EXCHANGE RATE PASS-THROUGH
INTO THE EXPORT AND IMPORT PRICES OF TURKEY

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ABSTRACT

EXCHANGE RATE PASS-THROUGH
INTO THE EXPORT AND IMPORT PRICES OF TURKEY

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In this study, exchange rate pass-through into the export prices and import prices is analyzed separately at the disaggregate level. The study also attempts to differentiate exchange rate pass-through in the short-run and long-run. To analyze pass-through in the short-run, dynamic modeling is used. To analyze pass-through in the long-run, cointegration analysis is conducted. Estimation results show that exchange rate pass-through into the import prices is complete even at the disaggregate level. However, there is variation in the pass-through into the export prices across sectors both in the short-run and long-run. Not all exporting sectors, even in a small open economy like Turkey, are price takers in the foreign markets.

Keywords: Exchange Rate Pass-Through, Export Prices, Import Prices, Disaggregate Analysis

ÖZ

DÖVİZ KURLARININ TÜRKİYE'NİN İTHALAT VE İHRACAT FİYATLARINA YANSIMASI

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Bu çalışmada, döviz kuru değişimlerinin Türkiye'nin ithalat ve ihracat fiyatlarına yansıma derecesi endüstri bazında incelenmiştir. Kısa ve uzun dönemdeki yansıma dereceleri ayırt edilmeye çalışılmaktadır. Kısa dönemdeki yansıma derecesini incelemek için, dinamik modelleme kullanılmıştır. Uzun dönemdeki yansıma derecesini incelemek için ise, eşbütünleşme analizi yapılmıştır. Tahmin sonuçları, endüstri bazında bile kur değişimlerinin ithalat fiyatlarına tam olarak yansıdığını göstermektedir. Fakat sonuçlar, hem kısa hem uzun dönemde, kur değişimlerinin ihracat fiyatlarına yansıma derecesinde endüstriler arasında farklılık olduğunu göstermektedir. Küçük, açık bir ekonomi olan Türkiye'de bile ihracat yapan sektörlerin tümünün yabancı piyasalarda fiyat alıcısı olmadığı gözlemlenmiştir.

Anahtar Kelimeler: Döviz Kuru Yansıması, İhracat Fiyatları, İthalat Fiyatları, Endüstriyel Baz

To My Parents

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CHAPTER 1

INTRODUCTION

Since the 1980s, there is a considerable amount of exchange rate variability under floating exchange rates regimes. It is expected that floating exchange rates will provide the necessary adjustment in the trade balance, i.e. external adjustment. However, the observed unresponsiveness of trade balances to exchange rate changes led researchers to investigate the relationship between exchange rates and traded goods' prices. In this context, exchange rate pass-through (ERPT) refers to the degree to which exchange rate changes are reflected in the destination currency prices of traded goods (Menon, 1995). Complete ERPT occurs when the destination currency prices of exports (imports) change in the same proportion to exchange rate changes. Incomplete ERPT takes place when the changes in exchange rates are not matched by the changes in the prices of the traded goods. Incomplete pass-through provides one explanation for the unresponsiveness of trade imbalances to exchange rate changes. When exchange rate changes are not fully or substantially reflected in the selling prices of traded goods, the quantity adjustment will be dampened even if demand is sufficiently elastic. Furthermore, if the adjustment of pass-through takes a long time, then the expected current account adjustment and expected "J-curve" response pattern of the trade balance to a currency depreciation cannot occur.

The degree of exchange rate pass-through also has implications for the optimal monetary and fiscal policy and international macroeconomics transmission. Under the new open economy macroeconomics framework, the implications of the degree of ERPT on optimal policies are analyzed. Betts and Devereux (2000) show that the effects of the fiscal and monetary policies can be very different depending on the degree of exchange rate pass-through.

While in the applied literature, the analysis of ERPT at the aggregate level, i.e. for the whole country or manufacturing industry has attracted considerable attention, the rise of imperfect competition and strategic trade theory led researchers to estimate ERPT at the disaggregate level, meaning industry level. Estimating the degree of ERPT at the disaggregate level provides several benefits. First, incomplete pass-through is more likely for individual sectors than at the aggregate level since aggregation of products could bias the results. Several empirical studies have found significant differences in ERPT estimates across sectors. Supporting this idea, it is argued that there is no reason why the pass-through of costs, demand pressure and competitor's price changes should remain constant across sectors. Another benefit of disaggregating the data is that more accurate estimation of time-lags involved in the transmission of exchange rate changes to prices can be obtained (Hooper and Mann, 1989). Understanding ERPT at the industry level also gives insights about international market power at the industry level.

For small open economies (SOEs), there is a widely held view that they are price takers both in their exports and imports in terms of the foreign currency. Hence, it is expected for a SOE, to have complete ERPT into their import prices (in the currency of the SOE) and zero ERPT into their export prices (in the foreign currency of the export market). However, there is the counter argument that even a SOE might not be price taker for some sectors. As stated by Helpman and Krugman (1989), especially in a monopolistically competitive market, a SOE might have some market power for some sectors.

> … in a monopolistically competitive world there are no price-takers. No matter how small a country is, it is still specialized in a range of products that nobody else produces and is therefore a price-setter that can influence its terms of trade. A small country is not small in the sense that it is a price-taker on world markets. (Helpman and Krugman, 1989, p.140)

ERPT into the export and import prices of Turkey is not investigated much[1]. To our knowledge, there are two studies on this issue. These are the studies by Alper (2003) and by Kan (2001). Alper (2003) investigates ERPT into the import prices at the aggregate level in the short-run and suggests complete pass-through into the import prices. Kan (2001) investigates ERPT into the export prices of the textile sector's subcategories in the short-run. Incomplete pass-through is found for some subcategories. Furthermore, there is variation in the pass-through estimates across subcategories. To conclude, ERPT into the import and export prices of Turkey at the disaggregate level is not investigated[2]. In this thesis, we intend to fill this gap in the literature for Turkey.

In this thesis, ERPT into the export and import prices of the manufacturing goods at the industry level is analyzed. This study focuses on manufacturing goods since data with higher frequency is available for the manufacturing sectors. Also as indicated in the survey article by Menon (1995):

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[1] The study by Leigh and Rossi (2002) analyzes pass-through of exchange rate changes into the domestic goods prices in Turkey.

[2] Kan (2001) investigates ERPT into the export prices of only textile sector.

> Manufacturing goods are typically viewed as being highly differentiated and frequently sold in imperfectly competitive and segmented markets where arbitrage is costly and mostly unprofitable. There is a considerable amount of empirical evidence to support both these views about manufactured goods. (Menon, 1995, p.201)

The degree of exchange rate pass-through into the import prices and export prices is estimated separately for each of the eight manufacturing sectors defined at the 3-digit level of the ISIC Rev.2. This is the most disaggregate level given the data and the model we use. However, again due to data limitations, the same sectors cannot be covered in the analysis of export prices and import prices. The novelty of our study is that it is a disaggregate analysis of ERPT for both export and import prices. The study also attempts to differentiate the degree of ERPT in the short-run and long-run. In order to estimate the degree of ERPT in the long-run, cointegration analysis is utilized. By using dynamic modeling, short-run ERPT analysis is conducted separately.

Theoretical analysis of the degree of ERPT and a review of empirical ERPT studies will be given in Chapter 2. The analytical framework and features of the data used in this thesis will be presented in Chapter 3 and 4, respectively. Afterwards, sequentially, estimation results for the analysis of export prices and import prices will be reported in Chapter 5 and 6. Finally, in Chapter 7, conclusions of our study will be given.

CHAPTER 2

THE LITERATURE ON EXCHANGE RATE PASS -THROUGH

In this chapter, first, determinants of the degree of exchange rate pass-through will be given. Then, we will present some empirical studies on the exchange rate pass-through. Studies on the exchange rate pass-through can be categorized into two, studies for large economies and those for small economies. In section 2.2, we will focus on studies for large economies. In section 2.3, studies for small economies will be reviewed. Lastly, in section 2.4, ERPT studies for Turkey will be reported.

2.1 The Determinants of the Degree of Exchange Rate Pass-Through

When the exchange rate changes, the exporting firm has three options. It may choose to pass the exchange rate change fully into its destination currency price (complete pass-through), to absorb the change to keep its destination currency price unchanged (zero pass-through) or some combination of these (partial pass-through)[3]. The combined sensitivity of the firms' production costs in domestic currency and mark-up of price over marginal cost to exchange rate changes determines the degree of exchange rate pass-through (Knetter, 1992).

The exporting firm's production cost in domestic currency might be sensitive to exchange rate changes. This sensitivity can depend on the weights of inputs priced in foreign currency units in total inputs. Following a depreciation of the exporter's currency, increase in the exporter's costs will be positively related to the weight of inputs priced in foreign currency units. If the share of imported inputs in total inputs is higher, the exporting firm will not be able to decrease its foreign currency export prices following an exchange rate depreciation due to increased total costs in the exporter's currency. Another factor is that if the exchange rate change results in relative price changes in foreign markets, then relative

[3] There is also a fourth option for the firm in which case percentage change in its destination currency export price will be higher than the percentage change in the exchange rate. This choice can result from a demand curve that is more convex than a constant elasticity of substitution function.

price change can cause a change in total production change. At the end, change in the total production might result in cost change.[4]

A change in the exchange rate might induce firms to vary their mark-up of price over marginal cost in order to maximize their profit. The degree of mark-up response depends on the shape of the demand curve. In order to see how the shape of the demand curve affects the degree of mark-up response, hence the degree of exchange rate pass-through, we will do a simple exercise as similar to the one demonstrated in Yang (1997) as follows;

Suppose an exporter having some market power sets its price in foreign currency (P*) for its exports to the foreign market and e is the exchange rate (in units of foreign currency per unit of the exporter's currency). P* will be referred as the import price. The inverse demand function is denoted as P*(q) giving the import price as a function of the quantity sold. The profits in terms of the exporter's currency, ∏, from sales in the foreign market are given by;

$$\prod(q) = \frac{P^*(q)\, q}{e} - C(q) \qquad (1)$$

where C(q) is the firm's cost function. Assuming constant marginal cost (MC), the profit maximizing condition of the exporting firm is

$$P^* \left(1 + \frac{1}{\eta}\right) = e\, MC \qquad (2)$$

where η is the demand elasticity facing the exporter in the foreign market. In equation 2, $(1 + 1/\eta)^{-1}$ is the mark-up over constant marginal cost. The elasticity of import price with respect to the exchange rate, known as the degree of exchange rate pass-through, is then

$$\tau = \frac{dP^*/ P^*}{de / e} = \left[\frac{\eta + 1}{\eta + 1 - (d \ln\eta / d \ln P^*)} \right] \qquad (3)$$

From equation 3, it is clear that exchange rate pass-through depends on how price affects the demand elasticity, i.e. the *elasticity of the demand elasticity with respect to the*

[4] If the firm does not produce with constant returns to scale, then the change in the quantity produced will affect marginal (average) cost of the firm (Knetter,1992).

import price[5]. It is captured by the last term in the denominator (d lnη / d lnP*). When the demand elasticity is constant (i.e., dη / dP* = 0), pass-through of exchange rate changes to the import price is 1 (complete pass-through, that is, when the destination currency depreciates by 1 % against the exporter's currency, the import price in destination currency will increase by 1 %). As long as the demand elasticity varies with price, the degree of pass-through will deviate from one. If the demand curve becomes more elastic as price increases (dη / dP* <0), pass-through will be less than 1, partial pass-through. This would include the case for the linear demand curve. If the demand curve becomes less elastic (dη / dP* >0), pass-through will be greater than one.

In this model we have assumed constant marginal cost. However, if the domestic factor price faced by the exporting firm were affected by the exchange rate (as in the case of an imported input), then there will be shifts in the marginal cost function (Knetter, 1992). Knetter's (1992) analysis includes variable marginal cost function. Cost function depends on the quantity sold and a single factor of production. His analysis shows that the slope of the marginal cost can be very important for the degree of exchange rate pass-through. If marginal costs were falling sufficiently in the neighborhood of the optimum, pass-through could exceed one even when demand is less convex than a constant elasticity schedule. On the other hand, if marginal costs were increasing sufficiently at the optimal output level, pass-through could be incomplete in spite of demand schedules having more convexity than a constant elasticity schedule.

As outlined above, the response of the mark-up depends on the curvature of the demand elasticity. Then, the next question should be about the factors that affect the curvature of the demand elasticity. Current literature cites a number of firm or industry characteristics, such as product differentiation, market share, a measure of competitiveness, among others, as factors that matter in the exchange rate pass-through.

The linkage between the degree of ERPT and some industry characteristics is shown in Dornbusch (1987). Dornbusch (1987) considers different types of imperfect competition models. He adopts partial equilibrium approach and assumes sticky wages and given exogenous movement in the exchange rate. He shows that under Cournot competition with a linear demand and constant marginal costs, pass-through becomes smaller the less competitive the industry (higher mark-up over marginal cost) and the smaller the number of foreign firms relative to the number of home firms. It is also suggested that under the Dixit-Stiglitz model, the degree of pass-through becomes higher, the higher the degree of substitution between the domestic and imported good. The limiting case for perfect

[5] See Dornbusch (1987), Feenstra(1989) and Marston(1990) for the discussion of the role of the convexity of the demand curve.

competition and a large number of foreign firms relative to the number of home firms demonstrates the case for the small country, where the country is a price taker in world markets. In that case, a currency depreciation will raise import prices in the same proportion, while foreign currency export prices will not change at all. Another indication is that in the case of differentiated products, export and domestic prices will stay closer in line than import and export prices.

Froot and Klemperer (1989) emphasize the perception of the duration of exchange rate changes in an oligopolistic market where protecting market share is important. Froot and Klemperer (1989) focus on demand side effects in an oligopolistic market. In such a market, they analyze pricing strategies that aim to protect market shares and how the response of the prices can differ when exchange rate change is perceived as temporary versus permanent. The vital assumption in the model is that a firm's future demand and profits depend on current market shares, which in turn depend on the firm's pricing strategy today. Then, the magnitude and even the sign of pass-through will depend on whether exchange rate changes are thought to be temporary or permanent. When the destination currency appreciates, exporting firms may either raise or lower their destination currency export prices depending on the expected future exchange rates. In case of a temporary appreciation, the exporting firm will find investments in market share less attractive and prefer instead to let their current profit margins grow. The expectation that the destination currency will depreciate over time may erode the value of future profits so much that exporting firms could conceivably raise their destination currency export prices when the destination currency appreciates temporarily. Permanent appreciations, on the other hand, do not create such incentives to shift profits from tomorrow to today. Since exporters' current and future costs (expressed in destination currency) fall as the destination currency undergoes permanent appreciation, exporting firms compete more vigorously, unambiguously driving export prices (in destination currency) down. To conclude, exporting firms decrease their destination currency prices more in their export market, attempting to gain more market share, when the value of the destination currency is expected to remain permanently higher. Therefore, current prices may be more sensitive to expected future exchange rate changes than they are to contemporaneous changes. The results of this analysis do not hinge on the type of competition assumed (Cournot or Bertrand), the functional form of the demand curve, the number of periods or the reasons why market share matters.

The existence of non-tariff barriers and trade by multinational corporations (MNCs) are suggested as further explanations for the incomplete pass-through by Bhagwati (1988). Through intra-firm pricing policies, a MNC can prevent or limit complete pass-through of exchange rate changes into its prices in individual markets, especially in the periods of exchange rate volatility, in order to achieve price stability. MNCs can protect themselves against exchange rate uncertainty using ‘internal’ exchange rate. It can also do its payments to subsidiaries when more favorable exchange rate is present. Its ability to choose the currency denomination of contract is another way of achieving price stability (Menon, 1995).

In some cases, although exchange rate pass-through can be complete in the long-run, it can be incomplete in the short-run. Menon (1994) addresses menu costs, the costs of changing supply, the dynamics of demand response to price changes, order delivery lags, forward exchange cover and the currency denomination of trade contracts as factors causing incomplete pass-through in the short-run.

In the short-run, if exchange rate changes are perceived as ‘temporary’, then firms might prefer not to change their destination currency prices in order to avoid costs associated with changing their prices. The firms also have costs associated with changing supply to foreign market. Expansion in sales requires expansion in infrastructure (e.g. service, distribution). Therefore, only if the firm believes that the exchange rate appreciation is of a permanent nature, then it will incur these costs and increase its sales cutting its destination currency price. Therefore, in the short-run firm might exploit higher profits. Actually, higher profits should invite new rival firms into the sector in which case existing firms might be in a position such that they must cut its price not to lose its market share. Then, there should be factors allowing existing firms not to cut their price and exploit higher profits in the short-run. One of these factors is the buyers’ costs associated with switching suppliers (costs incurred in information acquisition, evaluation of product quality and reliability of supply). The slow adjustment of customers to price differentials gives the opportunity to firms for higher profits. Another factor is the existence of irreversible sunk costs to enter into a market. Due to the irreversible sunk costs, firms are less likely to enter a market following a temporary and/or small exchange rate change (Dixit, 1988, Baldwin 1989).

Besides microeconomic (or industry-specific) explanations, macroeconomic performance is also addressed in the literature to explain incomplete exchange rate pass-through. Taylor (2000) hypothesized that degree of pass-through into the import prices is smaller in economies with less inflationary environment.

2.2 ERPT Studies for Large Economies

Most of the empirical studies on exchange rate pass-through have focused on the “large” economies. A survey by Menon (1995) on 43 studies on exchange rate pass-through indicates that most of the research in this area is for U.S and Japan. Furthermore, the estimates for most of the small open economies are obtained from multi-country studies. At first, exchange rate pass-through studies focused on the impact of exchange rate into the aggregate import or export prices. However, there is now growing interest on the exchange rate pass-through at the industry level. Some studies find significant differences in the rates of pass-through across industries. Therefore, this raises the concern of possible aggregation bias in the pass-through estimates at the aggregate level.

The model used in Hooper and Mann (1989) is widely used in empirical studies on the exchange rate pass-through. It is a mark-up model for price determination. Hooper and Mann (1989) investigate the pass-through relationship for both total U.S. imports of manufactured goods and U.S imports of manufactured goods from Japan, using quarterly data over the period 1973:Q1 through 1988:Q2. They estimated an import price equation involving the variables of exchange rate, foreign cost, U.S domestic price level and foreign capacity utilization rate using ordinary least squares (OLS) estimation procedure with polynomial distributed lags. The results suggest incomplete pass-through. While short-run pass-through for total manufactured goods ranges between 20 and 24 percent, long-run pass-through estimate ranges between 60 and 74 percent. Lag length ranges between 5 and 7 both for total manufactured imports and imports from Japan. Pass-through estimate for imports from Japan do not differ much from the aggregate pass-through estimates so that no evidence for the price discriminating behavior of Japanese firms has been found. These results only suggest that "if Japanese firms price discriminate in the U.S market they are not alone" (Hooper and Mann, 1989).

There are also studies on ERPT which try to explain cross-sectional variation in the pass-through estimates of the industries. Yang (1997, 1998) try to do this job besides estimating the degree of pass-through for each industry.

Both of the studies by Yang (1997, 1998) adopt a two-stage estimation procedure. In the first stage, the degree of pass-through is estimated for each industry and in the second stage; pass-through estimates obtained in the first stage are used as the dependent variable and regressed against the proxies of the variables that are supposed to explain cross-sectional variation in the pass-through estimates by the theoretical models. These variables are product differentiation, elasticity of marginal cost with respect to the output and market share. It is hypothesized that while higher degree of product differentiation results in higher degree of pass-through, the other two variables are negatively related to the degree of pass-through. Yang (1997) analyzes pass-through of exchange rate changes into the manufactured import prices in 3 and 4 digit SIC industries of U.S. First stage regression for each industry involves 3 time series in first difference, namely, import price in terms of home currency (dollar), exchange rate, U.S producer price and one-lagged import price variable. The equation is estimated by OLS. Thus, the degree of pass-through is measured as the elasticity of the import price with respect to the exchange rate. For 77 of 87 industries analyzed, incomplete pass-through has been found. There is also large variation in the pass-through across industries, ranging between 0.025 and 0.757. The results of the second stage analysis suggest that market share of foreign firms is insignificant in explaining differences in pass-through estimates. However, the variables of product differentiation and elasticity of marginal cost with respect to output are found to be significant with expected signs. Hence, higher product differentiation results in higher pass-through, while higher elasticity of marginal cost with respect to the output results in lower pass-through. Therefore, it is suggested that market structure and industry differences are important in understanding differences in pass-through behavior. Yang (1998) analyzes pass-through of exchange rate changes into manufactured import and export prices in the 2, 3 and 4 digit SIC industries of U.S. As opposed to Yang (1997), Yang (1998) uses level data and cointegration approach is followed. The first stage regression for each industry analyzed involves 4 time series: import (export) price, exchange rate, U.S producer price, foreign producer price. For 93 out of the 103 industries demonstrate incomplete pass-through of exchange rate changes into the import prices. There is also large variation in ERPT estimates for the import analysis as in Yang (1997). The analysis of ERPT for U.S export prices demonstrates that for most of the industries, incomplete pass-through is present. However, pass-through estimate for most of the industries is above 90 % being near to complete pass-through. There is not much variation in the ERPT estimates for export prices. In the analysis of cross-sectional variation in ERPT estimates for export prices, explanatory variables are generally found to be insignificant. However, the results suggest that the explanations for cross-sectional variation in the ERPT into the import prices are nearly same as those in Yang (1997). Only market share of foreign firms in explaining cross-sectional variation is found to be significant at 10 % with a negative sign indicating that foreign firms prefer to pass less of the exchange rate changes into the export prices in destination currency in order to keep their market share.

The literature review by Goldberg and Knetter (1997) shows that the median rate of pass-through is 50 % for shipments to U.S.

Rockerbie (1992) studies ERPT for Canadian exports in each of the four aggregate industry categories to U.S. These industries analyzed are food products, crude materials, fabricated products and end products. In order to estimate the degree of ERPT, a reduced form from a simple export demand-supply model is estimated for each industry. VAR technique is utilized and the period of analysis covers the period from 1971:1 to 1990:2. For two sectors, namely food products and crude materials, complete pass-through is suggested by the results. For the fabricated and end products sectors, pass-through estimates are 70 % and 67%, respectively. It is suggested that Canada's export industry is competitive if the degree of pass-through can be used as a measure of international competitiveness. Following a depreciation of the Canadian dollar, Canadian exporting firms lower their export price in the U.S. by the same degree of the depreciation when there is complete pass-through. In case of an appreciation, export prices will increase by the same degree of the appreciation since complete pass-through has been found.

It should be noticed that these models outlined above assume a single ERPT estimate in case of appreciation and depreciation, i.e. the price response to an appreciation and depreciation is symmetric. However, a firm faces different opportunities in the case of an appreciation and depreciation. Therefore, there is no certainty that the response will be symmetric (Coughlin and Pollard, 2000). In case of a depreciation of the destination currency, the exporting firm possessing some market power can decrease its export price in domestic currency by the same degree of depreciation (no pass-through) so that it will maintain the destination currency export price or it can increase the destination currency price by the same degree of depreciation to maintain its domestic currency export price (complete pass-through) or some combination of both (partial pass-through). With either complete or partial pass-through, the exporting firm's profits will decrease following a destination currency depreciation, since destination currency export price will increase resulting in decreasing demand. Of course, the extent of the decline in profits depends on the elasticity of the demand in export market. However, in case of an appreciation of destination currency, there are desirable options for exporting firms. The exporting firm can maintain its destination currency export price (no pass-through) so that the home currency price will increase by the same degree of the destination currency appreciation resulting in unchanged demand and increasing profits. The second option for the exporting firm is to decrease its destination currency export price by the same degree of appreciation (complete pass-through) in which case home currency price remains the same but the demand and hence profits will increase. The third option is to decrease the destination currency price but by less than the degree of appreciation in which case again demand and profits will increase. As in the case of a destination currency depreciation, the extent of the increase in the profits depends on the elasticity of demand in the export market. As explained above, the exporting firm faces different options in case of a depreciation and appreciation. Therefore, pass-through might be asymmetric in the response of prices to the exchange rate changes.

Kadiyali (1997), Athukorala and Menon (1994) and (Coughlin and Pollard, 2000) analyze pass-through asymmetry issue besides estimating the degree of exchange rate pass-through.

Kadiyali (1997) analyzes how much of exchange rate changes are reflected in the import prices of the U.S. photographic film industry. The behavior of the two firms, a domestic (Kodak) and Japanese (Fuji), operating in the U.S photographic film industry is analyzed. These two firms are the two most powerful firms regarding their market share in the U.S. A structural model of industry behavior for the duopolistic market is utilized and the period of analysis is from 1980 to 1990. For the appreciation and depreciation periods, pass-through coefficients are estimated separately. The results suggest that pass-through is not symmetric. For the dollar appreciation period, 1980-84, pass-through is estimated as 0.076 while for the dollar depreciation period, 1985-90, it is estimated as 0.178. Another result of the model is that the Japanese firm passes more of the exchange rate changes into its export prices in terms of dollar as its market share in the U.S. market increases.

Athukorala and Menon (1994) use a mark-up framework for price determination as in Hooper and Mann (1989). The originality of their paper lies in that they divide total pass-through of exchange rate changes on Japanese export prices into two components as pricing to market behavior and indirect effect of exchanges rate changes on domestic currency prices operating through the cost of imported inputs. They achieve this by using a two equation model. They estimate an export price equation and a cost equation using OLS. Export price equation includes explanatory variables of capacity utilization rate, competitor's price in foreign currency, exchange rate, cost of materials input, labor cost and a time trend to capture the effects of productivity changes. As the cost equation, they regress materials cost on the capacity utilization in the intermediate goods sector, nominal effective exchange rate for intermediate imports, cost of intermediate imports (in foreign currency) used in the intermediate goods sector and the productivity-adjusted labor costs in the intermediate goods sector. These equations are estimated for total exports and seven 2-digit ISIC industries using quarterly data covering the period 1980:Q1 and 1992:Q1. When we look at each pass-through estimate for individual industries, estimates for six industries except textiles (for which the pass-through estimate is 0.04) vary between 0.42 and 0.53. The weighted average of these estimates is 0.47. However, the pass-through estimate for total manufactured exports is 0.67. Since the weighted average of the individual pass-through estimates and pass-through estimate for total manufactured goods is different, there can be some aggregation bias obtained from the analysis at the aggregate level. There is considerable upward aggregation bias involved in estimating pass-through from an aggregate equation. In order to test the possible asymmetry in the exchange rate pass-through behavior during periods of depreciation and appreciation, they have tested the existence of a structural shift using an intercept and slope dummy for the exchange rate variable. The intercept and slope dummies included to test for the asymmetry in the exchange rate pass-through behavior turn out to be insignificant in all cases. While the pricing to market behavior accounts for much of the total pass-through, the cost effect of exchange rate changes is also considerable. Comparison of the pricing to market and total pass-through estimates both at the aggregate and disaggregate level suggest that the estimates capturing only the pricing to market effect tend to overestimate the degree of pass-through to the extent that the cost of production is sensitive to the exchange rate changes. Therefore, considering the cost effect of exchange rate changes becomes an important issue for analyzing pass-through especially in import-dependent countries.

ERPT asymmetry is examined by splitting the sample period into two parts, as one appreciation period and one depreciation period, by most studies. However, a different approach is implemented by Coughlin and Pollard (2000). They extract the quarter by quarter appreciation and depreciation over the whole sample period and tests if the magnitude of pass-through is the same in case of either appreciation or depreciation. Their disaggregate analysis for the pass-through into the U.S. import prices between the period 1980:4 and 1992:1 shows that there is a large variation in pass-through estimates across industries whichever exchange rate index is used.[6] It is indicated that asymmetric pass-through is present in many industries. Pass-through is more likely to be observed in the case of dollar depreciation. Furthermore, in those industries in which pass-through occurs both when the dollar is appreciating and depreciating, the degree of pass-through is higher when the dollar is depreciating.

2.3 ERPT Studies for Small Economies

Exchange rate pass-through studies can be categorized as the studies which analyze ERPT at the aggregate level and at the industry level. There are also studies which analyze ERPT in more than one country. The study by Campa and Goldberg (2002) analyzes the degree of exchange rate pass-through into the import prices for 25 OECD countries using quarterly data from 1975 through 1999. They investigate ERPT into the import prices for 25 OECD countries using quarterly data from 1975 through 1999. They also investigate ERPT into the import prices for five sub-sectors; food, energy, raw materials, manufacturing products and non-manufacturing products. Partial pass-through is strongest for manufacturing imports since partial pass-through is present for 19 out of 24 countries. Unweighted average of pass-through elasticities at the aggregate level is about 61 % in the short-run (over one quarter) and 77 % in the long-run. U.S has the lowest pass-through rate, 41 % in the L-R. However, some large countries have high pass-through rates (e.g. Japan, 88

[6] Coughlin and Pollard (2000) also analyze sensitivity of pass-through estimates to the chosen exchange rate index and look for the appropriate index out of three exchange rate indices.

% in the S-R) while some small countries have low pass-through rates (e.g. Czech Republic, 38 % in the S-R) In the second-stage, they regress country-specific ERPT elasticities against the variables that are supposed to explain the variation in country-specific exchange rate elasticities. Their second-stage analysis suggests that there is no systematic relationship between ERPT into the import prices and country size (real GDP).

Kenny and McGettigan (1998) analyze pass-through relationship between exchange rates and Irish import prices using aggregate data. Their data covers the period between 1963:Q1 to 1995:Q3. They made use of Johansen technique and variables included in the estimation are import unit values, domestic competing prices, nominal import-weighted exchange rate and foreign labor costs. Two cointegration relationships are considered, one between import prices and both the exchange rate and foreign costs and another between domestic competing prices, the exchange rate and foreign costs. While the results suggest incomplete pass-through in the short-run, full pass-through is found in the long-run.

As the study above, the study by Dwyer and Pease (1994) suggests incomplete pass-through in the L-R for the Australian experience. However, the adjustment of prices takes long time in Dwyer and Pease (1994). They examine ERPT for the price of imports and manufactured exports covering the period from 1974:Q3 to 1992:Q4. To estimate long-run pass-through relationship for import prices and manufactured export prices, a log linear form of the "law of one price" equation in absolute form is used allowing for a constant. Cointegrating relationship between the exchange rate, domestic prices and the world price is first tested and estimated using the Phillips and Hansen (P-H) fully modified OLS estimator. The residuals from the P-H estimation are substituted into an error correction model (ECM) in order to analyze short-run dynamics of adjustment towards long-run equilibrium. Results confirm nearly complete pass-through both for import prices and manufactured export prices (in terms of Australian domestic currency) in the long-run. The adjustment of export prices to exchange rate changes is found to be higher than the adjustment of import prices to exchange rate changes. While it takes between two and three years until export prices reaches their long-run value after an exchange rate depreciation, this adjustment for import prices decreases to about one year. It is also found that while domestic import prices over the docks have exhibited a consistent pattern of response over time, responsiveness of manufactured export prices to currency movements has increased significantly since the mid 1980's.

Athukorala (1991) employed a mark-up model of export price determination for the Korean case following Hooper and Mann (1989). Mark-up is hypothesized to depend on the demand pressure in the domestic market and world market. Demand pressure in the domestic market is proxied by the capacity utilization rate and the latter by the ratio of competitor price in domestic currency to the domestic production cost. He obtained exchange rate pass-through coefficients by estimating the export price equation. Export price is explained by a constant, capacity utilization rate, competitor price, one-period lagged production cost, exchange rate and its lagged forms. While the cost effect of exchange rate changes is not considered, Athukorala (1991) pointed out that there isn't a statistically significant relationship between cost of production and export price, so that not including the cost effect in the export price equation is not a serious problem. The model is estimated for total non-food manufactured goods and three product categories therein (textile, clothing and footwear; metal products; machinery and transport equipment) covering the period between 1980:1 and 1989:1. After converting each data series into first differences the equations were estimated by OLS. Total pass-through estimate for each of these three sectors varies between 18 % and 27 %. However, each total pass-through estimate is not significantly different from zero at 5 %. While average pass-through coefficient of three product categories has been found as 28 %, it is not significantly different from zero. The estimate for the variable of the level of competitors' prices is significant and not different from unity suggesting that exporters attempt to keep their price in line with those of their competitors. This evidence is interpreted as Korea being virtually a price-taker in her export markets. Adjustment of exchange rate pass-through occurs within 4 to 5 quarters. However major part of this adjustment occurs within 2 quarters. Possible asymmetry in the export price response to currency depreciation and appreciation is tested using the Chow's parameter stability test and it is also tested by a second test; adding intercept dummy on the exchange rate. Results of both tests suggest for no asymmetry.

Another mark-up pricing study has been done by Menon (1992) for the Australian exports. He analyzes the degree of exchange rate pass-through for each 2-digit Australian Standard Industrial Classification category of Australian non-food manufactured exports, namely, textiles; chemical, petroleum and coal products; basic metal product and transport equipment for the period between 1980:Q1 and 1990:Q2. Export price equation of each product category is estimated using OLS in order to obtain ERPT coefficients. Besides estimating the pass-through coefficients, the determinants of the variation in the pass-through estimates across the industries have been investigated. While variation in the pass-through estimates has been usually attributed to the market structure characteristics, Menon looked at other factors that can affect pass-through estimates; namely, the extent of foreign ownership and control in each industry, the share of output exported and export share of the industry in total exports. These seemed to be positively related to the degree of exchange rate pass-through. While zero pass-through has been found both for textiles and basic metal products (small country assumption holds), pass-through estimates for chemical, petroleum and coal products and transport equipment is 0.67 and 0.70 respectively. These higher estimates are explained by the higher extent of foreign ownership (via intra-firm trade and transfer pricing practices) and control in these sectors. Full adjustment of exchange rate pass-through varies also between 3 and 8 quarters. Pass-through estimates, some of them being different from zero, provide evidence against the argument that exchange rate movements will not have any effect on the terms of trade simply because of the "size" of the Australian economy compared with its major trading partners.

In the study by Menon (1993), determinants of exchange rate pass-through is analyzed through econometric analysis. He examined pass-through for Australian import prices of total manufactures and 40 product categories between 1981:Q3 and 1992:Q2. He has also analyzed determinants of the exchange rate pass-through. Following mark-up framework, pass-through elasticities are obtained from an import price equation including the variables of price of import competing goods, exporter's production cost in foreign currency and the exchange rate using OLS after differencing the series. Furthermore, cointegrating vectors for each product category is also estimated using Johansen Maximum Likelihood procedure. However, cointegration relationship can be identified only for total manufactured imports and 11 out of 40 product categories. The reason for this is attributed to the relatively short sample period. Then to explain the reasons for the difference in the pass-through estimates across product categories, he has regressed pass-through elasticities on the variables of import-domestic sales ratio, elasticity of substitution between domestically produced and imported goods, product differentiation variable, four-firm concentration ratio, foreign control of imports and quantitative restrictions. Except substitutability between imported and domestically produced goods all the variables are negatively related to pass-through as being expected. Although P-T estimate for total manufactured imports obtained from difference models is 75.19 %, there is substantial variation in the P-T estimates across products (also incomplete for most products) (about 20 % of the P-T estimates record a value of 90 % or above while about 18 % lie at or below 50 %). Asymmetry in pass-through estimates is not detected. In addition, there is little evidence of an aggregation bias since weighted average of disaggregate P-T estimates is 77.55 %. Little aggregation bias can be the result of the use of actual import price indexes rather than unit value indexes. Adjustment of the import prices into the exchange rate changes never goes beyond 2 quarters for a product category. The results suggest that quantitative restrictions and foreign control variables have more power than the aspects of market structure and product characteristics in explaining inter-product differences in pass-through. P-T estimate for total manufactured imports obtained using Johansen ML procedure is 66.27 which is about 15 % lower than the weighted measure. These comparisons suggest that, if anything, the aggregation bias is likely to lead to an under rather than an over estimation of pass-through

Athukorala and Menon (1995) analyze exchange rate pass-through into the export prices of Swedish machinery and transport equipment and four sub-categories therein for the period between 1977:Q1 and 1990:Q4. They utilize an error correction model. It is argued that although Sweden's market share in total world machinery trade is low, its export structure is dominated by highly specialized and differentiated products. For total machinery and transport equipment, the degree of ERPT is estimated as 74 % while for the four subcategories, it varies between 48 % and 81 %. The adjustment of export prices to exchange rate changes is fairly quickly, about one to two quarters. Their results support Helpman-Krugman proposition that no matter how small a country is if specialized in a range of products, it is not small in the sense that it is a price taker in world markets.

Toh and Hung (2001) analyze the degree of ERPT for export prices of some Asian economies, namely Malaysia, Thailand, Taiwan, and Singapore. Beside the investigation of the degree of ERPT of export prices at the aggregate level for each country, they have also investigated degree of ERPT for the export of some primary commodities of Malaysia and Thailand. For Taiwan and Singapore, some categories of manufacturing industry are analyzed. They have estimated an export price equation derived from mark-up pricing model for each category of the country utilizing cointegration techniques and error correction modeling. Although the sample covered changes from country to country, it is generally for the period between mid-70s and mid-90s. ERPT for the aggregate exports has been found highest for Thailand which is 99.7 % and lowest for Taiwan, 12.7 %. For Malaysia and Singapore, it is estimated as 66.3 % and 80.7 %, respectively. Although the degree of ERPT is high for primary commodities, it is less than complete, i.e. not all exchange rate changes are passed through to export prices of primary commodities.

Another method of estimation to analyze pass-through at the product level is panel data estimation procedure. This procedure is used in Lee (1997). He investigates pass-through of exchange rate changes into Korean import prices for 24 three-digit or four-digit manufacturing industries covering the period from 1980:Q1 to 1990:Q4. To evaluate the importance of imperfect competition, special attention is given to the effect of market concentration ratio of each industry on the pass-through elasticity. Import price of each industry is regressed against the interaction term of market concentration and the industry-specific real exchange rate, industry specific real exchange rate, foreign unit labor cost, foreign labor cost, Korean wages, Korean wholesale prices and Korean real gross domestic product. By estimating such a model, exchange rate pass-through elasticity is obtained as a function of market concentration ratio. The coefficient for the interaction term of market concentration and industry-specific real exchange rate is found to be significant and negative as being expected. It is nearly –0.80 reflecting the fact that the more concentrated the industry, the smaller is the pass-through elasticity. The results suggest incomplete pass-through for all the industries. Average pass-through elasticity for all the industries is 0.62. 19 of 24 industries have elasticities smaller than 0.70. This study suggests that market concentration have a systematic effect on the exchange rate pass-through in Korea being an example of a small country. This result might be taken as an implication that imperfect competition matters even for the import prices of a small country.

2.4 ERPT Studies for Turkey

For the exchange rate pass-through in Turkey, there are not many studies. To our knowledge, only studies of Alper (2003) and Kan (2001) focus on the relationship between exchange rates and traded goods' prices[7]. Actually, Alper (2003) focuses mainly on the pass-through of exchange rate changes into domestic inflation. However, he also analyzes pass-through of exchange rate changes into the prices of aggregate imports, imported consumer goods and imported intermediate goods. To analyze the degree of exchange rate pass-through, an import price equation explained by the one-period lagged import price, a constructed world producer price and differential of the exchange rate and domestic price level is estimated by OLS. For the analysis of ERPT at the aggregate level, the period from 1987:1 to 2003:5 is covered while for the analysis of imported consumer goods and intermediate goods, the period from 1994:1 to 2003:5 is covered. Complete ERPT is found for all three import price series. While Alper (2003) investigates ERPT into the import prices, Kan (2001) investigates ERPT into the export prices of the textile sector's sub-categories. Kan (2001) analyzes export price response to real exchange rate changes for each 29 sub-categories of the textile sector defined at the SITC classification. An export price equation explained by the real exchange rate variable and its lagged forms is estimated by OLS for different frequencies between the years of 1990 and 1997. The results suggest that there is substantial variation in the response of export prices to real exchange rates across textile categories.

To conclude, there is not any study investigating ERPT into the import prices at the disaggregate level for Turkey. Furthermore, ERPT into the export prices is investigated only for the subcategories of textile sector. In this study, we try to fill this gap in the literature by investigating ERPT into the export and import prices separately for each of the eight

[7] The study by Leigh and Rossi (2002) analyzes pass-through of exchange rate changes into the wholesale and consumer prices in Turkey.

subcategories of the manufacturing industry. It should be also noted that Alper (2003) and Kan (2001) do not analyze the degree of ERPT into the traded goods' prices in the long-run. Our study also attempts to differentiate the degree of ERPT in the short-run and long-run. To investigate the degree of ERPT in the short-run, dynamic modeling is utilized. For the investigation of the degree of ERPT in the long-run, cointegration analysis is conducted.

CHAPTER 3

THE ANALYTICAL FRAMEWORK

In the analysis of exchange rate pass-through for both imports and exports, we have used a mark-up pricing model proposed by Hooper and Mann (1989). Using the mark-up framework has become popular in analyzing exchange rate pass-through since mark-up framework makes strategic interaction between domestic and foreign firms possible by variations in the mark-up (Athukorala and Menon,1994). By using this mark-up model, import and export price equations are derived to estimate pass-through coefficients or elasticities.

3.1 Exchange Rate Pass-Through for Exports

In the mark-up pricing model, it is assumed that domestic firms set their export price (PX) in home currency as a mark-up (λ) on their production cost (CP) in home currency. Here, mark-up (λ) is (1+ ∏) , where ∏ is the profit margin.

$$PX = \lambda \, CP \qquad (1)$$

We have a variable mark-up rate. According to Menon (1992), mark-up is a function of demand pressures on the domestic market and competitive pressures on the world market. Domestic demand pressure refers to the demand for the goods in the exporter's home country and competitive pressures on the world market refer to the competitiveness among the suppliers in the international trade. Demand pressure on the domestic market is proxied by the level of capacity utilization rate while competitive pressure on the world market is proxied by the gap between the foreign or competitor price in the domestic currency and the domestic production cost. Now, the mark-up (λ) can be expressed as;

$$\lambda = (CU)^{\alpha} \, (WPP \; ER \, / \, CP)^{\beta} \qquad (2)$$

where ER is the price of home currency per unit of foreign currency

WPP ER is the foreign or competitor price in domestic currency.

By substituting λ, equation (2), into the export price determination equation (1), we arrive at;

$$PX = (CU)^{\alpha} (WPP\ ER / CP)^{\beta} CP \qquad (3)$$

Then, taking the logarithm of equation (3) and denoting logarithms of the variables as lower-case letters, the export price equation becomes;

$$px = c + \alpha cu + \beta wpp + \beta er + (1- \beta)cp \qquad (4)$$

The operational form of equation (4) is;

$$px = \beta_0 + \beta_1 cu + \beta_2 wpp + \beta_3 er + \beta_4 cp + u \qquad (5)$$

where u is the error term.

In this model, β_3 measures the proportion of exchange rate changes that is reflected in the domestic currency export price. It is also a measure of the degree to which firms absorb exchange rate changes into profit margins to influence their foreign currency export price. For this reason, β_3 is called the "pricing-to-market coefficient". (Athukorala and Menon, 1995) By the definition of exchange rate pass-through, our pass-through coefficient is $(1-\beta_3)$ since pass-through is the degree to which exchange rate changes are reflected in the destination currency of traded goods prices. It is the absolute value of the partial derivative of the logarithm of foreign currency export price (ln(PX/ER)) with respect to the ln(ER) (i.e. the exchange rate elasticity of foreign currency export price). Mathematically;

$$-\frac{\partial \ln (PX/ER)}{\partial \ln (ER)} = -\frac{\partial (\ln PX - \ln ER)}{\partial \ln (ER)} = -\frac{\partial \ln PX}{\partial \ln ER} + 1 = (1-\beta_3)$$

We have two extreme cases. In the first case, exporters are prices takers in the foreign markets. This reflects the exporters of a small open economy. When exporters are price takers in foreign markets, none of the exchange rate changes can be reflected into the foreign currency export prices. Consequently, our pass-through coefficient $(1-\beta_3)$ will be zero and $\beta_3 = 1$. In order to keep export prices in foreign currency units remain the same, exporters will fully absorb changes in the exchange rate in profit margins (zero pass-through). At the other extreme, exporters do not face any competition in the world market. This shows the existence of market power. Then, changes in the exchange rate will be fully reflected in the foreign currency export price and exporters do not change their domestic currency export price. Their profit margins will remain unchanged. Thus, there will be complete pass-through, $(1-\beta_3)$ will be one and $\beta_3 = 0$. Between these two extremes, we have partial pass-though $(0<(1-\beta_3)<1)$. Hence, the degree of pass-through $(1-\beta_3)$ increases as the degree of market power increases (Athukorala, 1991). However, Feenstra(1989) suggested that the degree of pass-through $(1-\beta_3)$ can be higher than 1 when marginal costs are decreasing and elasticity of demand is constant or decreasing in price.

An alternative to the equation (4) could be written if the export price is in foreign currency. In this case, by substracting the "er" term from both sides of equation (4) we achieve the following equation;

$$px_f = c + \alpha cu + \beta wpp + (\beta - 1)er + (1-\beta)cp \qquad (6)$$

where px_f is the export price in foreign currency ($px_f = \ln(PX/ER) = px - er$)

However, we will not estimate by imposing cross-coefficient restrictions in equation (6). If we turn equation (6) in to an estimable form, it will become[8];

$$px_f = \beta_0 + \beta_1 cu + \beta_2 wpp + (\beta_3 - 1)er + \beta_4 cp + u \qquad (7)$$

In equation (7), the coefficient on the "er" term is our pass-through coefficient. The coefficient on the "er" term is expected to be between 0 and -1. When there is complete pass-through of exchange rate changes into the export prices, then the coefficient on "er" will be -1. When there is no pass-through, it will be 0. Between these two extremes, there is partial pass-through in which case, the coefficient on "er" is expected to be between 0 and -1. The coefficients on cu, cp and wpp are expected to take a positive value. Since export price series in Turkey are dollar denominated series, we will deal with equation (7) during the rest of the analysis.

3.2 Exchange Rate Pass-Through for Imports

Smilarly like the model for pricing exported goods, we begin by assuming that foreigners set their foreign currency export price (PX*) as a mark-up (λ) on their production cost in foreign currency (CP*). Here, mark-up (λ) is $(1+\prod)$, where $\prod$ is the profit margin:

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[8] It should be noticed that equation (7) can also be derived by subtracting the "er" term from both sides of equation (5).

$$PX^* = \lambda\, CP^* \quad (8)$$

The import price in home currency (PM) is therefore given by :

$$PM = PX^*\, ER = (\lambda\, CP^*)\, ER \quad (9)$$

The profit mark-up is assumed to depend on competitive pressures in the domestic market and the exchange rate. The gap between the price of import-competing goods (PD) and the exporter's production cost (CP*) is used to measure the competitive pressure. The influence of domestic demand conditions on the import pricing decision is also captured by PD. Now the mark-up (λ) can be expressed as;

$$\lambda = (PD \;/\; CP^*ER)^{\delta} \quad (10)$$

where ER is the price of home currency per unit of foreign currency

PD/ER is the price of import competing goods in home currency.

Substituting (10) into (9) we obtain;

$$PM = (PD \;/\; CP^*ER)^{\delta}\; CP^*\, ER \quad (11)$$

Then, taking the logarithm of equation (11) and denoting logarithms of the variables as lower-case letters, the import price equation becomes;

$$pm = a + \delta\, pd + (1-\delta)cp^* + (1-\delta)er \quad (12)$$

Operational form of the equation (12) is;

$$pm = \gamma_0 + \gamma_1 pd + \gamma_2 cp^* + \gamma_3 er + u \quad (13)$$

where u is the error term.

In this model, γ_3 measures the proportion of exchange rate changes that is reflected in the domestic currency import price. If the home country is a price taker in her foreign currency import prices, then following an exchange rate change there will be no change in her import prices in foreign currency but a proportionate change in her import prices in home currency. In this case, pass-through is complete, i.e. $\gamma_3 = 1$. In the opposite case, if the foreign firm is a price taker in the competitive market of the home country, then $\gamma_3 = 0$ and pass-through is zero. In this case, following a change in the exchange rate, there will be no change in the import prices in home currency. Between these two extremes, we have partial pass-through of exchange rate changes into the import prices, hence $0< \gamma_3<1$.

Like the export price series, import price series in Turkey are dollar denominated. By subtracting er from both sides of the equation (12), we arrive at the equation (14) in which import price in foreign currency is used as the dependent variable.

$$pm_f = a + \delta\, pd + (1- \delta)cp^* + (- \delta)er \qquad (14)$$

where pm_f is the foreign currency import price ($pm_f = \ln(PM/ER) = pm - er$)

If we turn it into an estimable form, it will be as the following[9];

$$pm_f = \gamma_0 + \gamma_1 pd + \gamma_2 cp^* + \gamma_4\, er + u \qquad (15)$$

where $\gamma_4 = (\gamma_3 -1)$ and $-1 < \gamma_4<0$

As it can be noted, by definition of exchange rate pass-through, the estimated coefficient on the exchange rate variable (er) in equation (15), is not our exchange rate pass-through coefficient The coefficient (γ_4) on er in equation (15) reflects the degree to which exchange rate changes are reflected in *foreign currency* import prices: Since exchange rate pass-through is defined as the degree to which exchange rate changes are reflected in *home currency* import prices, we should add 1 to the estimated coefficient on er in equation (15). Hence, our exchange rate pass-through coefficient will be ($\gamma_4 + 1$). When foreign firms do not change their foreign currency prices following an exchange rate ($\gamma_4=0$) , i.e. they completely pass exchange rate changes into the home currency import prices, there will be complete pass-through ($\gamma_4 +1 = 1$). When foreign firms do not change their import prices in home currency following an exchange rate change and instead absorb all of the exchange rate changes into their mark-ups ($\gamma_4= -1$), there will be no pass-through of exchange rate changes into the home currency import prices ($\gamma_4 +1 = 0$). The coefficients on pd and cp* are expected to take a positive value. During the rest of the analysis for imports, equation (15) will be used.

9 It should be noticed that equation (15) can be derived by subtracting er from both sides of the equation (13).

CHAPTER 4

DATA: VARIABLE DEFINITIONS, DATA SOURCES AND METHOD OF CONSTRUCTION

4.1 Exchange Rate Pass-Through for Exports

Our analysis for the export pass-through covers eight manufactured goods sectors defined at the 3 digit level of the ISIC Rev.2 for the period 1988q1 to 2001q2. Eight product categories for which ERPT for exports has been analyzed separately in this thesis are reported in Table 4.1. Table 4.1 includes these sectors' names and their respective codes in ISIC Rev.2. The average export shares of the sectors defined at the 3 digit level are reported in Table 4.2 for the period between 1995-2001. Since there are data limitations, all of the sectors having meaningful export shares in total manufactured goods' exports cannot be covered. We have selected eight sectors that have high export shares where data permits.

Table 4.1: List of the Sectors Covered in the Analysis of ERPT for Exports

ISIC Rev.2 code	Sector's name
314	Tobacco manufactures
321	Manufacture of textiles
324	Manufacture of footwear, except vulcanized or molded rubber or plastic footwear
351	Manufacture of industrial chemicals
353	Petroleum refineries
371	Iron and steel basic industries
381	Manufacture of fabricated metal products, except machinery &equipment
383	Manufacture of electrical machinery, apparatus, appliances and supplies

Table 4.2: Average Export Shares of the Sectors in Total Manufactured Goods

ISIC Rev.2 code	average share between 1995-2001	ISIC Rev.2 code	average share between 1995-2001
321	28.42	**355**	1.36
322	11.22	**362**	1.33
311	8.32	**353**	1.29
371	8.22	**390**	1.23
384	7.21	**341**	0.63
383	6.31	**324**	0.57
382	3.47	**332**	0.37
312	3.23	**323**	0.35
381	2.97	**361**	0.33
351	2.70	**331**	0.31
352	2.36	**385**	0.27
314	2.20	**313**	0.27
369	2.12	**342**	0.11
372	1.44	**354**	0.02
356	1.36		

Source: Computed using data from State Institute of Statistics, Turkey

For the analysis of export pass-through, abbreviations of the variables and their explanations are given below:

EXPR: Export price index of the individual product category. Our index is unit export price index. In Turkey, true export price index hasn't been constructed. It is a dollar denominated index. (1990 = 100)

Source: State Institute of Statistics, unpublished series

PPTR: Turkey's wholesale price index for the individual product category. It is used as a proxy for the unit production cost (cp) of the Turkish exporters in the equation (7). Although we prefer using producer price index, in Turkey producer price index hasn't been constructed. Besides, wholesale price index is not available for the whole period of analysis neither in ISIC Rev.2 nor in ISIC Rev.3. Therefore, an adjustment has been done between the two series in ISIC Rev.2 and ISIC Rev.3 in order to have wholesale price index for the whole period. (1990 = 100)

Source: Organization for Economic Cooperation and Development, *Indicators of Industry and Services, Historical ISIC Rev.2 Indicators*

Organization for Economic Cooperation and Development, *Indicators of Industry and Services*

CU : Capacity utilization rate of the individual product category.

Source: State Institute of Statistics, Turkey

EXCH: Exchange rate variable of the individual product category. Export-weighted nominal exchange rate series are constructed for each of the 8 product categories in order to show "the effects of differences that exist across product categories in terms of: (i) the range and relative importance of countries to which goods are exported, and (ii) the magnitude of bilateral exchange rate changes across countries" (Menon, 1993). The export-weighted exchange rate index for product i in period t is expressed as:

$$EXCH_{it} = \Sigma_j \; \Theta_{ij} \; . \; EXCH_{jt}$$

where j = foreign country

$EXCH_{jt}$ = nominal exchange rate of country j in terms of Turkey in period t

Θ_{ij} = share of country j in Turkey's exports of product i between the period 1999-2001

In most cases, export shares of the five major source countries are used to average the exchange rate series into a weighted index[10]. Here fixed weights are used. Average export shares between the period 1999-2001 are applied to the entire time series. The export shares or weights used for each of the product category are reported in Table 4.3. Weights are calculated using trade data according to the classification of ISIC Rev.2 from State Institute of Statistics. All nominal exchange rate series except Spain's are obtained from IMF's International Financial Statistics.

Source: Central Bank of the Republic of Turkey, *electronic publications* (Spain)

International Monetary Fund, *International Financial Statistics*

[10] For the sector 371, UK's producer price index is not available and for the sector 383, US' producer price index is not available. Therefore, for these sectors, not all of the five major source countries can be included in the analysis.

Table 4.3: Export Weights for Trading Partner Countries between 1999-2001

	314	321	324	351	353	371	381	383
US	0.63	0.22	0.05	0.14	0.19	0.35	0.17	-
UK	0.01	0.17	0.19	0.16	0.01	-	0.16	0.26
Germany	0.27	0.48	0.59	0.14	0.01	0.09	0.38	0.52
Italy	0.05	0.10	0.14	0.39	0.62	0.40	0.21	0.11
Spain	0.04	0.03	0.03	0.16	0.16	0.16	0.08	0.11
TOTAL	1	1	1	1	1	1	1	1

Source: Computed using data from State Institute of Statistics, Turkey

WPP : Foreign or competitor price variable of the individual product category. This variable (world producer price variable) is a weighted average of the foreign producer prices of the individual product category. Foreign producer price series are not available for the whole period of the analysis neither in ISIC Rev.2 nor in ISIC Rev.3. In order to have foreign producer price series in ISIC Rev. 2, we did an adjustment between two series as in the adjustment of the Turkey's wholesale price series for each of the country's product category. The weights are the same as those used in constructing the exchange rate variable. (1990 = 100)

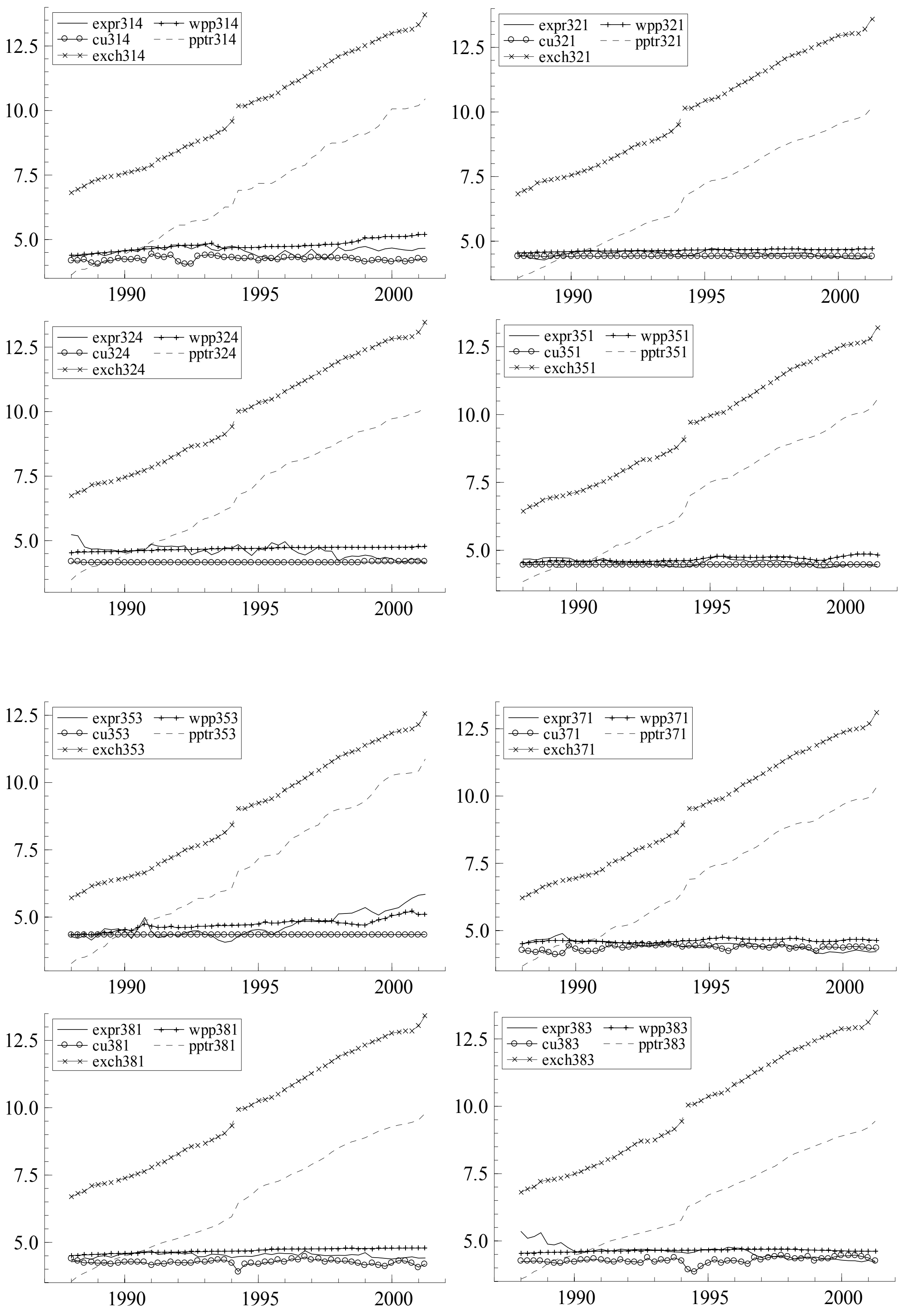
Source: Organization for Economic Cooperation and Development, *Indicators of Industry and Services, Historical ISIC Rev.2 Indicators*

Organization for Economic Cooperation and Development, *Indicators of Industry and Services*

Through the analysis, lower-case letters will denote logarithms of the variables. Variables are denoted with their sector codes since each variable is specific to the sector. For example, expr314 denotes logarithm of the export price variable of the sector whose ISIC Rev.2 code is 314.

In order to see the behavior of the series, time series plots of the variables used in the analysis of exchange rate pass-through into the exported goods' prices are presented in Figure 1. As it can be seen in Figure 1, exchange rate and producer price of Turkey specific to each sector follow approximately the same pattern. There is a sudden increase in the levels of both series in 1994 which was the year when an economic crisis occurred. Almost no fluctuation can be seen in the time series plots of the capacity utilization rates for the sectors 324, 351 and 353. World producer price variable keep a fairly smooth pattern.

Figure 1: Time Series Plots of the Variables Specific to each Exporting Sector



4.2 Exchange Rate Pass-Through for Imports

Our analysis for the import pass-through covers eight manufacturing goods sectors defined at the 3 digit level of the ISIC Rev.2 for the period 1989q1 to 2001q2. Codes and names of the eight sectors, which are covered in the analysis of ERPT for imports, are reported in Table 4.4. The average import shares of the sectors defined at the 3 digit level are reported in Table 4.5 for the period between 1995-2001. As in the analysis of export pass-through, the sectors with high import shares for which data permits are chosen.

Table 4.4: List of the Sectors Covered in the Analysis of ERPT for Imports

ISIC Rev.2 code	Sector's name
321	Manufacture of textiles
351	Manufacture of industrial chemicals
353	Petroleum refineries
371	Iron and steel basic industries
381	Manufacture of fabricated metal products, except machinery &equipment
382	Manufacture of machinery except electrical
383	Manufacture of electrical machinery, apparatus, appliances and supplies
384	Manufacture of transport equipment

Table 4.5: Average Import Shares of the Sectors in Total Manufactured Goods

ISIC Rev.2 code	Average share between 1995-2001	ISIC Rev.2 code	Average share between 1995-2001
382	18.33	**355**	1.01
384	14.04	**314**	0.78
351	12.57	**323**	0.68
383	10.59	**369**	0.54
321	6.38	**362**	0.42
352	6.09	**331**	0.37
371	5.51	**322**	0.31
311	3.77	**332**	0.29
353	3.69	**312**	0.28
381	3.03	**324**	0.25
385	2.86	**342**	0.23
372	2.52	**354**	0.14
341	2.40	**361**	0.10
356	1.49	**313**	0.04
390	1.30		

Source: Computed using data from State Institute of Statistics, Turkey

For the analysis of import pass-through, abbreviations of the variables and their explanations are given below:

IMPR : Import price index of the individual product category. Our index is unit import Price index. In Turkey, true import price index hasn't been constructed. It is a dollar denominated index. (1990 = 100)

Source: State Institute of Statistics, unpublished series

EXCHM : Exchange rate variable. To capture the effects of differences that exist across product categories in terms of: (i) the range and relative importance of countries from which imports are sourced, and (ii) the magnitude of bilateral exchange rate changes across countries, import-weighted nominal exchange rate series are constructed for each of the 8 product categories. The import-weighted exchange rate index for product i in period t is expressed as:

$$EXCHM_{it} = \Sigma_j \ \Theta_{ij} \ . \ EXCH_{jt}$$

where j = foreign country

$EXCHM_{jt}$ = nominal exchange rate of country j in terms of Turkey in period t

Θ_{ij} = share of country j in Turkey's imports of product i between the period 1999-2001

In most cases, import shares of the five major source countries are used to average the exchange rate series into a weighted index as in the analysis of the export pass-through[11]. The import shares or weights used for each of the product category between the period 1999-2001 are reported in Table 4.6. All nominal exchange rate series except Spain's are obtained from IMF's International Financial Statistics.

Source: Central Bank of the Republic of Turkey, *electronic publications* (Spain)
International Monetary Fund, *International Financial Statistics*

Table 4.6: Import Weights for Trading Partner Countries between 1999-2001

	321	351	353	371	381	382	383	384
US	0.26	0.17	0.21	0.05	0.11	-	-	0.25
UK	0.09	0.12	0.16	-	0.10	0.15	0.26	0.15
Germany	0.27	0.40	0.04	0.51	0.44	0.49	0.52	0.60
Italy	0.34	0.20	0.44	0.27	0.30	0.32	0.11	-
Spain	0.04	0.11	0.15	0.17	0.05	0.04	0.11	-
TOTAL	1	1	1	1	1	1	1	1

Source: Computed using data from State Institute of Statistics, Turkey

[11] For some sectors, producer price index is not available for some countries.

WPPM : This variable is a weighted average of the foreign producer prices of the individual product category. It is used as a proxy for the production costs of the foreign firms (cp*) in equation (15). An adjustment between the series in ISIC Rev.2 and ISIC Rev.3 is done due to the data limitations explained above in the export analysis. The weights are the same as those used in constructing the exchange rate variable. (1990 = 100)

Source: Organization for Economic Cooperation and Development, *Indicators of Industry and Services, Historical ISIC Rev.2 Indicators*

Organization for Economic Cooperation and Development, *Indicators of Industry and Services*

PPTR : Turkey's wholesale price index for the individual product category. An adjustment is done between the two series as in the analysis for exports. Although we prefer to use producer price index, in Turkey producer price index hasn't been constructed. (1990 = 100)

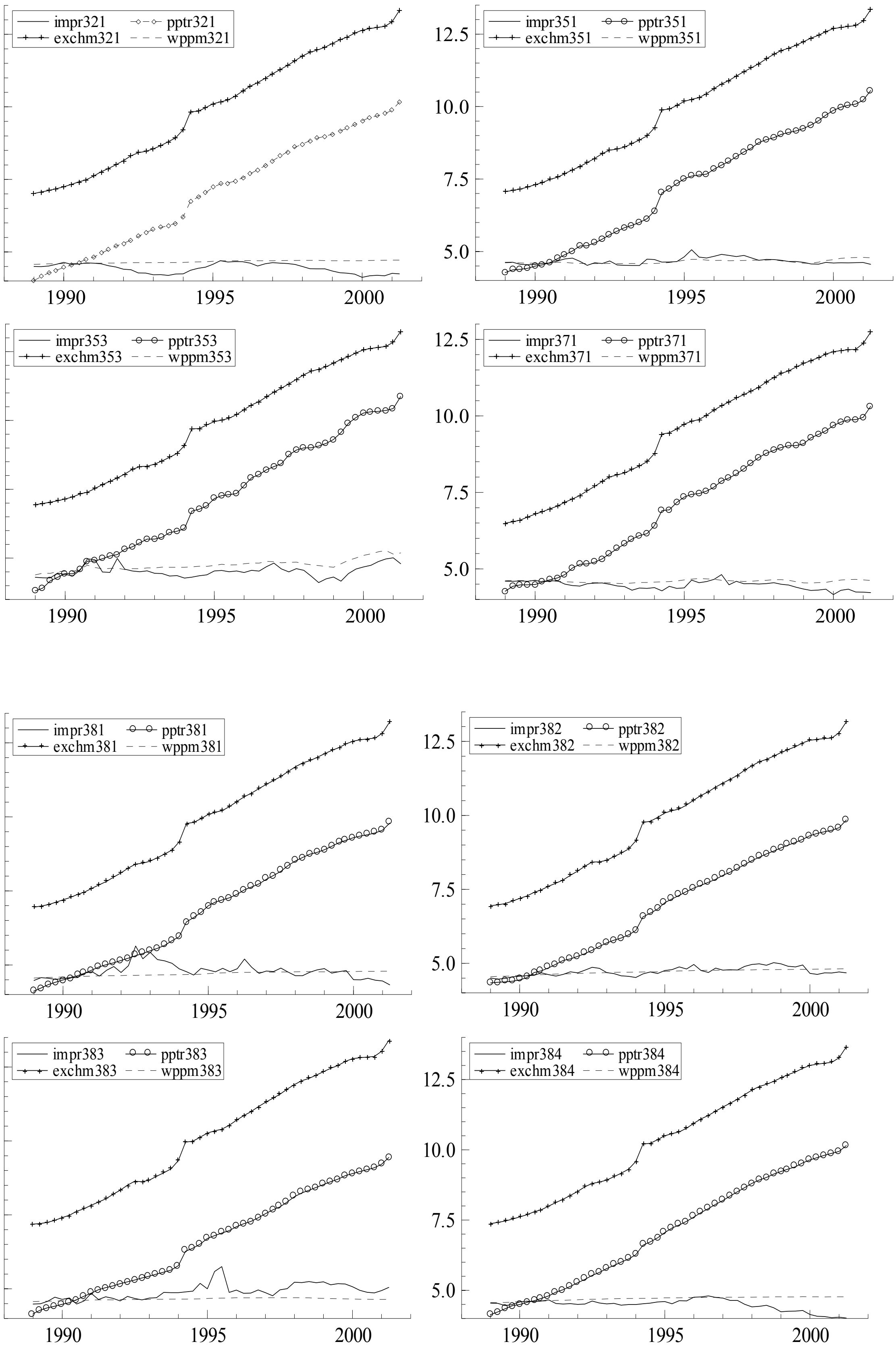
Source: Organization for Economic Cooperation and Development, *Indicators of Industry and Services, Historical ISIC Rev.2 Indicators*

Organization for Economic Cooperation and Development, *Indicators of Industry and Services*

Through the analysis, lower-case letters will denote logarithms of the variables. Variables are denoted with their sector codes since each variable is specific to the sector.

Time series plots of the variables used in the analysis of exchange rate pass-through into the imported goods' prices are presented in Figure 2. As in the analysis of exports, exchange rate and producer price of Turkey specific to each importing sector follow approximately the same pattern. The effect of the economic crisis in 1994 can be seen in the graphs of these variables. World producer price constructed for each importing sector keeps a fairly smooth pattern while import price exhibits a volatile pattern for all sectors.

Figure 2: Time Series Plots of the Variables Specific to each Importing Sector:



CHAPTER 5

EMPIRICAL ANALYSIS OF EXCHANGE RATE PASS-THROUGH FOR EXPORTS

The conventional approach to time-series econometrics is based on the implicit assumption that the underlying data series are stationary. Initially following the standard procedure, stationarity of the variables is tested using the Augmented Dickey-Fuller (ADF) test. Then cointegration tests for each sector are conducted in a VAR system. For the sectors, which have at least one cointegration relationship, cointegrating vectors are estimated. Finally, we estimate the series in first-differences by least squares.

5.1 Unit Root Tests:

Before the cointegration analysis, the stationarity of the data set is checked by using the augmented Dickey-Fuller (ADF) unit root tests (Dickey and Fuller, 1981). ADF statistics for each sector are reported in Table 5.1. Lag length for the ADF tests are selected by looking at the Akaike Information Criteria, and the sequential F-tests. The critical values for rejection of a unit root are from MacKinnon (1991). (**) and (*) signs indicate rejection of a unit root at the 1 % and 5 % significance levels respectively. Critical values at the 5 % and 1 % significance levels are -2.93 and -3.58 respectively. When a trend term is included, critical values at the 5 % and 1 % significance levels are -3.51 and -4.17 respectively.

Table 5.1: ADF Statistics for Testing Unit Root

(1) Tobacco manufactures (ISIC Rev. 2 code: 314)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
expr314	4	-2.277	4	-2.888	**Δexpr314**	3	-2.969*	3	-2.921
exch314	0	0.2182	1	-2.759	**Δexch314**	0	-5.674**	0	-5.622**
wpp314	3	0.0358	3	-1.477	**Δwpp314**	2	-2.931*	2	-2.988
cu314	0	-4.235**	0	-4.412**	**Δcu314**	5	-4.976**	5	-5.041**
pptr314	0	-0.0596	0	-3.529**	**Δpptr314**	0	-7.206**	7	-4.735**

Table 5.1 (continued)

(2) Manufacture of textiles (ISIC Rev. 2 code: 321)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
expr321	0	-0.977	1	-2.666	**Δexpr321**	0	-6.098**	0	-6.116**
exch321	0	-0.029	1	-2.602	**Δexch321**	0	-5.435**	0	-5.377**
wpp321	6	-3.238*	6	-0.548	**Δwpp321**	4	-3.706**	5	-4.988**
cu321	7	-0.654	2	-3.42e+005**	**Δcu321**	6	-8576**	6	-7424**
pptr321	1	0.013	1	-2.654	**Δpptr321**	0	-4.451**	0	-4.385**

(3) Manufacture of foot wear, except vulcanize or moulded rubber of plastic footwear (ISIC Rev.2 code: 324)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
expr324	0	-1.926	0	-3.677**	**Δexpr324**	3	-5.805**	3	-6.084**
exch324	1	-0.1401	1	-2.510	**Δexch324**	0	-5.337**	0	-5.277**
wpp324	0	-4.448**	0	-2.243	**Δwpp324**	2	-2.069	0	-5.184**
cu324	0	-7200**	0	-1.09e+004**	**Δcu324**	0	-7197**	0	.NaN
pptr324	0	-0.713	0	-1.031	**Δpptr324**	0	-6.583**	0	-6.562**

(4) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
expr351	1	-2.135	1	-2.420	**Δexpr351**	0	-5.186**	0	-5.125**
exch351	0	0.1071	1	2.756	**Δexch351**	0	-5.455**	0	-5.400**
wpp351	1	-2.385	1	-3.866*	**Δwpp351**	4	-4.490**	4	-4.407**
cu351	0	-9770**	8	-1.43e+004**	**Δcu351**	7	-9579**	7	.NaN
pptr351	1	0.02213	1	-2.545	**Δpptr351**	0	-4.514**	0	-4.454**

(5) Petroleum refineries (ISIC Rev. 2 code: 353)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
expr353	5	1.674	2	-1.424	**Δexpr353**	1	-7.174**	4	-5.222**
exch353	0	0.2853	1	-2.944	**Δexch353**	0	-5.657**	0	-5.612**
wpp353	3	-1.813	4	-4.715**	**Δwpp353**	6	-3.994**	6	-3.931*
cu353	0	-8652**	8	-1.26e+004	**Δcu353**	7	-8493**	7	.NaN
pptr353	6	1.595	0	-3.011	**Δpptr353**	3	-4.714**	5	-4.790**

(6) Iron and steel basic industries (ISIC Rev. 2 code: 371)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	Lags	η_τ		lags	η_μ	lags	η_τ
expr371	2	-1.327	1	-2.774	**Δexpr371**	0	-5.801**	0	-5.733**
exch371	0	0.2558	1	-2.842	**Δexch371**	0	-5.689**	0	-5.641**
wpp371	3	-1.409	3	-1.764	**Δwpp371**	2	-4.757**	2	-4.704**
cu371	6	-2.303	6	-2.026	**Δcu371**	5	-3.051*	4	-5.994**
pptr371	0	-0.1155	1	-2.259	**Δpptr371**	0	-5.292**	0	-5.222**

Table 5.1 (continued)

(7) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
expr381	1	-1.577	0	-3.784*	**Δexpr381**	0	-9.495**	0	-9.467**
exch381	0	0.03032	1	-2.617	**Δexch381**	0	-5.428*	0	-5.370**
wpp381	5	-2.243	5	-0.7823	**Δwpp381**	4	-2.779	4	-3.570*
cu381	0	-3.786**	0	-3.762*	**Δcu381**	2	-5.690**	2	-5.640**
pptr381	1	0.07998	2	-2.478	**Δpptr381**	0	-4.732**	0	-4.681**

(8) Manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev. 2 code: 383)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
expr383	3	-0.1839	0	-2.219	**Δexpr383**	2	-5.461**	2	-5.462**
exch383	1	-0.1325	1	-2.567	**Δexch383**	0	-5.325**	0	-5.265**
wpp383	4	-2.102	4	-1.490	**Δwpp383**	3	-1.296	0	-4.952**
cu383	0	-2.911	0	-3.162	**Δcu383**	2	-5.586**	2	-5.507**
pptr383	0	0.4722	1	-2.401	**Δpptr383**	0	-5.114**	0	-5.099**

(**) and (*) signs indicate rejection of a unit root at the 1 % and 5 % significance levels respectively.

In the Table 5.1 we see that the export price variable (expr) achieves stationarity after differencing once for almost all of the sectors. This variable is stationary in levels for only two sectors, namely for the sectors of manufacture of foot wear, except vulcanize or moulded rubber of plastic footwear (ISIC Rev.2 code: 324) and manufacture of fabricated metal products, except machinery and equipment (ISIC Rev.2 code: 381). Export price variable for the sector 324 (expr324) is trend-stationary at the 1 % significance level while expr381 is trend-stationary at the 5 % significance level.

When we look at the exchange rate variable (exch), this variable is non-stationary for all sectors. This variable achieves stationarity after differencing once for all sectors. Like the exchange rate variable, Turkey's producer price variable (pptr) can achieve stationarity after differencing once for all of the sectors except the sector 314. pptr314 is trend-stationary at the 1 % significance level.

World producer price variable is stationary in level forms for half of the sectors. These sectors' codes are 321, 324, 351 and 353. wpp321 is stationary at the 5 % significance level while wpp324 is stationary at the 1 % significance level. The remaining two sectors' world producer price variables, wpp351 and wpp353, are trend-stationary at the 5 % and 1 % significance levels respectively. Lastly, capacity utilization variable is stationary almost for all of the sectors. Only for the sectors 371 and 383, it is I(1). cu371 and cu383 can achieve stationary after differencing once.

In general, there are two stationary variables for each sector. The codes of these sectors are 314, 321, 351, 353 and 381. Only one sector, namely the sector of manufacture of foot wear, except vulcanize or moulded rubber of plastic footwear (ISIC Rev.2 code: 324), has three stationary variables. For the remaining two sectors, 371 and 383, all variables are I(1).

5.2 Lag Selection

In order to determine the lag length of each VAR system, we utilize the sequential F-tests and SC, HQ and AIC statistics. The system is reduced sequentially from VAR(k) to VAR(k-1) starting from k=5. The results of these tests are reported in the Appendix A. In the estimation of the systems of the sectors 324, 351 and 353, we have omitted the variable capacity utilization rate since we have seen that this variable specific to these sectors does not exhibit a fluctuation at all. Thus, adding this variable would be like adding a constant into the system.

The lag length for the sectors 314, 324, 353, 381 is decided as 1. Lag length of the sectors 351, 371, 383 is 2 and the remaining sector, 321 has lag length of 4.

5.3 Cointegration Tests

Cointegration analysis allows us to see if there is a long-run relationship between the export prices and exchange rates. Existence of at least one cointegration vector suggests a long-run relationship between the export prices and exchange rates. After deciding on the lag length, cointegration rank tests are conducted. The results of the cointegration analysis are reported in the Table 5.2 which includes Johansen’s trace statistic, maximal-eigenvalue or max statistic and Reimers’ adjusted trace and max statistics. These statistics are used to determine the cointegration rank. Testing for cointegration amounts to finding the number of linearly independent columns of $\prod$. Trace test is a standard likelihood ratio test with non-standard distribution. Critical values have been tabulated by inter alia Johansen (1988), Johansen and Juselius (1990), Osterwald-Lenum (1992), and Doornik (1998). The p-values are based on the approximations to the asymptotic distributions derived by Doornik (1998). This statistic tests the null of r = k (k=1,…, n-1) against the alternative of unrestricted r. Table 5.2 also includes max statistic and this statistic tests that there are r cointegration vectors against the alternative that (r+1) cointegration vectors exist (Harris 1995). To overcome the problem of small samples to make finite-sample correction we also have

Reimers' adjusted trace and max statistics in the fourth and fifth columns of Table 5.2. (Reimers 1992)

Table 5.2: Rank Determination for ∏

(1) Tobacco manufactures (ISIC Rev. 2 code: 314)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	70.64 [0.041]*	31.98 [0.081]	63.98 [0.133]	28.96 [0.176]
r = 1	38.67 [0.277]	22.20 [0.217]	35.02 [0.452]	20.10 [0.345]
r = 2	16.47 [0.686]	14.86 [0.311]	14.91 [0.788]	13.46 [0.426]
r = 3	1.61 [0.996]	1.45 [0.995]	1.46 [0.997]	1.31 [0.997]
r = 4	0.16 [0.690]	0.16 [0.690]	0.14 [0.705]	0.14 [0.705]

(2) Manufacture of textiles (ISIC Rev. 2 code: 321)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	107.29[0.000]**	38.20 [0.011]*	64.37 [0.125]	22.92 [0.548]
r = 1	69.09 [0.000]*	34.62 [0.004]**	41.45 [0.176]	20.77 [0.300]
r = 2	34.47 [0.013]*	22.94 [0.025]*	20.68 [0.389]	13.76 [0.399]
r = 3	11.53 [0.184]	10.73 [0.171]	6.92 [0.594]	6.44 [0.565]
r = 4	0.80 [0.372]	0.80 [0.372]	0.48 [0.489]	0.48 [0.489]

(3) Manufacture of foot wear, except vulcanize or moulded rubber of plastic footwear (ISIC Rev.2 code: 324)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	74.11 [0.000]**	34.15 [0.004]**	68.52 [0.000]**	31.57 [0.012]*
r = 1	39.96 [0.002]**	24.26 [0.015]*	36.95 [0.006]**	22.43 [0.031]*
r = 2	15.71 [0.045]*	10.64 [0.176]	14.52 [0.069]	9.84 [0.227]
r = 3	5.06 [0.024]*	5.06 [0.024]*	4.68 [0.030]*	4.68 [0.030]*

(4) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	43.81 [0.114]	18.83 [0.441]	37.07 [0.349]	15.93 [0.677]
r = 1	24.98 [0.167]	14.60 [0.331]	21.14 [0.360]	12.36 [0.527]
r = 2	10.38 [0.257]	9.57 [0.247]	8.78 [0.393]	8.10 [0.377]
r = 3	0.80 [0.370]	0.80 [0.370]	0.68 [0.410]	0.68 [0.410]

Table 5.2 (continued)

(5) Petroleum refineries (ISIC Rev. 2 code: 353)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	36.61 [0.370]	20.44 [0.323]	33.85 [0.515]	18.89 [0.435]
r = 1	16.18 [0.706]	10.85 [0.670]	14.96 [0.786]	10.03 [0.744]
r = 2	5.33 [0.773]	5.32 [0.704]	4.92 [0.815]	4.92 [0.752]
r = 3	0.01 [0.934]	0.01 [0.934]	0.01 [0.936]	0.01 [0.936]

(6) Iron and steel basic industries (ISIC Rev. 2 code: 371)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	73.05 [0.025]*	29.88 [0.141]	59.00 [0.269]	24.14 [0.459]
r = 1	43.16 [0.128]	20.99 [0.287]	34.86 [0.460]	16.95 [0.593]
r = 2	22.18 [0.298]	11.40 [0.617]	17.91 [0.582]	9.21 [0.813]
r = 3	10.77 [0.230]	10.64 [0.176]	8.70 [0.401]	8.59 [0.329]
r = 4	0.14 [0.711]	0.14 [0.711]	0.11 [0.739]	0.11 [0.739]

(7) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	117.53[0.000]**	40.08 [0.006]**	106.44 [0.000]**	36.30 [0.021]*
r = 1	77.45 [0.000]**	33.47 [0.006]**	70.14 [0.000]**	30.31 [0.018]*
r = 2	43.98 [0.000]**	24.62 [0.013]*	39.83 [0.002]**	22.29 [0.032]*
r = 3	19.36 [0.011]*	17.94 [0.011]*	17.54 [0.023]*	16.25 [0.022]*
r = 4	1.42 [0.234]	1.42 [0.234]	1.29 [0.257]	1.29 [0.257]

(8) Manufacture of electrical machinery, apparatus, appliances and supplies(ISIC Rev. 2 code: 383)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	87.47 [0.001]**	32.36 [0.072]	70.65 [0.041]*	26.14 [0.323]
r = 1	55.11 [0.008]**	24.42 [0.122]	44.51 [0.099]	19.72 [0.373]
r = 2	30.69 [0.039]*	17.22 [0.168]	24.79 [0.174]	13.91 [0.387]
r = 3	13.47 [0.098]	13.38 [0.067	10.88 [0.222]	10.81 [0.166]
r = 4	0.09 [0.762]	0.09 [0.762]	0.07 [0.785]	0.07 [0.785]

(**) and (*) signs indicate rejection of Ho: rank=r at the 1 % and 5 % significance levels respectively.

In the rank determination of ∏ matrix, priority is given to the Reimers' adjusted trace and max tests considering the small sample size of the current study. By looking at the tests statistics we conclude that there is no cointegration relationship for five sectors whose codes are 314, 321, 351, 353 and 371. For these five sectors, Reimers' adjusted trace and max tests suggest that the rank is zero. For the sector of tobacco manufactures (ISIC Rev.2 code: 314) and iron and steel basic industries (ISIC Rev.2 Code: 371), all the tests other than trace test suggest that the rank is zero. Although null of r=0 is rejected at the 5 % significance level for the trace test we conclude that there is no cointegration relationship by looking at Reimers' adjusted trace and max tests. For the manufacture of textiles (ISIC Rev. 2 code: 321), although trace and max tests suggest for different number of cointegration relationships, we conclude that the rank is zero since Reimers' adjusted trace and max tests suggest r=0. The sectors for which all cointegration tests show that the rank is zero are manufacture of industrial chemicals (ISIC Rev.2 code: 351) and petroleum refineries (ISIC Rev.2 code: 353). For each of the remaining three sectors whose codes are 324, 381 and 383, cointegration relationship exists. Reimers' adjusted trace and max tests reject the null of r=1 and r=2 is not rejected so we decide that the rank is two for the sector of manufacture of foot wear, except vulcanize or moulded rubber of plastic footwear (ISIC Rev.2 code:324). For the sector of manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381), original and adjusted trace reject the null of r=2 at the 1 % significance level and the null of r=3 is rejected at the 5 % significance level but not rejected at the 1 % significance level. Therefore, considering Reimers' adjusted trace test we conclude that there are three cointegration relationships between the variables specific to this sector. Lastly, for the manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev.2 code: 383), both max tests suggest that the rank is zero. However, trace test rejects the null of r=1 at the 1 % significance level and r=2 at the 5 % significance level while small sample adjusted trace test rejects the null of r=0 at the 5 % significance level and does not reject r=1. Therefore, we prefer to conclude that there is a single cointegration vector using information given by trace tests since it is suggested by the Monte Carlo experiments that "… between Johansen's two LR tests (trace and max tests) for cointegration, the trace test shows more robustness to both skewness and excess kurtosis in (the residuals) than the maximal eigenvalue test" (Harris 1995).

5.4 Cointegration Vectors

There are three exporting sectors, for which there is at least one cointegrating vector. The codes of these three sectors are 324, 381 and 383. For the sectors 324 and 383, a single cointegrating vector is estimated[12] while for the sector 381, three cointegrating vectors are estimated.

For the sector 324, a single cointegration vector is considered. Estimated cointegration vector and the LR-tests for the exclusion of the variables from the cointegration vector are reported in Table 5.3. In Table 5.3, the symbols in parentheses denote respective coefficients on the explanatory variables.

Table 5.3: Cointegration Vector for the Sector 324

Cointegration vector:	
expr324 = - 3.688 wpp324 + 2.033 pptr324 - 2.03 exch324 (γ_0) (γ_1) (γ_2)	
Restrictions:	**LR tests:**
$\gamma_0 = 0$	$\chi^2(1)$ = 1.5872 [0.2077]
$\gamma_1 = 0$	$\chi^2(1)$ = 9.8414 [0.0017]**
$\gamma_2 = 0$	$\chi^2(1)$ = 9.8264 [0.0017]**
$\gamma_0 = 0, \gamma_1 = 0, \gamma_2 = 0$	$\chi^2(3)$ = 13.730 [0.0033]**
$\gamma_1 = 1$	$\chi^2(1)$ = 2.8066 [0.0939]
$\gamma_2 = -1$	$\chi^2(1)$ = 3.3863 [0.0657]
$\gamma_1 = 1, \gamma_2 = -1$	$\chi^2(2)$ = 4.8528 [0.0884]
$\gamma_0 = 0, \gamma_1 = 1, \gamma_2 = -1$	$\chi^2(3)$ = 7.7295 [0.0519]
$\gamma_0 - \gamma_2 = 1$	$\chi^2(1)$ = 1.0064 [0.3158]
$\gamma_1 + \gamma_2 = 0$	$\chi^2(1)$ = 0.0013880 [0.9703]
$\gamma_0 + \gamma_1 = 1$	$\chi^2(1)$ = 1.0707 [0.3008]
$\gamma_0 - \gamma_2 = 1, \gamma_1 + \gamma_2 = 0$	$\chi^2(2)$ = 4.3812 [0.1119]

For the sector 324, all variables except world producer price (wpp324) have expected signs. Although wpp324 has a negative coefficient, it is statistically not significant. The other two variables are statistically significant since individual exclusion of these variables, pptr324 and exch324 is rejected at 1 %. The null hypothesis whether a change in producer prices (used as a proxy for the unit production costs) is completely reflected in the foreign currency export prices ($\gamma_1 = 1$) is not rejected. The null hypothesis of complete ERPT ($\gamma_2 = -1$) is also not rejected. The joint hypothesis whether there is complete pass-through of exchange rate changes and production costs into the export prices ($\gamma_1 = 1$, $\gamma_2 = -1$) is not rejected. We have tested all cross-coefficient restrictions ($\gamma_0 - \gamma_2 = 1$, $\gamma_1 + \gamma_2 = 0$, $\gamma_0 + \gamma_1 = 1$)

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[12] The cointegration tests in section 5.3 suggest that there exist two cointegration relationships for the sector 324. However, after the identification restrictions, simultaneous exclusion of all explanatory variables from the second cointegration vector is not rejected. Therefore, we choose to use a single cointegration vector.

and they are also not rejected. The results suggest that in sector 324, Turkish exporters are not price takers in foreign markets since changes in the exchange rate and production costs are reflected in the foreign currency export prices completely.

For the sector 381, three cointegrating relationships are considered. These three cointegration vectors are identified and one of them is interpreted as export price, second one as the domestic price and the third one as the capacity utilization equation. Estimated cointegration vectors and the tests for the exclusion of the explanatory variables of the export price equation are reported in Table 5.4. The symbols, δ_0 and δ_1 denote the coefficients on the Turkey's producer price and exchange rate variable, respectively.

Table 5.4: Cointegration Vectors for the Sector 381

Cointegration vectors:

$$expr381 = \underset{(\delta_0)}{0.051} pptr381 - \underset{(\delta_1)}{0.095}\, exch381$$

$$pptr381 = -7.89\, wpp324 + 1.123\, exch324$$

$$cu381 = -12.861 expr381 - 0.698 pptr381$$

Restrictions:	**LR tests:**
$\delta_0 = 0$	$\chi^2(2) = 12.846$ [0.0016]**
$\delta_1 = 0$	$\chi^2(1) = 0.0050345$ [0.9434]
$\delta_0 = 0, \delta_1 = 0$	$\chi^2(3) = 13.001$ [0.0046]**

Turkish exporters in the sector 381 can reflect changes in the production costs (pptr381) into their export prices. However, one percentage point increase can result in only 0.051 percentage point increase in the foreign currency export prices. It should be noted that it is statistically different from zero since exclusion of pptr381 from the cointegration vector ($\delta_0 = 0$) is rejected at the 1 %. However, exclusion of the exchange rate variable from the cointegration vector ($\delta_1 = 0$) is not rejected indicating that ERPT in the sector 381 is zero in the long-run.

For the sector 383, we have one cointegration vector. In Table 5.5, cointegrating vector and LR test results for the restrictions on the coefficients of explanatory variables are reported. In Table 5.5, the symbols in parentheses denote respective coefficients on the explanatory variables. First, the exclusion of each variable is tested. Exclusion of the producer price of this sector in Turkey and exchange rate variable is rejected at 5 %. However, exclusion of the world producer price and capacity utilization rate is not rejected. We have also tested each of the cross-coefficient restrictions implied by our theoretical model. All of the cross-coefficient restrictions ($\Theta_0 - \Theta_3 = 1$, $\Theta_2 + \Theta_3 = 0$, $\Theta_0 + \Theta_2 = 1$) are rejected by the LR-tests. It should be also noted that exchange rate variable is significant but with a positive coefficient being against our theoretical model. Producer price of Turkey is also significant at 5 % but with a negative coefficient being against our theoretical expectations. The results suggest that estimated cointegration vector for the sector 383 does not fit the theoretical framework explained in Chapter 3[13].

Table 5.5 Cointegration Vector for the Sector 383

Cointegration vector:	
expr383 = - 2.35 wpp383 (Θ_0) – 1.204 cu383 (Θ_1) – 2.539 pptr383 (Θ_2) + 2.165 exch383 (Θ_3)	
Restrictions:	**LR tests:**
$\Theta_0 = 0$	$\chi^2(1) = 1.3079$ [0.2528]
$\Theta_1 = 0$	$\chi^2(1) = 2.0077$ [0.1565]
$\Theta_2 = 0$	$\chi^2(1) = 6.6011$ [0.0102]*
$\Theta_3 = 0$	$\chi^2(1) = 6.4771$ [0.0109]*
$\Theta_0 = 0, \Theta_1 = 0$	$\chi^2(2) = 3.8979$ [0.1424]
$\Theta_0 = 0, \Theta_1 = 0, \Theta_2 = 0, \Theta_3 = 0$	$\chi^2(4) = 16.851$ [0.0021]**
$\Theta_0 = 0, \Theta_1 = 0, \Theta_2 = 0$	$\chi^2(3) = 11.388$ [0.0098]**
$\Theta_0 = 0, \Theta_1 = 0, \Theta_3 = 0$	$\chi^2(3) = 12.288$ [0.0065]**
$\Theta_2 = 0, \Theta_3 = 0$	$\chi^2(2) = 6.7469$ [0.0343]*
$\Theta_3 = 1$	$\chi^2(1) = 2.9517$ [0.0858]
$\Theta_0 - \Theta_3 = 1$	$\chi^2(1) = 3.9243$ [0.0476]*
$\Theta_2 + \Theta_3 = 0$	$\chi^2(1) = 5.9322$ [0.0149]*
$\Theta_0 + \Theta_2 = 1$	$\chi^2(1) = 4.1450$ [0.0418]*
$\Theta_0 - \Theta_3 = 1, \Theta_2 + \Theta_3 = 0$	$\chi^2(2) = 6.1047$ [0.0472]*

5.5 Difference Models

Finally, we have estimated the models in first difference by least squares for each sector. We have started from a general model in which all variables have three lags[14]. Then, we have omitted insignificant variables sequentially. However, we try to leave the exchange

[13] Misspecification error in the estimated difference model for the sector 383 in section 5.6 supports the idea that this theoretical framework is not appropriate for this sector.

[14] The lag length of the short-run models are chosen independent of the lag lengths of the long-run models to achieve uniformity in the short-run models. Estimation results are not sensitive to the lag length.

rate variable in the equation even it is insignificant so that we could show that the coefficient on exchange rate variable is statistically not different from zero. Showing this would be equal to showing that exchange rate pass-through is zero. Difference models used for analysing short-run exchange rate pass-through for each exporting sector are reported in Table 5.6. To denote differences of the variables, "D" prefix is used. "Dvariable_i" denotes the i-period lagged form of the differenced variable. Model reduction process is reported in the Appendix C.

Table 5.6: Estimation Results from Difference Models

(1) Tobacco manufactures (ISIC Rev. 2 code: 314)

Dexpr314 = 0.065 – 0.624 Dexpr314_2 + 0.126 Dexch314 – 0.184 Dexch314_1
(1.76)* (-5.27)*** (0.856) (-1.10)

– 0.131 Dexch314_2 – 0.286 Dexch314_3
(-0.792) (-1.70)*

sigma = 0.094, RSS = 0.388, R^2 = 0.444, F(5,44) = 7.021 [0.000]***
log-likelihood = 50.491, DW = 2.39
AR 1-4 test: F(4,40) = 1.1124 [0.3641], ARCH 1-4 test: F(4,36) = 0.40307 [0.8051]
Normality test: Chi^2(2) = 3.6808 [0.1588], hetero test: F(10,33) = 0.31670 [0.9711]
hetero-X test: F(20,23) = 0.74383 [0.7463], RESET test: F(1,43) = 2.1661 [0.1484]

(2) Manufacture of textiles (ISIC Rev. 2 code: 321)

Dexpr321 = – 0.041 + 7.337 Dwpp321_1 – 0.918 Dcu321 + 0.186 Dpptr321_3
(-2.28)** (4.36)*** (-3.50)*** (2.12)**

– 0.051 Dexch321 – 0.058 Dexch321_1 + 0.102 Dexch321_2
(- 0.794) (-0.824) (1.48)

sigma = 0.04, RSS = 0.069, R^2 = 0.507, F(6,43) = 7.358 [0.000]***
log-likelihood = 93.696, DW = 2.12
AR 1-4 test: F(4,39) = 0.28549 [0.8856], ARCH 1-4 test: F(4,35) = 1.1445 [0.3519]
Normality test: Chi^2(2) = 4.3226 [0.1152], hetero test: F(12,30) = 0.45335 [0.9261]
hetero-X test: F(27,15) = 0.31123 [0.9960], RESET test: F(1,42) = 0.70364 [0.4063]

Table 5.6 (continued)

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(3) Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear (ISIC Rev. 2 code: 324)

Dexpr324 = – 0.082 – 0.267 Dexpr324_1 – 0.224 Dexpr324_3 + 11.84 Dwpp324
(-1.19) (-1.95)* (-1.82)* (1.81)*

– 17.756 Dwpp324_1 + 11.0864 Dwpp324_2 + 0.916 Dpptr324_1
(-2.55)** (1.66) (2.68)**

– 0.759 Dpptr324_2 + 0.598 Dpptr324_3 +0.43 Dexch324 – 0.859 Dexch324_1
(-3.14)*** (2.48)** (2.10)** (-3.03)***

sigma = 0.119, RSS = 0.549, R^2 = 0.434, F(10,39) = 2.986 [0.007]***
log-likelihood = 41.857, DW = 1.98

AR 1-4 test: F(4,35) = 2.3444 [0.0737], ARCH 1-4 test: F(4,31) = 0.47533 [0.7535]
Normality test: Chi^2(2) = 2.4296 [0.2968, hetero test: F(20,18) = 0.35878 [0.9855]
Not enough observations for hetero-X test, RESET test: F(1,38) = 1.0390 [0.3145]

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(4) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

Dexpr351 = – 0.049 + 1.483 Dwpp351 + 0.045 Dexch351 + 0.016 Dexch351_1
(-3.78)*** (6.31)*** (0.836) (0.263)

+ 0.044 Dexch351_2 + 0.181 Dexch351_3
(0.725) (3.06)***

sigma = 0.035, RSS = 0.053, R^2 = 0.609, F(5,44) = 13.71 [0.000]***
log-likelihood = 100.378, DW = 2.37
AR 1-4 test: F(4,40) = 1.6545 [0.1796], ARCH 1-4 test: F(4,36) = 1.0310 [0.4046]
Normality test Chi^2(2) = 6.2050 [0.0449]**, hetero test: F(10,33) = 0.42038 [0.9265]
hetero-X test: F(20,23) = 0.42476 [0.9713], RESET test: F(1,43) = 1.3676 [0.2487]

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(5) Petroleum refineries (ISIC Rev. 2 code: 353)

Dexpr353 = – 0.053 – 0.342 Dexpr353_2 + 0.918 Dwpp353 + 0.096 Dexch353
(-0.911) (-2.53)** (2.04)** (0.425)

+ 0.081 Dexch353_1 + 0.299 Dexch353_2 + 0.191 Dexch353_3
(0.325) (1.20) (0.772)

sigma = 0.143, RSS = 0.885, R^2 = 0.289, F(6,43) = 2.917 [0.018]**
log-likelihood = 29.897, DW = 1.68

AR 1-4 test: F(4,39) = 0.51372 [0.7260], ARCH 1-4 test: F(4,35) = 0.86773 [0.4930]
Normality test Chi^2(2) = 0.97323 [0.6147], hetero test: F(12,30) = 2.6074 [0.0165]**
hetero-X test: F(27,15) = 1.0807 [0.4506], RESET test: F(1,42) = 0.15269 [0.6980]

Table 5.6 (continued)

(6) Iron and steel basic industries (ISIC Rev. 2 code: 371)

$$Dexpr371 = \underset{(-1.37)}{-0.022} - \underset{(-3.20)^{***}}{0.273\ Dcu371} - \underset{(-2.24)^{**}}{0.183\ Dcu371\_1} - \underset{(-2.08)^{**}}{0.178\ Dcu371\_2}$$

$$+ \underset{(2.72)^{***}}{0.399\ Dpptr371} + \underset{(4.27)^{***}}{0.602\ Dpptr371\_1} - \underset{(-1.82)^{*}}{0.257\ Dexch371}$$

$$- \underset{(-3.72)^{***}}{0.505\ Dexch371\_1} - \underset{(-1.12)}{0.09\ Dexch371\_2}$$

sigma = 0.044, RSS = 0.079, R^2 = 0.568, F(8,41) = 6.747 [0.000]***
log-likelihood = 90.331, DW = 2.29
AR 1-4 test: F(4,37) = 0.90542 [0.4708], ARCH 1-4 test: F(4,33) = 0.29826 [0.8770]
Normality test:Chi^2(2) = 6.8783 [0.0321]**, hetero test: F(16,24) = 0.52835 [0.9050]
Not enough observations for hetero-X test, RESET test: F(1,40) = 1.6776 [0.2027]

(7) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

$$Dexpr381 = \underset{(-0.0575)}{-0.001} - \underset{(-2.93)^{***}}{0.398\ Dexpr381\_1} + \underset{(2.67)^{**}}{0.677\ Dpptr381\_2} - \underset{(-1.44)}{0.141\ Dexch381}$$

$$+ \underset{(1.17)}{0.129\ Dexch381\_1} - \underset{(-2.69)^{***}}{0.502\ Dexch381\_2} - \underset{(-0.874)}{0.098\ Dexch381\_3}$$

sigma = 0.059, RSS = 0.15, R^2 = 0.26, F(6,43) = 2.518 [0.035]**
log-likelihood = 74.324, DW = 2.17

AR 1-4 test: F(4,39) = 0.94704 [0.4472], ARCH 1-4 test: F(4,35) = 0.66496 [0.6206]
Normality test: Chi^2(2) = 1.5993 [0.4495], hetero test: F(12,30) = 0.29383 [0.9857]
hetero-X test: F(27,15) = 0.31959 [0.9952], RESET test: F(1,42) = 0.22818 [0.6354]

(8) Manufacture of electrical machinery, apparatus, appliances and supplies(ISIC Rev. 2 code: 383)

$$Dexpr383 = \underset{(-2.95)^{***}}{-0.081} - \underset{(-3.96)^{***}}{1.184\ Dpptr383} + \underset{(3.59)^{***}}{1.067\ Dpptr383\_1} + \underset{(4.05)^{***}}{0.87\ Dexch383}$$

$$- \underset{(-3.16)^{***}}{0.656 Dexch383\_1} + \underset{(1.61)}{0.195\ Dexch383\_2} + \underset{(1.49)}{0.184\ Dexch383\_3}$$

sigma = 0.07, RSS = 0.213, R^2 = 0.402, F(6,43) = 4.808 [0.001]***
log-likelihood = 65.545, DW = 1.73

AR 1-4 test: F(4,39) = 0.21606 [0.9279], ARCH 1-4 test: F(4,35) = 1.2144 [0.3222]
Normality test: Chi^2(2) = 2.8007 [0.2465], hetero test: F(12,30) = 1.3266 [0.2553]
hetero-X test: F(27,15) = 1.2941 [0.3057], RESET test: F(1,42) = 7.6045 [0.0086]***

Notes: 1) The values in parentheses are t-values.
2) (*), (**) and (***) signs indicate significance at 10 %, 5 % and 1 %, respectively.

In the short-run model for the sector 314, there are only two variables entering into the equation being statistically significant. These are two-period lagged export price variable in first difference and the three-period lagged exchange rate variable in first difference. The coefficient on the three-period lagged exchange rate variable is (-0.286), which is our estimated S-R exchange rate pass-through coefficient. However, it is significant only at the 10 %. Exchange rate pass-through estimate suggests that a one percentage point depreciation (appreciation) of the T.L would result in a 0.286 % decrease (increase) in foreign currency export prices after 3 quarters. We also see that there is an internal adjustment mechanism in the export prices against to the outside shocks. When there is a change in the export prices, it corrects itself by 0.624 percentage point after 2 quarters. It should be noted that this S-R model does not give much insight about the export pricing behavior in the sector 314 since one of two significant variables is the two-period lagged form of the dependent variable, Dexpr314_2 and the other significant variable is the three-lagged exchange rate variable being significant only at the 10 %.

Exchange rate pass-through estimate for the sector 321 is zero. Exchange rate variable and its lagged variables in first difference are not statistically significant, i.e. they are statistically not different from zero. S-R model suggests that export price is determined by the following variables: one period lagged world producer price, capacity utilization level and three-period lagged producer price of Turkey in first difference, which is used as a proxy for the unit production cost of the exporters. It is found that export pricing in this sector mainly depends on the world producer price. As we expect, it has a positive sign. However, although our model expects the coefficient on the world producer price to be between 0 and 1, our estimated coefficient is 7.337. We think that this can be due the fact that our constructed world producer variable does not represent "actual world producer price variable". While exchange rate changes are fully absorbed by the exporting firms into their profit margins, increases in the production costs are reflected into the export prices to some degree. When there is a one percentage point increase in the production costs, then there would be 0.186 percentage increase in the foreign currency export prices. In our analytical model, capacity utilization rate variable was added to proxy the demand pressure in the domestic market. Therefore, it was expected to take a positive sign. However, in all of the equations into which capacity utilization rate enters as a significant variable, it has a negative sign. The reason could be that increase in the capacity utilization rate by its nature also represents the supply increase, and increase in the supply causes prices to decrease. We see that the capacity utilization rate is a measure of supply in our S-R models. Hence, increase in the capacity utilization level results in the decrease in the export price.

In the sector 324, world producer price (Dwpp324) and its one-period lagged form (Dwpp324_1) is individually significant. However, total effect of world producer price on the export price (sum of the coefficients on the Dwpp324 and Dwpp324_1) is statistically not different from zero indicated by the chi-square test statistics with a value of 0.57304 and probability of 0.4491. Total exchange rate pass-through, which is the sum of the estimated coefficients on the significant exchange rate variables, is estimated as -0.429. However, the null hypothesis of zero exchange rate pass-through is not rejected by the chi-square test statistics with a value of 2.4351 and probability of 0.1186.

For the sector 351, producer price, which is a proxy for the unit production cost, does not enter into the S-R model. It does not have any effect on the S-R pricing behavior of the export prices while world producer price is significant at the 1 %. Although we do not expect the coefficient on wpp351 to be not higher than one, the coefficient on wpp351 is estimated as 1.483. However, the null hypothesis of whether the coefficient on wpp351 is one is not rejected with a chi-square value of 4.2296 and probability of 0.0397 at the 1 % although it is rejected at the 5 %. This reveals the fact that the export price of the sector 351 is mainly determined by the world prices. The exporters in this sector are mainly price takers in the foreign markets. Three-period lagged exchange rate variable in first difference is significant at the 1 % and its coefficient is 0.181 which is positive as opposed to the theoretical expectations.

In the determination of export prices for the sector 353, the world price plays a significant role. Estimated coefficient on wpp353 is 0.918 and it is statistically not different from 1 as indicated by the chi-square value of 0.032956 and probability of 0.8559. Exchange rate variable is not significant revealing the fact that exporters of the sector 353 do not change export prices following an exchange rate change. They absorb exchange rate changes fully into their profit margins. Following exchange rate depreciation (appreciation), their foreign currency export prices remain the same but their domestic currency export prices increase (decrease) proportionately. In the case of an appreciation of domestic currency they absorb exchange rate changes fully into their profit margins. Like in the sector 314, there is a correction mechanism since two-period lagged variable enters into the model being a significant variable. However, the degree of correction in the sector 353 is lower than in the sector 314.

In the sector 371, export price is determined by the capacity utilization variable and its one-period and two-period lagged forms, sector's producer price in Turkey, exchange rate variable and their respective one-period lagged forms. World producer price does not enter into the equation. Hence the model suggests that exporters are not foreign currency price takers in this sector. Instead they pass exchange rate changes and unit production cost changes into the export prices in foreign currency. After one quarter, total pass-through of exchange rate changes is (-0.762) implying that a one percentage point depreciation (appreciation) of the T.L would result in a 0.762 % decrease (increase) in the foreign currency export prices within one quarter. Furthermore, we have tested the hypothesis whether complete pass-through occurs within one quarter, i.e. the coefficients on the Dexch371 and Dexch371_1 sums up to -1. This hypothesis is not rejected with a chi-square value of 2.544 and probability of 0.1107. Hence, complete pass-through hypothesis is not rejected. Besides reflecting exchange rate changes, they also reflect production cost increases one to one into the export prices within one quarter. Although total effect of production cost increases (proxied by the producer price of this sector in Turkey) is estimated as 1.001, it is statistically not different from 1 with a chi-square statistics value of 6.3237e-006 and probability of 0.9980.

As for the sector 371, world producer price in the sector 381 does not play a significant role in the export pricing for the sector 381. World producer price does not enter into the equation as a significant variable. One-period lagged export price, two-period lagged producer price of this sector in Turkey and two-period lagged exchange rate variables are significant. The coefficient on the Dpptr382_2 is 0.677. The coefficient on the Dexch381_2 is (-0.502) which is our exchange rate pass-through coefficient. It implies that one percentage point depreciation (appreciation) of the T.L would result in a 0.502 % decrease (increase) in foreign currency export prices after 2 quarters. Exporters in the sector 381 are not price takers in foreign markets. As they reflect exchange rate changes into the export prices, they also pass unit production cost changes (changes in pptr381) into the export prices.

When we look at the model for the sector 383, it seems as if the results are not very informative. Because we have misspecification at all stages of the model reduction process as indicated by Reset test[15]. The contemporaneous exchange rate is significant at the 1 % but its coefficient is 0.87 being positive as opposed to our theoretical expectations. One-period lagged exchange rate variable is also significant at the 1 % and its coefficient is -0.656. We have tested whether exchange rate pass-through turns out to be zero within one quarter, i.e. the coefficients of Dexch383 and Dexch383_1 sums up to zero. This hypothesis is not rejected with a chi-square value of 0.76184 and probability of 0.3828.

[15] For the results of the Reset test at each stage, see Appendix C.

5.6 Conclusions on the Estimation Results for the Export Analysis

In the cointegration analysis, there are only three sectors for which at least one cointegration vector can be identified. Furthermore, for one of these three sectors, sector 383, cointegration analysis cannot suggest information on the exchange rate pass-through. For the sector 324, exchange rate pass-through is statistically not different from -1, i.e. complete pass-through. However, for the sector 381; it is statistically not different from zero, i.e. no pass-through.

The results of the total ERPT estimates from S-R models are presented in Table 5.7. As previously stated, total ERPT is the sum of the estimated coefficients on the exchange rate variable and its lagged forms that are significant at the 10 %. Hence, an estimate of total ERPT, 0 indicates that none of the exchange rate variables is significant at the 10 %. Additionally, we have reported whether total ERPT for each product category is significantly different from 0 or -1 at 5 %.

Table 5.7: Total Exchange Rate Pass-Through into Export Prices

SECTORS	Total ERPT	
314 - Tobacco manufactures	-0.286	no pass-through
321 - Manufacture of textiles	0	no pass-through
324 - Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear	-0.429	no pass-through
351 - Manufacture of industrial chemicals	0.181*+	partial pass-through
353 - Petroleum refineries	0	no pass-through
371 - Iron and steel basic industries	-0.762*	complete pass-through
381 - Manufacture of fabricated metal products, except machinery &equipment	-0.502*+	partial pass-through
383 - Manufacture of electrical machinery, apparatus, appliances and supplies	-0.114	no pass-through

* , significantly different from 0 at 5 percent level

+ , significantly different from -1 at 5 percent level

As it can be seen in Table 5.7, there is variation in the total ERPT estimates across sectors. Zero pass-through is estimated for the sectors 321 and 353. Furthermore, total pass-through estimate is significantly not different from zero for the sectors 314, 324 and 383[16].

[16] Interpretation of the analysis for the sector 383 requires care since misspecification error is present. For the sector 314, total pass-through estimate is statistically different from zero at 10 %.

Total ERPT being significantly different from zero is estimated for the sectors 351, 371 and 381. For the sector 381, partial pass-through is indicated since total ERPT is significantly different from 0 and -1. Ten percent depreciation of T.L. would result in about five percent decrease in the foreign currency export prices of the sector 381. Total ERPT estimate for the sector 371 is (-0.762) and it is significantly not different from -1 at the 5 % indicating complete pass-through.

For the textile sector, we have found zero pass-through. However, Kan (2001) finds significant incomplete ERPT rates for some subcategories of textile factor. Therefore, although we do our analysis at the most disaggregate level given the data and the model we use, there can be possible aggregation bias, especially in the textile sector, even in our analysis.

The results show that in some sectors, exporters do not change their foreign currency export prices following an exchange rate depreciation (no pass-through) so that they increase their mark-ups proportionately to the depreciation. However, in some sectors, exporters decrease their foreign currency export prices following an exchange rate depreciation. By decreasing their foreign currency export prices, they intend to increase their market shares. Therefore, we have found that in sectors 371 and 381, exporters decrease their foreign currency export prices following an exchange rate depreciation in order to increase their market shares.

There is a common feature of the sectors for which total ERPT estimate is different from zero and negative. In these sectors (314, 324, 371, 381 and 383), world producer price does not have any effect on the foreign currency export prices in the short-run, i.e. world producer price is not significant in the difference models. However, when world producer price is significant, the exporters do not reflect changes in the exchange rates into their foreign currency export prices (zero pass-through). In this case, since they are price takers in foreign markets they absorb exchange rate changes into their profit margins.

CHAPTER 6

EMPIRICAL ANALYSIS OF EXCHANGE RATE PASS-THROUGH FOR IMPORTS

In this chapter, empirical analysis of the exchange rate pass-through into the import prices at the disaggregate level will be conducted. The same estimation procedure is followed in the analysis of exchange rate pass-through into the import prices as into the export prices. Sequentially; unit root tests, lag length of each VAR system, cointegration tests and cointegration vectors of each sector which has at least one cointegration vector and finally, least-squares estimation results from difference models will be reported.

6.1 Unit Root Tests:

ADF statistics for each sector are reported in Table 6.1. As in the analysis of export pass-through, (**) and (*) signs indicate rejection of a unit root at 1 % and 5 % levels respectively. Critical values at the 5 % and 1 % significance levels are -2.93 and -3.58 respectively. When a trend term is included, critical values at the 5 % and 1 % significance levels are -3.51 and -4.17 respectively.

Table 6.1: ADF Statistics for Testing Unit Root

(1) Manufacture of textiles (ISIC Rev. 2 code: 321)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
impr321	4	-3.553*	4	-3.491	**Δimpr321**	0	-5.380**	0	-5.313**
Pptr321	1	-0.405	1	-2.442	**Δpptr321**	0	-4.331**	0	-4.265**
exchm321	0	-0.487	1	-2.521	**Δexchm321**	0	-4.761**	0	-4.653**
wppm321	5	-1.818	5	-0.729	**Δwppm321**	1	-3.145*	4	-3.992*

(2) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
impr351	0	-2.390	0	-2.363	**Δimpr351**	2	-5.567**	2	-5.537**
Pptr351	1	-0.260	1	-2.317	**Δpptr351**	0	-4.368**	0	-4.276**
exchm351	0	-0.532	1	-2.457	**Δexchm351**	0	-4.694**	0	-4.591**
wppm351	1	-2.445	1	-3.877*	**Δwppm351**	3	-3.892**	3	-3.867*

Table 6.1 (continued)

(3) Petroleum refineries (ISIC Rev. 2 code: 353)

Vars.	**ADF**				**Vars.**	**ADF**			
	lags	**η_μ**	**lags**	**η_τ**		**lags**	**η_μ**	**lags**	**η_τ**
impr353	5	-3.670	5	-3.358	**Δimpr353**	1	-7.376**	1	-7.845**
Pptr353	6	-1.520	1	-3.553*	**Δpptr353**	3	-4.548**	5	-4.521**
exchm353	0	-0.346	1	-2.725	**Δexchm353**	0	-4.735**	0	-4.626**
wppm353	1	-0.369	4	-3.548*	**Δwppm353**	0	-4.817**	0	-4.877**

(4) Iron and steel basic industries (ISIC Rev. 2 code: 371)

Vars.	**ADF**				**Vars.**	**ADF**			
	lags	**η_μ**	**lags**	**η_τ**		**lags**	**η_μ**	**lags**	**η_τ**
impr371	1	-1.306	1	-1.612	**Δimpr371**	0	-9.739**	0	-9.652**
pptr371	0	-0.721	0	-1.643	**Δpptr371**	0	-5.110**	0	-5.039**
exchm371	0	-0.792	1	-2.142	**Δexchm371**	0	-4.662**	0	-4.583**
wppm371	1	-3.932**	0	-1.537	**Δwppm371**	2	-4.170**	2	-4.068*

(5) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

Vars.	**ADF**				**Vars.**	**ADF**			
	lags	**η_μ**	**lags**	**η_τ**		**lags**	**η_μ**	**lags**	**η_τ**
impr381	0	-2.191	0	-3.437	**Δimpr381**	0	-8.211**	1	-6.312**
Pptr381	1	-0.259	3	-2.782	**Δpptr381**	0	-4.589**	0	-4.514**
exchm381	0	-0.574	1	-2.398	**Δexchm381**	0	-4.675**	0	-4.576**
wppm381	5	-1.504	5	-0.405	**Δwppm381**	4	-3.114*	4	-3.472

(6) Manufacture of machinery except electrical (ISIC Rev. 2 code: 382)

Vars.	**ADF**				**Vars.**	**ADF**			
	lags	**η_μ**	**lags**	**η_τ**		**lags**	**η_μ**	**lags**	**η_τ**
impr382	0	-2.380	0	-2.265	**Δimpr382**	0	-7.171**	0	-7.163**
pptr382	0	-0.652	1	-1.630	**Δpptr382**	0	-4.988**	0	-4.923**
exchm382	0	-0.593	1	-2.386	**Δexchm382**	0	-4.625**	0	-4.531**
wppm382	6	-3.782**	6	-1.813	**Δwppm382**	7	-1.412	5	-3.774*

(7) Manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev. 2 code: 383)

Vars.	**ADF**				**Vars.**	**ADF**			
	lags	**η_μ**	**lags**	**η_τ**		**lags**	**η_μ**	**lags**	**η_τ**
impr383	0	-2.735	0	-3.162	**Δimpr383**	3	-4.457**	3	-4.405**
pptr383	0	0.244	1	-2.461	**Δpptr383**	0	-4.898**	0	-4.848**
exchm383	0	-0.491	1	-2.525	**Δexchm383**	0	-4.616**	0	-4.516**
wppm383	4	-1.671	1	-0.260	**Δwppm383**	3	-1.635	0	-4.440**

Table 6.1 (continued)

(8) Manufacture of transport equipment (ISIC Rev. 2 code: 384)

Vars.	ADF				Vars.	ADF			
	lags	η_μ	lags	η_τ		lags	η_μ	lags	η_τ
impr384	0	0.017	0	-0.838	**Δimpr384**	0	-6.512**	0	-6.642**
pptr384	0	-1.371	0	-0.258	**Δpptr384**	0	-4.960**	0	-5.079**
exchm384	0	-0.562	1	-2.414	**Δexchm384**	0	-4.701**	0	-4.599**
wppm384	4	-3.370*	7	-2.073	**Δwppm384**	0	-5.382**	6	-2.855

(**) and (*) signs indicate rejection of a unit root at the 1 % and 5 % significance levels respectively.

Non-stationary variables for the import analysis have been observed more frequently than those for the export analysis. The exchange rate variable (exchm) for each sector achieves stationarity after differencing once. Also import price variable and Turkey's producer price variable for each sector are I(1) except the import price variable for manufacture of textiles (impr321) which is stationary at the 5 % significance level and Turkey's producer price variable for petroleum refineries (pptr353) which is trend-stationary at the 5 % significance level. However, world producer price variable is I(0) for five sectors out of total eight sectors. wppm351and wppm353 are trend-stationary at the 5 % significance level while wppm371 and wppm382 are stationary at the 1 % significance level and wppm384 is stationary at the 5 % significance level. For each of the remaining three sectors, world producer price variable achieves stationarity after differencing once.

6.2 Lag Selection

The statistics used to decide on the lag length, namely the sequential F-tests and SC, HQ and AIC statistics, are reported in the Appendix B. There are no sectors having lag length higher than 3. The lag length for the sectors 353, 383 and 384 is decided as 1. The lag lengths of 321, 351 and 371 are 2. The remaining two sectors, whose codes are 381 and 382, have lag length of three.

6.3 Cointegration Tests

Cointegration analysis allows us to see if there is a long-run relationship between the import prices and exchange rates. Existence of at least one cointegration vector suggests a long-run relationship between the import prices and exchange rates. The results of the cointegration analysis are reported in the Table 6.2 which includes Johansen's trace statistic, maximal-eigenvalue or max statistic and Reimers adjusted trace and max statistics.

Table 6.2: Rank Determination for ∏

(1) Manufacture of textiles (ISIC Rev. 2 code: 321)

Ho: rank=r	Tracetest (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	32.20 [0.605]	22.61 [0.196]	26.84 [0.858]	18.84 [0.439]
r = 1	9.59 [0.982]	6.27 [0.968]	7.99 [0.995]	5.22 [0.989]
r = 2	3.32 [0.943]	3.31 [0.914]	2.77 [0.969]	2.76 [0.951]
r = 3	0.02 [0.893]	0.02 [0.893]	0.02 [0.903]	0.02 [0.903]

(2) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	42.03 [0.159]	22.33 [0.210]	35.02 [0.452]	18.60 [0.458]
r = 1	19.70 [0.454]	14.32 [0.353]	16.42 [0.690]	11.93 [0.566]
r = 2	5.38 [0.768]	5.33 [0.702]	4.48 [0.857]	4.44 [0.806]
r = 3	0.05 [0.830]	0.05 [0.831]	0.04 [0.845]	0.04 [0.845]

(3) Petroleum refineries (ISIC Rev. 2 code: 353)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	56.01 [0.006]**	35.62 [0.002]**	51.43 [0.021]*	32.72 [0.008]**
r = 1	20.38 [0.408]	13.47 [0.425]	18.72 [0.524]	12.37 [0.525]
r = 2	6.92 [0.593]	6.05 [0.614]	6.35 [0.658]	5.55 [0.675]
r = 3	0.87 [0.351]	0.87 [0.351]	0.80 [0.371]	0.80 [0.371]

(4) Iron and steel basic industries (ISIC Rev. 2 code: 371)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	44.61 [0.097]	22.89 [0.183]	37.17 [0.344]	19.07 [0.421]
r = 1	21.72 [0.324]	16.56 [0.202]	18.10 [0.569]	13.80 [0.396]
r = 2	5.16 [0.790]	4.44 [0.807]	4.30 [0.872]	3.70 [0.882]
r = 3	0.73 [0.394]	0.73 [0.394]	0.61 [0.437]	0.61 [0.437]

(5) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	47.85 [0.048]*	31.87 [0.010]*	35.63 [0.420]	23.73 [0.147]
r = 1	15.98 [0.720]	7.87 [0.903]	11.90 [0.931]	5.86 [0.978]
r = 2	8.11 [0.461]	6.02 [0.617]	6.04 [0.694]	4.48 [0.802]
r = 3	2.09 [0.148]	2.09 [0.148]	1.56 [0.212]	1.56 [0.212]

Table 6.2 (continued)

(6) Manufacture of machinery except electrical (ISIC Rev. 2 code: 382)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	114.44[0.000]**	63.84 [0.000]**	85.22 [0.000]**	47.54 [0.000]**
r = 1	50.60 [0.000]**	35.39 [0.000]**	37.68 [0.004]**	26.35 [0.007]**
r = 2	15.21 [0.054]	12.50 [0.093]	11.33 [0.195]	9.31 [0.267]
r = 3	2.71 [0.100]	2.71 [0.100]	2.02 [0.156]	2.02 [0.156]

(7) Manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev. 2 code: 383)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	69.81 [0.000]**	34.20 [0.004]**	64.11 [0.001]**	31.41 [0.012]*
r = 1	35.61 [0.009]**	18.67 [0.109]	32.71 [0.022]*	17.15 [0.171]
r = 2	16.94 [0.028]*	15.23 [0.033]*	15.56 [0.047]*	13.99 [0.053]
r = 3	1.71 [0.192]	1.71 [0.192]	1.57 [0.211]	1.57 [0.211]

(8) Manufacture of transport equipment (ISIC Rev. 2 code: 384)

Ho: rank=r	Trace test (Prob)	Max test (Prob)	Trace test (T-nm)	Max test (T-nm)
r = 0	79.49 [0.000]**	46.80 [0.000]**	73.00 [0.000]**	42.98 [0.000]**
r = 1	32.69 [0.022]*	23.85 [0.018]*	30.02 [0.047]*	21.90 [0.037]*
r = 2	8.84 [0.387]	6.52 [0.555]	8.12 [0.460]	5.98 [0.621]
r = 3	2.32 [0.127]	2.32 [0.127]	2.14 [0.144]	2.14 [0.144]

(**) and (*) signs indicate rejection of Ho:rank=r at the 1 % and 5 % significance levels respectively.

The cointegration tests reported above in the Table 6.2 show that there is no cointegration relationship for four sectors which are manufacture of textiles (ISIC Rev.2 code: 321), manufacture of industrial chemicals (ISIC Rev.2 code: 351), iron and steel basic industries (ISIC Rev.2 code: 371) and manufacture of fabricated metal products, except machinery and equipment (ISIC Rev.2 code: 381). For the sectors whose codes are 321, 351 and 371, all the tests suggest that the rank is zero. While for the sector 381 trace and max tests reject r=0 at the 5 % significance level but they do not reject r=0 at the 1 % significance level.Considering that Reimers' adjusted trace and max tests suggest r=0, we conclude that also for this sector there is no cointegration relationship. For three sectors 353, 383 and 384 we decide that there is single cointegration vector. While Reimers' adjusted trace test rejects the null of r=0 at the 5 %, all the other tests rejects the null of r=0 at the 1 % significance level for the sector 353. None of the tests reject the null of r=1. Therefore, we will use single cointegration vector during the rest of the analysis for the sector 353. For the sector 383, we choose to use single cointegration vector since Reimers' adjusted trace and max tests do not reject r=1 at the 1 % significance level although adjusted trace test rejects r=1 at the 5 % significance level. For the sector 384, all the tests reject the null of r=0 at the 1 % significance level but they do not reject r=1 at the 1 % significance level. They reject r=1 only at the 5 % significance level. Therefore, we conclude that there is a single cointegration vector for the sector 384. Lastly, there are two cointegration relationships between the variables specific to the remaining one sector whose code is 382. For the sector 382, all the tests reject r=1 at the 1 % significance level but they do not reject the null of r=2.

6.4 Cointegration Vectors

There are four importing sectors for which at least one cointegration vector exists. These sectors are 353, 382, 383 and 384. These sectors, except sector 382, have one cointegration vector. The sector 382 has two cointegration vectors. In this section, cointegration vectors and the test results for the linear restrictions on the coefficients of explanatory variables will be given. The symbols Θ_0, Θ_1 and Θ_2 denote respective coefficients on the Turkey's producer price, exchange rate and world producer price specific to the product category. First, exclusion of each variable from the cointegration vector is tested. We have also tested cross-coefficient restrictions ($\Theta_0 + \Theta_1 = 0$, $\Theta_2 - \Theta_1 = 1$, $\Theta_0 + \Theta_2 = 1$) implied by our theoretical model in Chapter 3.

For the sector 353, individual exclusion of the variables is rejected as it can be seen in Table 6.3. It is rejected for pptr353 and wppm353 at the 5 % significance level while it is rejected for exch353 at the 1 % significance level. All the coefficients have the expected signs and except the coefficient on wppm353, all coefficients are inside the theoretically expected interval. The coefficient on wppm353 is slightly higher than 1 being against the theoretical model since it is expected to be between 0 and 1. However, the null hypothesis whether the coefficient on wppm353 is one ($\Theta_2 = 1$) is not rejected. The coefficient on exchm353 is estimated as (-0.752) implying an exchange rate pass-through estimate of (0.248). A one percentage point increase in exchange rate results in a 0.248 percentage point increase in the import prices in T.L. Hence, our cointegration vector suggests that there is not complete pass-through of exchange rate changes into the prices of the imported goods in the sector 353 instead a pass-through rate which is close to zero is suggested. Therefore, we have tested the null hypothesis of whether the coefficient on the exchange rate (Θ_1) is -1, i.e. the null hypothesis of whether exchange rate pass-through into the import prices in T.L is zero. Then the null hypothesis of whether the coefficient on pptr353 is one is tested and it is not rejected. However, although these three restrictions ($\Theta_0 = 1$, $\Theta_1 = -1$, $\Theta_2 = 1$) are not rejected individually, they are rejected when we test joint hypothesis comprising from these three restrictions. Lastly, for the sector 353, each of the cross-coefficient restrictions is rejected at the 1 % significance level.

Table 6.3: Cointegration Vector for the Sector 353

Cointegration vector: impr353 = 0.648pptr353 (Θ_0) – 0.752 exchm353 (Θ_1) + 1.031wppm353 (Θ_2)	
Restrictions	**LR tests**
$\Theta_0 = 0$	$\chi^2(1) = 6.3691$ [0.0116]*
$\Theta_1 = 0$	$\chi^2(1) = 8.5378$ [0.0035]**
$\Theta_2 = 0$	$\chi^2(1) = 5.0847$ [0.0241]*
$\Theta_0 = 1$	$\chi^2(1) = 1.3965$ [0.2373]
$\Theta_1 = -1$	$\chi^2(1) = 0.79623$ [0.3722]
$\Theta_2 = 1$	$\chi^2(1) = 0.0076339$ [0.9304]
$\Theta_0 = 1, \Theta_1 = -1, \Theta_2 = 1$	$\chi^2(3) = 26.520$ [0.0000]**
$\Theta_0 = 1, \Theta_1 = -1$	$\chi^2(2) = 12.626$ [0.0018]**
$\Theta_1 = -1, \Theta_2 = 1$	$\chi^2(2) = 1.6359$ [0.4413]
$\Theta_0 = 1, \Theta_2 = 1$	$\chi^2(2) = 3.2988$ [0.1922]
$\Theta_0 + \Theta_1 = 0$	$\chi^2(1) = 10.726$ [0.0011]**
$\Theta_2 - \Theta_1 = 1$	$\chi^2(1) = 8.3902$ [0.0038]**
$\Theta_0 + \Theta_2 = 1$	$\chi^2(1) = 7.8681$ [0.0050]**

For the sector 383, individual exclusion of the variables from the cointegration vector is not rejected while simultaneous exclusion of the variables from the cointegration vector ($\Theta_0 = 0$, $\Theta_1 = 0$, $\Theta_2 = 0$) is rejected at the 1 % significance level. Cross-coefficient restrictions are not rejected both individually and as a whole. Since the coefficient on the exchange rate variable is statistically not different from zero, complete ERPT into the import prices in T.L. might be suggested for the sector 383.

Table 6.4: Cointegration Vector for the Sector 383

Cointegration vector: impr383 = -287.65 pptr383 (Θ_0) + 291.04 exchm383 (Θ_1) – 897.43 wppm383 (Θ_2)	
Restrictions	**LR tests**
$\Theta_0 = 0$	$\chi^2(1) = 1.3983$ [0.2370]
$\Theta_1 = 0$	$\chi^2(1) = 1.9188$ [0.1660]
$\Theta_2 = 0$	$\chi^2(1) = 1.1202$ [0.2899]
$\Theta_0 = 0, \Theta_1 = 0, \Theta_2 = 0$	$\chi^2(3) = 14.676$ [0.0021]**
$\Theta_0 + \Theta_1 = 0$	$\chi^2(1) = 0.0087764$ [0.9254]
$\Theta_2 - \Theta_1 = 1$	$\chi^2(1) = 1.4756$ [0.2245]
$\Theta_0 + \Theta_2 = 1$	$\chi^2(1) = 1.3920$ [0.2381]
$\Theta_0 + \Theta_1 = 0, \Theta_2 - \Theta_1 = 1$	$\chi^2(2) = 3.4535$ [0.1779]

For the sector 384, individual exclusion of the pptr384 and exchm384 from the cointegration vector is rejected at the 1 %. However, it is not rejected for the wppm384. The estimated coefficients of the two variables, pptr384 and exchm384 have the theoretically expected signs but they are not inside the expected interval. pptr384 is higher than 1 and exchm353 is lower than -1. For this reason we have tested two hypothesizes, namely $\Theta_0 = 1$ and $\Theta_1 = -1$. Both hypothesizes are rejected at the 1 %. Cross-coefficient restrictions are not rejected both individually and jointly. The results suggest that changes in world producer price do not affect import prices. The results suggest for a negative ERPT coefficient. Hence, depreciation of T.L. results in a decrease in the import prices in terms of T.L.

Table 6.5: Cointegration Vector for the Sector 384

Cointegration vector: impr384 = 4.309 pptr384 (Θ_0) – 4.174 exchm384 (Θ_1) – 2.786 wppm384 (Θ_2)	
Restrictions	LR tests
$\Theta_0 = 0$	$\chi^2(1) = 21.035$ [0.0000]**
$\Theta_1 = 0$	$\chi^2(1) = 21.173$ [0.0000]**
$\Theta_2 = 0$	$\chi^2(1) = 0.79024$ [0.3740]
$\Theta_0 = 1$	$\chi^2(1) = 11.998$ [0.0005]**
$\Theta_1 = -1$	$\chi^2(1) = 12.107$ [0.0005]**
$\Theta_0 + \Theta_1 = 0$	$\chi^2(1) = 1.3481$ [0.2456]
$\Theta_2 - \Theta_1 = 1$	$\chi^2(1) = 0.014185$ [0.9052]
$\Theta_0 + \Theta_2 = 1$	$\chi^2(1) = 0.027235$ [0.8689]
$\Theta_0 + \Theta_1 = 0, \Theta_2 - \Theta_1 = 0$	$\chi^2(2) = 3.5085$ [0.1730]
$\Theta_0 + \Theta_1 = 0, \Theta_2 = 0$	$\chi^2(2) = 1.4034$ [0.4958]

For the sector 382, two cointegrating vectors are identified. In the first row of Table 6.6, unrestricted cointegrating vectors are reported. In the unrestricted import price equation, world producer price has a negative coefficient as opposed to the theoretical expectation. However, individual exclusion of the world producer price (wppm382) from the cointegration vector is not rejected by the LR test with a chi-square value of 2.5357 and probability of 0.1113. Since exclusion of the wppm382 is not rejected, we reestimate the cointegrating vectors under the restriction that the coefficient on the wpmm382 is zero. In the second row of Table 6.5, restricted cointegration vectors are reported. In the restricted cointegration vector, the coefficient on the exchange rate variable is -0.164. Further exclusion of the exchange rate variable from the restricted cointegration vector is rejected at the 1 % with a chi-square value of 17.532 and probability of 0.0002. The results suggest that ERPT estimate is 0.836 (=1-0.164). One percentage point depreciation (appreciation) of T.L. would result in a 0.836 percentage point increase (decrease) in import prices in terms of T.L. Hence, partial exchange rate pass-through exists in the sector 382.

Table 6.6: Cointegration Vectors for the Sector 382

Unrestricted cointegration vectors	impr382 = - 0.002exchm382 – 8.083 wppm382 pptr382 = 0.923exchm382 +1.629 wppm382
Restricted cointegration vectors	impr382 = - 0.164exchm382 pptr382 = 0.946exchm382 +0.476 wppm382

6.5 Difference Models

As in the analysis of exports, we have estimated the series in first differences by OLS starting from a general model in which all variables have three lags[17]. Then sequentially, omitting insignificant variables we have arrived at the short-run models to analyze exchange rate pass-through for each sector covered in this paper. The estimation results from difference models are reported in Table 6.6 and details of the reduction process for each sector are reported in Appendix D. To denote differences of the variables, "D" prefix is used. "Dvariable_i" denotes the i-period lagged form of the differenced variable.

[17] The lag length of the short-run models are chosen being independent of the lag lengths of the long-run models to achieve uniformity in the short-run models. Estimation results are not sensitive to the lag length.

Table 6.7: Estimation Results from Difference Models

(1) Manufacture of textiles (ISIC Rev. 2 code: 321)

Dimpr321 = – 0.069 + 0.632 Dpptr321_1 + 0.132 Dexchm321 – 0.368 Dexchm321_1
(-3.45)*** (2.63)** (1.56) (-1.93)*

+6.279 Dwppm321_1 – 8.974 Dwppm321_2 + 7.384 Dwppm321_3
(2.27)** (-2.74)*** (2.87)***

sigma = 0.049, RSS = 0.093, R^2 = 0.405, F(6,39) = 4.429 [0.002]***
log-likelihood = 77.434, DW = 1.77
AR 1-4 test: F(4,35) = 0.20597 [0.9334], ARCH 1-4 test: F(4,31) = 0.46795 [0.7588]
Normality test: Chi^2(2) = 1.3455 [0.5103], hetero test: F(12,26) = 0.38619 [0.9565]
Not enough observations for hetero-X test, RESET test: F(1,38) = 1.7533 [0.1934]

(2) Manufacture of industrial chemicals (ISIC Rev.2 code: 351)

Dimpr351 = 0.018 – 0.264 Dimpr351_2 – 0.185 Dexchm351_2 + 1.314 Dwppm351
(0.856) (-1.89)* (-1.32) (2.18)**

sigma = 0.08, RSS = 0.271, R^2 = 0.189, F(3,42) = 3.26 [0.031]**
log-likelihood = 52.786, DW = 2.34
AR 1-4 test: F(4,38) = 0.93929 [0.4517], ARCH 1-4 test: F(4,34) = 0.93476 [0.4555]
Normality test: Chi^2(2) = 8.3247 [0.0156]**, hetero test: F(6,35) = 0.55883 [0.7598]
hetero-X test: F(9,32) = 0.35248 [0.9491], RESET test: F(1,41) = 0.060929 [0.8063]

(3) Petroleum refineries (ISIC Rev. 2 code: 353)

Dimpr353 = – 0.042 – 0.344 Dimpr353_1 – 0.478 Dimpr353_2 – 0.443 Dpptr353_2
(-0.852) (-2.60)** (-3.67)*** (-1.92)*

+ 0.101 Dexchm353 – 0.243 Dexchm353_1 + 0.333 Dexchm353_2
(0.547) (-1.15) (1.16)

+ 0.324 Dexchm353_3 + 1.165 Dwppm353 + 1.694 Dwppm353_1
(1.68) (3.58)*** (4.27)***

+ 0.908 Dwppm353_2
(1.69)*

sigma = 0.111, RSS = 0.432, R^2 = 0.676, F(10,35) = 7.297 [0.000]***
log-likelihood = 42.07, DW = 2.14
AR 1-4 test: F(4,31) = 0.95510 [0.4458], ARCH 1-4 test: F(4,27) = 0.083577 [0.9868]
Normality test: Chi^2(2) = 2.9671 [0.2268], hetero test: F(20,14) = 1.1650 [0.3918]
Not enough observations for hetero-X test, RESET test: F(1,34) = 0.24200 [0.6259]

Table 6.7 (continued)

(4) Iron and steel basic industries (ISIC Rev. 2 code: 371)

Dimpr371 = – 0.007 – 0.455 Dimpr371_1 – 0.11 Dexchm371 + 0.212 Dexchm371_1
(-0.227) (-3.50)*** (-0.878) (1.54)

+ 0.014 Dexchm371_2 – 0.161 Dexchm371_3 + 2.209 Dwppm371_1
(0.101) (-1.18) (3.46)***

sigma = 0.077, RSS = 0.232, R^2 = 0.413, F(6,39) = 4.581 [0.001]***
log-likelihood = 56.344, DW = 2.01
AR 1-4 test: F(4,35) = 1.3194 [0.2819], ARCH 1-4 test: F(4,31) = 0.94181 [0.4529]
Normality test:Chi^2(2) = 11.356 [0.0034]***,hetero test: F(12,26) = 0.71846 [0.7208]
Not enough observations for hetero-X test, RESET test: F(1,38) = 1.0098 [0.3213]

(5) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

Dimpr381 = – 0.023 – 0.462 Dimpr381_1 – 0.294 Dimpr381_2 – 1.229 Dpptr381_1
(-0.383) (-3.22)*** (-2.14)** (-3.09)***

-2.024 Dpptr381_2 + 1.794 Dexchm381_2 + 0.621 Dexchm381_3
(-2.62)** (3.16)*** (1.86)*

+ 19.573 Dwppm381_ 1
(3.02)***

sigma = 0.158, RSS = 0.951, R^2 = 0.382, F(7,38) = 3.362 [0.007]***
log-likelihood = 23.944, DW = 2.15
AR 1-4 test: F(4,34) = 0.41548 [0.7963], ARCH 1-4 test: F(4,30) = 0.16221 [0.9558]
Normality test: Chi^2(2) = 6.0109 [0.0495]**, hetero test: F(14,23) = 0.59755 [0.8398]
Not enough observations for hetero-X test, RESET test: F(1,37) = 0.049276 [0.8255]

(6) Manufacture of machinery except electrical (ISIC Rev. 2 code: 382)

Dimpr382 = – 0.092 + 0.258 Dexchm382 + 0.258 Dexchm382_3 + 6.438 Dwppm382_2
(-2.48)** (1.94)* (1.51) (1.93)*

sigma = 0.084, RSS = 0.293, R^2 = 0.15, F(3,42) = 2.477 [0.074]*
log-likelihood = 50.9859, DW = 2.4
AR 1-4 test: F(4,38) = 0.72273 [0.5818], ARCH 1-4 test: F(4,34) = 0.21645 [0.9275]
Normality test: Chi^2(2) = 4.0731 [0.1305], hetero test: F(6,35) = 0.30866 [0.9282]
hetero-X test: F(9,32) = 0.26947 [0.9785], RESET test: F(1,41) = 0.036573 [0.8493]

Table 6.7 (continued)

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(7) Manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev. 2 code: 383)

$$Dimpr383 = \underset{(-0.0762)}{-0.005} + \underset{(0.165)}{0.047}\, Dexchm383 - \underset{(-0.108)}{0.034}\, Dexchm383\_1 + \underset{(2.43)^{**}}{0.77}\, Dexchm383\_2$$

$$- \underset{(-2.14)^{**}}{0.665}\, Dexchm383\_3 + \underset{(2.34)^{**}}{14.673}\, Dwppm383 - \underset{(-1.99)^{*}}{12.037}\, Dwppm383\_3$$

sigma = 0.181, RSS = 1.274, R^2 = 0.244, F(6,39) = 2.097 [0.076]*
log-likelihood = 17.226, DW = 2.13
AR 1-4 test: F(4,35) = 1.5988 [0.1964], ARCH 1-4 test: F(4,31) = 0.64717 [0.6331]
Normality test: Chi^2(2) = 22.830 [0.0000]***,hetero test: F(12,26) = 0.72081 [0.7187]
Not enough observations for hetero-X test, RESET test: F(1,38) =0.0037029 [0.9518]

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(8) Manufacture of transport equipment (ISIC Rev. 2 code: 384)

$$Dimpr384 = \underset{(-1.77)}{-0.077} - \underset{(-1.89)^{*}}{0.844}\, Dpptr384 + \underset{(2.02)^{*}}{0.830}\, Dpptr384\_3 + \underset{(1.82)^{*}}{0.363}\, Dexchm384$$

$$+ \underset{(0.964)}{0.121}\, Dexchm384\_1 + \underset{(1.54)}{0.188}\, Dexchm384\_2 - \underset{(-1.32)}{0.269}\, Dexchm384\_3$$

$$+ \underset{(1.81)^{*}}{3.671}\, Dwppm384$$

sigma =0.064, RSS = 0.155, R^2 = 0.171, F(7,38) = 1.118 [0.372]
log-likelihood = 65.718, DW = 2.17
AR 1-4 test: F(4,34) = 0.75217 [0.5635], ARCH 1-4 test: F(4,30) = 0.19992 [0.9364]
Normality test: Chi^2(2) = 2.2189 [0.3297], hetero test: F(14,23) = 0.36344 [0.9731]
Not enough observations for hetero-X test, RESET test: F(1,37) = 0.23747 [0.6289]

Notes: 1) The values in parentheses are t-values.
2) (*), (**) and (***) signs indicate significance at 10 %, 5 % and 1 %, respectively.

In the short-run model for the sector 321, estimated coefficient on the one-period lagged exchange rate variable is (-0.368), implying that the exchange rate pass-through into the import prices in T.L is 0.632 (it is equal to 1 - 0.368). Exchange rate pass-through estimate suggests that a one percentage point depreciation (appreciation) of the T.L would result in a 0.632 % increase (decrease) in import prices after 1 quarter. It is less than 1 so that for this sector, complete exchange rate pass-through into the import prices cannot be observed. However, it should be noted that it is statistically significant at the 6.1 %[18]. This estimated S-R model also suggests that import price also depends on the producer prices of this sector in Turkey as well as the world producer prices which is used as a proxy for the unit production costs of the foreign firms. An increase in the Turkey's producer prices would result in an increase in the import prices. Total effect of a change in the world producer price is estimated as 4.689 although theoretically it is expected to be between 0 and 1. The reason for this high estimate can be that our constructed world producer variable is only a proxy for the unit production costs of the foreign firms and also it cannot represent "actual world producer price" for this sector. However, the null hypothesis of whether the total effect of world producer price is one is not rejected by the chi-square test statistics with a value of 2.7143 and with a probability of 0.0995.

For the sector 351, the coefficient on the exchange rate variable is not statistically different from zero. Therefore, complete pass-through is suggested by the model. Import prices in T.L would change proportionately following a change in the exchange rate. What plays a significant role in determining import prices in the sector 351 is the world producer price. Estimated coefficient on the world producer price is 1.314. However, it is statistically not different from 1 as indicated by the chi-square test statistics with a value of 0.27065 and probability of 0.6029. An increase (decrease) in the world producer price would result in a proportionate increase (decrease) in the import price contemporaneously. We also observe that there is an internal adjustment mechanism in the import prices against to the outside shocks since two-period lagged form of the import prices enters into the equation as a significant variable at the 10 %. When there is a one percentage point change in the import prices, it corrects itself by 0.264 percentage point after 2 quarters. For all of the models, in which a lagged form of the import prices is significant, lagged form of the import prices has a negative coefficient.

The short-run model for the sector 353 suggests complete exchange rate pass-through since the exchange rate variable and its lagged variables are not statistically significant. It is found that import pricing in this sector is mainly affected by the world producer prices. Increase in the world producer prices result in an increase in the import prices. However, the estimated coefficients on the world producer prices and its lagged forms is higher than 1 as opposed to our theoretical expectations. This can be due to the factors explained above. Producer price of this sector in Turkey also affects import prices. In this sector, a change in the Turkey's producer prices would cause import prices to change in the opposite direction. This can be due to the fact that domestic goods in this sector can be

[18] See Appendix D.

complementary goods to the imported goods of this sector. Therefore, an increase in the prices of domestic goods can cause the demand for the imported goods to decrease so that prices of the imported goods to decrease. Another reason can be strategic action of the foreign firms. They might act strategically to increase their market share in response to an increase in the domestic prices. However, it should be noted that the coefficient on the producer price of this sector in Turkey is significant at the 6.2 %[19].

As in the models for the sectors 351 and 353, we observe complete pass-through for the sector 371. Foreign firms do not prefer to change their foreign currency import prices and their mark-ups following an exchange rate change. Therefore, import prices in T.L change one to one following an exchange rate change. It is found that estimated coefficient on the one-period lagged world producer variable is positive but higher than one. However, once again, chi-square test statistics does not reject the null hypothesis of whether it is equal to one with a value of 3.5837 and probability of 0.0584. To conclude, it is suggested that foreign currency import prices in the sector 371 is mainly determined by the world producer price as well as one-period lagged import price.

For the sector 381, the coefficients on the lagged exchange rate variables are found as positive. This positive estimate is against the theoretical expectations by our analytical model. The null hypothesis of whether total effect of exchange rate on import prices in terms of dollar is not rejected with a chi-square value of 3.534 and probability of 0.0601. We have also tested the null hypothesis of whether the total effect of exchange rate on import prices in terms of dollar is zero. However, it is rejected by chi-square tests statistics with a value of 10.293 and probability of 0.0013. In the light of this information, our model suggests a positive coefficient on the exchange rate variable, i.e. following a depreciation of T.L., import prices in T.L increases more than the degree of exchange rate depreciation. In the import price determination, once again world producer price variable is significant having expected positive sign. However, total effect of Turkey's producer price on the import price in terms of dollars is negative and statistically not different from -1 at the 1 % significance level with a chi-square value of 5.5479 and probability of 0.0185. For this sector 381, there might be different pricing strategy dynamics which cannot be captured by our model since we have significantly negative effect of Turkey's producer price variable on the import price in terms of dollars.

The short-run model for the sector 382 suggests that the coefficient on the exchange rate variable is statistically significant only at the 10 %. At the 5 % significance level we can suggest that the coefficient on the exchange rate variable is statistically not different from

[19] See Appendix D.

zero so that exchange rate pass-through into the import prices in T.L is complete. The model also indicates that world producer price variable has a role in the import price determination of foreign firms. A change in the world producer price has a one to one effect on the import prices since chi-square statistics does not reject the null hypothesis of whether the coefficient on the world producer price variable is one, with a value of 2.6651 and probability of 0.1026. However, it should be noticed that the equation is overall significant only at the 92.6 percent.

For the sector 383, the short-run model shows that world producer price has a role in the determination of import prices. The hypothesis of whether the total effect of world producer price on import prices is one is not rejected by the chi-square statistics with a value of 0.073064 and probability of 0.7869. Thus, there will be a proportionate increase in the import prices following an increase in the world producer price within 3 quarters. The second hypothesis we have tested is regarding to the complete pass-through of exchange rate into the import prices in T.L, i.e. we have tested whether the coefficients on the Dexchm383_2 and Dexchm383_3 sums up to zero. This hypothesis is not rejected with a chi-square value of 0.074089 and probability of 0.7855. This implies that a one percentage point depreciation (appreciation) of T.L. would result in a one percentage point increase (decrease) in the import prices in T.L. within 3 quarters. However, a deficiency of the model for the sector 383 is that the variables are overall significant only at 7.6 % but not even at the 5 %.

As we observe in the equations for the sectors 381 and 382, the coefficient on the exchange rate variable for the sector 384 has been estimated as having a positive value. However, as in the sector 382, this coefficient is significant only at the 10 %. Actually, the variables can enter into this equation being significant only at the 10 %. It should be also noted that we do not have overall significance of the variables. The explanatory variables other than the exchange rate variable are producer price of this sector in Turkey and its three-period lagged form and the world producer price variable. The null hypothesis of whether a change in the world producer price causes a proportionate change in the import price is not rejected by the chi-square statistics with a value of 1.7386 and probability of 0.1873. On the side of producer prices of Turkey, it seems as if the effect of a change in the producer price on the import price turns out into zero within 3 quarters. This hypothesis is not rejected by the chi-square statistics with a value of 0.0008 and a probability of 0.9781. For the exchange rate pass-through, we can suggest that although the coefficient on the exchange rate variable is significant at the 10 %, it is not significant even at the 5 %. Therefore, the coefficient on the exchange rate variable is not different from zero at the 5 %. Complete pass-through of exchange rate changes into the import prices in T.L can be suggested.

6.6 Conclusions on the Estimation Results for the Import Analysis

In the long-run analysis, there are four sectors (353, 382, 383, 384) for which at least a single cointegration relationship exists. For the sectors 353, 383 and 384, there is a single cointegration vector. For the sector 382, there are two cointegration vectors. Cointegration analysis does not give very informative results for the exchange rate pass-through in the sectors 383 and 384. However, complete pass-through hypothesis is not rejected for the sector 383. For the sector 384, it might be negative ERPT, i.e. depreciation of T.L. would result in a decrease in the import prices in terms of T.L. For the remaining two sectors (353 and 382) for which at least one cointegration relationship exists partial ERPT estimate is found. For the sector 353, ERPT is estimated as 0.248. In the long-run, ten percent depreciation of T.L. would result in 2.48 percent increase in the import prices in T.L. Furthermore, zero pass-through is not rejected. For the sector 382, ERPT is estimated as 0.836, which is close to one (complete pass-through). However, the hypothesis of complete pass-through is rejected.

Short-run analysis of exchange rate pass-through suggests complete pass-through of exchange rate changes into the import prices in terms of T.L for almost all models. Only for the sector 321, a partial ERPT, 0.632 is estimated. However, it is statistically not different from one (complete ERPT) at 5%. In the analysis for import prices, there is not variation in the ERPT estimates across sectors.

CHAPTER 7

CONCLUSION

In this thesis, ERPT into the export and import prices is analyzed separately at the disaggregate level. Sector-specific ERPT coefficients are estimated for eight manufacturing sectors defined at the 3-digit level of ISIC Rev.2. The study also attempts to differentiate ERPT in the short-run and long-run. To estimate ERPT in the long-run, cointegration analysis is used. When there are more than one cointegration vector in a sector, cointegration vectors are identified. On the cointegration vectors, the existence of complete or zero pass-through is tested. To estimate ERPT in the short-run, dynamic modeling is utilized. Also in the short-run models, two opposite extremes; complete and zero ERPT is tested.

As for the empirical results, there are only three exporting sectors for which at least one cointegration vector exists. Hence, for these three sectors, there is a long-run relationship between the export prices and exchange rates. These sectors are manufacture of footwear, except vulcanized or molded rubber or plastic footwear (ISIC Rev.2, 324), manufacture of fabricated metal products, except machinery and equipment (ISIC Rev.2, 381) and manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev.2, 383). For the sector 383, cointegration vector is not very informative. However, complete exchange rate pass-through is found for the sector 324 in the long-run while zero pass-through is found for the sector 381.

In the S-R, total ERPT into the export prices is zero for five sectors. These are tobacco manufactures (ISIC Rev.2, 314), manufacture of textiles (ISIC Rev.2, 321), manufacture of footwear, except vulcanized or molded rubber or plastic footwear (ISIC Rev.2, 324), petroleum refineries (ISIC Rev.2, 353) and manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev.2, 383). In the sectors 314, 321 and 353, export prices are not responsive to the exchange rate in the S-R. Although there is a dynamic response of the export prices to the exchange rate in the sectors 324 and 383, pass-through of exchange rate changes into the export prices turns out to be zero within one quarter in these sectors. In the iron and steel basic industries (ISIC Rev.2, 371), complete ERPT is found in the S-R. In the manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev.2, 383), an incomplete ERPT estimate, -0.502 is found. For only one sector, manufacture of industrial chemicals (ISIC Rev. 2, 351), a positive estimate of ERPT, 0.181 is suggested.

The results show that there is variation in the ERPT estimates across exporting sectors. In sectors in which there is no pass-through, exporters do not change their foreign currency export prices following an exchange rate change so that their mark-ups change proportionately. This means that in these sectors, exporting firms do not have any market power in the international markets. In the cases where imported inputs constitute a significant portion of total costs, exporting firms' mark-ups do not change proportionately to the exchange rate change even though zero pass-through is found.

We have found complete pass-through only for sector 371. This means that in this sector, exporters decrease their foreign currency prices proportionately to the exchange rate depreciation. So, in this sector, firms have some market power in the international markets and are not price takers. The exporters in the sector 381 also have some market power although they do not have it as the same degree as in sector 371. Exporters in sector 381 decrease their foreign currency prices less than proportionately to the exchange rate depreciation (partial pass-through). Following an exchange rate depreciation, the exporters in both sectors have the ability to increase their market shares in foreign markets.

When we compare the results from the long-run analysis with the results from the short-run analysis for the export prices, we see that the dynamic response of prices to the exchange rate varies from one sector to the other depending on the sector-specific characteristics. For the sector 324, ERPT is zero in the short-run but complete in the long-run. For the sector 381, it is incomplete in the short-run but zero in the long-run.

In the long-run analysis of ERPT into the import prices, there are four sectors (353, 382, 383, 384) for which at least one cointegration vector exists, i.e. there is a long-run relationship between exchange rates and import prices for these sectors. In the manufacture of machinery except electrical (ISIC Rev.2, 382), an ERPT estimate, 0.836 which is significantly different from one is found. In the sector 383, complete ERPT is suggested while in the sector 353, zero ERPT is suggested. The results for the remaining one sector, 384 are not conclusive. Although variation can be seen in the pass-through estimates across sectors in the L-R, variation is not observed in the S-R. In the S-R, exchange rate pass-through is complete for all sectors. The short-run analysis of ERPT into the aggregate import prices by Alper (2003) suggests complete ERPT. Thus, our analysis does not give any empirical evidence for the aggregation bias in case of the ERPT into the import prices. Although we analyze ERPT at the disaggregate level, the indication of complete pass-through into the import prices does not change. However, our short-run analysis for the export prices suggests variation in the estimates of ERPT into the export prices across sectors and there are sectors for which ERPT is different from zero.

Since there is variation in the degree of ERPT into the export prices across sectors, further research can be on the determinants of the degree of ERPT into the export prices. Another venue for future research can be panel data estimation procedure. By following this estimation procedure, analysis at the more disaggregate level can be achieved since annual data is available at more disaggregate level. At more disaggregate levels, the results might change. The other important issue which is not covered in this study is the asymmetric response of the prices to exchange rate changes. Further research in the ERPT area needs to include asymmetry issues.

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APPENDICES

APPENDIX A

Results of the SC, HQ and AIC Statistics and Sequential F Tests for the Determination of the Lag Length: (for the Analysis of ERPT for Exports)[20]

(1) Tobacco manufactures (ISIC Rev. 2 code: 314)

Models for 314	SC	HQ	AIC
VAR(5)	-7.4035	-10.518	-12.423
VAR(4)	-7.8302	-10.346	-11.884
VAR(3)	-8.4668	-10.384	-11.556
VAR(2)	-9.3001	-10.618	-11.424
VAR(1)	-10.444	-11.163	-11.602
VAR(0)	-2.4846	-2.6044	-2.6777

Sequential F tests:

VAR(5) --> VAR(4) : F(25,72) = 1.5034 [0.0924]
VAR(5) --> VAR(3) : F(50,90) = 1.6058 [0.0256]*
VAR(5) --> VAR(2) : F(75,95) = 1.6939 [0.0076]**
VAR(5) --> VAR(1) : F(100,97)= 1.6857 [0.0051]**
VAR(5) --> VAR(0) : F(125,98)= 15.300 [0.0000]**

VAR(4) --> VAR(3) : F(25,90) = 1.5877 [0.0595]
VAR(4) --> VAR(2) : F(50,112)= 1.6485 [0.0154]*
VAR(4) --> VAR(1) : F(75,119)= 1.6044 [0.0105]*
VAR(4) --> VAR(0) : F(100,121)= 17.334 [0.0000]**

VAR(3) --> VAR(2) : F(25,109)= 1.5891 [0.0542]
VAR(3) --> VAR(1) : F(50,135)= 1.4878 [0.0379]*
VAR(3) --> VAR(0) : F(75,143)= 21.167 [0.0000]**
VAR(2) --> VAR(1) : F(25,127)= 1.3006 [0.1737]
VAR(2) --> VAR(0) : F(50,158)= 30.563 [0.0000]**
VAR(1) --> VAR(0) : F(25,146)= 79.290 [0.0000]**

(2) Manufacture of textiles (ISIC Rev. 2 code: 321)

Models for 321	SC	HQ	AIC
VAR(5)	-24.753	-27.868	-29.772
VAR(4)	-25.504	-28.020	-29.558
VAR(3)	-25.841	-27.757	-28.929
VAR(2)	-22.510	-23.828	-24.634
VAR(1)	-22.869	-23.588	-24.027
VAR(0)	-13.268	-13.388	-13.461

[20] * indicates 5 percent significance level while ** indicates 10 percent significance level.

Sequential F tests:
VAR(5) --> VAR(4) : F(25,72) = 1.1372 [0.3276]
VAR(5) --> VAR(3) : F(50,90) = 1.5878 [0.0285]*
VAR(5) --> VAR(2) : F(75,95) = 5.7635 [0.0000]**
VAR(5) --> VAR(1) : F(100,97)= 6.3234 [0.0000]**
VAR(5) --> VAR(0) : F(125,98)= 60.296 [0.0000]**

VAR(4) --> VAR(3) : F(25,90) = 2.0259 [0.0083]**
VAR(4) --> VAR(2) : F(50,112)= 8.1344 [0.0000]**
VAR(4) --> VAR(1) : F(75,119)= 7.9632 [0.0000]**
VAR(4) --> VAR(0) : F(100,121)= 74.943 [0.0000]**

VAR(3) --> VAR(2) : F(25,109)= 13.908 [0.0000]**
VAR(3) --> VAR(1) : F(50,135)= 9.7184 [0.0000]**
VAR(3) --> VAR(0) : F(75,143)= 89.431 [0.0000]**

VAR(2) --> VAR(1) : F(25,127)= 2.8090 [0.0001]**
VAR(2) --> VAR(0) : F(50,158)= 54.253 [0.0000]**

VAR(1) --> VAR(0) : F(25,146)= 126.60 [0.0000]**

(3) Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear (ISIC Rev. 2 code: 324)

Models for 324	SC	HQ	AIC
VAR(5)	-11.448	-13.461	-14.691
VAR(4)	-12.110	-13.740	-14.736
VAR(3)	-12.756	-14.001	-14.763
VAR(2)	-13.601	-14.464	-14.991
VAR(1)	-14.375	-14.855	-15.148
VAR(0)	-4.1811	-4.2769	-4.3355

Sequential F tests:
VAR(5) --> VAR(4) : F(16,77) = 1.0607 [0.4064]
VAR(5) --> VAR(3) : F(32,93) = 1.1647 [0.2819]
VAR(5) --> VAR(2) : F(48,98) = 1.1031 [0.3362]
VAR(5) --> VAR(1) : F(64,100)= 1.1491 [0.2639]
VAR(5) --> VAR(0) : F(80,101)= 38.634 [0.0000]**

VAR(4) --> VAR(3) : F(16,89) = 1.2673 [0.2361]
VAR(4) --> VAR(2) : F(32,108)= 1.1183 [0.3275]
VAR(4) --> VAR(1) : F(48,113)= 1.1713 [0.2463]
VAR(4) --> VAR(0) : F(64,115)= 48.435 [0.0000]**

VAR(3) --> VAR(2) : F(16,101)= 0.94714 [0.5193]
VAR(3) --> VAR(1) : F(32,123)= 1.0939 [0.3534]
VAR(3) --> VAR(0) : F(48,129)= 64.359 [0.0000]**

VAR(2) --> VAR(1) : F(16,113)= 1.2532 [0.2401]
VAR(2) --> VAR(0) : F(32,138)= 106.22 [0.0000]**

VAR(1) --> VAR(0) : F(16,125)= 327.67 [0.0000]**

(4) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

Models for 351	SC	HQ	AIC
VAR(5)	-11.520	-13.533	-14.764
VAR(4)	-11.477	-13.107	-14.103
VAR(3)	-12.021	-13.267	-14.029
VAR(2)	-12.894	-13.756	-14.284
VAR(1)	-13.047	-13.526	-13.819
VAR(0)	-4.0222	-4.1181	-4.1767

Sequential F tests:

VAR(5) --> VAR(4) : F(16,77) = 2.5865 [0.0029]**
VAR(5) --> VAR(3) : F(32,93) = 2.1667 [0.0022]**
VAR(5) --> VAR(2) : F(48,98) = 1.8104 [0.0068]**
VAR(5) --> VAR(1) : F(64,100)= 2.3173 [0.0001]**
VAR(5) --> VAR(0) : F(80,101)= 41.045 [0.0000]**

VAR(4) --> VAR(3) : F(16,89) = 1.4987 [0.1180]
VAR(4) --> VAR(2) : F(32,108)= 1.2102 [0.2325]
VAR(4) --> VAR(1) : F(48,113)= 1.8727 [0.0036]**
VAR(4) --> VAR(0) : F(64,115)= 42.705 [0.0000]**

VAR(3) --> VAR(2) : F(16,101)= 0.88264 [0.5904]
VAR(3) --> VAR(1) : F(32,123)= 1.9592 [0.0048]**
VAR(3) --> VAR(0) : F(48,129)= 55.053 [0.0000]**

VAR(2) --> VAR(1) : F(16,113)= 3.1393 [0.0002]**
VAR(2) --> VAR(0) : F(32,138)= 90.950 [0.0000]**

VAR(1) --> VAR(0) : F(16,125)= 220.90 [0.0000]**

(5) Petroleum refineries (ISIC Rev. 2 code: 353)

Models for 353	SC	HQ	AIC
VAR(5)	-4.4136	-6.4263	-7.6567
VAR(4)	-5.1659	-6.7952	-7.7913
VAR(3)	-5.8872	-7.1332	-7.8949
VAR(2)	-6.8252	-7.6878	-8.2151
VAR(1)	-7.6649	-8.1441	-8.4371
VAR(0)	0.86198	0.76614	0.70754

Sequential F tests:

VAR(5) --> VAR(4) : F(16,77) = 0.89034 [0.5823]
VAR(5) --> VAR(3) : F(32,93) = 0.98449 [0.5025]
VAR(5) --> VAR(2) : F(48,98) = 0.89855 [0.6542]
VAR(5) --> VAR(1) : F(64,100)= 0.93370 [0.6121]
VAR(5) --> VAR(0) : F(80,101)= 22.821 [0.0000]**

VAR(4) --> VAR(3) : F(16,89) = 1.0990 [0.3684]
VAR(4) --> VAR(2) : F(32,108)= 0.91686 [0.5986]
VAR(4) --> VAR(1) : F(48,113)= 0.96281 [0.5485]
VAR(4) --> VAR(0) : F(64,115)= 29.106 [0.0000]**

VAR(3) --> VAR(2) : F(16,101)= 0.72988 [0.7577]
VAR(3) --> VAR(1) : F(32,123)= 0.88677 [0.6430]
VAR(3) --> VAR(0) : F(48,129)= 39.055 [0.0000]**

VAR(2) --> VAR(1) : F(16,113)= 1.0766 [0.3855]
VAR(2) --> VAR(0) : F(32,138)= 64.782 [0.0000]**

VAR(1) --> VAR(0) : F(16,125)= 186.53 [0.0000]**

(6) Iron and steel basic industries (ISIC Rev. 2 code: 371)

Models for 371	SC	HQ	AIC
VAR(5)	-11.245	-14.360	-16.264
VAR(4)	-12.545	-15.061	-16.599
VAR(3)	-13.460	-15.377	-16.549
VAR(2)	-14.801	-16.118	-16.924
VAR(1)	-15.164	-15.883	-16.322
VAR(0)	-6.8712	-6.9910	-7.0642

Sequential F tests:
VAR(5) --> VAR(4) : F(25,72) = 0.58484 [0.9329]
VAR(5) --> VAR(3) : F(50,90) = 0.84550 [0.7392]
VAR(5) --> VAR(2) : F(75,95) = 0.82642 [0.8045]
VAR(5) --> VAR(1) : F(100,97)= 1.2474 [0.1375]
VAR(5) --> VAR(0) : F(125,98)= 13.614 [0.0000]**

VAR(4) --> VAR(3) : F(25,90) = 1.2103 [0.2531]
VAR(4) --> VAR(2) : F(50,112)= 1.0302 [0.4386]
VAR(4) --> VAR(1) : F(75,119)= 1.6005 [0.0108]*
VAR(4) --> VAR(0) : F(100,121)= 18.624 [0.0000]**

VAR(3) --> VAR(2) : F(25,109)= 0.82902 [0.6977]
VAR(3) --> VAR(1) : F(50,135)= 1.7472 [0.0061]**
VAR(3) --> VAR(0) : F(75,143)= 24.285 [0.0000]**

VAR(2) --> VAR(1) : F(25,127)= 2.7994 [0.0001]**
VAR(2) --> VAR(0) : F(50,158)= 39.895 [0.0000]**

VAR(1) --> VAR(0) : F(25,146)= 87.295 [0.0000]**

(7) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

Models for 381	SC	HQ	AIC
VAR(5)	-15.800	-18.915	-20.819
VAR(4)	-16.640	-19.156	-20.694
VAR(3)	-17.360	-19.277	-20.449
VAR(2)	-17.703	-19.021	-19.827
VAR(1)	-18.583	-19.302	-19.741
VAR(0)	-8.9084	-9.0282	-9.1014

Sequential F tests:
VAR(5) --> VAR(4) : F(25,72) = 1.0413 [0.4301]
VAR(5) --> VAR(3) : F(50,90) = 1.2541 [0.1743]
VAR(5) --> VAR(2) : F(75,95) = 1.6896 [0.0079]**
VAR(5) --> VAR(1) : F(100,97)= 1.8295 [0.0015]**
VAR(5) --> VAR(0) : F(125,98)= 23.232 [0.0000]**

VAR(4) --> VAR(3) : F(25,90) = 1.4720 [0.0958]
VAR(4) --> VAR(2) : F(50,112)= 2.0126 [0.0012]**
VAR(4) --> VAR(1) : F(75,119)= 2.0842 [0.0002]**
VAR(4) --> VAR(0) : F(100,121)= 29.037 [0.0000]**

VAR(3) --> VAR(2) : F(25,109)= 2.4292 [0.0009]**
VAR(3) --> VAR(1) : F(50,135)= 2.2428 [0.0001]**
VAR(3) --> VAR(0) : F(75,143)= 36.733 [0.0000]**

VAR(2) --> VAR(1) : F(25,127)= 1.7727 [0.0213]*
VAR(2) --> VAR(0) : F(50,158)= 48.894 [0.0000]**

VAR(1) --> VAR(0) : F(25,146)= 129.27 [0.0000]**

(8) Manufacture of electrical machinery, apparatus, appliances and supplies(ISIC Rev. 2 code: 383)

Models for 383	SC	HQ	AIC
VAR(5)	-14.054	-17.169	-19.073
VAR(4)	-14.393	-16.909	-18.447
VAR(3)	-15.620	-17.536	-18.708
VAR(2)	-17.173	-18.490	-19.296
VAR(1)	-17.701	-18.420	-18.859
VAR(0)	-6.3069	-6.4267	-6.4999

Sequential F tests:
VAR(5) --> VAR(4) : F(25,72) = 1.6081 [0.0614]
VAR(5) --> VAR(3) : F(50,90) = 1.2505 [0.1774]
VAR(5) --> VAR(2) : F(75,95) = 1.0266 [0.4489]
VAR(5) --> VAR(1) : F(100,97)= 1.3748 [0.0582]
VAR(5) --> VAR(0) : F(125,98)= 27.793 [0.0000]**

VAR(4) --> VAR(3) : F(25,90) = 0.82194 [0.7048]
VAR(4) --> VAR(2) : F(50,112)= 0.67376 [0.9408]
VAR(4) --> VAR(1) : F(75,119)= 1.1735 [0.2161]
VAR(4) --> VAR(0) : F(100,121)= 31.317 [0.0000]**

VAR(3) --> VAR(2) : F(25,109)= 0.53978 [0.9613]
VAR(3) --> VAR(1) : F(50,135)= 1.3929 [0.0693]
VAR(3) --> VAR(0) : F(75,143)= 44.343 [0.0000]**

VAR(2) --> VAR(1) : F(25,127)= 2.4560 [0.0006]**
VAR(2) --> VAR(0) : F(50,158)= 78.812 [0.0000]**

VAR(1) --> VAR(0) : F(25,146)= 208.78 [0.0000]**

*** indicates 5 percent significance level while ** indicates 10 percent significance level.**

APPENDIX B

Results of the SC, HQ and AIC Statistics and Sequential F Tests for the Determination of the Lag Length: (for the Analysis of ERPT for Imports) [21]

(1) Manufacture of textiles (ISIC Rev. 2 code: 321)

Models for 321	SC	HQ	AIC
VAR(5)	-14.480	-16.595	-17.852
VAR(4)	-15.225	-16.937	-17.955
VAR(3)	-15.602	-16.912	-17.690
VAR(2)	-16.430	-17.337	-17.876
VAR(1)	-16.527	-17.031	-17.330
VAR(0)	-6.4714	-6.5721	-6.6320

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 0.89284 [0.5800]
VAR(5) --> VAR(3) : F(32,79) = 1.3255 [0.1572]
VAR(5) --> VAR(2) : F(48,82) = 1.2600 [0.1772]
VAR(5) --> VAR(1) : F(64,84) = 1.7994 [0.0059]**
VAR(5) --> VAR(0) : F(80,85) = 44.052 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 1.8109 [0.0446]*
VAR(4) --> VAR(2) : F(32,93) = 1.4724 [0.0785]
VAR(4) --> VAR(1) : F(48,98) = 2.1433 [0.0007]**
VAR(4) --> VAR(0) : F(64,100)= 56.792 [0.0000]**

VAR(3) --> VAR(2) : F(16,89) = 1.0466 [0.4177]
VAR(3) --> VAR(1) : F(32,108)= 2.1078 [0.0024]**
VAR(3) --> VAR(0) : F(48,113)= 70.398 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 3.2272 [0.0002]**
VAR(2) --> VAR(0) : F(32,123)= 115.65 [0.0000]**

VAR(1) --> VAR(0) : F(16,113)= 290.35 [0.0000]**

(2) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

Models for 351	SC	HQ	AIC
VAR(5)	-8.8912	-11.006	-12.264
VAR(4)	-9.5585	-11.271	-12.289
VAR(3)	-10.497	-11.807	-12.585
VAR(2)	-11.374	-12.281	-12.820
VAR(1)	-11.549	-12.053	-12.352
VAR(0)	-3.8443	-3.9450	-4.0049

[21] * indicates 5 percent significance level while ** indicates 10 percent significance level.

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 1.0197 [0.4488]
VAR(5) --> VAR(3) : F(32,79) = 0.85905 [0.6782]
VAR(5) --> VAR(2) : F(48,82) = 0.87421 [0.6898]
VAR(5) --> VAR(1) : F(64,84) = 1.3490 [0.0988]

VAR(5) --> VAR(0) : F(80,85) = 20.231 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 0.69956 [0.7859]
VAR(4) --> VAR(2) : F(32,93) = 0.80109 [0.7582]
VAR(4) --> VAR(1) : F(48,98) = 1.4577 [0.0589]
VAR(4) --> VAR(0) : F(64,100)= 25.287 [0.0000]**

VAR(3) --> VAR(2) : F(16,89) = 0.94141 [0.5262]
VAR(3) --> VAR(1) : F(32,108)= 1.9218 [0.0069]**
VAR(3) --> VAR(0) : F(48,113)= 35.876 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 2.9861 [0.0004]**
VAR(2) --> VAR(0) : F(32,123)= 58.000 [0.0000]**
VAR(1) --> VAR(0) : F(16,113)= 130.69 [0.0000]**

(3) Petroleum refineries (ISIC Rev. 2 code: 353)

Models for 353	SC	HQ	AIC
VAR(5)	-4.6093	-6.7245	-7.9817
VAR(4)	-5.2303	-6.9427	-7.9604
VAR(3)	-6.0683	-7.3778	-8.1560
VAR(2)	-6.8238	-7.7303	-8.2691
VAR(1)	-7.7376	-8.2412	-8.5405
VAR(0)	-0.28175	-0.38247	-0.44234

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 1.0972 [0.3766]
VAR(5) --> VAR(3) : F(32,79) = 0.99464 [0.4905]
VAR(5) --> VAR(2) : F(48,82) = 1.0622 [0.3986]
VAR(5) --> VAR(1) : F(64,84) = 1.0468 [0.4188]
VAR(5) --> VAR(0) : F(80,85) = 16.681 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 0.88469 [0.5885]
VAR(4) --> VAR(2) : F(32,93) = 1.0331 [0.4367]
VAR(4) --> VAR(1) : F(48,98) = 1.0175 [0.4610]
VAR(4) --> VAR(0) : F(64,100)= 20.517 [0.0000]**

VAR(3) --> VAR(2) : F(16,89) = 1.2059 [0.2796]
VAR(3) --> VAR(1) : F(32,108)= 1.1023 [0.3463]
VAR(3) --> VAR(0) : F(48,113)= 28.171 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 0.98162 [0.4824]
VAR(2) --> VAR(0) : F(32,123)= 43.462 [0.0000]**

VAR(1) --> VAR(0) : F(16,113)= 119.91 [0.0000]**

(4) Iron and steel basic industries (ISIC Rev. 2 code: 371)

Models for 371	SC	HQ	AIC
VAR(5)	-9.6242	-11.739	-12.997
VAR(4)	-10.511	-12.223	-13.241
VAR(3)	-10.813	-12.123	-12.901
VAR(2)	-11.380	-12.286	-12.825
VAR(1)	-11.190	-11.693	-11.992
VAR(0)	-3.3629	-3.4636	-3.5235

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 0.66840 [0.8135]
VAR(5) --> VAR(3) : F(32,79) = 1.2579 [0.2049]
VAR(5) --> VAR(2) : F(48,82) = 1.4152 [0.0829]
VAR(5) --> VAR(1) : F(64,84) = 2.2081 [0.0003]**
VAR(5) --> VAR(0) : F(80,85) = 27.908 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 1.9771 [0.0253]*
VAR(4) --> VAR(2) : F(32,93) = 1.8938 [0.0096]**
VAR(4) --> VAR(1) : F(48,98) = 2.8804 [0.0000]**
VAR(4) --> VAR(0) : F(64,100)= 37.164 [0.0000]**

VAR(3) --> VAR(2) : F(16,89) = 1.6382 [0.0750]
VAR(3) --> VAR(1) : F(32,108)= 2.9893 [0.0000]**
VAR(3) --> VAR(0) : F(48,113)= 44.668 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 4.1692 [0.0000]**
VAR(2) --> VAR(0) : F(32,123)= 66.727 [0.0000]**

VAR(1) --> VAR(0) : F(16,113)= 136.30 [0.0000]**

(5) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

Models for 381	SC	HQ	AIC
VAR(5)	-11.933	-14.048	-15.306
VAR(4)	-12.625	-14.337	-15.355
VAR(3)	-13.214	-14.524	-15.302
VAR(2)	-13.548	-14.454	-14.993
VAR(1)	-14.009	-14.513	-14.812
VAR(0)	-4.4326	-4.5333	-4.5932

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 0.97981 [0.4887]
VAR(5) --> VAR(3) : F(32,79) = 1.1661 [0.2866]
VAR(5) --> VAR(2) : F(48,82) = 1.5324 [0.0444]*
VAR(5) --> VAR(1) : F(64,84) = 1.7768 [0.0068]**
VAR(5) --> VAR(0) : F(80,85) = 38.604 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 1.3678 [0.1807]
VAR(4) --> VAR(2) : F(32,93) = 1.8233 [0.0138]*
VAR(4) --> VAR(1) : F(48,98) = 2.0553 [0.0013]**
VAR(4) --> VAR(0) : F(64,100)= 49.001 [0.0000]**

VAR(3) --> VAR(2) : F(16,89) = 2.2100 [0.0100]**
VAR(3) --> VAR(1) : F(32,108)= 2.3048 [0.0008]**
VAR(3) --> VAR(0) : F(48,113)= 64.088 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 2.1508 [0.0113]*
VAR(2) --> VAR(0) : F(32,123)= 91.214 [0.0000]**

VAR(1) --> VAR(0) : F(16,113)= 247.17 [0.0000]**

(6) Manufacture of machinery except electrical (ISIC Rev. 2 code: 382)

Models for 382	SC	HQ	AIC
VAR(5)	-14.685	-16.800	-18.058
VAR(4)	-14.982	-16.694	-17.712
VAR(3)	-15.538	-16.847	-17.625
VAR(2)	-15.096	-16.002	-16.541
VAR(1)	-15.920	-16.423	-16.723
VAR(0)	-5.9416	-6.0423	-6.1022

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 1.6741 [0.0753]
VAR(5) --> VAR(3) : F(32,79) = 1.6142 [0.0447]*
VAR(5) --> VAR(2) : F(48,82) = 2.7286 [0.0000]**
VAR(5) --> VAR(1) : F(64,84) = 2.5191 [0.0000]**
VAR(5) --> VAR(0) : F(80,85) = 53.296 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 1.4360 [0.1477]
VAR(4) --> VAR(2) : F(32,93) = 2.9895 [0.0000]**
VAR(4) --> VAR(1) : F(48,98) = 2.5592 [0.0000]**
VAR(4) --> VAR(0) : F(64,100)= 61.230 [0.0000]**

VAR(3) --> VAR(2) :): F(16,89) = 4.4601 [0.0000]**
VAR(3) --> VAR(1) : F(32,108)= 2.9791 [0.0000]**
VAR(3) --> VAR(0) : F(48,113)= 79.734 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 1.1998 [0.2814]
VAR(2) --> VAR(0) : F(32,123)= 92.223 [0.0000]**

VAR(1) --> VAR(0) : F(16,113)= 282.91 [0.0000]*

(7) Manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev. 2 code: 383)

Models for 383	SC	HQ	AIC
VAR(5)	-10.921	-13.036	-14.293
VAR(4)	-11.234	-12.947	-13.964
VAR(3)	-11.939	-13.249	-14.027
VAR(2)	-13.045	-13.952	-14.490
VAR(1)	-13.583	-14.087	-14.386
VAR(0)	-3.2256	-3.3264	-3.3862

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 1.6425 [0.0830]
VAR(5) --> VAR(3) : F(32,79) = 1.4343 [0.1000]
VAR(5) --> VAR(2) : F(48,82) = 1.1285 [0.3110]
VAR(5) --> VAR(1) : F(64,84) = 1.3460 [0.1005]
VAR(5) --> VAR(0) : F(80,85) = 40.611 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 1.1381 [0.3371]
VAR(4) --> VAR(2) : F(32,93) = 0.80628 [0.7515]
VAR(4) --> VAR(1) : F(48,98) = 1.1462 [0.2815]
VAR(4) --> VAR(0) : F(64,100)= 46.686 [0.0000]**

VAR(3) --> VAR(2) : F(16,89) = 0.47123 [0.9548]
VAR(3) --> VAR(1) : F(32,108)= 1.1335 [0.3103]
VAR(3) --> VAR(0) : F(48,113)= 62.929 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 1.9399 [0.0248]*
VAR(2) --> VAR(0) : F(32,123)= 111.22 [0.0000]**

VAR(1) --> VAR(0) : F(16,113)= 321.24 [0.0000]**

(8) Manufacture of transport equipment (ISIC Rev. 2 code: 384)

Models for 384	SC	HQ	AIC
VAR(5)	-15.233	-17.348	-18.605
VAR(4)	-14.977	-16.689	-17.707
VAR(3)	-15.625	-16.935	-17.713
VAR(2)	-16.465	-17.371	-17.910
VAR(1)	-17.094	-17.598	-17.897
VAR(0)	-4.1855	-4.2862	-4.3461

Sequential F tests:
VAR(5) --> VAR(4) : F(16,64) = 2.8082 [0.0018]**
VAR(5) --> VAR(3) : F(32,79) = 2.1561 [0.0031]**
VAR(5) --> VAR(2) : F(48,82) = 1.8726 [0.0062]**
VAR(5) --> VAR(1) : F(64,84) = 1.9509 [0.0021]**
VAR(5) --> VAR(0) : F(80,85) = 96.406 [0.0000]**

VAR(4) --> VAR(3) : F(16,77) = 1.2490 [0.2523]
VAR(4) --> VAR(2) : F(32,93) = 1.1481 [0.2992]
VAR(4) --> VAR(1) : F(48,98) = 1.3439 [0.1096]
VAR(4) --> VAR(0) : F(64,100)= 96.652 [0.0000]**

VAR(3) --> VAR(2) : F(16,89) = 1.0222 [0.4419]
VAR(3) --> VAR(1) : F(32,108)= 1.3532 [0.1276]
VAR(3) --> VAR(0) : F(48,113)= 130.14 [0.0000]**

VAR(2) --> VAR(1) : F(16,101)= 1.6955 [0.0593]
VAR(2) --> VAR(0) : F(32,123)= 220.35 [0.0000]**

VAR(1) --> VAR(0) : F(16,113)= 749.75 [0.0000]**

*** indicates 5 percent significance level while ** indicates 10 percent significance level.**

APPENDIX C

Estimation Results for the Reduction Process of the Difference Models for each Exporting Sector[22]:

(1) Tobacco manufactures (ISIC Rev. 2 code: 314)

```
EQ( 1) Modelling Dexpr314 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr314_1          -0.237649     0.1749    -1.36   0.184   0.0579
Dexpr314_2          -0.642413     0.1494    -4.30   0.000   0.3812
Dexpr314_3          -0.139222     0.1745   -0.798   0.431   0.0208
Constant            0.0152726    0.06803    0.224   0.824   0.0017
Dwpp314              0.814351     0.6631     1.23   0.229   0.0479
Dwpp314_1           -0.187025     0.6460   -0.290   0.774   0.0028
Dwpp314_2           -0.182094     0.6881   -0.265   0.793   0.0023
Dwpp314_3            0.831864     0.7238     1.15   0.259   0.0422
Dcu314              -0.106108     0.2028   -0.523   0.605   0.0090
Dcu314_1            0.0218606     0.1869    0.117   0.908   0.0005
Dcu314_2         -0.000516768     0.1833 -0.00282   0.998   0.0000
Dcu314_3             0.181386     0.1952    0.929   0.360   0.0280
Dpptr314             0.121638     0.1795    0.678   0.503   0.0151
Dpptr314_1          0.0122479     0.1877   0.0652   0.948   0.0001
Dpptr314_2          -0.142894     0.1930   -0.740   0.465   0.0179
Dpptr314_3           0.186545     0.1997    0.934   0.358   0.0283
Dexch314             0.184146     0.2774    0.664   0.512   0.0145
Dexch314_1          -0.109880     0.3326   -0.330   0.743   0.0036
Dexch314_2          0.0840690     0.3122    0.269   0.790   0.0024
Dexch314_3          -0.550938     0.2937    -1.88   0.070   0.1050

sigma                0.104186  RSS              0.325644572
R^2                  0.533767  F(19,30) =      1.808 [0.071]
log-likelihood        54.9024  DW                      1.92
no. of observations        50  no. of parameters         20
mean(Dexpr314)     0.00406783  var(Dexpr314)      0.0139692

AR 1-4 test:       F(4,26)  =  0.59927 [0.6665]
ARCH 1-4 test:     F(4,22)  = 0.097265 [0.9822]
Normality test:    Chi^2(2) =   2.5026 [0.2861]
hetero test:       Chi^2(38)=   37.291 [0.5021]
RESET test:        F(1,29)  =  0.57120 [0.4559]

EQ( 2) Modelling Dexpr314 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr314_1          -0.191982     0.1296    -1.48   0.146   0.0520
Dexpr314_2          -0.623316     0.1199    -5.20   0.000   0.4031
```

[22] (*) and (**) signs indicate significance at 5 % and 1 %, respectively.

```
Constant              0.0161735    0.04996    0.324   0.748   0.0026
Dwpp314                0.618423     0.5134     1.20   0.235   0.0350
Dwpp314_3              0.704445     0.5948     1.18   0.243   0.0339
Dcu314_3               0.153476     0.1553    0.988   0.329   0.0238
Dexch314               0.261962     0.1680     1.56   0.127   0.0573
Dexch314_1           -0.0124040     0.1942  -0.0639   0.949   0.0001
Dexch314_2            -0.183559     0.1691    -1.09   0.284   0.0286
Dexch314_3            -0.300329     0.1729    -1.74   0.090   0.0701

sigma                 0.0935736  RSS                 0.350240707
R^2                    0.498552  F(9,40) =      4.419 [0.000]**
log-likelihood           53.082  DW                         2.12
no. of observations          50  no. of parameters            10
mean(Dexpr314)       0.00406783  var(Dexpr314)         0.0139692

AR 1-4 test:       F(4,36)  =  0.59509 [0.6685]
ARCH 1-4 test:     F(4,32)  =  0.32745 [0.8574]
Normality test:    Chi^2(2) =   2.5665 [0.2771]
hetero test:       F(18,21) =  0.18573 [0.9997]
Not enough observations for hetero-X test
RESET test:        F(1,39)  =  0.38051 [0.5409]

EQ( 3) Modelling Dexpr314 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr314_2            -0.624060     0.1183    -5.27   0.000   0.3873
Constant              0.0653530    0.03714     1.76   0.085   0.0658
Dexch314               0.125572     0.1467    0.856   0.397   0.0164
Dexch314_1            -0.184203     0.1668    -1.10   0.275   0.0270
Dexch314_2            -0.130934     0.1653   -0.792   0.432   0.0141
Dexch314_3            -0.285690     0.1681    -1.70   0.096   0.0616

sigma                 0.0939649  RSS                 0.388493866
R^2                    0.443784  F(5,44) =      7.021 [0.000]**
log-likelihood          50.4906  DW                         2.39
no. of observations          50  no. of parameters             6
mean(Dexpr314)       0.00406783  var(Dexpr314)         0.0139692

AR 1-4 test:       F(4,40)  =   1.1124 [0.3641]
ARCH 1-4 test:     F(4,36)  =  0.40307 [0.8051]
Normality test:    Chi^2(2) =   3.6808 [0.1588]
hetero test:       F(10,33) =  0.31670 [0.9711]
hetero-X test:     F(20,23) =  0.74383 [0.7463]
RESET test:        F(1,43)  =   2.1661 [0.1484]
```

(2) Manufacture of textiles (ISIC Rev. 2 code: 321)

```
EQ( 1) Modelling Dexpr321 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr321_1           -0.0730351     0.1722   -0.424   0.674   0.0060
Dexpr321_2            -0.151233     0.1704   -0.888   0.382   0.0256
Dexpr321_3            -0.186731     0.1580    -1.18   0.246   0.0445
Constant             -0.0526734    0.02382    -2.21   0.035   0.1402
Dwpp321                -5.23981      3.268    -1.60   0.119   0.0789
```

```
Dwpp321_1            10.5586      3.618     2.92   0.007   0.2211
Dwpp321_2           0.304353      3.735   0.0815   0.936   0.0002
Dwpp321_3          -0.403248      3.019   -0.134   0.895   0.0006
Dcu321              -8.83837      5.562    -1.59   0.123   0.0776
Dcu321_1            -7.89601      5.623    -1.40   0.171   0.0617
Dcu321_2            -7.71655      5.597    -1.38   0.178   0.0596
Dcu321_3            -7.82127      5.599    -1.40   0.173   0.0611
Dpptr321            0.186144     0.2919    0.638   0.528   0.0134
Dpptr321_1          0.146505     0.2976    0.492   0.626   0.0080
Dpptr321_2         -0.142089     0.3050   -0.466   0.645   0.0072
Dpptr321_3          0.439783     0.2718     1.62   0.116   0.0803
Dexch321           -0.166104     0.2014   -0.825   0.416   0.0222
Dexch321_1         -0.208949     0.2111   -0.990   0.330   0.0316
Dexch321_2          0.179825     0.2171    0.828   0.414   0.0224
Dexch321_3         -0.135008     0.2085   -0.647   0.522   0.0138

sigma              0.0433036  RSS             0.0562560596
R^2                 0.597691  F(19,30) =     2.346 [0.018]*
log-likelihood       98.7997  DW                      2.19
no. of observations       50  no. of parameters         20
mean(Dexpr321)   0.000188636  var(Dexpr321)     0.00279666

AR 1-4 test:      F(4,26)  =  0.74468 [0.5704]
ARCH 1-4 test:    F(4,22)  =  0.40536 [0.8027]
Normality test:   Chi^2(2) =   1.5875 [0.4521]
hetero test:      Chi^2(38)=   34.284 [0.6420]
RESET test:       F(1,29)  =   1.5049 [0.2298]

EQ( 2) Modelling Dexpr321 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr321_2         -0.188037     0.1438    -1.31   0.199   0.0453
Dexpr321_3         -0.208656     0.1346    -1.55   0.130   0.0626
Constant          -0.0447516    0.01957    -2.29   0.028   0.1268
Dwpp321             -3.81592      2.755    -1.39   0.174   0.0506
Dwpp321_1            10.3735      2.645     3.92   0.000   0.2993
Dcu321              -9.29234      4.781    -1.94   0.060   0.0950
Dcu321_1            -8.36222      4.814    -1.74   0.091   0.0773
Dcu321_2            -8.32526      4.825    -1.73   0.093   0.0764
Dcu321_3            -8.38571      4.800    -1.75   0.089   0.0781
Dpptr321_3          0.269509     0.2022     1.33   0.191   0.0470
Dexch321          -0.0648925    0.07022   -0.924   0.362   0.0232
Dexch321_1        -0.0791760    0.07728    -1.02   0.312   0.0283
Dexch321_2         0.0963774    0.07699     1.25   0.219   0.0417
Dexch321_3        -0.0180586     0.1627   -0.111   0.912   0.0003

sigma              0.0403511  RSS             0.0586155696
R^2                 0.580817  F(13,36) =    3.837 [0.001]**
log-likelihood       97.7725  DW                      2.33
no. of observations       50  no. of parameters         14
mean(Dexpr321)   0.000188636  var(Dexpr321)     0.00279666

AR 1-4 test:      F(4,32)  =  0.51073 [0.7282]
ARCH 1-4 test:    F(4,28)  =  0.85930 [0.5003]
Normality test:   Chi^2(2) =   2.0492 [0.3589]
hetero test:      F(26,9)  =  0.46262 [0.9397]
Not enough observations for hetero-X test
RESET test:       F(1,35)  =   1.8700 [0.1802]
```

EQ(3) Modelling Dexpr321 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr321_3	-0.227912	0.1351	-1.69	0.100	0.0715
Constant	-0.0421966	0.01966	-2.15	0.038	0.1107
Dwpp321	-2.62908	2.626	-1.00	0.323	0.0264
Dwpp321_1	9.09397	2.481	3.67	0.001	0.2664
Dcu321	-7.65847	4.658	-1.64	0.109	0.0681
Dcu321_1	-6.72957	4.693	-1.43	0.160	0.0526
Dcu321_2	-6.64820	4.696	-1.42	0.165	0.0514
Dcu321_3	-6.83845	4.696	-1.46	0.154	0.0542
Dpptr321_3	0.195468	0.1960	0.997	0.325	0.0262
Dexch321	-0.0461967	0.06941	-0.666	0.510	0.0118
Dexch321_1	-0.0853915	0.07787	-1.10	0.280	0.0315
Dexch321_2	0.101189	0.07763	1.30	0.200	0.0439
Dexch321_3	0.0252466	0.1608	0.157	0.876	0.0007

sigma	0.0407362	RSS	0.0613991676
R^2	0.560911	F(12,37) =	3.939 [0.001]**
log-likelihood	96.6126	DW	2.36
no. of observations	50	no. of parameters	13
mean(Dexpr321)	0.000188636	var(Dexpr321)	0.00279666

```
AR 1-4 test:       F(4,33)  =  0.89431 [0.4784]
ARCH 1-4 test:     F(4,29)  =  0.40428 [0.8040]
Normality test:    Chi^2(2) =   2.9800 [0.2254]
hetero test:       F(24,12) =  0.27334 [0.9967]
Not enough observations for hetero-X test
RESET test:        F(1,36)  =  0.99187 [0.3259]
```

EQ(4) Modelling Dexpr321 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr321_3	-0.204827	0.1237	-1.66	0.106	0.0657
Constant	-0.0401952	0.01854	-2.17	0.036	0.1076
Dwpp321_1	7.28490	1.720	4.24	0.000	0.3151
Dcu321	-6.34839	4.375	-1.45	0.155	0.0512
Dcu321_1	-5.43558	4.407	-1.23	0.225	0.0375
Dcu321_2	-5.43810	4.433	-1.23	0.227	0.0372
Dcu321_3	-5.70110	4.457	-1.28	0.208	0.0403
Dpptr321_3	0.193828	0.08876	2.18	0.035	0.1090
Dexch321	-0.0477978	0.06784	-0.705	0.485	0.0126
Dexch321_1	-0.0764042	0.07617	-1.00	0.322	0.0251
Dexch321_2	0.0906997	0.07186	1.26	0.214	0.0392

sigma	0.0402364	RSS	0.0631398277
R^2	0.548463	F(10,39) =	4.737 [0.000]**
log-likelihood	95.9137	DW	2.33
no. of observations	50	no. of parameters	11
mean(Dexpr321)	0.000188636	var(Dexpr321)	0.00279666

```
AR 1-4 test:       F(4,35)  =  0.83225 [0.5139]
ARCH 1-4 test:     F(4,31)  =  0.90609 [0.4725]
Normality test:    Chi^2(2) =   3.0338 [0.2194]
hetero test:       F(20,18) =  0.39846 [0.9754]
Not enough observations for hetero-X test
RESET test:        F(1,38)  =  0.99159 [0.3257]
```

```
EQ( 5) Modelling Dexpr321 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr321_3          -0.158590     0.1165    -1.36   0.181   0.0432
Constant           -0.0386049    0.01839    -2.10   0.042   0.0971
Dwpp321_1             7.48900      1.694     4.42   0.000   0.3228
Dcu321              -0.971507     0.2999    -3.24   0.002   0.2038
Dcu321_3            -0.233113     0.2985   -0.781   0.439   0.0147
Dpptr321_3           0.188885    0.08775     2.15   0.037   0.1015
Dexch321           -0.0492063    0.06504   -0.757   0.454   0.0138
Dexch321_1         -0.0753534    0.07350    -1.03   0.311   0.0250
Dexch321_2          0.0859095    0.07128     1.21   0.235   0.0342

sigma               0.0400022  RSS            0.065607269
R^2                  0.530817  F(8,41) =     5.798 [0.000]**
log-likelihood        94.9554  DW                    2.24
no. of observations        50  no. of parameters         9
mean(Dexpr321)    0.000188636  var(Dexpr321)      0.00279666

AR 1-4 test:      F(4,37)  =  0.75062 [0.5640]
ARCH 1-4 test:    F(4,33)  =  0.95299 [0.4461]
Normality test:   Chi^2(2) =   4.8371 [0.0890]
hetero test:      F(16,24) =  0.54199 [0.8960]
Not enough observations for hetero-X test
RESET test:       F(1,40)  =   1.0063 [0.3218]

EQ( 6) Modelling Dexpr321 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr321_3          -0.140040     0.1135    -1.23   0.224   0.0350
Constant           -0.0377739    0.01827    -2.07   0.045   0.0924
Dwpp321_1             7.32465      1.673     4.38   0.000   0.3134
Dcu321              -0.862927     0.2645    -3.26   0.002   0.2022
Dpptr321_3           0.186036    0.08727     2.13   0.039   0.0976
Dexch321           -0.0577116    0.06382   -0.904   0.371   0.0191
Dexch321_1         -0.0825904    0.07257    -1.14   0.262   0.0299
Dexch321_2           0.101243    0.06821     1.48   0.145   0.0498

sigma                0.039816  RSS           0.0665832437
R^2                  0.523837  F(7,42) =     6.601 [0.000]**
log-likelihood        94.5862  DW                    2.21
no. of observations        50  no. of parameters         8
mean(Dexpr321)    0.000188636  var(Dexpr321)      0.00279666

AR 1-4 test:      F(4,38)  =  0.55387 [0.6974]
ARCH 1-4 test:    F(4,34)  =  0.93839 [0.4536]
Normality test:   Chi^2(2) =   4.2538 [0.1192]
hetero test:      F(14,27) =  0.53248 [0.8916]
Not enough observations for hetero-X test
RESET test:       F(1,41)  =  0.75845 [0.3889]

EQ( 7) Modelling Dexpr321 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant           -0.0413193    0.01815    -2.28   0.028   0.1076
Dwpp321_1             7.33723      1.683     4.36   0.000   0.3065
Dcu321              -0.918240     0.2623    -3.50   0.001   0.2219
```

```
Dpptr321_3           0.185819    0.08780     2.12   0.040   0.0943
Dexch321            -0.0507998   0.06396   -0.794   0.431   0.0145
Dexch321_1          -0.0577945   0.07015   -0.824   0.415   0.0155
Dexch321_2           0.101514    0.06862     1.48   0.146   0.0484

sigma               0.0400569  RSS             0.068995762
R^2                  0.506585  F(6,43) =     7.358 [0.000]**
log-likelihood        93.6964  DW                     2.12
no. of observations        50  no. of parameters         7
mean(Dexpr321)    0.000188636  var(Dexpr321)      0.00279666

AR 1-4 test:       F(4,39)  =  0.28549 [0.8856]
ARCH 1-4 test:     F(4,35)  =   1.1445 [0.3519]
Normality test:    Chi^2(2) =   4.3226 [0.1152]
hetero test:       F(12,30) =  0.45335 [0.9261]
hetero-X test:     F(27,15) =  0.31123 [0.9960]
RESET test:        F(1,42)  =  0.70364 [0.4063]
```

---

(3) Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear (ISIC Rev. 2 code: 324)

```
EQ( 1) Modelling Dexpr324 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr324_1          -0.179720     0.1541    -1.17   0.252   0.0385
Dexpr324_2          0.0192401     0.1333    0.144   0.886   0.0006
Dexpr324_3          -0.235187     0.1253    -1.88   0.069   0.0938
Constant           -0.0960477    0.07245    -1.33   0.194   0.0492
Dwpp324               13.1335      7.355     1.79   0.083   0.0857
Dwpp324_1            -19.0748      7.706    -2.48   0.018   0.1527
Dwpp324_2             17.7380      7.515     2.36   0.024   0.1408
Dwpp324_3            -11.0746      7.273    -1.52   0.137   0.0638
Dpptr324             0.346746     0.3296     1.05   0.300   0.0315
Dpptr324_1           0.929558     0.3741     2.48   0.018   0.1537
Dpptr324_2          -0.977599     0.3712    -2.63   0.013   0.1694
Dpptr324_3            1.01343     0.3637     2.79   0.009   0.1859
Dexch324             0.309114     0.2983     1.04   0.307   0.0306
Dexch324_1           -1.01284     0.3225    -3.14   0.003   0.2248
Dexch324_2           0.349290     0.3307     1.06   0.298   0.0318
Dexch324_3          -0.370864     0.2980    -1.24   0.222   0.0436

sigma                0.118797  RSS             0.479833366
R^2                  0.504773  F(15,34) =      2.31 [0.021]*
log-likelihood        45.2116  DW                     2.02
no. of observations        50  no. of parameters        16
mean(Dexpr324)     -0.0109357  var(Dexpr324)       0.0193783

AR 1-4 test:       F(4,30)  =   1.3619 [0.2705]
ARCH 1-4 test:     F(4,26)  =  0.36504 [0.8312]
Normality test:    Chi^2(2) =   2.8491 [0.2406]
hetero test:       F(30,3)  = 0.095956 [0.9999]
Not enough observations for hetero-X test
RESET test:        F(1,33)  =  0.41734 [0.5227]
```

```
EQ( 2) Modelling Dexpr324 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                   Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr324_1           -0.185798     0.1461    -1.27   0.212   0.0441
Dexpr324_3           -0.237941     0.1221    -1.95   0.059   0.0978
Constant            -0.0980216    0.07014    -1.40   0.171   0.0528
Dwpp324                13.0872      7.244     1.81   0.079   0.0853
Dwpp324_1             -18.8665      7.463    -2.53   0.016   0.1544
Dwpp324_2              17.6592      7.390     2.39   0.022   0.1403
Dwpp324_3             -11.1244      7.162    -1.55   0.129   0.0645
Dpptr324              0.345867     0.3249     1.06   0.294   0.0314
Dpptr324_1            0.931950     0.3684     2.53   0.016   0.1545
Dpptr324_2           -0.964859     0.3555    -2.71   0.010   0.1739
Dpptr324_3             1.01036     0.3580     2.82   0.008   0.1854
Dexch324              0.318938     0.2863     1.11   0.273   0.0342
Dexch324_1            -1.01266     0.3180    -3.18   0.003   0.2247
Dexch324_2            0.345214     0.3248     1.06   0.295   0.0313
Dexch324_3           -0.377183     0.2906    -1.30   0.203   0.0459

sigma                 0.117124  RSS               0.480127483
R^2                    0.50447  F(14,35) =     2.545 [0.013]*
log-likelihood         45.1962  DW                       2.01
no. of observations         50  no. of parameters          15
mean(Dexpr324)      -0.0109357  var(Dexpr324)       0.0193783

AR 1-4 test:       F(4,31)  =   1.3729 [0.2660]
ARCH 1-4 test:     F(4,27)  =  0.38167 [0.8197]
Normality test:    Chi^2(2) =   2.8182 [0.2444]
hetero test:       F(28,6)  =  0.19430 [0.9989]
Not enough observations for hetero-X test
RESET test:        F(1,34)  =  0.41917 [0.5217]

EQ( 3) Modelling Dexpr324 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                   Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr324_1           -0.204452     0.1454    -1.41   0.168   0.0521
Dexpr324_3           -0.246058     0.1221    -2.01   0.051   0.1013
Constant            -0.0981052    0.07027    -1.40   0.171   0.0514
Dwpp324                15.8504      6.776     2.34   0.025   0.1319
Dwpp324_1             -19.9518      7.407    -2.69   0.011   0.1678
Dwpp324_2              16.8821      7.368     2.29   0.028   0.1273
Dwpp324_3             -10.4724      7.149    -1.46   0.152   0.0562
Dpptr324_1             1.02141     0.3594     2.84   0.007   0.1832
Dpptr324_2            -1.06530     0.3434    -3.10   0.004   0.2109
Dpptr324_3             1.05652     0.3560     2.97   0.005   0.1965
Dexch324              0.524437     0.2118     2.48   0.018   0.1455
Dexch324_1            -1.06380     0.3149    -3.38   0.002   0.2407
Dexch324_2            0.424124     0.3169     1.34   0.189   0.0474
Dexch324_3           -0.353907     0.2903    -1.22   0.231   0.0397

sigma                  0.11734  RSS               0.495674543
R^2                   0.488424  F(13,36) =     2.644 [0.011]*
log-likelihood         44.3995  DW                       2.08
no. of observations         50  no. of parameters          14
mean(Dexpr324)      -0.0109357  var(Dexpr324)       0.0193783

AR 1-4 test:       F(4,32)  =   1.5364 [0.2152]
ARCH 1-4 test:     F(4,28)  =  0.31865 [0.8631]
```

```
Normality test:   Chi^2(2) =   2.6750 [0.2625]
hetero test:      F(26,9)  =  0.26133 [0.9965]
Not enough observations for hetero-X test
RESET test:       F(1,35)  =  0.30095 [0.5868]

EQ( 4) Modelling Dexpr324 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr324_1          -0.235054     0.1391    -1.69   0.099   0.0699
Dexpr324_3          -0.231141     0.1223    -1.89   0.067   0.0859
Constant           -0.0789317    0.06866    -1.15   0.257   0.0336
Dwpp324               13.5578      6.645     2.04   0.048   0.0987
Dwpp324_1            -16.3589      7.008    -2.33   0.025   0.1254
Dwpp324_2             14.0636      7.070     1.99   0.054   0.0943
Dwpp324_3            -8.48482      7.044    -1.20   0.236   0.0368
Dpptr324_1           0.870984     0.3420     2.55   0.015   0.1458
Dpptr324_2          -0.757604     0.2404    -3.15   0.003   0.2072
Dpptr324_3           0.679688     0.2492     2.73   0.010   0.1637
Dexch324             0.427190     0.2032     2.10   0.042   0.1042
Dexch324_1          -0.844328     0.2823    -2.99   0.005   0.1906

sigma                0.117939  RSS               0.528566874
R^2                  0.454476  F(11,38) =     2.878 [0.008]**
log-likelihood        42.7933  DW                       1.95
no. of observations        50  no. of parameters          12
mean(Dexpr324)     -0.0109357  var(Dexpr324)       0.0193783

AR 1-4 test:      F(4,34)  =   1.6592 [0.1822]
ARCH 1-4 test:    F(4,30)  =  0.42587 [0.7887]
Normality test:   Chi^2(2) =   2.3671 [0.3062]
hetero test:      F(22,15) =  0.29807 [0.9950]
Not enough observations for hetero-X test
RESET test:       F(1,37)  =   1.3882 [0.2462]

EQ( 5) Modelling Dexpr324 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr324_1          -0.267474     0.1373    -1.95   0.059   0.0887
Dexpr324_3          -0.223817     0.1229    -1.82   0.076   0.0784
Constant           -0.0821793    0.06900    -1.19   0.241   0.0351
Dwpp324               11.8392      6.528     1.81   0.077   0.0778
Dwpp324_1            -17.7585      6.951    -2.55   0.015   0.1434
Dwpp324_2             11.0864      6.662     1.66   0.104   0.0663
Dpptr324_1           0.915884     0.3419     2.68   0.011   0.1554
Dpptr324_2          -0.759198     0.2418    -3.14   0.003   0.2018
Dpptr324_3           0.598236     0.2412     2.48   0.018   0.1362
Dexch324             0.429870     0.2044     2.10   0.042   0.1019
Dexch324_1          -0.859346     0.2836    -3.03   0.004   0.1906

sigma                0.118619  RSS               0.548749725
R^2                  0.433646  F(10,39) =     2.986 [0.007]**
log-likelihood        41.8565  DW                       1.98
no. of observations        50  no. of parameters          11
mean(Dexpr324)     -0.0109357  var(Dexpr324)       0.0193783

AR 1-4 test:      F(4,35)  =   2.3444 [0.0737]
ARCH 1-4 test:    F(4,31)  =  0.47533 [0.7535]
Normality test:   Chi^2(2) =   2.4296 [0.2968]
```

```
hetero test:      F(20,18) =  0.35878 [0.9855]
Not enough observations for hetero-X test
RESET test:       F(1,38)  =   1.0390 [0.3145]
```

(4) Manufacture of industrial chemicals (ISIC Rev. 2 code: 351)

```
EQ( 1) Modelling Dexpr351 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr351_1          -0.109600     0.1538   -0.713   0.481   0.0147
Dexpr351_2         -0.0704338     0.1552   -0.454   0.653   0.0060
Dexpr351_3         -0.0409570     0.1637   -0.250   0.804   0.0018
Constant           -0.0582728    0.01686    -3.46   0.001   0.2599
Dwpp351               1.55104     0.4012     3.87   0.000   0.3054
Dwpp351_1            0.380750     0.5111    0.745   0.461   0.0161
Dwpp351_2            0.110636     0.5103    0.217   0.830   0.0014
Dwpp351_3            0.346510     0.4494    0.771   0.446   0.0172
Dpptr351            -0.131085     0.1598   -0.820   0.418   0.0194
Dpptr351_1         -0.0544555     0.1508   -0.361   0.720   0.0038
Dpptr351_2          -0.141971     0.1441   -0.985   0.331   0.0278
Dpptr351_3         -0.0564481     0.1389   -0.406   0.687   0.0048
Dexch351             0.149954     0.1489     1.01   0.321   0.0289
Dexch351_1          0.0854569     0.1445    0.591   0.558   0.0102
Dexch351_2           0.188359     0.1399     1.35   0.187   0.0506
Dexch351_3           0.270767     0.1388     1.95   0.059   0.1007

sigma               0.0378189  RSS            0.0486292684
R^2                  0.640093  F(15,34) =    4.031 [0.000]**
log-likelihood        102.442  DW                     2.31
no. of observations        50  no. of parameters        16
mean(Dexpr351)    -0.00644595  var(Dexpr351)      0.00270232

AR 1-4 test:      F(4,30)  =   1.9619 [0.1259]
ARCH 1-4 test:    F(4,26)  =  0.83711 [0.5141]
Normality test:   Chi^2(2) =   4.7491 [0.0931]
hetero test:      F(30,3)  = 0.080568 [1.0000]
Not enough observations for hetero-X test
RESET test:       F(1,33)  =   2.3904 [0.1316]

EQ( 2) Modelling Dexpr351 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr351_1         -0.0954545     0.1423   -0.671   0.506   0.0114
Constant           -0.0560737    0.01488    -3.77   0.001   0.2669
Dwpp351               1.56898     0.3452     4.54   0.000   0.3463
Dwpp351_1            0.320594     0.4353    0.736   0.466   0.0137
Dwpp351_3            0.197857     0.2592    0.763   0.450   0.0147
Dpptr351            -0.134534     0.1382   -0.973   0.336   0.0237
Dpptr351_2          -0.150510     0.1299    -1.16   0.254   0.0333
Dexch351             0.158201     0.1296     1.22   0.229   0.0368
Dexch351_1          0.0420604    0.06681    0.630   0.533   0.0101
Dexch351_2           0.183870     0.1263     1.46   0.153   0.0515
Dexch351_3           0.212345    0.06612     3.21   0.003   0.2091

sigma               0.0356268  RSS            0.0495015541
R^2                  0.633637  F(10,39) =    6.745 [0.000]**
```

log-likelihood	101.997	DW	2.32
no. of observations	50	no. of parameters	11
mean(Dexpr351)	-0.00644595	var(Dexpr351)	0.00270232

```
AR 1-4 test:       F(4,35)   =   2.0570 [0.1076]
ARCH 1-4 test:     F(4,31)   =   1.5492 [0.2125]
Normality test:    Chi^2(2) =   4.3594 [0.1131]
hetero test:       F(20,18) =  0.33728 [0.9896]
Not enough observations for hetero-X test
RESET test:        F(1,38)   =   1.5480 [0.2210]
```

EQ(3) Modelling Dexpr351 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.0480436	0.01323	-3.63	0.001	0.2348
Dwpp351	1.53183	0.2448	6.26	0.000	0.4767
Dpptr351_2	-0.0847675	0.1124	-0.754	0.455	0.0131
Dexch351	0.0427765	0.05412	0.790	0.434	0.0143
Dexch351_1	0.00886892	0.06034	0.147	0.884	0.0005
Dexch351_2	0.110450	0.1072	1.03	0.308	0.0241
Dexch351_3	0.196546	0.06285	3.13	0.003	0.1853

sigma	0.0348168	RSS	0.0521251301
R^2	0.61422	F(6,43) =	11.41 [0.000]**
log-likelihood	100.706	DW	2.39
no. of observations	50	no. of parameters	7
mean(Dexpr351)	-0.00644595	var(Dexpr351)	0.00270232

```
AR 1-4 test:       F(4,39)   =   1.4626 [0.2321]
ARCH 1-4 test:     F(4,35)   =   1.2018 [0.3274]
Normality test:    Chi^2(2) =   5.5123 [0.0635]
hetero test:       F(12,30) =  0.35147 [0.9707]
hetero-X test:     F(27,15) =  0.28778 [0.9976]
RESET test:        F(1,42)   =   1.6655 [0.2039]
```

EQ(4) Modelling Dexpr351 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.0493362	0.01305	-3.78	0.000	0.2452
Dwpp351	1.48315	0.2349	6.31	0.000	0.4753
Dexch351	0.0449728	0.05378	0.836	0.408	0.0156
Dexch351_1	0.0156157	0.05938	0.263	0.794	0.0016
Dexch351_2	0.0439597	0.06065	0.725	0.472	0.0118
Dexch351_3	0.181373	0.05925	3.06	0.004	0.1756

sigma	0.0346459	RSS	0.052814776
R^2	0.609116	F(5,44) =	13.71 [0.000]**
log-likelihood	100.378	DW	2.37
no. of observations	50	no. of parameters	6
mean(Dexpr351)	-0.00644595	var(Dexpr351)	0.00270232

```
AR 1-4 test:       F(4,40)   =   1.6545 [0.1796]
ARCH 1-4 test:     F(4,36)   =   1.0310 [0.4046]
Normality test:    Chi^2(2) =   6.2050 [0.0449]*
hetero test:       F(10,33) =  0.42038 [0.9265]
hetero-X test:     F(20,23) =  0.42476 [0.9713]
RESET test:        F(1,43)   =   1.3676 [0.2487]
```

(5) Petroleum refineries (ISIC Rev. 2 code: 353)

```
EQ( 1) Modelling Dexpr353 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr353_1          0.0957299     0.1646    0.582   0.565   0.0099
Dexpr353_2          -0.332880     0.1665    -2.00   0.054   0.1052
Dexpr353_3          0.0753741     0.1768    0.426   0.673   0.0053
Constant          -0.00993922    0.07238   -0.137   0.892   0.0006
Dwpp353               1.02689     0.6622     1.55   0.130   0.0661
Dwpp353_1          -0.0823628     0.6629   -0.124   0.902   0.0005
Dwpp353_2            0.473839     0.7336    0.646   0.523   0.0121
Dwpp353_3            0.340419     0.7278    0.468   0.643   0.0064
Dpptr353             0.119644     0.3271    0.366   0.717   0.0039
Dpptr353_1          -0.461595     0.3430    -1.35   0.187   0.0506
Dpptr353_2          -0.214062     0.3196   -0.670   0.508   0.0130
Dpptr353_3          -0.318434     0.3179    -1.00   0.324   0.0287
Dexch353            -0.193337     0.4128   -0.468   0.643   0.0064
Dexch353_1           0.410553     0.4350    0.944   0.352   0.0255
Dexch353_2           0.495285     0.4100     1.21   0.235   0.0412
Dexch353_3           0.438714     0.4169     1.05   0.300   0.0315

sigma                0.151237  RSS              0.777666944
R^2                  0.375737  F(15,34) =      1.364 [0.220]
log-likelihood        33.1401  DW                      1.85
no. of observations        50  no. of parameters         16
mean(Dexpr353)      0.0339339  var(Dexpr353)      0.0249147

AR 1-4 test:       F(4,30)   =  0.41797 [0.7943]
ARCH 1-4 test:     F(4,26)   =  0.41380 [0.7971]
Normality test:    Chi^2(2) =   2.9385 [0.2301]
hetero test:       F(30,3)   =  0.14382 [0.9989]
Not enough observations for hetero-X test
RESET test:        F(1,33)   =   1.1672 [0.2878]

EQ( 2) Modelling Dexpr353 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr353_2          -0.290456     0.1363    -2.13   0.039   0.0975
Constant           -0.0295783    0.05885   -0.503   0.618   0.0060
Dwpp353               1.07894     0.4519     2.39   0.022   0.1195
Dpptr353_1          -0.395526     0.2421    -1.63   0.110   0.0597
Dexch353           -0.0292614     0.2351   -0.124   0.902   0.0004
Dexch353_1           0.406094     0.3153     1.29   0.205   0.0380
Dexch353_2           0.352898     0.2471     1.43   0.161   0.0463
Dexch353_3           0.163207     0.2434    0.670   0.506   0.0106

sigma                0.140789  RSS              0.832508628
R^2                  0.331713  F(7,42) =      2.978 [0.013]*
log-likelihood        31.4364  DW                      1.69
no. of observations        50  no. of parameters          8
mean(Dexpr353)      0.0339339  var(Dexpr353)      0.0249147

AR 1-4 test:       F(4,38)   =  0.55384 [0.6974]
ARCH 1-4 test:     F(4,34)   =  0.51976 [0.7218]
Normality test:    Chi^2(2) =  0.64779 [0.7233]
```

```
hetero test:       F(14,27) =   2.5451 [0.0181]*
Not enough observations for hetero-X test
RESET test:        F(1,41)  =  0.78126 [0.3819]

EQ( 3) Modelling Dexpr353 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr353_2          -0.342263     0.1351    -2.53   0.015   0.1298
Constant           -0.0529858    0.05818   -0.911   0.368   0.0189
Dwpp353              0.918383     0.4496     2.04   0.047   0.0885
Dexch353            0.0961305     0.2264    0.425   0.673   0.0042
Dexch353_1          0.0809266     0.2492    0.325   0.747   0.0024
Dexch353_2           0.298535     0.2496     1.20   0.238   0.0322
Dexch353_3           0.191171     0.2475    0.772   0.444   0.0137

sigma                0.143495  RSS                  0.88540234
R^2                  0.289254  F(6,43) =      2.917 [0.018]*
log-likelihood        29.8965  DW                         1.68
no. of observations        50  no. of parameters             7
mean(Dexpr353)      0.0339339  var(Dexpr353)         0.0249147

AR 1-4 test:       F(4,39)  =  0.51372 [0.7260]
ARCH 1-4 test:     F(4,35)  =  0.86773 [0.4930]
Normality test:    Chi^2(2) =  0.97323 [0.6147]
hetero test:       F(12,30) =   2.6074 [0.0165]*
hetero-X test:     F(27,15) =   1.0807 [0.4506]
RESET test:        F(1,42)  =  0.15269 [0.6980]
```

(6) Iron and steel basic industries (ISIC Rev. 2 code: 371)

```
EQ( 1) Modelling Dexpr371 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr371_1          -0.174977     0.1940   -0.902   0.374   0.0264
Dexpr371_2          -0.161246     0.1776   -0.908   0.371   0.0267
Dexpr371_3          0.0290995     0.1644    0.177   0.861   0.0010
Constant          -0.00641601    0.02542   -0.252   0.802   0.0021
Dwpp371             -0.158622     0.7975   -0.199   0.844   0.0013
Dwpp371_1             1.08432     0.7065     1.53   0.135   0.0728
Dwpp371_2           -0.671479     0.7967   -0.843   0.406   0.0231
Dwpp371_3            0.360021     0.6678    0.539   0.594   0.0096
Dcu371              -0.261758     0.1045    -2.50   0.018   0.1730
Dcu371_1            -0.157261     0.1199    -1.31   0.199   0.0543
Dcu371_2            -0.245936     0.1147    -2.14   0.040   0.1330
Dcu371_3            0.0119940     0.1087    0.110   0.913   0.0004
Dpptr371             0.246523     0.2079     1.19   0.245   0.0448
Dpptr371_1           0.648081     0.2207     2.94   0.006   0.2233
Dpptr371_2           0.177167     0.2367    0.749   0.460   0.0183
Dpptr371_3          -0.166380     0.2817   -0.591   0.559   0.0115
Dexch371            -0.122329     0.1813   -0.675   0.505   0.0149
Dexch371_1          -0.593762     0.1825    -3.25   0.003   0.2608
Dexch371_2          -0.191758     0.2043   -0.939   0.355   0.0285
Dexch371_3        -0.00398191     0.2293  -0.0174   0.986   0.0000

sigma               0.0452033  RSS                0.0613002796
R^2                  0.664759  F(19,30) =    3.131 [0.003]**
```

log-likelihood	96.6529	DW	2.02
no. of observations	50	no. of parameters	20
mean(Dexpr371)	-0.00911033	var(Dexpr371)	0.00365708

```
AR 1-4 test:       F(4,26)   =  0.27008 [0.8945]
ARCH 1-4 test:     F(4,22)   =  0.35308 [0.8391]
Normality test:    Chi^2(2)  =   5.7920 [0.0552]
hetero test:       Chi^2(38)=   36.739 [0.5277]
RESET test:        F(1,29)   =  0.20870 [0.6512]
```

EQ(2) Modelling Dexpr371 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr371_1	-0.177177	0.1726	-1.03	0.312	0.0310
Dexpr371_2	-0.164188	0.1651	-0.994	0.327	0.0291
Constant	-0.00444544	0.02025	-0.220	0.828	0.0015
Dwpp371_1	1.01067	0.5874	1.72	0.095	0.0823
Dwpp371_2	-0.689472	0.7441	-0.927	0.361	0.0254
Dwpp371_3	0.452706	0.5291	0.856	0.398	0.0217
Dcu371	-0.259290	0.09638	-2.69	0.011	0.1799
Dcu371_1	-0.156741	0.09703	-1.62	0.116	0.0733
Dcu371_2	-0.241851	0.09426	-2.57	0.015	0.1663
Dpptr371	0.229177	0.1722	1.33	0.192	0.0510
Dpptr371_1	0.645944	0.2076	3.11	0.004	0.2268
Dpptr371_2	0.160022	0.2170	0.738	0.466	0.0162
Dpptr371_3	-0.166484	0.1887	-0.882	0.384	0.0231
Dexch371	-0.109107	0.1538	-0.709	0.483	0.0150
Dexch371_1	-0.595031	0.1737	-3.43	0.002	0.2623
Dexch371_2	-0.183819	0.1895	-0.970	0.339	0.0277
Dexch371_3	-0.00709856	0.1719	-0.0413	0.967	0.0001

sigma	0.043166	RSS	0.0614890684
R^2	0.663726	F(16,33) =	4.071 [0.000]**
log-likelihood	96.576	DW	2
no. of observations	50	no. of parameters	17
mean(Dexpr371)	-0.00911033	var(Dexpr371)	0.00365708

```
AR 1-4 test:       F(4,29)   =  0.15596 [0.9587]
ARCH 1-4 test:     F(4,25)   =  0.41196 [0.7983]
Normality test:    Chi^2(2)  =   5.4690 [0.0649]
hetero test:       Chi^2(32)=  0.00000 [1.0000]
Not enough observations for hetero-X test
RESET test:        F(1,32)   =  0.17885 [0.6752]
```

EQ(3) Modelling Dexpr371 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0.000521967	0.01829	0.0285	0.977	0.0000
Dwpp371_1	0.534859	0.3917	1.37	0.180	0.0456
Dcu371	-0.282383	0.08401	-3.36	0.002	0.2246
Dcu371_1	-0.168898	0.08140	-2.07	0.045	0.0994
Dcu371_2	-0.183761	0.08397	-2.19	0.035	0.1094
Dpptr371	0.348131	0.1427	2.44	0.019	0.1324
Dpptr371_1	0.592129	0.1513	3.91	0.000	0.2821
Dpptr371_3	-0.180647	0.08220	-2.20	0.034	0.1102
Dexch371	-0.193159	0.1386	-1.39	0.171	0.0475
Dexch371_1	-0.537927	0.1437	-3.74	0.001	0.2644
Dexch371_2	-0.0724939	0.07820	-0.927	0.360	0.0216

```
sigma                0.0421031  RSS              0.0691341006
R^2                   0.621917  F(10,39) =    6.415 [0.000]**
log-likelihood         93.6463  DW                       2.21
no. of observations         50  no. of parameters          11
mean(Dexpr371)     -0.00911033  var(Dexpr371)      0.00365708

AR 1-4 test:       F(4,35)  =  0.74805 [0.5660]
ARCH 1-4 test:     F(4,31)  =  0.27513 [0.8918]
Normality test:    Chi^2(2) =   4.2423 [0.1199]
hetero test:       F(20,18) =  0.51848 [0.9214]
Not enough observations for hetero-X test
RESET test:        F(1,38)  =0.0037879 [0.9512]

EQ( 4) Modelling Dexpr371 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)
```

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.00525459	0.01798	-0.292	0.772	0.0021
Dcu371	-0.299483	0.08397	-3.57	0.001	0.2413
Dcu371_1	-0.197081	0.07958	-2.48	0.018	0.1329
Dcu371_2	-0.202215	0.08376	-2.41	0.020	0.1272
Dpptr371	0.359554	0.1440	2.50	0.017	0.1349
Dpptr371_1	0.670736	0.1414	4.74	0.000	0.3600
Dpptr371_3	-0.152294	0.08039	-1.89	0.065	0.0823
Dexch371	-0.206547	0.1397	-1.48	0.147	0.0518
Dexch371_1	-0.592564	0.1395	-4.25	0.000	0.3109
Dexch371_2	-0.0654036	0.07887	-0.829	0.412	0.0169

```
sigma                0.0425555  RSS               0.072438905
R^2                   0.603843  F(9,40) =     6.774 [0.000]**
log-likelihood         92.4789  DW                       2.21
no. of observations         50  no. of parameters          10
mean(Dexpr371)     -0.00911033  var(Dexpr371)      0.00365708

AR 1-4 test:       F(4,36)  =  0.75323 [0.5625]
ARCH 1-4 test:     F(4,32)  =  0.32468 [0.8593]
Normality test:    Chi^2(2) =   6.4263 [0.0402]*
hetero test:       F(18,21) =  0.43547 [0.9601]
Not enough observations for hetero-X test
RESET test:        F(1,39)  = 0.028238 [0.8674]

EQ( 5) Modelling Dexpr371 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)
```

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.0221167	0.01611	-1.37	0.177	0.0439
Dcu371	-0.272825	0.08535	-3.20	0.003	0.1995
Dcu371_1	-0.182675	0.08168	-2.24	0.031	0.1087
Dcu371_2	-0.177542	0.08532	-2.08	0.044	0.0955
Dpptr371	0.398883	0.1469	2.72	0.010	0.1524
Dpptr371_1	0.601508	0.1408	4.27	0.000	0.3079
Dexch371	-0.257394	0.1414	-1.82	0.076	0.0748
Dexch371_1	-0.504871	0.1357	-3.72	0.001	0.2525
Dexch371_2	-0.0897830	0.08023	-1.12	0.270	0.0296

```
sigma                0.0438787  RSS              0.0789389735
R^2                   0.568296  F(8,41) =     6.747 [0.000]**
log-likelihood         90.3307  DW                       2.29
no. of observations         50  no. of parameters           9
```

mean(Dexpr371)	-0.00911033	var(Dexpr371)	0.00365708

AR 1-4 test:	F(4,37) =	0.90542	[0.4708]
ARCH 1-4 test:	F(4,33) =	0.29826	[0.8770]
Normality test:	Chi^2(2) =	6.8783	[0.0321]*
hetero test:	F(16,24) =	0.52835	[0.9050]

Not enough observations for hetero-X test

RESET test:	F(1,40) =	1.6776	[0.2027]

---

(7) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

EQ(1) Modelling Dexpr381 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr381_1	-0.555084	0.1706	-3.25	0.003	0.2609
Dexpr381_2	-0.316113	0.1819	-1.74	0.093	0.0914
Dexpr381_3	-0.00732353	0.1799	-0.0407	0.968	0.0001
Constant	-0.0230048	0.03246	-0.709	0.484	0.0165
Dwpp381	6.52652	3.638	1.79	0.083	0.0969
Dwpp381_1	-5.19055	4.381	-1.18	0.245	0.0447
Dwpp381_2	2.83255	3.829	0.740	0.465	0.0179
Dwpp381_3	0.938067	3.083	0.304	0.763	0.0031
Dcu381	0.0480849	0.1630	0.295	0.770	0.0029
Dcu381_1	-0.104214	0.1838	-0.567	0.575	0.0106
Dcu381_2	0.329042	0.1803	1.82	0.078	0.0999
Dcu381_3	0.0933189	0.1624	0.575	0.570	0.0109
Dpptr381	0.0910700	0.3325	0.274	0.786	0.0025
Dpptr381_1	-0.491016	0.3447	-1.42	0.165	0.0634
Dpptr381_2	0.733190	0.4049	1.81	0.080	0.0985
Dpptr381_3	0.156625	0.3468	0.452	0.655	0.0068
Dexch381	-0.223588	0.2298	-0.973	0.338	0.0306
Dexch381_1	0.262409	0.2715	0.967	0.342	0.0302
Dexch381_2	-0.113675	0.3029	-0.375	0.710	0.0047
Dexch381_3	-0.386279	0.2602	-1.48	0.148	0.0684

sigma	0.0592341	RSS	0.105260417
R^2	0.479806	F(19,30) =	1.456 [0.174]
log-likelihood	83.1366	DW	1.88
no. of observations	50	no. of parameters	20
mean(Dexpr381)	0.00104847	var(Dexpr381)	0.00404697

AR 1-4 test:	F(4,26) =	2.8586	[0.0435]*
ARCH 1-4 test:	F(4,22) =	0.37972	[0.8207]
Normality test:	Chi^2(2) =	1.0025	[0.6058]
hetero test:	Chi^2(38)=	38.670	[0.4393]
RESET test:	F(1,29) =	0.053555	[0.8186]

EQ(2) Modelling Dexpr381 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr381_1	-0.529061	0.1433	-3.69	0.001	0.2640
Dexpr381_2	-0.251224	0.1374	-1.83	0.075	0.0808
Constant	-0.00381272	0.02432	-0.157	0.876	0.0006

Dwpp381	6.02070	2.652	2.27	0.029	0.1194
Dwpp381_1	-2.72661	2.727	-1.00	0.324	0.0256
Dcu381_2	0.326124	0.1393	2.34	0.025	0.1260
Dpptr381_1	-0.460464	0.2799	-1.65	0.108	0.0665
Dpptr381_2	0.948222	0.2933	3.23	0.003	0.2157
Dexch381	-0.236717	0.1058	-2.24	0.031	0.1163
Dexch381_1	0.390824	0.2148	1.82	0.077	0.0801
Dexch381_2	-0.330152	0.1919	-1.72	0.094	0.0722
Dexch381_3	-0.355385	0.1435	-2.48	0.018	0.1390

sigma	0.0546011	RSS	0.113288511
R^2	0.440132	F(11,38) =	2.716 [0.011]*
log-likelihood	81.2991	DW	1.92
no. of observations	50	no. of parameters	12
mean(Dexpr381)	0.00104847	var(Dexpr381)	0.00404697

AR 1-4 test: F(4,34) = 1.5787 [0.2023]
ARCH 1-4 test: F(4,30) = 0.59841 [0.6666]
Normality test: Chi^2(2) = 0.33616 [0.8453]
hetero test: F(22,15) = 0.34081 [0.9892]
Not enough observations for hetero-X test
RESET test: F(1,37) = 0.15593 [0.6952]

EQ(3) Modelling Dexpr381 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr381_1	-0.514591	0.1440	-3.57	0.001	0.2419
Dexpr381_2	-0.216245	0.1392	-1.55	0.128	0.0569
Constant	-0.0147071	0.02400	-0.613	0.544	0.0093
Dwpp381	3.56230	2.103	1.69	0.098	0.0669
Dcu381_2	0.241384	0.1339	1.80	0.079	0.0751
Dpptr381_2	0.660322	0.2648	2.49	0.017	0.1345
Dexch381	-0.133949	0.09496	-1.41	0.166	0.0474
Dexch381_1	0.0767235	0.1105	0.694	0.492	0.0119
Dexch381_2	-0.310113	0.1970	-1.57	0.123	0.0583
Dexch381_3	-0.253355	0.1238	-2.05	0.047	0.0948

sigma	0.056139	RSS	0.126063535
R^2	0.376998	F(9,40) =	2.689 [0.015]*
log-likelihood	78.6279	DW	1.95
no. of observations	50	no. of parameters	10
mean(Dexpr381)	0.00104847	var(Dexpr381)	0.00404697

AR 1-4 test: F(4,36) = 2.2372 [0.0843]
ARCH 1-4 test: F(4,32) = 0.86390 [0.4961]
Normality test: Chi^2(2) = 0.50306 [0.7776]
hetero test: F(18,21) = 0.21870 [0.9990]
Not enough observations for hetero-X test
RESET test: F(1,39) = 1.1281 [0.2947]

EQ(4) Modelling Dexpr381 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr381_1	-0.417501	0.1320	-3.16	0.003	0.1961
Constant	-0.0192550	0.02423	-0.795	0.431	0.0152
Dwpp381	2.63055	2.051	1.28	0.207	0.0386
Dcu381_2	0.237353	0.1362	1.74	0.089	0.0690
Dpptr381_2	0.667472	0.2693	2.48	0.017	0.1303

Dexch381	-0.119108	0.09610	-1.24	0.222	0.0361
Dexch381_1	0.111525	0.1101	1.01	0.317	0.0244
Dexch381_2	-0.324463	0.2002	-1.62	0.113	0.0602
Dexch381_3	-0.226929	0.1247	-1.82	0.076	0.0748

sigma	0.0570986	RSS	0.133670471
R^2	0.339405	F(8,41) =	2.633 [0.020]*
log-likelihood	77.1631	DW	2.12
no. of observations	50	no. of parameters	9
mean(Dexpr381)	0.00104847	var(Dexpr381)	0.00404697

```
AR 1-4 test:       F(4,37)  =   1.8855 [0.1336]
ARCH 1-4 test:     F(4,33)  =  0.81891 [0.5224]
Normality test:    Chi^2(2) =  0.42066 [0.8103]
hetero test:       F(16,24) =  0.26241 [0.9961]
Not enough observations for hetero-X test
RESET test:        F(1,40)  =   1.8716 [0.1789]
```

EQ(5) Modelling Dexpr381 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr381_1	-0.401957	0.1325	-3.03	0.004	0.1798
Constant	-0.0128545	0.02389	-0.538	0.593	0.0068
Dcu381_2	0.246470	0.1370	1.80	0.079	0.0715
Dpptr381_2	0.786896	0.2547	3.09	0.004	0.1852
Dexch381	-0.139725	0.09547	-1.46	0.151	0.0485
Dexch381_1	0.143651	0.1080	1.33	0.191	0.0404
Dexch381_2	-0.415953	0.1885	-2.21	0.033	0.1039
Dexch381_3	-0.203887	0.1243	-1.64	0.108	0.0602

sigma	0.0575359	RSS	0.139035935
R^2	0.312889	F(7,42) =	2.732 [0.020]*
log-likelihood	76.1792	DW	2.13
no. of observations	50	no. of parameters	8
mean(Dexpr381)	0.00104847	var(Dexpr381)	0.00404697

```
AR 1-4 test:       F(4,38)  =  0.90561 [0.4704]
ARCH 1-4 test:     F(4,34)  =  0.74077 [0.5708]
Normality test:    Chi^2(2) =  0.26789 [0.8746]
hetero test:       F(14,27) =  0.30441 [0.9885]
Not enough observations for hetero-X test
RESET test:        F(1,41)  =  0.82190 [0.3699]
```

EQ(6) Modelling Dexpr381 by OLS
The estimation sample is: 1989 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr381_1	-0.398446	0.1358	-2.93	0.005	0.1667
Constant	-0.00135724	0.02361	-0.0575	0.954	0.0001
Dpptr381_2	0.676508	0.2535	2.67	0.011	0.1421
Dexch381	-0.140683	0.09792	-1.44	0.158	0.0458
Dexch381_1	0.129143	0.1105	1.17	0.249	0.0308
Dexch381_2	-0.502277	0.1869	-2.69	0.010	0.1437
Dexch381_3	-0.0981437	0.1124	-0.874	0.387	0.0174

sigma	0.0590121	RSS	0.149744213
R^2	0.259969	F(6,43) =	2.518 [0.035]*
log-likelihood	74.3243	DW	2.17
no. of observations	50	no. of parameters	7

```
mean(Dexpr381)      0.00104847  var(Dexpr381)       0.00404697

AR 1-4 test:       F(4,39)   =  0.94704 [0.4472]
ARCH 1-4 test:     F(4,35)   =  0.66496 [0.6206]
Normality test:    Chi^2(2)  =   1.5993 [0.4495]
hetero test:       F(12,30)  =  0.29383 [0.9857]
hetero-X test:     F(27,15)  =  0.31959 [0.9952]
RESET test:        F(1,42)   =  0.22818 [0.6354]
```

---

(8) Manufacture of electrical machinery, apparatus, appliances and supplies(ISIC Rev. 2 code: 383)

```
EQ( 1) Modelling Dexpr383 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                   Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr383_1            0.172252     0.1738    0.991   0.330   0.0317
Dexpr383_2           -0.158060     0.1549    -1.02   0.316   0.0335
Dexpr383_3           0.0795181     0.1292    0.615   0.543   0.0125
Constant            -0.0350880    0.04001   -0.877   0.387   0.0250
Dwpp383               -3.18155      2.818    -1.13   0.268   0.0407
Dwpp383_1            0.0884849      3.159   0.0280   0.978   0.0000
Dwpp383_2              3.46022      2.962     1.17   0.252   0.0435
Dwpp383_3             -1.22868      2.648   -0.464   0.646   0.0071
Dcu383             -0.00892088     0.1661  -0.0537   0.958   0.0001
Dcu383_1            -0.0634642     0.1460   -0.435   0.667   0.0063
Dcu383_2              0.103101     0.1411    0.731   0.471   0.0175
Dcu383_3             -0.146909     0.1430    -1.03   0.312   0.0340
Dpptr383             -0.886705     0.3576    -2.48   0.019   0.1701
Dpptr383_1             1.23796     0.3855     3.21   0.003   0.2558
Dpptr383_2           -0.714697     0.3888    -1.84   0.076   0.1012
Dpptr383_3           -0.147111     0.3950   -0.372   0.712   0.0046
Dexch383              0.667803     0.2420     2.76   0.010   0.2024
Dexch383_1           -0.910128     0.2714    -3.35   0.002   0.2727
Dexch383_2            0.603491     0.2927     2.06   0.048   0.1241
Dexch383_3            0.237362     0.2665    0.891   0.380   0.0258

sigma                0.0707311  RSS                0.150086726
R^2                     0.5778  F(19,30) =     2.161 [0.029]*
log-likelihood         74.2672  DW                        1.85
no. of observations         50  no. of parameters           20
mean(Dexpr383)      -0.0218593  var(Dexpr383)       0.00710975

AR 1-4 test:       F(4,26)   =  0.42064 [0.7922]
ARCH 1-4 test:     F(4,22)   =  0.47789 [0.7516]
Normality test:    Chi^2(2)  =   3.6577 [0.1606]
hetero test:       Chi^2(38)=    41.574 [0.3179]
RESET test:        F(1,29)   =   6.9761 [0.0132]*

EQ( 2) Modelling Dexpr383 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                   Coefficient  Std.Error  t-value  t-prob Part.R^2
Dexpr383_1            0.155590     0.1468     1.06   0.296   0.0302
Dexpr383_2           -0.215131     0.1155    -1.86   0.071   0.0879
Constant            -0.0560824    0.03171    -1.77   0.085   0.0799
Dwpp383               -3.74978      2.126    -1.76   0.086   0.0795
```

Dwpp383_2	2.71073	2.169	1.25	0.219	0.0416
Dcu383_2	0.145014	0.1212	1.20	0.239	0.0383
Dcu383_3	-0.120357	0.1253	-0.961	0.343	0.0250
Dpptr383	-0.941159	0.3001	-3.14	0.003	0.2146
Dpptr383_1	1.26435	0.3247	3.89	0.000	0.2963
Dpptr383_2	-0.753435	0.3193	-2.36	0.024	0.1340
Dexch383	0.714838	0.2101	3.40	0.002	0.2434
Dexch383_1	-0.886571	0.2435	-3.64	0.001	0.2691
Dexch383_2	0.677502	0.2136	3.17	0.003	0.2184
Dexch383_3	0.164611	0.1455	1.13	0.265	0.0343

```
sigma                  0.065984  RSS              0.156739941
R^2                    0.559085  F(13,36) =    3.511 [0.001]**
log-likelihood          73.1828  DW                      1.88
no. of observations          50  no. of parameters         14
mean(Dexpr383)       -0.0218593  var(Dexpr383)      0.00710975

AR 1-4 test:       F(4,32)  =  0.33156 [0.8547]
ARCH 1-4 test:     F(4,28)  =  0.34031 [0.8484]
Normality test:    Chi^2(2) =   8.7922 [0.0123]*
hetero test:       F(26,9)  =  0.45737 [0.9423]
Not enough observations for hetero-X test
RESET test:        F(1,35)  =   4.6949 [0.0371]*

EQ( 3) Modelling Dexpr383 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)
```

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dexpr383_2	-0.186065	0.1150	-1.62	0.113	0.0600
Constant	-0.0627207	0.02823	-2.22	0.032	0.1075
Dpptr383	-1.01510	0.2954	-3.44	0.001	0.2236
Dpptr383_1	1.12798	0.2889	3.90	0.000	0.2711
Dpptr383_2	-0.571426	0.2671	-2.14	0.038	0.1004
Dexch383	0.760055	0.2113	3.60	0.001	0.2398
Dexch383_1	-0.769368	0.2092	-3.68	0.001	0.2481
Dexch383_2	0.518467	0.1879	2.76	0.009	0.1567
Dexch383_3	0.214495	0.1211	1.77	0.084	0.0710

```
sigma                 0.0674193  RSS              0.186359698
R^2                    0.475763  F(8,41) =     4.651 [0.000]**
log-likelihood          68.8556  DW                      1.88
no. of observations          50  no. of parameters          9
mean(Dexpr383)       -0.0218593  var(Dexpr383)      0.00710975

AR 1-4 test:       F(4,37)  =  0.94317 [0.4499]
ARCH 1-4 test:     F(4,33)  =   1.6614 [0.1825]
Normality test:    Chi^2(2) =   6.4055 [0.0407]*
hetero test:       F(16,24) =  0.75025 [0.7204]
Not enough observations for hetero-X test
RESET test:        F(1,40)  =   7.7360 [0.0082]**

EQ( 4) Modelling Dexpr383 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)
```

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.0639640	0.02876	-2.22	0.032	0.1054
Dpptr383	-1.10178	0.2961	-3.72	0.001	0.2480
Dpptr383_1	1.14911	0.2941	3.91	0.000	0.2666
Dpptr383_2	-0.461272	0.2632	-1.75	0.087	0.0681
Dexch383	0.817174	0.2123	3.85	0.000	0.2607

```
Dexch383_1          -0.772443     0.2131    -3.62   0.001   0.2382
Dexch383_2           0.446346     0.1860     2.40   0.021   0.1206
Dexch383_3           0.228347     0.1231     1.85   0.071   0.0757

sigma               0.0687045  RSS              0.198253204
R^2                  0.442306  F(7,42) =     4.759 [0.001]**
log-likelihood        67.3089  DW                      1.92
no. of observations        50  no. of parameters          8
mean(Dexpr383)     -0.0218593  var(Dexpr383)     0.00710975

AR 1-4 test:       F(4,38)  =  0.11077 [0.9780]
ARCH 1-4 test:     F(4,34)  =  0.97408 [0.4345]
Normality test:    Chi^2(2) =   2.3827 [0.3038]
hetero test:       F(14,27) =  0.73872 [0.7195]
Not enough observations for hetero-X test
RESET test:        F(1,41)  =   9.1792 [0.0042]**

EQ( 5) Modelling Dexpr383 by OLS
       The estimation sample is: 1989 (1) to 2001 (2)

                   Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant            -0.0814083    0.02762    -2.95   0.005   0.1681
Dpptr383              -1.18404     0.2993    -3.96   0.000   0.2669
Dpptr383_1             1.06702     0.2972     3.59   0.001   0.2306
Dexch383              0.870398     0.2151     4.05   0.000   0.2757
Dexch383_1           -0.655665     0.2073    -3.16   0.003   0.1888
Dexch383_2            0.195135     0.1213     1.61   0.115   0.0568
Dexch383_3            0.184376     0.1234     1.49   0.143   0.0493

sigma               0.0703393  RSS              0.212747287
R^2                  0.401534  F(6,43) =     4.808 [0.001]**
log-likelihood        65.5449  DW                      1.73
no. of observations        50  no. of parameters          7
mean(Dexpr383)     -0.0218593  var(Dexpr383)     0.00710975

AR 1-4 test:       F(4,39)  =  0.21606 [0.9279]
ARCH 1-4 test:     F(4,35)  =   1.2144 [0.3222]
Normality test:    Chi^2(2) =   2.8007 [0.2465]
hetero test:       F(12,30) =   1.3266 [0.2553]
hetero-X test:     F(27,15) =   1.2941 [0.3057]
RESET test:        F(1,42)  =   7.6045 [0.0086]**
```

Note: (*) and (**) signs indicate significance at 5 % and 1 %, respectively.

APPENDIX D

Estimation Results for the Reduction Process of the Difference Models for each Importing Sector[23]:

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(1) Manufacture of textiles (ISIC Rev. 2 code: 321)

```
EQ( 1) Modelling Dimpr321 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr321_1          0.0220559     0.1733    0.127   0.900   0.0005
Dimpr321_2         -0.0186642     0.1775   -0.105   0.917   0.0004
Dimpr321_3           0.117812     0.1743    0.676   0.504   0.0150
Constant           -0.0703963    0.03768    -1.87   0.072   0.1042
Dpptr321             0.159531     0.3474    0.459   0.649   0.0070
Dpptr321_1           0.538976     0.3857     1.40   0.173   0.0611
Dpptr321_2           0.167354     0.3965    0.422   0.676   0.0059
Dpptr321_3           0.121342     0.3612    0.336   0.739   0.0037
Dexchm321           0.0270444     0.2541    0.106   0.916   0.0004
Dexchm321_1         -0.299845     0.2844    -1.05   0.300   0.0357
Dexchm321_2         -0.117536     0.2839   -0.414   0.682   0.0057
Dexchm321_3         -0.136276     0.2614   -0.521   0.606   0.0090
Dwppm321              1.64101      3.840    0.427   0.672   0.0061
Dwppm321_1            3.32525      4.213    0.789   0.436   0.0203
Dwppm321_2           -8.46303      4.034    -2.10   0.044   0.1279
Dwppm321_3            6.40080      3.107     2.06   0.048   0.1239

sigma               0.0539942  RSS              0.0874613309
R^2                  0.440245  F(15,30) =      1.573 [0.142]
log-likelihood        78.8284  DW                       1.89
no. of observations        46  no. of parameters          16
mean(Dimpr321)    -0.00714305  var(Dimpr321)      0.00339673

AR 1-4 test:      F(4,26)  =  0.15052 [0.9611]
ARCH 1-4 test:    F(4,22)  =  0.29721 [0.8766]
Normality test:   Chi^2(2) =  0.49042 [0.7825]
hetero test:      Chi^2(30)=   26.869 [0.6302]
Not enough observations for hetero-X test
RESET test:       F(1,29)  =   2.3102 [0.1394]

EQ( 2) Modelling Dimpr321 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr321_3           0.127894     0.1620    0.789   0.435   0.0180
Constant           -0.0642817    0.02522    -2.55   0.015   0.1605
Dpptr321_1           0.564733     0.3245     1.74   0.091   0.0818
Dpptr321_2           0.181795     0.3157    0.576   0.568   0.0097
Dexchm321            0.124754    0.09227     1.35   0.185   0.0510
Dexchm321_1         -0.297396     0.2553    -1.17   0.252   0.0384
```

[23] (*) and (**) signs indicate significance at 5 % and 1 %, respectively.

```
Dexchm321_2          -0.137707     0.2249   -0.612   0.544   0.0109
Dexchm321_3         -0.0486784     0.1164   -0.418   0.678   0.0051
Dwppm321               2.53867      3.095    0.820   0.418   0.0194
Dwppm321_1             3.31079      3.954    0.837   0.408   0.0202
Dwppm321_2            -8.45004      3.716    -2.27   0.029   0.1320
Dwppm321_3             6.36336      2.879     2.21   0.034   0.1256

sigma                0.0509729  RSS             0.0883402115
R^2                   0.434621  F(11,34) =     2.376 [0.026]*
log-likelihood         78.5985  DW                      1.84
no. of observations         46  no. of parameters         12
mean(Dimpr321)     -0.00714305  var(Dimpr321)     0.00339673

AR 1-4 test:       F(4,30)  = 0.060358 [0.9929]
ARCH 1-4 test:     F(4,26)  =  0.27145 [0.8937]
Normality test:    Chi^2(2) =  0.48988 [0.7827]
hetero test:       F(22,11) =  0.42176 [0.9592]
Not enough observations for hetero-X test
RESET test:        F(1,33)  =   2.2647 [0.1419]

EQ( 3) Modelling Dimpr321 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                 Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr321_3            0.119212     0.1540    0.774   0.444   0.0159
Constant            -0.0629934    0.02147    -2.93   0.006   0.1888
Dpptr321_1            0.575222     0.2572     2.24   0.031   0.1191
Dexchm321             0.115969    0.08748     1.33   0.193   0.0453
Dexchm321_1          -0.332992     0.2071    -1.61   0.116   0.0653
Dwppm321               2.18672      2.724    0.803   0.427   0.0171
Dwppm321_1             4.25993      3.413     1.25   0.220   0.0404
Dwppm321_2            -8.31334      3.409    -2.44   0.020   0.1384
Dwppm321_3             6.34350      2.749     2.31   0.027   0.1258

sigma                0.0491671  RSS             0.0894440611
R^2                   0.427556  F(8,37) =     3.454 [0.005]**
log-likelihood         78.3128  DW                      1.84
no. of observations         46  no. of parameters          9
mean(Dimpr321)     -0.00714305  var(Dimpr321)     0.00339673

AR 1-4 test:       F(4,33)  = 0.054212 [0.9942]
ARCH 1-4 test:     F(4,29)  =  0.23821 [0.9144]
Normality test:    Chi^2(2) =  0.65877 [0.7194]
hetero test:       F(16,20) =  0.42944 [0.9544]
Not enough observations for hetero-X test
RESET test:        F(1,36)  =   1.5190 [0.2258]

EQ( 4) Modelling Dimpr321 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                 Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant            -0.0693435    0.02008    -3.45   0.001   0.2342
Dpptr321_1            0.631902     0.2407     2.63   0.012   0.1502
Dexchm321             0.132011    0.08471     1.56   0.127   0.0586
Dexchm321_1          -0.367591     0.1907    -1.93   0.061   0.0870
Dwppm321_1             6.27877      2.771     2.27   0.029   0.1163
Dwppm321_2            -8.97372      3.269    -2.74   0.009   0.1619
Dwppm321_3             7.38360      2.575     2.87   0.007   0.1742

sigma                0.0488141  RSS             0.0929297812
```

R^2	0.405247	F(6,39) =	4.429 [0.002]**
log-likelihood	77.4335	DW	1.77
no. of observations	46	no. of parameters	7
mean(Dimpr321)	-0.00714305	var(Dimpr321)	0.00339673

AR 1-4 test: F(4,35) = 0.20597 [0.9334]
ARCH 1-4 test: F(4,31) = 0.46795 [0.7588]
Normality test: Chi^2(2) = 1.3455 [0.5103]
hetero test: F(12,26) = 0.38619 [0.9565]
Not enough observations for hetero-X test
RESET test: F(1,38) = 1.7533 [0.1934]

---

(2) Manufacture of industrial chemicals (ISIC Rev.2 code: 351)

EQ(1) Modelling Dimpr351 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr351_1	-0.214396	0.1835	-1.17	0.252	0.0435
Dimpr351_2	-0.336069	0.1938	-1.73	0.093	0.0911
Dimpr351_3	-0.169693	0.1954	-0.869	0.392	0.0245
Constant	0.00519078	0.03846	0.135	0.894	0.0006
Dpptr351	-0.00397725	0.3757	-0.0106	0.992	0.0000
Dpptr351_1	-0.359363	0.3868	-0.929	0.360	0.0280
Dpptr351_2	-0.142543	0.3847	-0.371	0.714	0.0046
Dpptr351_3	-0.159717	0.3639	-0.439	0.664	0.0064
Dexchm351	-0.0436747	0.3583	-0.122	0.904	0.0005
Dexchm351_1	0.398470	0.3744	1.06	0.296	0.0364
Dexchm351_2	-0.0291603	0.3781	-0.0771	0.939	0.0002
Dexchm351_3	0.224886	0.3635	0.619	0.541	0.0126
Dwppm351	1.09572	1.050	1.04	0.305	0.0350
Dwppm351_1	0.604221	1.170	0.516	0.609	0.0088
Dwppm351_2	1.06549	1.159	0.919	0.365	0.0274
Dwppm351_3	-0.209559	0.9601	-0.218	0.829	0.0016

sigma	0.0885602	RSS	0.235287372
R^2	0.296715	F(15,30) =	0.8438 [0.626]
log-likelihood	56.0674	DW	2.07
no. of observations	46	no. of parameters	16
mean(Dimpr351)	0.000220248	var(Dimpr351)	0.00727293

AR 1-4 test: F(4,26) = 2.1272 [0.1060]
ARCH 1-4 test: F(4,22) = 0.42425 [0.7895]
Normality test: Chi^2(2) = 10.386 [0.0056]**
hetero test: Chi^2(30)= 30.459 [0.4423]
Not enough observations for hetero-X test
RESET test: F(1,29) = 2.0478 [0.1631]

EQ(2) Modelling Dimpr351 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr351_1	-0.180364	0.1624	-1.11	0.274	0.0341
Dimpr351_2	-0.306794	0.1718	-1.79	0.083	0.0835
Dimpr351_3	-0.210239	0.1675	-1.26	0.218	0.0431
Constant	0.000647053	0.03519	0.0184	0.985	0.0000
Dpptr351_1	-0.323786	0.3494	-0.927	0.360	0.0239
Dexchm351	-0.0623886	0.1418	-0.440	0.663	0.0055

Dexchm351_1	0.394890	0.3344	1.18	0.246	0.0383
Dexchm351_2	-0.150960	0.1569	-0.962	0.343	0.0258
Dexchm351_3	0.0757557	0.1524	0.497	0.622	0.0070
Dwppm351	1.28994	0.7874	1.64	0.110	0.0712
Dwppm351_2	0.820600	0.7502	1.09	0.282	0.0331

```
sigma                 0.0829452  RSS              0.240796526
R^2                    0.280248  F(10,35) =      1.363 [0.238]
log-likelihood           55.535  DW                      2.15
no. of observations          46  no. of parameters         11
mean(Dimpr351)      0.000220248  var(Dimpr351)      0.00727293

AR 1-4 test:       F(4,31)  =  0.90728 [0.4718]
ARCH 1-4 test:     F(4,27)  =  0.65365 [0.6294]
Normality test:    Chi^2(2) =   8.9213 [0.0116]*
hetero test:       F(20,14) =  0.87628 [0.6157]
Not enough observations for hetero-X test
RESET test:        F(1,34)  =   1.1889 [0.2832]
```

EQ(3) Modelling Dimpr351 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr351_2	-0.270391	0.1472	-1.84	0.074	0.0816
Dimpr351_3	-0.151283	0.1491	-1.01	0.317	0.0264
Constant	0.00865584	0.03364	0.257	0.798	0.0017
Dexchm351	-0.0717474	0.1370	-0.524	0.604	0.0072
Dexchm351_1	0.0986691	0.1513	0.652	0.518	0.0111
Dexchm351_2	-0.213737	0.1497	-1.43	0.161	0.0509
Dexchm351_3	0.0831072	0.1477	0.563	0.577	0.0083
Dwppm351	1.13320	0.6426	1.76	0.086	0.0756

```
sigma                 0.0827257  RSS              0.260054696
R^2                    0.222684  F(7,38) =       1.555 [0.179]
log-likelihood          53.7654  DW                      2.45
no. of observations          46  no. of parameters          8
mean(Dimpr351)      0.000220248  var(Dimpr351)      0.00727293

AR 1-4 test:       F(4,34)  =   1.1803 [0.3369]
ARCH 1-4 test:     F(4,30)  =  0.71314 [0.5895]
Normality test:    Chi^2(2) =   10.856 [0.0044]**
hetero test:       F(14,23) =   1.2523 [0.3065]
Not enough observations for hetero-X test
RESET test:        F(1,37)  =  0.44612 [0.5083]
```

EQ(4) Modelling Dimpr351 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr351_2	-0.262126	0.1470	-1.78	0.082	0.0754
Constant	0.0100580	0.03362	0.299	0.766	0.0023
Dexchm351	-0.0534037	0.1359	-0.393	0.696	0.0039
Dexchm351_1	0.0621587	0.1470	0.423	0.675	0.0046
Dexchm351_2	-0.215407	0.1497	-1.44	0.158	0.0504
Dexchm351_3	0.0887156	0.1476	0.601	0.551	0.0092
Dwppm351	1.21594	0.6377	1.91	0.064	0.0853

```
sigma                 0.0827576  RSS              0.267103688
R^2                    0.201615  F(6,39) =       1.641 [0.162]
log-likelihood          53.1503  DW                      2.41
```

```
no. of observations        46  no. of parameters            7
mean(Dimpr351)    0.000220248  var(Dimpr351)       0.00727293

AR 1-4 test:       F(4,35)   =   1.3533 [0.2700]
ARCH 1-4 test:     F(4,31)   =  0.65001 [0.6312]
Normality test:    Chi^2(2)  =   10.957 [0.0042]**
hetero test:       F(12,26)  =   1.0756 [0.4179]
Not enough observations for hetero-X test
RESET test:        F(1,38)   =  0.19711 [0.6596]

EQ(5) Modelling Dimpr351 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr351_2          -0.263690     0.1397    -1.89   0.066   0.0782
Constant            0.0176511    0.02062    0.856   0.397   0.0171
Dexchm351_2         -0.185188     0.1398    -1.32   0.192   0.0401
Dwppm351              1.31404     0.6036     2.18   0.035   0.1014

sigma                0.080381  RSS              0.271366364
R^2                  0.188873  F(3,42) =       3.26 [0.031]*
log-likelihood        52.7861  DW                      2.34
no. of observations        46  no. of parameters          4
mean(Dimpr351)    0.000220248  var(Dimpr351)      0.00727293

AR 1-4 test:       F(4,38)   =  0.93929 [0.4517]
ARCH 1-4 test:     F(4,34)   =  0.93476 [0.4555]
Normality test:    Chi^2(2)  =   8.3247 [0.0156]*
hetero test:       F(6,35)   =  0.55883 [0.7598]
hetero-X test:     F(9,32)   =  0.35248 [0.9491]
RESET test:        F(1,41)   = 0.060929 [0.8063]
```

(3) Petroleum refineries (ISIC Rev. 2 code: 353)

```
EQ( 1) Modelling Dimpr353 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr353_1          -0.354025     0.1802    -1.97   0.059   0.1140
Dimpr353_2          -0.473015     0.1598    -2.96   0.006   0.2261
Dimpr353_3         -0.0597413     0.1634   -0.366   0.717   0.0044
Constant           -0.0435249    0.05536   -0.786   0.438   0.0202
Dpptr353            -0.287221     0.2770    -1.04   0.308   0.0346
Dpptr353_1           0.190341     0.2857    0.666   0.510   0.0146
Dpptr353_2          -0.459938     0.2506    -1.84   0.076   0.1009
Dpptr353_3       -0.000639932     0.2611  -0.0025   0.998   0.0000
Dexchm353            0.401819     0.3265     1.23   0.228   0.0481
Dexchm353_1         -0.381726     0.3484    -1.10   0.282   0.0385
Dexchm353_2          0.277199     0.3233    0.857   0.398   0.0239
Dexchm353_3          0.365751     0.3189     1.15   0.261   0.0420
Dwppm353              1.44893     0.4621     3.14   0.004   0.2469
Dwppm353_1            1.61786     0.5124     3.16   0.004   0.2494
Dwppm353_2           0.768471     0.5872     1.31   0.201   0.0540
Dwppm353_3         -0.0563991     0.6118  -0.0922   0.927   0.0003

sigma                0.115885  RSS              0.402879164
R^2                  0.697971  F(15,30) =     4.622 [0.000]**
log-likelihood        43.6973  DW                      1.93
```

```
no. of observations        46  no. of parameters          16
mean(Dimpr353)      0.00731017  var(Dimpr353)       0.0289981

AR 1-4 test:      F(4,26)  =   1.1503 [0.3553]
ARCH 1-4 test:    F(4,22)  =  0.31307 [0.8661]
Normality test:   Chi^2(2) =   2.2320 [0.3276]
hetero test:      Chi^2(30)=   33.223 [0.3130]
Not enough observations for hetero-X test
RESET test:       F(1,29)  =0.0037627 [0.9515]

EQ( 2) Modelling Dimpr353 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)
```

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr353_1	-0.306820	0.1372	-2.24	0.032	0.1317
Dimpr353_2	-0.465693	0.1316	-3.54	0.001	0.2752
Constant	-0.0469108	0.04891	-0.959	0.344	0.0271
Dpptr353	-0.289958	0.2637	-1.10	0.279	0.0353
Dpptr353_1	0.226149	0.2449	0.924	0.362	0.0252
Dpptr353_2	-0.489019	0.2351	-2.08	0.045	0.1159
Dexchm353	0.414831	0.3117	1.33	0.192	0.0510
Dexchm353_1	-0.428820	0.3096	-1.38	0.175	0.0549
Dexchm353_2	0.317073	0.2924	1.08	0.286	0.0344
Dexchm353_3	0.379591	0.1986	1.91	0.065	0.0997
Dwppm353	1.44578	0.4206	3.44	0.002	0.2637
Dwppm353_1	1.53902	0.4506	3.42	0.002	0.2612
Dwppm353_2	0.715250	0.5550	1.29	0.206	0.0479

```
sigma                 0.111074  RSS                0.407133253
R^2                   0.694782  F(12,33) =     6.26 [0.000]**
log-likelihood         43.4557  DW                         2.1
no. of observations        46  no. of parameters          13
mean(Dimpr353)      0.00731017  var(Dimpr353)       0.0289981

AR 1-4 test:      F(4,29)  =   1.2370 [0.3171]
ARCH 1-4 test:    F(4,25)  =  0.27726 [0.8899]
Normality test:   Chi^2(2) =   2.4984 [0.2867]
hetero test:      F(24,8)  =  0.75613 [0.7202]
Not enough observations for hetero-X test
RESET test:       F(1,32)  = 0.048839 [0.8265]

EQ( 3) Modelling Dimpr353 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)
```

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr353_1	-0.344117	0.1324	-2.60	0.014	0.1618
Dimpr353_2	-0.478079	0.1302	-3.67	0.001	0.2780
Constant	-0.0415501	0.04879	-0.852	0.400	0.0203
Dpptr353_2	-0.442665	0.2300	-1.92	0.062	0.0957
Dexchm353	0.101291	0.1852	0.547	0.588	0.0085
Dexchm353_1	-0.243168	0.2105	-1.15	0.256	0.0367
Dexchm353_2	0.333201	0.2883	1.16	0.256	0.0368
Dexchm353_3	0.324227	0.1934	1.68	0.103	0.0744
Dwppm353	1.16537	0.3256	3.58	0.001	0.2680
Dwppm353_1	1.69394	0.3964	4.27	0.000	0.3428
Dwppm353_2	0.907943	0.5358	1.69	0.099	0.0758

```
sigma                 0.111152  RSS                0.432415522
R^2                   0.675829  F(10,35) =    7.297 [0.000]**
log-likelihood         42.0701  DW                        2.14
```

```
no. of observations        46  no. of parameters          11
mean(Dimpr353)      0.00731017  var(Dimpr353)       0.0289981

AR 1-4 test:       F(4,31)  =  0.95510 [0.4458]
ARCH 1-4 test:     F(4,27)  = 0.083577 [0.9868]
Normality test:    Chi^2(2) =   2.9671 [0.2268]
hetero test:       F(20,14) =   1.1650 [0.3918]
Not enough observations for hetero-X test
RESET test:        F(1,34)  =  0.24200 [0.6259]
```

(4) Iron and steel basic industries (ISIC Rev. 2 code: 371)

```
EQ( 1) Modelling Dimpr371 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr371_1          -0.398590     0.1687    -2.36   0.025   0.1570
Dimpr371_2          -0.378862     0.1828    -2.07   0.047   0.1253
Dimpr371_3          -0.197279     0.1478    -1.33   0.192   0.0561
Constant           0.00277073    0.03470   0.0798   0.937   0.0002
Dpptr371           -0.0521909     0.2372   -0.220   0.827   0.0016
Dpptr371_1          -0.677297     0.2636    -2.57   0.015   0.1804
Dpptr371_2           0.430110     0.2529     1.70   0.099   0.0879
Dpptr371_3          -0.563826     0.2585    -2.18   0.037   0.1369
Dexchm371          -0.0682699     0.2143   -0.319   0.752   0.0034
Dexchm371_1          0.669084     0.2227     3.00   0.005   0.2313
Dexchm371_2         -0.415715     0.2503    -1.66   0.107   0.0842
Dexchm371_3          0.492771     0.2370     2.08   0.046   0.1260
Dwppm371            -0.481907      1.252   -0.385   0.703   0.0049
Dwppm371_1            4.86479      1.438     3.38   0.002   0.2761
Dwppm371_2           -3.11316      1.561    -1.99   0.055   0.1171
Dwppm371_3            2.32684      1.209     1.92   0.064   0.1099

sigma               0.0705924  RSS               0.14949844
R^2                  0.622781  F(15,30) =    3.302 [0.003]**
log-likelihood        66.4984  DW                      1.78
no. of observations        46  no. of parameters         16
mean(Dimpr371)    -0.00810165  var(Dimpr371)      0.00861558

AR 1-4 test:       F(4,26)  =  0.87016 [0.4950]
ARCH 1-4 test:     F(4,22)  =  0.59658 [0.6689]
Normality test:    Chi^2(2) =   2.1768 [0.3368]
hetero test:       Chi^2(30)=   37.665 [0.1585]
Not enough observations for hetero-X test
RESET test:        F(1,29)  =  0.34632 [0.5608]

EQ( 2) Modelling Dimpr371 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr371_1          -0.362265     0.1594    -2.27   0.030   0.1353
Dimpr371_2          -0.249573     0.1422    -1.75   0.089   0.0853
Constant           0.00750748    0.03122    0.240   0.811   0.0017
Dpptr371_1          -0.672721     0.2385    -2.82   0.008   0.1943
Dpptr371_2           0.479388     0.2380     2.01   0.052   0.1095
Dpptr371_3          -0.538219     0.2249    -2.39   0.023   0.1479
Dexchm371           -0.119507     0.1230   -0.972   0.338   0.0278
Dexchm371_1          0.659975     0.2036     3.24   0.003   0.2415
```

Dexchm371_2	-0.459643	0.2262	-2.03	0.050	0.1112
Dexchm371_3	0.453426	0.2254	2.01	0.052	0.1093
Dwppm371_1	4.21268	1.042	4.04	0.000	0.3311
Dwppm371_2	-2.80554	1.510	-1.86	0.072	0.0947
Dwppm371_3	1.98402	1.090	1.82	0.078	0.0912

```
sigma                0.0694939  RSS                0.15937009
R^2                   0.597872  F(12,33) =    4.089 [0.001]**
log-likelihood         65.0277  DW                       2.01
no. of observations         46  no. of parameters          13
mean(Dimpr371)     -0.00810165  var(Dimpr371)      0.00861558

AR 1-4 test:       F(4,29)   =  0.33853 [0.8497]
ARCH 1-4 test:     F(4,25)   =  0.76281 [0.5594]
Normality test:    Chi^2(2)  =   2.9644 [0.2271]
hetero test:       F(24,8)   =  0.43458 [0.9453]
Not enough observations for hetero-X test
RESET test:        F(1,32)   =  0.55978 [0.4598]
```

EQ(3) Modelling Dimpr371 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr371_1	-0.349966	0.1368	-2.56	0.015	0.1575
Constant	0.00896372	0.03244	0.276	0.784	0.0022
Dpptr371_1	-0.655713	0.2473	-2.65	0.012	0.1673
Dpptr371_2	0.451550	0.2413	1.87	0.070	0.0909
Dpptr371_3	-0.512683	0.2336	-2.20	0.035	0.1210
Dexchm371	-0.0523467	0.1230	-0.426	0.673	0.0051
Dexchm371_1	0.613246	0.2114	2.90	0.006	0.1938
Dexchm371_2	-0.395836	0.2291	-1.73	0.093	0.0786
Dexchm371_3	0.362753	0.2315	1.57	0.126	0.0656
Dwppm371_1	3.52325	1.003	3.51	0.001	0.2606
Dwppm371_2	-1.10401	0.9923	-1.11	0.273	0.0342

```
sigma                 0.072531  RSS               0.184126296
R^2                   0.535406  F(10,35) =    4.033 [0.001]**
log-likelihood         61.7066  DW                       1.92
no. of observations         46  no. of parameters          11
mean(Dimpr371)     -0.00810165  var(Dimpr371)      0.00861558

AR 1-4 test:       F(4,31)   =   1.6961 [0.1760]
ARCH 1-4 test:     F(4,27)   =   1.9182 [0.1362]
Normality test:    Chi^2(2)  =   8.4589 [0.0146]*
hetero test:       F(20,14)  =  0.44765 [0.9508]
Not enough observations for hetero-X test
RESET test:        F(1,34)   =  0.54128 [0.4669]
```

EQ(4) Modelling Dimpr371 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr371_1	-0.435073	0.1295	-3.36	0.002	0.2337
Constant	0.0189131	0.03268	0.579	0.566	0.0090
Dpptr371_1	-0.390882	0.2189	-1.79	0.082	0.0794
Dpptr371_3	-0.362515	0.2213	-1.64	0.110	0.0676
Dexchm371	-0.100899	0.1230	-0.820	0.417	0.0179
Dexchm371_1	0.436372	0.1985	2.20	0.034	0.1155
Dexchm371_2	-0.0285258	0.1394	-0.205	0.839	0.0011
Dexchm371_3	0.168016	0.2153	0.780	0.440	0.0162

Dwppm371_1	3.02860	0.7318	4.14	0.000	0.3165

```
sigma                 0.0748639  RSS              0.20737017
R^2                    0.476757  F(8,37) =     4.214 [0.001]**
log-likelihood          58.9723  DW                     1.89
no. of observations          46  no. of parameters         9
mean(Dimpr371)      -0.00810165  var(Dimpr371)      0.00861558

AR 1-4 test:       F(4,33)  =   2.7164 [0.0464]*
ARCH 1-4 test:     F(4,29)  =  0.70503 [0.5950]
Normality test:    Chi^2(2) =   5.9408 [0.0513]
hetero test:       F(16,20) =  0.61800 [0.8339]
Not enough observations for hetero-X test
RESET test:        F(1,36)  =  0.95889 [0.3340]
```

EQ(5) Modelling Dimpr371 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr371_1	-0.455210	0.1302	-3.50	0.001	0.2386
Constant	-0.00699748	0.03088	-0.227	0.822	0.0013
Dexchm371	-0.109637	0.1249	-0.878	0.385	0.0194
Dexchm371_1	0.212448	0.1380	1.54	0.132	0.0573
Dexchm371_2	0.0143647	0.1422	0.101	0.920	0.0003
Dexchm371_3	-0.160696	0.1359	-1.18	0.244	0.0346
Dwppm371_1	2.20889	0.6386	3.46	0.001	0.2348

```
sigma                 0.0772072  RSS             0.232477161
R^2                    0.413406  F(6,39) =     4.581 [0.001]**
log-likelihood          56.3437  DW                     2.01
no. of observations          46  no. of parameters         7
mean(Dimpr371)      -0.00810165  var(Dimpr371)      0.00861558

AR 1-4 test:       F(4,35)  =   1.3194 [0.2819]
ARCH 1-4 test:     F(4,31)  =  0.94181 [0.4529]
Normality test:    Chi^2(2) =   11.356 [0.0034]**
hetero test:       F(12,26) =  0.71846 [0.7208]
Not enough observations for hetero-X test
RESET test:        F(1,38)  =   1.0098 [0.3213]
```

(5) Manufacture of fabricated metal products, except machinery and equipment (ISIC Rev. 2 code: 381)

EQ(1) Modelling Dimpr381 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr381_1	-0.523155	0.1812	-2.89	0.007	0.2174
Dimpr381_2	-0.323873	0.1758	-1.84	0.075	0.1017
Dimpr381_3	-0.0279251	0.1716	-0.163	0.872	0.0009
Constant	-0.00582809	0.09215	-0.0632	0.950	0.0001
Dpptr381	-0.439552	0.9560	-0.460	0.649	0.0070
Dpptr381_1	-1.47865	1.021	-1.45	0.158	0.0654
Dpptr381_2	-1.35952	1.218	-1.12	0.273	0.0399
Dpptr381_3	-0.750850	1.151	-0.652	0.519	0.0140
Dexchm381	-0.000587252	0.7175	-0.00082	0.999	0.0000
Dexchm381_1	0.492219	0.8355	0.589	0.560	0.0114
Dexchm381_2	1.25051	0.9428	1.33	0.195	0.0554

Dexchm381_3	1.13547	0.8202	1.38	0.176	0.0600
Dwppm381	0.0482749	10.63	0.00454	0.996	0.0000
Dwppm381_1	18.9680	11.50	1.65	0.110	0.0831
Dwppm381_2	2.92941	10.29	0.285	0.778	0.0027
Dwppm381_3	0.700255	9.269	0.0756	0.940	0.0002

sigma	0.173988	RSS	0.908155347
R^2	0.410276	F(15,30) =	1.391 [0.214]
log-likelihood	25.0034	DW	2
no. of observations	46	no. of parameters	16
mean(Dimpr381)	-0.00401552	var(Dimpr381)	0.0334775

AR 1-4 test: F(4,26) = 0.044757 [0.9960]
ARCH 1-4 test: F(4,22) = 0.21913 [0.9249]
Normality test: Chi^2(2) = 3.4820 [0.1753]
hetero test: Chi^2(30)= 30.470 [0.4418]
Not enough observations for hetero-X test
RESET test: F(1,29) = 0.077350 [0.7829]

EQ(2) Modelling Dimpr381 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr381_1	-0.477699	0.1484	-3.22	0.003	0.2236
Dimpr381_2	-0.298646	0.1411	-2.12	0.041	0.1106
Constant	-0.00730497	0.07343	-0.0995	0.921	0.0003
Dpptr381_1	-1.63665	0.8978	-1.82	0.077	0.0845
Dpptr381_2	-1.69670	0.9411	-1.80	0.080	0.0828
Dexchm381	-0.213427	0.3211	-0.665	0.511	0.0121
Dexchm381_1	0.372302	0.7206	0.517	0.609	0.0074
Dexchm381_2	1.62169	0.6330	2.56	0.015	0.1542
Dexchm381_3	0.609524	0.3423	1.78	0.083	0.0810
Dwppm381_1	19.0159	6.758	2.81	0.008	0.1803

sigma	0.161472	RSS	0.938640829
R^2	0.39048	F(9,36) =	2.563 [0.022]*
log-likelihood	24.244	DW	2.15
no. of observations	46	no. of parameters	10
mean(Dimpr381)	-0.00401552	var(Dimpr381)	0.0334775

AR 1-4 test: F(4,32) = 0.34355 [0.8465]
ARCH 1-4 test: F(4,28) = 0.17064 [0.9516]
Normality test: Chi^2(2) = 5.3863 [0.0677]
hetero test: F(18,17) = 0.57411 [0.8737]
Not enough observations for hetero-X test
RESET test: F(1,35) = 0.15875 [0.6927]

EQ(3) Modelling Dimpr381 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr381_1	-0.462125	0.1435	-3.22	0.003	0.2143
Dimpr381_2	-0.293595	0.1371	-2.14	0.039	0.1077
Constant	-0.0227754	0.05950	-0.383	0.704	0.0038
Dpptr381_1	-1.22946	0.3981	-3.09	0.004	0.2006
Dpptr381_2	-2.02407	0.7722	-2.62	0.013	0.1531
Dexchm381_2	1.79382	0.5676	3.16	0.003	0.2082
Dexchm381_3	0.621356	0.3335	1.86	0.070	0.0837
Dwppm381_1	19.5731	6.489	3.02	0.005	0.1932

```
sigma                  0.158195  RSS               0.950979537
R^2                    0.382467  F(7,38) =     3.362 [0.007]**
log-likelihood          23.9436  DW                       2.15
no. of observations          46  no. of parameters           8
mean(Dimpr381)      -0.00401552  var(Dimpr381)       0.0334775

AR 1-4 test:       F(4,34)  =  0.41548 [0.7963]
ARCH 1-4 test:     F(4,30)  =  0.16221 [0.9558]
Normality test:    Chi^2(2) =   6.0109 [0.0495]*
hetero test:       F(14,23) =  0.59755 [0.8398]
Not enough observations for hetero-X test
RESET test:        F(1,37)  = 0.049276 [0.8255]
```

---

(6) Manufacture of machinery except electrical (ISIC Rev. 2 code: 382)

```
EQ( 1) Modelling Dimpr382 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                   Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr382_1          -0.0989841     0.1804   -0.549   0.587   0.0099
Dimpr382_2          -0.0684918     0.1813   -0.378   0.708   0.0047
Dimpr382_3          -0.0818656     0.1772   -0.462   0.647   0.0071
Constant            -0.0920900    0.06372    -1.45   0.159   0.0651
Dpptr382             -0.821846     0.4828    -1.70   0.099   0.0881
Dpptr382_1            0.724003     0.4685     1.55   0.133   0.0737
Dpptr382_2           -0.286305     0.4681   -0.612   0.545   0.0123
Dpptr382_3           -0.301102     0.4158   -0.724   0.475   0.0172
Dexchm382             0.807507     0.3346     2.41   0.022   0.1626
Dexchm382_1          -0.224833     0.3447   -0.652   0.519   0.0140
Dexchm382_2         0.00260912     0.3361  0.00776   0.994   0.0000
Dexchm382_3           0.526621     0.3272     1.61   0.118   0.0795
Dwppm382               4.24714      7.082    0.600   0.553   0.0118
Dwppm382_1            -2.89496      7.659   -0.378   0.708   0.0047
Dwppm382_2             11.6179      7.230     1.61   0.119   0.0792
Dwppm382_3            -6.35575      6.558   -0.969   0.340   0.0304

sigma                 0.0883796  RSS                0.23432861
R^2                    0.321527  F(15,30) =     0.9478 [0.527]
log-likelihood          56.1613  DW                        2.2
no. of observations          46  no. of parameters          16
mean(Dimpr382)       0.00296117  var(Dimpr382)      0.00750818

AR 1-4 test:       F(4,26)  =   1.4371 [0.2499]
ARCH 1-4 test:     F(4,22)  =  0.18496 [0.9437]
Normality test:    Chi^2(2) =   5.0983 [0.0781]
hetero test:       Chi^2(30)=   18.943 [0.9412]
Not enough observations for hetero-X test
RESET test:        F(1,29)  =   2.1914 [0.1496]

EQ( 2) Modelling Dimpr382 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                   Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant            -0.0780955    0.05069    -1.54   0.132   0.0619
Dpptr382             -0.856032     0.4261    -2.01   0.052   0.1008
Dpptr382_1            0.597375     0.3895     1.53   0.134   0.0613
Dpptr382_3           -0.389961     0.3526    -1.11   0.276   0.0329
Dexchm382             0.782456     0.2894     2.70   0.010   0.1688
```

```
Dexchm382_1         -0.115665      0.2591   -0.446   0.658   0.0055
Dexchm382_2         -0.216083      0.1595    -1.35   0.184   0.0485
Dexchm382_3          0.582297      0.2702     2.15   0.038   0.1142
Dwppm382_2            8.79540       3.991     2.20   0.034   0.1189
Dwppm382_3           -4.07090       3.834    -1.06   0.295   0.0304

sigma               0.0822952  RSS                0.243810076
R^2                  0.294074  F(9,36) =       1.666 [0.134]
log-likelihood         55.249  DW                        2.32
no. of observations        46  no. of parameters           10
mean(Dimpr382)     0.00296117  var(Dimpr382)      0.00750818

AR 1-4 test:       F(4,32)  =  0.37340 [0.8258]
ARCH 1-4 test:     F(4,28)  =  0.25479 [0.9043]
Normality test:    Chi^2(2) =   4.9772 [0.0830]
hetero test:       F(18,17) =  0.28350 [0.9944]
Not enough observations for hetero-X test
RESET test:        F(1,35)  =  0.57809 [0.4522]

EQ( 3) Modelling Dimpr382 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant           -0.0950088    0.04129    -2.30   0.027   0.1196
Dpptr382            -0.566886     0.4012    -1.41   0.166   0.0487
Dexchm382            0.532624     0.2578     2.07   0.046   0.0986
Dexchm382_1          0.219310     0.1525     1.44   0.158   0.0503
Dexchm382_2        -0.0984925     0.1454   -0.677   0.502   0.0116
Dexchm382_3          0.338411     0.1616     2.09   0.043   0.1010
Dwppm382_2            7.03079      3.343     2.10   0.042   0.1019

sigma               0.0832411  RSS                 0.27023435
R^2                  0.217565  F(6,39) =       1.807 [0.123]
log-likelihood        52.8823  DW                        2.34
no. of observations        46  no. of parameters            7
mean(Dimpr382)     0.00296117  var(Dimpr382)      0.00750818

AR 1-4 test:       F(4,35)  =  0.50860 [0.7297]
ARCH 1-4 test:     F(4,31)  =  0.26405 [0.8988]
Normality test:    Chi^2(2) =   4.8556 [0.0882]
hetero test:       F(12,26) =  0.24356 [0.9932]
Not enough observations for hetero-X test
RESET test:        F(1,38)  =  0.16320 [0.6885]

EQ( 4) Modelling Dimpr382 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant           -0.0918328    0.03699    -2.48   0.017   0.1279
Dexchm382            0.258180     0.1330     1.94   0.059   0.0824
Dexchm382_3          0.211896     0.1402     1.51   0.138   0.0516
Dwppm382_2            6.43772      3.331     1.93   0.060   0.0817

sigma               0.0835891  RSS                0.293460044
R^2                  0.150318  F(3,42) =       2.477 [0.074]
log-likelihood        50.9859  DW                         2.4
no. of observations        46  no. of parameters            4
mean(Dimpr382)     0.00296117  var(Dimpr382)      0.00750818

AR 1-4 test:       F(4,38)  =  0.72273 [0.5818]
```

```
ARCH 1-4 test:     F(4,34)   =  0.21645 [0.9275]
Normality test:    Chi^2(2) =   4.0731 [0.1305]
hetero test:       F(6,35)   =  0.30866 [0.9282]
hetero-X test:     F(9,32)   =  0.26947 [0.9785]
RESET test:        F(1,41)   = 0.036573 [0.8493]
```

(7) Manufacture of electrical machinery, apparatus, appliances and supplies (ISIC Rev. 2 code: 383)

```
EQ( 1) Modelling Dimpr383 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr383_1          -0.216352     0.1759    -1.23   0.228   0.0480
Dimpr383_2          -0.238645     0.1727    -1.38   0.177   0.0598
Dimpr383_3          0.0680578     0.1725    0.395   0.696   0.0052
Constant           -0.0393165    0.09177   -0.428   0.671   0.0061
Dpptr383             0.408992      1.050    0.389   0.700   0.0050
Dpptr383_1           0.618308      1.205    0.513   0.612   0.0087
Dpptr383_2           0.972683      1.244    0.782   0.440   0.0200
Dpptr383_3          -0.402504      1.051   -0.383   0.705   0.0049
Dexchm383           -0.160704     0.7644   -0.210   0.835   0.0015
Dexchm383_1         -0.342525     0.9101   -0.376   0.709   0.0047
Dexchm383_2        -0.0204389     0.9215  -0.0222   0.982   0.0000
Dexchm383_3         -0.442184     0.7280   -0.607   0.548   0.0121
Dwppm383              13.8802      8.149     1.70   0.099   0.0882
Dwppm383_1          -0.382652      8.780  -0.0436   0.966   0.0001
Dwppm383_2           0.570490      8.326   0.0685   0.946   0.0002
Dwppm383_3           -9.28788      7.824    -1.19   0.244   0.0449

sigma                 0.18853  RSS               1.06630351
R^2                  0.366973  F(15,30) =      1.159 [0.352]
log-likelihood         21.311  DW                      1.71
no. of observations        46  no. of parameters         16
mean(Dimpr383)     0.00726805  var(Dimpr383)      0.0366185

AR 1-4 test:       F(4,26)   =   2.5745 [0.0613]
ARCH 1-4 test:     F(4,22)   =   1.7416 [0.1768]
Normality test:    Chi^2(2) =   12.738 [0.0017]**
hetero test:       Chi^2(30)=   38.021 [0.1492]
Not enough observations for hetero-X test
RESET test:        F(1,29)   =   14.031 [0.0008]**

EQ( 2) Modelling Dimpr383 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Dimpr383_1          -0.238390     0.1479    -1.61   0.116   0.0691
Dimpr383_2          -0.267016     0.1438    -1.86   0.072   0.0897
Constant           -0.0632561    0.07622   -0.830   0.412   0.0193
Dpptr383_1           0.840924      1.016    0.828   0.413   0.0192
Dpptr383_2           0.795477     0.9939    0.800   0.429   0.0180
Dexchm383            0.141370     0.3062    0.462   0.647   0.0061
Dexchm383_1         -0.474297     0.7981   -0.594   0.556   0.0100
Dexchm383_2          0.154697     0.6809    0.227   0.822   0.0015
Dexchm383_3         -0.627555     0.3214    -1.95   0.059   0.0982
Dwppm383              13.8846      6.321     2.20   0.035   0.1212
Dwppm383_3           -9.15051      6.109    -1.50   0.143   0.0603
```

sigma	0.175821	RSS	1.08195307
R^2	0.357682	F(10,35) =	1.949 [0.071]
log-likelihood	20.9759	DW	1.76
no. of observations	46	no. of parameters	11
mean(Dimpr383)	0.00726805	var(Dimpr383)	0.0366185

AR 1-4 test: F(4,31) = 1.8125 [0.1516]
ARCH 1-4 test: F(4,27) = 2.2748 [0.0873]
Normality test: Chi^2(2) = 13.987 [0.0009]**
hetero test: F(20,14) = 2.8678 [0.0241]*
Not enough observations for hetero-X test
RESET test: F(1,34) = 10.282 [0.0029]**

EQ(3) Modelling Dimpr383 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr383_1	-0.198533	0.1457	-1.36	0.181	0.0478
Dimpr383_2	-0.231917	0.1429	-1.62	0.113	0.0665
Constant	-0.0140049	0.06950	-0.201	0.841	0.0011
Dexchm383	0.0343270	0.2799	0.123	0.903	0.0004
Dexchm383_1	-0.0402925	0.3068	-0.131	0.896	0.0005
Dexchm383_2	0.743142	0.3098	2.40	0.022	0.1346
Dexchm383_3	-0.536822	0.3170	-1.69	0.099	0.0719
Dwppm383	14.7228	6.237	2.36	0.024	0.1309
Dwppm383_3	-10.8380	5.965	-1.82	0.077	0.0819

sigma	0.176927	RSS	1.1582141
R^2	0.312409	F(8,37) =	2.101 [0.061]
log-likelihood	19.4094	DW	1.79
no. of observations	46	no. of parameters	9
mean(Dimpr383)	0.00726805	var(Dimpr383)	0.0366185

AR 1-4 test: F(4,33) = 1.8843 [0.1365]
ARCH 1-4 test: F(4,29) = 4.2660 [0.0078]**
Normality test: Chi^2(2) = 17.995 [0.0001]**
hetero test: F(16,20) = 2.9378 [0.0122]*
Not enough observations for hetero-X test
RESET test: F(1,36) = 9.6072 [0.0038]**

EQ(4) Modelling Dimpr383 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.00536846	0.07042	-0.0762	0.940	0.0001
Dexchm383	0.0470341	0.2854	0.165	0.870	0.0007
Dexchm383_1	-0.0336850	0.3133	-0.108	0.915	0.0003
Dexchm383_2	0.769525	0.3162	2.43	0.020	0.1319
Dexchm383_3	-0.665382	0.3110	-2.14	0.039	0.1050
Dwppm383	14.6731	6.275	2.34	0.025	0.1230
Dwppm383_3	-12.0367	6.059	-1.99	0.054	0.0919

sigma	0.180706	RSS	1.27352894
R^2	0.243951	F(6,39) =	2.097 [0.076]
log-likelihood	17.2264	DW	2.13
no. of observations	46	no. of parameters	7
mean(Dimpr383)	0.00726805	var(Dimpr383)	0.0366185

AR 1-4 test: F(4,35) = 1.5988 [0.1964]

ARCH 1-4 test: F(4,31) = 0.64717 [0.6331]
Normality test: Chi^2(2) = 22.830 [0.0000]**
hetero test: F(12,26) = 0.72081 [0.7187]
Not enough observations for hetero-X test
RESET test: F(1,38) =0.0037029 [0.9518]

(8) Manufacture of transport equipment (ISIC Rev. 2 code: 384)

EQ(1) Modelling Dimpr384 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Dimpr384_1	-0.0429855	0.1806	-0.238	0.813	0.0019
Dimpr384_2	0.00740488	0.1847	0.0401	0.968	0.0001
Dimpr384_3	-0.0170613	0.1858	-0.0918	0.927	0.0003
Constant	-0.0972826	0.05847	-1.66	0.107	0.0845
Dpptr384	-0.721045	0.5680	-1.27	0.214	0.0510
Dpptr384_1	-0.368476	0.6275	-0.587	0.561	0.0114
Dpptr384_2	0.433380	0.6161	0.703	0.487	0.0162
Dpptr384_3	0.730053	0.5858	1.25	0.222	0.0492
Dexchm384	0.315845	0.2628	1.20	0.239	0.0459
Dexchm384_1	0.275757	0.2914	0.946	0.351	0.0290
Dexchm384_2	0.0425257	0.2904	0.146	0.885	0.0007
Dexchm384_3	-0.243019	0.2550	-0.953	0.348	0.0294
Dwppm384	2.28445	2.638	0.866	0.393	0.0244
Dwppm384_1	1.80381	2.482	0.727	0.473	0.0173
Dwppm384_2	-0.649654	2.497	-0.260	0.797	0.0023
Dwppm384_3	2.53699	2.523	1.01	0.323	0.0326

sigma	0.0695973	RSS	0.14531357
R^2	0.220823	F(15,30) =	0.5668 [0.877]
log-likelihood	67.1514	DW	2.1
no. of observations	46	no. of parameters	16
mean(Dimpr384)	-0.0104096	var(Dimpr384)	0.00405427

AR 1-4 test: F(4,26) = 1.0032 [0.4238]
ARCH 1-4 test: F(4,22) = 0.17042 [0.9512]
Normality test: Chi^2(2) = 0.54364 [0.7620]
hetero test: Chi^2(30)= 26.985 [0.6241]
Not enough observations for hetero-X test
RESET test: F(1,29) =0.00017397 [0.9896]

EQ(2) Modelling Dimpr384 by OLS
The estimation sample is: 1990 (1) to 2001 (2)

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	-0.100160	0.04900	-2.04	0.049	0.1066
Dpptr384	-0.839603	0.4822	-1.74	0.090	0.0797
Dpptr384_2	0.308505	0.5070	0.609	0.547	0.0105
Dpptr384_3	0.662388	0.4719	1.40	0.169	0.0533
Dexchm384	0.393840	0.2130	1.85	0.073	0.0890
Dexchm384_1	0.125864	0.1385	0.909	0.370	0.0230
Dexchm384_2	0.0540091	0.2485	0.217	0.829	0.0013
Dexchm384_3	-0.211710	0.2187	-0.968	0.340	0.0261
Dwppm384	2.46095	2.288	1.08	0.289	0.0320
Dwppm384_1	1.11697	2.048	0.545	0.589	0.0084
Dwppm384_3	2.41579	2.199	1.10	0.280	0.0333

sigma	0.0649074	RSS	0.147453878

```
R^2                  0.209347  F(10,35) =     0.9267 [0.521]
log-likelihood        66.8151  DW                      2.16
no. of observations        46  no. of parameters         11
mean(Dimpr384)     -0.0104096  var(Dimpr384)      0.00405427

AR 1-4 test:      F(4,31)  =  0.53551 [0.7106]
ARCH 1-4 test:    F(4,27)  =  0.12300 [0.9730]
Normality test:   Chi^2(2) =  0.40201 [0.8179]
hetero test:      F(20,14) =  0.36709 [0.9799]
Not enough observations for hetero-X test
RESET test:       F(1,34)  =0.0031061 [0.9559]

EQ( 3) Modelling Dimpr384 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant           -0.0845016    0.04379    -1.93   0.061   0.0915
Dpptr384            -0.781307     0.4494    -1.74   0.090   0.0755
Dpptr384_3           0.793023     0.4126     1.92   0.062   0.0908
Dexchm384            0.365870     0.1993     1.84   0.074   0.0835
Dexchm384_1          0.102701     0.1265    0.812   0.422   0.0175
Dexchm384_2          0.173743     0.1225     1.42   0.164   0.0516
Dexchm384_3         -0.252714     0.2041    -1.24   0.224   0.0398
Dwppm384              2.79954      2.180     1.28   0.207   0.0427
Dwppm384_3            2.24234      2.095     1.07   0.291   0.0300

sigma               0.0636734  RSS               0.1500092
R^2                  0.195645  F(8,37) =      1.125 [0.370]
log-likelihood        66.4199  DW                      2.18
no. of observations        46  no. of parameters          9
mean(Dimpr384)     -0.0104096  var(Dimpr384)      0.00405427

AR 1-4 test:      F(4,33)  =  0.57999 [0.6792]
ARCH 1-4 test:    F(4,29)  =  0.13333 [0.9688]
Normality test:   Chi^2(2) =  0.56069 [0.7555]
hetero test:      F(16,20) =  0.30723 [0.9899]
Not enough observations for hetero-X test
RESET test:       F(1,36)  =   1.2614 [0.2688]

EQ( 4) Modelling Dimpr384 by OLS
       The estimation sample is: 1990 (1) to 2001 (2)

                  Coefficient  Std.Error  t-value  t-prob Part.R^2
Constant           -0.0766857    0.04326    -1.77   0.084   0.0764
Dpptr384            -0.844129     0.4464    -1.89   0.066   0.0860
Dpptr384_3           0.830387     0.4119     2.02   0.051   0.0966
Dexchm384            0.362849     0.1996     1.82   0.077   0.0800
Dexchm384_1          0.121047     0.1256    0.964   0.341   0.0239
Dexchm384_2          0.187821     0.1220     1.54   0.132   0.0587
Dexchm384_3         -0.268585     0.2040    -1.32   0.196   0.0436
Dwppm384              3.67107      2.026     1.81   0.078   0.0795

sigma               0.0637956  RSS             0.154655432
R^2                  0.170732  F(7,38) =      1.118 [0.372]
log-likelihood        65.7184  DW                      2.17
no. of observations        46  no. of parameters          8
mean(Dimpr384)     -0.0104096  var(Dimpr384)      0.00405427

AR 1-4 test:      F(4,34)  =  0.75217 [0.5635]
ARCH 1-4 test:    F(4,30)  =  0.19992 [0.9364]
```

```
Normality test:   Chi^2(2) =   2.2189 [0.3297]
hetero test:      F(14,23) =  0.36344 [0.9731]
Not enough observations for hetero-X test
RESET test:       F(1,37)  =  0.23747 [0.6289]
```

Note: (*) and (**) signs indicate significance at 5 % and 1 %, respectively.