EXPORT RESPONSE TO THE REDUCTION OF ANTI-EXPORT BIAS: EMPIRICS FROM BANGLADESH

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Abstract

The paper assesses the relationship between export growth of Bangladesh and trade liberalisation, the latter being proxied by the reduction of anti-export bias. In the empirical analysis, separate supply equations for total exports, (total) manufacturing exports, and textiles and readymade garment exports have been undertaken using quarterly time series data. The empirical results, based on vector error correction modelling (VECM), show that trade liberalisation has both long run and contemporaneous effects on total exports, manufacturing exports, and textiles and readymade garment exports supply. Besides, domestic price, export price, anti-export bias reduction, the degree of openness and production capacity all have either unidirectional or bi-directional causality between them.

Key Words: anti-export bias reduction, cointegration, error correction modeling, general-to-specific modeling, granger causality, trade liberalisation.

(JEL Code: C32, F13, F14.)

1. INTRODUCTION

The purpose of the paper is to empirically examine the relationship between expansion of exports and trade liberalisation as proxied by the trade policy bias (TPB) or anti-export bias, in an underdeveloped economy. The trade policy bias (TPB) or anti-export bias is defined as the ratio of the real effective exchange rate applied to exports ($REER_X$) to the real effective exchange rate applied to imports ($REER_M$)[1] $REER_X$ and $REER_M$ are the weighted indices of the nominal bilateral exchange rates for exports and imports respectively of Bangladesh's major trading partners, adjusted for the changes in the domestic consumer prices relative to the partner countries. The weights used are the 1995 export- and import shares respectively of 22 major trading partners of Bangladesh.[2] This is precisely the method advocated by Bahmani-Oskoooee (1995) except that we calculate the one-dollar equivalent of Bangladesh *taka* instead of vice versa and that we replace the official exchange rate by the nominal exchange rates for exports and imports. As defined, an increase in $REER_X$ or $REER_M$ represents depreciation and, hence, an increase TPB represents anti-export bias reduction

The rationale for the study stems from the contention that recent expansion of exports of the developing countries in general, and that of the High Performance Asian Economies (HPAEs) in particular, is the result of the implementation of export-oriented growth strategies in the 1970s and the 1980s spearheaded by an increase in manufacturing exports. Manufacturing exports have emerged as the new engine of the export-oriented growth for these countries replacing the total-export engine [Reidel, 1993; Helleiner, 1994 and 1995; Weiss, 1992; Thomas and Nash, 1991;

[1] The definition follows from Bhagwati (1978). A value of $REER_X/REER_M = 1$ is described as a pro-export bias strategy. $REER_X/REER_M > 1$ represents an ultra pro-export bias regime. while $REER_X/REER_M < 1$ indicates an anti-export bias policy.

[2] The countries considered here include: Australia, Belgium, Canada, Denmark, France, Germany, Hong Kong, India, Indonesia, Italy, Japan, Korea, Malaysia, the Netherlands, Norway, Pakistan, Singapore, Spain, Sweden, Switzerland, UK and USA which accounted for 87% of Bangladesh's exports and 68% of imports in 1995. The two

Joshi and little, 1996; and Krueger, 1997]. These two propositions constitute the controversial *de novo* hypothesis. The anti-export bias reduction hypothesis formed in this study postulates that a typical developing country experimented with an import-substituting industrialising (ISI) strategy and used it as a stepping stone to embark on export-led growth, whilst the *de novo* hypothesis denies the stepping stone effect of the ISI and asserts that export oriented manufacturing industries started a new engine of growth. Several studies (Little et al. (1970), Balassa (1971 and 1982), Bhagwati (1978), Krueger (1978), Michaely et al. (1991) and Athukorala (1998)) suggest that there is a positive relationship between trade liberalisation and export expansion. On the other hand, studies by UNCTAD (1989), Agosin (1991), Shafaeuddin (1994), Clarke and Kirkpatrick (1992) find that trade liberalisation retarded export expansion.

In this paper we attempt to shed light on this controversial issue by using Bangladesh as a case study. Bangladesh inherited an inward-oriented policy regime at its independence in 1971, which it continued until the early part of the 1980's. The country has, in effect, been pursuing an outward-looking strategy since 1982, when it initiated the structural adjustment programmes at the behest of the World Bank. The three key areas of the Bangladesh economy, trade, financial and fiscal, have undergone various types of changes although the trade sector reforms stand out to be the most significant [World Bank 1996:V]. It is, therefore, worthwhile to examine how exports responded to these stimuli. Bangladesh experience provides insights on how trade liberalisation promoted exports [Rahman, 1992 and 1995; Bayes, et al., 1995; Hossain et al., 1997; Ahmed, 2000]. However, barring Ahmed (2000), these studies are flawed as they are subject to spurious statistical inferences because of the failure to test for stochastic trends (unit roots) in the time series data. Ahmed (2000) presents a more rigorous treatment of the issue. However, the study suffers from two serious drawbacks. First, it uses the ratio of unit export

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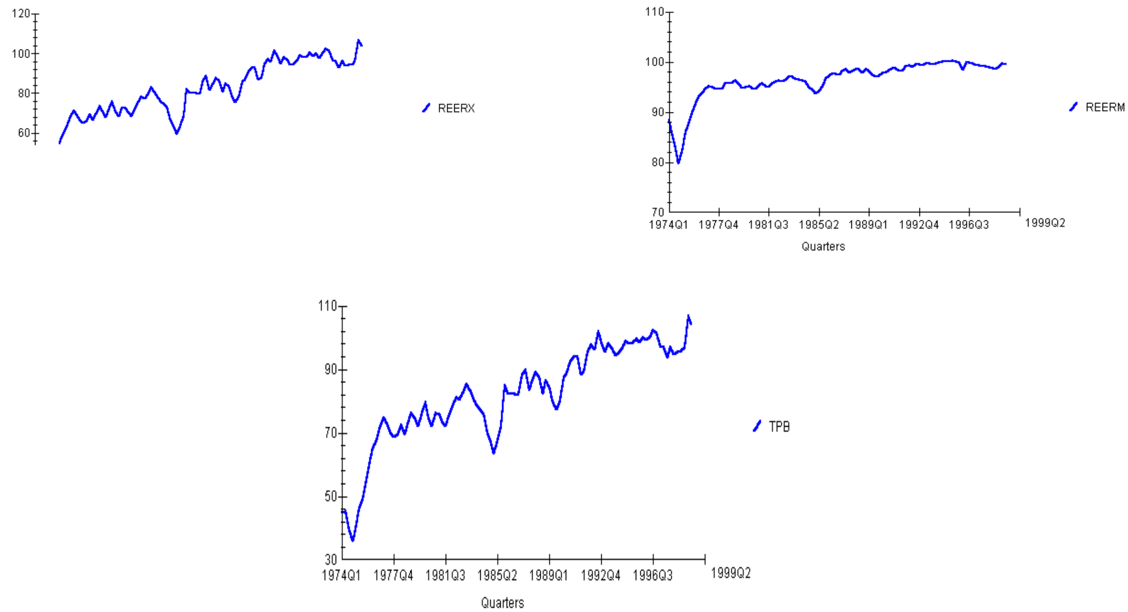
notable omissions are China and Thailand especially from the point of view of imports. These two countries could not be included due to lack of consistent data set for the exchange rates and the consumer price indices.

price of Bangladesh to that of the industrialised countries as the relative price of Bangladesh's exports. From the exporting country's point of view, this makes sense only if interpreted as an index of international competitiveness. Even in that case, the unit price index of the underdeveloped countries would have been more appropriate since these are the countries Bangladesh competes with in the world export market. Second, the study identifies 1991 as the breakpoint of the policy regime. But available documents and studies show that the rationalisation of the trade regime started in 1982 and was further consolidated in 1985-86 before being overhauled by a third intensive phase beginning in 1991 [Shand and Alauddin, 1996; Salim, 1999]. The present study overcomes the drawbacks mentioned above by choosing more appropriate variables. The study also explicitly defines and calculates a trade policy bias index (TPB) and uses it as a separate argument rather than using $REER_X$ to proxy for it. Indeed, the construction of the anti-export bias index itself constitutes part of the contribution of this study. Also considered in this study is the degree of openness (DOP) defined as the ratio of total trade (exports + imports) to gross domestic product (GDP) to represent the intensity of trade and the importance of the external trade sector. DOP also captures the extent of import liberalisation, which might have a 'spill-over' effect on exports. Finally, the analysis is extended to examine the performance of manufacturing exports, and textile and readymade garment exports and thereby to address the main thrust of the *de novo* hypothesis. Indeed, as can be seen from Table 3.1 (Section 3), manufacturing, and textile and readymade garment exports grew at rates much faster than total exports. The analysis is done by estimating three separate supply equations for total exports, manufacturing exports, and textile and readymade garment exports by applying the vector error correction modelling. It is intended that an analysis of the export performance at the disaggregated levels should provide more effective policy implications. The rest of the paper is organised as follows. Section 2 gives a brief overview of the Bangladesh's exchange rate regime. Section 3 presents the trends in exports. Section 4 sets out the analytical framework. Section 5 describes the data and their time series properties. Section 6 and 7 report the estimated results. And finally, Section 8 presents the conclusion.

2. A BRIEF OVERVIEW OF BANGLADESH'S EXCHANGE RATE REGIME

Since anti-export bias reduction is defined in terms of the exchange rates, it is worthwhile to provide a brief preview of the Bangladesh's exchange rate regime. Bangladesh had a pegged exchange rate system and in August 1979 it was made a managed float. In 1993 the national currency, *taka*, was floated and made convertible on the current account. The current account convertibility is considered as a precondition to further liberalisation of the exchange rate regime. The continual depreciation of the nominal exchange rate, especially since 1985 provided an extra impetus on the speed of consolidation of the foreign exchange regime. Since 1974 the various measures of real exchange rates, defined in terms of domestic currency per US dollar show secular increase implying the depreciation of the domestic currency, *taka.* For example, in 1976 the real effective exchange rate for exports ($REER_X$) was 25.31 taka/US dollar. In 1986 it was 32.59 taka/US dollar and in 1998 the rate was 38.52/US dollar. The real effective exchange rate for imports ($REER_M$) also shows an upward tendency over time, although the rate of increase is rather slow. The corresponding figures for $REER_M$ for the years mentioned above are 37.97, 39.92 and 39.50 respectively. That very aptly explains why the trade policy bias index (TPB) registers an upward movement meaning a reduction in anti-export bias over time. The TPB rose from 0.67 in 1976 to 0.82 in 1986 to 0.98 in 1998. The quarterly data might capture the dynamics of the exchange rate policy more effectively. We, therefore, present the quarterly data (index: 1995=100) on $REER_X$, $REER_M$ and TPB in Figure 2.1.

Figure 2.1: *Plots of $REER_X$, $REER_M$ and TPB (Index: 1995=100)*



3. TRENDS AND CHANGING PATTERNS OF EXPORTS OF BANGLADESH

The depreciation of the domestic currency as discussed in the previous section indicates a reduction in the anti-export bias. This was proved conducive to the growth of exports. In fact, real total exports increased by an average annual rate of 5.48% over the study period 1974-1999. Real manufacturing exports grew at an average annual rate of 12.92% during the same period while real textiles and readymade garment exports grew at an average annual rate of 16.78% during 1975-1999. However, the growth rates differ across the pre-liberalisation and the post-liberalisation periods. As mentioned before, Bangladesh initiated the transition towards outward-orientation in 1982 and took a gradualist approach to remove the controls on the external sector. The 1982 efforts were followed by measures in 1985-86 and 1991. Therefore, we interpret the period until 1982 as the pre-liberalisation era and the period from 1982 onwards as the post-liberalisation era of which, period 1983 through 1991 can be described as the period

Table 3.1 *Annual Average Growth Rates of Total Exports, Manufacturing exports, and Textiles and Readymade Garment Exports*

Export Category	1974-99*	1974-82*	1983-91	1992-99	1983-99
Total Exports	05.48	03.14	02.88	10.91	06.66
Manufacturing Exports	12.92	08.91	12.22	17.77	16.98
Textiles Exports	16.77	17.93	13.71	16.98	15.24

** The starting year for textiles and readymade garment exports is 1975 instead of 1974.*
Source: Authors' calculation from IMF data.

of transition. The growth rates of total exports for the pre-liberalisation and the post-liberalisation periods are 3.14% and 6.66% respectively. For manufacturing exports as a whole, and textiles and readymade garment exports, the growth rates are respectively 8.91% and 14.80%, and 17.93% and 15.24%. The scenario is better explained in Table 3.1.

4. THE FRAMEWORK FOR ECONOMETRIC ANALYSIS

Historically, econometric modelling of the supply of exports has been limited to the use of single equation framework (Urbain, 1995; Goldstein and Khan, 1985) based on the theory of imperfect substitutes, which assumes that neither imports nor exports are perfect substitutes for domestic goods. Though consistent with the profit maximising behaviour of the firms (Dornbusch, 1974; Corden, 1997), the imperfect substitutes model avoids the issue of simultaneity between domestic price, export price and the exchange rates, as well as simultaneity between supply of and demand for exports. The assumption of the absence of simultaneity is alarming at least on two counts. First, it ignores the empirical findings that domestic and export prices are indeed influenced by exchange rate changes [Goldstein; 1980]. Secondly, the existence of export supply functions independently of the demand functions presupposes the existence of perfect competition for the assumption of exogenous export prices is legitimate only under perfect competition [Goldstein and Khan, 1985]. The fundamental logic behind considering the demand side alongside the supply side in the imperfect substitutes models, as Orcutt (1950) points out, is to spell out that the relationship between quantities and prices is simultaneous, at least in theory. The issue of simultaneity is especially important when it comes to assessing the impact of alternative trade regimes on trade flows [Urbain, 1995]. In the empirical framework used to test rival hypotheses in this paper, we apply the Vector Error Correction (VEC) modelling. This methodology overcomes the limitations of the past empirics

4.1 Explanation of and Rationale for the Choice of the Non-Export Variables

In implementing the vector error correction modelling (VECM), the following variables have been considered:

TX_t = real total exports;
MX_t = real (total) manufacturing exports;
TXX_t=real textile exports including readymade garments;
PX_t = price of exports;
PD_t = domestic price
$TPB_t = REER_X / REER_M$ trade policy bias or anti-export bias;
PC_t = production capacity;
DOP_t = degree of openness;
t = time subscript.

The domestic price here is represented by the domestic wholesale price index. The inclusion of the domestic price in the model serves two purposes. First, given export price, the profitability of producing and selling exports decreases as factor costs increase in the export industries. Since factor costs are likely to be correlated with domestic price, the latter acts as a proxy for the former. Secondly, domestic price includes both the prices of tradables sold at home as well as the nontradables. Thus domestic price captures supply substitution between the home and export market for a given tradable good as well as all tradables and nontradables. The inclusion of the price of export captures the internal profitability of producing and selling export goods. The trade policy bias (TPB) indicates the degree of export-orientation. The production capacity, PC_t, is represented by the incremental fixed capital formation or investment in the economy as a whole. While PX_t, PD_t and TPB_t are expected to influence exports as a result of the movement along the production possibility curve, PC_t captures the shifts in the production possibility curve over time. The latter is alone sufficient to bring about changes in exports in the absence of any changes in PX_t, PD_t or *TPBt*. Defined as the trade-GDP ratio, DOP_t measures the importance of the foreign trade sector and, to an extent, import liberalisation. All the explanatory variables, except PD_t, are expected to have positive coefficients. All the variables including the prices are expressed in domestic currency.

4.2 The Empirical Technique

As mentioned before, the study applies cointegration and vector error correction modelling in order to estimate the export supply equations. The literature on time series econometrics suggests a number of alternatives to deal with non-stationarity in the data, of which the Box-Jenkins ARIMA approach (Box and Jenkins, 1970), the Vector Autoregression (Sims, 1980), Cointegration and Error Correction Model (Engle and Granger, 1987) and the Maximum Likelihood in a Fully Specified Error Correction model (MLECM) (Johansen, 1988 and Johansen and Juselius, 1992) are the examples. For quite sometime, the Engle-Granger procedure had been the 'state-of-the-art' methodology in testing causality in economic models where all the variables are treated as endogenous. However, due to better statistical properties, the Johansen-Juselius MLECM got wider acceptance in empirical applications. [3] One advantage with the latter is that, unlike the former, it produces identical error correction term irrespective of the choice of the variable to be normalised. In addition, the MLECM can explain Granger causality, overcoming the problems of simultaneity bias. In order to specify the Vector Error Correction Model in the Johansen-Juselius proper, we proceed as follows. Concentrating on total export supply, the six-variable VAR model can be described as follows:

$$V = (TX_t, PX_t, PD_t, TPB_t, DOP_t, PC_t)' \qquad (4.1.)^{4}.$$

The corresponding unrestricted VAR model with the deterministic term can be specified as

$$V_t = A_0 + A(L)V_t + \varepsilon_t \qquad (4.2)$$

where, $A(L) = (a_{ij}(L))$ is a 6×6 matrix of the polynomial and $a_{ij}(L) = \Sigma\, a_{ij,1}L^1$, m_{ij} is the degree of the polynomial. $A_0 = (a_{10} \;\; a_{20} \;\; a_{30} \;\; a_{30} \;\; a_{50} \;\; a_{60})'$ is a constant, and ε_t is 6×1 vector of the random errors. Assuming exactly one cointegrating vector to exist between the variables and that the variables are stationary in the first differences, Model (4.1) can be rewritten as

$$\Delta V_t = A_0 + A(L)\, \Delta V_{t-1} \;\; + \delta\, EC_{t-1} + \mu_t \qquad (4.3)$$

where EC_t denotes the error correction term. μ_t is a 6×1 vector of white noise errors, that is, $E(\mu_t) = 0$ and $E(\mu_t\, \mu_{t-s}) = \sigma$ for $t = s$ and zero otherwise. Using the lower case letters to denote

[3] For a comparative analysis of the alternative empirical techniques dealing with 'non-stationary data, see for example, Enders, 1995 and Maddala and Kim, 1998. Gonzalo (1994) contains a detailed discussion on the relative merit of the alternative methods suggested for cointegrated systems. Of Ordinary Least Squares (Engle and Granger, 1987), Non-Linear Least Squares (Stock, 1987), Principal Components (Stock and Watson, 1988) and MLECM (Johansen, 1988 and Johansen and Juselius, 1992), Gonzalo finds MLECM to capture the desirable elements in a cointegrated system.

[4] The manufacturing export supply and the textiles and readymade garment supply models can be formed in a similar way in that TX_t is replaced by MX_t and TXX_t respectively.

the log of the relevant variable and normalising on the total export variable, the VECM equivalent of equation (4.1) can be written as

$$\Delta tx_t = a_0 + \sum_{i=1}^{n} a_{1i}\Delta tx_{t-i} + \sum_{i=0}^{n} a_{2i}\Delta px_{ti}, + \sum_{i=0}^{n} a_{3i}\Delta pd_{ti} + \sum_{i=0}^{n} a_{4i}\Delta tpb_{t-i} + \sum_{i=0}^{n} a_{5i}\Delta dop_{t-i} + \sum_{i=0}^{n} a_{6i}\Delta pc_{t-i}, + EC_{t-1} \tag{4.4}$$

where EC_t is the error term defined as the residual of the sample regression of tx_t on the rest of the variables, that is,

$$EC_t = tx_t - \alpha_1\, px_t - \alpha_2\, pd_t - \alpha_3\, tpb_t - \alpha_4\, dop_t - \alpha_5\, pc_t$$

Similar specifications hold for any other variable in equation (4.1), and for the manufacturing export and textiles and readymade garment export supply equations.

5. THE DATA AND THEIR TIME SERIES PROPERTIES

The sample period covered in this study is 1974Q1 through 1999Q4 for the total exports and the manufacturing export supply models and 1975Q1 through 1999Q4 for the textiles and readymade garment exports supply model. The data have been sourced from various international and national publications that include *International Financial Statistics* (both monthly and yearly), *Monthly Statistical Bulletin, World Commodity Trade*, *Direction of Trade Statistics and Bangladesh Statistical Yearbook.* The series for which quarterly observations are not available, annual data have been converted into quarterly figures by using the Lisman-Sandee technique (Lisman and Sandee, 1965). Such series include textiles and readymade garment exports, and production capacity. Real gross capital formation series is constructed by deflating the corresponding nominal series by the domestic wholesale price index while the export series are converted into real figures by deflating them by the unit price index of exports of Bangladesh. All the variables are expressed in domestic currency.

5.1 The Order of Integration of the Variables

In order to test for 'stationarity' or the order of integration of the time series, first the series have been tested for the presence of structural breaks or jumps[5] by using three pulse dummies, DP_1, DP_2 and DP_3, for the years 1982, 1986 and 1991 respectively[6]. The results are presented in Table 5.1. The 't' values corresponding to the coefficients of the pulse dummy variables for each series, suggest that there is no break in any of the sequences since none of the DP_j coefficients are statistically significant even at a 10% level of significance.

Table 5.1: *'t' Values of the Coefficients of the Pulse Dummy Variables**

Series	Sample Size	't'-DP_1	't'-DP_2	't'-DP_3
tx_t	103	0.16	0.04	-0.02
mx_t	103	-0.34	1.30	1.12
txx_t	99	-0.19	1.42	0.38
px_t	103	1.24	-1.26	-0.24
pd_t	103	-0.26	-0.41	-0.93
tpbt	103	0.79	0.11	-0.33
dop_t	103	-0.65	0.19	0.37
pc_t	103	1.37	1.31	-0.38

- 't' values correspond to the equation: $y_t = y_{t-1} + \epsilon_t + DP_1 + DP_2 + DP_3$ where $DP_1 = 1$ for 1982 and 0 otherwise, $DP_2 = 1$ for 1986 and 0 otherwise and $DP_3 = 1$ for 1991 and 0 otherwise.

[5] The presence of a break or jump have different implications for unit root testing and cointegration [Zivot and Andrews, 1992; Gregory and Hansen, 1996; Ben-David et al., 1997].

[6] Major policy reforms in the form of structural structural adjustments took place in Bangladesh in three phases in the years mentioned. Although some suggest that the location of a breakpoint is unknown, as Maddala and Kim (1998) point out, one may look for a breakpoint around a period when major policy shifts occurred.

Table 5.2: *Summary Results of the Nested Hypothesis**

Series	Sample Size	$t_{\hat{\rho}}$
tx	102	3.40
mx	102	2.13
txx	97	2.05
px	102	3.02
pd	102	2.53
tpb	102	1.96
dop	102	1.88
pc	102	3.17

*A TSP can be distinguished from a DSP as follows:

TSP: $y_t = \alpha + \delta t + u_t$

DSP: $y_t = \alpha + \rho y_{t-1} + u_t$

where u_t is stationary. The nested model can be written as

$y_t = \alpha + \delta t + \rho y_{t-1} + e_t$

where e_t is assumed to be white noise. If the null hypothesis of H_0: $\rho = 1$ and $\delta = 0$ is rejected on the basis of the sample regression, then y_t is TSP; else it belongs to the DSP class. The t-values are to be compared with the critical 't'. The one-tailed 't' at 5% level of significance and for a sample of 100 is -3.45 (from Nelson and Plosser, 1982, p. 151).

The absence of a break or jump in the data series implies that the conventional unit root testing procedure can be used to determine the order of integration of the variables. Applying the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests, we find all the variables to be non-stationary in their levels. The test statistics are reported in Table 1 in the Appendix. A non-stationary series can be made stationary by detrending or differencing depending on whether the series contains a trend stationary process (TSP) or a difference stationary process (DSP). To see if the variables are TSP or DSP, we carry out a Nelson-Plosser-Bhargava type hypothesis testing that nests a TSP with a DSP [Nelson and Plosser, 1982; Bhargava, 1986]. The results, summarized in Table 5.2, show that all of the variables considered in this study fall into the DSP category.

The ADF and the PP tests on the first differences of the variables show that the hypothesis of unit root can be rejected for all the variables considered. We, therefore, conclude that all the level variables follow an I(1) process. The results are presented in Table 2 in the Appendix.

5.2 Test for Cointegration

Let us first consider the total export supply model. The relevant variable vector is: $(tx_t, px_t, pd_t, tpb_t, dop_t, pc_t)'$. To determine the order of the VAR, we begin with an arbitrary lag length of 12 in the unrestricted VAR that includes three centered seasonal dummies besides the six variables. While the Akaike Information criterion (AIC) suggests an order of the VAR of 4, the Schwarz Bayesian Criterion (SBC) suggests an order of 2. Both the orders are supported by the Adjusted Likelihood Ratio (LR) test. Since the SBC has superior large sample properties while the AIC favours an overparameterised model in general, one is tempted to applying the SBC. However, in a situation like this, one must look at the residual serial correlation as well as normality of the individual equations in the unrestricted VAR [Pesaran and Pesaran, 1997]. Both the orders fail to satisfy either or both the conditions for the equations for all six variables. As can be seen from Figure 1 in the Appendix, the first differences of the variables show important outliers in the years 1974, 1975, 1977, 1978, 1981, 1983, 1984, 1986 and 1994; the most common being 1975 that succeeded the 1974 famine. Using dummies for the outliers, and for the three phases of microeconomic reforms in 1982, 1986 and 1991, d_1, d_2 and d_3 respectively, we find a third order VAR to satisfy the serial correlation and normality conditions of the individual equations in the unrestricted VAR. We, therefore, choose a third order VAR for the total export model.

In order to examine the number of cointegrating vectors (CV) in the model, we compute the maximum eigen value statistic (λ_{max}) and the trace statistic (λ_{trace}) according to the Johansen-

Juselius procedure. Both criteria indicate the existence of two cointegrating relationships between the I(1) variables in the model. The results are presented in Table 5.3. The λ_{max} test rejects the null hypothesis of no cointegration (r = 0) against the alternative of one cointegrating relationship (r = 1) since the test statistic of 46.77 is greater than the 95 percent quintile value of 36.27. The λ_{max} test also rejects the null hypothesis of $r \leq 1$ against the alternative hypothesis of r = 2 at 5 percent level of significance. However, the λ_{max} test cannot reject the null of $r \leq 2$ against the alternative of r = 3. Similarly, λ_{trace} test rejects the null hypotheses of r =0 and $r \leq 1$ against the alternative hypotheses of $r \geq 1$ and $r \geq 2$ respectively but not $r \leq 2$ against $r \geq 3$. The results lead to the conclusion that there are two cointegrating vectors in the total export supply model.

It is not surprising that more than one cointegrating relationship exist among the variables. It might be argued that in the long run, the relevant price to be considered is the price of exports, *px,* relative to the domestic price, pd_t, such that the coefficients on px_t and pd_t should be equal

Table 5.3: *Test Statistics for Cointegrating Rank:*(z_t: $\boldsymbol{tx_t}$, px_t,pd_t, tpb_t, dop_t, pc_t)

Null	Alternative	Eigen Values	λ_{max} Statistic		95% Quintile	Null	Alternative	λ_{trace} Statistic		95% Quintile
r = 0	r = 1	0.379	**46.67**	>	**36.27**	r = 0	r ≥ 1	**111.83**	>	**83.18**
r ≤ 1	r = 2	0.283	**32.60**	>	**29.95**	r ≤ 1	r ≥ 2	**64.98**	>	**59.33**
r ≤ 2	r = 3	0.156	16.62	<	23.92	r ≤ 2	r ≥ 3	32.55	<	39.81
r ≤ 3	r = 4	0.098	10.11	<	17.68	r ≤ 3	r ≥ 4	15.89	<	24.05

Note: r denotes the number of cointegrating vectors.

but have opposite signs. This presupposes infinite price elasticity for the export demand function. Relaxation of the assumption suggests that an additional equation be incorporated in order to capture the export demand response. A merit of a cointegration approach is that it addresses the issue of identification of different long run structural relations, at least in principle. The existence of both the demand and supply functions in a relation suggests that r should at least be equal to 2 [Patterson, 2000].

5.3 Identification of the Cointegrating Vectors

The fact that the set of variables is cointegrated implies that the long run relationships among them can be effectively estimated. The Johansen-Juselius MLECM identifies the long run relationships in terms of the error correction term(s). Since we have two cointegrating relationships to exist among the variables in question, we must impose at least 1 (=(r - 1)) restriction on each of the cointegrating vectors as a necessary condition for having just-identification cointegrating vectors. Let $(a_1\ a_2\ a_3\ a_4\ a_5\ a_6)'$ be the coefficient vector corresponding to the variable vector $(\boldsymbol{tx_t}, px_t, pd_t, tpb_t, dop_t, pc_t)'$. We suggest the following two generically identifying restrictions. For the first vector, we constrain the coefficients on px_t and pd_t to be equal but have opposite signs, that is, $a_2 = -a_3$. For the second vector, the coefficient of tpb_t, that is a_4, is constrained to be equal to zero, where $tpb_t = log\ (REER_X / REER_M)$ as defined before. The restrictions are consistent with the long run purchasing power parity assumption.[7] Imposing these restrictions and normalising on the total exports variable, $\boldsymbol{tx_t}$, we find the estimated long run relationships, denoted by ec_{1t} and ec_{2t}, as follows:

$$ec_{1t} = \boldsymbol{tx_t} - \underset{(0.87)}{1.57}\, px_t + \underset{(0.87)}{1.57}\, pd_t - \underset{(0.26)}{0.46}\, tpb_t + \underset{(0.42)}{0.11}\, -dop_t - \underset{(0.82)}{0.90}\, pc_t \qquad (5.1)$$

$$ec_{2t} = \boldsymbol{tx_t} - \underset{(0.49)}{0.88}\, px_t + \underset{(0.25)}{0.54}\, pd_t + \underset{(0.41)}{0.24}\, dop_t - \underset{(0.46)}{1.15}\, pc_t \qquad (5.2)$$

The standard errors (in parentheses) of the estimated coefficients show that the coefficients on dop_t and pc_t in the first and the coefficient on dop_t in the second cointegrating vector are not statistically significant. Hence the two variables can be treated as weakly exogenous with respect

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[7] For a similar application, see Urbain, 1995.

to the respective cointegrating vectors. We therefore impose overidentifying restrictions on the two vectors, the restrictions being $a_6 = 0$ and $a_5 = 0$ respectively. The two restrictions also follow from the empirical observation that there exists a substantial amount of excess capacity in the manufacturing sector of Bangladesh [Krishna and Sahota, 1991: Salim, 1999]. Since manufacturing exports constitute the lion's share of total exports of Bangladesh, one can tentatively apply the restrictions to total exports model as well. The overidentifying cointegrating vectors, as distinct from the just-identifying vectors, are as follows:

$$ecm_{1t} = \boldsymbol{tx_t} - 2.86\, px_t + 2.86\, pd_t - 0.94\, tpb_t - 0.33\, dop_t \quad (5.3)$$

$$ecm_{2t} = \boldsymbol{tx_t} - 1.32\, px_t + 0.76\, pd_t - 0.69\, pc_t \quad (5.4)$$

All the coefficients in (5.3) and (5.4) have the correct signs and are found to be statistically significant. A joint test of the over-identifying restrictions on the adjustment coefficients, a_j, produces a test statistic of 1.345 that is distributed as $\chi^2\,(2)$ under the null hypothesis. The joint null hypothesis cannot be rejected since the critical value of χ^2 at 5 percent significance level, 14.067, far exceeds the calculated value. We, therefore, interpret ecm_{1t} and ecm_{2t} as the long run relations pertaining to the total exports model.

5.3 Identification of Long Run Relationships in Manufacturing Exports and Textiles and Readymade Garment Exports Models

The AIC suggests a fourth order VAR for both the manufacturing exports model and the textiles and readymade garment exports models while the SBC suggests a third and second order VAR respectively. Again, the suggested orders are not consistent with the residual serial correlation and the normality checks for the individual equations in the unrestricted VAR. Introducing the intervention dummies, d_1, d_2 and d_3, and the outlier dummies, as suggested by the first

Table 5.4: *Test Statistics for Cointegrating Rank:(zt: mxt, pxt,pdt, tpbt, dopt, pct)*

Null	Alternative	Eigen Values	λ_{max} Statistic	95% Quintile	Null	Alternative	λ_{trace} Statistic	95% Quintile
r = 0	r = 1	0.466	**61.55 >**	**36.27**	r = 0	r ≥ 1	**134.67 >**	**83.18**
r ≤ 1	r = 2	0.328	**38.95 >**	**29.95**	r ≤ 1	r ≥ 2	**73.21 >**	**59.33**
r ≤ 2	r = 3	0.183	19.81 <	23.92	r ≤ 2	r ≥ 3	34.31 <	39.81
r ≤ 3	r = 4	0.096	9.89 <	17.68	r ≤ 3	r ≥ 4	14.52 <	24.05

Table 5.5: *Test Statistics for Cointegrating Rank:(zt: txxt, pxt,pdt, tpbt, dopt, pct)*

Null	Alternative	Eigen Values	λ_{max} Statistic	95% Quintile	Null	Alternative	λ_{trace} Statistic	95% Quintile
r = 0	r = 1	0.353	**40.93 >**	**36.27**	r = 0	r ≥ 1	**106.82 >**	**83.18**
r ≤ 1	r = 2	0.275	**30.23 >**	**29.95**	r ≤ 1	r ≥ 2	**65.92 >**	**59.33**
r ≤ 2	r = 3	0.186	19.35 <	23.92	r ≤ 2	r ≥ 3	35.66 <	39.81
r ≤ 3	r = 4	0.133	13.42 <	17.68	r ≤ 3	r ≥ 4	16.29 <	24.05

Note: r denotes the number of cointegrating vectors.

differences of the relevant variables, for the years 1974, 1975, 1978, 1981, 1983 and 1986 for the manufacturing exports model and for the years 1975, 1978, 1981, 1983 and 1986 for the textiles exports model, we find a second order VAR to satisfy all the diagnostic checks for both the models. Test statistics for cointegration based on a second order VAR are presented in Tables 5.4 and 5.5. Both the λ_{max} and the λ_{trace} test statistics indicate that there are two cointegrating vectors for each of the models. The just-identifying cointegrating vectors for the two models as found after imposing the restrictions suggested before are presented below:

$$ec_{1t}^{M} = mx_t - \underset{(0.62)}{1.14}\, px_t + \underset{(0.62)}{1.14}\, pd_t - \underset{(0.32)}{0.87}\, tpb_t - \underset{(0.42)}{0.02}\, dop_t - \underset{(0.82)}{1.83}\, pc_t \qquad (5.5)$$

$$ec_{2t}^{M} = mx_t - \underset{(2.25)}{4.26}\, px_t + \underset{(3.70)}{5.18}\, pd_t - \underset{(0.36)}{0.56}\, dop_t - \underset{(1.15)}{1.17}\, pc_t \qquad (5.6)$$

$$ec_{1t}^{T} = txx_t - \underset{(1.45)}{2.68}\, px_t + \underset{(1.45)}{2.68}\, pd_t - \underset{(0.16)}{0.10}\, tpb_t - \underset{(0.70)}{1.13}\, dop_t - \underset{(2.03)}{0.13}\, pc_t \qquad (5.7)$$

$$ec_{2t}^{M} = txx_t - 3.00\, px_t + 3.07\, pd_t - 1.30\, dop_t - 0.46\, pc_t \qquad (5.8)$$

(1.86) (2.28) (1.65) (0.42)

where superscripts *M* and *T* stand for manufacturing- and textiles exports models respectively. In the first cointegrating vector for the manufacturing exports model, the coefficients of px_t, pd_t, tpb_t, and pc_t are significant at 10 percent level of significance or less, while the coefficient of dop_t is not statistically significant. In the second cointegrating vector, only the coefficient of px_t is statistically significant (at 10 percent level). Of the other three variables, pc_t has the lowest t-value. Turning to the textiles exports model, the coefficients of tpb_t, dop_t and pc_t in the first cointegrating vector and none in the second cointegrating vector are statistically significant at even 10 percent level. However, in the first cointegrating vector, the coefficient of dop_t and in the second, the coefficient of pc_t has the smallest t-value. In order to get over-identifying long run relationships for the manufacturing exports model, we thus restrict the coefficient of dop_t and pc_t to zero in the first and second cointegrating vector respectively, and *vice versa* for the textiles exports model. The estimated over-identifying cointegrating vectors are presented in Table 5.6, (which also reproduces the over-identifying cointegrating vectors for the total exports model). The restrictions cannot be rejected at the 5 percent level of significance on the basis of the joint tests on the adjustment coefficients, the test statistics being χ^2 *(2)* = 1.280 and χ^2 *(2)* = 3.107 respectively for the manufacturing- and the textiles exports model respectively.

Table 5.6: *Over-Identifying Cointegrating Vectors for the Total Exports, Manufacturing Exports, and Textiles Exports Models*

Total Exports			Manufacturing Exports			Textiles Exports		
Equation	ecm_1	ecm_2	Equation	ecm_1	ecm_2	Equation	ecm_1	ecm_2
tx_t	1.00	1.00	mx_t	1.00	1.00	txx_t	1.00	1.00
px_t	-2.86	-1.32	px_t	-3.64	-1.71	px_t	-2.56	-1.29
pd_t	2.86	0.76	pd_t	3.64	1.09	pd_t	2.56	1.08
tpb_t	-0.94	0.00	tpb_t	-0.72	0.00	tpb_t	-0.54	0.00
dop_t	-0.33	0.00	dop_t	-0.00	-0.26	dop_t	-0.60	0.00
pc_t	0.00	-0.69	pc_t	-0.68	0.00	pc_t	-0.00	-0.89

6. ESTIMATION OF THE ERROR CORRECTION MODELS AND THE ESTIMATED RESULTS

Since the variables in each of the three models of the present study are cointegrated, following Granger Representation Theorem[8], each model can be expressed in an error correction model, which would capture the short run dynamics of the models leading to the long run equilibrium. Specifically, we estimate three error correction equations using a specification similar to (4.4). The maximum lag length for each variable in the VAR is determined by using Akaike's minimum final prediction error criterion. The lag lengths for the variables $tx_{t,}$, $mx_{t,}$ txx_t, px_t, pd_t, $tpb_{t,}$, dop_t *and* pc_t are *11, 10, 10, 11, 7, 11, 10* and *12* quarters in that order. We then apply the principle of the 'general-to-specific modelling' (Hendry, 1995) to arrive at a 'parsimonious' and economically interpretable models. This is a 'testing down' procedure whereby statistically insignificant lag terms are dropped until a stage is reached when the model passes a battery of diagnostic tests. The results are shown in Table 6.1.

Total Exports Supply: All the explanatory variables except dop_t appear as determinants of total exports supply. The results reveal that a reduction of anti-export bias or trade policy bias has significantly contributed to the expansion of the overall exports during the sample period under study. The trade policy bias index has a combined coefficient of (0.67), which indicates that a less than 2 percent reduction in the anti-export bias translates into a one- percent increase in total exports. The negative and significant coefficient of the error correction term, (-)0.23, suggests the presence of short-term adjustments towards the long run equilibrium, although the speed of

[8] The Granger's Representation Theorem states that if a set of variables are cointegrated, then they can be expressed in an error correction model and *vice versa* [Engle and Granger, 1987].

adjustment is rather slow, suggesting a period of adjustment of just over 4 quarters. The positive coefficient of the intervention dummy d_2 connotes that there has been a shift, though very small in magnitude, in the total export supply curve following the liberalising measures in 1985-86.

Table 6.1 *Estimated Regression Results of Exports Supply Equations*

(1) Total Exports		**Manufacturing Exports**		**Textiles Exports**	
Regressor	*Parameter Estimate*	*Regressor*	*Parameter Estimate*	*Regressor*	*Parameter Estimate*
constant	*-0.15**	*constant*	*-0.08**	*constant*	*0.04**
$\Delta tx_t(-2)$	*0.26**	$\Delta mx_t(-4)$	*0.23**	$\Delta txx_t(-1)$	*0.86**
$\Delta tx_t(-4)$	*-0.14***	$\Delta mx_t(-5)$	*-0.09**	$\Delta txx_t(-2)$	*0.21***
$\Delta px_t(-3)$	*0.40***	$\Delta px_t(-3)$	*0.15**	$\Delta txx_t(-3)$	*-0.20**
$\Delta pd_t(-4)$	*-0.92***	$\Delta pd_t(-2)$	*-0.11**	$\Delta px_t(-2)$	*0.18**
$\Delta pd_t(-5)$	*0.67***	$\Delta pd_t(-5)$	*-0.08**	$\Delta pd_t(-2)$	*-0.07**
$\Delta tpb_t(-2)$	*0.32***	$\Delta tpb_t(-2)$	*0.38***	$\Delta tpb_t(-2)$	*0.46**
$\Delta tpb_t(-4)$	*0.35***	$\Delta tpb_t(-3)$	*0.44***	$\Delta dop_t(-2)$	*0.08**
$\Delta pc_t\ (-3)$	*0.78**	$\Delta dop_t\ (-2)$	*0.07**	$\Delta pc_t\ (-4)$	*0.20**
$ecm_{1t}(-1)$	*- 0.23**	$\Delta pc_t\ (-4)$	*0.27**	$ecm_{1t}(-1)$	*-0.47***
d_2	*0.04**	$\Delta pc_t\ (-5)$	*0.10**	d_1	*0.04**
		$ecm_{1t}(-1)$	*-0.34***	d_2	*0.14***
		d_2	*0.09**		
R^2 = .52		R^2 = .47		R^2 = .69	
Adjusted R^2 =.45		Adjusted R^2 = .32		Adjusted R^2 = .65	
F(10,83) = 6.75*		F(12,81) = 3.18*		F(11,78) = 17.50*	
DW = 2.16		DW = 2.04		DW = 2.07	
LMS = 5.48 (.241)		LMS = 2.39 (.664)		LMS = 4.96 (.291)	
RESET = 3.02 (.082)		RESET = 2.24 (.134)		RESET = 0.74 (.390)	
NORM = 1.06 (.590)		NORM = 5.35 (.069)		NORM = 0.82 (.664)	
HET = 2.93 (.087)		HET = 3.07 (.080)		HET = 2.59 (.108)	

Legend:
* significant at 5% level or less; * * significant at 10% level.
Note: figures in parentheses denote the rejection level of significance.
Diagnostic Tests:
LMS: Lagrange multiplier test for residual serial correlation.
RESET: Ramsey RESET test for functional form mis-specification.
NORM: Jarques-Bera test for normality of residuals.
HET: Test for heteroskedasticity based on squared residuals.

Both exports price and domestic price have statistically significant impacts. Of all the determinants, however, the production capacity appears to be the most important factor affecting total exports supply.

(Total) Manufacturing Exports: Similar pattern can be seen, with minor changes of course, in the case of total manufacturing exports supply. Manufacturing exports responded slightly more than total exports to reductions in anti-export bias, the coefficient being 0.82. Also the error correction term has a bigger coefficient (in absolute term), (-)0.34, indicating a short run adjustment process of roughly 3 quarters. The degree of openness, though has an influence of manufacturing exports supply, the coefficient is rather small (0.07). The manufacturing exports supply curve registers a slightly bigger shift, again due to the policy measures of 1985-86. And, unlike total exports, production capacity does not play a vitally important role in the manufacturing exports expansion.

Textiles and Readymade Garments: Turning to textiles and readymade garment exports, once again anti-export bias reduction turns out to be a significant determinant. However, its coefficient of 0.46 is much smaller than either total exports or manufacturing exports model. The degree of openness has a slightly bigger coefficient than for the manufacturing exports as a whole (0.08 against 0.05). As the coefficient of the error correction term suggests, textiles and readymade garment exports sector adjusts even faster than the manufacturing exports sector as a whole; the period of (short run) adjustment being just over 2 quarters. Production capacity still plays a positive role but not as much as in the other two sectors. Unlike the other two sectors, textiles and readymade garment exports are heavily dependent on the past record of exports. Clearly, the textiles and readymade garment exports supply curve has undergone a bigger shift overtime as it responded to both first phase (1982) and second phase (1985-86) reforms.

7. GRANGER CAUSALITY, AND A DIGRESSION ON OTHER EQUATIONS IN THE SYSTEM

The results in the previous section show that all the variables simultaneously determine exports supply except for dop_t in the total exports supply equation. It is, however, important to separate out the contribution of each of the explanatory variables in the short run adjustment process(es) We do this by estimating parsimonious error correction models for all the non-export variables and examining the coefficient of the respective error correction term. The process also enables us to check Granger causality from export variables to the other variables as well as among the other variables themselves. The estimated equations are presented in Table 3 in the Appendix. Significant F-values for all three exports supply equations imply that all the explanatory variables, barring dop_t, Granger-cause exports. dop_t does not Granger-cause total exports. As to the relationships among the non-exports variables, let us concentrate on the total exports model. The causal relations are summarised in Table 6.2. The results reveal that total exports Granger-cause trade policy bias, degree of openness and to a very small extent production capacity but not export price or domestic price. The last observation points to the existence of substantial excess capacity in the exports sector in that additional exports supply can be made possible without affecting the domestic price and/or the export price. That exports do not Granger cause domestic price is also evident from the manufacturing exports and textiles and readymade garment exports models. As can be seen from Table 3 in the Appendix, there is negative causality from manufacturing exports to domestic price while textiles and readymade garment exports do not cause domestic price. However, unlike total exports, both have positive effects on the export price. Also both manufacturing exports as a whole and textiles exports marginally contribute to production capacity. As to the causality among the non-export variables, there exists bi-directional causality between domestic price and export price, export price and trade policy bias reduction, and unidirectional causality from reduction of trade policy

Table 6.2: *Summary of Causal Relations: Total Exports Model*

Variable		tx_t	px_t	pd_t	tpb_t	dop_t	pc_t
tx_t	→	…	N	N	Y+	Y+	Y+
px_t	→	Y+	…	Y+	Y+	Y+	Y+
pd_t	→	Y-	Y+	…	N	Y+	Y-
tpb_t	→	Y+	Y-	Y+	…	Y+	Y-
dop_t	→	N	Y-	Y+	Y-	…	N
pc_t	→	Y+	Y+	Y+	N	Y-	…
ecm_{1t}	→	Y-	Y+	Y-	Y-	Y+	Y-
ecm_{2t}	→	N	N	Y+	N	N	Y+

legend:
Y stands for the presence of causality.
N stands for the absence of causality.
+ denotes positive causality from the variable.
- denotes negative causality from the variable.
→ *denotes the direction of causality.*

bias to domestic price. This suggests simultaneity between domestic price, export price and the exchange rates. The same also holds for degree of openness and the production capacity. Similar conclusion can be drawn from the manufacturing and the textiles export models. As to the short run adjustment process(es) of the non-export variables, as can be seen from the total exports model, the error correction coefficient for the export price equation is positive (0.02), the domestic price equation has a combined coefficient of (-)0.02, the trade policy bias has a coefficient of (-)0.07, the degree of openness equation has a combined coefficient of (-) 0.16 and the production capacity equation has a combined coefficient of 0.06. Thus the transition to long run equilibrium for the total exports supply is by and large due to anti-export bias reduction and openness. The manufacturing exports and textiles and readymade garment exports model also convey similar conclusion.

8. CONCLUSION

The basic objective of the study was to assess the of effect trade liberalisation, as proxied by the reduction of anti-export bias on the expansion of exports of Bangladesh. While there are a few studies on total exports, there has been no significant study concerning manufacturing exports as a whole and its major contributor, textiles and readymade garment exports. The findings of this study therefore shed light on export performance at disaggregated levels that are useful for policy purposes.

The findings lend support to the general contention that both total- and manufacturing exports of Bangladesh have responded positively to anti-export bias reduction and greater openness. Both anti-export bias reduction and openness have both contemporaneous and long run effects on total exports, manufacturing exports, and textiles and readymade garment exports supply except that no contemporaneous effect from openness to total exports supply is discernible. These findings also confirm that the exports-growth phenomenon is a post-liberalisation consequence. It thus refutes the structuralist view that the recent expansion of exports is an outcome of the industrial build-up in the import-substitution era. It is also noteworthy that the expansion of productive capacity and the past record of exports play a vital role-- the former being more dominant in the case of total exports while the latter being more important in the case of textiles and readymade garment exports. Furthermore, trade liberalisation has spearheaded the increase in the imports of capital goods, which in turn has expanded the productive capacity of these sectors and thus contributed to the acceleration of growth.

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APPENDIX

Table 1: *The ADF and the PP Tests for Unit Roots in the Levels of the Variables*

Series	Test Category	t-Values (with constant)	t-Values (with constant & trend)	Comment
tx_t	ADF	-0.18 (6)^{aic,}	-2.21 (5)^{aic}	Not I(0)
		0.14 (2)^{sbc,}	-1.89 (2)^{sbc}	Not I(0)
	PP	***-2.09***	***-3.20***	***Not I(0)***
mx	ADF	1.05 (5)^{aic,}	-1.80 (6)^{aic}	Not I(0)
		0.92 (2)^{sbc}	-1.76 (2)^{sbc}	Not I(0)
	PP	***-0.15***	***-1.45***	***Not I(0)***
txx	ADF	0.13 (3)^{aic,sbc}	-2.17(3)^{aic,sbc}	Not I(0)
	PP	***-1.04***	***-1.70***	***Not I(0)***
px	ADF	-1.61 (6)^{sac}	-1.24 (6)^{sbc}	Not I(0)
	PP	-1.45 (3)^{sbc}	-1.35 (2)^{sbc}	Not I(0)
		-1.70	***-2.28***	***Not I(0)***
pd	ADF	-2.05 (4)^{aic,sbc}	-2.52 (1)^{sbc}	Not I(0)
	PP	***-0.23***	***0.96***	***Not I(0)***
tpb	ADF	-1.83 (1)^{aic,sbc}	-2.62 (1)^{aic,sbc}	Not I(0)
	PP	***2.47***	***3.08***	***Not I(0)***
dop	ADF	-1.25 (5)^{aic}	-1.51 (5)^{aic}	Not I(0)
		-2.60 (1)^{sbc}	-2.99 (1)^{sbc}	Not I(0)
	PP	***-2.85***	***-3.29***	***Not I(0***
pc	ADF	-0.79 (2)^{aic,sbc}	-3.10 (3)^{aic,sbc}	Not I(0)
	PP	***-1.39)***	***-2.44 (8)***	***Not I(0)***

Legend: As in Table 3 below

Table 2: *The ADF and the PP Unit Root Tests in the First-Differences of the Variables*

Series	Test Category	t-Values (with constant)	t-Values (with constant & trend)	Comment
Δtx	ADF	-5.19 (6)[aic]	- 5.23 (6)[aic]	I(0)
		-9.84 (2)[sbc]	- 9.85 (2)[sbc]	I(0)
	PP	***-7.25***	***-7.33***	***I(0)***
Δmx	ADF	-4.44 (4)[aic]	-4.62 (4)[aic]	I(0)
		-4.15 (1)[sbc]	-4.40 (1)[sbc]	I(0)
	PP	***-5.21***	***-5.21***	***I(0)***
Δtxx	ADF	-5.14 (4)[aic]	-7.02 (2) [aic,sbc]	I(0)
		-7.01 (2)[sbc]		I(0)
	PP	***-8.55***	***-8.67***	***I(0)***
Δpx	ADF	-4.40 (5)[aic]	-4.67 (5)[aic]	I(0)
		-6.92 (1)[sbc]	-7.09 (1)[sbc]	I(0)
	PP	***-9.70***	***-8.70***	***I(0)***
Δpd	ADF	-4.78 (3)[aic,sbc]	-5.88 (3)[aic]	I(0)
			-9.91 (1) [sbc]	I(0)
	PP	***-3.64***	***-3.59***	***I(0)***
Δtpb	ADF	-7.14 (1)[aic,sbc]	-7.22 (2)[aic]	I(0)
			-8.21 (1) [sbc]	I(0)
	PP	***-16.50***	***-16.53***	***I(0)***
Δdop	ADF	-6.61 (6)[aic]	-6.57 (6)[aic]	I(0)
		-7.62 (4)[sbc]	-7.58 (4)[sbc]	I(0)
	PP	***-8.30***	***-8.25***	***I(0)***
Δpc	ADF	-6.61 (1)[aic,sbc]	-6.57 (2)[aic,sbc]	I(0)
	PP	***-10.17***	***-10.42***	***I(0)***

Legend:

[aic] = Akaike's Information Criterion
[sbc] = Schwartz Bayesian Criterion

Notes:(a) numbers within the brackets corresponding to ADF t-statistics are optimal lags specified by AIC or SBC

(b) t-values corresponding to Phillips-Perron (PP) tests are based on 4 truncation lags. similar results are obtained for different lags up to 12, the maximum examined; and

(c) Critical values for t-statistics with constant and with constant and trend at 5% significance levels are -2.89 and -3.45 respectively.

Table 3: *Parsimonious ECM for export price, domestic price, trade policy bias, degree of openness and production capacity under alternative models*

a. Total Exports Model

Δpx_t	**=0.18**Δpx_{t-3}	**+1.16**Δpd_{t-1}	**-1.20**Δpd_{t-2}	**+ 1.70**Δpd_{t-3}	**-0.16** Δtpb	**-0.15**Δtpb_{t-2}	**-0.25**Δtpb_{t-4}
	(2.34)	(3.45)	(2.40)	(4.58)	(-2.18)	(-2.13)	(-3.69)
	-0.10Δdop_{t-2}	**+ 1.22**Δpc_{t-1}	**-1.85**Δpc_{t-2}	**+1.34**Δpc_{t-3}	**+0.02**ecm_{1t-1}	**+0.09**d_1	**-0.04**d_2
	(-3.62)	(4.49)	(-4.44)	(4.88)	(4.86)	(4.28)	(-2.83)

R^2 =0.49 Adjusted R^2=0.40 F(13,80)=5.80* DW=2.25

Δpd_t	**=0.02**$_1$	**+0.05**Δpx_{t-}	**-0.04**Δpx_{t-4}	**+0.04**Δpx_{t-5}	**+1.01**Δpd_{t-1}	**-0.92**Δpd_{t-2}	**+0.38**Δpd_{t-3}	**+0.02**Δdop_{t-4}
	(4.42)	(8.81)	(-7.23)	(4.13)	(-2.29)	(-2.32)	(1.88)	(2.25)
	+0.01Δdop_{t-2}	**-0.55**Δpc_t	**+0.88**Δpc_{t-3}	**- 0.75**Δpc_{t-2}	**+0.27**Δpc_{t-3}	**-0.05**ecm_{1t-1}	**+0.03**ecm_{2t-1}	**+0.01**d_1
	(1.99)	(-11.76)	(8.27)	(-6.43)	(4.01)	(-3.34)	(3.53)	(2.38)

R^2 =0.79 Adjusted R^2=0.75 F(15,78)=20.01* DW=1.97

Δtpb_t	**=0.03**	**+0.09**Δtx_{t-5}	**+0.24**Δpx_{t-2}	**-0.36**Δtpb_{t-1}	**-0.07**Δdop_{t-3}	**-0.07**ecm_{1t-1}	**+0.06**d_t	**+0.03**d_2
	(1.59)	(2.12)	(2.11)	(-3.87)	(-1.90)	(-2.21)	(1.77)	(1.23)

R^2 = .27 Adjusted R^2 = .21 F(7,86) = 4.58* DW = 2.09

Δdop_t	**= 0.10**	**+0.18**Δtx_t	**+ 0.57**Δpx_t	**-0.73**Δpx_{t-3}	**-4.35**Δpd_{t-5}	**+4.58**Δpd_{t-6}	**+0.65**Δtpb_{t-1}	**+0.45**Δtpb_{t-4}
	(2.00)	(1.84)	(2.34)	(-3.43)	(-4.61)	(4.37)	(3.61)	(2.16)
	-0.35Δdop_{t-2}	**-0.48**Δdop_{t4-}	**-2.99**Δpc_{t-5}	**+0.17**ecm_{1t-1}	**-0.43** ecm_{2t-1}	**-0.24**d_1	**-0.20**d_2	
	(-3.44)	(-4.60)	(-2.99)	(2.37)	(-3.70)	(-3.13)	(-2.90)	

R^2=0.66 Adjusted R^2=.54 F(14,79)=5.84* DW=1.83

Δpc_t	**=0.03**	**-0.03**Δtx_{t-1}	**+0.04**Δtx_{t-1}	**+0.07**Δpx_{t-6}	**-1.04**Δpd_t	**+0.95**Δpd_{t-1}	**-0.06**Δtpb_{t-6}	**+0.82**Δpc_{t-1}
	(3.82)	(-1.96)	(2.60)	(2.25)	(-9.33)	(7.62)	(-2.03)	(13.75)
	-0.17Δpc_{t-3}	**-0.07**ecm_{1t-1}	**+0.13**ecm_{2t-1}	**+0.04**d_2				
	(-3.69)	(-4.04)	(4.39)	(3.99)				

R^2=0.82 Adjusted R^2 = .79 F(11,82) = 33.57* DW = 1.85

b. Manufacturing Exports Model

Δpx_t	**=0.01**	**+0.26**Δmx_{t-3}	**+0.57**Δpd_t	**-0.14**Δtpb_{t-4}	**-0.10**Δdop_{t-2}	**+0.26**Δpc_{t-3}	**+0.11**ecm_{1t-1}	**-0.16**ecm_{2t-1}	**-0.09**d_1
	(3.24)	(2.38)	(2.91)	(-2.01)	(-3.34)	(2.28)	(3.00)	(-2.64)	(-3.59)

R^2 =0.37 Adjusted R^2=0.31 F(8,85)=6.40* DW=2.09

Δpd_t	**=0.04**	**-0.09**Δmx_t	**-0.04**Δpx_{t-4}	**+0.76**Δpd_{t-1}	**-0.59**Δpd_{t-2}	**+0.03**Δtpb_{t-1}	**+0.02**Δtpb_{t-4}	**-0.01**Δdop_{t-3}
	(5.81)	(-2.84)	(-2.14)	(7.31)	(-6.26)	(1.81)	(0.92)	(-1.69)
	-0.50Δpc_t	**+0.62**Δpc_{t-1}	**-0.35**Δpc_{t-3}	**+0.01**ecm_{1t-1}	**-0.01**ecm_{2t-1}			
	(-6.92)	(6.92)	(-5.48)	(2.26)	(-2.52)			

R^2 =0.70 Adjusted R^2 = .66 F(12,81) = 16.10* DW = 1.97

Δtpb_t	**= 0.02**Δpx_{t-2}	**-0.17**Δpx_{t-5}	**-0.38**Δtpb_{t-1}	**-0.09**Δdop_{t-1}	**-0.09**Δdop_{t-2}	**+ 0.24**Δpc_{t-4}	**-0.12**$ecm_{1t-2\ 4}$
	(2.31)	(-1.68)	(-3.99)	(-1.82)	(-1.92)	(1.86)	(-2.71)

R^2 = .25 Adjusted R^2 = .20 F(6,87) = 4.91* DW = 2.02

Δdop_t	**= -0.48**Δmx_{t-4}	**-1.16**Δmx_{t-5}	**+1.05**Δmx_{t-7}	**+0.58**Δpx_t	**-0.47**Δpx_{t-7}	**-0.63**Δpd_{t-5}	**+0.62**Δtpb_{t-1}
	(-1.78)	(-4.04)	(3.44)	(2.55)	(-2.53)	(2.73)	(3.50)
	-0.61Δdop_{t-1}	**-0.17**Δdop_{t-3}	**-0.63**Δpc_{t-4}	**-0.07**ecm_{2t-1}			
	(-7.42)	(-2.24)	(-2.37)	(-2.52)			

R^2 =0.52 Adjusted R^2=46 F(10.83)=8.97* DW=2.11

Δpc_t	**=0.08**Δmx_{t-3}	**+0.05**Δpx_{t-5}	**-0.98**Δpd_t	**+1.97**Δpd_{tt-1}	**-1.99**Δpd_{t-2}	**+0.05**Δtpb_{t-3}	**+0.02**Δdop_{t-1}	**+0.18**Δpc_{t-5}
	(2.55)	(2.27)	(-13.16)	(17.06)	(-9.48)	(2.49)	(2.05)	(2.08)

R^2 =0.62 Adjusted R^2=0.60 F(7,86)=69.50* DW=2.08

c. *Textiles and Readymade Garment Exports Model*

$$\Delta px_t = \underset{(5.30)}{0.51\Delta txx_{t-5}} \underset{(-2.74)}{-0.22\Delta txx_{t-7}} \underset{(2.55)}{+0.22\Delta px_{t-4}} \underset{(2.18)}{+0.54\Delta pd_{t-2}} \underset{(2.11)}{+0.14\Delta tpb_{t-3}} \underset{(-2.51)}{-0.07dop_{t-2}} \underset{(2.83)}{+0.31\Delta pc_{t-1}} \underset{(1.97)}{+0.23\Delta pc_{t-7}} \underset{(-2.17)}{-0.03ec_{1t-1}} \underset{(2.34)}{+0.11ecm_{1t-1}}$$

R^2 =0.47 Adjusted R^2=0.40 F(10,79)=7.03* DW=2.29

$$\Delta pd_t = \underset{(-3.25)}{-0.07\Delta px_{t-4}} \underset{(8.09)}{+1.01\Delta pd_{t-1}} \underset{(-6.35)}{-0.90\Delta pd_{t-2}} \underset{(3.44)}{+0.35\Delta pd_{t-3}} \underset{(-10.61)}{-0.56\Delta pc_t} \underset{(7.86)}{+0.90\Delta pc_{t-1}} \underset{(-6.01)}{-0.75\Delta pc_{t-2}} \underset{(3.87)}{+0.29\Delta pc_{t-3}} \underset{(-4.25)}{-0.02ecm_{1t-1}} \underset{(1.96)}{+0.02ecm_{2t-1}}$$

R^2 =0.72 Adjusted R^2=0.68 F(9,80)=22.50* DW=1.72

Table 3 continued

c.Textiles and Readymade Garment Exports Model

$$\Delta px_t = \underset{(5.30)}{0.51\Delta txx_{t-5}} \underset{(-2.74)}{-0.22\Delta txx_{t-7}} \underset{(2.55)}{+0.22\Delta px_{t-4}} \underset{(2.18)}{+0.54\Delta pd_{t-2}} \underset{(2.11)}{+0.14\Delta tpb_{t-3}} \underset{(-2.51)}{-0.07dop_{t-2}} \underset{(2.83)}{+0.31\Delta pc_{t-1}} \underset{(1.97)}{+0.23\Delta pc_{t-7}} \underset{(-2.17)}{-0.03ec_{1t-1}} \underset{(2.34)}{+0.11ecm_{1t-1}}$$

R^2 =0.47 Adjusted R^2=0.40 F(10,79)=7.03* DW=2.29

$$\Delta pd_t = \underset{(-3.25)}{-0.07\Delta px_{t-4}} \underset{(8.09)}{+1.01\Delta pd_{t-1}} \underset{(-6.35)}{-0.90\Delta pd_{t-2}} \underset{(3.44)}{+0.35\Delta pd_{t-3}} \underset{(-10.61)}{-0.56\Delta pc_t} \underset{(7.86)}{+0.90\Delta pc_{t-1}} \underset{(-6.01)}{-0.75\Delta pc_{t-2}} \underset{(3.87)}{+0.29\Delta pc_{t-3}} \underset{(-4.25)}{-0.02ecm_{1t-1}} \underset{(1.96)}{+0.02ecm_{2t-1}}$$

R^2 =0.72 Adjusted R^2=0.68 F(9,80)=22.50* DW=1.72

$$\Delta tpb_t = \underset{(1.96)}{0.23\Delta px_{t-6}} \underset{(2.00)}{+0.70\Delta pd_{t-1}} \underset{(-2.95)}{-0.28\Delta tpb_{t-1}} \underset{(-3.60)}{-0.18\Delta dop_{t-1}} \underset{(-3.53)}{-0.19\Delta dop_{t-2}} \underset{(-3.58)}{-0.18\Delta dop_{t-3}} \underset{(-2.32)}{-0.09\Delta dop_{t-6}} \underset{(2.35)}{+0.34\Delta pc_{t-3}} \underset{(1.56)}{+ecm_{1t-1}}$$

R^2 =0.35 Adjusted R^2=0.29 F(8,81)=5.47* DW=2.13

$$\Delta dop_t = \underset{(4.53)}{0.40} \underset{(-1.83)}{-0.55\Delta txx_{t-1}} \underset{(-2.37)}{-0.42\Delta px_{t-7}} \underset{(2.28)}{+1.91\Delta pd_{t-1}} \underset{(-2.15)}{-1.31\Delta pd_{t-5}} \underset{(-1.75)}{-0.32\Delta tpb_t} \underset{(-1.90)}{-0.32\Delta tpb_{t-2}} \underset{(-6.61)}{-0.63\Delta dop_{t-1}} \underset{(-3.54)}{-0.36\Delta dop_{t-2}} \underset{(-4.62)}{-0.42\Delta dop_{t-3}} \underset{(2.49)}{+0.86\Delta pc_{t-1}} \underset{(3.78)}{+0.34ecm_{1t-1}} \underset{(-2.88)}{-0.38ecm_{2t-1}}$$

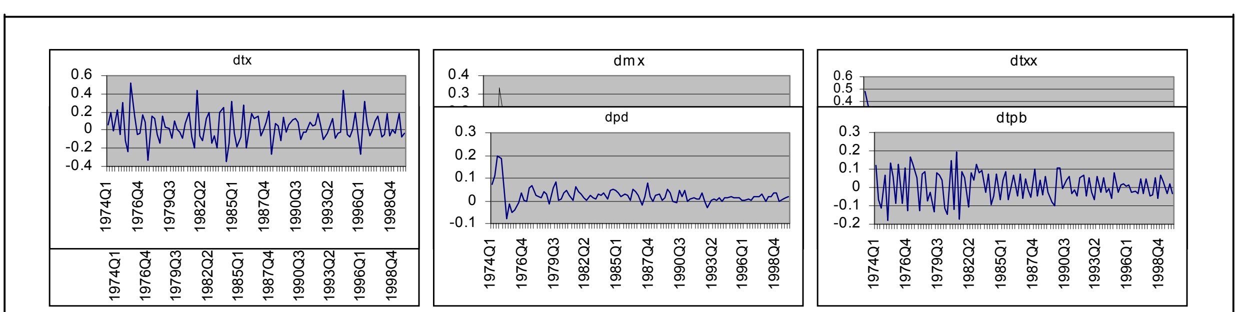
R^2 =0.62 Adjusted R^2=0.54 F(13,76)=7.97* DW=2.02

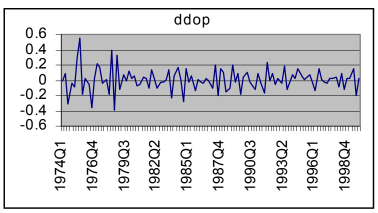
$$\Delta pc_t = \underset{(2.80)}{0.24\Delta txx_{t-1}} \underset{(-2.92)}{-0.15\Delta txx_{t-2}} \underset{(2.35)}{+0.14\Delta px_{t-5}} \underset{(8.75)}{+0.84\Delta pc_{t-1}} \underset{(-3.35)}{-0.33\Delta pc_{t-2}} \underset{(-2.62)}{-0.02ecm_{1t-3}} \underset{(1.96)}{+0.05ecm_{2t-1}}$$

R^2 =0.59 Adjusted R^2=0.57 F(7,82)=20.32* DW=1.94

Note: Figures in parentheses denote calculated t-values

Figure 1: *Plots of the First Differences of the Variables*

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0.2
0
-0.2
-0.4
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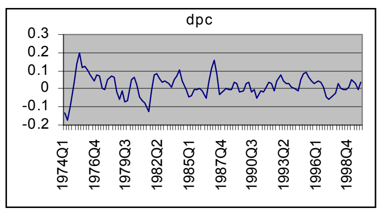
1976Q4
1979Q3
1982Q2
1985Q1
1987Q4
1990Q3
1993Q2
1996Q1
1998Q4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0.1
0
-0.1
-0.2
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1976Q4
1979Q3
1982Q2
1985Q1
1987Q4
1990Q3
1993Q2
1996Q1
1998Q4