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India's Export by Countries and Commodities: On the Estimation of a Forecasting Model Using Panel Data

Rajesh Mehta
and
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RIS-DP # 84/2004

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India's Export by Countries and Commodities: On The Estimation of a Forecasting Model Using Panel Data[1]

Rajesh Mehta and Parul Mathur[2]

Abstract: The main objective of this paper is to develop a framework for forecasting of India's annual exports at regular intervals, which would be carried out for principal trading partners and their principal commodities. Individual country/commodity analysis takes into account the country/commodity wise characteristics such as non-tariff barriers, language differences, locational/distance differences, preferential and other trading arrangements etc. Apart from the above mentioned country/commodity specific characteristics it may be due to the demand conditions, differences in the degree of the sensitiveness of prices, which cannot be captured at an aggregate level. The general framework of the econometric model for forecasting of India's export by selected destinations and its selected commodities at the 6-digit HS classification level is developed in the first half of the paper. The econometric analysis of the framework rests on panel data. The primary factors taken to be influencing India's exports at a disaggregated level are total imports of the destination country and relative prices reflecting the level of competitiveness of India's exports in the destination country. The entire model constitutes of around 280 variables for the purpose of forecasting. For illustration purposes, the estimation of econometric sub-model for India's export to USA is stated. There are 17 cross-sectional commodity codes with the time–series ranging from 1993-2001. The independent variables forecasting is performed using time-series models. The revised forecasts estimate for India's export to USA stands at 8.85 per cent for 2003-04 with the base year of Mar02-Feb03.

To understand the behaviour of export from developing countries there exist a large number of studies[3] in the literature. For the Indian economy as well, several macro-econometric models[4] have been developed for capturing the behaviour of the trade sector[5]. Infact, such models have their assumed

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[1] An earlier version of this paper has been presented at *40th Annual Conference of the Indian Econometric Society* (TIES), during 13-15 February 2004, Bangalore.
This paper draws from the RIS project reports (i) Mehta, R, S. Bhat and P Mathur, "2003-04 Forecasts of India's exports: A disaggregated analysis by countries and commodities", February 2003, and (ii) Mehta R., S. Bhat and P. Mathur, "2003-04 Revised Forecasts of India's Export: A Disaggregate Analysis by Countries and Commodities", August 2003; submitted to the Ministry of Commerce, Government of India as a part of the research project on "Modelling of the Export Sector for Short-term Forecasts". The views expressed in this paper are personal and not necessarily of organisation to which they are attached.

[2] The authors wish to acknowledge and thank Prof. K. Krishnamurthy, Prof. K.L. Krishna, Dr. Ashok Parikh, Dr. R. Srinivasan, Ms. Vinita Kumar for their valuable guidance and/or comments.

[3] For a review of studies in India on external sector, see Panchamukhi, V.R. (1997).

[4] See Krishnamurty (2002), among others.

[5] For a review of export sector in India's country-wide econometric models, see Mehta and Mathur (2003).

importance in the policy and decision-making process not just for the entire economy only but also for the specific sectors as well. These kind of modelling exercises help in imparting a direction to the development and reform process of the economy. The existing country-wide econometric models have not given due attention to the trade sector since most of them have been built keeping in view specific objectives, and a systematic effort is still required for building a short-term econometric forecasting model for India’s export sector. It is with this view that this paper intends to fill one of the gaps in the existing Macro-econometric models for the trade sector. The main objective of this paper is to develop a framework for forecasting of India’s annual exports at regular intervals, which would be carried out for principal trading partners and their principal commodities. Individual country/commodity analysis takes into account the country/commodity wise characteristics such as non-tariff barriers, language differences, locational/ distance differences, preferential and other trading arrangements etc. Apart from the above mentioned country/commodity specific characteristics it may be due to the demand conditions, differences in the degree of the sensitiveness of prices, which cannot be easily captured at an aggregate level. More so, India’s exports are highly diversified in terms of its commodity basket. At the 6-digit HS classification, India exported a total of 4599 commodities (out of the total no. of all 5237 commodities defined at 6-digit level) in 2001-02.

This necessitates the need for following a commodity specific analysis of India’s exports. Such country and commodity wise disaggregated analysis could also be used in policy and decision making process of the government such as export promotion measures etc.

Section I lays out the general framework of the model and the methodology for building a short-term export-forecasting model for India’s export. As an illustration to the framework developed, the-sub model of India’s exports to USA forms Section II. Section II starts with the Indo-USA trade trends in the recent past followed by its model layout. The next part of the section constitutes the estimation procedure and model selection. The regression and the forecasting results are followed thereafter. The conclusions and the summary enlist the future follow-up of the model.

I. Short term Export Forecasting Model: The General Framework

One of the foremost achievements of developing a framework for modelling of the short-term forecasting is that it is an attempt to generate forecasts of merchandise exports in a highly disaggregated manner i.e. by specific commodities at a level of 6-digit HS classification and by specific countries. The advantages of carrying out the analysis for commodities at the 6-digit HS classification level is that firstly the data at this level is applicable world over and beyond this level even though there is a comparable classification existing, it is not mandatory to be followed by all the countries. Secondly, even at the 6-digit level the top few (say 20) commodities form a sizeable proportion of the total India’s export to the destination country thereby forming a well-representative share in the export basket for e.g. in 2001-02, the top 16 commodity codes at 6-digit HS classification level of India’s export to USA formed a percentage share of 41.95 per cent in total India’s export to USA. Thirdly, the estimates of foreign prices (unit value) are more reliable at dis-aggregate level as compared to estimates based on the average price of the commodity groups. Such disaggregated analysis could then be used to India’s advantage in trade policy and decision-making by concentrating on selected commodity codes for future trade. An additional advantage of such an exercise is that it can be used for estimating specific commodity codes specific elasticity and countries specific elasticities. For the purpose, the use of panel data/pooled cross-section & time series data would be made.

In somewhat general form the analysis of India’s export market will be based on the following set of equations:

$$IX = \sum_{c=1}^{C} IX_c \qquad \text{.......(1.1)}$$

Where, IX = India’s exports to world
IX_c=India’s exports to country c
c= 1,2,……,C (Countries/regions)

India’s export to world is taken as the sum of the India’s export to the customer countries/regions.

$$IX_c = \sum_{i=1}^{n_c} IX_{ci} \qquad \ldots\ldots(1.2)$$

Where, IX_{ci} = India's exports to c countries and i commodities.
$i = 1,2,\ldots\ldots\ldots\ldots\ldots,n_c$ (No. of commodities per country c)

The value of India's exports to the c-th customer country is defined as the sum total of the value of the n commodities of export to country c. The selection of the customer countries of India's export to be included in the model was carried out largely on the basis of (i) Top 20 countries of India's export market, (ii) Availability of data, and (iii) Share of the countries in India's total export. On the basis of the above-mentioned criteria, 10 destination countries have been selected to be included in the model including USA, EU, Japan, China, Canada, Malaysia, Singapore, Hong Kong, Thailand and 'rest of the world'. We estimate IX_{ci} for each of the selected customer countries of India's exports using the following equation[6].

$$\ln IX_{cit} = \alpha_1 + \alpha_{1i} \ln MC_{cit} + \alpha_{2i} \ln \left(\frac{(PX_{cit} * EXRT_{ct} * (1+TT_{cit}) * (1+TR_{cit}) * (1-SB_{cit}))}{(PXCC_{cit} * EXRT_{cct} * (1+TT_{ccit}) * (1+TR_{ccit}) * (1-SB_{ccit}))} \right) + \alpha_{3i} \ln Z_{cit} + \epsilon_{cit} \qquad \ldots.(1.3)$$

or

$$= \alpha_1 + \alpha_{1i} \ln MC_{cit} + \alpha_{2i} \ln \left(\frac{UVIM_{cit} * (1+TR_{cit})}{UVICC_{cit} * (1+TR_{cit})} \right) + \alpha_{3i} \ln Z_{cit} + \epsilon_{cit} \qquad \ldots\ldots\ldots(1.4)$$

Where,

IX_{cit} = India's export to the c-th customer country for commodity group i in year t
$UVIM_{cit}$ = Unit value Index of c-th customer country import from India for commodity group i in year t
$UVICC_{cit}$ = Unit value index of c-th customer country imports from competitive countries (other than India) of commodity group i in year t.

[6] For details see Mehta and Mathur (2003).

PX_{cit} = India's export price (or unit value) to the c-th customer country for commodity group i in year t
$PXCC_{cit}$ = Export price of competitive countries (other than India) in the c-th customer country, of commodity group i in year t
MC_{cit} = Total import of the c-th customer country of commodity i in year t
$EXRT_{ct}$ = Exchange rate of the India's currency vis-à-vis c-th customer country in year t
EXRTcc = Exchange rate of the Competitive country's currency vis-à-vis c-th customer country in year t
TT_{cit} = Transportation costs
TR_{cit} = Tariff rate of c-th customer country to India of commodity i in year t
TR_{ccit} = Tariff rate of c-th customer country to competitive countries of commodity i in year t
SB_{cit} = Export Incentives[7] (including subsidy granted) on India's export of commodity i in year t.
SB_{ccit} = Export subsidy granted by competitive countries of commodity i in year t
Z = Other factors, like imposition of Trade embargo after Pokhran test, ASEAN Economic Crisis, Non-tariff Barriers, MFA, etc.
T = time-period
= 1,2,….,T
i = Important commodity groups of India's Export to the c-th customer country
= 1,2,…., n_c

α_I, α_{1i}, α_{2i} and α_{3i} are co-efficients, which are different for different commodity groups (to be estimated).

This reflects primarily a demand side equation for India's export to the c-th country for commodity group i. The factors taken into consideration are: Total imports of the c-th customer country and the relative price ratio of India's export price to c-th customer country vis-à-vis competitive countries price to c-th customer country. The former is an activity variable and the latter represents the degree of competitiveness of India's exports. We have taken

[7] For details on the incentives, see Ahuja, (2001).

unit values as the proxy for the prices, which would incorporate the elements of export subsidies granted and taxes levied. Since unit value of c-th customer country's import to India has been taken as the proxy for unit value of India's export to the customer country, the unit value would also include like transportation costs, insurance, etc (differences between f.o.b. and c.i.f. prices). Similar argument would hold true for the unit value of India's competitive countries' export to c-th custom country. In cases of a preferential tariff arrangement/treaty, the adjustment is accounted for; else they are assumed to have the same effect on the prices (i.e. $TR_{cit} = TR_{ccit}$).

The above-mentioned equation will give the estimated value of coefficients (or elasticities), which are different for different commodity groups. These commodity groups for c-th customer country are identified on the basis of India's export basket to c-th country. The selection procedure for the commodity groups of each of the selected customer country of India's export is outlined in the Annex I. Once the estimated model for each country is finalised, the annual forecast were carried out for the dependent variable, i.e., IXc (c=1,2, …, C), for given forecast values of independent variables defined in equation 1.3. The forecasting of independent variables of the econometric models of these countries were carried out using (i) time-series data (of each exogenous variable), and (ii) *a priori* information (or forecast available from other sources, like multilateral organisations, consensus forecasts, etc.) for future periods. The forecasting of independent variables were conducted using time series techniques like Auto regressive, Moving-Average, through different packages like 4-thought, SPSS, free for etc.

For the variable MC_{cit}, the forecasts are obtained using the time series model as given below for each commodity of country c. The aggregate forecasts are thereafter adjusted on a pro rata basis.

$$MC_{c1t} = \phi_{1t}\ MC_{c1t-1} + \ldots\ldots \phi_p MC_{c1t-p} + \epsilon_t - \theta_1 \epsilon_{t-1} \ldots - \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF \quad ..(1.5)$$
$$MC_{c2t} = \phi_{1t}\ MC_{c2t-1} + \ldots\ldots \phi_p MC_{c2t-p} + \epsilon_t - \theta_2 \epsilon_{t-2} \ldots - \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF \quad ..(1.6)$$
$$MC_{cnt} = \phi_{1t}\ MC_{cnt-1} + \ldots\ldots \phi_p MC_{cnt-p} + \epsilon_t - \theta_2 \epsilon_{t-2} \ldots - \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF \quad ..(1.7)$$
$$\sum MC_{cit} = MC_C \quad \ldots\ldots\ ..(1.8)$$

Similarly, the forecasts of relative prices are estimated for the c-th customer country by its commodity groups using the time series equation given below.

$$UVIM_{c1t} = \phi_{1t}\ UVIM_{c1t-1} + \ldots \phi_p UVIM_{c1t-p} + \epsilon_t - \theta_1 \epsilon_{t-1} \ldots - \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF \quad \ldots(1.9)$$
$$UVIM_{c2t} = \phi_{1t}\ UVIM_{c2t-1} + \ldots \phi_p UVIM_{c2t-p} + \epsilon_t - \theta_2 \epsilon_{t-2} \ldots - \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF \ldots(1.10)$$
$$UVIM_{cnt} = \phi_{1t}\ UVIM_{cnt-1} + \ldots \phi_p UVIM_{cnt-p} + \epsilon_t - \theta_2 \epsilon_{t-2} \ldots - \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF \ldots(1.11)$$

This exercise would be carried out separately for the unit value index of c-th customer country's imports from India (UVIM) and from competitive countries (UVICC) for each of its commodity group.

$$UVICC_{c1t} = \phi_{1t}\ UVICC_{c1t-1} + \ldots \phi_p UVICC_{c1t-p} + \epsilon_t - \theta_1 \epsilon_{t-1} \ldots \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF ..(1.12)$$
$$UVICC_{c2t} = \phi_{1t}\ UVICC_{c2t-1} + \ldots \phi_p UVICC_{c2t-p} + \epsilon_t - \theta_2 \epsilon_{t-2} \ldots \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF ..(1.13)$$
$$UVICC_{cnt} = \phi_{1t}\ UVICC_{cnt-1} + \ldots \phi_p UVIM_{cnt-p} + \epsilon_t - \theta_2 \epsilon_{t-2} \ldots \theta q\ \epsilon_{t-q} + \gamma D\tau + \delta DS\tau + \eta\ DLt' + \alpha\ DF \quad ..(1.14)$$

t = time period (1,2, … … ,T)
p = order of the auto-regressive factor (1, 2, .. … p)
q = order of the moving average factor (1, 2, .. … q)
$D\tau$ = Pulse Dummy = 1, when $t = \tau$, an outlier due to specific factor,
= zero, otherwise
$DS\tau$ = Seasonal Pulse Dummy = 1 for t = one particular month of each year
= zero, otherwise
DLt' = Level or Structural Shift = 1 for t = 1 … … t'
= zero , otherwise
DF = all other factors affecting the intercept term.

Given the values of

1. estimated parameters (α's) or elasticities from models,
2. forecasted values of exogenous variables (MC and UVIM/UVICC) and
3. base year value of endogenous variables.

We make the annual forecast for different commodities of a country.

In short our model, at present, consists of around 280 variables for the purpose of forecasting. It consists of 10 country models out of which 5 of them have been estimated by their principal commodities. For the rest of the 5 countries, commodity wise estimation and forecasting could not be performed due to data deficiencies and constraints. The 10 countries include: USA, EU, Japan, China, Canada, Hong Kong, Malaysia, Singapore, Thailand and 'Rest of the World'. The 5 countries for which commodity-wise estimation and forecasting has been performed are: USA, EU, Japan, China and Canada.

II. Short-term Forecasting of India's Export: An Illustration of the Econometric Model for USA

In this section we present the econometric sub-model for USA using panel data and the results emerging from it. This section would outline the procedure followed in construction, estimation and forecasting procedure for USA. It starts with a brief review of the past and the emerging of India's exports to USA. The theoretical model, its construction and estimation methodology form the following two sub-sections. Next section enlists the regression results and the elasticities obtained from the model followed by the conclusions.

II.1 Indo-USA Trade Trends

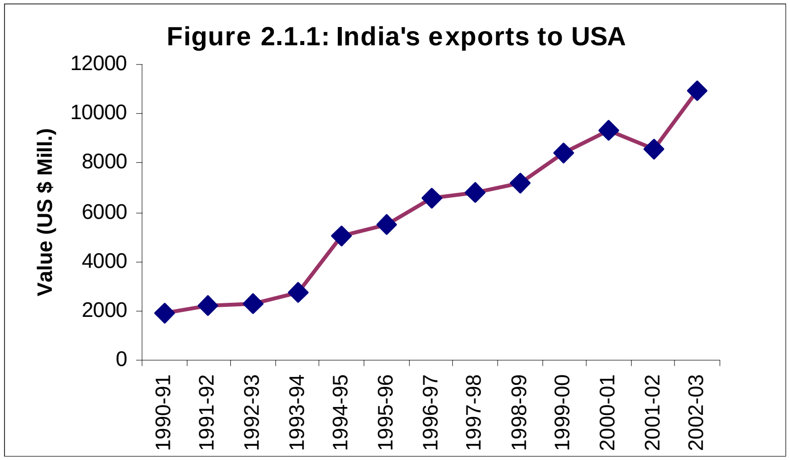
The importance of USA as a key-trading partner of India has long been established. With a sizeable share of 21 per cent in India's export value in 2002-03, USA stands as one of the single major trading partners of India. Past trends depict that its share in India's total exports has remained consistently around 20 per cent.

Table 2.1.1: India's exports to USA

Year	Value of India's Exports to USA (US $ Mill.)	Growth rate (% p.a.)	% Share of USA in India's total Exports
1993-94	2749	-	-
1994-95	5013	82.36	19.35
1995-96	5524	10.21	17.64
1996-97	6549	18.55	19.89
1997-98	6778	3.48	19.41
1998-99	7170	5.79	21.67
1999-00	8392	17.05	22.84
2000-01	9320	11.06	20.88
2001-02	8542	-8.35	19.43
2002-03	10924	27.88	20.67

As can be seen from the graph a clear upward growth trend in India's exports to USA has been emerging throughout the nineties. Apart from the 2001-02

year, which experienced a negative growth rate of 8.35 per cent, recent years have been a witness to a high double-digit growth rate.



The following graphs (Figures 2.1.2, 2.1.3 and 2.1.4) study the commodity composition of India's exports to USA at a broad commodity level of HS 2-digit classification during different time intervals of 1990-91,1995-96 and 2002-03.

The major items of India's exports to USA, during 1990-91, comprise of Precious Stones and Metals, Textile articles, Fish and seafood, Iron and steel products, Organic chemicals and Machinery.

This composition has changed favourably for the items such as Precious stones, metals, Fish and seafood, Machinery etc. whose share has seen a considerable rise during the nineties. Precious stones and metals alone constitute a substantial share of 31 per cent in India's exports during 2002-03. On the other hand, Textile and Textile articles have witnessed a steady decline in its share from 38.5 per cent in 1990-91 to 24 per cent in 2002-03. Apart from these top ten broad commodity items, share of the rest of the commodities has remained stable at 30 per cent.

Figure 2.1.2: India's Exports to USA by Broad Commodity Composition,1990-91

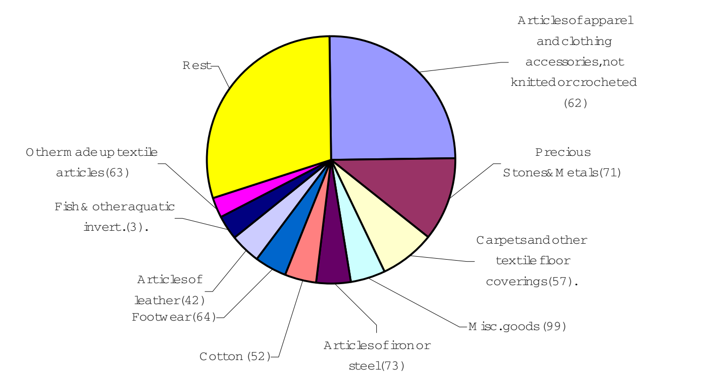


Figure 2.1.3: India's Exports to USA by Broad Commodity Composition,1995-96

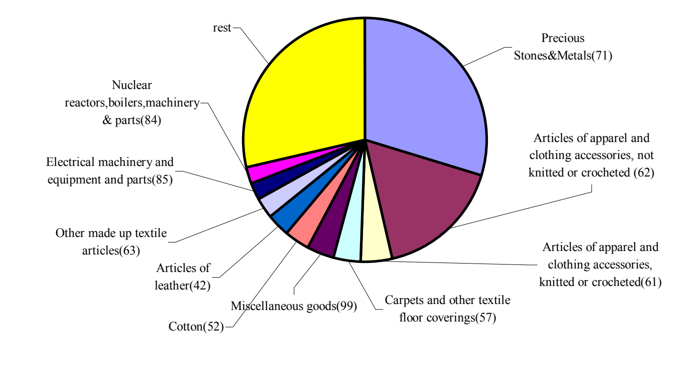
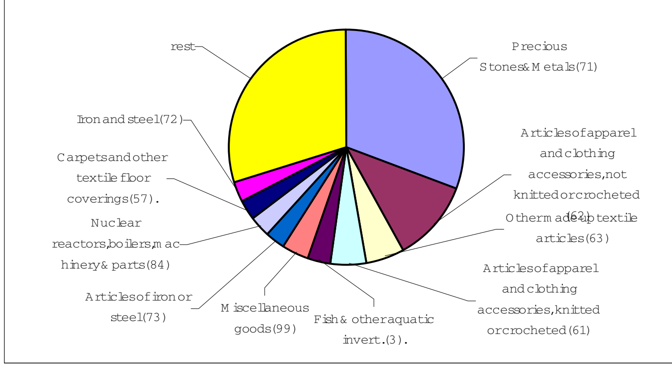


Figure 2.1.4: India's Exports to USA by Broad Commodity Composition, 2002-03



II.2 The Model

This section outlines the sub model of India's exports to USA based on the general framework of the model for India's exports. The econometric model for India's export to USA was estimated using the following equation:

$$\ln XUS_{it} = \alpha + \alpha_{1i} \ln MUS_{it} + \alpha_{2i} \ln (UVIM_{it}/UVICC_{it}) + \varepsilon_{it} \quad \ldots\ldots(2.2.1)$$

$$\varepsilon_{it} = \mu_i + e_{it} \quad \ldots\ldots.(2.2.2)$$

$$UVIM_{it} = PX_{cit} * EXRT*(1+TT)*(1-SB)$$

$$UVICC_{it} = PXCC_{cit} *EXRT* (1+TT_{cc})* (1-SB_{cc})$$

where

$XIUS_{it}$ = India's export to the US for commodity group i in year t

$UVIM_{it}$ = Unit value Index of USA import from India for commodity group i in year t

$UVICC_{it}$ = Unit value index of USA imports from competitive countries (other than India) of commodity group i in year t

MUS_{it} = Total import of the USA of commodity i in year t

i = Important commodity groups of India's Export to the USA,
= USCom1, USCom2, …, USCom17

t = 1993,94,…….,2001

α_{1i}, and α_{2i} are co-efficients, which are different for different commodity groups.

The above-mentioned equation (2.2.1) gives the estimated value of coefficients (or elasticities), which are different for different commodity codes. These commodity codes for USA are selected on the basis of India's export basket to the USA. The details of the selected 17 commodity codes are given in Annex II.

The model primarily reflects a demand side equation for India's exports to USA with factors such as total import demand of USA and relative price ratio i.e. India's export price to USA vis-à-vis export price of the competitive countries (other than India) to the USA. The total import demand of USA serves as an activity variable reflecting its total income level. The relative price ratio is a factor depicting the competitiveness of India's exports to USA vis-à-vis the rest of the competitive countries. We have taken unit values as the proxy for the prices, which would incorporate the elements of export subsidies granted and taxes levied. Since unit value of USA's import from India has been taken as the proxy for unit value of India's export to USA, the unit value would also include the transportation costs. Similar argument would hold true for the unit value of competitive countries' export price to the USA. Since India and USA do not hold any preferential trading arrangements or treaties we assume that the tariff rate associated with the India's export price to USA would have a more or less same effect as that of the tariff rate associated with competitive countries' export price to the USA in the relative price ratio.

II.3 Estimation Procedures and Model Selection

Our model estimation is based on the panel data i.e. time series cross-sectional data which has the advantage of allowing greater flexibility in modelling differences in behaviour across individuals. As in the case of a typical panel, we have a larger number of cross-sectional units as compared to the time-series. Our USA model consists of 17 cross sections of commodity codes and yearly time series ranging from 1993-2001. In order to avoid any kind of structural break in our time-series due to the reform process in the early nineties, we have chosen the starting period as 1993. The data is stacked by cross-section and is balanced with no missing observation.

The essential structure for most of the models for the panel data is the classical regression model of the form:

$$Y_{it} = \mu_i + \beta' x_{it} + \varepsilon_{it} \quad \text{, where } \varepsilon_{it} \text{ is a classical disturbance} \qquad \ldots(2.3.1)$$

Where, i= cross-sections, t = time-series

There are K regressors in $x_{it,}$ not including the constant term. Here, the individual effect α_i is taken to be constant over time t and specific to the individual cross-sectional unit i. There are two basic frameworks to estimate this model: The fixed effects approach and the Random effects approach.

Fixed effects approach: This approach assumes that the differences across the commodity groups can be captured in differences in the constant term. In this model, α_i is a separate constant term for each unit i.

$$Y_{it} = \alpha_1 d_{1it} + \alpha_2 d_{2it} + \ldots\ldots + \beta' x_{it} + \varepsilon_{it} \qquad \ldots(2.3.2)$$
$$= \alpha_i + \beta' x_{it} + \varepsilon_{it,} \qquad \ldots(2.3.3)$$

where the α_i's are individual specific constants and the d_j's are group specific dummy variables which equal 1 only when j=i. The model is a classical regression model and is referred to as the least squares with dummy variable model. This approach can be extended to include the time specific effects simply by adding the time effect γ_t as in

$$Y_{it} = \alpha_i + \gamma_t + \beta' x_{it} + \varepsilon_{it} \qquad \ldots.(2.3.4)$$

Here the problem of singular matrix – the time and group dummy variables both sum to one can be avoided by imposing the restriction $\Sigma_i\alpha_i = \Sigma_t \gamma_t = 0$.We tested for the significance of the time effects in our model and found them to be not significant.

Random effects approach: This approach is more appropriate when one views the individual specific constant terms as randomly distributed across cross sectional units. This view would be more appropriate if we believed that sampled cross-sectional units were drawn from the larger population. The model is reformulated as follows:

$$Y_{it} = \alpha + \beta' x_{it} + \varepsilon_{it} + u_i \qquad \ldots.(2.3.5)$$

Where, $E(u_i) = 0$, $Var(u_i) = \sigma_u^2$, $Cov(\varepsilon_{it,} u_i) = 0$

The random effects model is generally estimated by a generalized regression model where all the disturbances have the variance Var ($\varepsilon_{it} + u_i$)= $\sigma^2 = \sigma_\varepsilon^2 + \sigma_u^2$.

The efficient estimator is generalized least squares. The two-step procedure used for estimation is that firstly the variance components are estimated by using the residuals from ordinary least squares. Thereafter, the feasible GLS estimates are computed using the estimated variances.

Once we obtain the estimates from the above-mentioned models, the next step is to select the appropriate model i.e. choice between the fixed and random effects model. There are 2 tests used for the selection namely: the Lagrange Multiplier (LM) test and the Hausman's test. The Lagrange Multiplier test statistic shows whether the Fixed effects model/random effect model is better than classical regression model/ OLS without group dummy variables. The Hausman Test shows the selection between the random effect model vis-à-vis the fixed effects model.

We have used Limdep as the software package to estimate the econometric model for USA. We obtained three sets of estimates as a result:

1. Constrained Least squares Regression/ OLS without Group Dummy Variables: The fixed effects model with all the individual specific constants assumed equal i.e. $Y_{it} = \alpha + \beta' x_{it} + \varepsilon_{it.}$ This model is estimated by simple ordinary least squares.
2. Least squares Dummy Variable: The fixed effects model with individual specific constant terms is estimated by partitioned ordinary least squares. The model is formulated with a N group specific constant and no overall constant.
3. Random Effects: The random effects model is estimated by feasible, two step GLS.

The first set of results taking the dependent variable at current prices, show that using Lagrange Multiplier test, Fixed effects model/random effect model is better than classical regression model/ OLS without group dummy variables. Hausman Test shows that between random effect model vis-à-vis

fixed effects model, random effect model is preferred. Thus, the model selected based on these tests would be the random effects model.

Looking at the results of Random effects model, the estimated coefficients do not show the satisfactory signs of the co-efficients based on the *a priori* information about co-efficients. In order to improve the estimated parameter we tried taking combined commodities group dummies of certain HS codes keeping in mind their respective descriptions. The groups considered were:

Combined Commodity Group 1 = *570110, 570231*
Combined Commodity Group 2 = *610510, 610910, 620442, 620443, 620520, 620630*

The results after incorporating the combined commodities group dummies show that the classical regression model is preferred over random/fixed effects model. Even though the results show some improvement, the estimated co-efficients still do not show *a priori* right sign.

Next, we tried estimating the regression equations with variables at constant prices. The results for this model show that by LM test, Classical Regression is preferred to Random and Fixed effects model. Since, the Classical Regression model showed better results as compared to the earlier models we discarded the earlier models in favour of this. In our finally selected model, one Commodity code 500720 still showed inappropriate coefficient signs. Annex IV shows the graph for the code, which clearly indicates that owing to its sizeable share of India's export in the US import market even with an unfavourable rise in its relative prices, India's export to USA of the code continues shows a rise.

Thus, based on (i) the various tests, (ii) *a priori* information about co-efficients and (iii) predictive performance, the most appropriate estimated equation of India's exports to USA was selected with the variables at constant prices based on the classical regression model.

One can see from the estimated results of this model that the estimated parameter of activity variable (MUS) is positive for almost all the commodity codes. In some cases where it has a negative sign, it is insignificant, such as for one commodity code i.e. USCom3 or HS 500720. Similarly, the result of relative price (PX/PXCC) is negative for all commodity codes. In case it is not negative, it is not significant. Here also we do not get appropriate sign of estimated parameter for USCom3 or HS 500720. R^2 of the regression equation is 0.92 i.e. the equation is able to explain a major portion of India's export to US. In short we can say that our model is able to capture the appropriate signs for almost all commodities except for one commodity i.e. HS 500720 or 'other fabrics containing 85 per cent or more of weight of silk and silk waste other than noil silk'. We would try and examine what other factors can explain the model for this commodity group.

II.4 Regression Results

Table 2.4.1: Regression Results of the Selected Commodities: Model With Dependent Variable in Constant Prices

(Base 1993=100)

Equation: $\ln XIUS93_{it} = \alpha_i + \alpha_{1i} \ln MUS93_{it} + \alpha_{2i} \ln (PX_{it}/PXCC_{it}) + \in_{it}$

Commodity Group (HS Sections)/ Commodities (HS 6-Digit)	**Description**	**Model used**	**Estimated Regression Results**			**R^2**
			α or μ_i	α_{1i}	α_{2i}	
OLS model (OLS) : $\ln XIUS93_{it} = \alpha + \alpha 1_i \ln MUS93_{it} + \alpha 2i \ln (PX_{it}/PXCC_{it}) + \in_{it}$						
		OLS	-1.21 (-10.65)			0.919
30613	Shrimps and prawns frozen	OLS		0.18 (1.53)	0.63 (0.67)	
420310	Articles of apparel, articles of apparel & clothing accessories, of leather or of composition of leather	OLS		0.35 (4.05)	-1.54 (-1.68)	
500720	Other fabrics, containing 85% or more by weight of silk or of silk waste other than oil silk	OLS		-1.01 (-3.85)	4.26 (3.97)	
570110	Of wool or fine animal hair	OLS		0.80 (1.98)	-0.984 (-0.787)	
570231	Of wool or fine animal hair	OLS		-0.083 (-0.32)	-0.82 (-3.25)	
610510	Men's or boys' shirts of cotton, knitted or crocheted	OLS		0.13 (0.89)	0.96 (1.29)	
610910	T-shirts, singlets & other vests, of cotton, knitted or crocheted	OLS		-0.19 (-0.97)	1.98 (1.46)	
620442	Of cotton	OLS		0.65 (0.81)	-0.56 (-0.12)	
620443	Of synthetic fibres	OLS		0.15 (0.41)	0.057 (0.043)	
620520	Of cotton	OLS		0.53 (4.24)	0.26 (0.085)	
620630	Of cotton	OLS		0.641 (6.65)	-3.53 (-3.50)	
630492	Other furnishing articles, not knitted or crocheted, of cotton	OLS		0.048 (0.093)	-1.76 (-4.42)	
640351	Other footwear with outer soles of leather covering the ankle	OLS		-0.87 (-0.55)	-0.27 (-0.20)	
680223	Simply cut or sawn granite with a flat/even surface	OLS		0.070 (0.65)	-1.08 (-7.65)	
710239	Other non-industrial diamonds	OLS		0.624 (8.78)	2.27 (-4.25)	
732599	Other cast articles of malleable cast iron, nes	OLS		1.54 (3.49)	0.19 (0.308)	
Rest	rest of the codes	OLS		0.49 (23.48)	-3.96 (-0.84)	

Fixed Effects Model (OLSWG): $\ln XIUS93_{it} = \alpha + \alpha_{1i} \ln MUS93_{it} + \alpha_{2i} \ln (PX_{it}/PXCC_{it}) + \mu_i + e_{it}$

		OLSWG				0.9357
30613	Shrimps and prawns frozen	OLSWG	-1.85 (-2.06)	0.42 (1.20)	0.25 (0.22)	
420310	Articles of apparel, articles of apparel & clothing accessories, of leather or of composition of leather	OLSWG	-1.59 (-2.15)	0.499 (1.63)	-1.83 (-1.89)	
500720	Other fabrics, containing 85% or more by weight of silk or of silk waste other than noil silk	OLSWG	-1.25 (-1.62)	-0.98 (-1.074)	4.25 (2.84)	
570110	Of wool or fine animal hair	OLSWG	-1.24 (-3.3)	0.87 (1.79)	-1.07 (-0.84)	
570231	Of wool or fine animal hair	OLSWG	-1.36 (-3.25)	-0.22 (-0.47)	-0.78 (-3.06)	
610510	Men's or boys' shirts of cotton, knitted or crocheted	OLSWG	-1.37 (-3.18)	0.13 (0.51)	1.56 (1.83)	
610910	T-shirts, singlets & other vests, of cotton, knitted or crocheted	OLSWG	-2.37 (-6.0)	0.32 (1.27)	1.05 (0.78)	
620442	Of cotton	OLSWG	-2.19 (-5.4)	2.10 (2.01)	-2.90 (-0.57)	
620443	Of synthetic fibres	OLSWG	-2.47 (-6.62)	0.97 (2.10)	0.0092 (0.07)	
620520	Of cotton	OLSWG	-2.5 (-4.0)	0.95 (4.15)	0.029 (0.01)	
620630	Of cotton	OLSWG	-2.4 (-4.0)	1.00 (3.98)	-5.13 (-4.53)	
630492	Other furnishing articles, not knitted or crocheted, of cotton	OLSWG	-1.02 (-1.89)	0.30 (0.32)	-1.77 (-4.31)	
640351	Other footwear with outer soles of leather covering the ankle	OLSWG	-1.12 (-5.59)	-0.75 (-0.42)	-0.29 (-0.13)	
680223	Simply cut or sawn granite with a flat/even surface	OLSWG	-1.03 (-1.69)	0.17 (0.56)	-1.03 (-4.74)	
710239	Other non-industrial diamonds	OLSWG	-0.84 (-2.29)	0.53 (4.93)	-2.32 (-4.44)	
732599	Other cast articles of malleable cast iron, nes	OLSWG	-0.95 (-4.26)	1.61 (3.45)	-0.515 (-0.64)	
Rest	Rest of the codes	OLSWG	-0.94 (-1.84)	0.46 (7.93)	-4.09 (-0.89)	

Random Effects Model (VCRWG): $\ln XIUS_{it} = = \alpha + \alpha_{1i} \ln MUS_{it} + \alpha_{2i} \ln (PX_{it}/PXCC_{it}) + \mu_i + e_{it}$

		VCRWG	-1.29 (-8.31)			0.9118
30613	Shrimps and prawns frozen	VCRWG		0.23 (1.47)	0.58 (0.60)	
420310	Articles of apparel, articles of apparel & clothing accessories, of leather or of composition of leather	VCRWG		0.39 (3.14)	-1.63 (-1.78)	
500720	Other fabrics, containing 85% or more by weight of silk or of silk waste other than noil silk	VCRWG		-1.00 (-2.56)	4.29 (3.81)	
570110	Of wool or fine animal hair	VCRWG		0.86 (2.04)	-1.01 (-0.81)	
570231	Of wool or fine animal hair	VCRWG		-0.16 (-0.49)	-0.80 (-3.27)	
610510	Men's or boys' shirts of cotton, knitted or crocheted	VCRWG		0.09 (0.52)	1.22 (1.59)	
610910	T-shirts, singlets & other vests, of cotton, knitted or crocheted	VCRWG		-0.04 (-0.18)	1.69 (1.28)	
620442	Of cotton	VCRWG		0.82 (0.93)	-0.459 (-0.97)	
620443	Of synthetic fibres	VCRWG		0.29 (0.78)	0.31 (0.23)	
620520	Of cotton	VCRWG		0.58 (3.96)	0.33 (0.11)	
620630	Of cotton	VCRWG		0.70 (5.39)	-4.00 (-3.87)	
630492	Other furnishing articles, not knitted or crocheted, of cotton	VCRWG		0.251 (0.40)	'-1.77 (-4.49)	
640351	Other footwear with outer soles of leather covering the ankle	VCRWG		-1.02 (-0.65)	-0.65 (-0.42)	
680223	Simply cut or sawn granite with a flat/even surface	VCRWG		0.04 (0.30)	-1.09 (-7.13)	
710239	Other non-industrial diamonds	VCRWG		0.61 (7.17)	-2.27 (-4.38)	
732599	Other cast articles of malleable cast iron, nes	VCRWG		1.59 (3.60)	0.003 (0.005)	
Rest	rest of the codes	VCRWG		0.50 (14.66)	-3.95 (-0.86)	

II.5 Forecasting

Once we obtained the price and income elasticities from the model, we carried out the time series forecasts for the independent variables of the model. Using the time series model of Auto Regressive Integrated Moving Average (ARIMA), the forecasts for the variables including: Total import of USA, Import unit value indices of USA from India and Import unit value indices of USA from the competitive countries were obtained.

Based on the estimated elasticities of the selected model for USA, forecasted values of the exogenous variables and the base year value of endogenous variable we calculated the final forecast of India's export to USA. Our forecast in February 2003 for the 2003-04 growth rate of India's export to USA stood at 6.55 per cent with the base year of Sept01- Aug02 value of 9527 US$ mill. We have recently revised our growth rate on the basis of the revised data available which puts the 2003-04 growth rate at 8.85 per cent with the base year value of 10681 US$ mill. in Mar02-Feb03. Table 2.5.1 gives out the forecasted growth rates of India's exports to USA by its selected 17 commodity groups for 2003-04 with the base year of Mar02-Feb03.

A comparison between the actual and forecasted growth rate is made by taking the actual figures for USA imports from India as the proxy for India's exports from USA. The average growth rate of USA imports from India for April-October 2003 with the base as April-October 2002 stands at 8.60 per cent p.a. in comparison with our forecasted growth rate of 8.85 per cent p.a. for 2003-04.

Table 2.5.1: Forecast Value (2003-04), growth rate of the selected commodity codes of India's exports to USA

Commodity Code (6-digit of HS-1996)	Code Description	India's Exp. to USA, Value Mar02-Feb03 (US $ Mill.)	% Share Mar 02-Feb 03	Base Year values (Mar02-Feb03)	Forecasted Values (US $ Mill.) April 03-Mar04	Final Growth rates (% per annum)
30613	Shrimps and prawns frozen	333	3.12	333	352	5.31
420310	Articles of apparel	49	0.46	49	35	-26.00
500720	Other fabrics, containing 85% or more by weight of silk or of silk waste other than noil silk	79	0.74	79	77	-2.98
570110	Carpets of other textile floor coverings knotted of wool or fine animal hair	96	0.90	96	93	-2.88
570231	Carpets of other textile floor coverings of wool or fine animal hair	53	0.50	53	72	31.72
610510	Men's or boys' shirts of cotton, knitted or crocheted	141	1.32	141	142	0.86
610910	T-shirts, singlets & other vests, of cotton, knitted or crocheted	158	1.48	158	118	-23.85
620442	Women's or girls suits, ensembles etc. of cotton	38	0.35	38	38	0.27
620443	Women's or girls suits, ensembles etc. of synthetic fibers.	42	0.39	42	44	4.86
620520	Men's or boys shirts, of cotton	197	1.84	197	189	-3.65
620630	Women's or girls blouses, shirts and shirts blouses of cotton	315	2.95	315	346	8.92
630492	Other furnishing articles, not knitted or crocheted, of cotton	240	2.25	240	322	31.13
640351	Other footwear with outer soles of leather covering the ankle.	42	0.39	42	31	-23.21
680223	Simply cut or sawn granite with a flat/even surface	110	1.03	110	130	16.54
710239	Other non-industrial diamonds	2447	22.91	2447	2727	10.51
732599	Other cast articles of malleable cast iron	66	0.62	66	90	32.91
Rest	Rest of the Codes	6275	60.59	6275	6902	9.20
Total	All Commodities	10681	100	10681	11709	8.85

II.6 Conclusions and Summary

This paper makes an attempt to develop a framework towards a short-term forecasting model for India's export by countries and commodities. We have provided the sub-model of USA as an illustration for the methodology and estimation procedure for forecasting. Regarding the commodity wise forecasts and estimation, we intend to incorporate the market structures of each of the selected commodities of countries during estimation. We have conducted similar estimation exercises for 4 other countries apart from USA including EU, Japan, China and Canada. Due to huge data gaps and deficiencies we have not been able to carry forward our modelling exercises to other countries, which we plan to fill up soon.

In future, we do hope to link our models to the other economy-wide forecasting models for worldwide linkage. We would be looking forward to receiving any kind of suggestions and inputs for our model and forecasting procedure.

Annex I: Selection of Countries and Commodities for the Proposed Model

Selection of Countries

Selection of the countries would be carried out on the basis of (i) exports in recent past (or India's export value rankings), and (ii) growth of export in recent past for few years, say 1996-2002. On the basis of those rankings one can shortlist the list of the selected Countries/region to be included in the proposed model. The selection of those countries/region could be based on the following criteria: (i) Top 20 Countries of India's export market, (ii) Availability of data, and (iii) Share of the countries in India's total export. The selected period for estimation of econometric model would vary from country to country depending on the data availability with respect to each of the selected country. For European Union it would be difficult to get a long time series data since in the pre-1996 era, the EU member countries were only 12 and presently there are 15 members. Therefore to ensure consistency of data (and objective of the study) one would have to reduce the number of years and can increase the number of commodities (HS codes) to ensure higher degrees of freedom. Generally, the sample year would vary from country to country as per the availability of data.

Annex Table I.1: Growth Rates of India's Export to Selected Countries

(Percent per annum based on US$)

Countries	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03
Canada	15.91	22.49	9.13	22.58	13.63	-11.04	16.04
USA	18.55	3.48	5.79	17.05	11.06	-8.62	26.61
Bangladesh	-17.22	-9.46	26.41	-36.01	47.05	7.37	-13.46
China	84.54	16.89	-40.68	26.52	54.37	11.18	100.03
Hong Kong	1.45	4.26	-3.21	33.49	6.17	-10.33	3.19
Japan	-9.59	-5.42	-13.11	2.31	6.65	-16.53	21.23
Malaysia	35.03	-7.77	-34.46	39.23	36.24	27.45	-4.61
Singapore	9.18	-20.28	-34.26	31.01	31.24	11.05	48.95
Thailand	-5.33	-23.1	-7.04	40.69	18.02	19.54	11.2
European Union	-0.77	5.64	-2.39	5.03	11.59	-5.62	13.88
World	5.12	6.05	-5.26	11.05	21.47	-1.5	16.7

Source: *India Trades*, CMIE.

Annex Table I.1 shows the growth rate of India's export of the selected countries. In 1996-97 US growth was 18.55 per cent in 1998 per cent, while in 1997-98 it was 3.48. With Canada, the growth rate, during 1997-98, was 22.49 per cent whereas the Growth rate, during 1998-99, was 9.13; and again in 1999-2000 the growth was 22.78. In EU, there was negative growth in 1996-97, 1998-99 and 2001-02. With China there was a very high Growth in 1996-97 but there was a heavy downfall in 1998-99 which goes down to –40.68, but in later years there is significant increasing growth rate. Overall from Annex Table I.1 it seems that there was certainly downfall in India's Export in 1998-99, and again in 2001-02. 2002-03 showed a significant rise in the India's export with a double-digit growth for almost all the selected destination countries. China showed outstanding growth of approx. 100 per cent during the period.

Annex Table I.2: Percentage Share of Selected Countries in India's total Exports

((per cent per annum based on US$

	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2002-03
Canada	0.97	1.07	1.24	1.43	1.57	1.47	1.32
USA	17.64	19.89	19.41	21.67	22.84	20.88	21.01
Bangladesh	3.35	2.64	2.25	3.01	1.73	2.1	1.7
China	1.06	1.87	2.06	1.29	1.47	1.87	3.68
Hong Kong	5.82	5.62	5.52	5.64	6.78	5.93	4.77
Japan	7.08	6.09	5.43	4.98	4.59	4.03	3.56
Malaysia	1.26	1.61	1.4	0.97	1.22	1.36	1.44
Singapore	2.85	2.96	2.23	1.54	1.82	1.97	2.83
Thailand	1.51	1.36	0.99	0.97	1.22	1.19	1.38
European Union	27.75	26.2	26.1	26.89	25.43	23.36	21.82

***Source**: India Trade, CMIE.*

Annex Table I.2. shows the trend of percent share of selected countries in India's total export from 1996 to 2001. US's per cent share shows the increase in export upto 1999-00 and there is a decline in 2000-01, Canada also

shows the consistent increasing trend upto 1999-00 but slight decrease in 2000-01. The share of India's export to China shows the sudden downfall in 1998-99, and after 1998-99 exports share again increased. Hong Kong trend shows the declining trend share till 1997-98, but there is increase in 1998-99 and very speedy jump in 1999-00 and again it declines in 2000-01. 2002-03 showed very minor fluctuations in the percentage share of selected countries in India's exports. EU declined by approx. 1.5 per cent whereas china captured a share of 3.68 per cent during the period.

Selection of Commodities

Selection of commodities for each country would be prepared on the basis of their value ranking and percentage share in the India's total export towards the destination country. For each country/region selected, we would select the top 20 commodities[8] at 6-Digit level because beyond this disaggregation e.g. at 8-digit the classification would differ from country to country but at 6-digit level data is comparable for all countries. Another reason for selecting the 6-digit classification is that even at such high level of disaggregation the top 20 commodities of India's export to a destination country carries a major share (for e.g. for USA it is more than 40 per cent in 2002-03) in its total export value to that destination country. Third reason is that the estimates of foreign prices (unit value) are more reliable[9] at disaggregate level as compared to estimates obtained from using the average price of commodity groups.

The final selection of commodities would be carried out using following criteria:

- (i) Significant share in total exports (top commodities)
- (ii) Growth rate in recent past
- (iii) Availability of reliable data
- (iv) Exact matching between trade classifications HS-92, HS-96 and HS-2002, and
- (v) Specific factors relating to country/commodities

At *6-digit* level total number of defined commodities, which are exported by India, are around 4645. During Mar02-Feb03, Annex Table I.3 shows that India exports 3339 number of commodities (at 6-digit HS level) to US, 1850 number of commodities to Japan, 3708 number of commodities to EU, 1982

[8] 40 commodities for EU

[9] The estimate of econometric equations using average price of commodity groups is not reliable.

number of commodities to Bangladesh, 1366 number of commodities to China, 1469 number of commodities to Hong Kong, 1834 number of commodities to Canada, 1571 number of commodities to Thailand, 2112 number of commodities to Malaysia and 2297 number of commodities to Singapore. Annex Table I.3 reveals that even at a highly disaggregated commodity level of 6-digit HS classification, the top 20 commodities of India's exports to most of the countries occupies a major portion of the share of India's total exports to the country.

Annex Table I.3: Share of Selected Commodities Export in India's Total Export

Countries	All Commodities Exported at HS 6-Digit in Mar02-Feb03		Top 20 Commodities at 6-Digit HS Classification share and value in total India's exports by Destination in Mar02-Feb03		
	Total No. of Commodities at HS 6-Digit traded	Total Value of Commodities at Mill. US$	No. of Commodity codes at HS-6-digit	Value of Selected Commodities at Mill. US$	% Share in India's total to customer country Export
United States	3339	10681	20	4657	43.60
Japan	1850	1814	20	983	54.17
European Union	3708	11201	20	3587	31.36
Bangladesh	1982	982	20	548	55.82
China	1366	1744	20	553	31.69
Hong Kong	1469	2161	20	1782	82.46
Canada	1834	668	20	280	38.47
Thailand	1571	655	20	442	67.51
Malaysia	2112	676	20	339	50.13
Singapore	2297	1276	20	837	65.57
Rest of World	-	19956	20	19956	-
World	4645	50492	-	-	-

Source: India Trades, CMIE

Annex II: List of the selected commodity codes of India's exports to USA AT 6-digit level

USCOM1=	HS 30613	Shrimps and Frozen Prawns
USCOM2=	HS 420310	Articles of Apparel and Clothing Accessories, of leather or of composition of leather
USCOM3=	HS 500720	Other Fabrics containing 85 per cent or more by weight of silk or silk waste other than noil silk
USCOM4=	HS 570110	Of Wool or fine animal hair, carpets and other textile floor coverings, knotted, whether or not made-up.
USCOM5=	HS 570231	Of Wool or fine animal hair, carpets and other textile floor coverings, woven, not toufted or flocked.
USCOM6=	HS 610510	Men's or boy's shirts of cotton, knitted or crocheted
USCOM7=	HS 610910	T-shirts, singlets and other vests, of cotton, knitted or crocheted
USCOM8=	HS 620442	Of cotton: Women's or girls suits, ensembles, jackets, blazers, dresses, skirts
USCOM9=	HS 620443	Of synthetic fibres, Women's or girls suits, ensembles, jackets, blazers, dresses, skirts
USCOM10=	HS 620520	Of cotton: Mens' and boys shirts.
USCOM11=	HS 620630	Of cotton: Women's or girls; blouse, shirts and shirt blouses.
USCOM12=	HS 630492	Other furnishing articles,Handloom, not knitted or crocheted, of cotton
USCOM13=	HS 640351	Other footwear with outer soles of leather covering the ankle
USCOM14=	HS 680223	Simply cut or sawn granite with a flat/even surface
USCOM15=	HS 710239	Other non-industrial diamonds
USCOM16 =	HS 732599	Other cast articles of malleable cast iron

USCOM17= Rest of codes, a commodity group consisting of the rest of all codes (other than above 16 codes) at 6-digit level of India's exports to USA.

Annex III: Construction of the Variables & Data Sources

This section lays out the procedure followed for developing, constructing and estimating the model for USA. Firstly, a list of the top 20 commodities of India's export to U.S.A. was prepared on the basis of their value rankings in the total value. These codes were extracted at the 6-digit level since India's code classification differs from that of USA beyond 6-digit level. Due to unavailability of data in World Trade Atlas, 4 codes had to be removed from the top 20 list, including: 999190, 80132, 630790, and 711319. Apart from the 16 selected commodity codes, 'rest of the codes' category was also computed for the model.

The construction of the variables by the selected 17 commodity codes (including the 'rest of the codes') with the time series ranging from 1993-2001 involved tedious and time-consuming cleaning and calculations from the dataset. The procedure followed for the construction and computation of the dependent and the independent variables is explained below:

India's Export to the U.S.A. for commodity code i in year t (**$XIUS_{it}$**): The data for the dependent variable was taken from *India Trades*, CMIE based on the DGCIS database for the time period ranging from 1993–2001 (i.e. t = 1993, …, 2001). This variable was constructed for the selected 17 commodity codes (i = USCOM1, USCOM2, … USCOM17) at both current and constant prices[10] depending on the model requirement. The figures for current prices were obtained by taking the value of India's export to USA (in million dollars) and the constant prices figures were computed by deflating the value by their respective unit value indices.

India's Export Price to the USA for commodity code i in year t (PX_{it}): For the USA model, USA Import price to India was taken as the proxy for India's Export Price to USA. The construction of this variable required data for both the value and quantity of USA Imports from India. Once the import unit values were calculated using the value and the quantity figures of USA imports from India, the indices were constructed based on the Laspeyer's

[10] A proxy for Quantity or Volume.

Index with the base year as 1993. The data for this variable was collected from *World Trade Atlas, GTIS*.

Export Price of competitive countries (other than India) to the USA for commodity code i in year t (**$PXCC_{it}$**): Similar to the case above, USA import price to the competitive countries was taken as a proxy for the export price. For the purpose of calculations, the competitive countries were taken as the "Rest of the world (ROW)" i.e. exporting countries from the world other than India. The data for this variable was collected from *World Trade Atlas, GTIS*. The import unit value indices for the 17 codes were constructed based on the Laspeyer's index with the base year as 1993. Since the total quantity figures are not available[11], 'rest of the codes' quantity figures could not be computed. Thus, Import unit value for the rest of the codes could not be computed in a similar fashion to that of the selected 16 codes due to unavailability of quantity figures for rest of the codes. The unit value index for the rest of the codes was computed using the formula mentioned below for each of the years ranging from 1993 to 2001.

Unit Value Index *'Rest of the Codes'* = [(Unit value index for total codes * weight of total codes)-(Aggregated value of (Unit value Indices for the 16 selected codes *respective code weights))/Weight of the Rest of the codes]
where,

Code weights = % share of the respective codes import value in the total.
Weight of the rest of the codes = 100 – Sum of the weight of the selected codes

The unit value indices for U.S.A. Imports from world and India were obtained from *IFS Yearbooks* (2000,2001).

Total Import of the USA for commodity code i in year t (MUS_{it}): This activity variable was obtained by taking the value of total USA imports in millions dollars. The data was extracted from the *World Trade Atlas* for the 16 selected codes and calculated for the rest of the codes by subtracting the

[11] Units of Quantity are different for different commodities; hence it is difficult to aggregate them.

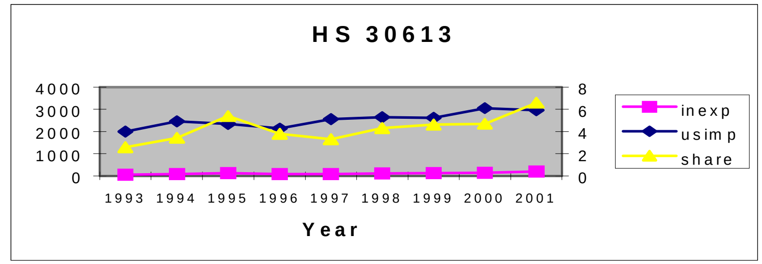
aggregated value of the selected codes from the value for the total codes. Depending on the model requirements, the variable was constructed at both current and constant prices. The figures for current prices were obtained by taking the value of US total import to US in million dollars and the constant price figures for the variable were computed by deflating the value numbers by their respective unit value indices.

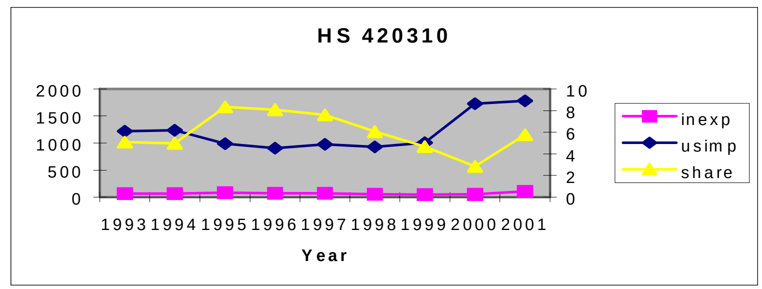
Apart from the variable construction for the econometric model, the forecasting procedure also necessitated the compilation and construction of the exogenous variables. Since the exogenous variable forecasts were based on the time-series modelling, it entailed preparing long time series data for the variables $PX_{it,}$ $PXCC_{it\ and}$ MUS_{it} for each of the 17 selected commodity codes. The frequency of the time series prepared was monthly and the data sources included *World Trade Atlas* (Jan. 1993-May2002) and *IFS Online* (Jan. 1993-Dec.2001).

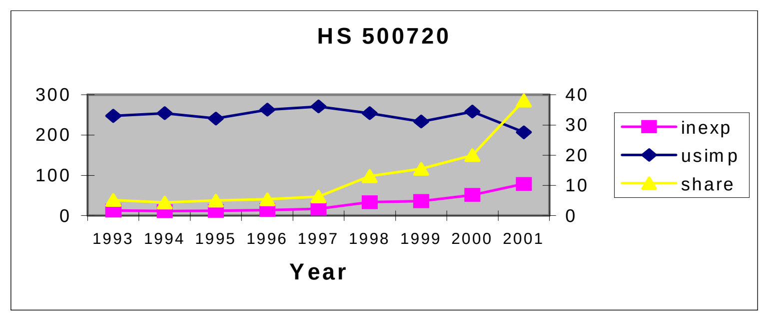
Annex IV

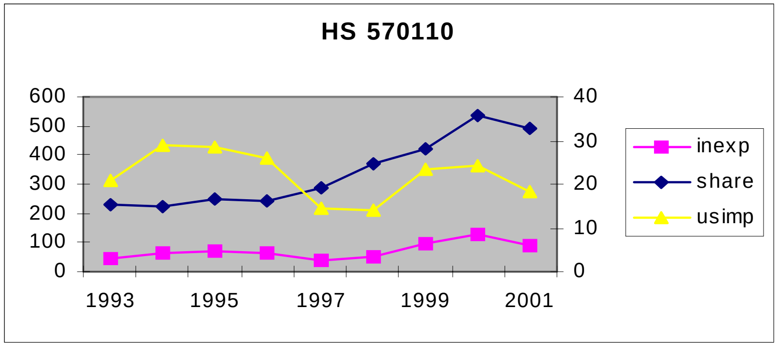
Annex Figure IV.1: US Total Imports, India's Export to US and India's Share in US Total Imports, 1993-2001: Select Commodity Groups (HS 6-digit)

Left Y Axis: India's Exports to US (Mill.US$), US Total Imports (USMill.$), Right Y Axis: India's Share(%) of Exports US Total Imports





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30
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10
0
1993
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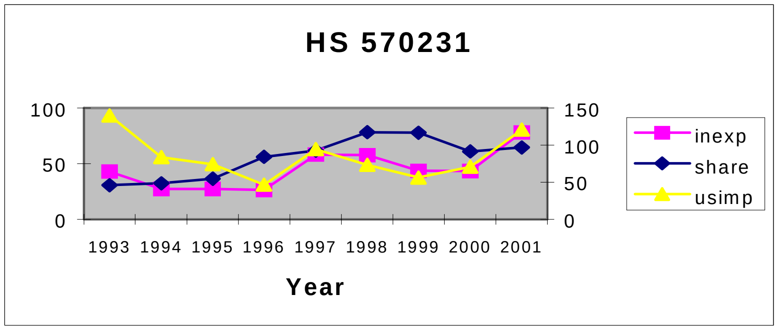
1997
1999
2001
inexp
share
usimp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Year
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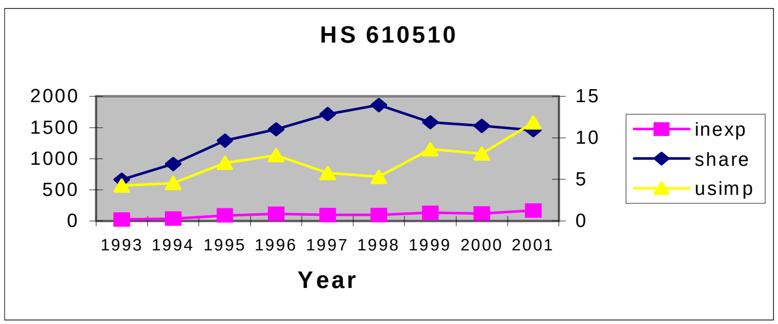
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1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
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share
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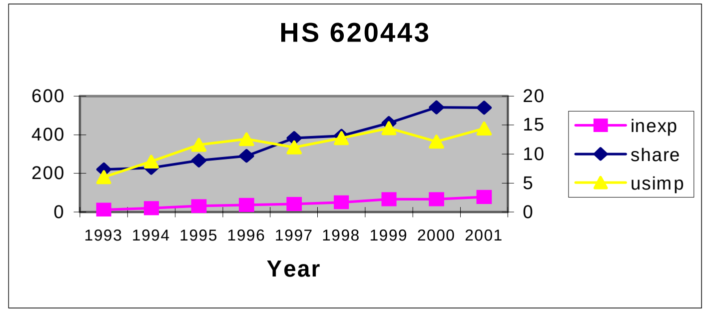
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1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
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share
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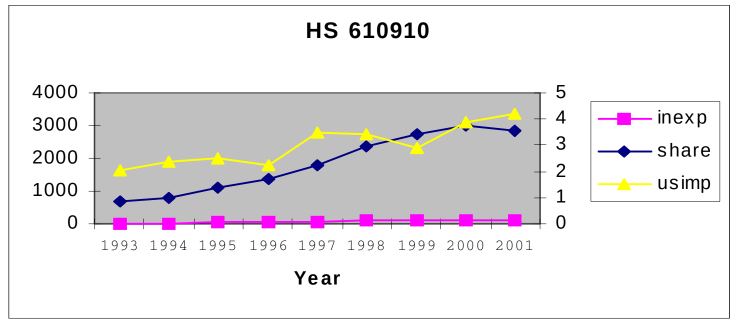
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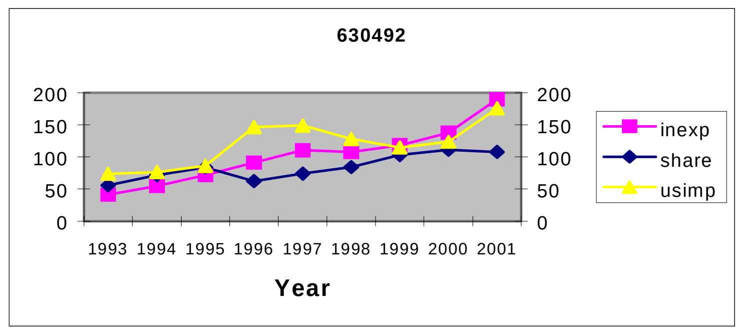
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Year
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share
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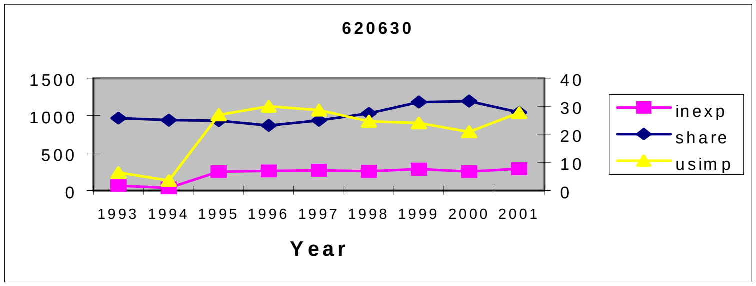
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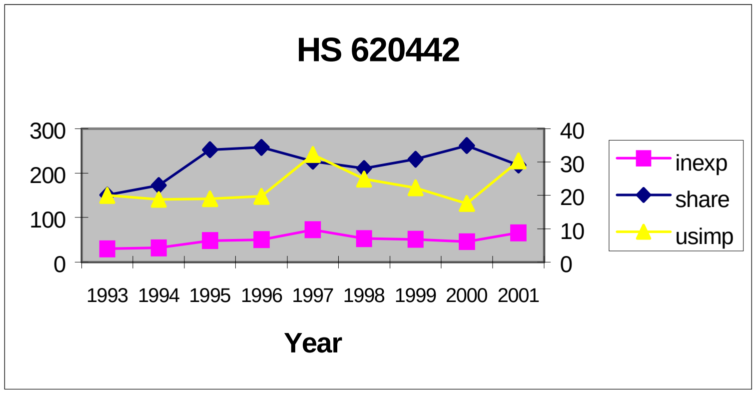
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Year
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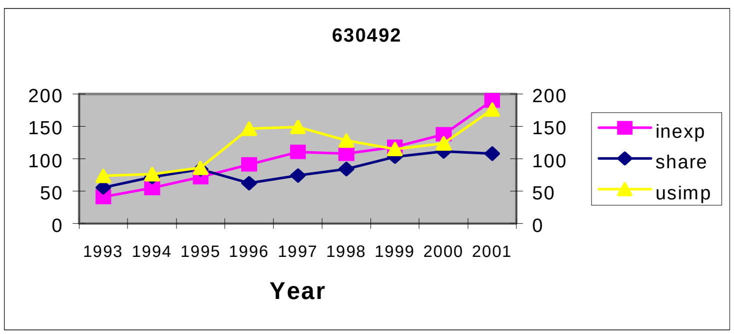
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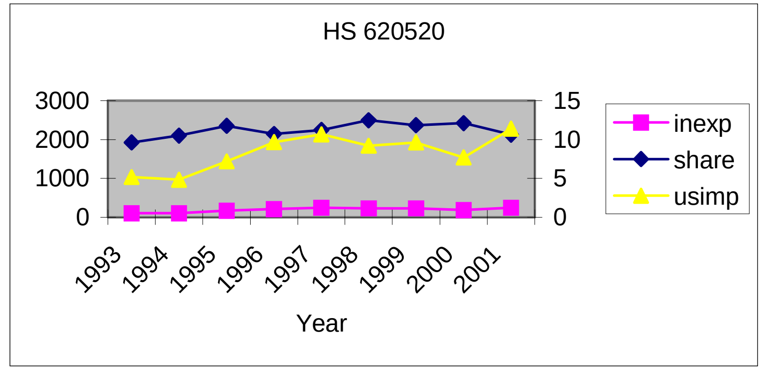
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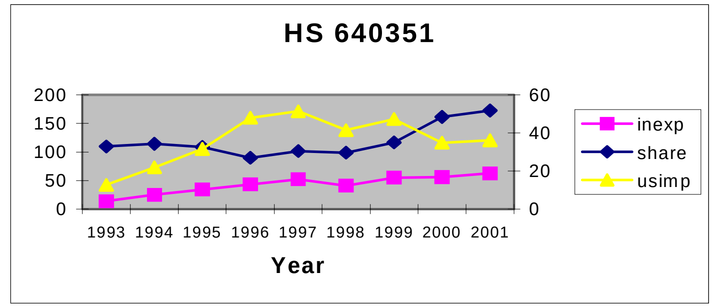
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Year
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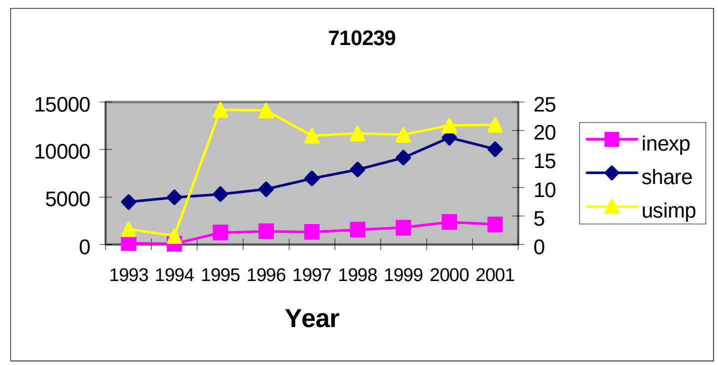
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Year
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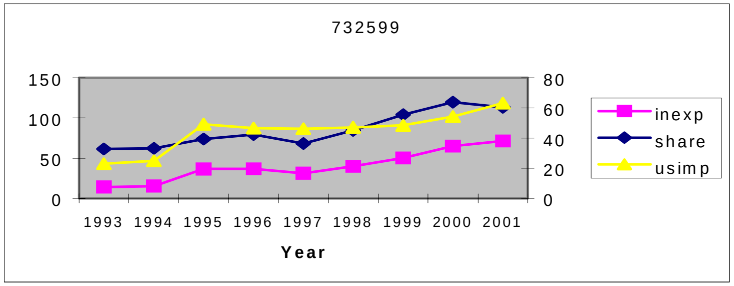
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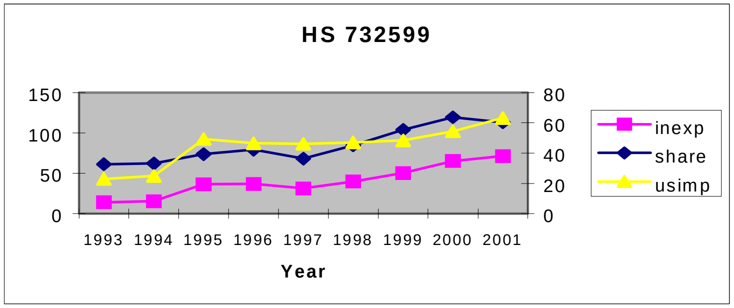
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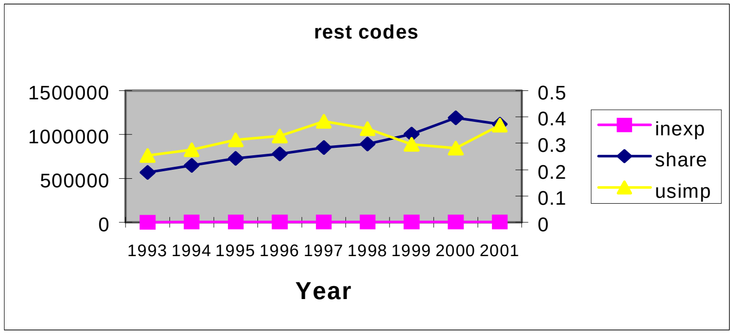
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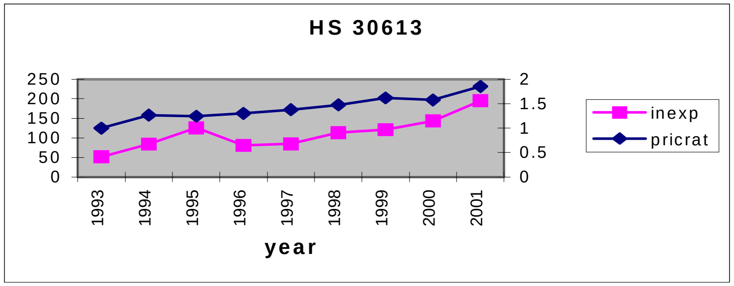
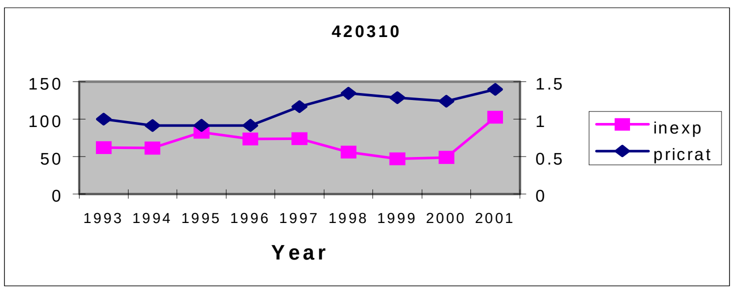
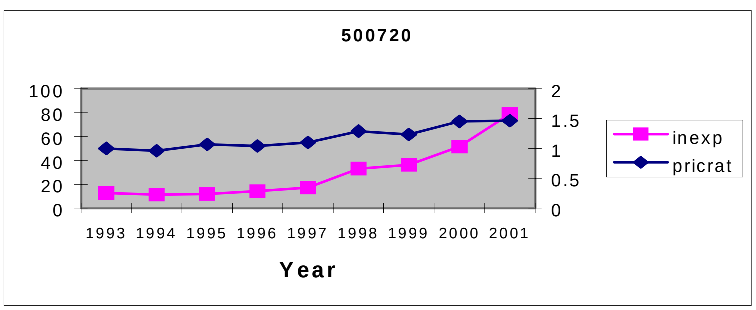
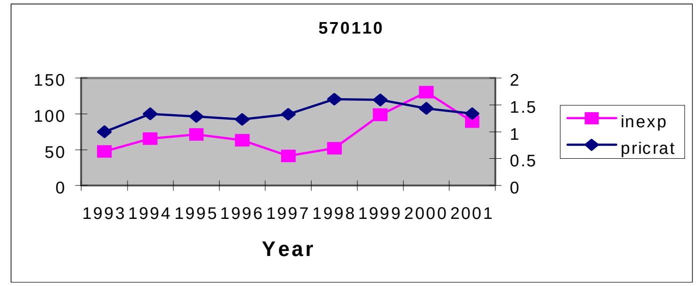
0.2
0.1
0
1993 1994 1995 1996 1997 1998 1999 2000 2001
Year
inexp
share
usimp

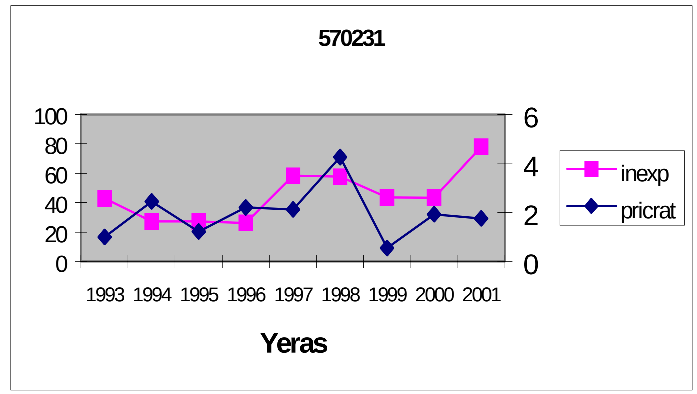
Annex Figure IV.2: India's Export to US and Price Ratio of India's Export Price to US w.r.t. Competitive Countries Export Price to US, 1993-2000, Select Commodity Groups (HS 6-digit) Left Y Axis: India's Export to US (Mill. US$), Right Y Axis: Price Ratio (US Import Unit Value from India/US Import Unit Value from Other Countries)

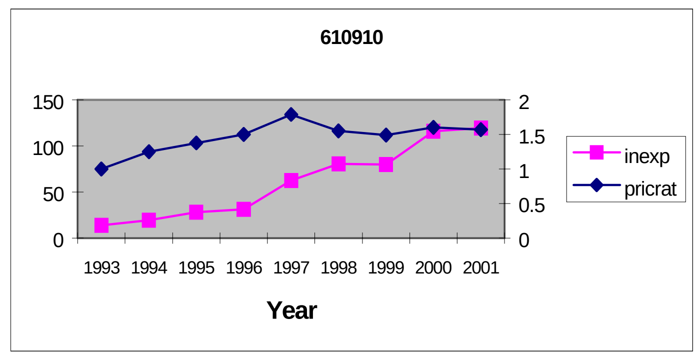


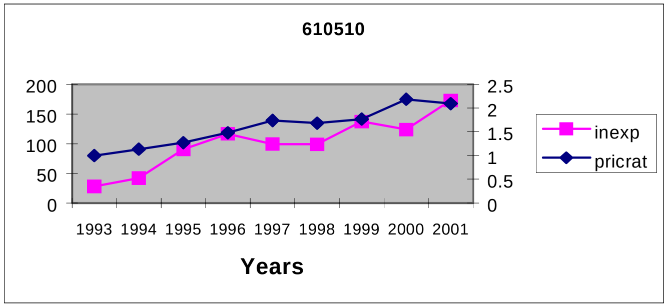








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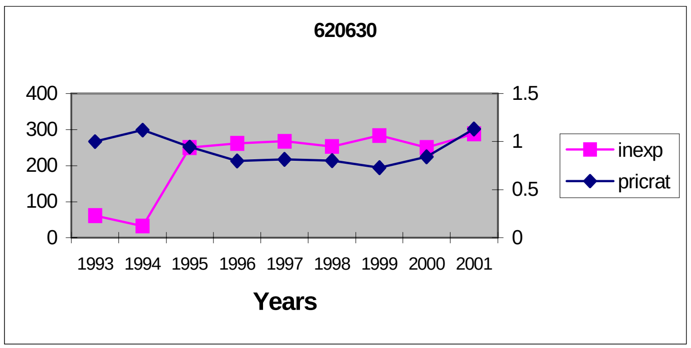
Years
inexp
pricrat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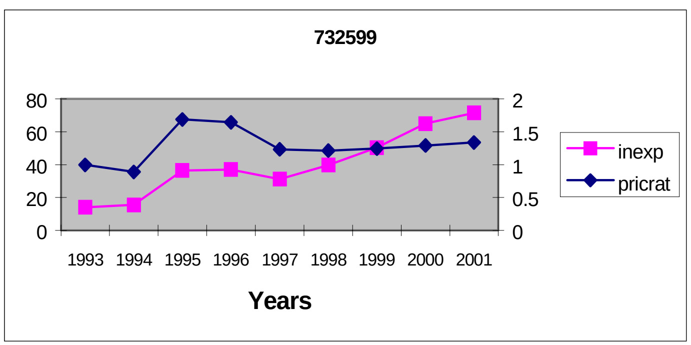
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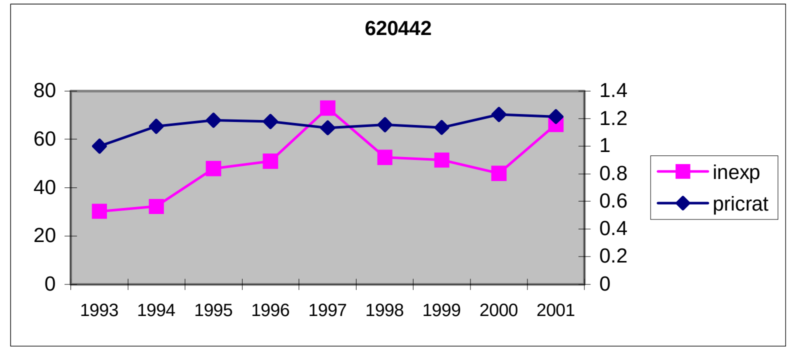
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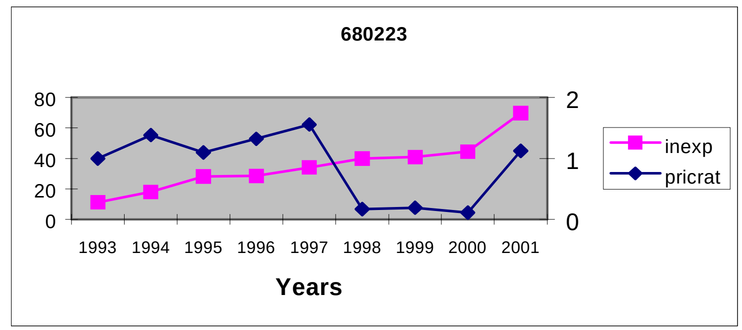
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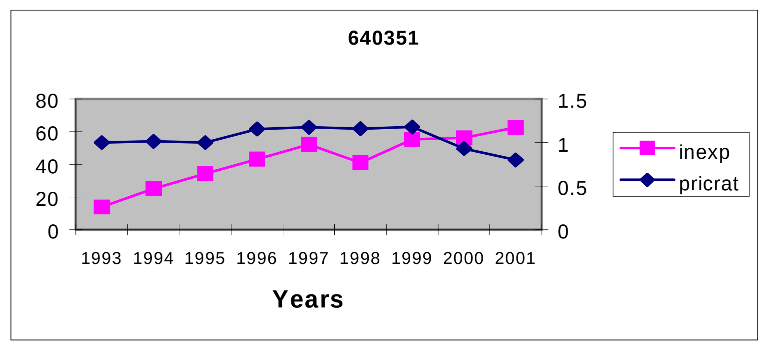
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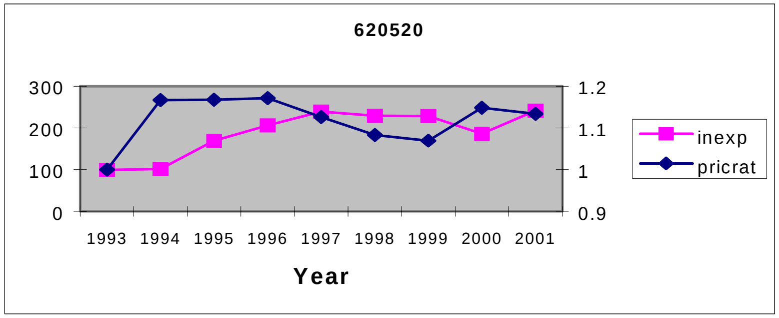
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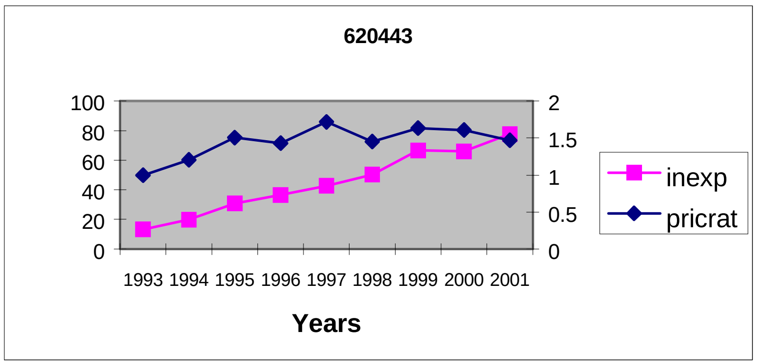
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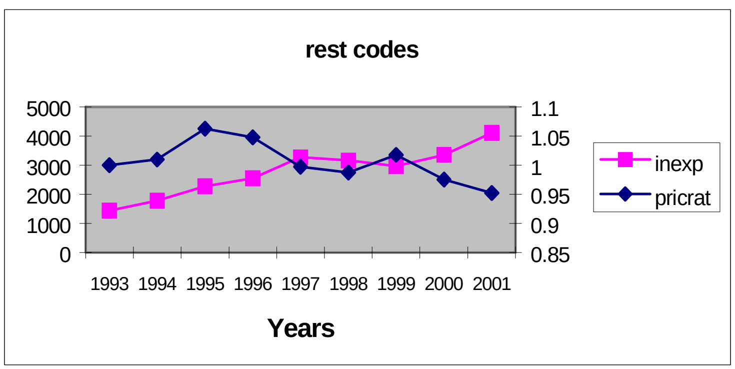
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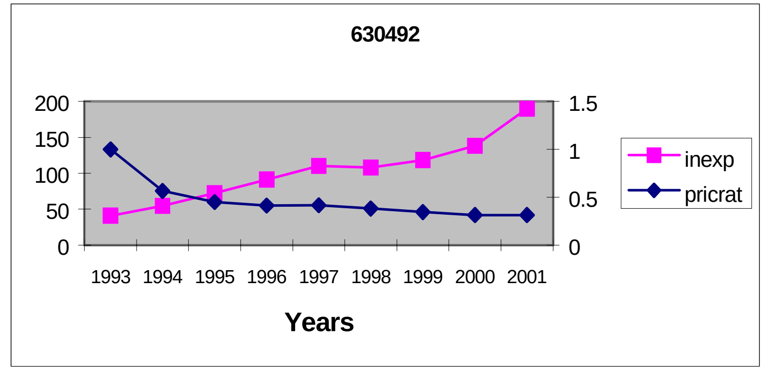
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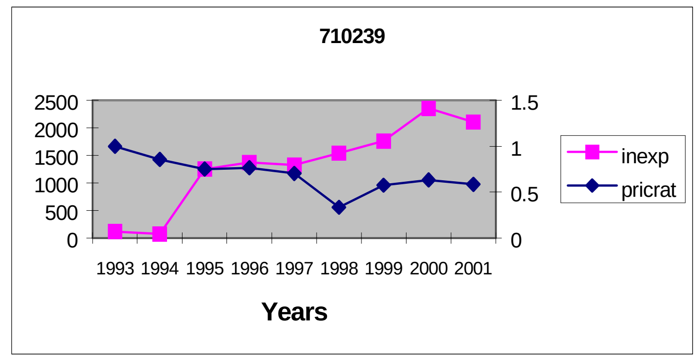
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