A Structural VAR Analysis of Pakistan's Textile Exports

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Abstract: This paper creates a structural vector autoregression (SVAR) model which looks at the macroeconomic factors that impact the export of Pakistani textiles and see how the Pakistani textile exports react to changes in these factors. The analysis used is unique because it separates out the impact of aggregate exchange rate changes with respect to trading 'partners' from aggregate exchange rate changes with respect to trading 'competitors'. It was found that Pakistani textile exports were positively impacted by the aggregate consumption of trading partners, the real exchange rate of Pakistan with its trading partners and growth in the manufacturing sector of Pakistan. The shocks that also significantly increased the growth in the Pakistani manufacturing sector were the trading partner aggregate consumption shocks and the shocks to the manufacturing sector output of Pakistan.

JEL Classification Code: F1, F14, E17

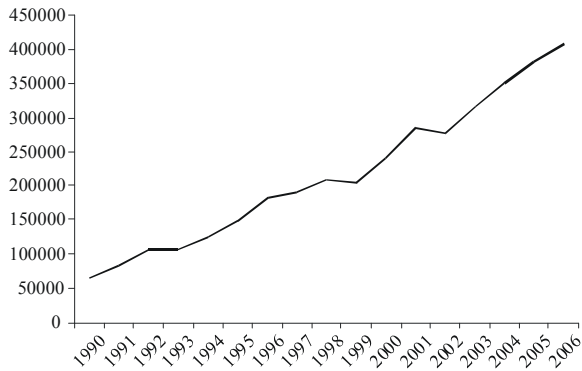**Key words:** Exports · Textiles · VAR · Pakistan

INTRODUCTION

Trade is a crucial component of any economy and Pakistan is no exception. Trade as a percentage of the GDP of Pakistan has risen from approximately 26% in 1999-2000 to approximately 34% in 2005-2006. But a crucial component of Pakistan's trade picture is the heavy reliance on the export of textiles. Between 60 and 70% of Pakistan's merchandise exports are accounted for by the textile and garment industry, which also accounts for about 8.5% of the GDP and 38% of the employed labor force. The aim of this paper is to create a structural vector autoregression (SVAR) model which looks at the particular factors that impact the export of Pakistani textiles and see how the Pakistani textile exports react to changes in these factors.

The reason for focusing on the textile sector is because over the last five years, Pakistani merchandise exports have grown at an average of about 12% per year, with about 60% of the growth in exports being accounted for by the textile and garment industry. Graph 1 shows the upward trend of Pakistani textile exports and it is important to notice the surge in textile exports after quotas were lifted on textile exports in FY 2005. But despite increasing textile exports, Pakistan is still a relatively small player on the global scale, which increases its susceptibility to export trends in other major textile producing countries. Graph 2 shows the share of Pakistani textile exports in terms of world textile exports and Graph 3 shows the various shares of textile exports by major producers of textiles over time.

Another perceived weakness of Pakistan's textile exports is that there is a narrow group of countries which are the major importers of Pakistani textiles. Graph 4 shows the breakdown over time of the major importers of Pakistani textiles and the narrowness of Pakistan's textile market makes it susceptible to both changes in growth (and preferences) in these countries and the trade policies of these countries.

Most analyses of Pakistan's exports in general and textile exports in particular, focus on issues of market access and export competitiveness. With the elimination of quotas on Pakistani export exports, there has been a surge in Pakistani textile exports, but this has also been accompanied by a surge in the textile exports of other major textile producing countries. In addition to this, Pakistan's textile exports will face even more competition from China, once quota restrictions placed on Chinese textiles are phased out in 2007-2008.

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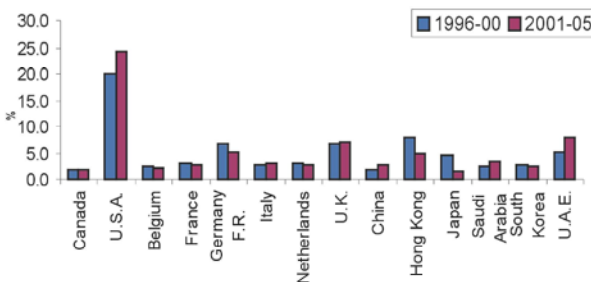
Graph 1: Exports of Textile and Clothing (Rs Million)

Graph 2: Share of Exports of Textile and Clothing of Pakistan in World
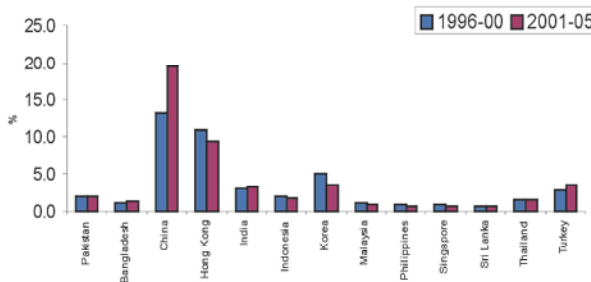
Graph 3: Average share of Major Exporters of Textile and Clothing

Graph 4: Average share of Destinations of Pakistani Exports

The objective of this paper is to see how textile exports and manufacturing output are affected by various macroeconomic factors which can vary over time. Though these factors are numerous, we focus on the impact of an income shock in the economies of the Pakistan's major trading partners, the impact of an increase in exports of Pakistan's major competitors in area of textiles, the impact of an exchange rate depreciation of Pakistan's currency with its trading partners and the impact of an exchange rate depreciation of the currency of Pakistan's major competitors. The primary goal of the analysis is to see how international macroeconomic factors impact Pakistan's exports of textiles and if there is an impact of a factor on Pakistan's exports, what does this imply for Pakistan's manufacturing sector growth. This paper is unique because it separates out the impact of aggregate exchange rate changes with respect to trading 'partners' from aggregate exchange rate changes with respect to trading 'competitors'.

The paper is organized as follows: Section 2 provides a selective literature review of findings on factors affecting the level of exports in Pakistan. Section 3 outlines the structural VAR model used in this paper. Section 4 shows the results from simulated macroeconomic shocks on the growth in textile exports. Section 5 presents the conclusions.

Literature Review: The literature on international trade starts with the Ricardo's idea of comparative advantage [1] which finds that trade patterns are explained by comparative labor productivity advantages across countries. The factor proportions theory added to this idea by analyzing how relative factor endowment differences explain comparative advantage [2]. In this theory, more capital abundant countries have higher labor productivity, but the advantage gained relative to the less abundant countries varies with the relative capital intensity of the good's technology.

Following Ricardo's theory of comparative advantage was the Heckscher-Ohlin analysis [3] of the factor proportions model which predicted that a country would have a comparative advantage in the good which made relatively intensive use of its relatively abundant factor. So if the home country were relatively abundant in capital, it would have a comparative advantage in the good which used capital relatively intensively.

Exchange rates entered the discussion when Alfred Marshall and Abba Lerner [4] discussed how depreciations in the domestic currency caused exports to rise (as long as the sum of export and import elasticities was greater than one). Mundell [5] and Fleming [6]

went on to look at the impact of exchange rates domestic output in an open economy ISLM framework and also found that exchange rate depreciations led to expansions in exports and higher domestic output. They also looked at the impact of increased demand for domestic exports on exchange rates and domestic output. Generally, exchange rate depreciations have been associated with an expansion in exports and a contraction in imports.

Much of the previous analyses on the factors affecting Pakistan exports has focused on the impact of external factors on Pakistani exports has focused on the effects of exchange rate movements on both real and nominal variables in Pakistan. Khan [7] looked at the effect of external factors on Pakistan's real exchange rate between 1977 and 1984. In particular, he found that counterintuitive relationships between real exchange rate movements and factors such as the terms of trade, the real GNP of industrial countries, real international interest rates and capital flows.

Research on the impact of currency depreciation on the trade balance has provided different results for different time periods. Hassan and Khan [8] looked at data from 1972 to 1991 and found that the Marshall-Lerner stability conditions were satisfied (or that devaluation increased exports), while Khan and Aftab [9] found the opposite result using data from 1983 to 1993. Akhtar and Malik [10] used data disaggregated by Pakistan's four major trading partners and found that real devaluation would improve Pakistan's trade balance with the United Kingdom and Japan, but not with the United States or Germany. Aftab and Aurangzeb [11] and Rehman and Afzal [12] both found evidence supporting the existence of a J-curve in the short run, where a currency depreciation leads to an initial deterioration in the trade balance and then an improvement.

The international evidence of the impact of exchange rate changes on exports generally finds a positive impact of depreciations on country exports. Safdari *et al*. [13] use a VAR analysis and find that exchange rate changes increase exports and domestic output in Iran. Similarly Gunduz [14] finds that following macroeconomic stabilization, exchange rates can be used to increase the exports of certain agricultural commodities in Turkey using a VAR analysis. Centinkaya and Erdogan [15] also find that higher exports in Turkey led to higher GDP while Corsetti *et al*. [16] finds that demand shocks in the US have led to appreciations in the US exchange rate and decreasing net exports (both also use a VAR analysis). Finally, Dussa [17] finds a significant impact of exchange rate shocks on the prices of imports and exports.

A separate strand of research has used time series tools to analyze the relationship Pakistan's exports and economic growth. Afzal [18] uses cointegration analyses and causality tests to find the relationship between Pakistan's GDP and exports and finds a strong and stable relationship between GDP and exports and bi-directional causality between manufactured exports and GDP. Love and Chandra [19] perform a similar analysis of causality for India, Pakistan and Bangladesh. Their analysis differs from previous analyses because they include terms of trade in their model and they find uni-directional causality between real exports and real income in Pakistan, or that growth is led by exports in Pakistan. Khan and Saqib [20] set up a simultaneous equation system to look at the relationship between exports and economic growth. Using 3SLS estimation techniques, they find a strong relationship between export performance and economic growth and also find that the majority of the contribution of export growth to economic growth is indirect in nature. Ahmad, Alam and Butt [21] perform causality tests and also find that export growth leads economic growth.

Up to this point, only some of the research looking at Pakistan's exports has used Vector Autoregressive (VAR) models. Ahmed, Ara and Hyder [22] present a structural VAR model which shows that external shocks are important in driving fluctuations in Pakistan. They also find that real exchange rate depreciations lead to declines in output the positive effect on net exports from real depreciations are more than offset by the contractionary effect on domestic absorption. The model used in this paper is similar to the one presented by Ahmed, Hyder and Ara, but focuses on the effect of macroeconomic shocks on textiles exports and manufacturing growth.

Recent papers in other areas of economics have used VAR analyses to look at the impact of monetary policy [23], as well as the impact of oil prices [24] and the impact of demand and supply shocks on aggregate demand [25].

Outline of the Structural Var Model: This section of the paper uses a Sims [26] structural VAR approach to create a model to look at the impact on Pakistan's textile exports of (1) Increased aggregate consumption in the countries which are the major importers of Pakistani textile exports, (2) Increased textile exports from the countries which are the major competitors to Pakistan in the textile sector, (3) Changes in the exchange rate of Pakistan with the countries which are the major importers of Pakistani textile exports.

The VAR (Vector Autoregression) model analyzes time series data by taking time series data on multiple variables and using this data to estimate a series of equations in which the variables mutually impact one another contemporaneously or with a time lag [27]. So a VAR model estimates the relationship between different time series variables and this estimated relationship is used to look at the impact of changes in one variable at time t (known as a shock) on every other variable in the system.

The VAR model used in this paper focuses on six variable: (i) The aggregate consumption of countries which are the major importers of Pakistani textile exports (or Pakistan's 'trading partners'), (ii) The textile exports of from countries which are the major competitors to Pakistan in the textile sector (or 'competitors'), (iii) The real exchange rate of Pakistan with its trading partners, (iv) The real exchange rate of Pakistan with its competitors, (v) The exports of Pakistani textiles, (vi) The total value-added of Pakistan's manufacturing sector. The sample period is 1973-2006. The aim of the VAR model estimation is to look various simulations; for example, one can look at the response of Pakistan's textile exports to its trading partners to an artificial shock to its real exchange rate with these partners.

An obvious issue that arises with some of these variables the question of how one measures each one, in particular those variables which combine elements from many countries (such as the aggregate consumption of major importers of Pakistan textile exports). The approach we adopted in this paper was to create an index for each variable using 2002 as the base year. For those variables which combine elements from many countries we took the weighted averages of each of these aggregate numbers and used these weighted averages to create indices. Since the SVAR analysis that follows looks at the relationship between growth rates of various variables, these were calculated using the indices we constructed.

Before the statistical analysis, one has to address an important issue: One of the usual problems with the estimation of VAR models is that if one was to try and capture all of the possible mutual effects for the six variables mentioned above, one would have to estimate a large number of parameters. This becomes a problem because a large number of parameters combined with a limited number of data observations would make it difficult to obtain reliable estimation results. Since we have 34 observations (from 1973-2006), we reduce the number of parameters to be estimated by making certain prior assumptions about the relationships among the

variables. These relationships (or in many cases the absence of relationships) are established by appealing to economic theory or common knowledge. A simple example is the assumption that changes in Pakistani textile exports will have no impact on the total consumption of Pakistan's trading partners. This can be assumed because of the relative size of Pakistani textile exports and the sizes of the economies to which Pakistan exports it textiles. Pre-determined relationships between variables of this type are known as prior restrictions and VAR models which use of prior restrictions are known as structural VARs. Structural VAR models are appealing because they reduce the demands on the data and also incorporate relationships into the model which are based on economic theory.

The structural VAR analysis which is used in the analysis that follows, we impose the prior restriction that certain parameters are zero, where economic theory tells us that there is no relationship between certain variables. So, if economic theory tells us that changes in Pakistan's textile exports in period t have no impact on aggregate consumption in Pakistan's trading partners during that period, we impose the restriction that the relevant structural parameter is zero and is not estimated. The specific restrictions imposed in the model are as follows:

- The aggregate consumption of the trading partners is unaffected by the other variables in the system.
- The real exchange rate of Pakistan with its trading partners is not affected contemporaneously by any variables, but is affected by the lagged values of all the variables.
- The textile exports from competitor countries are not contemporaneously affected by any variables, but are affected by lagged values of (a) the aggregate consumption of the trading partners, (b) the real exchange rate between Pakistan and its competitors and (c) the real exchange rate between Pakistan and its trading partners.
- The real exchange rate between Pakistan and its competitors is not affected contemporaneously by any variables, but is affected by the lagged values of all the variables.
- The total value-added of Pakistan's manufacturing sector is not affected contemporaneously by any variables, but is affected by the lagged values of all the variables.
- The exports of Pakistani textiles are not affected contemporaneously by any variables, but are affected by the lagged values of all the variables.

At this stage it is important to note that the restrictions above are contemporaneous restrictions, i.e. restrictions on changes in one variable causing changes in another variable in the same time period. So when one says that the level of textile exports from Pakistan's competitors does not contemporaneously affect the level of Pakistani exports, one is basically saying that changes in the level of exports of Pakistan's competitors does not immediately affect Pakistani exports, but could possibly affect it in subsequent time periods.

Results of Simulations: After the system of equations is set up and the restrictions are placed on the system, the six variable reduced form VAR is estimated, using a lag length of three (which was selected using statistical criteria). As is the usual procedure in the analysis of structural vector autoregressions, a series of shock simulations are performed. The shock simulation is used to see the impact of a 1 standard deviation positive shock to each of the variables in the system. So using this analysis we can see what the impact of a positive shocks will be on Pakistan's textile exports, the exports of Pakistan's competitors and the size of Pakistan's manufacturing sector.

In structural VAR models, the impact of variable shocks is illustrated through impulse response functions which graph the impact of a shock to one variable on each of the other variables over time. Appendix A shows the impulse response functions for shocks to each of the six variables in the model. Because there are six variables, there are 36 impulse response functions (6 variable shocks

each affecting six variables), but in this section we will focus on key shocks and the effects of these shocks on key economic variables.

Figure 1 shows the impact of an increase in the growth rate of aggregate consumption of Pakistan's trading partners on some of the key variables in the system. The first panel shows the consumption shock. The second panel and fourth panels show that the consumption shock leads to a higher growth in textile exports in both Pakistan and in the competitor countries. But notice what happens to the real exchange rate of Pakistan: it rises slightly and then falls. This exchange rate effect has a tendency to cause a slow down the growth rate of Pakistani textile exports. The last panel shows the impact on Pakistan's manufacturing sector: the aggregate consumption shock leads to an increase in the growth rate of Pakistan's manufacturing sector.

Figure 2 looks at the impact of a positive shock to the level of textile exports by Pakistan's competitors. One could think of this as a positive shock to Chinese textile exports after the removal trade restrictions. Notice what happens in the system: The exports of competitors rises, but this is followed by a appreciation of the real exchange rate of competitors. So the higher growth rate of exports of competitors starts to decline by the second period. The exports of Pakistani textiles start to increase (due to the appreciation of the real exchange rates of competitors) but then decrease by the second period. The impact on growth rate of Pakistan's manufacturing sector is negligible.
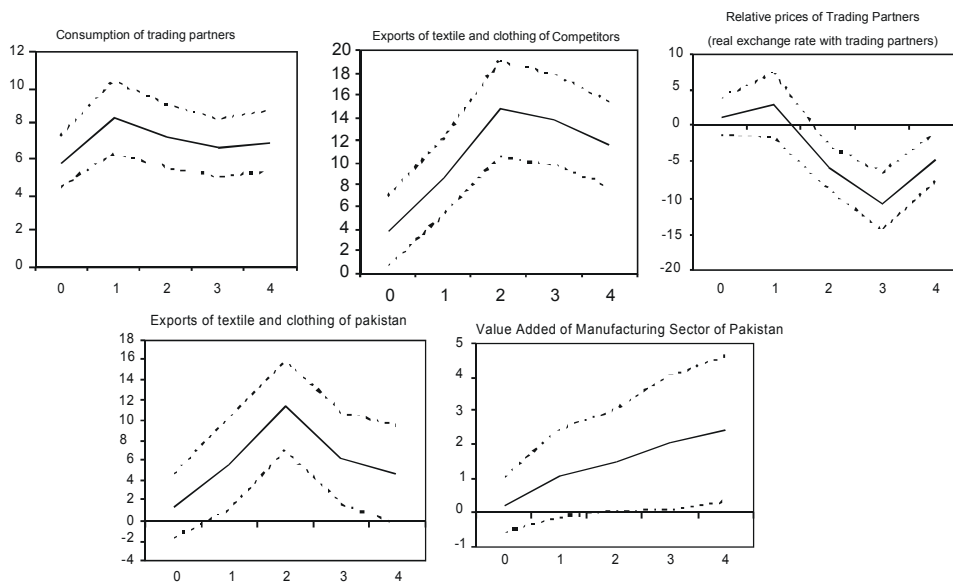

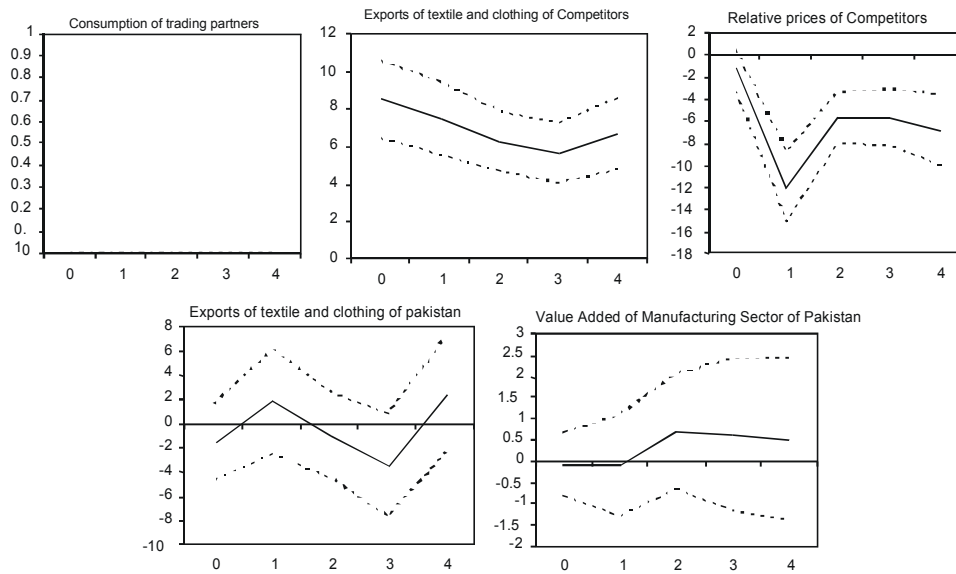Fig. 1: Shock to Trading Partners' Aggregate Consumption
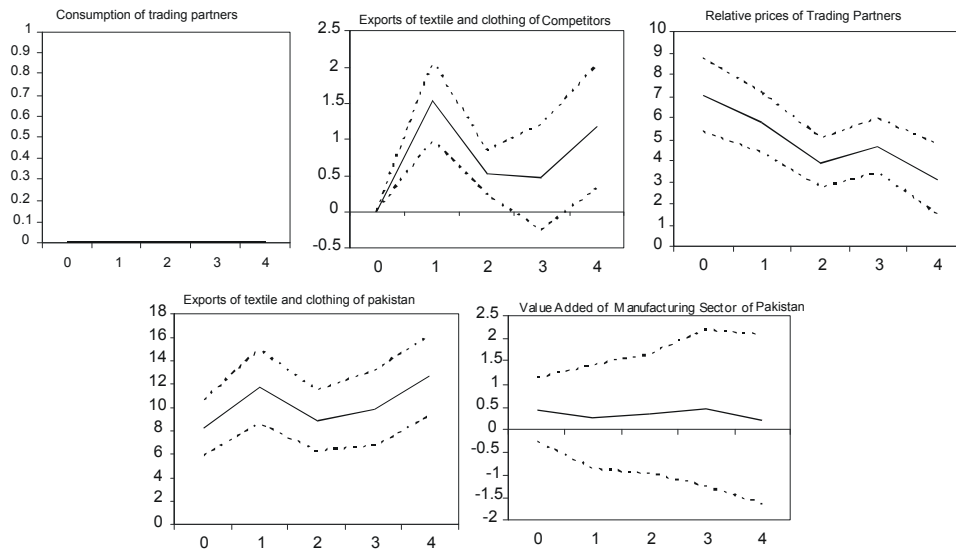
Fig. 2: Shock to Competitors' Textile Exports

Fig. 3: Shock to Pakistani Real Exchange Rate with Trading Partners

Figure 3 looks at the impact of a positive shock (depreciation) on the real exchange rate of Pakistan with its trading partners. As you can see in the fourth panel, the original impact on the amount of Pakistan's textile exports is significant and positive. But as the third panel shows, real exchange rate of Pakistan with its competitors starts to decline (appreciate), which causes Pakistani textile exports to fall. Competitors exports are initially unaffected by the Pakistan rate increase, but interestingly start to increase (perhaps in response to an exchange rate realignment by the competitors). The impact on growth rate of Pakistan's manufacturing sector is interesting,

because there is a slight increase in the growth rate of Pakistan's manufacturing sector, though this is not significantly positive.

Figure 4 shows the impact of an increase in the growth rate of Pakistani textile exports. Let's say the changes in consumer preferences of changes in trade policy lead to a positive shock in the growth of textile exports from Pakistan. The second panel shows that this positive shock to Pakistani textile exports will be accompanied by a decrease in the growth of textile exports by competitors. But the third panel shows that as Pakistani textile exports grow, there will be a real
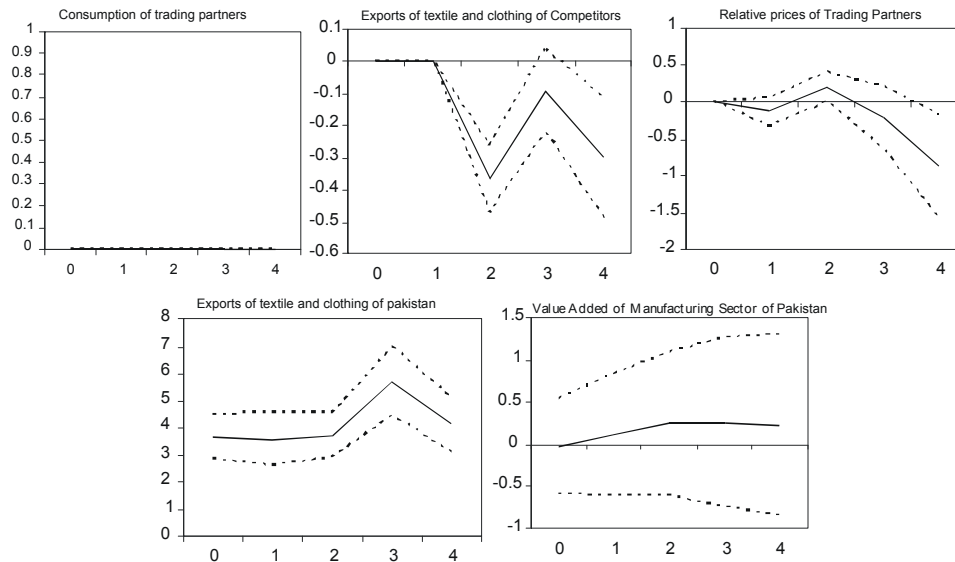
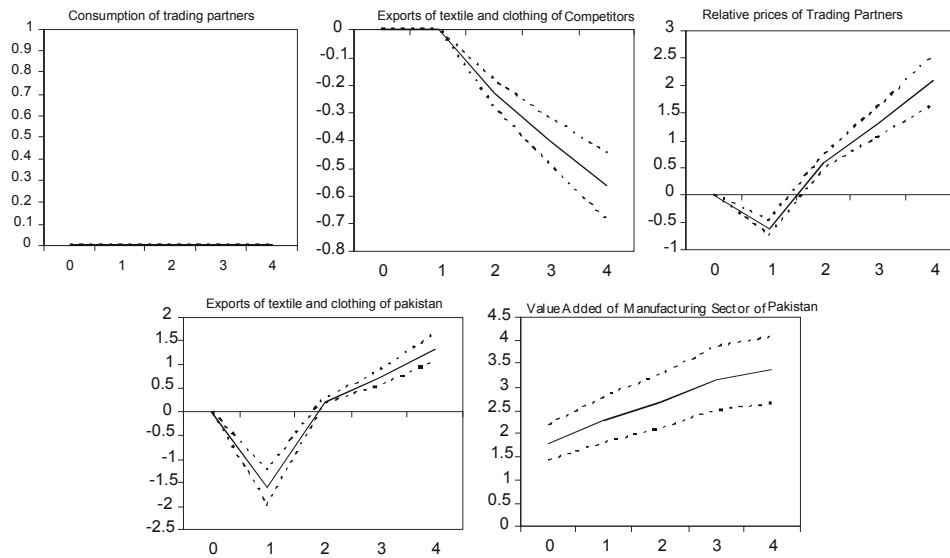Fig. 4: Shock to Pakistani Textile Exports

Fig. 5: Shock to Pakistan's Manufacturing Sector

depreciation in the exchange rate of competitors. This leads to a dampening of the impact of the shock which means that textile export growth starts returning to its original levels and the fifth panel shows that after a very small increase in the growth rate of Pakistan's manufacturing sector, this fizzles out after the second period.

Figure 5 shows the impact of an positive shock to the growth rate of the manufacturing sector, which could be interpreted as a productivity shock. Interestingly we see a J-Curve type of effect with the real exchange rate initially appreciating, accompanied by a decrease in

textile exports, followed by a depreciation of the exchange rate accompanied by an increase in textile exports. This increase in textile exports happens at the same time as a decrease in the textile exports of Pakistan's competitors.

CONCLUSIONS

This paper attempts to look at the impact of macroeconomic shocks on Pakistan's textile exports by creating a structural VAR model that incorporates 5 major macroeconomic factors that affect these exports.

The analysis separates out the impact of aggregate exchange rate changes with respect to trading 'partners' from aggregate exchange rate changes with respect to trading 'competitors'. After certain restrictions were put on the model, it was found that Pakistani textile exports were positively impacted by the aggregate consumption of trading partners, the real exchange rate of Pakistan with its trading partners and growth in the manufacturing sector of Pakistan.

But while textile exports were positively and significantly affected by each of these factors, the shocks that also significantly increased the growth in the Pakistani manufacturing sector were the trading partner aggregate consumption shocks and the shocks to the manufacturing sector output of Pakistan. This is an important result because both of these shocks are fundamental structural shocks to the system which implies that economic growth in Pakistan can be increased by either significant growth in the economies of the trading partners (which is typically unreliable) or by increasing the productivity of the manufacturing sector.

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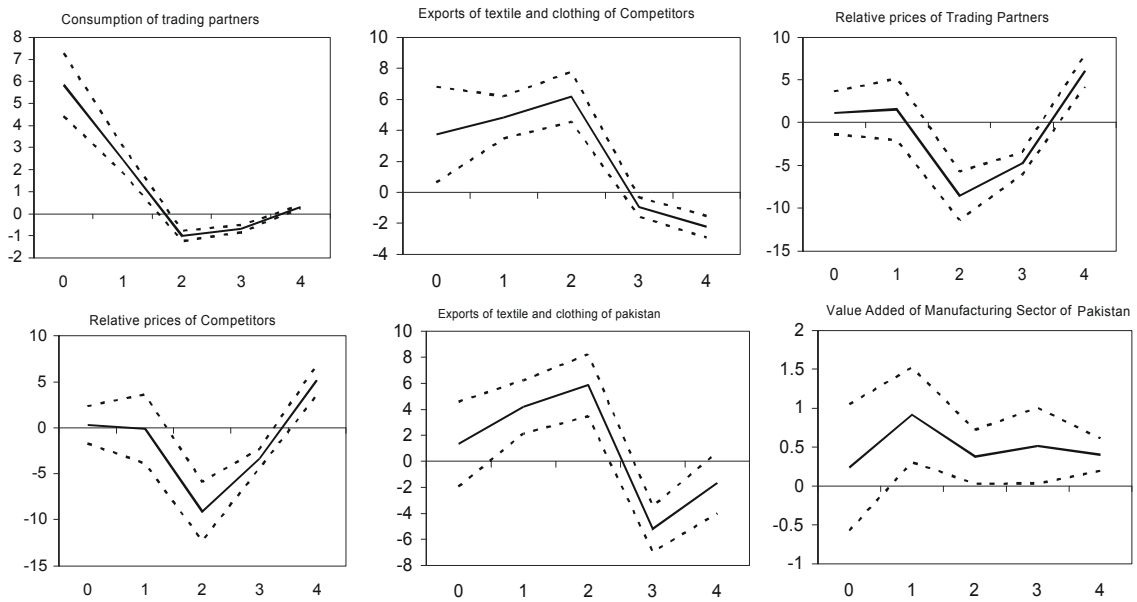
Appendix A: Impulse Response Functions

Response of shock to Consumption of Trading Partners
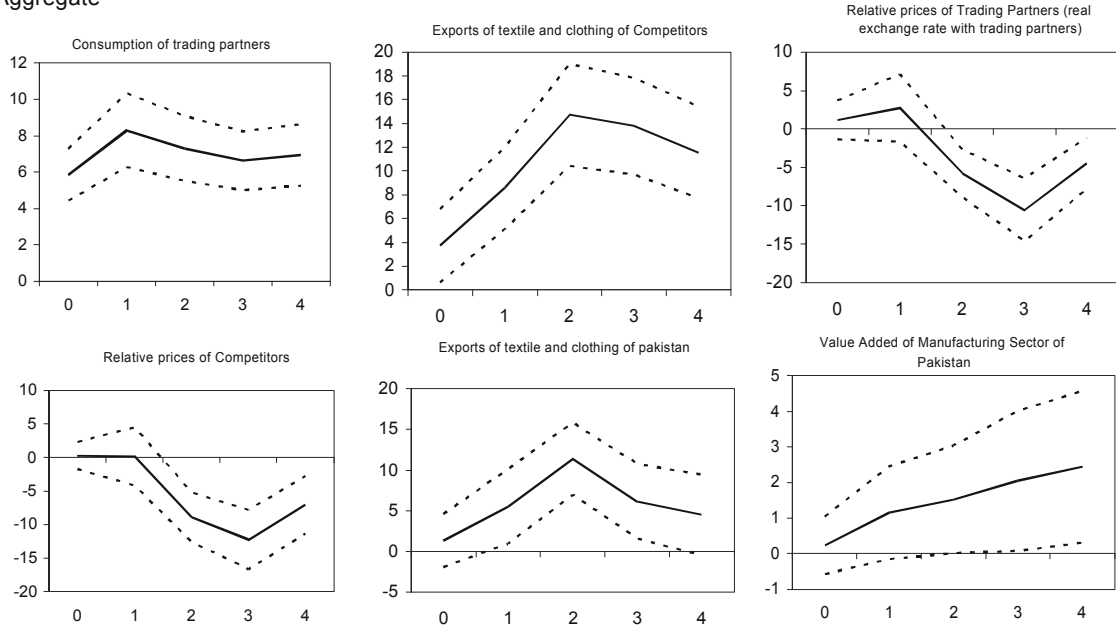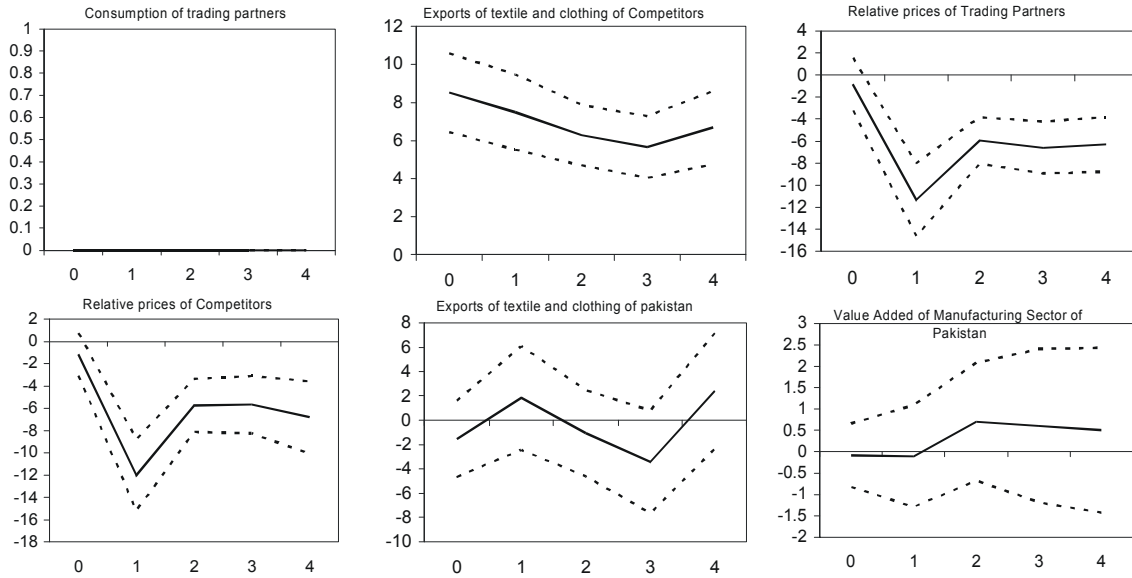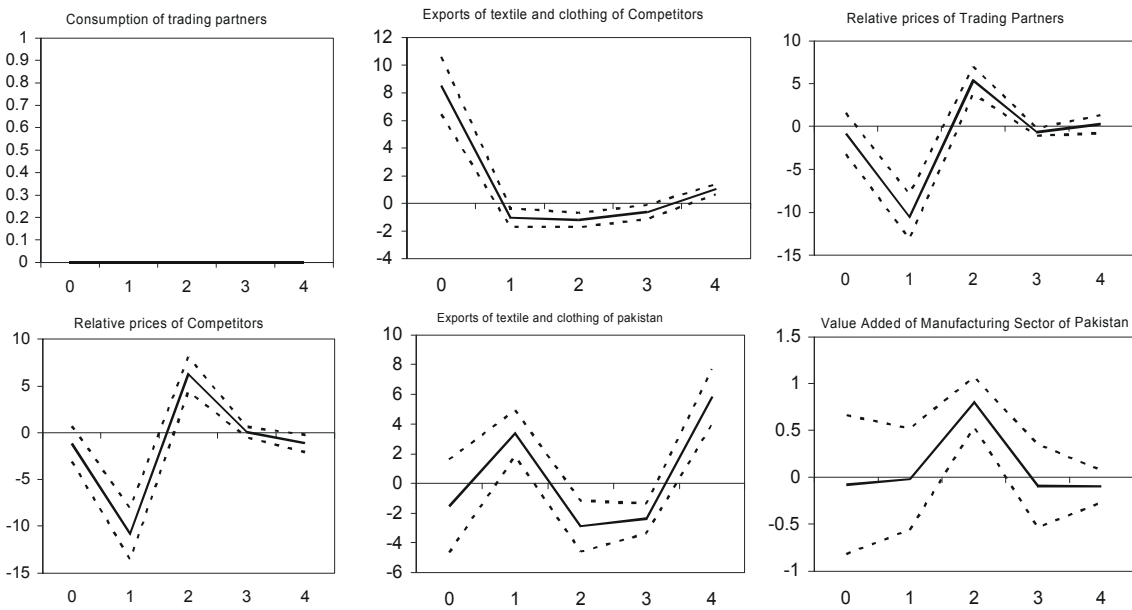
Aggregate

Growth

Appendix A (Continued): Impulse Response Functions

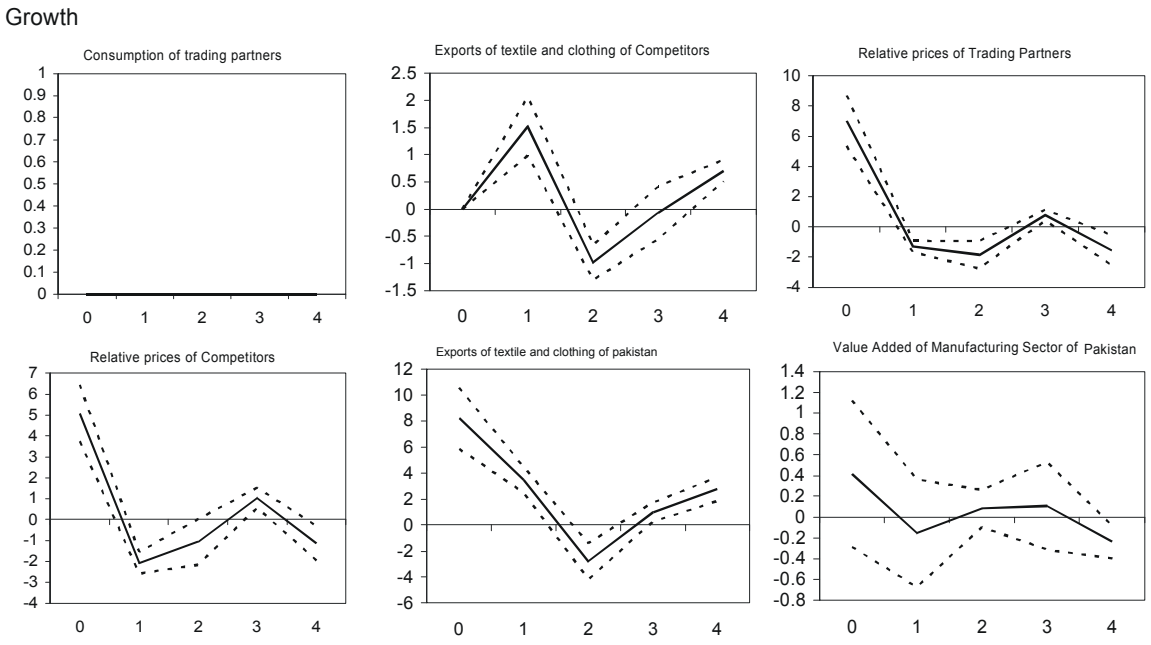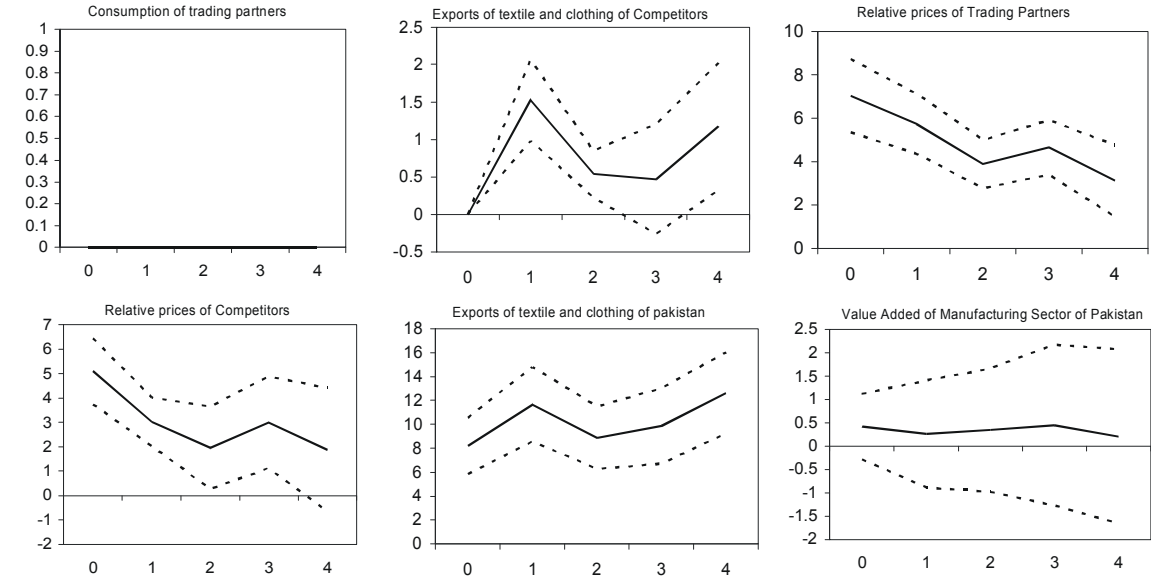### Response of shock to Exports of textile and clothing of Competitors

Aggregate

Growth

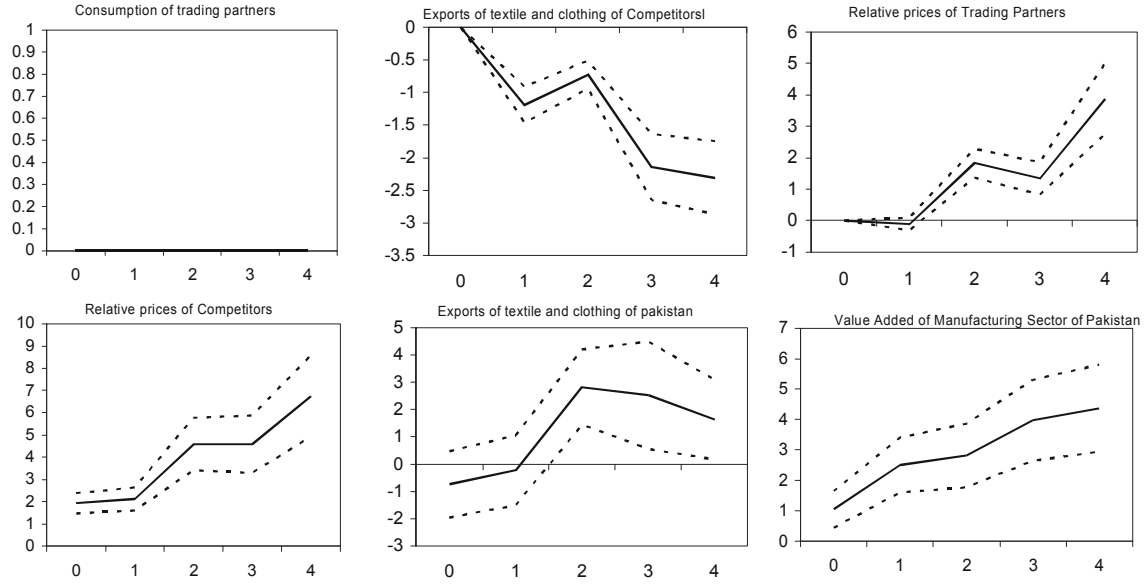## Appendix A (Continued): Impulse Response Functions

Response of shock to relative prices of trading partners (real exchange rate with trading partners)

Aggregate
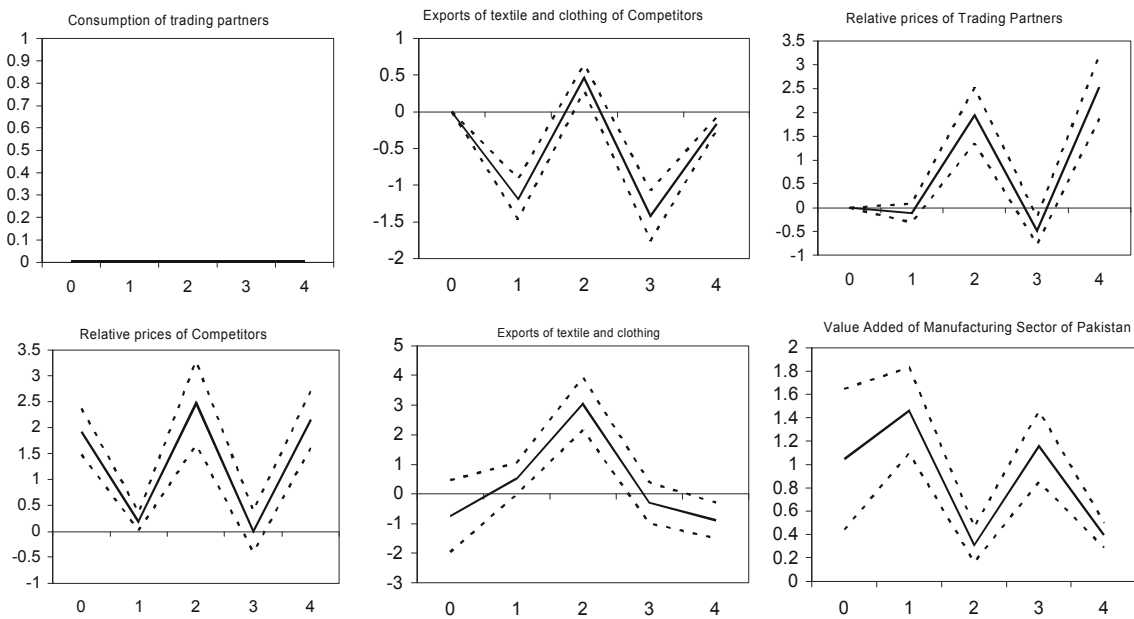

Growth

Appendix A (Continued): Impulse Response Functions

Response of shock to Relative prices of Competitors

Aggregate

Consumption of trading partners

Exports of textile and clothing of Competitorsl

Relative prices of Trading Partners

Relative prices of Competitors

Exports of textile and clothing of pakistan

Value Added of Manufacturing Sector of Pakistan

Growth

Consumption of trading partners

Exports of textile and clothing of Competitors

Relative prices of Trading Partners

Relative prices of Competitors

Exports of textile and clothing
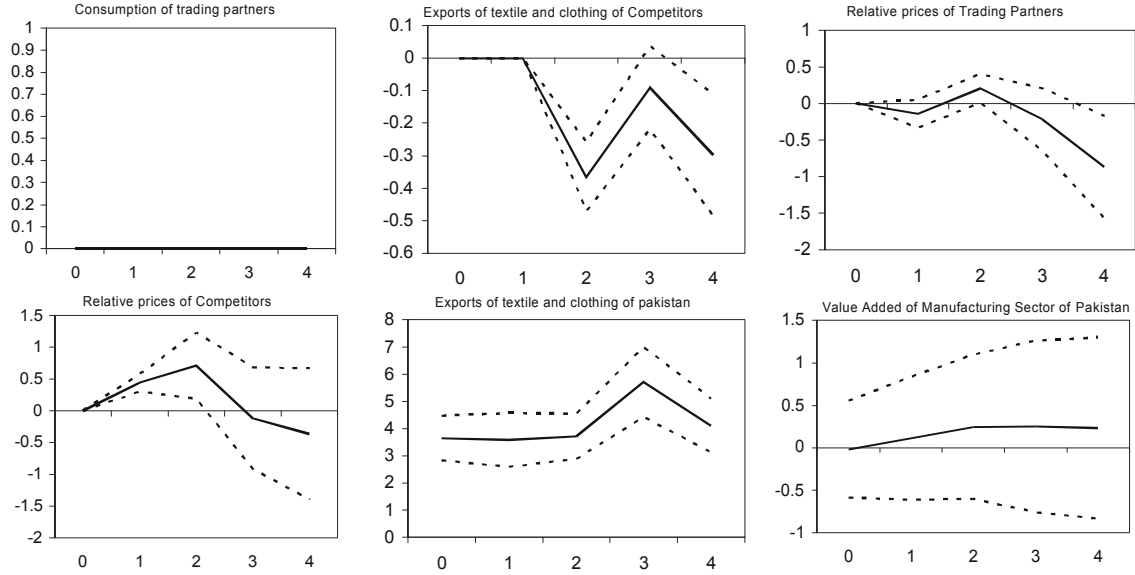
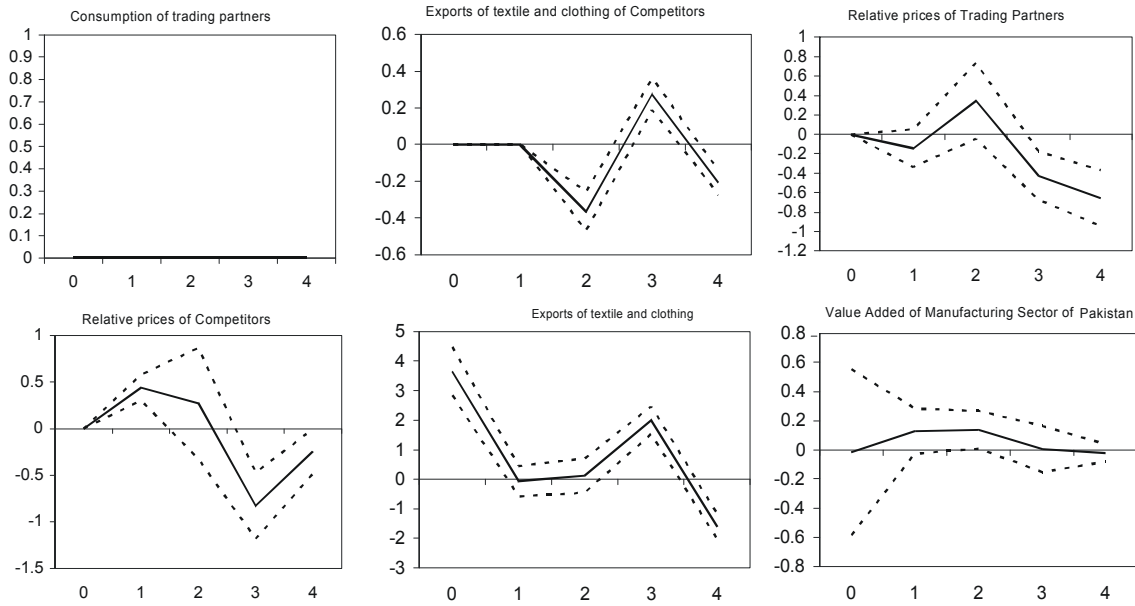Value Added of Manufacturing Sector of Pakistan

Appendix A (Continued): Impulse Response Functions

Response of shock to Exports of textile and clothing of Pakistan
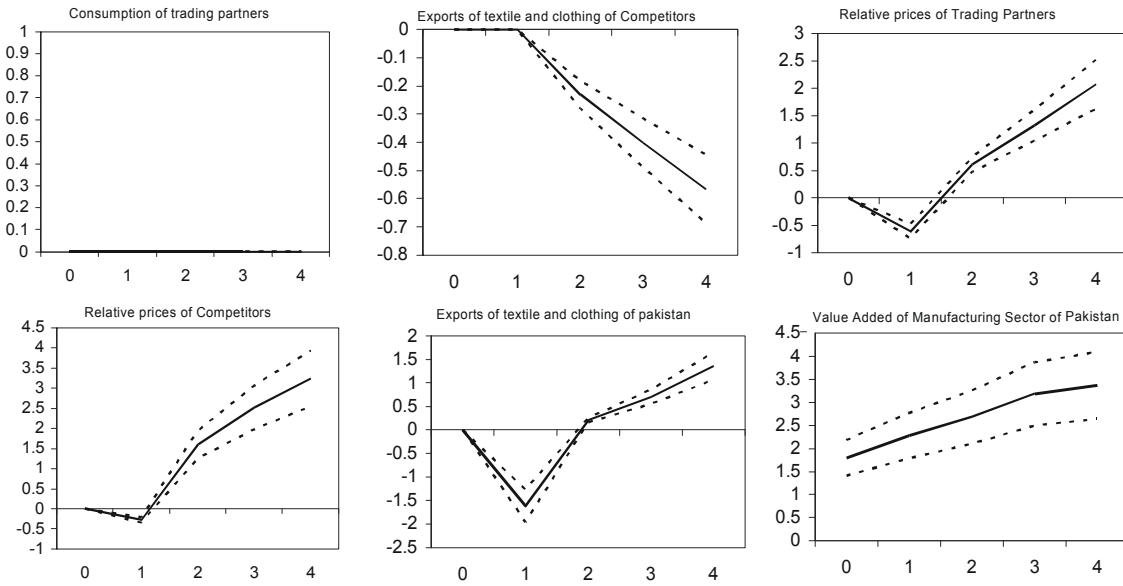
Aggregate

Growth

Appendix A (Continued): Impulse Response Functions

Response of shock to Value Added of Manufacturing Sector of Pakistan

Aggregate

Growth