 3$ and $k = 4$. As the figures indicate, the impulse responses are similar, except for the different times when peaks and troughs occur. This suggests that the main results of the essay are robust for alternative specifications.

6. Conclusion

Numerous studies have shown that the terms of trade plays a key role in explaining the variance in output growth, savings, consumption and trade balance of small open economies. Jääskelä and Smith (2013) argue that the effect of the terms of trade on the economy depends on the nature of the underlying structural shocks. Therefore, this study has investigated the impact of

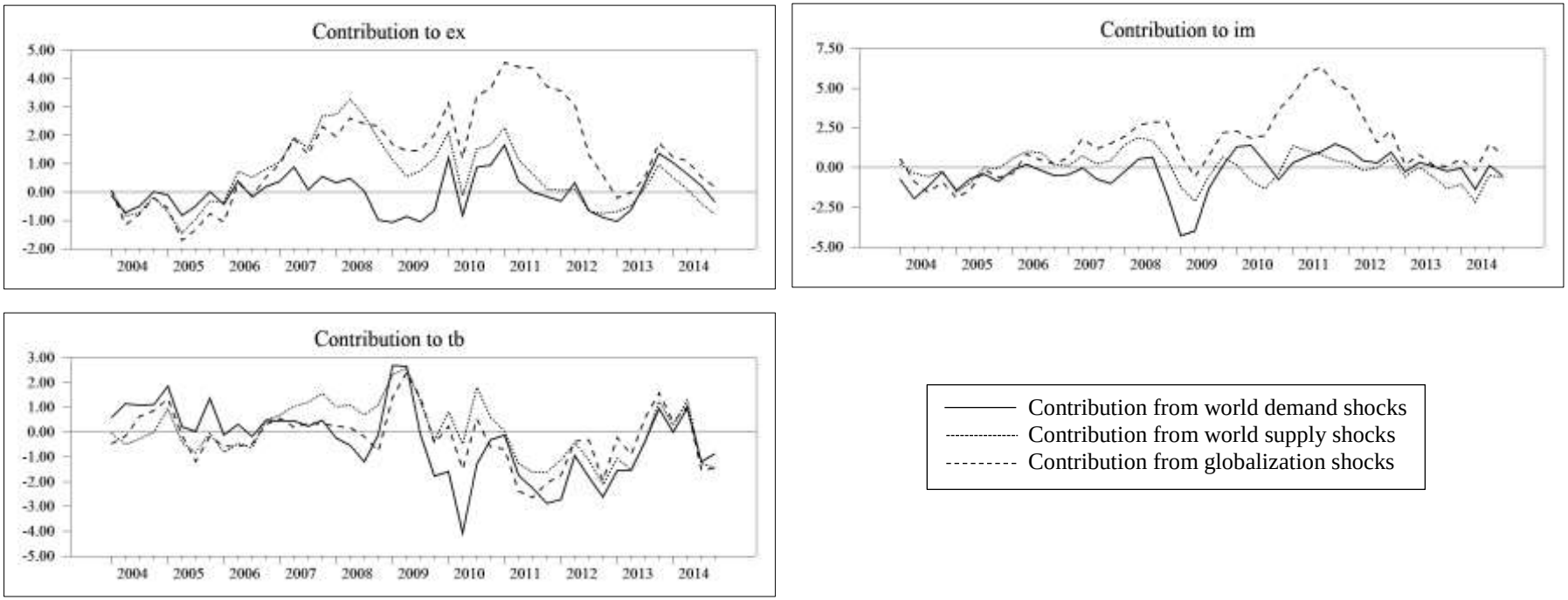


Figure 12. Historical Decomposition of the Trade Balance, Exports and Imports

external shocks, which trigger terms of trade movements, on the Sri Lankan economy using a VAR model with sign restrictions.

Positive world demand shocks and negative world supply shocks deteriorate the terms of trade instantaneously, though terms of trade improves after two quarters with the world supply shock. In contrast, positive globalization shocks improve the terms of trade temporarily. However, none of these shocks have a permanent effect on the country's terms of trade.

World demand shocks do not have a significant long-term effect on Sri Lanka's real GDP, but negative world supply shocks are contractionary. Globalization shocks increase the domestic output permanently along with world output, which suggests that the growth in emerging markets has a positive impact on Sri Lanka's real GDP. Both positive world demand shocks and globalization shocks are inflationary increasing domestic price levels permanently. On the other hand, negative world supply shocks increase domestic prices initially but reduce the price level after two quarters when the terms of trade improve for the country. In all three cases, the real exchange rate appreciates instantaneously, but it depreciates rapidly under a globalization shock. In contrast, real exchange rate gradually depreciates with the world demand and world supply shocks. The Central Bank of Sri Lanka responds to the three shocks differently. The domestic interest rate decreases instantaneously under all three shocks but subsequently the Bank will raise the domestic interest rate under world demand and globalization shocks to control domestic inflation. On the other hand, the Central Bank will reduce the domestic interest rate further to boost the economy under a world supply shock.

All three shocks result in a deterioration of trade balance of Sri Lanka in the impact period, but the effect is not persistent. However, positive globalization shocks permanently and significantly raise both the imports and exports of the country. In contrast, Sri Lanka's exports decline significantly for a considerably long period due to world supply shocks. However, world supply shocks do not worsen the trade balance significantly in the long-run.

All three foreign shocks are equally important for the variance in domestic output. When the full sample period is considered, world demand and world supply shocks are marginally more important than globalization shocks for the variation in domestic price levels. However, historical decomposition indicates that globalization shocks had a prominent impact on domestic price levels and real GDP since 2007. Foreign shocks have contributed to 39 per cent

of the fluctuations in both domestic output and prices. World demand shocks have largely contributed to the fluctuations in trade balance since 2007, whereas the importance of globalization shocks on the imports, exports and trade balance has increased since 2010.

In general, the fraction of error variance explained by foreign shocks is more or less equal for all domestic variables. Further, the external shocks play a larger role in explaining domestic output and price levels in Sri Lanka compared to Australian and New Zealand economies. This indicates that the managed floating exchange rate regime of Sri Lanka is less efficient in insulating the domestic economy from the external shocks compared to the flexible floating exchange rate regime in Australia and New Zealand.

The findings of this essay affirm that the effect of terms of trade movements on the domestic economy depends on the nature of the underlying external shocks. Therefore, this study highlights the importance of modelling the terms of trade of a small open economy as an endogenous variable within the global economy instead of as a shock orthogonal to other foreign variables.

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Appendix A. Data Description and Data Sources

$\boldsymbol{expr}$ = Quarterly chain-linked Merchandise Export Unit Value Index (2010=100) of Sri Lanka is seasonally adjusted using Census X-12 method and is multiplied by ($reer_t/100$) where $reer$ is the quarterly chain-linked real effective exchange rate (2010=100) series.
(Data source: Central Bank of Sri Lanka)

$\boldsymbol{impr}$ = Quarterly chain-linked Merchandise Import Unit Value Index (2010=100) of Sri Lanka is seasonally adjusted using Census X-12 method and is multiplied by ($reer_t/100$) where $reer$ is the quarterly chain-linked real effective exchange rate (2010=100) series.
(Data source: Central Bank of Sri Lanka)

$\boldsymbol{y^w}$ = Quarterly trade weighted-GDP of the major trading partners of Sri Lanka is compiled by the author using different data series and sources. Based on the total annual average trade (i.e. both import and exports) during 2005-2014, top thirteen major trading partners of Sri Lanka is selected. The trading partner countries selected are India, United States of America (USA), China, Singapore, United Kingdom, United Arab Emirates (UAE), Islamic Republic of Iran, Japan, Italy, Germany, Belgium, Malaysia and Hong Kong.

Trade weights-
The trade weights are calculated as below.

$$TW_j = \frac{[\sum_{t=2005}^{2014}(exports_{t,j} + imports_{t,j})]/10}{\sum_{j=1}^{13}([\sum_{t=2005}^{2014}(exports_{t,j} + imports_{t,j})]10)} \quad \text{(A.1)}$$

where TW_j is the trade weight of country j; $exports_{t,j}$ is the exports to country j by Sri Lanka in period t; $imports_{t,j}$ is the imports from country j by Sri Lanka in period t.
(Data source: Direction of Trade Statistics database of IMF)

Real GDP of USA – Seasonally adjusted annualized chain-linked quarterly real GDP series (2010=100) in terms of US Dollars is used (data source: OECD database).

Real GDP of Belgium, India, Germany, Italy, Japan and UK – Seasonally adjusted annualized chain-linked quarterly real GDP series (2010=100) in terms of home-country currency (data source: OECD database) are converted in to US Dollar terms using quarterly average exchange rate of each country (data source: IFS database of IMF).

GDP of China – A chained-linked real quarterly GDP series in Ren Min Bi (RMB) term (2010=100) is compiled using quarterly nominal GDP of China (data source : CEIC Global database, data code: 369703417 (CAASNW)) for 2000-2014 period, quarterly GDP deflator (2010=100) of China (CEIC Global database, data code : 324175801) for 2000-2014 period and real quarterly Chinese GDP growth rate for 1997-1999 period (Tilak Abeysinge's homepage - http://courses.nus.edu.sg/course/ecstabey/Tilak.html). The series is seasonally adjusted using Census X-12 method and was converted to US Dollar term using quarterly average USD to RMB exchange rate (CEIC Global data code: 229434801) and later, the series is annualized.

Real GDP of Singapore - Seasonally adjusted chain-linked quarterly real GDP series (2010=100) in terms of Singapore Dollars (data source: CEIC Global database, data code: 359342347) is converted in to US Dollar terms using quarterly average exchange rate of Singapore (data source: CEIC Global database, data code: 225355201). Then the series is annualized.

Real GDP of Malaysia - *C*hain-linked quarterly nominal GDP series (2010=100) in terms of Malaysian Ringgit (data source: CEIC Global database, data code: 225122401) and the quarterly GDP deflator (2010=100) is used to compile a quarterly real GDP series for Malaysia. Then the series is seasonally adjusted using Census X-12 method and is converted in to US Dollar terms using quarterly average exchange rate of Malaysia (data source: CEIC Global database, data code: 225041001). After that, the series is annualized.

Real GDP of Hong Kong - *C*hain-linked quarterly real GDP series in terms of Hong Kong Dollar is created through data splicing technique using quarterly real GDP series (2010=100) of Hong Kong (data source: CEIC Global database, data code: 324317101 (HAVVABA)) and quarterly real GDP series (2012=100) of Hong Kong (data source: CEIC Global database, data code: 354569587 (HAVVAMAAAAAARK)). Then the series is seasonally adjusted using Census X-12 method and is converted in to US Dollar terms using quarterly average exchange rate of Hong Kong (data source: CEIC Global database, data code: 224652301).

Real GDP of UAE and Iran – Quarterly GDP data are not available for both UAE and Iran. Hence, annual real GDP (2010=100) series in US Dollar term (data source: CEIC Global database, for UAE - data code: 377889307 and for Iran – data code: 377890327) are used to

obtain an interpolated quarterly real GDP series for the two counties. Cubic spline (cubic-match-last) technique in Eviews is used to create the interpolated series. Both series are seasonally adjusted using Census X-12 method.

The compiled quarterly real GDP series (2010=100) in US Dollar term for each of the major trading partners are used to compile the aggregate trade weighted-GDP:

$$y_t^w = \sum_{j=1}^{13}(TW_j * RealGDP_{j,t}) \quad \text{(A.2)}$$

$\boldsymbol{y}$ = A chain-linked quarterly real GDP (2010=100) series for Sri Lanka is created using quarterly real GDP series (2000=100), quarterly real GDP series (2006=100) and quarterly real GDP series (2010=100). Series are seasonally adjusted using Census X-12 method. (Data source: Central Bank of Sri Lanka)

$\boldsymbol{cpi}$= Consumer price index of Sri Lanka is seasonally adjusted using Census X-12 method. (Data source : IFS database of IMF)

$\boldsymbol{int}$ = Short-term government securities rate. (Data source: IFS database of IMF)

$\boldsymbol{reer}$ = Real effective exchange rate (2010=100). (Data source: Central Bank of Sri Lanka)

$\boldsymbol{tb}$ = Trade balance was calculated using imports and exports of Sri Lanka. TB is specified as exports/imports. (Data source: IFS database of IMF)

$\boldsymbol{ex}$ = Chained linked export value index was calculated based on Exports value index (base=1997) and Exports value index (base=2010) (Data source: CEIC Global database, data code: 30920601(LIOK) and 325289302(LIDBA))

$\boldsymbol{im}$ = Chained linked import value index was calculated based on Imports value index (base=1997) and Imports value index (base=2010) (Data source: CEIC Global database, data code: 30940801(LIOQ) and 325290702(LIDBB)).

Appendix B. Foreign and Domestic Data

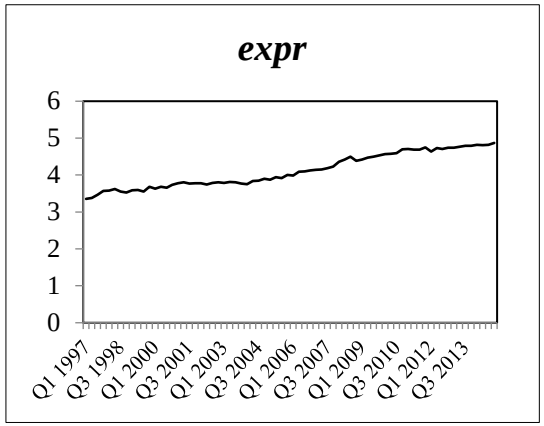


Figure B.1 Export Prices

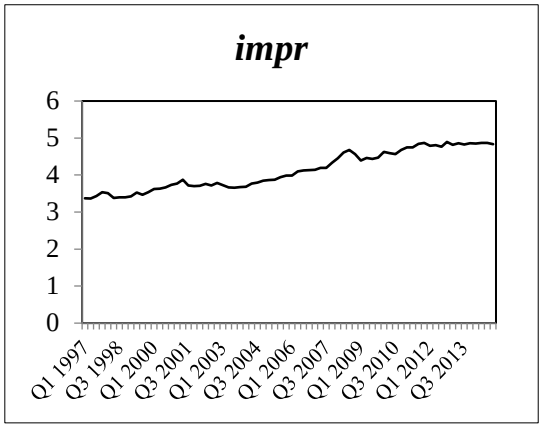


Figure B.2 Import Prices

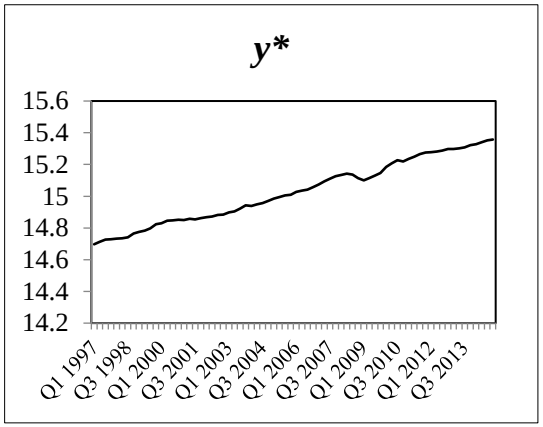


Figure B.3 Foreign Output

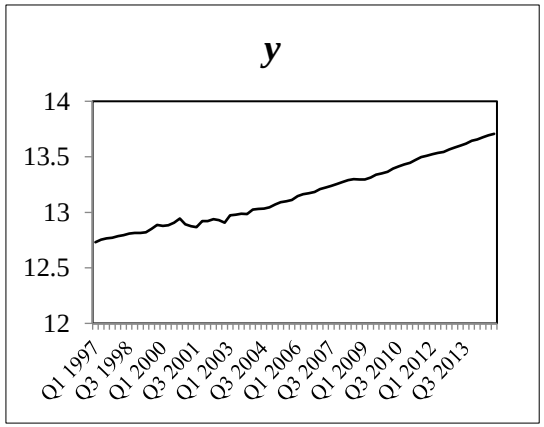


Figure B.4 Domestic output

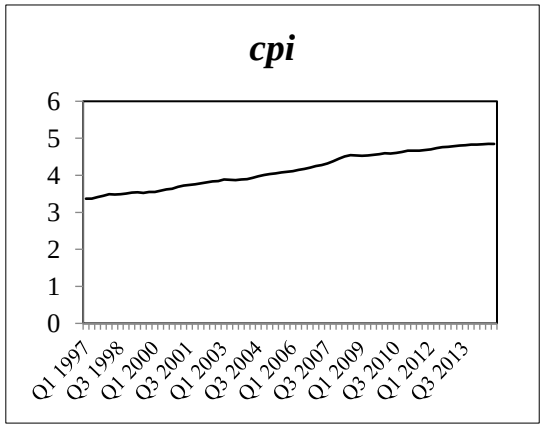


Figure B.5 Domestic prices

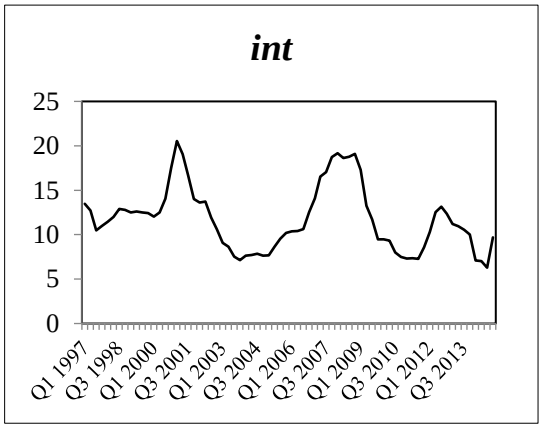


Figure B.6 Domestic interest rate

Note : All data except interest rate are in natural logarithm. Interest rate is in percentages.

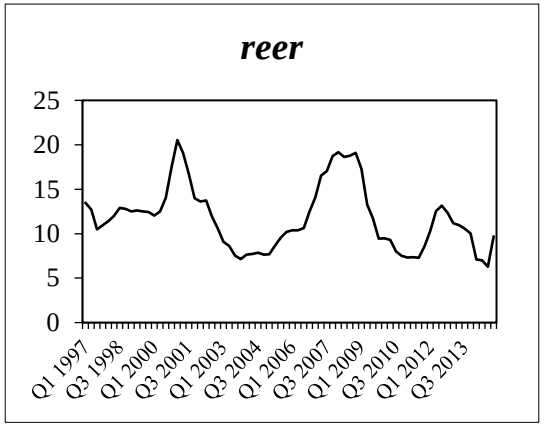


Figure B.7 Real Effective Exchange Rate

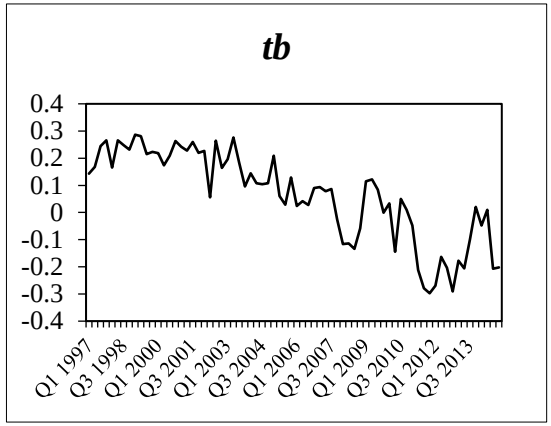


Figure B.8 Trade Balance

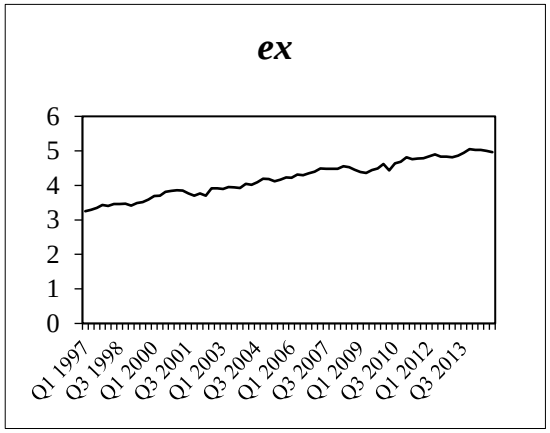


Figure B.9 Exports

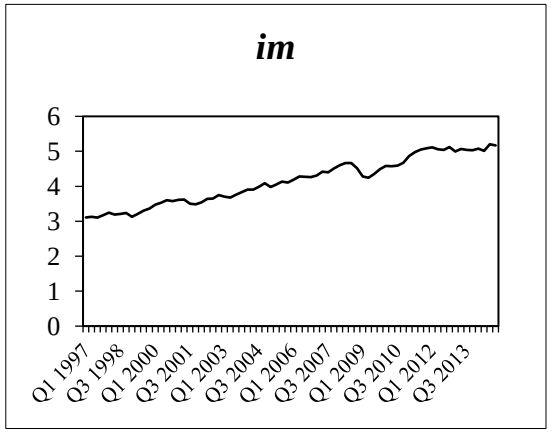


Figure B.10 Imports

Note : All data are in natural logarithm.

Appendix C. Unit root tests

Table C.1 Summary of Unit Root Tests

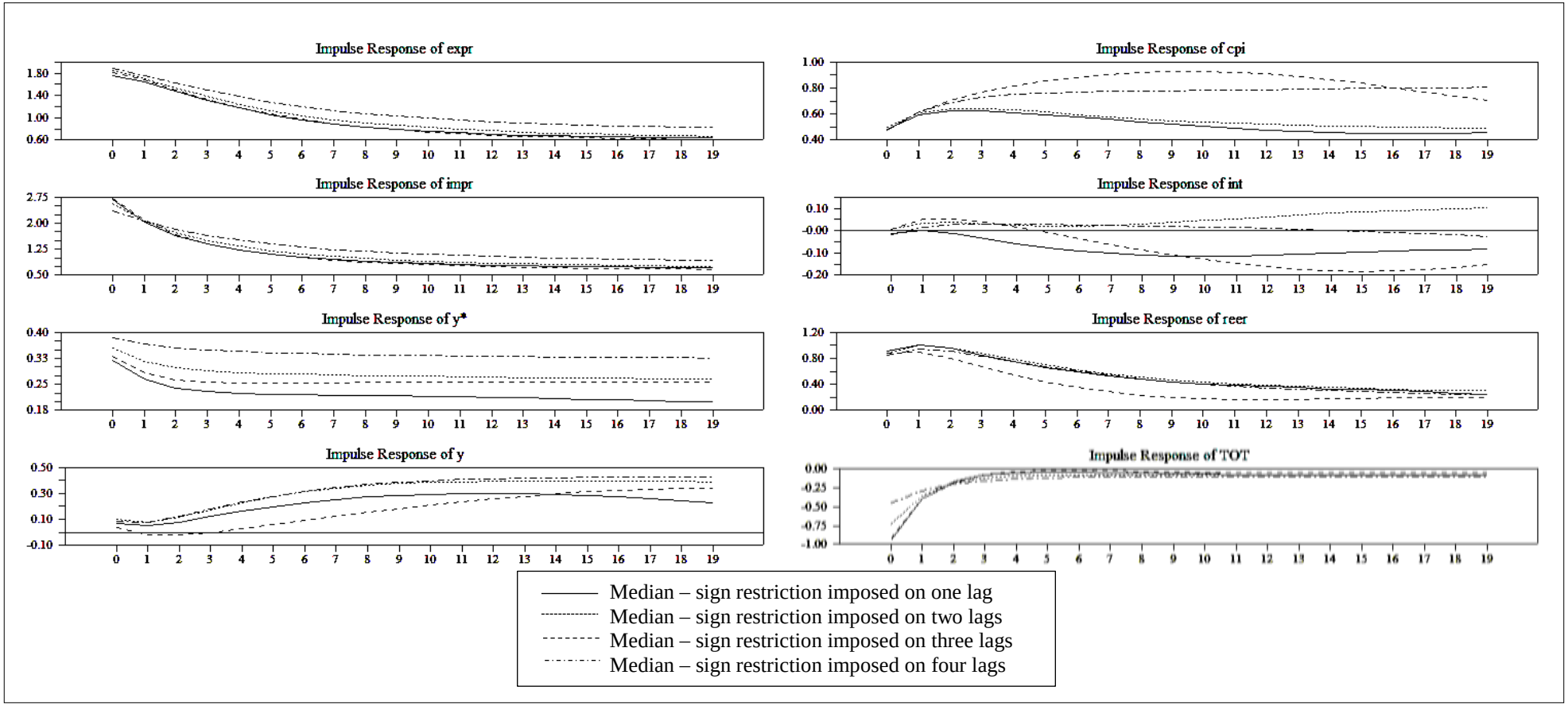
	Level			1st Difference			Decision
	ADF	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**	
$expr$	NS	NS	NS	S	S	S	I(1)
$impr$	NS	NS	NS	S	S	S	I(1)
$y*$	NS	NS	NS	S	S	S	I(1)
y	NS	NS	NS	S	S	NS	I(1)
cpi	NS	NS	NS	S	S	S	I(1)
int	S	NS	S	NA	S	NA	I(0)
$reer$	NS	NS	NS	S	S	S	I(1)
tb	NS	NS	NS	S	S	S	I(1)
ex	NS	NS	NS	S	S	S	I(1)
im	NS	NS	NS	S	S	S	I(1)

Note : NS – Series is nonstationary at 5% level

S - Series is stationary at 5% level

NA – Not applicable

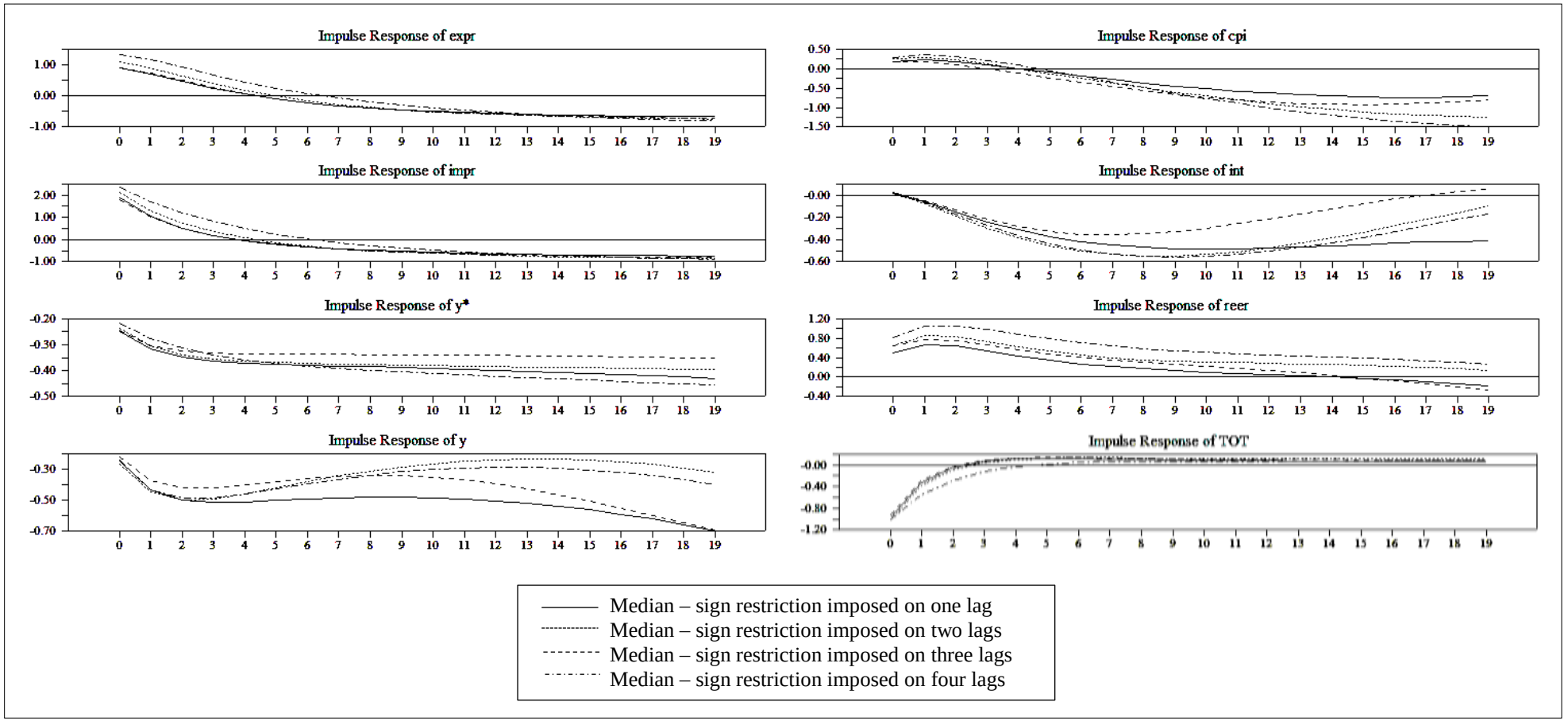
Appendix D. Impulse Responses for Robustness Check



Note: * VAR (1) indicates the VAR model with 1 lag.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

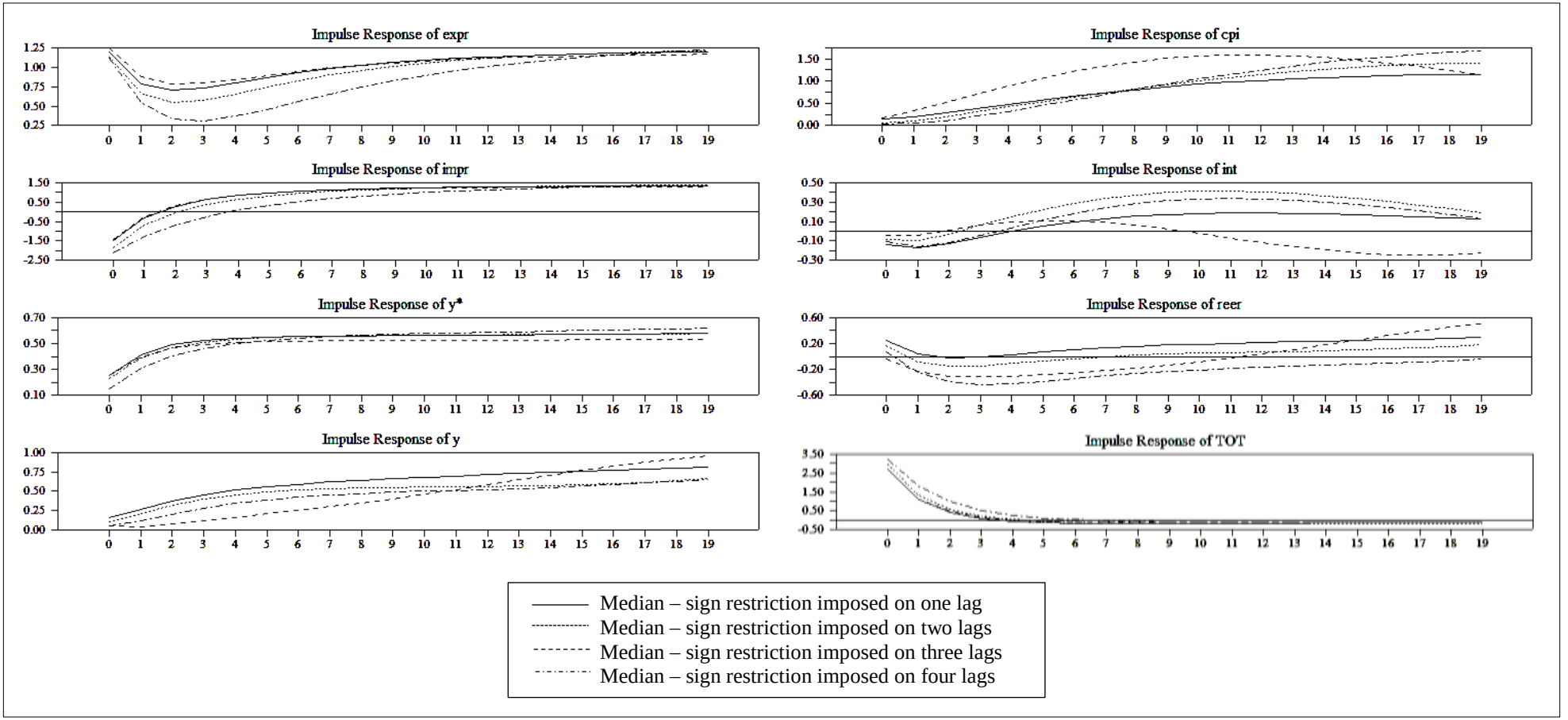
Figure D.1 Impulse Responses to a Positive World Demand Shock - VAR (1)*



Note: * VAR (1) indicates the VAR model with 1 lag.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase

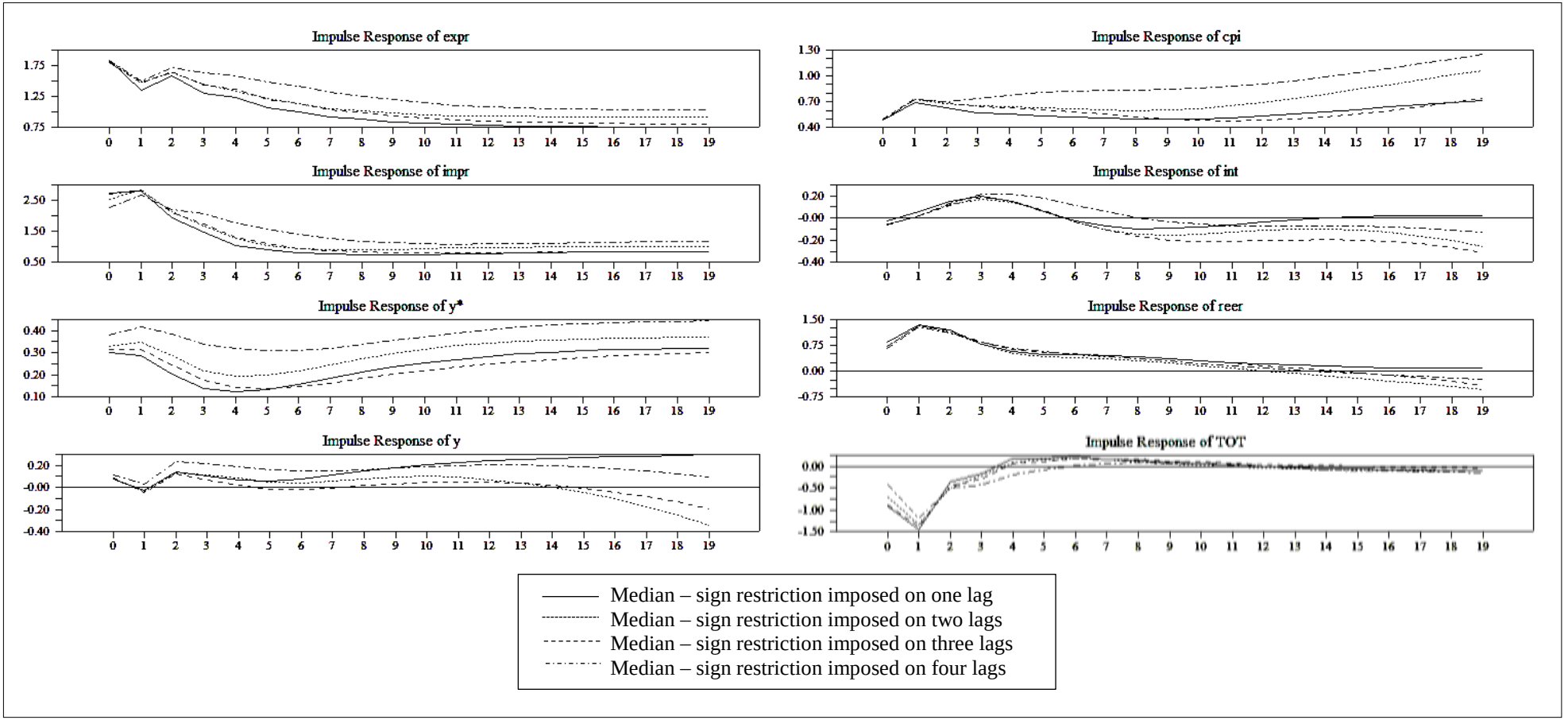
Figure D.2 Impulse Responses to a Negative World Supply Shock - VAR (1)*



Note: * VAR (1) indicates the VAR model with 1 lag.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase

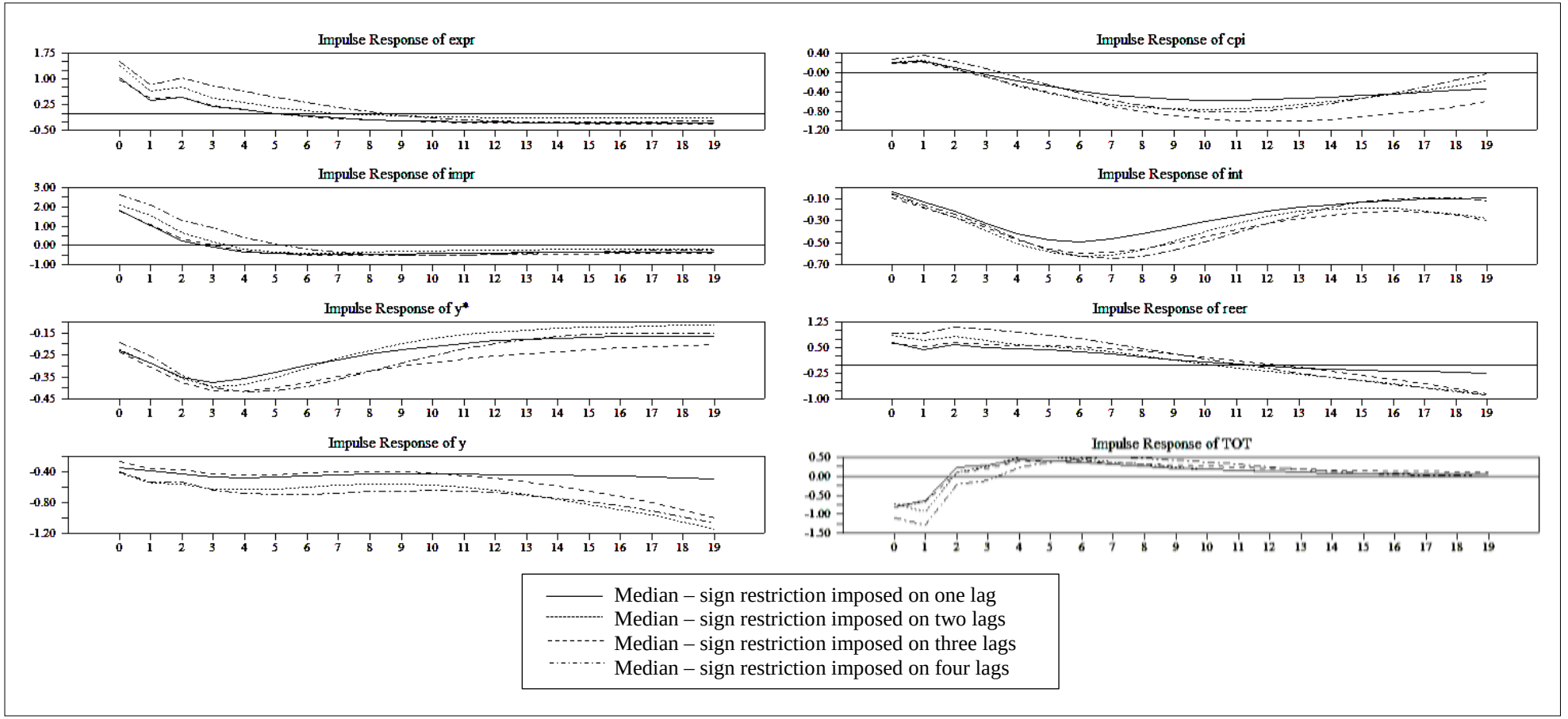
Figure D.3 Impulse Responses to a Positive Globalization Shock - VAR (1)*



Note: * VAR (2) indicates the VAR model with 2 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

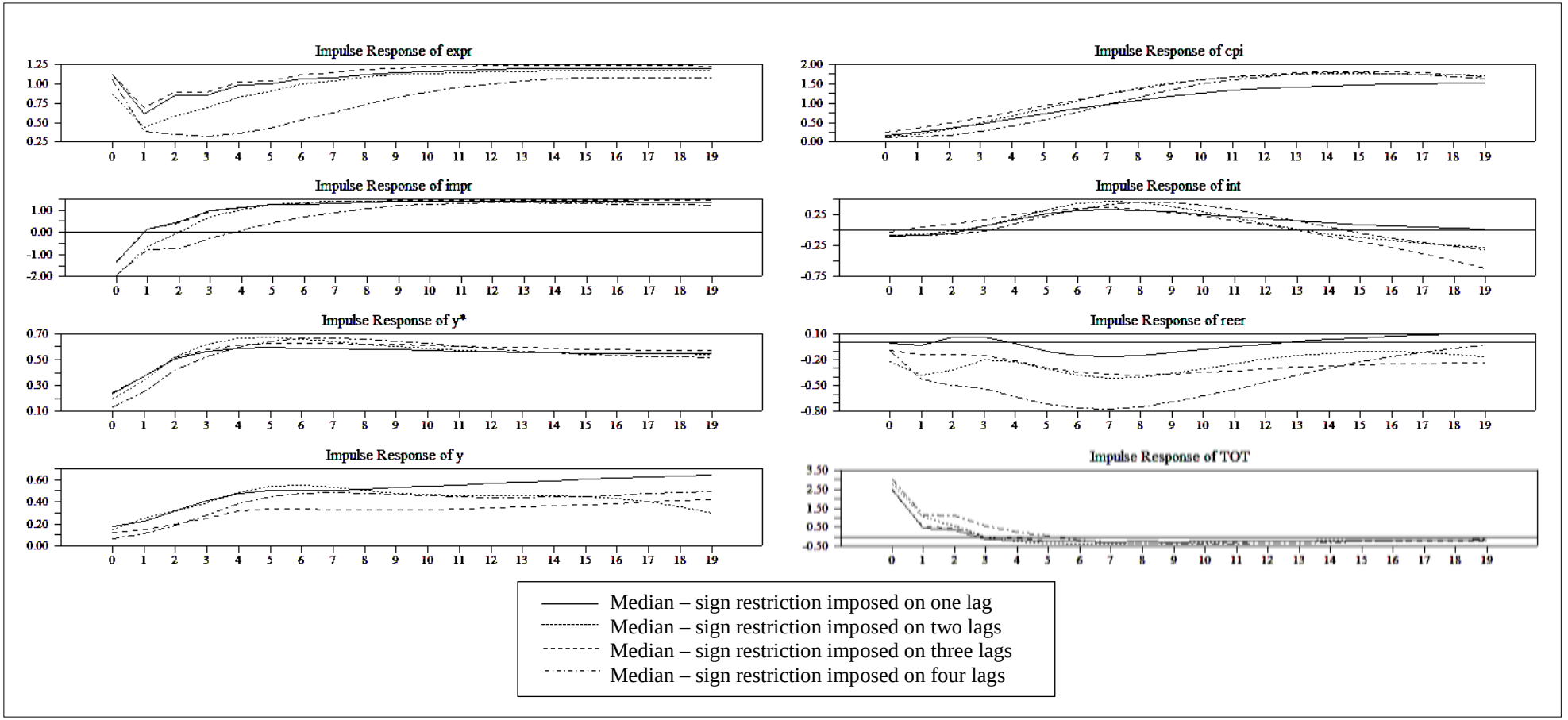
Figure D.4 Impulse Responses to a Positive World Demand Shock - VAR (2)*



Note: * VAR (2) indicates the VAR model with 2 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

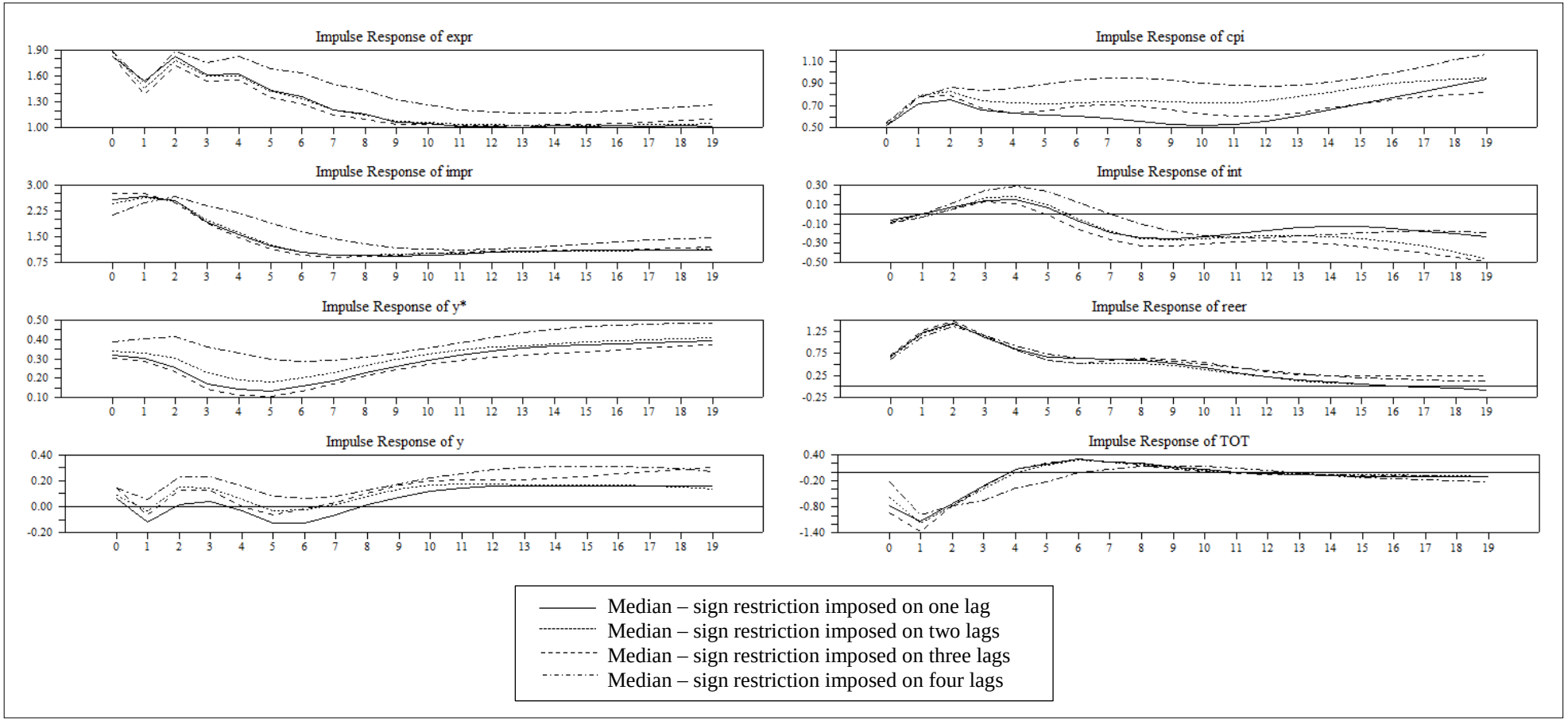
Figure D.5 Impulse Responses to a Negative World Supply Shock - VAR (2)*



Note: * VAR (2) indicates the VAR model with 2 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

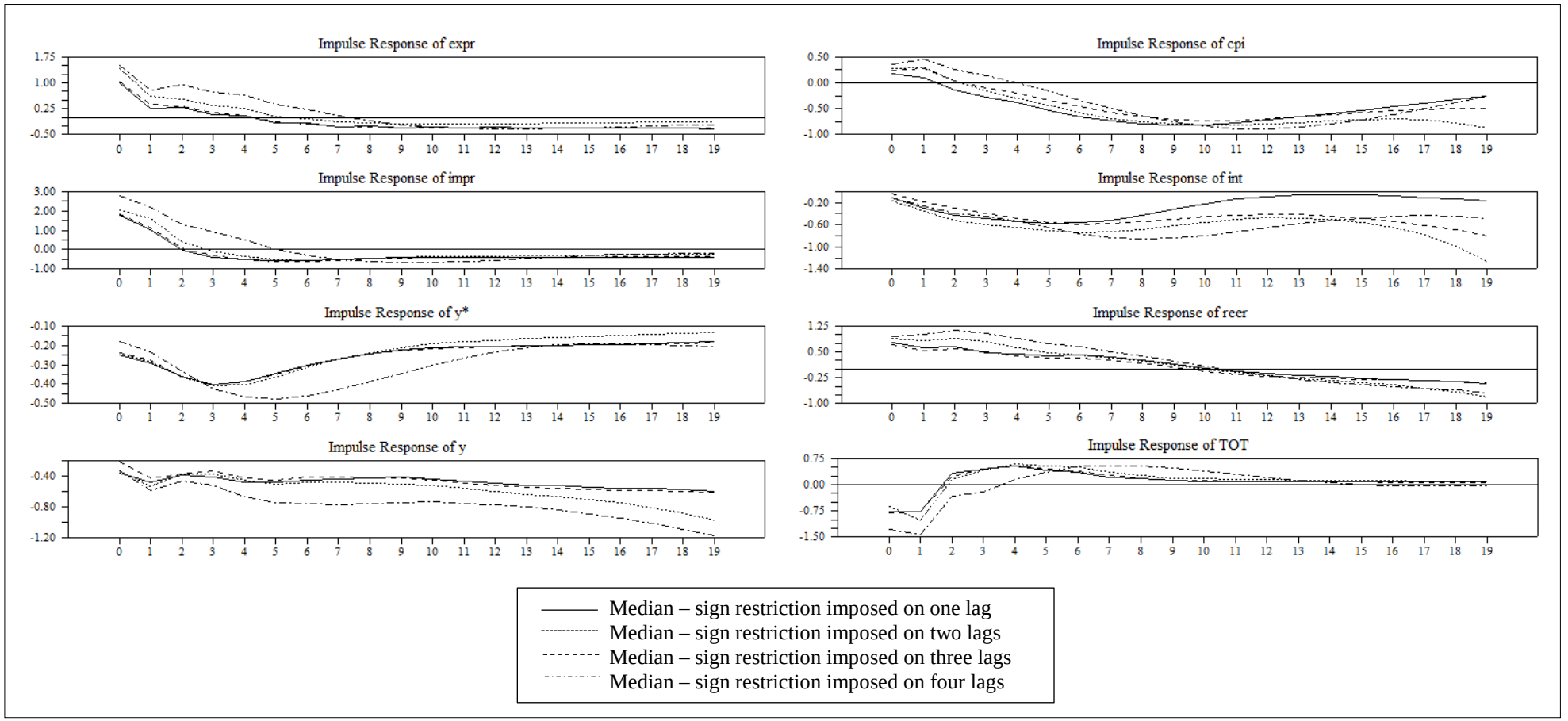
Figure D.6 Impulse Responses to a Positive Globalization Shock - VAR (2)*



Note: * VAR (3) indicates the VAR model with 3 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

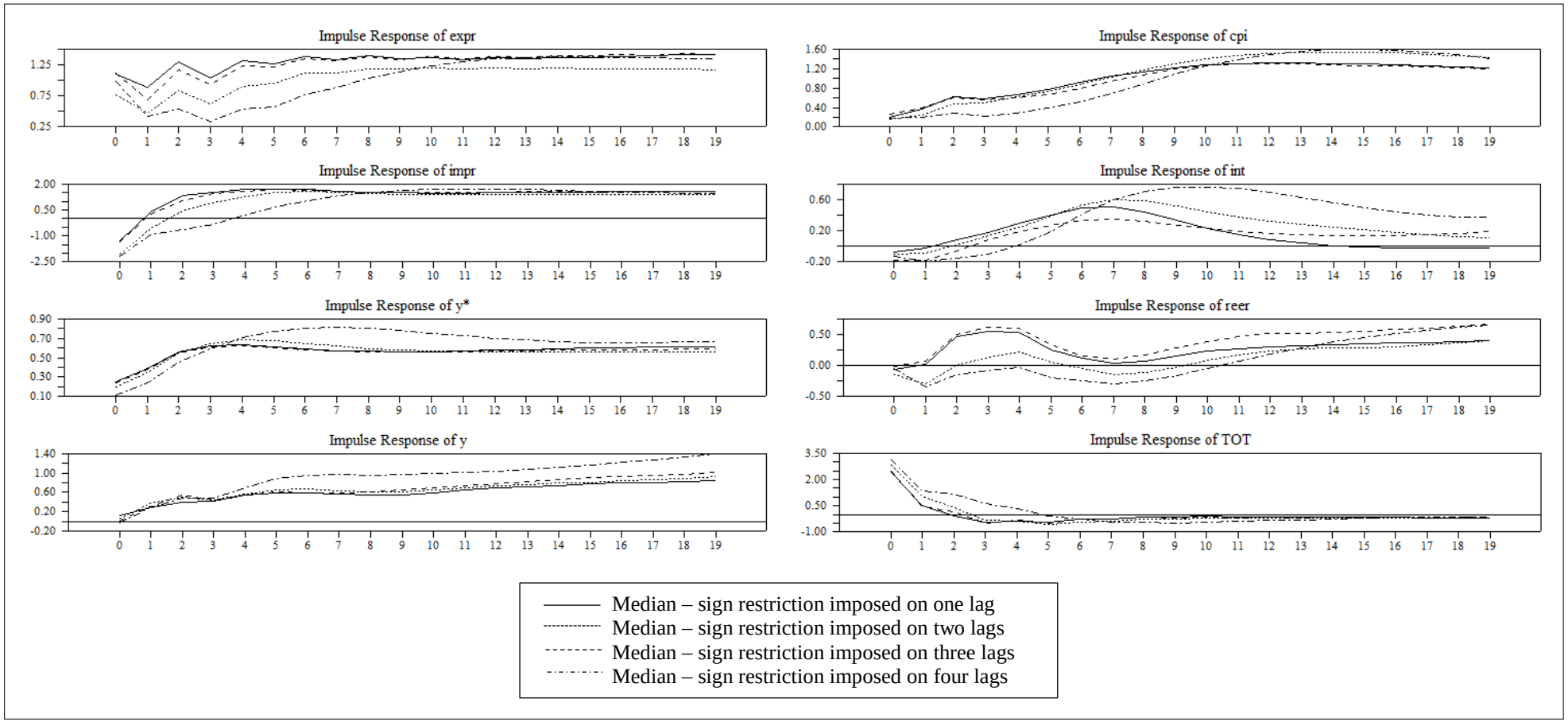
Figure D.7 Impulse Responses to a Positive World Demand Shock - VAR (3)*



Note: * VAR (3) indicates the VAR model with 3 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

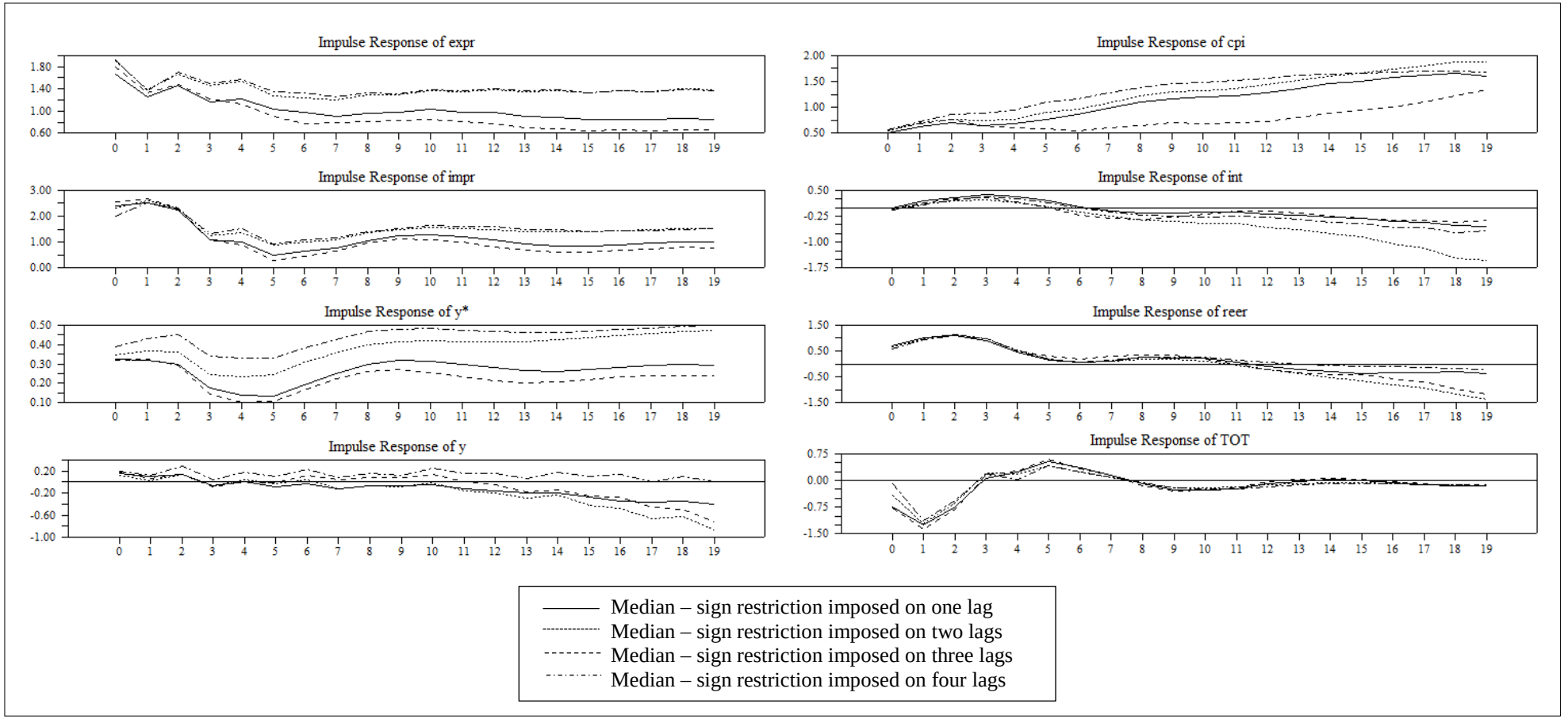
Figure D.8 Impulse Responses to a Negative World Supply Shock - VAR (3)*



Note: * VAR (3) indicates the VAR model with 3 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

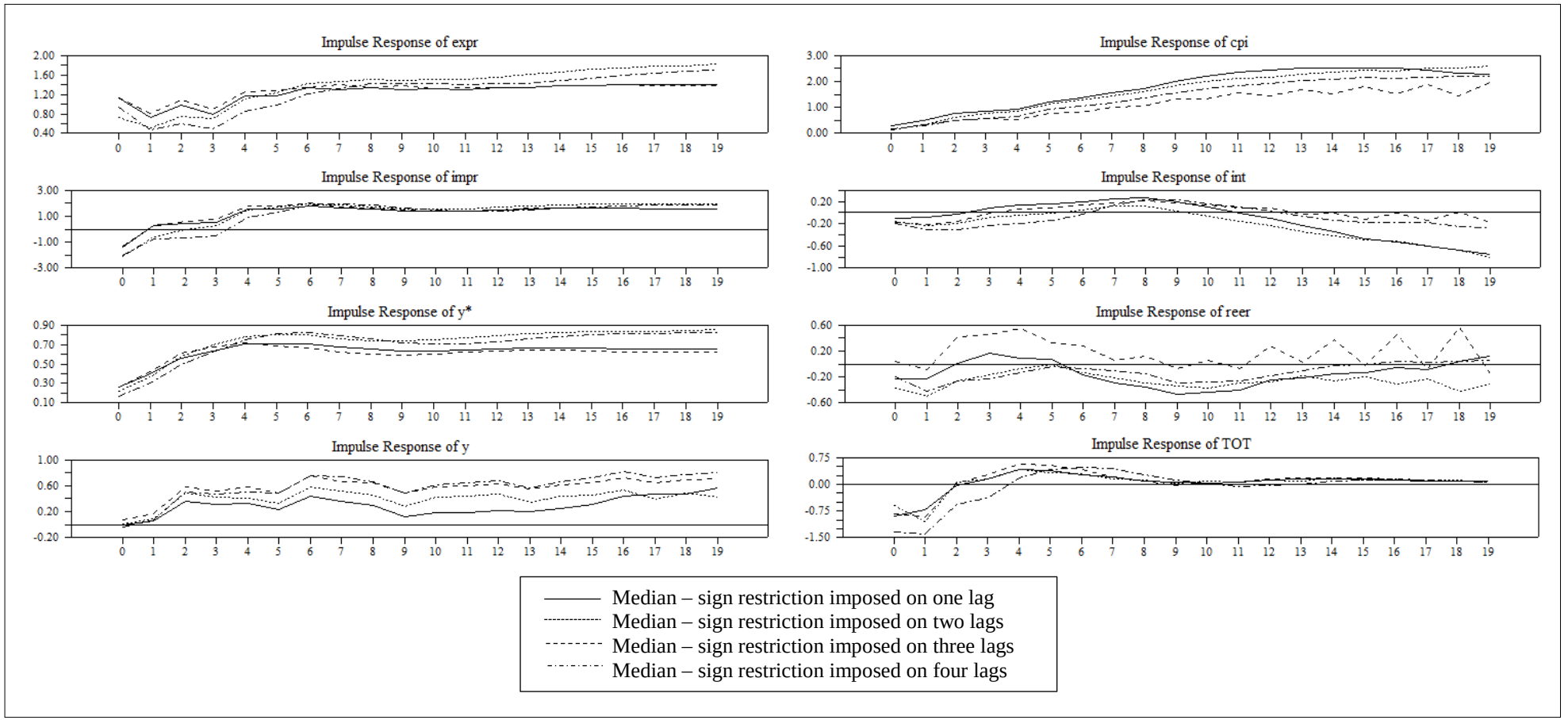
Figure D.9 Impulse Responses to a Positive Globalization Shock - VAR (3)*



Note: * VAR (4) indicates the VAR model with 4 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

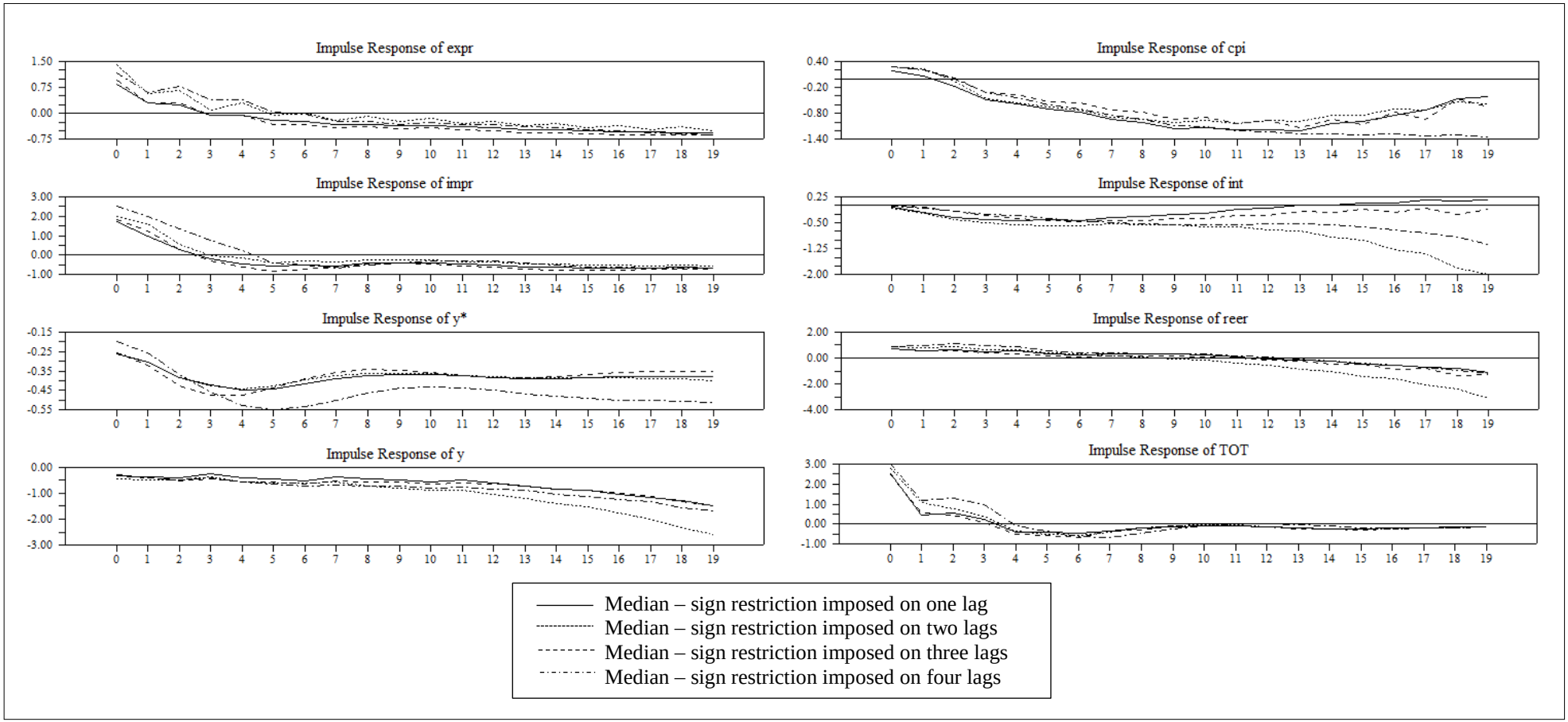
Figure D.10 Impulse Responses to a Positive World Demand Shock - VAR (4)*



Note: * VAR (4) indicates the VAR model with 4 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

Figure D.11 Impulse Responses to a Negative World Supply Shock - VAR model (4)*



Note: * VAR (4) indicates the VAR model with 4 lags.

Impulse responses of all variables, except domestic interest rate, are multiplied by 100 to obtain percentage increase.

Figure D.12 Impulse Responses to a Positive Globalization Shock - VAR (4)*