Terms-of-Trade Shocks, External Adjustments and Growth in Pakistan: How Much to Sacrifice

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Abstract

Pakistan is largely considered as having balance of payments constrained economy. These constraints become more intense when external shocks hit, such as unfavorable changes in the country's external terms-of-trade. In this paper, we attempt to document the cost to the economy when sailing through such shocks. Empirical estimates show substantial external adjustment takes place after the terms-of-trade bust in case of Pakistan. These adjustments largely work through income effect as the role of expenditure switching effect is estimated to be lower, though overtime increasing. Our main finding is about the cost to the domestic output when such shocks hit, which we call a sacrifice ratio. We find this impact is quite large, albeit decreasing overtime. We also find that the role of exchange rate policy is an important determinant of how large that sacrifice ratio will be. From the policy perspective, including monetary policy, these are important findings as they provide insights to policymakers about choices they can make during the stress times.

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I. Introduction

Emerging and developing economies are vulnerable to fluctuations in the external terms-of-trade, which is generally defined as the ratio of price of exports relative to the price of imports. Large swings in terms-of-trade can generate abrupt changes in a country's trade balance, current account and economic output. Generally, the effect of terms-of-trade on economic growth is very important especially for countries that are heavily dependent on imports. This is because, a persistent deterioration in the terms-of-trade of such countries can lead to difficulties in financing perennial current account deficits and a large external debt, having implications for country's underlying economic growth trajectory. For instance, Mauro and Becker (2006) using a dataset that covers developed and developing countries for 1970–2001, found that for developing countries the largest output costs are associated with terms-of-trade shocks. They found that on average a 10 percent decline in the terms-of-trade leads to a 2.8 percent annual decline in growth.

Like other import-dependent small open economies, Pakistan also face significant macroeconomic challenges overtime with sharp but unfavorable changes in its external terms-of-trade.[1] Especially, the magnitude of these challenges become much more important as Pakistan falls in balance of payments constrained economies.[2] This assessment is also reinforced by the fact that, the country lies among the top seven frequent users of the IMF money and had to resort to the Fund 23 times for balance of payments support since its independence. Importantly, if not all, most of these external pressures that country faced historically were also accompanied by the deterioration in terms-of-trade. Thus, in order to resolve multiple challenges and to attain macroeconomic stability, often the economy's near-term growth momentum need to be *sacrificed*.

In economic literature, however, the influence of terms-of-trade on the economy is still a matter of empirical debate.[3] For example, generally it is accepted and reported that an improvement in terms-of-trade will lead to an increase in investment and thus economic growth (see Mendoza, 1997 and Bleaney and Greenaway, 2001 amongst others). In contrast, Eicher et al. (2007) shows that a decrease in terms-of-trade will have a negative effect on income and wealth. However, their model showed that in the long run, a decrease in terms-of-trade will lead to a proportional decrease in the debt level of an economy whereas output, capital, and borrowing will

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[1] The improvement in terms-of-trade generally defined as when export prices as a whole grow relatively sharper than import prices. Alternatively, if increase in import prices outpace export prices, this is marked as deterioration in terms-of-trade. Accordingly, the terms *favourable* and *unfavourable* terms-of-trade shocks appear in this study.

[2] See, for example works by Felipe et al. (2010), Rosbach and Aleksanyan (2019) and Raza (2021).

[3] There are several seminal studies that provides theoretical linkages of how changes in terms-of-trade affect growth through different channels. We internationally avoided such discussion in main text to keep focus on empirical part. Nevertheless, for details, see Heckscher (1919), Ohlin (1933) and Krugman & Obstfeld (2003).

not change. Thus, they concluded that a change in terms-of-trade will only affect economic growth in the short run and not in the long run.

Apart from the impact of terms-of-trade on growth, the literature is also divided on the direction of their impact, especially in the long run. For example, as Caballero and Hammour (1994) demonstrated that, a negative terms-of-trade shocks can have a positive effect on income growth if they change comparative advantages and lead to discovery of new growth opportunities. Negative terms-of-trade shocks could help improve income growth in the medium term if they help the economy to get rid of inefficient firms. On the macro level, Sachs (1999) showed that, in the face of a negative terms-of-trade shock, cutting real wages may be a necessary policy but they have been usually resisted by states in developing countries. The result is persistent fiscal deficits that bring about growth collapse. Therefore, he argued, for the policymakers it is important to identify the policies needed to recover from a negative terms-of-trade shock.

About the impact of the terms-of-trade shock on growth, one key determinant for transmission of such shocks is the exchange rate policy (Broda, 2004). The results indicated that the impact is smaller in countries with a flexible exchange rate, where relative prices tend to adjust quickly through the nominal exchange rate. In countries with a fixed exchange rate, the adjustment of relative prices may be slower, depending on the stickiness of domestic prices. Countries subject to negative terms-of-trade shocks recover more rapidly if their exchange rate is flexible. In addition to exchange rate, Rodrik (1999) emphasized that how severely a terms-of-trade shock affects economic growth depends on the interaction of institutions of conflict management with terms-of-trade shock. Using a large sample for the 1960–89 period, he showed that the drop in growth is most abrupt when divided societies interact with weak institutions.

In this background, we attempt to empirically estimate the impact of adverse terms-of-trade shock on Pakistan's near term growth outlook. Specifically, we are interested in finding the magnitude with which the growth has to fall or sacrifice in order to absorb the terms-of-trade shock. Certainly, this affect is dependent upon changes in country's exchange rate regimes overtime along with the economy's cyclical position when an unfavorable shock hit. Furthermore, in addition to historical context – especially covering the period since the country had abandon the fixed rate regime in early 1980s, this study focuses more on recent episodes of changes in Pakistan's term of trade and their likely impact on economic growth. From the monetary policy perspective, these are critically important insights as they will keep inform the policymakers about the potential change in output with their given policy choices, especially with regards to exchange rate management and Pakistan's volatile experience with it.

The rest of the paper is organized as follows. Section II discusses in detail stylized facts about the episodes of changing in Pakistan's terms-of-trade and draw some relationships with changes in other key economic indicators during such episodes. Section III presents the empirical set-up for measuring the impact of terms-of-trade on country's economic growth through adjustment in external accounts. In section IV, we discuss the empirical results and attempt to compute the sacrifice ratio for domestic growth based on the evolving trends and changes in the

underlying key determinants, especially the role of exchange rate policy. Section V makes the concluding remarks.

II.   Terms-of-Trade Episodes, External Account and Growth Patterns

Pakistan's external terms-of-trade experienced significant fluctuations over the last six decades. In particular, the changes in terms-of-trade largely reflected the underlying evolving pattern in the country's trade structure and related policies. For instance, during the 1970s, around three-fourth of country's exports were made up of primary products while around half of country's imports were of capital goods for infrastructure development. Given this trade structure, terms-of-trade bound to fluctuate more frequent due to volatile commodity prices in the global markets (Kazi, 1987). Overtime, this volatility in terms-of-trade decreased as export structure moved gradually towards more manufactured base. However, as shown in **Figure 1**, the underlying increase in country's import prices consistently outpace the increase in export prices over the last six decades. This led to persistent decline in country's terms-of-trade in the same period along with deterioration in trade balance.

Figure 1: Pakistan's External Terms-of-Trade
*(2010=100, quarterly indices based on data 1980Q1-2023Q1)*
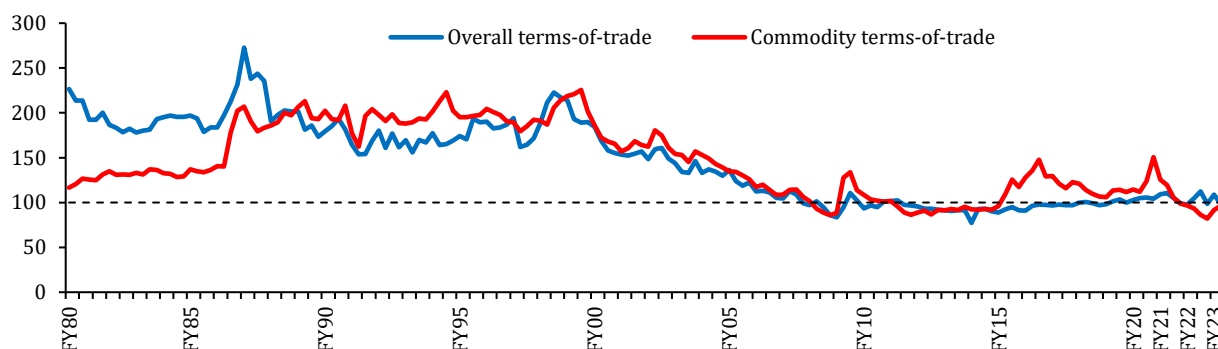
Source: PBS, IMF, SBP staff estimates

Note: Terms-of-trade = Export price index on PKR basis/Import price index on PKR basis. Furthermore, overall terms-of-trade index is based on complete trade data available with the Pakistan Bureau of Statistics (PBS). Commodity terms-of-trade data index, on the other hand, is calculated using the IMF (2019) method where the impact of complex goods such as machinery, transport and equipment, and other manufactured goods excluded from the terms-of-trade calculations.

Furthermore, the decomposition of changes in terms-of-trade suggests that, at times, exchange rate depreciation plays an important role along with changes in the global commodity prices. This broadly highlights the fact that, during the large part of history, PKR only moved in one direction with short-lived episodes of appreciation. For instance, it could be observed from the **Figure 2** that, after abandoning of fixed foreign exchange regime in January 1982, depreciation in PKR led to weaknesses in the terms-of-trade despite broadly no change in global commodity prices. In contrast, during 2014-16 period, decline in global oil prices caused improvement in terms-of-trade amid stable exchange rate. In the recent period, especially after COVID, it could be observed that the deterioration in terms-of-trade is explained by both surge in global commodity prices and sharp decline in exchange rate.

Figure 2: Decompostion of Terms-of-Trade
*(% y/y changes, contribution in ppts., quarterly data 1981Q1-2022Q4)*
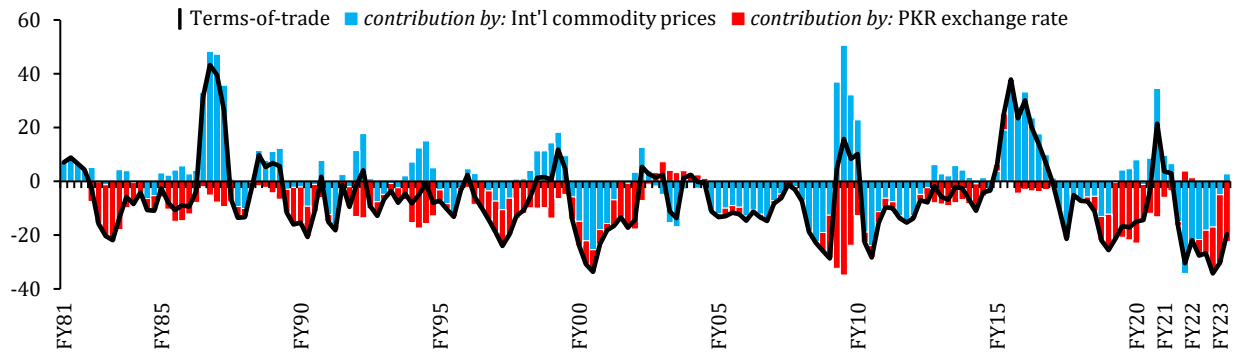
Source: PBS, IMF, SBP staff estimates

Note: The decomposition is based on commodity terms-of-trade due to unavailability of unit prices of complex goods in the international markets. The contribution of changes in the international commodity prices is calculated using export/import price indices on USD basis. The contribution of changes in exchange rate is just a difference between export/import price indices on PKR basis and those on USD basis.

Since we are interested in knowing the economy's path to adjustment after unfavorable shock in the terms-of-trade, we first attempt to identify the episodes of busts using statistical techniques. Specifically, based on Adler et al. (2018), we used a Markov regime-switching methodology, which identifies statistically large and persistent terms-of-trade busts. The method identifies 7 episodes of terms-of-trade busts and 5 episodes of booms over the period 1980Q1–2023Q1. Statistics show that on average 26 percent decline in Pakistan's terms-of-trade recorded in 7 episodes of busts based on peak-to-trough method. As expected, the bust after COVID is the biggest in magnitude with 44 percent decline reported as of 2023Q1 (**Figure 3**).

Figure 3: Episodes of Terms-of-Trade Busts in Pakistan over the last Four Decades
(quartely indices, peak to trough where peak (t)=100)
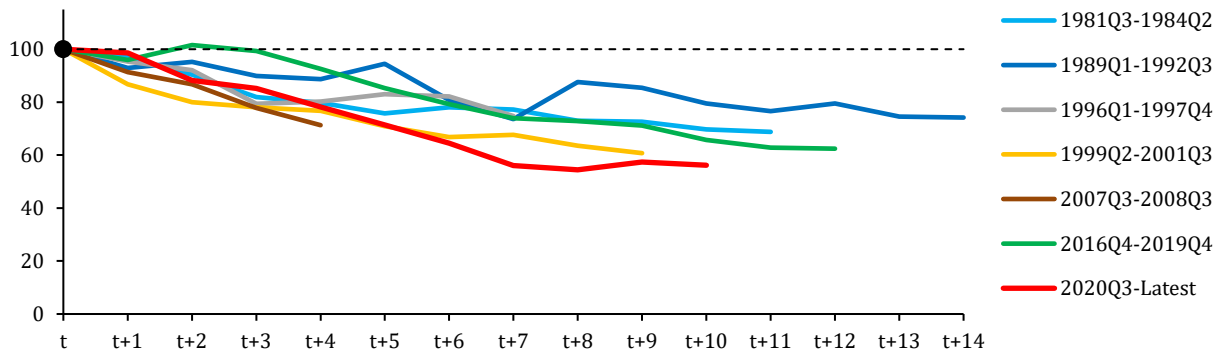
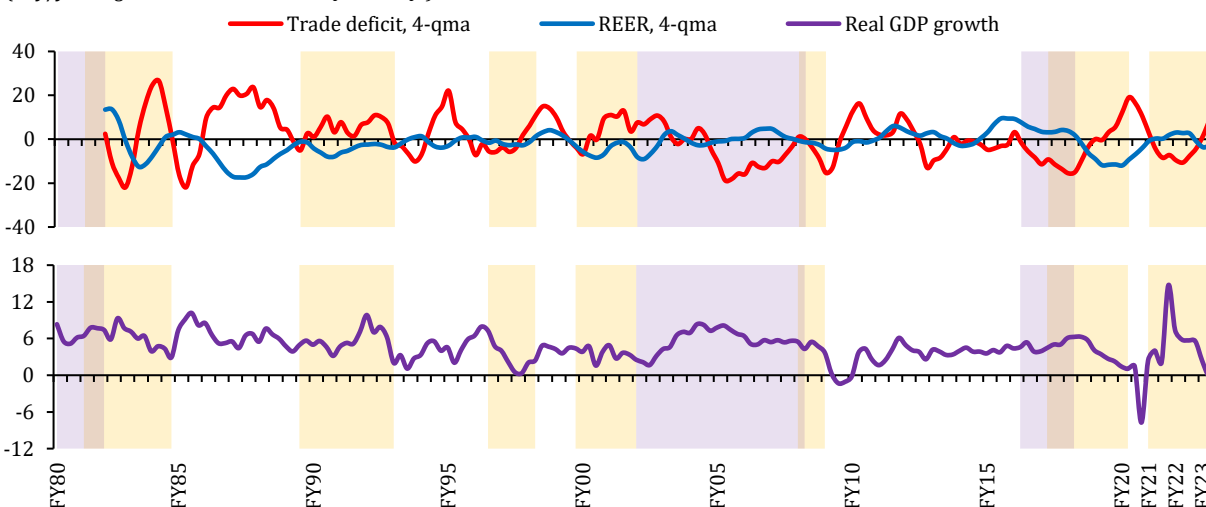Source: PBS, IMF, SBP staff estimates

Note: The identification of unfavorable shocks are based on Adler et al. (2018) Markov regime-switching methodology.

So what happened on part of external adjustments during the episodes of terms-of-trade busts in Pakistan? For this, we look at changes in two important external sector indicators during

each episode of bust; real effective exchange rate (REER) and trade balance.[4] This is because, in line with standard literature, decline in terms-of-trade tends to depreciate REER to support external adjustment through improvement in trade balance, and thus in current account.[5] In Pakistan's case, REER on average recorded 10.8 percent decline in periods of terms-of-trade busts. However, despite sharp deterioration in terms-of-trade in recent episode, interestingly, REER only depreciated by 5 percent (**Figure 4**, **upper panel**). For trade balance, on average 16 percent improvement recorded in trade balance during the episodes of busts in terms-of-trade. In recent bust after COVID, the level of improvement in trade balance reached to 22.6 percent.[6] Furthermore, it also appears from the trends observed in Figure 4 that, the widening in trade deficit accelerated during the periods when PKR exchange rate remained broadly stable under a kind of soft peg.

Figure 4: Terms-of-Trade Busts, REER, Trade Deficit and Growth
(% y/y changes, based on data 1980Q1-2023Q1)

Source: PBS, IMF, SBP staff estimates

Note: Yellow shade denotes the periods identified as terms-of-trade busts. Purple shade denotes periods where PKR exchange rate is considered as fixed and moved in a narrow band of ± 1 percent. Trade deficit = Export/Import ratio. Accordingly, increase in value of trade deficit denote improvement or reduction in deficit and vice versa. The REER is calculated using trade weights of 37 major trade partners/competitors' of Pakistan with a base of 2010. Quarterly real GDP estimates based on Tahir et al. (2018).

After having stylized facts on external adjustments during the terms-of-trade busts, we are naturally interested to see the pattern of economic growth in the middle of such adjustments. To see this impact, we extrapolated the quarterly real GDP estimates for Pakistan by Tahir et al. (2018). We observed from the data that, on average real GDP growth declined by 4.6 percentage points during episodes of terms-of-trade busts. Excluding the recent post-COVID episode, where the magnitude of fall in growth reached to around 15 percentage points, the average decline in growth reduced to 2.9 percentage points (**Figure 4, lower panel**). Interestingly, it also appears from the

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[4] In literature, most studies used current account deficit as percent of GDP to see the impact of terms-of-trade decline on higher frequency. However, due to data limitations as Quarterly National Accounts in case of Pakistan are yet not available, we relied on the changes in trade balance ratio (exports divided by imports) to analyse the impact.

[5] This impact is estimated to be larger under the flexible exchange rate regimes (Mendoza, 1995).

[6] The underlying development in recent terms-of-trade bust after COVID points to some interesting facts. For example, while depreciation in REER is relatively smaller, the large contraction in trade deficit highlights the impact of import compression measures. Counterfactually, in absence of these measures, REER depreciation could possibly be higher.

trends that the real GDP growth tends to fall more in all three post-fixed exchange rate periods. Specifically, the fall in growth is about 2 percentage points higher when the terms-of-trade bust while fixed exchange rate regime was in place. Certainly, there are significant identification issues here, especially for recent period as several other policy and regulatory measures are currently in place that may have caused such sharp decline in growth. It is possible that these measures remain unrelated to the terms-of-trade bust and ensuing external adjustment.

III. Impact of Terms-of-Trade Busts on External Adjustment and Growth: Econometric Set-up

The stylized facts presented above suggest that, broadly, when terms-of-trade busts, the decline in growth is relatively lower when economy operates under the floating PKR exchange rate regime compared to periods when fixed regime was in place.[7] This could be a result of the presence of some expenditure switching, offsetting the negative income effect from the collapse in the terms-of-trade.[8] To quantify the relative importance of these two effects in case of Pakistan, this section computes a *sacrifice ratio*, which measures the burden of external adjustment on domestic growth under both fixed and floating exchange rate regimes.

To capture such mechanics of external adjustment and its ensuing impact on growth, borrowed from literature, we used the Structural Vector Auto-regression (SVAR) framework.[9] This framework allows the dynamic relationship between changes in the trade balance, changes in domestic growth, and changes in the real effective exchange rate to terms-of-trade shocks, controlling for external demand conditions. The analysis covers the period from 1980Q1 to 2022Q2. We intentionally excluded the recent quarters from our analysis due to the interplay of several other domestic factors, including quantitative measures to control imports and capital outflows, that may have influenced the changes in subject variables, for which model is not trained. Specifically, the SVAR model is defined as;

$$A_0 \begin{bmatrix} w_t \\ d_t \end{bmatrix} = \alpha x_t + \sum_{i=1}^{p} A_i \begin{bmatrix} w_{t-i} \\ d_{t-i} \end{bmatrix} + B \begin{bmatrix} \epsilon_t^w \\ \epsilon_t^d \end{bmatrix}$$

where:
$$w_t = [y_t^w]' \ , \ d_t = \begin{bmatrix} y_t^d & q_t^d & \gamma_t^d & \theta_t^d \end{bmatrix}'$$

Thus the model contains two blocks: one foreign (w_t) and one domestic (d_t). The foreign block only consists of quarterly changes in output (y_t^w), for which we used OECD real GDP volumes

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data from Haver Analytics. The domestic block consists of: (i) domestic real GDP growth (y_t^d), for which we used quarterly estimates by Tahir et al. (2018); (ii) quarterly changes in PKR real effective exchange rate (q_t^d) calculated by the IMF; quarterly changes in real trade balance as percent of GDP (γ_t^d); and quarterly changes in Pakistan's external terms-of-trade (θ_t^d). For real trade balance, we deflated the nominal merchandize exports and imports by their respective price deflators taken from the IMF. For terms-of-trade data, we used both overall terms-of-trade data published by the PBS and calculated commodity terms-of-trade data based on IMF (2019) method.

Furthermore, in order to ensure system stationarity, all variables are seasonally adjusted and measured as quarterly growth rates or changes. Give the small open economy assumption, w_t is considered as block exogenous to d_t, which means the variables in d_t and the domestic shocks ϵ_t^d do not affect the variable in foreign block. Moreover, the recursive structure of the VAR assumes that all variable in the domestic block to restricting the contemporaneous impact matrix B and the lag matrices A_i to be block lower triangular.

Based on the above empirical set-up, the course of the adjustment to terms-of-trade shocks are illustrated using cumulative conditional impulse response functions at eight-quarter horizons of the REER, domestic output, and the trade balance. However, to capture the relative importance of expenditure switching in the external adjustment process after a terms-of-trade bust in case of Pakistan, counterfactual scenarios to an unanticipated reduction in the terms-of-trade were constructed, by holding the REER response fixed at all forecast horizons. Comparing the hypothetical impulse response with the actual response help compute the importance of expenditure switching in the external adjustment to unanticipated terms-of-trade shocks.

IV.   Impact of Terms-of-Trade Busts on External Adjustment and Growth: Empirical Results and Discussion

The empirical results confirm that, after one year, a 10 percent fall in the country's external terms-of-trade led to significant improvement in the trade balance of about 1.4 percent of GDP. However, this impact is estimated to be slightly lower if we control for fixed exchange rate periods.[10] The underlying dynamics of this behavior indicates the presence of some expenditure switching effect when PKR trades under the floating or managed exchange rate regime. The channel mainly works through relatively larger depreciation in the REER, which help in boosting exports and reducing imports. Indeed, our results reveal that, when controlling for fixed exchange rate, depreciation in REER is about 2.3 percentage points higher than the full sample estimate. This led to relatively lower burden of adjustment process on domestic output. Specifically, empirical results show that the decline in domestic output under the managed or floating PKR exchange rate regime

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[10] We control this effect through introduction of time dummy in our baseline SVAR model, where periods with fixed exchange rate takes the value of 1, otherwise zero. Specifically, based on narrow movement of PKR in a band of ± 1 percent following three periods are broadly defined having fixed exchange rate regime: 1980Q1-1981Q4, 2001Q4-2007Q4 and 2015Q4-2017Q4. As described earlier, all other periods are considered as having managed float or flexible exchange rate regime.

is estimated to be about 0.7 percentage points lower compared to the results obtained with full sample estimation, which also includes the impact of fixed exchange rate (**Figure 5**).

Figure 5: Cumulative response to a 10 percent reduction in the Pakistan's Terms of Trade
*(response up to four quarters, based on sample period 1980Q1-2022Q2)*
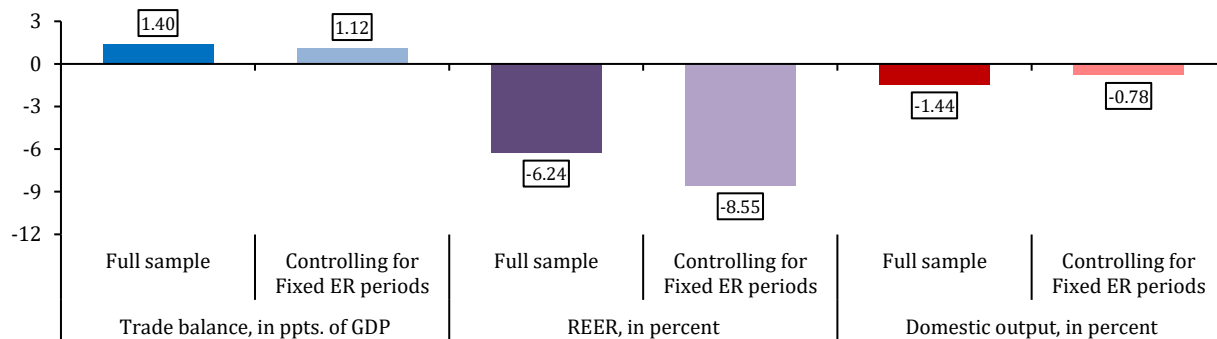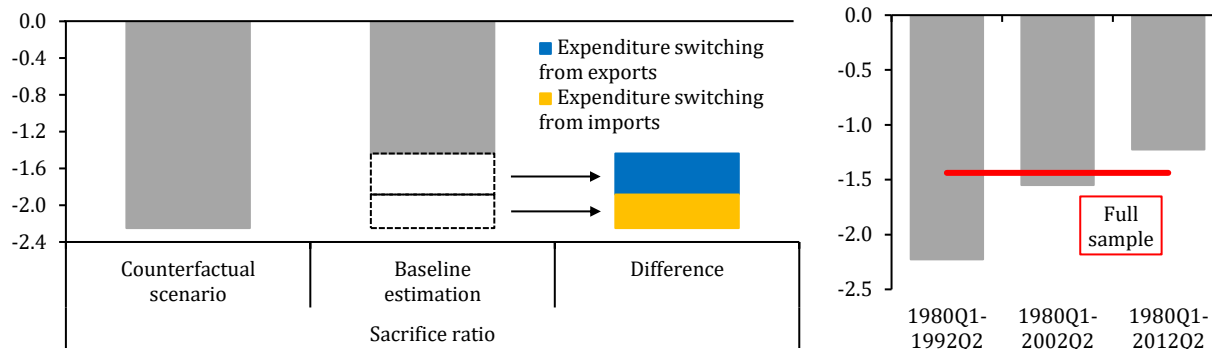

Source: SBP staff estimates

Note: ppts. = percentage points. REER = real effective exchange rate. ER = nominal exchange rate. Domestic output = real GDP

In the next, we are interested to know how much is the role of expenditure switching effect in lowering the adjustment burden on domestic output? Especially we attempted to see this evolving underlying effect over the whole sample. For this, as described in the previous section, we performed a counterfactual analysis through which we attempted to dissect the reduction in country's trade balance due to expenditure switching effect in addition to income effect. Our results from counterfactual analysis, while support the presence of significant expenditure switching effect, however, the role of income effect in case of Pakistan is estimated to be larger during the adjustment in trade balance after the terms-of-trade bust. Specifically, as **Figure 6** has shown, over the last four decades, around two-thirds of the adjustment in Pakistan's trade balance is explained by income effect after decline in terms-of-trade. Notwithstanding its lesser role, the expenditure switching effect is getting more significant overtime. This basically implies the increasing role of exchange rate policy in determining the country's trade fundamentals, especially when the global trade networks have also become more integrated.

Figure 6: Decomposition of Trade Balance: response to a 10 percent reduction in the terms of trade
(%age points of GDP, response up to four quarters, full sample period 1980Q1-2022Q2)
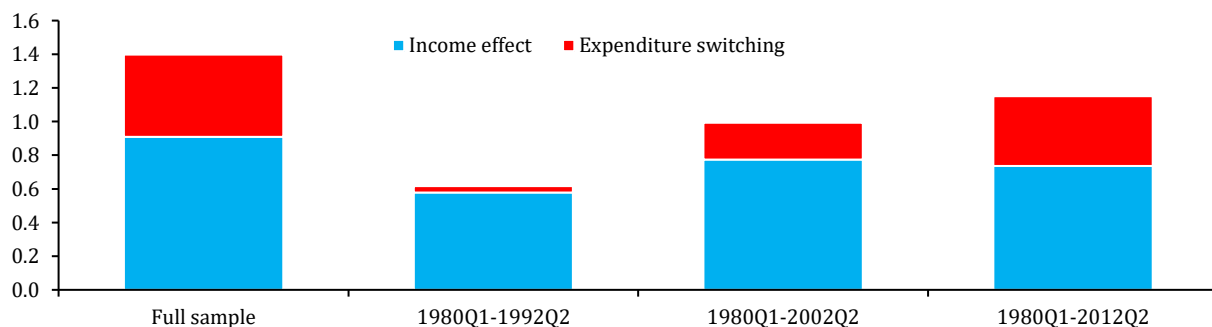
Source: SBP staff estimates

Moreover, within the expenditure switching effect on trade balance, we also attempted to estimate such effect separately for the real exports and imports. As presented in **Figure 7**, the real exports increased by 5.8 percent over one-year after 10 percent fall in the terms-of-trade. On the other hand, real imports showed relatively lower impact and decrease by 3.7 percent after the terms-of-trade bust.[11] Furthermore, based on counterfactual analysis, around three-fourth of such estimated increase in real exports is driven changes in REER over the whole sample period. However, this impact is gradually increasing over time, as suggested by recursive sub-sample estimations. Similarly, for decline in real imports after the terms-of-trade bust, the contribution by other variables is estimated to be larger than changes in the REER. Like exports, contribution of REER is also increasing overtime for imports.

The underlying dynamics behind such trends again point towards the increasing role of expenditure switching effect in country's external adjustment, albeit at lower pace. At the same time, these results reinforced the earlier argument about relatively larger role of income effect in Pakistan during the external adjustment after terms-of-trade bust.

Figure 7: Decomposition of Exports and Imports: response to a 10 percent reduction in the terms of trade
(% change, response up to four quarters, full sample period 1980Q1-2022Q2)
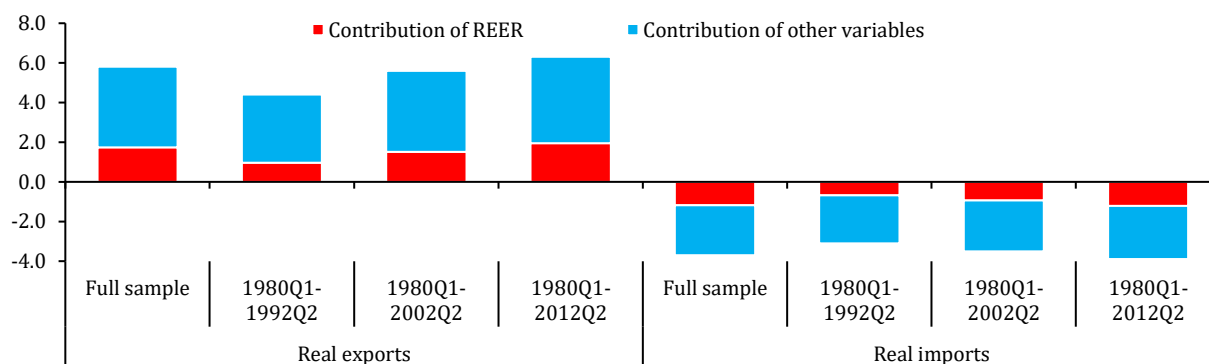
Source: SBP staff estimates

Note: Contribution from other variables mainly refers to the role of external demand – in case of real exports, and domestic demand – incase of real imports.

So, given the larger role of income effect in Pakistan, does this imply a higher *sacrifice ratio* of external adjustment – defined as the extent to which domestic output must compress for the trade balance to improve by 1 percentage point of GDP? Arithmetically, the sacrifice ratio is computed as the share of the cumulative response of domestic output to the cumulative response of the trade balance to the terms-of-trade shock. Results show that, in case of Pakistan, in order to reduce the trade balance by 1 percent of GDP in a year, domestic output has to sacrifice by about 1.4 percentage points. However, in the counterfactual analysis, where we muted the impact of REER, the sacrifice ratio is estimated to be as large as 2.2 percent. Comparing the lower baseline impact than the counterfactual analysis suggests the presence of expenditure switching effect as detailed above. Specifically, given the larger estimated response of real exports to REER, around 55 percent

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[11] These results are broadly in line with previous results found in case of Pakistan by Mahmood and Awais (2021).

of expenditure switching effect is estimated to works through export channel. The remaining effect is explained by narrowing in real imports (**Figure 8, left panel**).

Figure 8: Sacrifice Ratio for Domestic Output after Terms-of-Trade Bust
(% change, response up to four quarters, sample period 1980Q1-2022Q2)

Overtime changes in sacrifice ratio

Source: SBP staff estimates

Note: Sacrifice ratio computed as the share of the cumulative response of domestic output to the cumulative response of the trade balance to the terms-of-trade shock.

Moreover, the results from recursive estimation indicated decline in sacrifice ratio for domestic output in Pakistan during the last four decades (**Figure 8, right panel**). For example, the sacrifice ratio was estimated to be about 2.2 percent during the 1990s, which declined to around 1.2 percent up to the last decade and against the full sample estimates of about 1.4 percent. These results are broadly anticipated given the increasing role of underlying expenditure switching effect after the terms-of-trade shock hit and ensuing external adjustments.

So, what does the above empirical results imply about the ongoing external adjustment phase in Pakistan after faced an unprecedented terms-of-trade bust? As we highlighted in section II above, in the most recent bust, Pakistan's terms-of-trade on average declined by 44 percent from their peak. So the back of envelope calculations based on the empirical evidence that - for every 10 percent reduction in terms-of-trade, domestic output in Pakistan has to sacrifice by about 1.4 percent, the implied contraction in output is calculated around 6.3 percent. This is slightly higher than the deceleration in real GDP growth of around 5.8 percentage points reported by the PBS for FY23; from 6.1 percent growth in FY22 to 0.3 percent provisional estimates for FY23. In the same period, real trade balance is estimated to improve by 3.3 percent of GDP; from 12.6 percent in FY22 to estimated 9.3 percent in FY23.

While the above estimates, apparently, support our empirical assessment, there is need to also take into account other important underlying developments that may have happened in recent period. In particular, the anecdotal evidence indicates that the large part of external adjustment (or decline in trade deficit) came on account of quantitative policy and regulatory measures that led to significant slowdown in the economic activity. This is because, as described in section II, the decline in the REER in recent episode is relatively lower despite large terms-of-trade shock and needed external adjustment. Counterfactually, what this implies is that, had this external adjustment came

through changes in economic fundamental, the sacrifice ratio for domestic output might have been lower as it has progressed overtime.

V.   Conclusion

Pakistan, a small open economy, is considered as balance of payments constrained, which is mainly reflected by frequent recourse to IMF over the course of its history. While these frequent balance of payments crises reflected a broader and bigger underlying structural problems in the economy, at times, these crises are triggered by factors, which are beyond the control of country's authorities. One such important external factor is an unfavorable change in the country's external terms-of-trade. Historically, Pakistan's economy has faced significant pressures due to unfavorable developments in the terms-of-trade that led to substantial but painful external adjustment. This has been reflected through prominent slowdown in the economic activity across all such episodes.

In this paper, we empirically attempted to estimate such cost to the economy in the face of terms-of-trade bust. We found that, when the terms-of-trade shock hits, Pakistan's trade balance showed significant improvement through changes in the real exchange rate. However, this improvement is achieved at the cost of economic growth. Specifically, based on empirical results, our estimation for domestic output sacrifice ratio indicated large coefficient when the terms-of-trade decline in case of Pakistan. However, this ratio has been declining overtime. The underlying dynamics for such decrease in sacrifice ratio indicated that, overtime, the role of expenditure switching effect - through both imports and exports, in external adjustment has been increasing, albeit at slower pace. While this is an important finding, the magnitude of this effect is still very low compared to the role of income effect, which leads to higher sacrifice ratio.

Importantly, despite data limitations, our preliminary results highlighted that when the economy operated under the floating or flexible exchange rate mechanism, the sacrifice ratio is estimated to be lower. From the policy perspective, including the monetary policy and the role of the central bank in the foreign exchange management, these are important findings as they provide insights to policy options in times of external pressures.

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Annexures

Annexure-I: Impulse Response Functions (IRF) - Baseline Response to Terms-of-Trade Bust

Full Sample 1980Q1-2022Q2
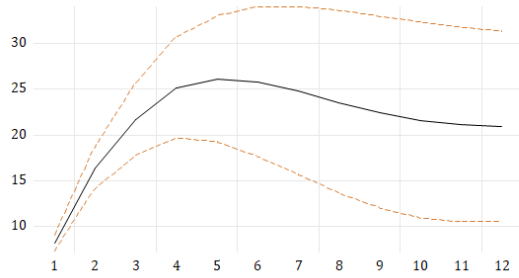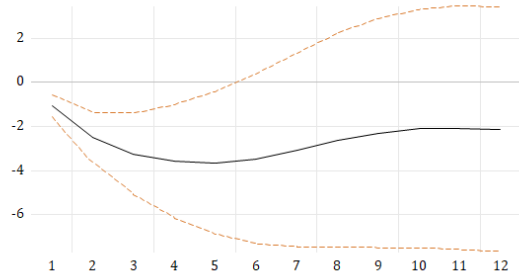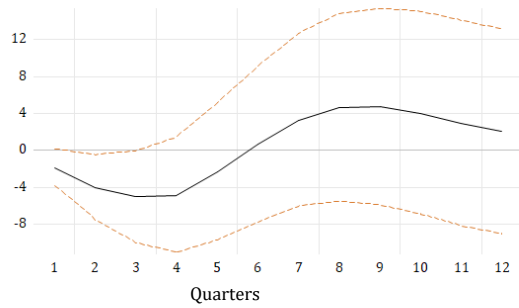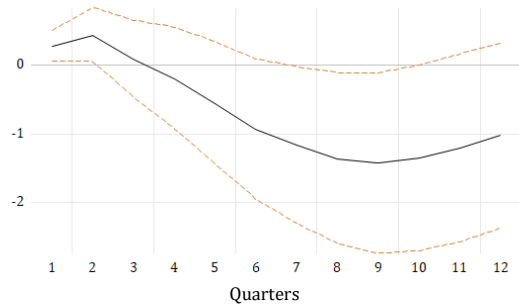
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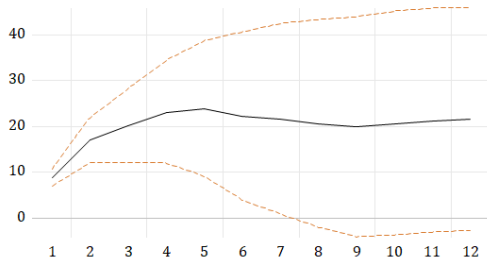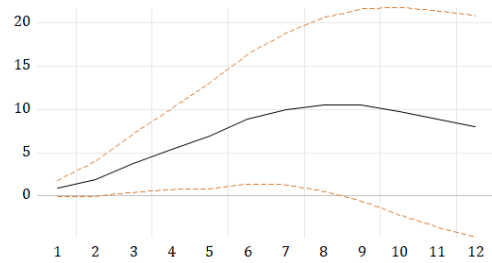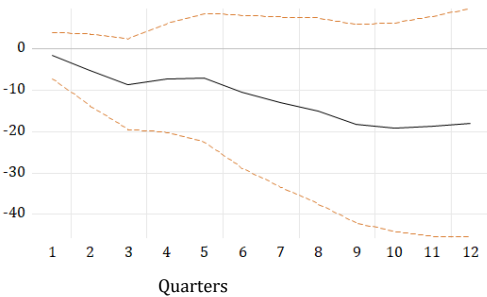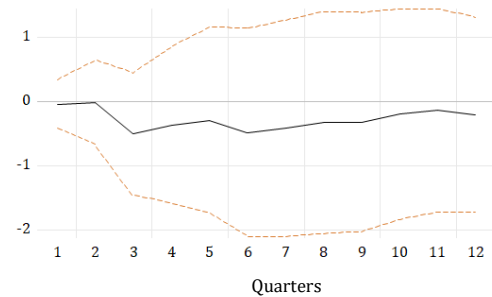
Source: SBP staff estimates

Full Sample 1980Q1-2002Q2
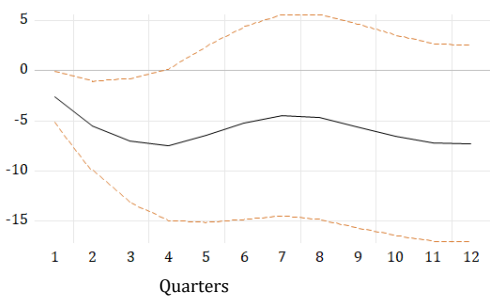
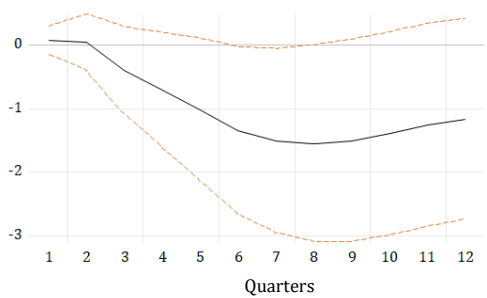Accumulated Response of @PCY(TOT)*-1 to @PCY(TOT)*-1 Innovation
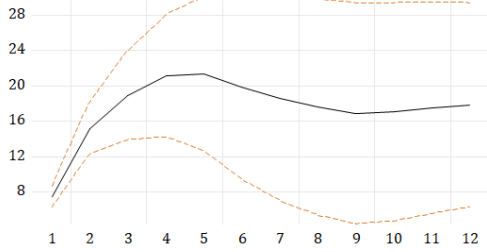
Accumulated Response of @PCY(REER) to @PCY(TOT)*-1 Innovation

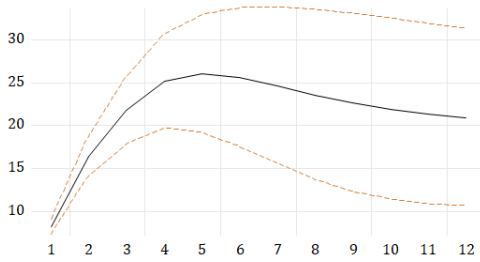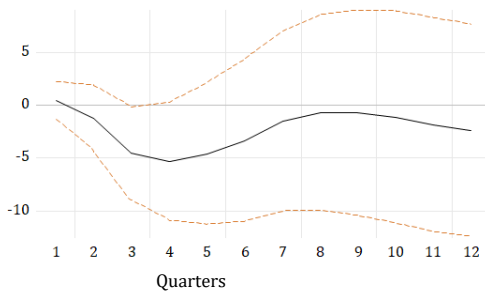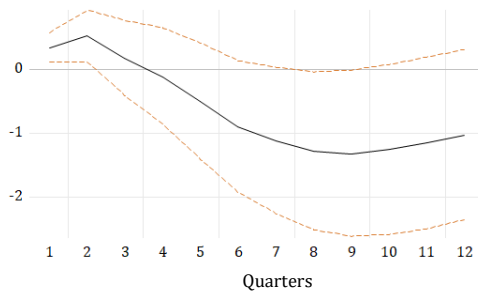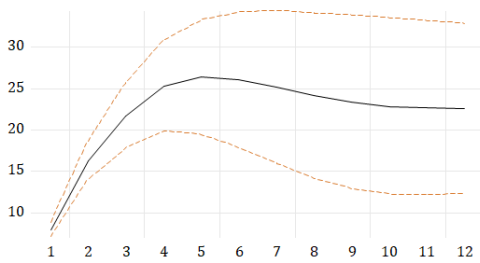Accumulated Response of @PCY(TD_E2M) to @PCY(TOT)*-1 Innovation

Accumulated Response of @PCY(R_GDP_SA) to @PCY(TOT)*-1 Innovation

Quarters
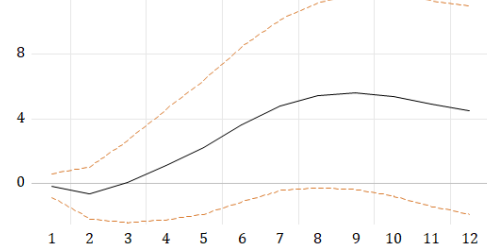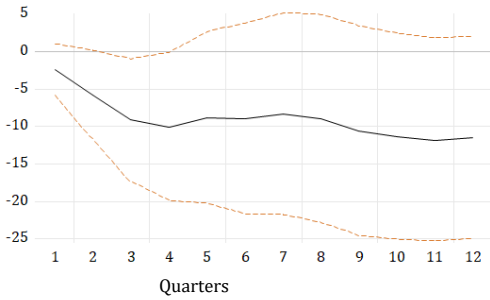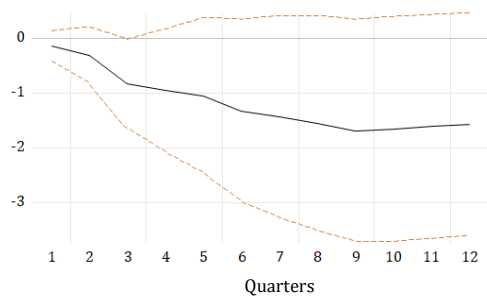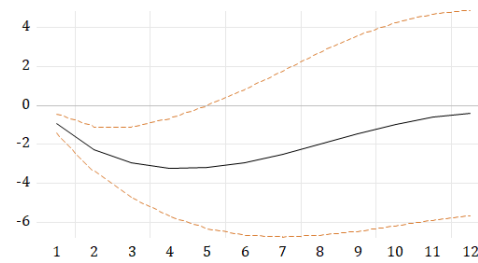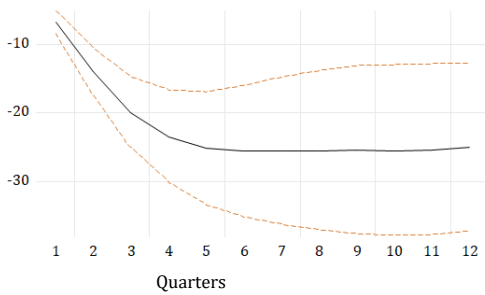
Full Sample 1980Q1-2012Q2

Accumulated Response of @PCY(TOT)*-1 to @PCY(TOT)*-1 Innovation
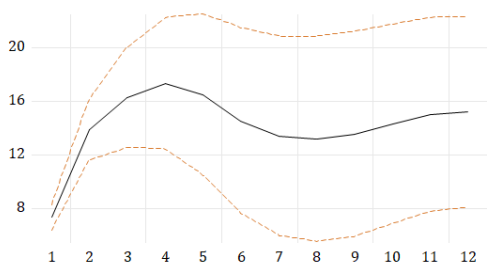
Accumulated Response of @PCY(REER) to @PCY(TOT)*-1 Innovation
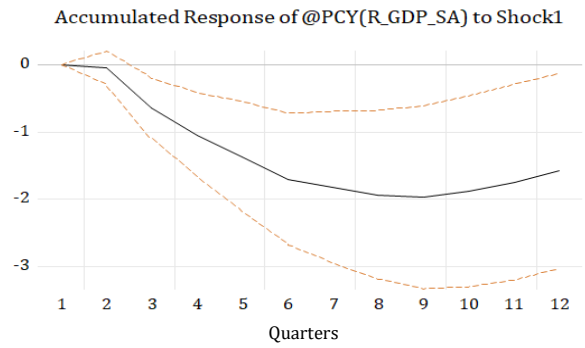
Accumulated Response of @PCY(TD_E2M) to @PCY(TOT)*-1 Innovation

Accumulated Response of @PCY(R_GDP_SA) to @PCY(TOT)*-1 Innovation

Quarters
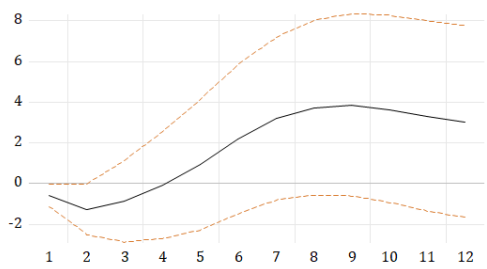
Source: SBP staff estimates

Annexure-II: IRF - Disaggregated Trade Balance Response to Terms-of-Trade Bust

Real Exports

Accumulated Response of @PCY(TOT)*-1 to @PCY(TOT)*-1 Innovation

Accumulated Response of @PCY(REER) to @PCY(TOT)*-1 Innovation
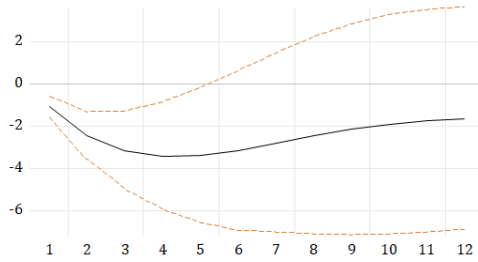
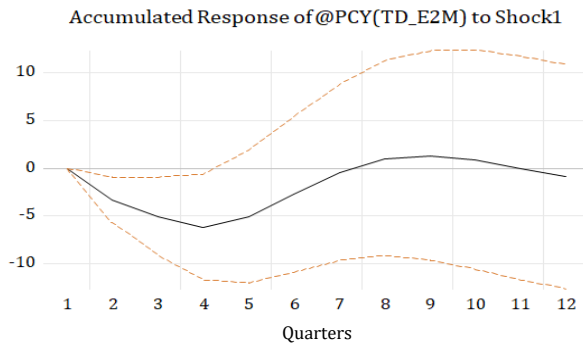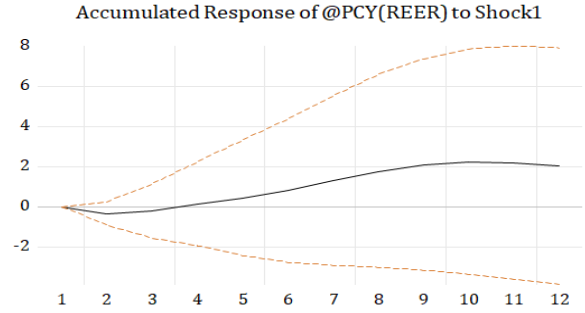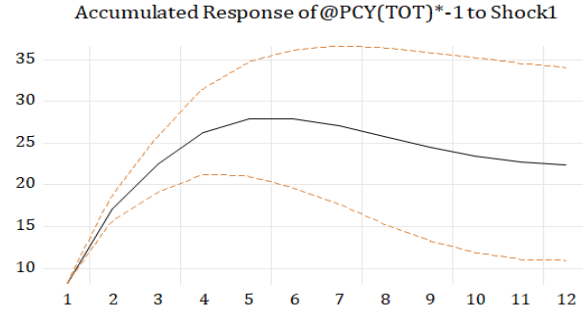Accumulated Response of @PCY(R_EXP_SA) to @PCY(TOT)*-1 Innovation

Quarters

Accumulated Response of @PCY(R_GDP_SA) to @PCY(TOT)*-1 Innovation

Quarters

Real Imports

Accumulated Response of @PCY(TOT)*-1 to @PCY(TOT)*-1 Innovation

Accumulated Response of @PCY(REER) to @PCY(TOT)*-1 Innovation

Accumulated Response of @PCY(R_IMP_SA) to @PCY(TOT)*-1 Innovation

Quarters

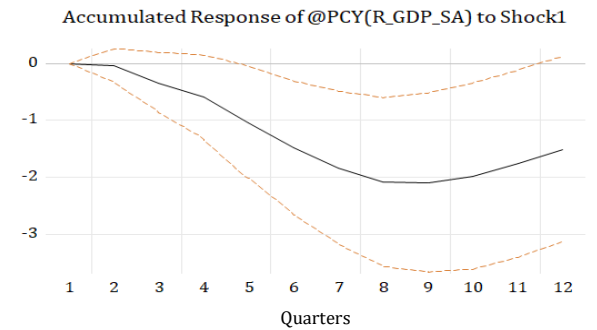Accumulated Response of @PCY(R_GDP_SA) to @PCY(TOT)*-1 Innovation

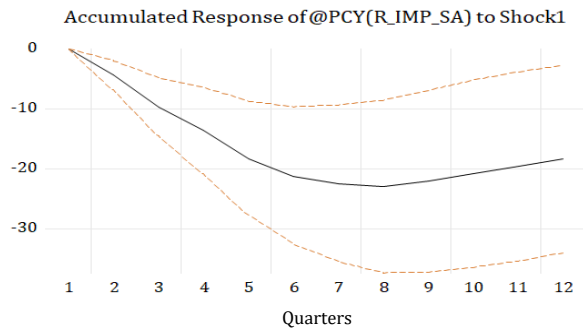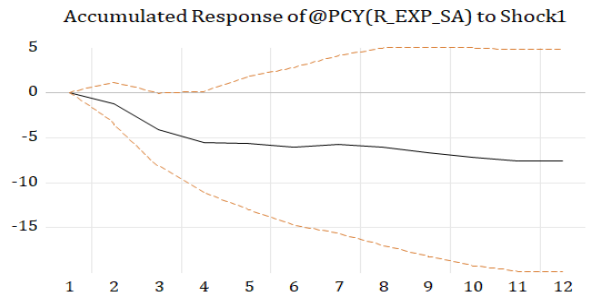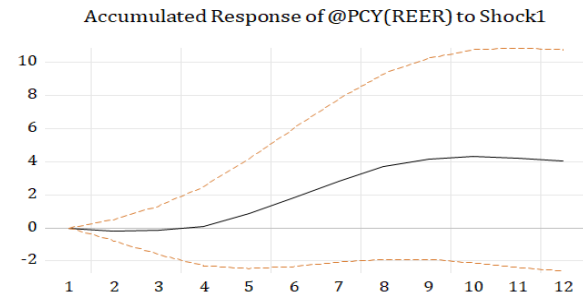Quarters
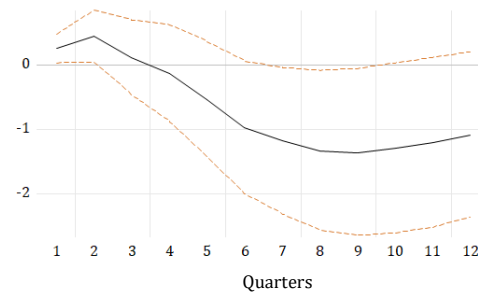
Source: SBP staff estimates

Annexure-III: IRF - Counterfactual Response to Terms-of-Trade Bust

With Trade Balance

Accumulated Response of @PCY(TOT)*-1 to Shock1

Accumulated Response of @PCY(REER) to Shock1

Accumulated Response of @PCY(TD_E2M) to Shock1

Accumulated Response of @PCY(R_GDP_SA) to Shock1

Quarters

With Disaggregated Trade Balance

Accumulated Response of @PCY(REER) to Shock1

Accumulated Response of @PCY(R_EXP_SA) to Shock1

Accumulated Response of @PCY(R_IMP_SA) to Shock1

Accumulated Response of @PCY(R_GDP_SA) to Shock1

Quarters

Source: SBP staff estimates