Demand and Supply Factors in the Determination of India's Disaggregated Manufactured Exports: A Simultaneous Error-Correction Aprroach

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May 2007

Working Paper
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This paper is drawn out of they author's doctoral dissertation at the Centre for Development Studies, Thiruvanathapuram. The author is grateful to Pulapre Balakrishnan and K. Pushpangadan for their supervision, to K.L. Krishna and Sarmila Banerjee for advising all through the work, to Aditya Bhattacharjea, Sugata Marjit, K. K. Subrahmanian, Sunil Mani and K. N. Harilal for their comments on an earlier draft of the paper, and to Kavita Rao and N. R. Bhanumurthy for their help at different stages. An earlier version of the paper was presented at the Centre for Development Studies, Thiruvananthapuram, 2nd International Conference on Issues in Development Economics organised by Burdwan University, West Bengal, and the South and Southeast Asia Econometric Society Meeting 2006 held at IFMR, Chennai. The author is also thankful to the participants in these conferences for their comments. The author is solely responsible for errors, if any.

ABSTRACT

This paper is an investigation of the demand and supply factors underlying the long-term behaviour of India's disaggregated manufactured exports. Broadly, there are two divided views on India's export behaviour: while the predominant view stresses the importance of supply and policy related factors, other studies find the significance of world demand in export determination. The issue is more important than empirical estimation of determinants of exports; it is theoretically motivated as India has been able to expand exports across sectors in tandem with changes in trade regimes. However, the fact of varying export growth across different sector does not lend support to the observation that only policies explain export performance, rather it highlights the importance of other demand and supply factors at the sectoral level. An imperfect substitutes demand-supply model of export determination is set out and the model is estimated in an error-correction framework using systems method. The model explains behaviour of disaggregated exports well. It shows the importance of demand as well as supply effects in the determination of India's disaggregated exports except textiles and garments.

Key words: Disaggregated manufactured exports, imperfect substitutes demand-supply model, simultaneous error-correction mechanism, price responsiveness of exports, world demand.

JEL Classification: F14, 024, C32

1. Introduction

This paper is an investigation of the factors underlying behaviour of India's disaggregated manufactured exports during 1960/61 to 1999/2000: whether it is demand or supply effects that determine the observed export growth patterns. At the aggregate level, India's exports registered high growth since the mid-1980's.[1] The growth pattern is no different in case of disaggregated exports. Such a changing growth path of exports, being coincidental with India's trade reforms,[2] is often attributed to price responsiveness of exports and improvements in incentive structures towards trade. However, the evidence of varying export growth rate across sectors even after reforms show the importance of supply capability as well as demand factors in export determination.

The existing literature explaining India's export behaviour is divided in this regard. While price responsiveness of exports lends support to "small" country assumption prevalent in theoretical trade models, effectiveness of demand or supply factors tends to prove that it is not only relative price that determine industrialising country

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1 Sinha Roy (2004).

2 Sinha Roy (2005a) argues that trade reforms in India, though often identified with structural adjustment programme, was in place since the mid-1980s. The structural adjustment programme only carried the trade reforms process forward.

exports[3] . Some studies, as those by Bhagwati and Srinivasan (1975), Wadhwa (1988), Virmani (1991), Joshi and Little (1994), Krishnamurthy and Pandit (1995), and Srinivasan (1998) provide evidence on price responsiveness of India's exports. Lucas (1988), however, finds varying price responsiveness across commodities and thus, questions the validity of small country assumption across export categories. The relative price responsiveness of exports, as discussed in the literature, depends on the development strategy followed: while import substitution leads to biases against exports as a result of distortions in relative prices, liberalisation - through competition and access to cheaper inputs - aim at "right" relative prices for exports. However, Nayyar (1988), Ghosh (1990), and Sarkar (1994) argue that Indian exports are not necessarily price responsive. Sinha Roy (2005 a) shows that turning points in India's post-reforms export performance were not often led by the movements in exchange rate. In addition to the impact of relative prices, these studies also establish the importance of various demand and supply factors determining export performance.[4]

The predominant view also stresses the importance of supply and other policy related constraints. For instance, Panchamukhi (1978) shows that domestic policies have significant effect on trade behaviour of developing countries. The studies by Bhagwati and Srinivasan (1975) and Wolf (1978) highlight that an inward looking policy, with capacity constraints, lack of competition, and high domestic demand, do not signal enough incentives to export. In contrast, other studies find the significance of world demand in the determination of exports. Nayyar (1976, 1988), for instance, argue that it is incorrect to suggest that the policy regime is the mainstay in explaining overall export performance, rather external constraints provide an upper limit to growth of exports

3 In this context, it would be interesting to highlight the debate on industrialising country exports between Athukorala and Riedel on one hand and Muscatelli and associates on the other.

4 Marjit and Ray Chaudhuri (1997) argue the importance of non-price factors apart from relative prices in the determination of India's exports.

from India. Sinha Roy (2005 a, b) provides evidence on the primacy of world demand in determining India's exports behaviour.

The scheme of the paper is as follows. The following section provides a brief overview of India's export performance. Section 3 outlines the simultaneous equation model estimated and the methodology used in the paper. The fourth section provides the estimates of the econometric model and an interpretation of the results. The paper concludes with a summary and implications of the main findings.

2. Behaviour of India's Disaggregated Exports: *Some Salient Features*

Like aggregate exports, disaggregated manufactured exports show distinct discontinuities in trend.[5] In particular, significant breaks in trend are observed in most export categories during the mid-1970s and mid-1980s.[6] However, the breakpoints do not synchronise across export categories. For analytical purposes, despite being arbitrary, the time path of exports can be divided into three distinct phases: 1960-72, 1973-84 and 1985-2000. This periodisation enables to observe behaviour of disaggregate exports in the context of changing trade regimes in India and during different phases of world demand.

Real exports[7], at the disaggregate level, showed an increasing trend over the period 1960/61 to 1999/2000 (Table 1). The growth path, being demarcated into three distinct phases, comprised of initial phases of low to moderate export growth till the mid-1980s and a phase of high growth thereafter till the 1999/2000. The period-wise growth rates point to such evidence.

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5 For an analysis on break in trend in India's aggregate exports, see Sinha Roy (2004). The significance of discontinuity in trend is usually established using Chow test. Such a test is, however, inappropriate if the time series is non-stationary.

6 Although export growth declined towards the end of the third period (see Sinha Roy, 2005 a), it is not necessary to periodise the two years of lower growth separately as the phase is short.

7 Volume index of exports could have been used instead. But the volume index suffers from various inherent problems (see Sinha Roy, 2001).

The different segments of manufacturing registered varying rates of export growth across different sub-periods. The exports of 'textiles and manufactures thereof' and 'metals and manufactures', especially iron and steel, grew at low or negative rates during the first two phases.[8] However, evidence from Table 1 point to higher rates of export growth for these categories during liberalisation. The low growth observed during the first two phases is perhaps a reflection of, among other factors, lack of diversification of the export basket and the presence of low value-added items therein.

Table 1: Period-wise Growth Rates[1] of India's Disaggregate Exports (in per cent)

Product Groups	1960-72	1973-84	1985-99
Textiles and Manufactures thereof	1.96	5.10	17.37
Clothing[2]	38.26	18.67	10.40
Chemicals	14.63	13.64	20.23
Machinery & Transport Equipment	26.18	13.95	14.87
Non-electrical Machinery[3]	—	3.55	8.74
Electrical Machinery[3]	—	6.37	30.27
Transport Equipment[3]	—	4.66	12.95
Metal Manufactures[2]	-11.02	6.45	19.78
Iron and steel[2]	-16.76	12.66	25.55
Leather and Manufactures thereof	9.10	1.04	9.98
Footwear[2]	2.84	1.18	16.29

Note: (1) The growth rates for each phase are average annual percentage change.

(2) In these product groups, growth rates for the first phase pertains to the 1968-72.

(3) For these product groups, growth rates for the second phase pertains to 1978-85. (-) indicates that data are not available for these years.

Source: Estimations based on Government of India, DGCI and S database.

8 During these two phases, especially during the first, the East Asian economies exported textiles in a substantial way in contrast to that from India.

In contrast, clothing exports grew at high rates during all the three phases even though the growth rates decelerated.[9] The high growth of clothing exports during the 1960s was due to low starting base of such exports. The evidence suggests that after making initial grounds, India's clothing exports could not break into new markets and neither did new value-added clothing items emerge in the export basket.

The exports of chemicals and machinery and transport equipment witnessed high growth rates throughout, even though average growth lowered during 1973/74 to 1984/85. Such high growth of chemical exports during trade liberalisation surpassed that during the first phase, but exports of machinery and transport equipments lowered substantially after the mid-1990s. The exports of leather and manufactures grew at over 9 per cent between 1960/61 and 1972/73, but witnessed a substantial decline in the next phase. It regained reaching over 10 per cent growth from the mid-eighties onwards. This is very much in tune with the turnaround observed in case of footwear exports during liberalisation. The demarcation of the entire period into three phases, however, might not exactly coincide with the trend growth path followed by these exports.

On the whole, export growth was high across most product groups during trade reforms period than in the earlier phases till the mid-1980's. Even though export expansion across sectors was coincidental with changes in trade regimes, it would be too naïve to attribute the observed acceleration in export growth to trade liberalization *per se*. Supply or demand factors on their own can only determine export behaviour for specific short periods, but cannot explain a long run phenomenon. It is the combination of supply and demand effects that cause long run export performance. In what follows is an econometric understanding of the demand and supply factors that explains India's long run export performance.

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9 However, growth of textiles exports well surpassed that of clothing exports after 1985. The evidence also shows that clothing exports growth declined after the mid-1990s.

3. Model Specification and the Econometric Method

3.1 *The Model*

The long run export performance can be related to various demand and supply factors. Goldstein and Khan (1978, 1985), Arize (1990), and Muscatelli et al. (1992) show that demand and supply factors are equally important in determining export growth across countries. Accordingly, I develop here a simultaneous equation model along the lines of an imperfect substitutes model with real exchange rate and world demand as demand-side determinants, and relative price and supply capability as explanatory variables on the supply side. Export demand is specified as follows:

$$X^d_t = f(REER_t, W_t), \text{ with } f_r' < 0 \text{ and } f_w' > 0 \quad (1)$$

where X^d is real exports demanded, REER = P^x / eP^w is real effective exchange rate expressed in terms of P^x as price of exports, eP^w as exchange rate multiplied by world prices, W is world demand, and f_r' and f_w' are first order derivatives of X^d_t with respect to $REER_t$ and W_t respectively.

Equation 1 can be re-written as:

$$X^d_t = f(P^x_t / eP^w_t, W_t) \quad (2)$$

$$\text{or, } X^d_t = g(P^x_t, eP^w_t, W_t) \quad (2a)$$

In log-linear form, Equation 4.2a can be written as

$$\ln X^d_t = \alpha_0 + \alpha_1 \ln P^x_t + \alpha_2 \ln e.P^w_t + \alpha_3 \ln W_t + u_t \quad (3)$$

with $\alpha_1 < 0$; $\alpha_2, \alpha_3 > 0$.

The supply of exports is specified as a function of the relative prices (i.e., the ratio of export prices to domestic prices) and supply capability measured in terms of GDP (denoted Y). This specification as distinct from Goldstein and Khan (1985) includes a supply scale variable. The export supply function is expressed as:

$$X^s_t = (RP_t, Y_t) \quad (4)$$

where X^s = real exports supplied, RP = relative price of exports expressed as P^x / P^d, P^d = domestic price, Y= supply capability in terms of sectoral value added.

As in the case of the demand Equation 3, Equation 4 can be re-written as

$$\ln X^s_t = \beta_0 + \beta_1 \ln P^x_t + \beta_2 \ln P^d_t + \beta_3 \ln Y_t + v_t \quad (5)$$

with $\beta_1, \beta_3 > 0; \beta_2 < 0$

In equilibrium, $X^d_t = X^s_t = X_t$ (say) (6)

The above system of equations assume that the underlying demand and supply conditions are broadly similar for different product groups. However, supply characteristics and demand conditions vary not only between primary products and manufactures, but also between different groups of manufactured goods. Though characterization of production and price formation vary across manufactured goods the basic model in terms of relative price and the scale variable is suitable for all product groups. Any change in the model structure based on conditions of production, even if more appropriate, would make a comparison of results across commodity groups difficult.

The demand specification in the model differs in the choice of the scale variable – instead of real income of the world economy, aggregate imports of major trading partners are used as a measure of world demand.[10] In the demand specification, often capacity to import by destination countries (Winters, 1981) and instability in exchange rate

10 Virmani (1991) adopts a multicountry framework in the demand specification by separating non-Indian goods that are traded and all other goods broadly classified as non-tradeable.

movements are used as explanatory variables, but they may not be important determinants in this case since India exports mostly to developed countries which are not constrained to import and instabilities in Indian exchange rate are not so significant as to be taken into account.

The supply specification in Equations 5 and 6 differs from the literature. While unit cost or wages in manufacturing along with prices of raw material inputs are used instead of domestic prices,[11] supply-side scale variable is often proxied by either domestic productive capacity, capital stock, imported inputs or time trend.[12] Some supply side scale variables used are domestic demand pressure (Ali, 1985; Joshi and Little, 1994, capacity utilisation (Virmani, 1991) or a measure of overall demand in terms of output of a particular sector relative to total real GDP (Krishnamurty and Pandit, 1995). However, important supply side factors such as technology developments, infrastructure and transactions costs have not been considered due to non-availability of time comparable data.

The system of equations, specified in Equations 3, 5 and 6, can be referred to as an equilibrium model with instantaneous adjustment of export prices and quantities and accordingly, no lags are specified in the system of equations. In this model X_t and P^x_t are jointly dependent variables, while other variables are predetermined. Two issues assume importance in estimation: identification, and normalisation. Identification of individual equations in a simultaneous equation system is in terms of rank and order conditions using pre-determined variables. Both the supply and demand equations satisfy the rank condition, the necessary and

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11 See, for instance, Riedel (1988), Holly and Wade (1991), Funke and Holly (1992) and Muscatelli et al. (1992).

12 See, for instance, Goldstein and Khan (1978), Moran (1988), Arize (1990), Gatt (1995), and Holly and Wade (1991). Joshi and Little (1994) have used time trend capturing capacity growth and improvements in productive capacity.

sufficient conditions for identification. The order condition shows that both the equations are over-identified with the number of exogenous variables in the system greater than the number of slope coefficients in each equation. The individual equations in the system can thus be estimated.

Simultaneous equation estimates vary depending on the normalisation procedure used. Conventionally, following Goldstein and Khan (1978), export demand is normalised by quantity as the dependent variable and export supply by price. Muscatelli et al. (1992) have followed this for estimating developing country exports. However, studies such as by Riedel (1988) and Athukorala and Riedel (1990) deviate from the convention instead, and arrive at results that contrast Muscatelli et al. (1992), although they use the same data set. The evidence in Indian trade literature is also mixed.[13] Following Goldstein and Khan (1978) and Muscatelli et al. (1992), Equations 3 and 5 are normalised as follows:

Export Demand: $\ln X^d_t = \alpha_0 + \alpha_1 \ln P^x_t + \alpha_2 \ln e.P^w_t + \alpha_3 \ln W_t + u_t$ (7)

Export Supply: $\ln P^x_t = \gamma_0 + \gamma_1 \ln X^s_t + \gamma_2 \ln P^d_t + \gamma_3 \ln Y_t + z_t$ (8)

where $X^d_t = X^s_t = X_t$,

and $\gamma_0 = (-\beta_0 / \beta_1)$; $\gamma_1 = (1 / \beta_1)$; $\gamma_2 = (\beta_2 / \beta_1)$; $\gamma_3 = (-\beta_3 / \beta_1)$ with $\gamma_1, \gamma_2 > 0$; $\gamma_3 < 0$.

With regard to interpretation of the coefficients in Equations 7 and 8, the following needs to be noted. Estimation of γ_1 in Equation 8 allows us to arrive at proximate determinants of exports, while not necessarily arriving at estimates of export supply price elasticity. Price elasticity of supply – β_1 in Equation 6 tends towards infinity as γ_1 in

13 While Krishnamurty and Pandit (1995) and Virmani (1991) follow Goldstein and Khan (1978), Arize (1990) normalises the export equations on the lines of Riedel (1988). Joshi and Little (1994) skirt the normalisation issue by presenting estimates of both demand and supply sides in terms of export quantity as the dependent variable.

Equation 8 tends towards zero. Further, a disequilibrium model has a distinct advantage over the equilibrium model as actual values adjust to equilibrium values with a time lag due to the existence of adjustment costs and incomplete information (Goldstein and Khan, 1985). The above equation system can be made dynamic introducing an appropriate lag structure.

3.2 *The Econometric Method*

Given its distinct advantages, most earlier studies on export determination have used two-stage least squares (2SLS) method. Arize (1990) uses the Sargan Two Stage Least Squares, which differs from the standard two-stage method in that lagged values of all variables in the reduced form model are also used as first-stage regressors.The 2SLS method is found to be valid even if the variables of the system are non-stationary and cointegrated.[14]

Usually long time series are found to have a structural break in the trend, as for exports in 1985-86. While testing the time series properties of any particular variable, dummy variable is introduced in the specification to take account of structural breaks. The existence of structural break, often multiple, in different variables led to the use of modified Augmented Dickey-Fuller (ADF) test while verifying stationarity.[15] In the estimation of unit roots, only level dummy is taken into account. For all variables, the estimation of the Perron equation has taken into account a single break keeping in view of the degrees of freedom. After incorporating structural break, exports and all other variables are found to be integrated of order 1, I (1). The use of an error

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14 Hsiao (1995), as quoted in Johnston and Dinardo (1997), finds that even if the variables in an equation system are non-stationary and cointegrated, a structural model building exercise has to only take into account issues of identification and simultaneity bias.

15 See Perron (1989) for detailed methodology.

correction specification is thus justified in this case of a simultaneous equations system where all variables are integrated of order 1, I (1).

Even estimates (as by Virmani, 1991) expressed in changes often take care of the time series properties of the variables, the method does not typically conform to an error-correction model. Muscatelli et al. (1992) estimate the dynamic generalised error-correction model (ECM) of an export demand-supply system incorporating the errors of individual equations estimated by the modified OLS method of Philips and Hansen (1990).[16] Alternately, the Johansen method can be used instead to find out the number of cointegrating vectors and Engle-Granger OLS procedure can then be applied to the structural equations, as suggested by Muscatelli and Hurn (1992).

Here structural error terms, e^d_t and e^s_t, are estimated for the demand and the supply equations by applying 2SLS method. The errors are as follows:

$$e^d_t = \ln X_t - a_0 - a_1 \ln P^x_t - a_2 \ln e.P^w_t - a_3 \ln Wt \quad (9)$$

$$e^s_t = \ln P^x_t - b_0 - b_1 \ln X_t - b_2 \ln P^d_t - b_3 \ln Y_t \quad (10)$$

The lagged error terms e^d_{t-1} and e^s_{t-1} are used in the demand and the supply equations respectively to arrive at the ECM estimates. For the purpose, a systems method – Full Information Maximum Likelihood (FIML) method – is used. The error correction equations, following Muscatelli et al. (1992), are specified as:

$$\Delta X_t = \gamma_0 + \Sigma \gamma_{1i} \Delta X_{t-i} + \gamma_2 \Delta P^x_t + \gamma_3 \Delta eP^w_t + \gamma_4 \Delta W_t + \gamma_5 e^d_{t-1} + \mu_t \quad (11)$$

$$\Delta P^x_t = \theta_0 + \Sigma\theta_{1i} \Delta P^x_{t-i} + \theta_2 \Delta X_t + \theta_3 \Delta P^d_t + \theta_4 \Delta Y_t + \theta_5 e^s_{t-1} + \nu_t \quad (12)$$

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16 Muscatelli et al. (1992) find that the use of OLS method in estimating long-run simultaneous models suffers from the deficiencies of small sample bias and endogeneity of regressors. In order to correct for these dual problems, they use Phillips and Hansen (1990) estimator.

Equation 11 with ΔX_t as the independent variable states the export demand relationship, while Equation 12 with ΔP^x_t shows the supply relationship. The significance of γ_5 and θ_5 in the above equations shows the validity of the error correction mechanism.

4. The Estimates: *Understanding Growth of Disaggregate Exports*

The error-correction estimates help understand the short run dynamics and identify the different causal factors leading to the long run performance. The ECM estimates of the export determination model across product groups are reported in Tables 2. As the dummy variable *Dum85*, indicating structural break in 1985, is found to be insignificant in both demand and supply equations, the equation system is re-estimated by dropping the variable. Despite variations in results across product groups, estimates for most product groups are found to have an error-correction representation with the lagged error terms, e^d_{t-1} and e^s_{t-1}, being negative and significant. For most disaggregate exports, the coefficients of the lagged error term for both demand and supply functions are significant at 1 per cent, the exceptions being iron and steel[17] and textiles and garment exports. The estimates in Table 2 also show that most demand factors are significant in explaining short-run export performance for a large number of export product groups.

For exports of chemicals and machinery and transport equipment, both demand and the supply side errors correct for the equilibrium. Unlike manufactured exports[18] , most demand side factors significantly explain short run export performance for both these products. Given the similarity of explanations on the demand side, variations in short run adjustment of the two product groups are essentially explained in terms of supply side factors. On the supply side, estimates vary across these commodity

17. See Table A1 for alternate estimates on iron and steel exports

18 See Sinha Roy (2004).

groups. Domestic prices and real exports are significant determinants in the inverse supply function for chemicals exports. On the other hand, the insignificance of all explanatory variables in explaining the inverse supply function for machinery and transport equipment exports is noteworthy.

In sharp contrast leather and leather manufactures exports do not respond to export price on the demand side, but they respond to world prices and, to a lesser extent, to world demand. Domestic prices are found to be the only significant factor in the inverse supply function. Being a traditional manufacture, domestic price responsiveness of leather and manufactures exports is justified. On the other hand, with their coefficients not significantly different from zero in the inverse supply function, supply of leather and leather manufactures exports may be interpreted to be infinitely elastic with respect to capability and exports prices.

Table 2 also shows that only the supply side of iron and steel exports has significant lagged error term indicating the short run adjustment process. While supply of iron and steel exports are found to have infinite elasticity with respect to supply price, the significance of domestic price and supply capability is to be noted. In contrast, all demand side factors are found to be insignificant in the short run determination of iron and steel exports. Re-estimating the equations with a modified specification, as Sinha Roy (2004) finds, leads to improvements in results with significant error correction representation both for demand and supply equations. However, the supply side factors predominantly determine short-run iron and steel export performance.

For textiles and garments exports, meaningful ECM estimates could not be arrived at. The ECM estimate of the existing model fails to converge, and thus no explanation can be provided for textiles and garments exports in terms of a short-run adjustment process. Perhaps,

Table 2: FIML Estimation of Structural ECM Model: India's Exports by Product Groups, 1960-99

Product Groups	Demand (ΔX)				Supply (ΔP^x)			
	ΔP^x	ΔeP^w	ΔW	e^d_{t-1}	ΔX	ΔP^d	ΔY	e^s_{t-1}
Chemicals	-0.85	1.07	0.95	-0.58	0.78	1.00	-0.60	-0.59
	(-3.51)*	(3.74)*	(3.03)*	(-4.30)*	(1.91)***	(2.60)**	(-1.49)	(-2.65)**
Machinery &	-2.49	1.42	1.63	-0.38	0.49	-0.72	-0.04	-0.65
Transport Equipment	(-2.70)**	(3.70)*	(3.36)*	(-3.06)*	(1.37)	(-0.89)	(-0.10)	(-2.22)**
Leather	-0.33	0.68	0.53	-0.87	0.09	1.28	-0.10	0.31
Manufactures	(-1.68)	(3.26)*	(1.83)***	(-5.81)*	(0.51)	(5.23)*	(-0.99)	(-2.08)**
Iron and Steel@	-12.11	8.58	3.83	-0.93	0.24	1.15	-0.52	-1.09
	(-1.12)	(1.12)	(0.92)	(-1.04)	(2.03)	(3.86)*	(-1.85)***	(-4.18)*

Note: The system of equations is over-identified. is used for estimation of the ECM equations. * denotes significance at 1%, ** denotes significance at 5%, *** denotes significance at 10%.

@ For alternate estimates on iron and steel exports, see Tale A1.

Variable Description: X-real merchandise exports, P^x – price of exports, P^d – domestic prices, eP^w – exchange rate multiplied by world prices, W – Total World Demand, Y – GDP, Δ – first difference and, (-1) denotes one-year lag of the variable.

estimates in terms of instantaneous adjustment model may be more appropriate in explaining behaviour of textiles and garments exports. Sinha Roy (2004) shows that estimates of a variant of the same model are far from being meaningful. The alternate estimation results only show the significance of supply side in error correction (see Table A2). Domestic price is the only significant factor explaining the short run variations in textiles and garment exports. Being a traditional item, the result of supply-side driven short run adjustment of export performance is possible. This is more so when only supply side factors have the scope to adjust under preset demand conditions laid down by the Multi Fibre Agreements. The results for textiles and garment exports may also reflect the inappropriateness of the model estimated. There is, thus, a need for a different model explaining behaviour of textiles and garments exports. A re-specified model with a demand factor such as capability to import, which proxies for quota restrictions of different trading partner countries under MFA, will possibly provide a better explanation of export performance of this very important product group.

Notwithstanding product specific variations, the above results show that disaggregated merchandise exports are predominantly determined by demand-side factors, both prices and world demand. Even though certain supply factors are found significant in the determination of disaggregate exports, their relevance is relatively less important than demand factors as determinants of exports. On the whole, these results are not in line with the existing literature.

An Interpretation of the Results

Behaviour of India's exports has to be understood in terms of policy changes, price and various non-price factors. Disaggregated manufactured exports are found to have responded to own prices both on the demand and the supply sides (see Table 3). Supply price responsiveness has varied across product groups. Supply price elasticity is positive, above unity and significant for chemicals exports indicating

a positively sloped supply curve of exports.[19] Such price elasticity of export supply results from a large change in export supply consequent upon a small change in its own price. Significance of supply price as a determinant also means merchandise exports have responded to growing supply incentives in terms of rising export profitability through the period. Thus, high supply price elasticity for chemicals is perhaps on account of either a large inventory of these merchandise or a large unutilized capacity in these industries. Even though supply price elasticity is found to be high for exports of machinery and transport equipment, leather and manufactures, and iron and steel, it is insignificant. Exports of leather and manufactures as well as iron and steel are significantly determined by domestic prices (see Table 2). However, domestic price is not the only factor determining these exports.

On the demand side, high price responsiveness is observed for iron and steel, machinery and transport equipment, and chemicals exports. While price elasticity of demand is significant for chemicals and machinery and transport equipment, insignificance of the coefficient for iron and steel is noteworthy. This shows that while price distortions did create disincentives for export performance during import-substitution, improvements in price incentives induced exports of these products during trade liberalization. As against expectations, traditional manufactured exports such as leather and manufactures and textiles and garments are not found to be price responsive.

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19 Estimates of export supply elasticity with respect to price are obtained by inverting the coefficient of ΔX in the inverse supply function.

Table 3: Price Elasticity of India's Exports

Product Groups	Price Elasticity of	
	Demand	Supply
Chemicals	-0.85	2.61
Machinery and Transport Equipment	-2.49	2.04
Leather and Manufactures	-0.33	11.11
Iron and Steel	-12.11	4.17

The expected positive impact of capability on supply of exports is independent of the impact of a change in domestic prices, if any. Even though the impact is found to be positive, it is insignificant in the inverse supply function of most product groups. This result of insignificant impact of supply capability on exports is despite GDP growth and accompanying diversification of the production structure. Import substitution led to the development of a wide industrial base, but certain industries only grew during the period leading to a lopsided industrial structure. Trade liberalization also did not alter the industrial structure in a significant way. Further, there has been only narrow diversification of manufacturing production to more value-added industries and the services that emerged were not necessarily trade-enabling services. As a result, the pattern of diversification of the production structure has led to only limited improvements in the capability to export. Even post-reforms productivity improvements in manufacturing are limited to a few sectors (Das, 2003). The observed high export growth during the phase of trade reforms is, thus, independent of improvements in supply capability or productivity growth across sectors. On the whole, whether explanations forwarded in terms of relative prices or supply capability, it would be simplistic to attribute significant increases in exports after mid-1980s to trade liberalisation *per se*.

On the demand side, the overriding importance of world demand in determining India's exports is worth further discussion. However, high growth of world demand till the early 1970s did not lead to commensurate growth in India's exports. This is primarily on account of intra-developed

country trade predominating world trade. Additionally, tariff barriers to trade in the destination countries restricted demand for India's exports. The sources of world demand changed since 1973. During the post-1973 period, new destinations became the emerging sources of demand. However, the emerging destinations could not neutralise the stagnating demand from traditional trade partners during this phase. As a result, world demand for India's exports slowed down leading to low growth of India's exports after 1973. Geographic diversification proved to be more beneficial for Indian exports after the mid-1980s with the market for India's exports further expanding to Asian destinations. The high growth of these emerging along with traditional destinations determined the increase in scale of world demand for India's exports.

However, growing world demand did not ensure increase in market access for India's exports. Even though tariff barriers were brought down in various rounds of multilateral trade negotiations, market access problems for exports from developing countries such as India continued. In particular, the spread of non-tariff barriers to trade, especially MFA, continued restricting India's exports. These affect mostly textiles and clothing, footwear and leather manufactures, iron and steel, which account for about 40 per cent of total exports. These market access restrictions limited structural mobility of India's exports, led to persisting asymmetries between structures of India's exports and world demand, and provided an effective limit on realization of world demand.[20] Thus, it was realized world demand that impacted on India's export behaviour.

In phases of high world economic growth, despite market access restrictions, growth of realized world demand remained high. Additions to demand arose largely from new tradeables. While growing demand was not very effective in driving India's exports to grow during the 1960s, its impact was significant after the mid-1980s (Sinha Roy, 2005 a). On

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20 Lall (1999) analyses India's manufactured exports to demonstrate this. Nayyar (1988) has also argued that various barriers to trade have put an upper limit to growth of exports from India.

the downswing of the international business cycle, overall world demand contracted. On this downturn, India's trade partners restricted imports by erecting trade barriers on fears of domestic market disruption. Even though such slowing down of demand was mostly for new generation products, the already low demand for traditional items was further constricted. Declining growth in realized demand explained low growth of exports during the late 1970s and after the mid-1990s.

5. Summary and Conclusions

In this paper I have explored, using an econometric model, the factors determining disaggregate exports from India. However, the issue is more important than empirical estimation of determinants of disaggregate manufactured exports. Rather, it is theoretically motivated as India has been able to expand exports across sectors in tandem with changes in trade regimes. A simultaneous equation export determination model was set out in terms of relative price and a scale factor both on the demand and the supply sides. World demand and GDP are the scale factors on the demand and the supply side, respectively. For purposes of estimation, the demand side is a quantity equation while the supply equation is normalized with respect to price. The error-correction model is used to arrive at the estimates. The results show significant error correction representation for both demand and supply sides and the estimates are found to be robust for most disaggregated product groups. The only exception to this pattern is exports of textiles and garments, for which the simultaneous error-correction representation was found inappropriate.

Demand factors are found to be predominant in explaining India's disaggregate export performance during 1960-1999. With respect to prices, responsiveness of demand for manufactured exports is insignificant, but it is significant for chemicals and machinery and transport equipment exports. Most disaggregate exports are responsive to world demand. On the upswing of the international growth trajectory, exports are found to have responded to growing world demand. On the

downswing, low or declining world demand constrained exports to grow. Exports, however, did not respond in a significant way to growing world demand during the 1960s. This was largely on account of restrictions in global textiles trade and large volume of intra-developed country trade. Exports have responded to world demand since the early 1970s, in particular since the mid-1980s when exports increasingly responded to growing world demand from Asian developing countries.

Even if the supply side is as significant as demand in understanding India's disaggregate export behaviour, export price is the only significant supply factor. This implies that price incentives, in particular export profitability, are important for domestic producers in their decision to export. On the other hand, the insignificant but positive impact of supply capability on exports is an interesting finding. Quantitative assessments of supply factors such as productivity improvements, removal of infrastructural bottlenecks, procedural simplifications, among others, would necessarily provided better supply side estimates.

Above all, these results highlight the importance of demand effects rather than an excessive reliance on supply side improvements in providing a viable strategy towards export growth. While prices provided the incentives for exports, world demand was found significant in determining India's disaggregate export behaviour.

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Appendix

Table A1: Determinants of India's Iron and Steel Exports: FIML Estimates

Demand Side Dependant Variable: ΔX			Supply Side Dependant Variable: ΔP^x		
Variable	Estimate I	Estimate II	Variable	Estimate I	Estimate II
ΔP^x	-5.82 (-2.14)**	-5.07 (-2.38)**	ΔX	0.14 (1.40)	0.11 (1.14)
ΔeP^w	1.63 (1.01)		ΔP^d	0.80 (2.48)**	0.75 (2.46)**
ΔW	6.23 (2.22)**	5.99 (2.45)**	ΔY	-0.63 (-2.32)**	-0.66 (-2.48)**
$\Delta eP^w(-1)$	5.55 (2.14)**	5.80 (2.52)**	*Dum85*	-0.02 (-0.49)	
e^d_{t-1}	-0.36 (-1.85)***	-0.28 (-1.98)***	e^s_{t-1}	-0.89 (-3.34)*	-0.82 (-3.27)*
Constant	-0.55 (-1.43)	-0.46 (-1.37)	*Constant*	0.06 (1.46)	0.06 (1.63)

Note: Period of Analysis: 1960-1999. The system of equations is over-identified.

Variable Description: X-real merchandise exports, P^x – price of exports, P^d – domestic prices, eP^w – exchange rate multiplied by world prices, W – Total World Demand, Y – GDP, *Dum85*-dummy variable with 1 from 1985 onwards, Δ – first difference and, (-1) denotes one-year lag of the variable.

(*), (**) and (***) denote significance at 1%, 5%, and 10% respectively.

Table A2: Determinants of India's Textile and Garments Exports: FIML Estimates

Demand Side Dependant Variable: ΔX		Supply Side Dependant Variable: ΔP^x	
Variable	Coefficient	Variable	Coefficient
ΔP^x	-0.21 (-0.67)	ΔX	0.30 (0.47)
$\Delta eP^w(-2)$	0.10 (0.68)	ΔP^d	1.26 (2.98)*
ΔW	0.42 (1.48)	ΔY	0.08 (0.32)
$\Delta X(-1)$	0.01 (0.25)	$\Delta P^x(-1)$	
Dum85	0.25 (1.79)***	*Dum85*	
Dum dw	-3.19 (-1.77)***		
e^d_{t-1}	-0.06 (-0.75)	e^s_{t-1}	-0.76 (-2.80)*

Note: Same as Table A1. (*), (**) and (***) denote significance at 1%, 5%, and 10% respectively.

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