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Competitiveness of India's Exports: Some Aspects

Rajiv Ranjan*

This paper attempts to measure the competitiveness of exports taking into account the responsiveness of prices of exports, imports as well as the general level of prices to exchange rate changes and also incorporating the import-intensity of exports. An important aspect of this paper relates to computation of an indicator of competitiveness of India's major as well as total exports. Given the type of structural rigidities prevalent in developing countries like India, it was more often than not expected that the foreign currency price of exports will fall partially as a result of currency depreciation and that the price elasticities of export supply and demand are crucial in determining the extent of exchange rate pass-through to export prices in foreign currency terms. In the Indian context, until recently, the prevalent pessimism over the values of foreign trade elasticities was strong enough to cast doubt on the efficacy of expenditure switching policies for improving the export performance and hence the trade balance. The results of this paper do not reflect the kind of pessimism that was attached to exchange rate as a policy tool to promote exports in the 'seventies and 'eighties. Disaggregated analysis shows that the response of different categories of exports to exchange rate changes differ, mainly because of differences in their supply elasticities and the ability of the exporters to pass on the exchange rate changes to export prices in foreign currency terms, as also the import intensity of exports. The results also indicate that devaluation does have an impact on the profitability and competitiveness of India's exports, and the evidence in support of this hypothesis seems to be stronger in case of exports of manufactured goods.

Introduction

The economic reforms programme put in place in the Indian economy in 1991 constituted a major turn-around in transforming the growth process and in integrating it with the rest of the world. The key issue centered around the degree of openness. The strength of the export

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performance reflects the effectiveness of the outward orientation of the economy. This in itself represents a paradigm shift in that the vent-for-surplus or residual approach to exports has given way to the one based on strategic selectivity, rooted in the tradition of the recent theories of managed trade. Drawing from the experience of NICs, it is being increasingly recognised that a policy stance aimed at gearing the promotion of a selected group of commodities has the beneficial impact of toning up the overall performance of the economy, not only by transforming the trading sectors in terms of developing economies of scope and scale but also by generating the pull effects for the rest of the export sector. Identifying the leading commodities in the export basket thus constitutes the major thrust of current and future trade strategy. Undoubtedly, the evolution of an appropriate selection criteria and a quantitative assessment of its impact on trade and growth form the core of policy research in carving an appropriate trade strategy in the Indian context.

A recent survey of the literature shows that competitiveness however nebulous may be its definition, is the accepted norm for a selective export promotion strategy. Identifying the international competitiveness of selected categories of exports thus helps in penetrating the global market more aggressively and in carving a niche in world trade. In this sense, a systematic study of the competitiveness of exports with emphasis on disaggregated analysis i.e., commodity-wise, gains relevance.

Few economic indicators attract as much controversy as those of international competitiveness, mainly because of the imprecision of the concept which can be used to cover almost any aspect of market performance - product quality, cost of production, relative prices, market prices, product innovation, process analysis, the capacity to adjust rapidly to customers needs and the absence of restrictive practices in the labour market. Economy wide measures such as consumer price indices have the virtue of being relatively comprehensive, but are not sufficiently focussed on those sectors of the economy that compete internationally - the tradeable sector. A number of authors, such as Artus and Knight (1984), Durand and Giorno (1987), Lipschitz and McDonald (1991), Turner and Van't dack (1993), Wickham (1993) and Marsh and Tokarick (1994) have provided a discussion of some commonly used indicators of competitiveness based on consumer price indices, export unit values in manufacturing, normalised unit labour cost in manufacturing, the relative price of traded to non-traded goods etc. Empirical evidence also reveal that no single indicator would provide an unambiguous assessment of competitiveness. This fact strengthens the case for looking at a battery of indica-

tors in addition to the standard measures of real effective rates.

In the Indian context, a number of empirical studies on export performance have been made during the last two decades. However, to our knowledge, there has hardly been any empirical work on export competitiveness in terms of a unique, measurable and comprehensive indicator or a set of indicators. The present paper[1] by adopting a quantitative approach, seeks to fill this important gap in the Indian context. Moreover, in order to gain analytical insight, the study adopts a disaggregated approach. The study implicitly assumes that the impact of non-price factors on competitiveness, is not quantifiable although it is well known that these factors affect the price differentials in international markets. The study primarily covers the thrust items under manufactured goods[2] exports, and makes broad comments on overall aggregates.

The rest of the paper is organised thus. Section II gives a historical perspective of the commercial policy in India highlighting the evolutionary aspects of export oriented growth. Section III presents methodological aspects relating to measurement of competitiveness and raises certain important issues particularly concerning the pass-through effect of exchange rate variations - an issue which in recent times has been attracting considerable attention of policy makers in the face of fundamental changes in the stance of exchange rate policy. Other issues presented in this section relate to an assessment of the impact of exchange rate changes on prices of domestic inputs and imports as well as on the import intensity of exports. Section IV presents results of the study in terms of the estimates of elasticities of demand and supply of exports, pass-through and the resultant competitiveness and profitability indicators. Finally, Section V analyses the results obtained and draws some inferences about the ideal stance that would help strengthen the current and prospective foreign trade regime with focus on the export sector.

Section II

Review of Trade and Exchange Rate Policies in India - Competitiveness as a Key element of Export Growth

Several export promotion measures were put in place in the late 'sixties and early 'seventies in the form of export incentives and export services in order to generate higher exports on a sustained and long-term basis. A package of selective export incentive schemes were introduced in order to assist the exporters to overcome their competitive disadvantages

as against competitors in the world market: these were in the nature of cash compensatory support (CCS), import replenishment (REP), duty drawback scheme (DDS), market development assistance (MDA), international price reimbursement scheme (IPRS) etc. Infrastructure development to promote exports in the 'seventies took the form of export promotion councils, commodity boards and specialised service institutions.

A major change in the trade policy was initiated in the mid 'seventies when import substitution gave way to import liberalisation. Accordingly, export promotion policies were favoured (Tondon Committee, 1981) and designed so as to encourage production for the world market (see Bhagwati and Srinivasan (1975), Nayyar (1976)).

Foreign trade policy issues became the subject of intense discussions in the early 'eighties. Competitiveness of exports received maximum priority and higher growth rates in exports were seen as necessary, in keeping with the evolving degree of openness of the economy and in line with the achievement of comparative advantage. It also became increasingly clear that production for exports cannot be isolated from production for the home market and that trade policy would have to be integrated with the policy for domestic industrialisation[3]. In the mid 'eighties, for the first time, a long-term three year import-export policy (1985-88) was adopted with a view to providing easy access to imports of essentials for maximising production and exports. As a part of the long term policy, the Abid Hussain Committee made a number of recommendations relating to trade policies, the major plank of which was to provide a strong base for improving the competitiveness of India's exports. In pursuance of this policy stance, the process of trade liberalisation was carried further for the subsequent three years spanning the period 1988-91. The major ingredients of this policy cover provision of easy access to essential imported capital goods, raw materials and components to industry. The period also witnessed policy supportive efforts towards modernisation and technological upgradation of the Indian industrial sector. Liberal imports of capital goods and technology during the 'eighties were viewed as a major incentives for exporters in undertaking technological upgradation for reducing costs and improving quality, facilitating in the process, the gaining of competitive strength in the international market.

While the signs of liberalised trade policy were clearly decernible in the later half of the 'eighties, it was only in July 1991 i.e., in the wake of the gulf crisis, that the country embarked on a truly liberalised trade regime. This structural shift marked a significant turnaround of the

earlier controlled regime. The new trade policy which formed a major ingredient of the economic reforms programme was characterised by a short negative list of exports and imports, lowering of height and dispersion of nominal tariffs and withdrawal of quantitative controls over all categories of imports, except in case of consumer goods. It was recognised that trade policies, exchange rate policies and industrial policies must form part of an integrated policy framework if the aim was to improve the overall productivity and efficiency of the economic system in general and the export sector, in particular.

Thus, the issue of export promotion of a selective basket of commodities, which this paper tries to examine, was all pervasive even in the 'seventies and the 'eighties when the various export promotion councils were operative and selective incentives to selected commodities under the International Price Reimbursement Scheme (IPRS) were given. The concept of 'extreme focus product' is a recent phenomenon where the criterion for selection is based on the achievement of a growth rate higher than 30 per cent. Vigorous policy thrust and administrative support are given to this group consisting of 34 items of exports so that their potential could be tapped and they can contribute significantly to the growth of exports[4]. While this policy undoubtedly helps in promoting exports of select products within the ambit of a general export promotion policy framework, it becomes imperative to develop a more comprehensive criteria that would truly reflect the competitiveness of the economy based on which the country and the exporting community would be better placed in terms of identifying and selecting potential products for export promotion.

Exchange Rate Management - an Overview

The salutary effects of exchange rate policies seem to have been well recognised in the Indian context despite a certain degree of pessimism in some quarters (Patra and Pattanaik, 1994). Empirical evidence has revealed that export volumes are responsive to exchange rate changes and the relevant elasticities are significantly higher than what it was generally thought[5]. Recognising this the exchange rate policy in India since 'eighties has been oriented with a distinct export bias[6].

In the wake of the payment crisis in 1991, restoration of competitiveness of India's exports in general and reduction in the trade and current account deficits in particular necessitated a downward adjustment of the exchange rate of the rupee as against major currencies by 18-19 per cent in July 1991. The underlying rationale in initiating this measure

was two-fold: in the short-run, it would help to stem the outflows of capital through a reversal of market expectations and later it would tend to encourage larger inflows. It was also felt that over the short and medium-term, the downward adjustment of the rupee becomes an instrument of improving the country's international competitiveness and in correcting the imbalances in trade and current account deficits (Rangarajan (1991)). It may be noted that the degree of improvement achieved in the country's balance of payments through exchange rate adjustments vitally depends upon the degree of pass-through of the latter to export and import prices. Nonetheless, the downward adjustment implies a movement out of the basket regime and assumes the nature of a corrective mechanism to bring the exchange rate in line with the macroeconomic fundamentals. Simultaneously, a closer alignment between exports and imports was provided through the introduction of EXIM Scrip scheme. The scheme provided a boost to exports and based on the experience gained in the working of the scheme, it was thought prudent to institutionalise the incentive component and convey it through the price mechanism, while simultaneously insulating essential imports from currency fluctuations. Therefore, a system of dual exchange rates under the Liberalised Exchange Rate Management System (LERMS) was introduced in March 1992. The dual exchange rate system, which was instituted as a transitional arrangement introduced a market leg, besides the existing official leg to exchange rate determination. However, it may be conceded that there was an implicit tax on exports in the dual exchange rate system arising out of the differential in the rates of surrender of export proceeds at the official and market rates which resulted in distortions in resource allocation in the long run[7]. This system, therefore, had eventually given way to a unified exchange rate system in March 1993. India has since then been on a fully floating exchange rate regime in which the exchange rate gets determined by the market forces of demand and supply. Alongside these regime changes, several initiatives have been taken to widen and deepen the foreign exchange market and the rupee was made fully convertible in respect of all current account transactions. Finally, the country accepted Article VIII status of the Articles of Agreement of the International Monetary Fund from August 1994. Apart from the reforms instituted on the foreign exchange front, there have been significant changes in the external environment since the inception of structural reforms which, *inter alia*, aims at bringing about market oriented export activity in India. The elements ingrained in the reform process includes aggressive efforts at ensuring balanced macroeconomic management, greater access to foreign investment and technology, reforms in trade and payment regimes including tariff

rationalisation, cheap availability of export credit, overall open door policy for promoting foreign investment, collaborations and joint ventures.

It has been however, argued that exchange rate management cannot be viewed in isolation from other macro parameters. Based on an analysis of the inter-links between money, exchange parity, share prices and wholesale prices, Brahmananda *et al* (1992) had underlined the strong link between exchange parity and the commodity prices and, cautioned that due care may need to be exercised in regard to fixation of exchange rates. On the other hand, studying the exchange rate impact in a macro economic modeling context, Anjaneyulu (1993) found that depreciation could stimulate exports only in an environment of relative price stability. The present study, incorporates the impact of exchange rate changes on domestic prices and confines itself to issues related to export competitiveness.

Section III

Methodological Framework

There has been a near unanimity of views about the major factors that determine competitiveness of exports viz., price elasticity of demand for and supply of exports, the export price responsiveness to exchange rate changes, the elasticity of import prices, the import intensity of exports and the degree of domestic price response to exchange rate changes. If the country is not a pure price-taker and cannot control domestic inflation and the elasticity of supply of exports is low, competitiveness may suffer as a result of devaluation.

The methodology adopted in this study broadly follows Hussain and Thirlwall (1984) in developing an indicator of competitiveness. The study adopted a disaggregated approach by considering not only the major product groups under manufactured goods but also the manufactured goods exports category as a whole as well as aggregate exports. The elasticities relating to the demand for and supply of exports are empirically estimated in respect of seven categories of exports. Using these elasticities, estimates of export pass-through are arrived at. These parameters throw light on the responsiveness of exports (of these commodities) to exchange rate changes. Devaluation opens up two possibilities for the exporters; either to fully absorb the benefit thereof in terms of profits or to pass on the same to the rest of the world by way of lowering export prices in foreign currency for gaining competitive advantage.

It may, however, be noted that the degree of pass-through of exchange rate movements on prices of exports and imports depends on the extent to which the exchange rate adjustment is transmitted to export prices denominated in foreign currency and import prices denominated in the domestic currency. The degree of pass-through is said to be complete when export prices (denominated in foreign currency) and import prices (expressed in local currency) rise or fall to the full extent of the exchange rate change. The more the export prices in foreign currency falls as a result of devaluation, the higher is the degree of export pass-through making exports more competitive in the international market. Similarly, the higher the import prices in domestic currency as a result of devaluation, the higher is the degree of import pass-through, rendering imports costlier. In such a situation, exports with relatively higher import content would suffer a loss in competitiveness. In the Indian context, this has been documented in a recent paper by Patra and Pattanaik (1994) and Krishnamurty and Pandit (1995). Patra and Pattanaik (1994), using time series data, have estimated the degree of pass-through in an aggregative framework covering overall exports and imports and concluded that less than 50 per cent of a unit change in the exchange rate of the rupee is passed on to prices of exports expressed in foreign currencies. Recognising the importance of the impact of exchange rate changes on the domestic price, this paper goes a step further by explicitly incorporating the feedback effects of the exchange rate variations on domestic prices[8] and attempts to estimate the degree of export pass-through in a disaggregated manner in case of India's major manufactured goods exports, their sub-categories as well as for overall exports. It is expected that this approach would throw greater insights into the factors and could guide the present and prospective policy formulations.

The study covers the period 1970-71 to 1993-94 for which the latest quantum and unit value indices of exports are available. The choice of the base year was made taking cognisance of the shift in the trade policy regime at the beginning of the 'seventies.

The broad approach followed in this study is to view the exchange rate not simply as an instrument for increasing the demand for a country's tradeable goods, but to assess its relative efficacy in increasing the profitability of supplies. The relationships are empirically tested in a framework that relates international value added to domestic resource cost (both at the disaggregated and aggregate levels). The international value added (V) is measured as the difference between the value of exports and value of imported inputs used in the production of exports (both mea-

sured in domestic currency). Competitiveness (C) is then computed as the ratio of the international value added (converted into foreign currency) to the cost of domestic inputs used in its production as shown below.

$$C = Vr / P_dD = (P_xX - P_mT)r / P_dD \qquad ...(1)$$

Where X represents exports, P_x, the world price of exports in domestic currency, T, the quantity of imported inputs, P_m, the price of imported inputs in domestic currency, r, the exchange rate (the foreign price of domestic currency), D, the amount of domestic resources used in production (non-traded goods and factors of production) and P_d, price of domestic inputs.

C is thus a measure of the foreign exchange obtained or saved (in the case of import substitutes) per unit of domestic resources used in the export sector.

The question of whether competitiveness improves or not depends on whether the change in C is positive or negative as the exchange rate is devalued. Equation (1) above could be transformed in terms of proportionate rates of change of the variables (denoted by a dot above the relevant variable), as follows.

$$\dot{C} = \frac{1}{P_d^2D^2} [rP_dD\ (\dot{P}_xX + P_x\dot{X} - \dot{P}_mT - P_m\dot{T})$$

$$+ P_dD\ (P_xX - P_mT)\ \dot{r} - (P_xX - P_mT)r\ \{\dot{P}_dD + P_d\dot{D}\}]$$

Rearranging the various terms of the equation, we get,

$$\dot{C} = \left[\frac{r\ (P_xX - P_mT)}{P_dD}\right] \left[\frac{P_xX}{(P_xX - P_mT)}\ (\dot{P}_x + \dot{X}) - \right.$$

$$\left. \frac{P_mT}{(P_xX - P_mT)}\ (\dot{P}m + \dot{T}) + \dot{r} - \dot{P}d - \dot{D}\right]$$

$$\text{or}\quad \dot{C} = w_1\ (\dot{P}_x + \dot{X}) - w_2\ (\dot{P}_m + \dot{T}) + \dot{r} - (\dot{P}_d + \dot{D}) \qquad ...(2)$$

Where w_1 is the ratio of export value (P_xX) to total value added ($P_xX - P_mT$) measured in domestic currency and w_2 is the ratio of imported inputs (P_mT) to total value added ($P_xX - P_mT$).

Dividing equation (2) by $\dot{r}$ (the proportionate change in the exchange rate) throughout gives,

$$\dot{C} / \dot{r} = w_1 \dot{P}_x / \dot{r} + w_1 \dot{X} / \dot{r} - w_2 \dot{P}_m / \dot{r} - w_2 \dot{T} / \dot{r} + \dot{r} / \dot{r} - \dot{P}_d / \dot{r} - \dot{D} / \dot{r} \quad ...(3)$$

Where $\dot{P}_x / \dot{r}$ is the elasticity of export prices in domestic currency with respect to proportionate changes in the exchange rate (<0). Similarly, for a given proportionate change in the exchange rate, $\dot{X} / \dot{r}$ represents the elasticity of export volume (<0); $\dot{P}_m / \dot{r}$, the elasticity of import prices in domestic currency (<0); $\dot{T} / \dot{r}$, the elasticity of demand for imported inputs (>0); $\dot{P}_d / \dot{r}$, the elasticity of domestic input prices (<0) and $\dot{D} / \dot{r}$, the elasticity of domestic resource use (<0). The signs of all relationships assume $\dot{r}$<0, representing devaluation.

$\dot{T} / \dot{r}$ and $\dot{D} / \dot{r}$ are assumed here to have an offsetting effect on $\dot{C}$. This assumption implies that the less expensive imported inputs will be substituted by domestic inputs. The effect of w_2 on $\dot{T} / \dot{r}$ will be small if the elasticity of imported inputs is small. In the extreme case of the value of imported inputs equaling the value added, w_2 would be close to unity.

If $\dot{T} / \dot{r}$ and $\dot{D} / \dot{r}$ are ignored, the issue that needs to be resolved would be whether or not the competitiveness of exports would improve as a result of a change in exchange rate. This obviously depends on other parameters like export prices, export supply, import prices and domestic input prices to exchange rate changes as well as on their feed-back effects on the foreign price of domestic currency. In other words, $\dot{C}$ would be greater than 0 only if the following condition holds:

$$\dot{r} [w_1 k (1 + e_x) - w_2 e_{pm} - e_{pd} + 1] > 0 \quad ...(4)$$

Where k ($=\dot{P}_x / \dot{r}$) measures the degree of 'pass-through' from exchange rate changes to export prices; e_x is the elasticity of supply of exports ($\dot{X} / \dot{P}_x$); e_{pm} is the elasticity of import prices ($\dot{P}_m / \dot{r}$); e_{pd} is the elasticity of domestic input prices ($\dot{P}_d / \dot{r}$) and $\dot{r}$<0 represents a 1 per cent devaluation.

The condition for profitability to increase is $\dot{C} - \dot{r} > 0$, which in terms of (2) and (4) implies,

$$\dot{r} [w_1 k (1 + e_x) - w_2 e_{pm} - e_{pd}] > 0 \qquad ...(5)$$

Equations (4) and (5) demonstrate that if the country is not a pure price taker and cannot control domestic inflation, and the elasticity of supply is low, competitiveness and profitability may suffer following devaluation. Whether the competitiveness of exports improves as a result of devaluation of domestic currency or not depends on the extent to which export prices fall in foreign currency (k) i.e., on the degree of export pass-through (determined by the estimates of elasticity of demand and supply for exports) as also the impact of devaluation on prices of domestic (e_{pd}) and imported goods (e_{pm}) and the import content of exports (w_1 and w_2). Once quantitative assessment of these parameters are made, one could arrive at the coefficient of competitiveness and profitability both at the aggregated and disaggregated levels of exports.

The Elasticity of Export Supply (e_x)

Exports (in terms of volumes) are subject to the twin influences of both demand and supply factors. Since, production could take place either for catering to domestic market or for exports, the estimation of the relevant parameters through a single equation framework presents problem of identification. This could give rise to simultaneity bias if the elasticities are derived from functional formulations based on only one set of factors. Very often, such elasticities based on single equation system may prove to be under-estimates. In order to overcome this difficulty, a variant of the method pioneered by Goldstein and Khan (1978), Hussain and Thirlwall (*op.cit.*), Virmani (1991), Patra and Pattanaik (*ibid*) and more recently, Krishnamurty and Pandit (1995), which allows for the simultaneous estimation of the supply and demand functions for exports, has been followed in this paper. Accordingly, two types of models are estimated viz., an equilibrium model and a dynamic model. The equilibrium model assumes that the adjustment of price and quantities are instantaneous, while the dynamic model relaxes this assumption and allows the adjustment of actual to equilibrium values to take place with a lag. In respect of most of the export categories, estimates of elasticities based on dynamic model are used in the estimation of exchange rate pass-through and in determining the coefficient of competitiveness and profitability. However, sometimes, working with annual data has the disadvan-

tage of bypassing the dynamic effects of adjustment particularly when the lag effects are of shorter duration (of less than a year). In such a case, estimates of elasticity based on equilibrium model are used. Both the models were estimated for seven categories of exports, viz., overall exports, manufactured goods and major items under manufactured goods exports, namely, gems and jewellery, leather and leather manufactures, chemical and related products, textile fabrics and manufactures and machinery and transport equipments.

The demand and supply functions of exports follow standard specifications. The price ratio (P^d_x/P_{xw})[9], - where P^d_x is the price of exports facing the foreign buyer and P_{xw} is the world export price - was included in the demand function of exports to capture the elasticity of substitution between India and her competitors. Exports are assumed to respond to changes in the world trade volume (WTV), which is an activity variable in the export demand function. In case of the supply functions, however, excepting for the categories of manufactured exports, leather and leather manufactures[10] and chemicals and related products[11], gross domestic product at factor cost (Y_t) was taken as the activity variable. There could, however, be a possibility that with rising income levels, the attractiveness of producing for the domestic market may outweigh the incentive for export sales.

The demand function for exports therefore takes the following functional form.

$$\log X^d_t = \log e_0 + e_1 \log (P^d_x / P_{xw})_t + e_2 \log WTV_t \qquad ...(6)$$

Where X^d_t is the quantity of India's exports demanded by the rest of the world (quantum index), P^d_{xt} is the price of exports facing the foreign buyer (the index of unit value of exports deflated by a nominal exchange rate index), P_{xwt} is the world export price (unit value index in US dollar terms), WTV_t is world trade volume representing trading activity in overseas market.

The dynamic model under the partial adjustment framework assumes that exports adjust to the difference between the demand for exports in period t and actual exports in the previous period:

$$\Delta \log X^d_t = \delta(\log X^d_t - \log X^d_{t-1}) \qquad ...(7)$$

Where Δ is the first difference operator and δ is the adjustment coefficient.

Substituting (7) into (6) gives :

$$\text{Log } X_t^d = \log C_0 + C_1 \log (P^d_x/P_{xw})_t + C_2 \log WTV_t + C_3 \log X^d_{t-1} \quad ...(8)$$

Where $C_0 = \delta e_0$, $C_1 = \delta e_1$, $C_2 = \delta e_2$, $C_3 = 1 - \delta$

The supply function for exports is specified as :

$$\log X_t^s = \text{Log } a_0 + a_1 \log (P^s_x/P_d)_t + a_2 \log Y_t \quad ...(9)$$

Where X_t^s is the quantity of export supplied, P_{dt} is the domestic price index (wholesale price index)[12], P^s_{xt} is the supply price of exports (unit value index in rupee terms) and Y_t is the domestic activity variable represented by gross domestic product at factor cost/ index of industrial production (see Notes : 10 and 11).

The hypothesis underlying the export supply function is that as the export price increases relative to domestic price, production for export becomes more profitable, which leads to more supply. The supply function of exports given at (9) is inverted and expressed as export price function as follows :

$$\log P^s_{xt} = \log b_0 + b_1 \log X_t^s + b_2 \log Y_t + b_3 \log P_{dt} \quad ..... (10)$$

Where $b_0 = - a_0 / a_1$, $b_1 = 1 / a_1$, $b_2 = - a_2 / a_1$, and $b_3 = - 1$. The price elasticity of supply of exports can be obtained indirectly from equation (10) by $1 / b_1$.

The price of exports is assumed to respond to the difference between the demand for and supply of exports so that :

$$\Delta \log P^s_{xt} = \varnothing (\log X_t^d - \log X_t^s) \quad ...(11)$$

Where $\varnothing$ is the coefficient of adjustment. Substituting the value of $\log X_t^s$ from equation (9) in equation (11) and solving for $\log P_{xt}$, we get,

$$\log P^{s}_{xt} = \log d_o + d_1 \log X^{s}_{t} + d_2 \log P_{dt} + d_3 \log Y_t + d_4 \log P^{s}_{xt-1} \quad \ldots\ldots (12)$$

Where $d_o = - \varnothing a_0 / (1 + \varnothing a_1)$, $d_1 = \varnothing / (1 + \varnothing a_1)$, $d_2 = \varnothing a_1 / (1 + \varnothing a_1)$, $d_3 = - \varnothing a_2 / (1 + \varnothing a_1)$, $d_4 = 1 / (1+ \varnothing a_1)$.

Equations (6) and (10) constitute the equilibrium model and equations (8) and (12) constitute the dynamic model. Both the models were estimated for all the 7 categories of exports considered in this study for the period 1970-71 to 1993-94, using two stage least square (2SLS) method of estimation, which is a limited information estimation technique applied to over-identified equations of a simultaneous system and yields consistent estimates of the structural parameters. As noted earlier, since the regressors include endogenous variables, the application of ordinary least squares to such structural equations will, in general, result in biased and inconsistent estimates of the parameters.

After estimating the equations, the elasticity of demand and supply of exports can be obtained as follows :

Table 1 : Price Elasticity of Demand and Supply of Exports

	Short-run Equilibrium estimates	Long-run estimates
Demand (e_d)	$\hat{e}_1$	$\hat{C}_1 / (1 - \hat{C}_3)$
Supply (e_x)	$1 / \hat{b}_1$	$1 / [\hat{d}_1/(1 - \hat{d}_4)]$

The Degree of Pass-Through

The extent of transmission of exchange rate changes to export prices i.e., the degree of pass-through (k), is important in order to gauge the impact of such changes in exchange rates on competitiveness of exports. Following Branson (*op. cit*) and more recently, the work of Patra and Pattanaik (*op. cit*), in the Indian case, the degree of export pass-through can be measured as :

$$k = 1 / (1 - e_d/e_x) \quad \ldots\ldots (13)$$

Where e_d and e_x are price elasticities of demand and supply of exports, respectively. It may be noted that the value of k in equation (13) varies between zero and unity.

Impact of Exchange Rate Changes on the Price of Imported Inputs (e_{pm})

The elasticity of the price of imported inputs with respect to change in exchange rate (e_{pm}) is assumed to be unity as it is unlikely that foreign suppliers would reduce the foreign currency price of imports in the wake of a devaluation. This might remain true even in the case of imports which are highly elastic to price. Patra and Pattanaik (*op.cit*) tried to estimate the coefficient of import pass-through, but the perverse sign of the price elasticity of supply of imports led to an indeterminate result. This is also evident in other empirical estimates of import pass-through (Hussain and Thirlwall, *op.cit*). Hence, the assumption that the price of imported inputs rises by the full amount of the devaluation (e_{pm} = 1) appears to be plausible.

Impact of Exchange Rate Changes on the Price of Domestic Input (e_{pd}).

The price elasticity of the domestic inputs stemming from exchange rate changes depends on the response of wages to domestic price (P_d) and its feed-back effect. The domestic input prices are affected by exchange rate changes via the mechanism of import prices. To capture these effects, the following simultaneous equation model was estimated by the two-stage least square (2SLS) procedure mentioned earlier.

$$\dot{W} = \alpha_0 + \alpha_1 N + \alpha_2 \dot{P}_d \qquad ...(14)$$

$$\dot{P}_d = ß_0 + ß_1 \dot{W} + ß_2 \dot{F} + ß_3 \dot{P}_m \qquad ...(15)$$

Where $\dot{W}$ is the rate of change of nominal wages, N is the index of employment[13], $\dot{P}_d$ is the rate of change of domestic prices (wholesale price index), $\dot{F}$ is the rate of change in the availability of foodgrains (production plus imports) and $\dot{P}m$ is the rate of change of import prices in domestic currency.

Now,

$$\dot{P}_m = k_m (\dot{r} + \dot{P}_f) \qquad ...(16)$$

Where k_m is the degree of import pass-through and $\dot{P}_f$ is the rate of change of import prices in foreign currency. If the elasticity of supply of imports is assumed to be infinite and $k_m = 1$, then $\dot{P}_m = \dot{r}$, the short-run and long-run relationship between a change in exchange rate and the domestic input prices and wages are given below:

Table - 2

	Short run	Long run
Wages	$\hat{\alpha}_2 \hat{\beta}_3$	$\hat{\alpha}_2 \hat{\beta}_3 / (1-\hat{\alpha}_2\hat{\beta}_1)$
Input prices	$\hat{\beta}_3$	$\hat{\beta}_3 / (1-\hat{\alpha}_2\hat{\beta}_1)$

The estimation of equations (14) and (15) yields the long-run elasticity of domestic input prices and wages with respect to changes in the exchange rates. The price elasticity of total domestic inputs is, however, taken as a weighted average of the two. This elasticity is assumed to hold good at the aggregate level of exports as well as across all the categories of exports considered in the study.

Estimates of Export and Import Value in Total Value Added (w_1 and w_2)

The weights w_1 and w_2 are proportions of export value (P_xX) and the value of imported inputs (P_mT) in the total value added. The latter is defined as the difference between the export value and the value of imported inputs ($P_xX - P_mT$). In the absence of detailed data in deriving broad trends in value of imported inputs used in production for exports i.e. import intensity of exports, indices based on import licenses issued to registered exporters/export promotion scheme were used in case of total exports as well as the manufactured exports. In most of the cases, the data provided by the Exim Bank of India (1991) were used to calculate these shares.

Having estimated the values of the parameters in equations (4) and (5), the coefficients of competitiveness and profitability are calculated for all the seven categories. The estimated coefficients are expected to throw light in judging whether devaluation is likely to improve (i) competitiveness defined as the ratio of foreign exchange earnings per unit of domestic resources used (C) and (ii) profitability defined as ratio of competitiveness to exchange rate (C/r).

Sources of Data

Data on world trade volume (WTV) and world export prices (P_{xw}) are taken from World Economic Outlook (various issues) published by the International Monetary Fund and that of gross domestic product at factor cost (Y_t) are from National Accounts Statistics, published by the Central Statistical Organisation. The data on world export price (P_{xw}) and exchange rate of the rupee per US dollar are taken from International Finance Statistics (IFS) of the International Monetary Fund. Data on quantum and unit value indices of exports and imports are drawn from Directorate General of Commercial Intelligence and Statistics, Government of India, from their volumes on Index Numbers of Foreign Trade of India: A Temporal Presentation (1943-44 to 1988-89), supplemented by Reports on Currency and Finance, Reserve Bank of India in respect of data for recent years. Data on quantum and unit value indices of exports of gems and jewellery were obtained from the Gems and Jewellery Export Promotion Council. Economic Survey of the Government of India was used for data on industrial production index of manufactured goods (MFDIP) and foodgrain availability (F). Finally, *World Table*, published by World Bank was used for culling out data on wage rate index and employment.

Section IV

Empirical Results

The preceding section discussed at length, the condition for competitiveness to improve ($\dot{C} > 0$) [equation (4)] as well as the methodology adopted for estimating the parameters of the equation. This section sets forth the results of the empirical exercise in what follows. To facilitate further discussion on the subject, the condition for competitiveness to improve ($\dot{C} > 0$) as specified in equation (4) is reproduced below :

Table 3 : 2SLS Estimates of Export Demand and Supply Functions (Equations used in the model)

			$\bar{R}^2$	h/DW Stat.	SEE
I.	**Total Exports**				
	Demand	$\text{Log } X^d_t = \underset{(0.09)}{0.07} - \underset{(-2.07)^{**}}{0.94}\ \text{Log } P^d x_t + \underset{(1.75)^{**}}{0.54}\ \text{Log } Pxw_t + \underset{(8.91)^{*}}{1.38}\ \text{Log } WTV_t$	0.97	1.54	0.70
	Supply	$\text{Log } P^s x_t = \underset{(-4.86)^{*}}{-2.51} + \underset{(2.88)^{**}}{0.58}\ \text{Log } X^s_t + \underset{(2.71)^{*}}{0.47}\ \text{Log } Pd_t + \underset{(1.65)^{**}}{0.51}\ \text{Log } Y_t$	0.99	1.84	0.06
II.	**Manufactured Goods**				
	Demand	$\text{Log } X^d_t = \underset{(2.03)^{**}}{2.67} - \underset{(-2.37)^{*}}{0.67}\ \text{Log } (P^d x/Pxw)_t + \underset{(2.53)^{*}}{0.58}\ \text{Log } WTV_t + \underset{(2.54)^{*}}{0.53}\ \text{Log } X^d_t(-1)$	0.94	0.86	0.09
	Supply	$\text{Log } P^s x_t = \underset{(-2.77)}{-2.20} + \underset{(1.46)^{***}}{0.28}\ \text{Log } X^s_t + \underset{(2.27)^{**}}{0.58}\ \text{Log } Pd_t + \underset{(1.73)^{**}}{0.38}\ \text{Log } MFDIP_t + \underset{(0.89)}{0.23}\ \text{Log } P^s x_t(-1)$	0.99	1.57	0.07
1.	**Chemicals & Related Products**				
	Demand	$\text{Log } X^d_t = \underset{(-2.33)^{**}}{-3.87} - \underset{(-1.84)^{**}}{0.46}\ \text{Log } (P^d x/Pxw)_t + \underset{(4.63)^{*}}{2.01}\ \text{Log } WTV_t + \underset{(1.67)^{**}}{0.27}\ \text{Log } X^d_t(-1)$	0.97	1.33	0.16
	Supply	$\text{Log } P^s x_t = \underset{(1.66)^{**}}{1.93} + \underset{(20.6)^{*}}{0.22}\ \text{Log } X^s_t + \underset{(4.09)^{*}}{1.44}\ \text{Log } Pd_t - \underset{(-2.16)^{**}}{1.22}\ \text{Log } PGDP_t + \underset{(0.88)}{0.17}\ \text{Log } P^s x_t(-1)$	0.96	0.80	0.12
2.	**Textile Fabrics & Manufactures**				
	Demand	$\text{Log } X^d_t = \underset{(1.36)^{***}}{8.45} - \underset{(-2.54)^{*}}{1.97}\ \text{Log } (P^d x/Pxw)_t + \underset{(1.19)}{0.86}\ \text{Log } WTV_t + \underset{(1.59)^{**}}{0.28}\ \text{Log } X^d_t(-1)$	0.90	2.19	0.34
	Supply	$\text{Log } P^s x_t = \underset{(1.00)^{**}}{2.52} + \underset{(2.09)^{**}}{0.20}\ \text{Log } X^s_t + \underset{(1.96)^{**}}{0.71}\ \text{Log } Pd_t - \underset{(-1.62)^{**}}{1.01}\ \text{Log } Y_t + \underset{(2.86)^{*}}{0.56}\ \text{Log } P^s x_t(-1)$	0.92	-1.62	0.13

(Contd...)

Table 3 : 2SLS Estimates of Export Demand and Supply Functions (Equations used in the model) (Contd..)

		$\bar{R}^2$	h/DW Stat.	SEE
3. Machinery & Transport Equipments				
Demand	$\text{Log } X^d_t = -5.50 - 0.55 \text{ Log } P^d_{xt} + 1.32 \text{ Log } P_{xwt} + 1.42 \text{ Log } WTV_t$ $(-1.90)^{**} \quad (-2.20)^{**} \quad (4.38)^{*} \quad (3.32)^{*}$	0.97	2.13	0.10
Supply	$\text{Log } P^s_{xt} = -2.40 - 0.51 \text{ Log } X^s_t + 0.88 \text{ Log } P_{dt} + 1.18 \text{ Log } Y_t$ $(-2.27)^{**} \quad (-3.10)^{*} \quad (2.38)^{**} \quad (2.73)^{*}$	0.98	1.97	1.08
4. Gems and Jewellery				
Demand	$\text{Log } X^d_t = 1.45 - 0.77 \text{ Log } (P^d_x/P_{xw})_t + 0.85 \text{ Log } WTV_t + 0.62 \text{ Log } X^d_t(-1)$ $(0.52) \quad (1.46)^{***} \quad (1.60)^{**} \quad (3.82)^{*}$	0.94	1.7	0.25
Supply	$\text{Log } P^s_{xt} = 0.33 + 0.65 \text{ Log } UVM_t + 0.51 \text{ Log } X^s_t + 0.48 \text{ Log } QM_t + 0.33 \text{ Log } P^s_{xt}(-1)$ $(1.78)^{**} \quad (4.10)^{**} \quad (2.47)^{*} \quad (2.24)^{**} \quad (2.18)^{**}$	0.99	-0.43	0.07
5. Leather & Leather Manufactures				
Demand	$\text{Log } X^d_t = 3.39 - 0.27 \text{ Log } (P^d_x/P_{xw})_t + 0.53 \text{ Log } WTV_t$ $(3.78)^{*} \quad (-1.87)^{**} \quad (4.19)^{*}$	0.57	1.90	0.14
Supply	$\text{Log } P^s_{xt} = -0.22 + 0.42 \text{ Log } X^s_t + 1.18 \text{ Log } P_{dt} + 0.29 \text{ Log } LTRIP_t$ $(-0.37) \quad (3.10)^{*} \quad (13.53)^{*} \quad (2.13)^{*}$	0.98	1.72	0.08

Note : *, **, ***, represents the statistical significance at 1, 5, 10 per cent level of significance, respectively.

Definition of variables

X^d_t = Quantity of India's Exports Demanded (Quantum index)
P^d_{xt} = Demand Price of India's Exports (Unit value / exchange rate) (Unit value / exchange rate)
P_{xwt} = World export price (US $ terms)
WTV_t = World trade Valume
$\text{Log } X^s_t$ = Quantity of India's Exports Supplied (Quantum Index)
$\text{Log } P^d_t$ = Whole sale price index
P^s_{xt} = Export Supply price (unit value in rupee terms)
Y_t = Gross domestic product at factor cost (GDPFC)
$MFDIP_t$ = Index of industrial production for Manufactured Goods
$LTRIP_t$ = Index of industrial production for Leather and Leather Manufacturers
$PGDP_t$ = Index of potential GDP
QM_t = Imports of gems and jewellery
UVM_t = Unit value index of Imports of gems and jewellery.

$$\dot{r}\,[w_1 k\,(1 + e_x) - w_2\, e_{pm} - e_{pd} + 1] > 0$$

Estimates of the Elasticity of Export Supply (e_x)

As set out earlier, demand and supply function of exports are estimated both under equilibrium and dynamic frameworks. Equations (6) and (10) constitute the equilibrium model of export demand and supply, whereas equations (8) and (12) constitute the dynamic model of export demand and supply. Both the models are estimated using two stage least squares (2SLS) technique, for seven categories of exports considered in this study, namely, total exports, manufactured goods, gems and jewellery, chemicals and related products, machinery and transport equipment, textile fabrics and manufactures and leather and leather manufactures.

In order to bring forth the superiority of the 2SLS estimation technique (in the wake of presence of simultaneity bias in the model which precludes the use of ordinary least square (OLS)), both the equilibrium and dynamic estimates of OLS and 2SLS are presented in appendices 1 to 4. However, the estimates of competitiveness are based on a dynamic 2SLS estimates excepting in cases of total exports, machinery and transport equipments and leather and leather manufactures, where equilibrium 2SLS estimates are used, as the dynamic effects implicit in the adjustment process in respect of these categories of exports could not be captured well. The equations used for calculating the coefficient of competitiveness are presented in Table 3.

The estimates are statistically robust. The positive first order serial correlation is absent in most of the cases. The results indicate that, the short run elasticity of demand for India's exports with respect to the world exports is highly significant and its value at 1.38 confirms that with the growth in world trade, the pull factor operating on India's exports is quite high.

The equilibrium (short run) and the dynamic price elasticities (long run) of demand for and supply of exports based on 2SLS estimates are given in Appendix 5. The estimates of price elasticities of export demand and supply based on the equations listed in table 3 which are used to calculate the coefficients of competitiveness and pass-through are listed in Table 4. As mentioned earlier, excepting for total exports, machinery and transport equipments and leather and leather manufactures, all the elasticities are based on the dynamic model.

Table 4 :
Estimates of Price Elasticities of Demand and Supply of India's Exports

	Demand	Supply
I. Total Exports	-0.94 **	1.72*
II. Manufactured Goods *of which*	-1.42*	2.75***
1. Chemicals & Related Products	-0.63**	3.77**
2. Textile Fabrics & Manufactures	-2.74*	2.20**
3. Machinery & Transport Equipments	-0.55**	-1.96*
4. Gems & Jewellery	-2.02***	1.32*
5. Leather & Leather Manufactures	-0.27**	2.38*

Note : *, **, ***, represents the statistical significance at 1, 5, 10 per cent level of significance, respectively.

The expected sign of price elasticity of demand for exports is negative and that of supply of exports is positive, the only exception being machinery and transport equipments. The results obtained have been consistent in showing negative price elasticity of demand for exports, but in some cases, the supply price elasticity of exports turned out to be negative, particularly in the case of the equilibrium model, reflecting that at least in the short run, the attractiveness of the domestic market is relatively stronger than that of export market. However, in the dynamic model, except for machinery and transport equipments, all the categories of exports have the expected positive sign in the supply equation and are significant.

Estimates of the Degree of Export Pass-Through

The estimates of price elasticities of demand and supply of exports listed in Table 4 are used to calculate the degree of export pass-through (k) given by the formulae in (13) i.e., $k = (1 - e_d/e_x)^{-1}$, where e_d and e_x are demand and supply elasticities of exports, respectively and the value of k varies between zero and unity. The values for export pass-through are given in table 5.

It may be seen that for each category of exports, the degree of pass-through of changes in exchange rates to prices of exports (expressed in foreign currency) is relatively high. As noted earlier, the degree of pass-through for total exports obtained from the equilibrium (short-run) model here is relatively high as compared to the estimates obtained by Patra and Pattanaik. Thus, a 10 per cent downward adjustment in the exchange rate of rupee is expected to cause the dollar price of total exports fall by 6.5 per cent, while export prices in rupee terms will rise by 3.5 per cent. The response would be similar in case of manufactured goods (6.6 per cent and 3.4 per cent, respectively). The degree of pass-through of exchange rate to export prices in foreign currency is lower in case of gems and jewellery and textile fabrics and manufactures, whereas, the corresponding transmission effect is high in case of leather and leather manufactures and chemicals and related products. This corroborates the importance of the exchange rate as a policy tool for promotion of exports. The perverse sign of the supply price elasticity of machinery and transport equipments, however, has precluded the possibility of obtaining an estimate of pass-through effect for this export category.

Table 5 : Estimates of Export Pass-through

	Degree of Pass-through
I. Total Exports	0.65
II. Manufactured Goods	0.66
of which	
1. Chemicals & Related Products	0.86
2. Textile Fabrics & Manufactures	0.45
3. Machinery & Transport Equipments	—
4. Gems & Jewellery	0.40
5. Leather & Leather Manufactures	0.89

Impact of Exchange Rate Changes on the Price of Imported Inputs (e_{pm}) and Domestic Inputs (e_{pd})

As outlined in section III (on methodology), the elasticity of imported inputs to exchange rate changes (e_{pm}) is assumed to be unity, which implies that the devaluation effect is fully absorbed in the price of imported inputs.

For estimating the price elasticity of the domestic inputs with respect to exchange rate changes (e_{pd}), the simultaneous equation model set out in equations (14) and (15) was estimated for the period 1974 to 1989, using 2SLS technique. The results obtained are as under :

Table 6 : Results of Input Price Model

	$\bar{R}^2$	DW
$\dot{W} = -18.0 + 0.25\ N + 0.57\ \dot{P}_d$ $(-1.79)^{**}\ (2.38)^{*}\quad (3.77)^{*}$	0.56	2.16
$\dot{P}_d = 1.3 + 0.49\ \dot{W} - 0.13\ \dot{F} + 0.16\ \dot{P}_m$ $(0.46)\quad (1.79)^{**}\quad (-0.87)\quad (2.65)^{*}$	0.59	2.10

Note: * and ** represents the statistical significance at 1 and 5 per cent level of significance, respectively.

Where $\dot{W}$ is the rate of change of domestic wages, $\dot{F}$ is the rate of change in the availability of foodgrains, $\dot{P}_m$, is the rate of change of import prices in domestic currency and $\dot{P}_d$ is the rate of change in domestic input prices. As the variables were taken in their 'difference' form, the adjusted coefficient of determination turns out to be low. Based on the above results, the elasticity of domestic input prices and wages were calculated from the formulae given in table 2.

Table 7: Elasticity of Wages and Input Prices

	Short-Run	Long-Run
Wages	0.10	0.13
Input prices	0.16	0.22

The long-run price elasticity of domestic inputs is taken as a weighted[14] average of the values obtained for the elasticities of wages and input prices. The value of this parameter stood at 0.20, and is used for all export categories considered in this study.

Estimates of Export and Import Value in Total Value Added (w_1 and w_2)

It may be mentioned at the outset that the weights viz., w_1 and w_2 *ipso facto* does not provide a direct measure of import intensity of exports. However, the ratio w_2 / w_1 provides an estimate of the quantum of imports that have gone into production of that particular export category. Appendix 6 gives trends in exports and imports for the period 1985-86 to 1989-90; based on which w_1 and w_2 are calculated.

Table - 8 : Share of Exports and Imports in Total Value Added

	Export value as proportion of total value added (w_1)	Imported inputs as a proportion of total value added (w_2)
I. Total Exports	1.50	0.50
II. Manufactured Goods *of which*	1.98	0.98
1. Chemicals & Related Products	1.45	0.45
2. Textile Fabrics & Manufactures	1.38	0.38
3. Machinery & Transport Equipments	1.39	0.39
4. Gems & Jewellery	4.48	3.48
5. Leather & Leather Manufactures	1.06	0.06

It is clear from the above table that the import content for production of exports is very high at around 78 per cent in the gems and jewellery sector, which would impact upon its competitiveness. Leather and leather manufactures however, yielded the lowest import intensity (around 6 per cent).

Coefficient of Competitiveness and Profitability

The parameters estimated above enable us in drawing certain inferences on the impact of devaluation on competitiveness (defined as the ratio of foreign exchange earnings per unit of domestic resources used

Table 9 : Elasticities (with respect to fall in r) , and Parameter Values for Application of Equations (4) and (5)

Exports	Supply elasticity e_x	Pass-through $k (< 0)$	Elasticity of import prices $e_{pm} (< 0)$	Elasticity of domestic inputs $e_{pd} (<0)$	w_1	w_2	Change in competitiveness $\dot{C}$	Change in profitability $\dot{C} - \dot{r}$
I. Total Exports	1.72	0.65	1.00	0.20	1.50	0.50	0.95	1.95
II. Manufactured Goods *of which*	2.75	0.66	1.00	0.20	1.98	0.98	2.72	3.72
1. Chemicals and Related Products	3.77	0.86	1.00	0.20	1.45	0.45	4.30	5.30
2. Textile Fabrics and Manufacturers	2.20	0.45	1.00	0.20	1.38	0.38	0.41	1.41
3. Machinery and Transport Equipments	-1.96	—	1.00	0.20	1.39	0.39	—	—
4. Gems and Jewellery	1.32	0.40	1.00	0.20	4.48	3.48	- 0.52	0.48
5. Leather and Leather Manufactures	2.38	0.89	1.00	0.20	1.06	0.06	1.93	2.93

($\dot{C}$)) and profitability (defined as $\dot{C}$ / $\dot{r}$). From equations (4) and (5), the condition for competitiveness ($\dot{C}$) to increase is :

$$\dot{r}\ [w_1 k\ (1 + e_x) - w_2\ e_{pm} - e_{pd} + 1] > 0$$

and the condition of profitability ($\dot{C}$ / $\dot{r}$) to increase is :

$$\dot{r}\ [w_1 k\ (1 + e_x) - w_2\ e_{pm} - e_{pd}] > 0$$

The above conditions for competitiveness and profitability are calculated for a 1 per cent devaluation of the exchange rate i.e., for $\dot{r}$ = -1. The results are presented in Table 9. It could be seen therefrom, that excepting for gems and jewellery, all the export categories considered in the study reveal an improvement in competitiveness and profitability as a result of devaluation. In case of aggregate exports, 1 per cent devaluation leads to a 0.95 per cent increase in foreign exchange per unit of domestic inputs. However, in case of manufactured goods, the increase in competitiveness is higher at 2.72 per cent. Chemicals and related products, being less import intensive, the exporters of these products were able to pass on the exchange rate changes (benefits) by lowering their export product prices in foreign currency, realising thereby an edge in their export competitiveness. The gems and jewellery exports display a relatively low degree of pass-through and their production involves higher use of imported inputs (in production for exports (w1 and w2)). This results in a loss of foreign exchange earnings per unit of domestic resources used (C), consequent on devaluation. Nevertheless, the results indicate that it is still profitable to export gems and jewellery. The coefficient of competitiveness for machinery and transport equipments, however, could not be calculated due to the perverse sign obtained for its supply price elasticity.

Section - V

Summary and Conclusion

The study, in a supply side framework, attempted to measure competitiveness of exports, at the overall as well as at the disaggregated levels in terms of important manufactured goods exports, taking into account the responsiveness of prices of exports, imports as well as the gen-

eral level of prices to exchange rate changes vis-a-vis the import-intensity of exports. Competitiveness, in this framework, is defined as a ratio of foreign exchange earnings per unit of domestic resources used. An important contribution of this paper is to compute an indicator of competitiveness. This indicator is used to test the hypothesis as to whether the competitiveness of exports improves as a result of depreciation in the exchange rate. The possible outcomes of this policy measure could be either that of raising the domestic currency price, or reducing the foreign currency price of exports. Devaluation generates price incentives which tend either to lower domestic demand for imports expressed in foreign currency (or raise domestic demand for and supply of import substitutes), or to increase the demand for exports (or lower domestic consumption to meet export demand). The precise responsiveness of this policy stance, of course, depends on the range and magnitudes of demand and supply elasticities, besides the nature of exchange controls in operation. Given the type of structural rigidities prevalent in developing countries like India, it was envisaged that the foreign currency price of exports will fall only to some extent as a result of currency depreciation and that the price elasticity of export supply and demand is crucial in determining the extent of exchange rate pass-through to export prices in foreign currency terms. In the Indian context, until recently, the prevalent pessimism[15] over the values of foreign trade elasticities had cast doubt on the efficacy of currency depreciation as a means to improve export performance.

The results of this paper do not reflect the kind of pessimism that was attached to exchange rate as a policy tool to promote exports in the 'seventies and 'eighties. Disaggregated analysis shows that the response of different categories of exports to exchange rate changes differ, mainly because of differences in their supply elasticities and the ability of the exporters in passing on the exchange rate changes by way of lowering of the export prices in foreign currency terms, as also because of the different degrees of import intensity of exports. Hence, there is a need to adopt a selective approach in export promotion to generate economies of scope and scale and to draw out the positive pull effects of such an approach for the buoyant performance of the export sector.

The results also indicate that devaluation has a positive impact on the profitability and competitiveness of India's exports, and the evidence in support of this hypothesis seems to be stronger in case of exports of manufactured goods. Thus, while opting for selective export promotion of extreme focus products, it could be useful to rank exporting activities according to their foreign exchange earnings per unit of domes-

tic resources used instead of following an *a priori* selection criteria based on growth rates of exports in the past years. The findings in the paper also points towards fairly significant impact of growth in the volume of world trade on India's exports. The results show that with an accelerated growth of world trade in 1994 (9.4 per cent) - with projections for the next two years in the range of 7 to 8 per cent - exports would gain considerably in the wake of significant responsiveness of India's exports to changes in world trade.

Notes :

1. The methodology adopted in this paper draws considerably from Hussain and Thirlwall (1984). See also Thirwall (1986).

2. The commodities under manufactured goods exports for which indicator of competitiveness is calculated are chemicals and related products, textile fabrics and manufactures, machinery and transport equipments, gems and jewellery and leather and leather manufactures.

3. See Rangarajan, C (1994) :India's Balance of Payments, The Emerging Dimensions; Sixteenth G.B. Pant memorial lecture.

4. See Annual Report of the Ministry of Commerce, 1994-95.

5. See Virmani (1991), Patra and Pattanaik (1994).

6. Following the collapse of the Bretton Woods System, the rupee was delinked from pound sterling in 1975 and pegged to a basket of currencies of India's major trading partners, the pound sterling being the intervention currency. This managed float regime which was in force for a decade and a half came under considerable pressure with the precipitation of the balance of payments crisis in 1991.

7. Reserve Bank of India, Annual Report, 1993-94.

8. Krishnamurty and Pandit (1995) explicitly incorporates this feedback effects of exchange rate changes on domestic prices.

9. In the case of overall exports and machinery and transport equipments, the elasticity of substitution worked out to be lower, hence P^{d}_{x} and P_{xw} were specified separately in these two cases.

10. For manufactured goods and leather and leather manufactures, the indices of industrial production of manufactured goods (MFDIP) and leather and leather manufactures (LTRIP) were found significant, so they were used as activity variables.

11. In the case of chemicals and related products, an index of potential GDP (PGDP) was constructed by regressing actual Gross Domestic Product at Factor Cost (Y_t) on time trend, to capture the adjustment between the actual demand and full capacity utilisation.

12. Exports of diamonds which accounts for more than 90 per cent of gems and jewellery exports from India was taken as a proxy for exports of gems and jewellery. In the absence of wholesale price index of gems and jewellery, the unit value index of imports of gems and jewellery (UVM) was used as a proxy of domestic price index, as imports of gems and jewellery is the major source of supply for the domestic market. On the same premise, the activity variable in the export supply function of gems and jewellery is imports of gems and jewellery (QM).

13. The typical Phillips curve relationship would allow for level of unemployment in equation (14), as is used by Hussain and Thirlwall, but in the absence of data on unemployment for India, the index of employment is used as an independent variable.

14. The weights assigned to input prices and wages are 0.75 and 0.25, respectively, on the assumption that the impact of input prices has a dominant effect in assessing the effect of exchange rate changes on domestic resource costs.

15. For literature on elasticity pessimism view in India, see Sarkar (1992,) Bagchi and Sarkar (1993), H.K. Pradhan (1993).

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Appendix 1 : Equilibrium OLS Estimates of Export Demand and Supply

			$\bar{R}^2$	DW	SEE
I.	**Total Exports**				
	Demand	$\text{Log } X^d_t = -0.65 - 0.58 \text{ Log } P^d_{xt} + 0.33 \text{ Log } P_{xwt} + 1.39 \text{ Log WTV}_t$ (-1.16) (-2.12)** (1.55)*** (9.29)*	0.97	1.47	0.06
	Supply	$\text{Log } P^s_{xt} = -2.35 + 0.29 \text{ Log } X^s_t + 0.67 \text{ Log Pd}_t + 0.56 \text{ Log Y}_t$ (-4.66)* (1.89)** (4.75)* (2.25)**	0.99	1.75	0.05
II.	**Manufactured Goods**				
	Demand	$\text{Log } X^d_t = 2.42 - 0.69 \text{ Log } (P^d_x/P_{xw})_t + 1.18 \text{ Log WTV}_t$ (2.43)** (-3.79)* (9.25)*	0.95	0.96	0.08
	Supply	$\text{Log } P^s_{xt} = -2.57 + 0.15 \text{ Log } X^s_t + 0.90 \text{ Log Pd}_t + 0.50 \text{ Log MFDIP}_t$ (-7.25)* (1.13) (5.64)* (1.92)**	0.99	2.01	0.06
1.	**Chemicals & Related Products**				
	Demand	$\text{Log } X^d_t = -5.40 - 0.57 \text{ Log } (P^d_x/P_{xw})_t + 2.70 \text{ Log WTV}_t$ (-3.56)* (-2.80)* (14.14)*	0.97	1.76	0.15
	Supply	$\text{Log } P^s_{xt} = -0.03 + 0.02 \text{ Log } X^s_t + 1.59 \text{ Log Pd}_t - 0.61 \text{ Log PGDP}_t$ (-0.02) (0.21) (4.78)* (-1.04)	0.97	1.87	0.11
2.	**Textile Fabrics & Manufactures**				
	Demand	$\text{Log } X^d_t = 4.61 - 1.86 \text{ Log } (P^d_x/P_{xw})_t + 1.85 \text{ Log WTV}_t$ (0.92) (-3.30)* (3.24)*	0.90	1.98	0.35
	Supply	$\text{Log } P^s_{xt} = -0.28 - 0.03 \text{ Log } X^s_t + 1.16 \text{ Log Pd}_t - 0.06 \text{ Log Y}_t$ (-0.26) (-0.39) (3.60)* (-0.13)*	0.94	1.81	0.12

(Contd..)

Appendix 1 : Equilibrium OLS Estimates of Export Demand and Supply (Concld.)

		$\bar{R}^2$	DW	SEE
3. Machinery & Transport Equipments				
Demand	$\text{Log } X^d_t = \underset{(-1.68)***}{-1.37} - \underset{(-5.57)*}{0.95}\ \text{Log } P^d_{xt} + \underset{(5.77)*}{1.11}\ \text{Log Pxwt} + \underset{(4.51)*}{1.12}\ \text{Log WTVt}$	0.98	1.68	0.08
Supply	$\text{Log } P^s_{xt} = \underset{(-3.06)*}{-3.09} - \underset{(-4.67)*}{0.53}\ \text{Log } X^s_t + \underset{(3.58)*}{1.06}\ \text{Log Pdt} + \underset{(2.79)*}{1.16}\ \text{Log Yt}$	0.98	2.04	0.08
4. Gems and Jewellery				
Demand	$\text{Log } X^d_t = \underset{(-1.99)**}{-6.15} - \underset{(-1.52)***}{0.63}\ \text{Log } (P^d x/Pxw)t + \underset{(7.13)*}{3.02}\ \text{Log WTVt}$	0.94	1.42	0.27
Supply	$\text{Log } P^s_{xt} = \underset{(5.03)*}{0.65} + \underset{(16.51)*}{0.96}\ \text{Log UVMt} + \underset{(6.54)*}{0.64}\ \text{Log } X^s_t + \underset{(5.35)*}{0.56}\ \text{Log QM}$	0.99	1.88	0.07
5. Leather & Leather Manufactures				
Demand	$\text{Log } X^d_t = \underset{(5.13)*}{3.37} - \underset{(-2.23)**}{0.26}\ \text{Log } (P^d x/Pxw)t + \underset{(4.68)*}{0.52}\ \text{Log WTVt}$	0.59	1.94	0.14
Supply	$\text{Log } P^s_{xt} = \underset{(-0.55)}{-0.31} + \underset{(3.77)*}{0.41}\ \text{Log } X^s_t + \underset{(19.53)*}{1.26}\ \text{Log Pdt} + \underset{(1.58)***}{0.22}\ \text{Log LTRIPt}$	0.99	1.79	0.08

Note : *, **, ***, represents the statistical significance at 1 , 5, 10 per cent level of significance, respectively.

Appendix 2 : Dynamic OLS Estimates of Export Demand and Supply

			$\bar{R}^2$	h Stat	SEE
I.	**Total Exports**				
	Demand	$\text{Log } X^d_t = -0.07 - 0.45 \text{ Log } P^d_{xt} + 0.24 \text{ Log } P_{xwt} + 0.66 \text{ Log WTV}_t + 0.57 \text{ Log } X^d_{t(-1)}$ $(-0.17)\ (-2.01)^{**}\quad (1.36)^{***}\quad (2.97)^{*}\quad (3.20)^{*}$	0.98	0.91	0.05
	Supply	$\text{Log } P^s_{xt} = -1.51 + 0.31 \text{ Log } X^s_t + 0.38 \text{ Log Pd}_t + 0.30 \text{ Log Y}_t + 0.35 \text{ Log } P^s_{xt(-1)}$ $(-2.42)^{**}\ (1.93)^{**}\quad (2.73)^{*}\quad (1.26)\quad (2.03)^{**}$	0.99	1.94	0.05
II.	**Manufactured Goods**				
	Demand	$\text{Log } X^d_t = 1.66 - 0.45 \text{ Log } (P^d x/Pxw)_t + 0.48 \text{ Log WTV}_t + 0.62 \text{ Log } X^d_{t(-1)}$ $(2.45)^{**}\ (-3.27)^{*}\quad (2.52)^{*}\quad (3.60)^{*}$	0.94	3.49	0.08
	Supply	$\text{Log } P^s_{xt} = -1.75 + 0.14 \text{ Log } X^s_t + 0.46 \text{ Log Pd}_t + 0.41 \text{ Log MFDIP}_t + 0.38 \text{ Log } P^s_{xt(-1)}$ $(-2.74)^{*}\ (1.10)\quad (2.10)^{**}\quad (1.91)^{**}\quad (1.75)^{**}$	0.99	0.68	0.07
1.	**Chemicals & Related Products**				
	Demand	$\text{Log } X^d_t = -4.13 - 0.39 \text{ Log } (P^d x/Pxw)_t + 1.98 \text{ Log WTV}_t + 0.29 \text{ Log } X^d_{t(-1)}$ $(-2.71)^{*}\ (-2.13)^{**}\quad (4.65)^{*}\quad (1.91)^{**}$	0.97	1.73	0.16
	Supply	$\text{Log } P^s_{xt} = 0.99 + 0.10 \text{ Log } X^s_t + 1.44 \text{ Log Pd}_t - 0.95 \text{ Log PGDP}_t + 0.22 \text{ Log } P^s_{xt(-1)}$ $(0.97)\quad (0.96)\quad (4.38)^{*}\quad (-1.84)^{**}\quad (1.30)^{***}$	0.97	0.69	0.11
2.	**Textile Fabrics & Manufactures**				
	Demand	$\text{Log } X^d_t = 6.57 - 1.47 \text{ Log } (P^d x/Pxw)_t + 0.55 \text{ Log WTV}_t + 0.51 \text{ Log } X^d_{t(-1)}$ $(1.45)^{***}\ (-2.46)^{*}\quad (0.89)\quad (2.48)^{*}$	0.95	-1.01	0.34
	Supply	$\text{Log } P^s_{xt} = 1.21 + 0.10 \text{ Log } X^s_t + 0.69 \text{ Log Pd}_t - 0.55 \text{ Log Y}_t + 0.52 \text{ Log } P^s_{xt(-1)}$ $(1.27)\ (1.49)^{***}\quad (2.07)^{*}\quad (-1.09)\quad (2.91)^{*}$	0.93	-0.06	0.12

(Contd...)

Appendix 2 : Dynamic OLS Estimates of Export Demand and Supply (Concld.)

			$\bar{R}^2$	h Stat.	SEE
3.	**Machinery & Transport Equipments**				
	Demand	$\text{Log } X^d_t = \underset{(1.59)^{**}}{1.18} \underset{(-7.70)^{*}}{- 1.21 \text{ Log } P^x_t} + \underset{(7.07)^{*}}{1.13 \text{ Log } Pxwt} + \underset{(2.34)^{*}}{0.47 \text{ Log WTV}t} + \underset{(3.95)^{*}}{0.34 \text{ Log } X^d_t(-1)}$	0.98	0.06	0.08
	Supply	$\text{Log } P^s_{xt} = \underset{(-0.89)}{- 0.75} \underset{(-1.91)^{**}}{- 0.23 \text{ Log } X^s_t} + \underset{(2.25)^{**}}{0.84 \text{ Log Pd}t} + \underset{(0.71)}{0.31 \text{ Log Y}t} + \underset{(1.38)^{***}}{0.26 \text{ Log } P^s_{xt}(-1)}$	0.96	2.25	0.11
4.	**Gems and Jewellery**				
	Demand	$\text{Log } X^d_t = \underset{(0.36)}{0.79} \underset{(-1.83)^{**}}{- 0.62 \text{ Log } (P^d_x/Pxw)t} + \underset{(1.56)^{*}}{0.81 \text{ Log WTV}t} + \underset{(4.40)^{*}}{0.64 \text{ Log } X^d_t(-1)}$	0.94	1.61	0.258
	Supply	$\text{Log } P^s_{xt} = \underset{(1.76)^{**}}{- 0.30} + \underset{(5.67)^{*}}{0.69 \text{ Log UVM}t} + \underset{(5.63)^{*}}{0.60 \text{ Log } X^s_t} + \underset{(4.85)^{*}}{0.55 \text{ Log QM}t} + \underset{(2.39)^{**}}{0.30 \text{ Log } P^s_{xt}(-1)}$	0.99	-0.41	0.07
5.	**Leather & Leather Manufactures**				
	Demand	$\text{Log } X^d_t = \underset{(4.16)^{*}}{3.28} \underset{(-2.17)^{**}}{- 0.24 \text{ Log } (P^d_x/Pxw)t} + \underset{(3.27)^{*}}{0.51 \text{ Log WTV}t} + \underset{(0.09)}{0.02 \text{ Log } X^d_t(-1)}$	0.57	1.89	0.14
	Supply	$\text{Log } P^s_{xt} = \underset{(-0.81)}{- 0.43} + \underset{(2.54)^{*}}{0.35 \text{ Log } X^s_t} + \underset{(5.93)^{*}}{1.13 \text{ Log Pd}t} + \underset{(2.03)^{**}}{0.23 \text{ Log LTRIP}t} + \underset{(0.60)}{0.08 \text{ Log } P^s_{xt}(-1)}$	0.98	2.26	0.09

Note : *, **, ***, represents the statistical significance at 1 , 5, 10 per cent level of significance, respectively.

Appendix 3: Equilibrium 2SLS Estimates of Export Demand and Supply

			$\bar{R}^2$	DW	SEE
I.	**Total Exports**				
	Demand	$\text{Log } X^d_t = \underset{(0.09)}{0.07} - \underset{(-2.07)^{**}}{0.94}\ \text{Log } P^d x_t + \underset{(1.75)^{**}}{0.54}\ \text{Log } Pxw_t + \underset{(8.91)^{*}}{1.38}\ \text{Log } WTV_t$	0.97	1.54	0.70
	Supply	$\text{Log } P^s x_t = \underset{(-4.86)^{*}}{-2.51} + \underset{(2.88)^{*}}{0.58}\ \text{Log } X^s_t + \underset{(2.71)^{*}}{0.47}\ \text{Log } Pd_t + \underset{(1.65)^{**}}{0.51}\ \text{Log } Y_t$	0.99	1.84	0.06
II.	**Manufactured Goods**				
	Demand	$\text{Log } X^d_t = \underset{(1.10)}{6.71} - \underset{(-1.43)^{***}}{1.33}\ \text{Log } (P^d x/Pxw)_t + \underset{(1.85)^{**}}{0.86}\ \text{Log } WTV_t$	0.92	1.20	0.09
	Supply	$\text{Log } P^s x_t = \underset{(-7.71)^{*}}{-2.66} + \underset{(1.60)^{**}}{0.30}\ \text{Log } X^s_t + \underset{(4.67)^{*}}{0.87}\ \text{Log } Pd_t + \underset{(1.28)^{***}}{0.40}\ \text{Log } MFDIP_t$	0.99	1.95	0.07
1.	**Chemicals & Related Products**				
	Demand	$\text{Log } X^d_t = \underset{(-1.88)^{**}}{-5.87} - \underset{(-1.34)^{*}}{0.53}\ \text{Log } (P^d x/Pxw)_t + \underset{(8.38)^{*}}{2.76}\ \text{Log } WTV_t$	0.97	1.78	0.16
	Supply	$\text{Log } P^s x_t = \underset{(1.38)^{*}}{2.16} + \underset{(1.95)^{**}}{0.27}\ \text{Log } X^s_t + \underset{(4.24)^{*}}{1.59}\ \text{Log } Pd_t - \underset{(-1.87)^{**}}{1.30}\ \text{Log } PGDP_t$	0.95	1.90	0.12
2.	**Textile Fabrics & Manufactures**				
	Demand	$\text{Log } X^d_t = \underset{(0.89)}{8.71} - \underset{(-2.25)^{**}}{2.34}\ \text{Log } (P^d x/Pxw)_t + \underset{(1.30)^{*}}{1.44}\ \text{Log } WTV_t$	0.90	1.96	0.36
	Supply	$\text{Log } P^s x_t = \underset{(-0.40)}{-0.60} - \underset{(-0.66)}{0.07}\ \text{Log } X^s_t + \underset{(2.80)^{*}}{1.18}\ \text{Log } Pd_t + \underset{(0.04)}{0.24}\ \text{Log } Y_t$	0.91	1.81	0.12

(Contd..)

Appendix 3: Equilibrium 2SLS Estimates of Export Demand and Supply (Concld.)

		$\bar{R}^2$	DW	SEE
3. Machinery & Transport Equipments				
Demand	$\text{Log } X^d_t = \underset{(-1.90)^*}{-5.50} - \underset{(-2.20)^{**}}{0.55}\ \text{Log } P^d x_t + \underset{(4.38)^*}{1.32}\ \text{Log } Pxw_t + \underset{(3.32)^*}{1.42}\ \text{Log } WTV_t$	0.97	2.13	0.10
Supply	$\text{Log } P^s_{x_t} = \underset{(-2.27)^*}{-2.40} - \underset{(-3.10)^*}{0.51}\ \text{Log } X^s_t + \underset{(2.38)^*}{0.88}\ \text{Log } Pd_t + \underset{(2.73)^*}{1.18}\ \text{Log } Y_t$	0.98	1.97	0.08
4. Gems and Jewellery				
Demand	$\text{Log } X^d_t = \underset{(1.44)^{***}}{17.56} - \underset{(-2.31)^{**}}{4.62}\ \text{Log } (P^d x/Pxw)_t + \underset{(1.94)^{**}}{1.69}\ \text{Log } WTV_t$	0.67	0.99	0.72
Supply	$\text{Log } P^s_{x_t} = \underset{(1.09)}{0.32} + \underset{(14.49)^*}{1.00}\ \text{Log } UVM_t + \underset{(3.33)^*}{0.99}\ \text{Log } X^s_t + \underset{(2.92)^*}{0.92}\ \text{Log } QM_t$	0.98	1.81	0.09
5. Leather & Leather Manufacturers				
Demand	$\text{Log } X^d_t = \underset{(3.78)^*}{3.39} - \underset{(-1.87)^{**}}{0.27}\ \text{Log } (P^d x/Pxw)_t + \underset{(4.19)^*}{0.53}\ \text{Log } WTV_t$	0.57	1.99	0.14
Supply	$\text{Log } P^s x_t = \underset{(-0.37)}{-0.22} + \underset{(3.10)^*}{0.42}\ \text{Log } X^s_t + \underset{(13.53)^*}{1.18}\ \text{Log } Pd_t + \underset{(2.13)^{**}}{0.29}\ \text{Log } LTRIP_t$	0.98	1.72	0.08

Note : *, **, ***, represents the statistical significance at 1 , 5, 10 per cent level of significance, respectively.

Appendix 4 : Dynamic 2SLS Estimates of Export Demand and Supply

			$\bar{R}^2$	h Stat.	SEE
I.	**Total Exports**				
	Demand	$\text{Log } X^d_t = \underset{(0.10)}{0.07} - \underset{(-1.11)}{0.55}\ \text{Log } P^d_{xt} + \underset{(0.86)}{0.31}\ \text{Log } P_{xwt} + \underset{(2.71)*}{0.69}\ \text{Log } WTV_t + \underset{(2.37)**}{0.54}\ \text{Log } X^d_t(-1)$	0.98	0.83	0.05
	Supply	$\text{Log } P^s_{xt} = \underset{(-2.58)*}{-1.83} + \underset{(2.09)**}{0.48}\ \text{Log } X^s_t + \underset{(2.71)*}{0.39}\ \text{Log } P_{dt} + \underset{(1.24)}{0.31}\ \text{Log } Y_t + \underset{(1.13)}{0.24}\ \text{Log } P^s_{xt}(-1)$	0.99	6.52	0.06
II.	**Manufactured Goods**				
	Demand	$\text{Log } X^d_t = \underset{(2.03)**}{2.67} - \underset{(-2.37)*}{0.67}\ \text{Log } (P^d_x/P_{xw})_t + \underset{(2.53)*}{0.58}\ \text{Log } WTV_t + \underset{(2.54)*}{0.53}\ \text{Log } X^d_t(-1)$	0.94	0.86	0.09
	Supply	$\text{Log } P^s_{xt} = \underset{(-2.77)*}{-2.20} + \underset{(1.46)***}{0.28}\ \text{Log } X^s_t + \underset{(2.27)**}{0.58}\ \text{Log } P_{dt} + \underset{(1.73)**}{0.38}\ \text{Log } MFDIP_t + \underset{(0.89)}{0.23}\ \text{Log } P^s_{xt}(-1)$	0.99	1.57	0.07
1.	**Chemicals & Related Products**				
	Demand	$\text{Log } X^d_t = \underset{(-2.33)**}{-3.87} - \underset{(-1.84)**}{0.46}\ \text{Log } (P^d_x/P_{xw})_t + \underset{(4.63)*}{2.01}\ \text{Log } WTV_t + \underset{(1.67)**}{0.27}\ \text{Log } X^d_t(-1)$	0.97	1.33	0.16
	Supply	$\text{Log } P^s_{xt} = \underset{(1.66)**}{1.93} + \underset{(2.06)**}{0.22}\ \text{Log } X^s_t + \underset{(4.09)*}{1.44}\ \text{Log } P_{dt} - \underset{(-2.16)**}{1.22}\ \text{Log } PGDP_t + \underset{(0.88)}{0.17}\ \text{Log } P^s_{xt}(-1)$	0.96	0.80	0.12
2.	***Textile Fabrics & Manufactures***				
	Demand	$\text{Log } X^d_t = \underset{(1.36)***}{8.45} - \underset{(-2.54)*}{1.97}\ \text{Log } (P^d_x/P_{xw})_t + \underset{(1.19)}{0.86}\ \text{Log } WTV_t + \underset{(1.59)**}{0.28}\ \text{Log } X^d_t(-1)$	0.90	2.19	0.34
	Supply	$\text{Log } P^s_{xt} = \underset{(1.90)**}{2.52} + \underset{(2.09)**}{0.20}\ \text{Log } X^s_t + \underset{(1.96)**}{0.71}\ \text{Log } P_{dt} - \underset{(-1.62)**}{1.01}\ \text{Log } Y_t + \underset{(2.86)*}{0.56}\ \text{Log } P^s_{xt}(-1)$	0.92	-1.62	0.13

(Contd...)

Appendix 4 : Dynamic 2SLS Estimates of Export Demand and Supply (Concld.)

		$\bar{R}^2$	h Stat.	SEE
3. Machinery & Transport Equipments				
Demand	$\text{Log } X^d_t = \underset{(1.68)^{**}}{1.84} - \underset{(-5.23)^{*}}{1.38}\ \text{Log } P^d_{xt} + \underset{(5.41)^{*}}{1.27}\ \text{Log } P_{xwt} + \underset{(1.49)^{**}}{0.36}\ \text{Log WTV}_t + \underset{(3.84)^{*}}{0.34}\ \text{Log } X^d_t(-1)$	0.98	0.12	0.08
Supply	$\text{Log } P^S_{xt} = \underset{(-0.82)}{-0.71} - \underset{(-0.39)}{0.10}\ \text{Log } X^S_t + \underset{(1.24)}{0.52}\ \text{Log } P_{dt} + \underset{(0.80)}{0.36}\ \text{Log } Y_t + \underset{(1.72)^{**}}{0.35}\ \text{Log } P^S_{xt}(-1)$	0.95	-0.40	0.12
4. Gems and Jewellery				
Demand	$\text{Log } X^d_t = \underset{(0.52)}{1.45} - \underset{(-1.46)^{***}}{0.77}\ \text{Log } (P^d_x/P_{xw})_t + \underset{(1.60)^{**}}{0.85}\ \text{Log WTV}_t + \underset{(3.82)^{*}}{0.62}\ \text{Log } X^d_t(-1)$	0.94	1.70	0.25
Supply	$\text{Log } P^S_{xt} = \underset{(1.78)^{**}}{0.33} + \underset{(4.10)^{*}}{0.65}\ \text{Log UVM}_t + \underset{(2.47)^{*}}{0.51}\ \text{Log } X^S_t + \underset{(2.24)^{**}}{0.48}\ \text{Log QM}_t + \underset{(2.18)^{**}}{0.33}\ \text{Log } P^S_{xt}(-1)$	0.99	-0.43	0.07
5. Leather & Leather Manufactures				
Demand	$\text{Log } X^d_t = \underset{(4.24)^{*}}{4.22} - \underset{(-2.81)^{*}}{0.50}\ \text{Log } (P^d_x/P_{xw})_t + \underset{(2.97)^{*}}{0.52}\ \text{Log WTV}_t + \underset{(0.20)}{0.05}\ \text{Log } X^d_t(-1)$	0.52	1.33	0.16
Supply	$\text{Log } P^S_{xt} = \underset{(-0.60)}{-0.52} + \underset{(2.58)^{*}}{0.74}\ \text{Log } X^S_t + \underset{(5.04)^{*}}{1.37}\ \text{Log } P_{dt} + \underset{(2.13)^{*}}{0.31}\ \text{Log LTRIP}_t + \underset{(0.26)}{0.05}\ \text{Log } P^S_{xt}(-1)$	0.97	1.16	0.11

Note : *, **, ***, represents the statistical significance at 1, 5, 10 per cent level of significance, respectively.

Appendix 5 : Short-run and Long-run Price Elasticities of Export Demand and Supply (Based on 2SLS Estimates)

	Short-run Elasticities		Long-run Elasticities	
	Demand	Supply	Demand	Supply
I. Total Exports	-0.94**	1.72*	-1.20	1.58**
II. Manufactured Goods *of which*	-1.33***	3.33**	-1.42*	2.75***
1. Chemicals & Related Products	-0.53***	3.70**	-0.63**	3.77**
2. Textile Fabrics & Manufactures	-2.34**	—	-2.74*	2.20**
3. Machinery & Transport Equipments	-0.55**	-1.96*	-2.09*	—
4. Gems and Jewellery	-4.62**	1.01*	-2.02***	1.32*
5. Leather & Leather Manufactures	-0.27**	2.38*	-0.52*	1.28*

Note : *, **, ***, represents the statistical significance at 1, 5, 10 per cent level of significance, respectively.

Appendix 6 : Share of Exports and Imports in Total Value Added

(Rs. Crore)

	1985-86	1986-87	1987-88	1988-89	1989-90	Geometric Average.
I. Total Exports						
i. Exports	10895	12452	15654	20295	27681	
ii. Import Licences issued to registered Exporters / Export Promotion Schemes	2849	3553	4952	8469	10535	
iii. Net Foreign Exchange Earnings	8046	8899	10702	11826	17146	
iv. w1 {(i) / (iii)}	1.35	1.40	1.46	1.72	1.61	1.50
v. w2 {(ii) / (iii)}	0.35	0.40	0.46	0.72	0.61	0.50
II. Manufactured Exports						
i. Exports	6374	7808	10865	14641	20310	
ii. Import Licences issued to registered Exporters / Export Promotion Schemes	2849	3553	4952	8469	10535	
iii. Net Foreign Exchange Earnings	3525	4255	5913	6172	9775	
iv. w1 {(i) / (iii)}	1.81	1.84	1.84	2.37	2.08	1.98
v. w2 {(ii) / (iii)}	0.81	0.84	0.84	1.37	1.08	0.98

(Contd...)

Appendix 6 : Share of Exports and Imports in Total Value Added (Contd.)

	1985-86	1986-87	1987-88	1988-89	1989-90	Geometric Average.
of which						
1. Readymade Garments						
i. Exports	1215	1509	2090	2386		
ii. Imports (including Yarn)	403	374	470	703		
iii. Net Foreign Exchange Earnings	812	1135	1620	1683		
iv. w1 {(i) / (iii)}	1.50	1.33	1.29	1.42		1.38
v. w2 {(ii) / (iii)}	0.50	0.33	0.29	0.42		0.38
2. Diamonds						
i. Exports	1344	1960	2440	4230	4936	
ii. Imports	1045	1440	1969	3090	4045	
iii. Net Foreign Exchange Earnings	299	520	471	1140	891	
iv. w1 {(i) / (iii)}	4.49	3.77	5.18	3.71	5.54	4.48
v. w2 {(ii) / (iii)}	3.49	2.77	4.18	2.71	4.54	3.48
3. Leather and Leather Manufactures						
i. Exports	662	934	1245	1605	2030	[illegible]
ii. Imports	37	52	69	90	114	
iii. Net Foreign Exchange Earnings	625	882	1176	1515	1916	
iv. w1 {(i) / (iii)}	1.06	1.06	1.06	1.06	1.06	1.06
v. w2 {(ii) / (iii)}	0.06	0.06	0.06	0.06	0.06	0.06

(Contd...)

Appendix 6 : Share of Exports and Imports in Total Value Added (Concld.)

4. Chemicals and Related Products (Based on Primary Response Survey for 1989-90)

	Exports	% of Total	Import Intensity	
i. Bulk Drugs, Fine chemicals & Formulations	752	36	49	
ii. Dyestuffs & Dye Intermediates	529	25	11	
iii. Organic, Inorganic and Agro Chemicals	242	11	24	
iv. Cosmetics	582	27	31	
v. Agarbattis	14	1	Nil	
Overall	2119	100	31	w1 = 1.45 w2 = 0.45

Note : 1. The Import intensity of readymade garments is used as a proxy for textile fabrics and manufactures. Also, weights are calculated using geometric average of four years instead of five years for others.

2. The import intensity of engineering products estimated at 28 per cent based on primary response survey for 1989-90 by the EXIM Bank study is used as proxy for the category of machinery and transport equipments. Hence, w1 and w2 takes the value of 1.39 and 0.39, respectively, however, this could not be used in the final analysis because of perverse sign of its supply price elasticity.

3. The source of above data is the study by the EXIM bank of India : "How import intensive are Indian Exports", except for the data on diamonds, which is used as a proxy for gems and jewellry, the source of which is Gems and Jewellry Export Promotion Council.

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Stock Market Risk and Foreign Portfolio Investments — An Empirical Investigation

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Abstract

This paper investigates the behavior of foreign portfolio investments vis-a-vis conditional risk and expectations associated with the sensitive index of stock prices at the Bombay Stock Exchange. Empirical results obtained in this study imply that foreign investors are significantly risk averse and tend to reduce fresh commitments in the face of increasing conditional uncertainty or volatility in the prices of stocks as also in the event of devaluation of the local currency. They respond positively and significantly to improving conditional stock price expectations. An upshot is that the transition in the nature of governance of the secondary market could only be gradual and smooth inclusive of attendant safeguards that enhance investor confidence if the goal to stabilise foreign portfolio investments flows is to be successfully achieved.

Even as it is theoretically recognised that benefits from portfolio diversifications across regional equity markets arise essentially owing to the existence of independent stochastic trends in returns, the process of international diversification into emerging equity markets in developing countries, especially during the first half of the 1990s, has been largely facilitated and stimulated by an increasing realisation among developing nations of the utility of opening up economies not only for purposes of accessing supplementary finance for development but also for reaping gains accruing from externalities such as improved resource use efficiency. An articulation of this belief in practice has translated into an accelerated opening of an array of hitherto insulated investment niches for international investors looking for efficient hedging mechanisms and higher earnings in equity markets across the globe. The process of opening and activation of equity markets has also been supported to a great deal by an increasing quantum of world trade turnover and competition in local markets coupled with a rapid development and deployment of communications technology. As a result of this favorable climate, international equity flows to emerging markets which were a meager US$ 3.5 billion in 1988 jumped sharply in the first half of the 1990s averaging about US$ 24.0

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billion per year. It is noteworthy that during this period a large proportion of the international flows were attracted by emerging Asian markets followed by Latin American and the Middle Eastern markets.

The relative attractiveness of equity markets in developing countries is attributed to certain 'pull factors' of which sound economic fundamentals and the commitment of the authorities to priorities related to price stability and economic growth are the most critical (El-Erian and Kumar, 1995). A recently conducted empirical analysis (Speidell,1995) shows, albeit surprisingly, that growth and investment prospects of many developed countries are less attractive than those of many that are small and poorer. Some of the small countries that are rated high on the attractiveness scale are from Asia such as Thailand, Taiwan, Singapore, Korea, and Malaysia which are remarkably different from others in terms of their approach and public policies towards economic growth. It is assumed that equity investments made into such identified markets offer rewarding opportunities over a period of time and the corresponding investments tend to have confident long run horizons despite the existence of higher transaction expenses and other market imperfections. Also, as mentioned earlier, a long run horizon for diversified investments benefits foreign investors since regional markets across the world show returns that have independent stochastic trends and are therefore not subject to common systematic shocks (Defusco, Geppert and Tsetsekos, 1995).

In tune with other Asian markets, the Indian economy at present also appears as an attractive emerging market with improving fundamentals as borne out of her Government's commitment to the implementation of the new economic policy of reform and stabilisation. Equity markets in India were opened to foreign participation only recently under the operational guidelines announced in September 1992. Portfolio investments which came cautiously during the opening phase accelerated despite the existence of initial bottlenecks and infrastructural constraints. Starting with mere US $ 0.18 million in January 1993, net flows began to accelerate and peaked at about US $ 400.0 million in January 1994 after which there has been some decline in the inflows in the recent times, especially, during the months of November and December, 1994 and thereafter owing to a host of domestic factors. Nonetheless, the overall pattern and volume of investments provide encouraging signs about investors' confidence in Indian capital market and the rewarding opportunities ahead as compared to many western markets.

More recent data on yearly equity returns show that earnings from equity investments in India have been relatively impressive. Foreign Institutional Investors (FIIs) in India are permitted to invest in both primary and secondary issues as well as in corporate debt instruments in a given ratio. Since a major chunk of foreign portfolio investments is expected to be in equities, it is natural that operational decisions pertaining to such investments would depend crucially upon the attractiveness in terms of expected returns. However, the variations observed in the holdings of investments by FIIs have at times appeared inexplicable in terms of returns alone. It is in this context that a study on investment flows assumes importance; especially in the context of management of balance of payments. The objective of this paper is to gather empirical evidence on the factors that influence foreign portfolio investments in India. In this study we employ a multivariate GARCH (Generalised Autoregressive Conditional Heteroscedasticity) model for a simultaneous full information maximum likelihood (FIML) estimation of a stock price equation with GARCH errors and a foreign portfolio investment supply equation to analyse the response of FII investments against conditionally generated expectations and risk (or volatility) associated with stock prices in India.

The plan of the paper is as follows. Section I briefly addresses the issues involved in GARCH modeling and the corresponding estimation routine. Section II highlights empirical results obtained in the study and Section III presents concluding observations.

Section I

The Model

Generalised Autoregressive Conditional Heteroscedastic (GARCH) model popularised by Bollerslev (1986) is an extension of Engle's (1982) Autoregressive Conditional Heteroscedastic model, both of which primarily allow the possibility of instrumenting expectations and risk corresponding to risky variables. Prior to these models, a number of adhoc procedures were used to proxy expectations and risk which most often led to inconsistent measures of risk (Wallis,1980, Feige and Pierce,1976). Uniqueness of ARCH and GARCH models stem from the fact that these allow the conditional variance of the chosen risky variable to change systematically over time and use the same information set to operationalise both conditional variance and mean. As opposed to the ARCH model, the GARCH approach allows not only a more efficient joint estimation of the defined system but also helps in staving off long lags that sometime become too unwieldy for purposes of satisfying associated regularity conditions.

Following Bollerslev (1986), we set up a univariate autoregressive scheme for a risky variable SENSEX as follows

$$SENSEX = \beta(L)\ SENSEX_t + e_{yt}, \qquad \text{.....(1)}$$

where SENSEX, as in our case could be considered as the Bombay Stock Exchange sensitive index, β a vector of parameters to be estimated and e_{yt} is a stochastic process distributed normally with zero mean and time varying conditional variance h_t.

$$e_{yt} | \varnothing_{t-1} \sim N\ (0,h_t) \qquad \text{.....(2)}$$

$\varnothing$ is an information set that includes mainly past values of SENSEX. Symbolically, a GARCH process of order (p,q) suggested by Bollerslev (1986) is

$$h_t = a0 + \sum_{i=1}^{p} a_i\ e^2_{yt-i} + \sum_{i=1}^{q} \beta_i h_{t-i} \qquad \text{.....(3)}$$

where 'p' and 'q' are order of lags of squared disturbances in the mean equation (1) and conditional variance as defined in equation (3), respectively. A GARCH model has a unique feature in that it allows an efficient estimation of the structural equation (in this case a supply equation defined below), including instruments capturing conditional expectations and risk associated with the risky variable (here SENSEX). The GARCH model imposes rationality by allowing the actual process that governs conditional variance to determine economic behavior (Kroner and Lastrapes, 1993). The estimation is carried out by invoking the simultaneous full information maximum likelihood procedure which leads to efficient and accurate coefficient estimates.

In the specification opted here, we have an equation that captures the supply schedule for foreign institutional investment flows (NETFII) which includes conditional expectations and risk in addition to one lag of the dependent variable and exchange rate as explanatory variables.

$$NETFII = b0 + b1SENSEX^{var} + b2SENSEX^{exp} + b3NETFII\ (t\text{-}i) + b4EXCHG_t + e_{xt} \qquad \text{.....(4)}$$

where $SENSEX^{var}$ is the conditional variance or h_t and $SENSEX^{exp}$ is conditional expectation of SENSEX obtained from autoregression (1). e_{xt} is also a normally distributed stochastic process with a time invariant variance and zero mean. e_{yt} and e_{xt} are distributed jointly as

$$\hat{e} = \begin{bmatrix} e_{xt} \\ e_{yt} \end{bmatrix} \sim N \left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} S_{11} & S_{12} \\ S_{12} & h_t \end{bmatrix} \right\}$$

where S_{11} and S_{12} are constants whose values need to be estimated. If the initial sample values are given, the log-likelihood function for the sample without a constant may be written as

$$L_T = 0.5 \; \Sigma \; l_t(\theta) \qquad \text{.....(5)}$$

and,

$$l_t = -\log|\pi_t| - \hat{e}_t' \; \pi^{-1} \hat{e}_t$$

where,

$$| \pi | = S_{11}h_t - S_{12}^2$$

log-likelihood function (5) can be maximised either using the analytical order conditions or through a direct search numerical optimisation routine to jointly estimate a_i, $ß_i$ and the vector θ which appear in the system. Parameter estimates, especially those in the conditional variance function must satisfy regularity and stationarity conditions. These require that (i) all coefficient estimates in the conditional variance function must be non-negative, and (ii) for wide-sense stationarity of the GARCH process, the sum of coefficients a_i and $ß_i$ must be less than one.

Section II

Estimation of Model

The data sample employed in this study refers to monthly observations on variables from May 1993 to September 1995 constituting 29 data points. We exclude investments over the initial phase from January 1993 to April 1993 to avoid the possibility of obtaining misleading inferences owing to their temporary role as 'risk testers' in uncharted waters. The variables considered in the model are (i) outstanding net FII investments (NETFII) that is, purchases net of sales in each month in US dol-

lar terms; (ii) BSE sensex (SENSEX) that is, the Bombay stock exchange sensitive index with base at 1978-79 and; (iii) the nominal Rupee-US dollar exchange rate (EXCHG). The choice of variables is based upon the fact that net holdings of FIIs on Indian bourses depend mainly upon the movements of the BSE sensex (since FII portfolios consist mainly of major indexed scrips in the specified section). Investment decisions are also expected to be affected by the movements in the nominal exchange rate. Investments in bonds are excluded from analysis as the transaction volumes in debt instruments are low and the prospective arbitrage profits from uncovered interest parity seem unattractive to investors in India. Other reasons for scarce interest in fixed income securities on the part of foreign investors could be the underdeveloped market for debt instruments in India as compared with that of stocks, possibilities of adverse tax wedges, and high transactions cost band which includes implicit risk and information and brokerage costs associated with cross country financial investments despite increasing degree of liberalisation, removal of legal restrictions on international capital flows and considerable reduction in information costs (Mishkin, 1984a and 1984b; Cumby and Mishkin, 1986; and Merrick and Saunders, 1986).

Assuming that FIIs have a greater interest in specified stocks, a long term expectation of the increase in the sensitive index of share prices is expected to encourage FIIs to retain investments. On the other hand volatile share prices may encourage FIIs to withdraw from Indian stocks for reasons related to risk management and for safeguarding returns against volatility. Another factor that could possibly influence behavior of FIIs is the recent phenomenon of frequent discounts on Global Depositary Receipts (GDRs). Due to increasing supply of GDRs of Indian origin in the international markets, prices of the same have been quoting below (15 to 20 percent in most cases) that in the domestic capital market. FII investments might be undergoing portfolio shifts in the face of arbitrage opportunities. Since comparable time series data on such discounts are not available, we have not taken this factor into consideration in the present study. Recent reports, however, suggest that arbitrage on this account is very limited and that Indian GDR prices, of late, have begun hardening. Yet another factor could be the evolving situation in respect of cross-currency exchange rates in the international market. An appreciating yen vis-a-vis the dollar, for instance, could give rise to hedging opportunities, in which case, short term foreign exchange trading or long term cross-currency interest swaps could take precedence in FIIs' investment decisions. We have not studied the role of this factor assuming that it has a secondary role in normal times and that returns in the

emerging Indian market could be considered relatively more appealing, despite the cross currency hedging opportunities. Finally, we also include nominal exchange rate of rupee vis-a-vis the US dollar in the equation. It is expected that a devaluation of the Indian rupee would be harmful to the smooth inflow of investments as both the principal and returns are depreciated with the effect.

The model is set up in the form of two main equations and an auxiliary conditional variance equation with a parsimonious GARCH structure on the process. Specifically, outstanding net holdings or supply of investments is determined by the conditionally expected index of stock prices and the associated risk (or volatility) in addition to an exchange rate variable and a lag term signifying partial adjustment. Conditional expectations and risk about the stock prices are generated from an autoregressive mean equation with three lags following the 'general to specific strategy' of Hendry and a GARCH (1,1) process conditional variance equation which makes the conditional variance of stock prices time dependent. The model with three equations is estimated using the full information maximum likelihood procedure (FIML) with appropriate cross-equation restrictions as implied by the mean equation. Maximisation of the log-likelihood is carried out with Broyden, Fletcher, Goldfarb and Shanno (BFGS) direct search nonlinear numerical optimisation routine which is a modification of the better known Davidson, Fletcher and Powell (DFP) algorithm. The FIML estimates of the model with stock price risk and GARCH generated expectations are reported in Table I and the plots of actual and expected (generated from the model) supply of FII investments are shown in Figure I.

Table I

Full Information Maximum Likelihood Estimates of the Model of Foreign Portfolio Investments in Indian Stock Market with GARCH Generated Expectations.

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[i] **Supply of NETFII:**

$$NETFII = \underset{(7.9)}{179.462} + \underset{(13.6)}{0.081}SENSEX_t^{exp} \underset{(-5.5)}{-0.009}SENSEX_t^{var}$$

$$+ \underset{(123.4)}{0.950}NETFII_{t-1} \underset{(-7.9)}{-5.961}EXCHG_{t-1} + e_{xt}$$

$R^2=0.99$

[ii] **Stock Price:**

$$(1 - \underset{(171.0)}{1.146}L + \underset{(26.8)}{0.180}L^2 + \underset{(19.8)}{0.133}L^3)\ SENSEX_t = \underset{(27.0)}{638.575} + e_{yt}$$

$R^2=0.94$

[iii] **Time Varying Conditional Variance :**

$$h_t = \underset{(3.7)}{4148.0} + \underset{(1.7)}{0.122}e^2_{t-1} + \underset{(9.4)}{0.482}h_{t-1}$$

Log-Likelihood = -153.44

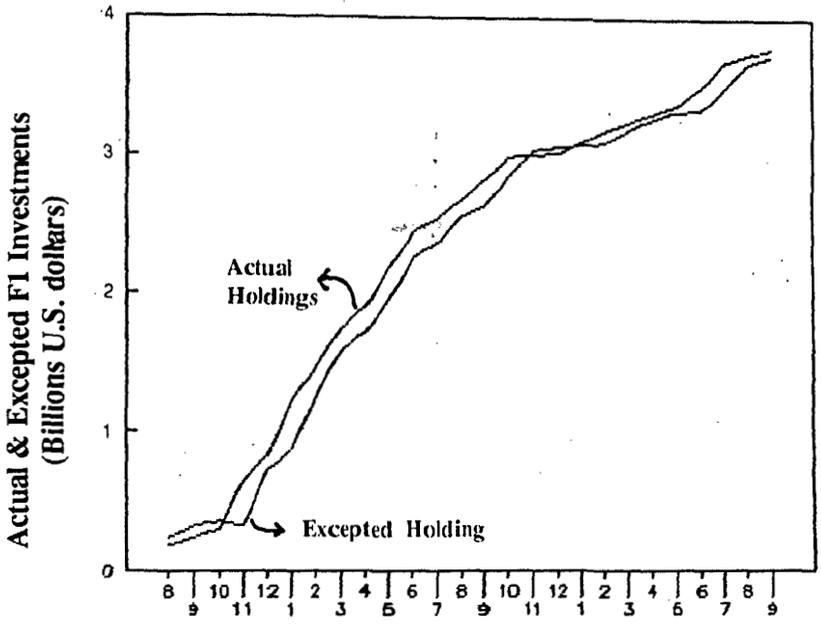
Note :

(a.) Figures in brackets are asymptotic t-statistics. L is a lag operator with its numeral superscript indicating the order of the lag. The choice of lags in Eq [i] *was based upon general to specific tests of the kind proposed by Hendry. Estimation is carried out for the period May-1993 to Sept-1995. R^2 reported for Eq* [i] *in the Table I is the proportion of the variation in NETFII which is explained by Eq* [i]*'s optimal one-step-ahead forecasts based on the FIML estimates.*

Figure -- II

FI Investments (1993:8 to 1995:9)

(Actual and Expected)



Months beginning 1993 : 8

The variables $SENSEX^{exp}$ and $SENSEX^{var}$ (h_t) in the first equation in Table I denote conditional expectation and variance of SENSEX, respectively, as implied by the GARCH model. Empirical estimates of coefficients corresponding to equations [i] to [iii] in Table I appear with correct signs. Regularity and stationarity conditions for the GARCH process as described in Section II are adequately satisfied. Of interest is the significantly negative coefficient on conditional variance of SENSEX in the NETFII supply equation, implying that increasing conditional uncertainty, volatility or risk in stock prices leads to a decline in fresh investments. Such behavior exemplifies caution and averseness to country risk in the first place even though it appears that the elasticity of investments with respect to conditional risk is quite small. At the same time, however, it is also observed that NETFII responds positively and significantly to optimistic expectations about the SENSEX (the implicit long run elas-

ticity of FII investment holdings with respect to the expected change in SENSEX is larger than one). In view of this evidence, it is possible, therefore, to assume that both risk (weakly elastic) and expectations (rather strongly elastic and therefore, quite sensitive) as perceived within the market are important and significant elements in investment commitments. Finally, the exchange rate variable shows up with a significantly negative sign implying that investers are also averse to a depreciation of the rupee.

Section III

Concluding Observations

The empirical evidence presented here on the response of foreign portfolio investments to market risk in India underline the critical significance of a stable stock market environment in sustaining the portfolio capital inflow into the country and in this context, the proper regulatory measures to stymie excessive speculation. It has been, by now, well recognised in the Indian context that while speculation is an integral part of securities market and it, in controlled measure, has the beneficial effect on the liquidity and smooth functioning, uncontrolled and over-leveraged speculation can be deleterious to the growth of the stock market. This is more so in the case of foreign institutional investors as volatility in stock prices leads to uncertain environment and exposure to high country risk. A major finding of the study is that while FIIs are found to be risk averse, they positively respond to optimistic expectations about the SENSEX which are more or less ingrained in the fundamentals of the economy. It is in this context that the regulatory frameworks have a positive role to play in promoting foreign investors confidence in Indian capital market.

The direction of reforms in the capital market should aim at eliminating volatility which appear unsystematic in relation to the fundamentals of the economy. This could imply monitoring a number of factors that distort the functioning of the market such as over-extensions and defaults, front running, insider trading, monopolised price rigging, bad deliveries, non-adherence to rules governing the conduct of corporates and the like. Notably, all this is quite in tune with the current thinking of the Securities and Exchange Board of India (SEBI) which desires healthy and transparent trading practices along with prudential regulation and stock market discipline. The results in the study also underscored the importance of a stable exchange rate regime for the sustained interest of foreign investors in the capital market.

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Basic Data : January 1993 to September 1995

Year/month	BSE Sensex (base:78-79)	Net FII Investments (million US $)	Re/US $ exchange rate
1993.01	2532.86	0.18	29.01
1993.02	2708.72	0.09	30.07
1993.03	2398.27	1.09	31.53
1993.04	2205.37	1.50	31.31
1993.05	2248.01	13.46	31.33
1993.06	2281.95	30.59	31.41
1993.07	2190.34	47.35	31.37
1993.08	2556.16	95.21	31.37
1993.09	2708.39	53.16	31.37
1993.10	2688.51	62.08	31.37
1993.11	2850.35	345.58	31.37
1993.12	3301.85	182.21	31.37
1994.01	3813.74	393.24	31.37
1994.02	4039.42	250.92	31.37
1994.03	3811.25	261.47	31.37
1994.04	3824.75	167.05	31.37
1994.05	3756.10	279.63	31.37
1994.06	4135.67	259.79	31.37
1994.07	4106.95	102.15	31.37
1994.08	4407.40	129.41	31.37
1994.09	4511.34	140.46	31.37
1994.10	4351.16	171.82	31.37
1994.11	4139.06	21.20	31.39
1994.12	3949.78	6.80	31.39
1995.01	3651.59	72.84	31.37
1995.02	3474.92	91.87	31.38
1995.03	3408.29	60.49	31.65
1995.04	3359.29	58.00	31.41
1995.05	3206.09	63	31.42
1995.06	3336.46	118	31.40
1995.07	3334.86	200	31.38
1995.08	3402.81	55	31.58
1995.09	3396.37	121	33.18

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Performance Variability of Public Sector Banks: Need for Strategic Planning

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The ongoing banking sector reform with its thrust on transparency, efficiency and profitability has provided an opportunity for rebuilding the financial intermediaries into effective instruments of growth by improving their viability and by toning up allocative efficiency of financial resources. This is all the more necessary when the Indian economy is set for global integration with concomitant thrust on competition, deregulation and technology. This calls for adoption of planning strategies on the part of the banks to improve their performance. Set against this backdrop, the present study attempts to identify the strategic variables from the performance variability of the public sector banks during the period 1991-94 by using the methodology of principal component. Their performance is sought to be judged on the basis of productivity, financial management, profitability and sustainability. In terms of relative overall performance, banks have been grouped into three categories, viz., top, middle and bottom, and the study finds that there was no relative change in the position of 18 out of 28 public sector banks during the period 1991-94. The dominance of continuity implies that performance is predominantly a persistent phenomenon conditioned by bank specific 'initial conditions' (i.e., before the reforms were effected). Hence any breakthrough has to come from deliberately designed action plan tailormade to bank specific needs. Nevertheless, any such design should focus on the strategic variables as identified in the study. Success in meeting these challenges however critically depends on the right leadership, quality of management, internal strengths as buttressed by the experience of top ranking banks.

Introduction

As a part of financial sector reform programme, Indian banking is currently undergoing metamorphosis with an accent on flexibility, transparency, efficiency and profitability of the system. The approach to financial sector reforms was laid out in the report of the Committee on the Financial System (Chairman: Mr. M. Narasimham), 1991, which prescribed prudential accounting norms at par with the practices prevalent in the international banking arena.

The reform measures undertaken since early 1992 had initially generated some systemic stresses as reflected in 'red' balance sheets of

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the banking system during 1992-93 and 1993-94. These strains are inevitable. They should be viewed as providing opportunities for building a strong, sound and vibrant system capable of playing its role effectively and making its due contribution to the growth process of the economy. This essentially implies adoption of planning strategies on the part of the Indian banks to improve their performance. It is against this backdrop, the present study attempts to identify the strategic variables which are the first essential prerequisites for evolving any pro-active plan. The significant performance variability of the 28[1] public sector banks in the pre- as well as post-liberalisation phase of the ongoing reform process provides some clues in this regard. In the process, the study brings out the relative performance ranking of the public sector banks through the years 1991-92 to 1993-94.

The paper is organised into four sections. Section I provides a brief survey of literature touching upon the issues relevant for the study. Section II describes the methodology. Section III presents the major findings while concluding observations are given in Section IV.

Section I

Review of Literature

The role of social banking assumed by the banks since nationalisation in 1969 has been a matter of intense debate in India, not only among the economists and the bankers but also the general public. While the major objectives of nationalisation appear to have been largely fulfilled as reflected in large credit flows to the priority sectors, widening of branch networks the length and breadth of the country and greater mobilisation of savings through bank deposits, there has been a progressive deterioration in the efficiency, profitability and viability of the system, with consequential adverse impact on the economy (Discussion Paper, p2., Govt. of India, 1993).

The costs involved in the switch to 'mass' banking had been dismissed by a few commentators, notably Kulkarni (1979) as some sort of research and development expenditure involved in the process of learning to discharge the new 'inescapable development responsibilities'. Chawla, Kilam & Mehta (1994), on the other hand, argued that in any case the banks on their own would have undertaken such activities in view of the shrinking business opportunities in the traditional fields. Verghese (1983)

has attempted to estimate the financial surplus generated by scheduled commercial banks during 1970-79, taking into account the opportunity cost of progressively rising SLR and CRR, subsidised priority sector financing and interest tax proceeds. She concluded that reduction in SLR, better operating and recovery procedures would improve the bottomline of the banks.

Angadi (1987) used two concepts of accounting profit and economic profit (the latter being accounting profit adjusted for solvency costs and opportunity costs on capital and reserves) and showed that economic profit of as many as 14 out of 28 public sector banks was negative in 1985 as against 11 in the previous year.

The apparently impressive performance of nationalised banks, set against the objectives of nationalisation, has been questioned by Shetty (1978). On the other hand, the declining trend of profitability of the nationalised banks is said to have started much prior to nationalisation (Raghupathy, 1979 and Angadi, 1986).

There has been a growing concern (notably Shah, 1977) in the seventies over the declining trend in bank profitability which ultimately led to a thorough review of the banking system under the Productivity, Efficiency and Profitability (PEP) Committee on Banking (Chairman : J.C. Luther), 1977 constituted by the Reserve Bank of India. The PEP Committee applied four criteria, namely, productivity, social objectives - (both spatial and sectoral) and profitability with a set of indicators under each criterion for judging the relative performance of nationalised banks during 1969 to 1975. In its opinion, assessment of operational efficiency at a more disaggregated and homogeneous level of groups was necessary since it seemed more realistic and meaningful than evolving an efficiency measure at the overall level. In a very similar vein, using the same criteria for bank efficiency, Divatia and Venkatachalam (1978) attempted to construct a composite index of bank performance which was however blighted in view of the negative correlation between productivity and profitability indicators on the one hand and the indicators of banks' social obligations on the other. In that case, as Godse (1983) suggested, a reduction in operational deficit for the branches below the breakeven point could be taken as a measure of productivity as against profit which has been pushed on the backburner as a corporate objective and as an indicator of productivity with the continued thrust on branch expansion in unbanked areas.

While Seshadri's (1980) conclusion of greater desirability of measures of intensive nature like greater share of priority loans from the profitability viewpoint than those of extensive nature such as indiscriminate expansion of banking facilities in rural areas, seemed to have lent credence to the main point of the writing of Godse (1983) who advocated use of profit as a measure of productivity as well as the implicit contestable hypothesis that the rural branches are loss making. As Karkal (1982) showed, while the percentage number of profit making branches in rural areas increased over time in the case of a particular public sector bank from 1976 to 1978, it declined for urban and metropolitan branches. Further, in the case of newly opened branches, regardless of their location the chances of reporting losses in the initial stages seemed to be high.

Shah (1982) has attributed the then dwindling deposit base of the banks to subdued flow of funds to the corporates from banks following the latter's prior commitment to rural and local development which made the businessmen walk out with their deposits in search for greener pastures. This argument however does not appear to be tenable in view of the fact that the corporate sector is in general the net deficit sector, borrowing funds from other sectors and that the payments system being the monopoly of the banks, fund flows would be ultimately reflected in banks' books.

However, juxtaposing the Indian banks with the banks of several developed and developing countries cannot be a cause for cheer (Varde & Singh, 1983 and Ojha, 1987). What is most striking is not only the former's low assets in the world ranking but large number of employees. The way out is suggested to be a judicious adoption of advanced technology in banking, development of human resources and above all cooperation from the employees' trade unions.

The poor cost effectiveness of Indian banks is again another cause for concern. While the significant increase in earning of all the banks during 1969 to 1980 was mainly due to favourable policy changes (Angadi & Devraj, 1983), high responsiveness of operating cost to the changes in output was the major factor for declining efficiency since 1976 (Angadi, 1983). However, the technical efficiency as reflected in profit rate should not be the sole criterion for evaluating the performance of banks; their efforts for improving the relative financial performance of the banking system as a whole should also be taken into account and this

has been attempted in Chakrabarty (1986) with the help of Herfindahl's index of concentration.

The methodology of documentary research based on financial ratio analysis was used in all these papers barring the PEP Committee (1977) and Divatia & Venkatachalam (1978) which applied the technique of principal component while econometric analysis was used in Seshadri (1980).

Section II

Methodoloy

Banking being a multiproduct industry, its perfomance evaluation involves identifying indicators reflecting the multifaceted dimension of this service industry. This study groups 25 such indicators under five performance criteria, viz., indicators of labour productivity (LP), branch productivity (BP), financial management (FM), profitability and growth. Since the indicators under each group are highly correlated, the problem of aggregation is overcome by applying the method of principal component which serves two-fold purpose. The principal component analysis designs a suitable weighting pattern for the variables, and in the process, identifies the major explanatory factors behind performance differential among banks, by reducing the effective dimensionality of the problem.

Indian banking being labour intensive, its productivity largely depends on the efforts put in by the employees. While labour productivity is determined by a host of socio-economic factors, of which technology plays a predominant role, measurement of such productivity through any specific banking indicator could be considered inadequate. This is more so in the case of Indian banking industry, where productivity takes on a different connotation in the context of the goals set for development banking. For representing labour productivity emphasis has been placed on two broad indicators, viz, (1) per employee efficiency in mobilisation of deposit and lending operations and (2) the management of fund and non-fund businesses with particular emphasis on non-performing assets. The former is represented by the indicators, viz, aggregate deposit per employee (dpe), total advances per employee (ape) and business (deposit + advances) per employee (bpe) while the latter by total income per employee (ipe) and net income (total income - interest expenditure) per employee (nipe).

The postnationalisation phase of the Indian banking witnessed a massive expansion of branch network the length and breadth of the country. Branch being the focal point of a bank, its productivity level is crucial for the system as a whole and more so in the current phase of profit banking initiated since 1992-93 which envisages that branches operate as independent profit centres. Five indicators have been chosen to represent the measure of branch productivity. They are: aggregate deposits per branch (dpb), total advances per branch (apb), business per branch (bpb), total income per branch (ipb) and net income per branch (nipb).

In an increasingly deregulated environment, financial management assumes critical importance. Integrated funds management forms a crucial aspect of bank management. The more efficiently a bank performs this function, the greater is its profitability, *ceteris paribus*. The chosen indicators here are the ratio of demand deposits to deposits (dd), the average yield from assets (ya), the average yield from advances (yl), the average yield from investment (yi) and the spread (sp). While the ratio of demand deposits to deposits (dd) focuses on the importance of liability management and the average yield from assets (ya), the average yield from advances (yl) and the average yield from investment (yi) on that of asset management, the spread (sp) reflects the net effect of an integrated funds management.

Current profitability is measured as return on assets and return on equity: these are the most widely accepted indicators of performance, in particular, of the viability of banks. Besides internal efficiency, it is affected by exogenous factors such as the demand conditions the banks are facing and the market structure. The indicators preferred for representing profitability are the ratio of operating profit to working fund (oprwf), the ratio of net profit to working fund (nprwf), the ratio of net interest to working fund (nitwf), the ratio of total income to average assets (incAast), the ratio of operating profit to operating expenditure (oprOex) and the ratio of net profit to equity (nprEq).

Current ratios are often not sufficient to judge the longterm performance of banks. Accordingly, growth indicators are taken into account, which are represented by the growth rate of deposits (d), the growth rate of advances (a), the growth rate of investment (i) and the growth rate of other income (o).

On the basis of the above indicators, the study evaluates banks' performance during the period, 1991-92 to 1993-94. It makes use of data

in the annual reports of banks and the Indian Banks' Association (IBA) publication *Financial Analysis of Banks* to compute the indicators.[2]

The method of principal component assigns suitable weights for the indicators to arrive at the composite score. However before applying the method it is necessary to make the indicators scale-free. This is done by dividing each indicator by its arithmetic mean. The usual way of standardisation has been avoided as it distorts the dispersion of the original variables in the process (Kundu, 1980). Once freed of the scale effect, the method is applied to each set of indicators instead of all the indicators taken together. This avoids the necessity of taking more than one principal component and the associated problem of interpreting the same, since the correlations among the variables in each set are high *vis-a-vis* the low cannonical correlation on an average between pairs of sets. The actual procedure of applying the principal component method involves computing the covariance matrix of the scale free indicators under each set, its eigen values and the associated eigenvectors. Next, the bankwise component scores are derived by using the eigenvector corresponding to the most significant eigen value. On the basis of the component scores obtained which are made standardised with mean zero and standard deviation one, banks are ranked under each criterion of performance evaluation. The derivation of principal components in the notational form is given below.

Let X_{ti} be the t^{th} observation ($t = 1,2,...,n$) of the i^{th} original variable ($i = 1, 2,...,k$) and P_{tj} ($t = 1,2,...,n$; $j = 1, 2,...,k$) be the t^{th} observation of the j^{th} principal component. Then the principal components, denoted P_j, $j = 1, 2,...,k$ can be constructed as linear combinations of the original data:

$$P_{tj} = \sum_{i=1}^{n} X_{ti}\, a_{ij}$$

where a_{ij} are constants. Written compactly, $P_j = Xa_j$ where a_j is the kx1 vector $[a_{1j}\ a_{2j}\ ...a_{kj}\ ]'$. These equations contain arbitrary scale factors and the normalisation condition

$$a'_j a_j = \sum_{i=1}^{n} a^2_{ij} = 1 \text{ for all } j = 1,.....,k \text{ is imposed.}$$

The variation in $\mathbf{P}_j$ is measured by the sum of squares $\mathbf{P}'_j\mathbf{P}_j$ and so the construction of the principal components may be written as a constrained optimization problem: Max $\mathbf{P}'_1\mathbf{P}_1 = \mathbf{a}'_1\mathbf{X}'\mathbf{X}\mathbf{a}_1$ subject to $\mathbf{a}'_1\mathbf{a}_1 = 1$. Defining a Lagrange multiplier by m_1, the Lagrangian is:

$$\mathbf{a}'_1\mathbf{X}'\mathbf{X}\mathbf{a}_1 - m_1(\mathbf{a}'_1\mathbf{a}_1 - 1)$$

which yields the first order conditions:

$$(\mathbf{X}'\mathbf{X} - m_1\mathbf{I})\mathbf{a}_1 = 0$$

Hence m_1 is an eigenvalue of $\mathbf{X}'\mathbf{X}$ and $\mathbf{a}_1$ is the corresponding eigenvector. In order to maximise the variation of $\mathbf{P}_1$, m_1 is chosen as the largest eigenvalue of $\mathbf{X}'\mathbf{X}$, m_2 is then chosen as the next largest eigenvalue, and so on. In the absence of perfect collinearity amongst the $\{\mathbf{X}_i\}$ variables, $\mathbf{X}'\mathbf{X}$ is a positive definite matrix which ensures that all the eigenvalues are strictly positive. Defining the orthogonal matrix of normalised eigenvectors, a, by $[\mathbf{a}_1 \ldots \mathbf{a}_k]$, the principal components are then defined by $\mathbf{P} = \mathbf{X}\mathbf{a}$.

The computing procedure outlined above gives rise to the same vexed question of computing the overall composite score for each bank based on the component scores under each criterion. For the purpose of this study, bankwise standardised component scores under each criterion have been used to generate indices following the UNDP's methodology for constructing the Human Development Index :

$$I(i,j) = [\{\text{Max}_j S(i,j) - S(i,j)\}/\text{Range}(i)]$$

I (i,j) = Index value for jth bank with respect to ith criterion

S (i,j) = Standardised component score under ith criterion for the jth bank

Max S(i,j) = Maximum of S(i,j) across banks
j

Range (i) = Range of the standardised component scores under the ith criterion across banks

The bankwise overall score [I(j)] is obtained by adding the index values under all criteria:

$$I(j) = \sum_{i=1}^{5} I(i,j)$$

Finally banks are ranked according to their overall score. We have avoided pooling of all the indicators together as this may hide the performance differential among banks under each criterion set.

Section III

Major Findings

Overall Performance

In terms of relative overall performance, banks have been grouped into three categories, viz., top, middle and bottom (Table 1). The common trends that emerge are as follows:

From among the 28 public sector banks, seven banks have been able to maintain their relative top position consistently for three years. The banks which emerged in this category are the ones which are generally doing well even in terms of such common yardsticks as profits and other financial indicators. In respect of banks, which are considered to be in the middle and bottom categories, based on their ranks, four banks continued to be under the middle category for consecutive three years, seven others were in the bottom group for the three years.

This implies that there was no relative change in the position of 18 out of the 28 public sector banks while the remaining 10 banks changed their position during 1991-94. A broad feature emerging from this exercise is that the relative position of banks remained more or less unchanged during the early periods of financial sector reform, although there could have been absolute improvement in performance in most of the public sector banks in the post reform period.

Another notable feature is that the implementation of the prudential accounting and capital adequacy norms in 1992-93 affected the position of some banks which were performing better otherwise.

The inter-group positions maintained by the majority of the banks across the years imply that the performance differential among the banks as obtained today is largely due to their relative strengths and weaknesses

inherited over a long period of time. In other words, even while the implementation of the prudential accounting standards and the capital adequacy norms has, for the first time, brought to sharp focus the true financial health of the banks since 1992-93, it has not significantly altered the relative position of most of the banks. This trend of continuity was dominant, notwithstanding some change noticed in the case of a few banks.

Disaggregated Performance

In order to have a more meaningful performance evaluation, it is necessary to go beyond the overall rank and examine the performance variation at the disaggregated level under each performance criterion.

Labour Productivity

Net income per employee (nipe) having the highest weight on the first principal component has turned out to be the principal variable in representing the variation in labour productivity since 1992-93 while advances per employee (ape) did so in 1991-92 (Annexure Table:1). This seems plausible in view of the shift in thrust from quantitative targets of advances and deposits in the earlier phase of social banking to qualitative improvement in performance in the new phase of profit banking initiated since 1992-93. Moreover, in the earlier phase very little variation in income could be noticed due to the then prevalent nontransparent accounting principles.

Based on the scores of principal components, one bank (the Bank of Baroda) topped the list of labour productivity throughout the period from 1991-92 to 1993-94 (Table 2). While six banks did consistently better than others in terms of labour productivity throughout the period, four banks were in the bottom category throughout. The broad trend of continuity in relative performance was accompanied with some significant changes in the individual position in the case of a few banks. The notable among them are the State Bank of Hyderabad and Punjab National Bank which improved their position from the middle category to the top category while UCO Bank slipped from the top category to the bottom.

Branch Productivity

As in the case of labour productivity, net income per branch (nipb) emerged as the principal variable for branch productivity, for 1992-

93 and 1993-94. Advances per branch (apb) was the principal variable for 1991-92 (Annexure Table:2). This seems to be reflecting the shift in policy emphasis in the banking industry since 1992-93 following the reforms.

While as many as eight banks were throughout in the top category, five banks were in the middle category and seven banks in the bottom category (Table 3).

Financial Management

The surge in foreign capital inflows and the resultant liquidity with the banking system opened a new vista of opportunities for the financial system during 1993-94. The different degrees of efficiency with which various banks managed such float funds appear to have played a significant role in their performance with respect to financial management. This is reflected by the fact that the ratio of demand deposits to total deposits (dd) emerged as the principal variable in 1993-94 whereas the spread (sp), which is a comprehensive indicator of financial management, was the principal variable during 1991-92 and 1992-93 (Annexure Table : 3).

While four banks were positioned in the top category all through in terms of their performance with respect to financial management, seven banks were placed in the bottom category (Table 4) in all the years under review.

The relative position of a few banks underwent change from the bottom and middle categories to the middle and top categories and vice-versa.

Profitability

In the preliberalisation phase, interest income used to be reckoned on accrual basis with little variation therein. In the absence of any uniform norm on provisioning against bad debts and depreciation in investment, the variation in accounting profit was mainly due to provisions and contingencies. Some semblance of uniformity was first introduced in 1992-93 with the phased implementation of prudential accounting standards which however brought about a wide variation in the current period income, as interest income was henceforth required to be reckoned on a realisation basis. This is reflected in the emergence of the ratio of oper-

ating profit to working fund (oprwf) as the principal variable since 1992-93 as against that of net profit to working fund (nprwf) in 1991-92 (Annexure Table: 4).

In terms of inter-bank performance, some of the State Bank associates, and only one nationalised bank, (Canara Bank) maintained their position in the top category throughout the period 1991-94 while two banks continued to be under the middle category and five banks in the bottom category (Table 5).

Growth

While the long term performance of banks seems to be primarily dependent upon the growth in traditional business, viz., deposits and advances which turned out to be the principal variable respectively in 1991-92 and 1993-94, the growing role of non banking business as represented by the growth rate in other income ('o') could not be ignored, as evident in its emergence as the principal variable in 1992-93 and as the major determinant in 1993-94 next only to the growth in advances (Annexure Table: 5). The major source of variation in 'o' during 1992-93 was the drastic fall in the profit from foreign exchange transactions.

Change, not continuity, was the dominant trend in growth performance. Barring three banks, in the top category, one in the middle category and two in the bottom category, no other bank could maintain its position consistently during 1991-94 (Table 6).

While a steep fall was observed in the case of some banks from the top category in 1991-92 to the bottom category in 1992-93, a sharp rise was noted in few others from the bottom to the top category during the same period.

Section IV

Concluding Observations

In the preliberalisation phase the banks used to function in a more or less uniform operational and regulatory regime. However the significant variation observed in their performance in 1991-92, suggests that organisational culture and quality of management had a significant bearing on the relative performance of banks.

The dominant trend of continuity that emerges in respect of the relative overall performance among the banks through the years 1991-92 to 1993-94 implies that performance is predominantly influenced by bank specific 'initial conditions' which may be having roots in the organisational structures and other such factors peculiar to the banking industry. Hence, any major breakthrough in performance has to come from a deliberately designed action plan with emphasis on bank specific needs. This apart, evaluation of performance of banks requires prior knowledge about some strategic variables which are of concern to the banking industry in their multifaceted business activity. The variables as identified in this study, are: the net income per employee and per branch, the ratio of demand deposits to total deposits, the spread ratio, the ratios of operating profit and net profit to working fund, and the growth in deposits/advances and in other income. In the current policy environment, a majority of these performance indicators reflect upon the commercial efficiency of the banks which has been given attention since the introduction of prudential norms. At the same time, they suggest the declining importance of the traditional indicators (for example deposit mobilisation, branch expansion, etc.) which had the objective of evaluating the performance of banks in the context of development banking.

With the increasing globalisation of the Indian economy, the banks need to develop necessary expertise in managing the float funds to their advantage while maintaining the broad thrust on spread ratio management. In the Indian context where the banks are predominantly in the government sector, net profit/operating profit to working fund continues to be the major viability indicator; the return on equity as measured by net profit to equity is yet to find its place. However, with the legal hurdles already removed in the way of tapping the capital market with equity, the future picture could be different. Growth in deposits/advances continues to shape up the long term prospect of the industry. However, with increasing disintermediation, the strategic response has to be some blending of innovative banking with thrust on growth in non-banking business.

The success in meeting these challenges of change rests with the individual banks gearing and bracing themselves up structurally, functionally and culturally to the needs of the hour. This brings into focus the crucial role of leadership and strategic vision, never so critical in the history of Indian banking, in bringing about both viability and competitiveness of Indian commercial banks in the public sector.

Notes

1. 27 with the merger of New Bank of India with Punjab National Bank in 1993-94. (See Table for the names of the public sector banks)

2. It should be noted, as Divatia and Venkatachalam (1978) rightly pointed out, 'the set of indicators once fixed does not become sacrosanct for all times'. It depends on the relevance of the indicator, at a particular point of time, to capture the bankwise variation in performance.

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Table 1: Bankwise Overall Rank

1993-94				1992-93				1991-92			
BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY
Bank of Baroda	0.776954	1	TOP	Canara Bank	1.158081	1	TOP	Bank of Baroda	1.340698	1	TOP
Corporation Bank	1.198552	2		Bank of Baroda	1.355427	2		OBC	1.407919	2	
OBC	1.271750	3		OBC	1.402329	3		Canara Bank	1.411718	3	
Union Bank of India	1.684217	4		Indian Bank	1.488870	4		SB of India	1.691464	4	
Canara Bank	1.855690	5		SB of India	1.509061	5		SB of H	1.996344	5	
SB of H	1.963708	6		Corporation Bank	1.573181	6		SB of P	2.041157	6	
SB of P	2.043460	7		SB of S	1.597208	7		Corporation Bank	2.113618	7	
SB of India	2.215938	8		SB of H	1.639328	8		Bank of India	2.448178	8	
SB of T	2.249460	9		SB of P	1.733766	9		SB of S	2.522250	9	
SB of Indore	2.393225	10	MIDDLE	SB of T	1.825668	10	MIDDLE	Indian Bank	2.597305	10	MIDDLE
SB of S	2.400839	11		PNB	1.997005	11		SB of B and J	2.868185	11	
Vijaya Bank	2.585263	12		Union Bank of India	2.257291	12		Union Bank of India	2.926322	12	
Bank of India	2.612816	13		SB of M	2.281343	13		SB of T	2.959885	13	
Indian Bank	2.643354	14		SB of B and J	2.492263	14		SB of Indore	2.970785	14	
Dena Bank	2.707465	15		SB of Indore	2.547663	15		SB of M	3.115389	15	
SB of M	2.832091	16		Allahabad Bank	2.582575	16		PNB	3.139502	16	
IOB	2.970970	17		Vijaya Bank	2.642979	17		IOB	3.526862	17	
				IOB	2.757028	18		Allahabad Bank	3.535955	18	
				Bank of India	2.816041	19		CBI	3.667552	19	
SB of B and J	3.032533	18	BOTTOM	Dena Bank	3.063331	20	BOTTOM	Vijaya Bank	3.676328	20	BOTTOM
Allahabad Bank	3.427963	19		CBI	3.392395	21		Syndicate Bank	3.696922	21	
P&S Bank	3.456771	20		Syndicate Bank	3.500605	22		Uco Bank	3.742312	22	
Syndicate Bank	3.544164	21		Andhra Bank	3.803095	23		Dena Bank	3.754449	23	
Andhra Bank	3.722508	22		Uco Bank	3.868939	24		Andhra Bank	3.869856	24	
CBI	4.073533	23		P&S Bank	3.968331	25		P&S Bank	3.916526	25	
Bank of Maharashtra	4.195574	24		Bank of Maharashtra	3.968800	26		United Bank of India	4.025569	26	
United Bank of India	4.694596	25		United Bank of India	4.380987	27		Bank of Maharashtra	4.229417	27	
Uco Bank	4.710221	26		New Bank of India	4.821209	28		New Bank of India	4.452609	28	

Legends : OBC: Oriental Bank of Commerce, SB of H: State Bank of Hyderabad, SB of P: State Bank of Patiala, SB of India: State Bank of India, SB of T: State Bank of Travancore, SB of Indore: State Bank of Indore, SB of S: State Bank of Saurashtra, SB of M: State Bank of Mysore, IOB: Indian Overseas Bank, SB of B and J: State Bank of Bikaner and Jaipur, P & S Bank: Punjab and Sind Bank, CBI: Central Bank of India, PNB: Punjab National Bank.

Table 2: Bankwise Rank in Labour Productivity

1993-94				1992-93				1991-92			
BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY
Bank of Baroda	1.85466	1	TOP	Bank of Baroda	1.485774	1	TOP	Bank of Baroda	1.370607	1	TOP
Indian Bank	1.00021	2		Indian Bank	1.423436	2		Indian Bank	1.088883	2	
OBC	0.9526363	3		SB of India	0.7898601	3		Bank of India	1.024948	3	
Corporation Bank	0.8254861	4		OBC	0.6665308	4		SB of India	0.7150877	4	
SB of India	0.507145	5		Canara Bank	0.5414082	5		OBC	0.5522419	5	
Bank of India	0.4842381	6		Bank of India	0.5375199	6		Canara Bank	0.3653552	6	
SB of H	0.4796634	7		SB of H	0.3673795	7		Allahabad Bank	0.2206858	7	
Canara Bank	0.353128	8		SB of P	0.2330589	8		IOB	0.1783397	8	
IOB	0.278457	9		PNB	0.1741335	9		Uco Bank	0.1518743	9	
Union Bank of India	0.2144692	10	MIDDLE	Corporation Bank	0.1584252	10	MIDDLE	SB of P	0.1393636	10	MIDDLE
Allahabad Bank	0.112361	11		Allahabad Bank	0.1495127	11		SB of H	0.0931029	11	
Vijaya Bank	-0.1399376	12		SB of T	0.0620809	12		PNB	0.0334659	12	
SB of P	-0.1682551	13		IOB	0.0451806	13		Corporation Bank	-0.1293087	13	
Dena Bank	-0.1716288	14		SB of S	-0.0836103	14		CBI	-0.1668982	14	
P&S Bank	-0.2037792	15		Union Bank of India	-0.1038946	15		SB of Indore	-0.2239888	15	
SB of T	-0.3110297	16		SB of Indore	-0.1730325	16		Union Bank of India	-0.228673	16	
Andhra Bank	-0.4169288	17		SB of M	-0.2586489	17		SB of T	-0.2572471	17	
				Uco Bank	-0.3063921	18		Andhra Bank	-0.2638956	18	
				CBI	-0.3454554	19		United Bank of India	-0.2837237	19	
Syndicate Bank	-0.5274715	18	BOTTOM	Dena Bank	-0.3729681	20	BOTTOM	SB of S	-0.3538588	20	BOTTOM
SB of Indore	-0.5294979	19		SB of B and J	-0.3735041	21		SB of B and J	-0.3540919	21	
SB of S	-0.5596991	20		Vijaya Bank	-0.3819356	22		P&S Bank	-0.3586389	22	
CBI	-0.562829	21		Andhra Bank	-0.4621724	23		Vijaya Bank	-0.4175794	23	
Uco Bank	-0.6187962	22		P&S Bank	-0.5870723	24		Dena Bank	-0.4867715	24	
United Bank of India	-0.6488162	23		United Bank of India	-0.6101176	25		Syndicate Bank	-0.5062085	25	
SB of B and J	-0.6888843	24		Syndicate Bank	-0.6685187	26		SB of M	-0.534999	26	
SB of M	-0.7497765	25		Bank of Maharashtra	-0.8207243	27		Bank of Maharashtra	-0.546178	27	
Bank of Maharashtra	-0.7651241	26		New Bank of India	-1.086253	28		New Bank of India	-0.8218938	28	

Table 3: Bankwise Rank in Branch Productivity

1993-94				1992-93				1991-92			
BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY
Bank of Baroda	1.448245	1	TOP	SB of India	1.708469	1	TOP	SB of India	1.693005	1	TOP
SB of India	1.219861	2		Canara Bank	1.326127	2		Bank of India	1.447536	2	
Canara Bank	0.941202	3		Bank of Baroda	1.244958	3		Bank of Baroda	1.184407	3	
OBC	0.9177471	4		Indian Bank	1.227302	4		Canara Bank	1.138155	4	
Bank of India	0.6904767	5		Bank of India	0.8702105	5		Indian Bank	0.8706114	5	
Indian Bank	0.6411572	6		OBC	0.7741666	6		OBC	0.6357968	6	
Corporation Bank	0.6257019	7		SB of P	0.4845628	7		SB of P	0.4353422	7	
SB of P	0.4236143	8		IOB	0.3090192	8		IOB	0.4156069	8	
IOB	0.4082098	9		SB of H	0.2375041	9		SB of S	0.120382	9	
SB of H	0.2528952	10	MIDDLE	SB of S	0.236855	10	MIDDLE	Uco Bank	0.0822264	10	MIDDLE
SB of T	0.2512858	11		Corporation Bank	0.2074985	11		SB of H	0.0379678	11	
SB of S	0.1166895	12		PNB	0.1228202	12		PNB	-0.0222882	12	
SB of Indore	-0.1583677	13		SB of T	0.1003094	13		Corporation Bank	-0.0489239	13	
Union Bank of India	-0.1695916	14		SB of Indore	-0.1697951	14		Syndicate Bank	-0.1821125	14	
Syndicate Bank	-0.2102067	15		SB of M	-0.2362621	15		SB of Indore	-0.2042634	15	
SB of M	-0.2191787	16		SB of B and J	-0.2855586	16		SB of T	-0.2518817	16	
Vijaya Bank	-0.3976934	17		Syndicate Bank	-0.2959083	17		SB of B and J	-0.3410904	17	
				Uco Bank	-0.3235773	18		Union Bank of India	-0.4452249	18	
				Union Bank of India	-0.3362465	19		CBI	-0.4718754	19	
SB of B and J	-0.4334612	18	BOTTOM	Vijaya Bank	-0.4860558	20	BOTTOM	SB of M	-0.5010241	20	BOTTOM
P&S Bank	-0.6214316	19		CBI	-0.6081572	21		Vijaya Bank	-0.5184694	21	
Uco Bank	-0.7063364	20		Allahabad Bank	-0.7089018	22		P&S Bank	-0.5261605	22	
Andhra Bank	-0.7311579	21		Andhra Bank	-0.7712437	23		United Bank of India	-0.5830759	23	
Dena Bank	-0.7422447	22		United Bank of India	-0.830997	24		Andhra Bank	-0.6300548	24	
CBI	-0.7835439	23		Dena Bank	-0.8349376	25		Allahabad Bank	-0.7297169	25	
Allahabad Bank	-0.8070833	24		P&S Bank	-0.8724098	26		New Bank of India	-0.7527961	26	
United Bank of India	-0.9188231	25		New Bank of India	-1.039762	27		Dena Bank	-0.9226994	27	
Bank of Maharashtra	-1.037966	26		Bank of Maharashtra	-1.049988	28		Bank of Maharashtra	-0.9293794	28	

Table 4: Bankwise Rank in Financial Management

1993-94				1992-93				1991-92			
BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY
Union Bank of India	1.729423	1	TOP	Canara Bank	1.355365	1	TOP	SB of P	0.8729755	1	TOP
Dena Bank	0.8686268	2		Corporation Bank	0.8967175	2		SB of B and J	0.6926986	2	
Corporation Bank	0.7463391	3		Union Bank of India	0.7489581	3		SB of S	0.6767739	3	
OBC	0.4439213	4		PNB	0.6554818	4		Canara Bank	0.5307204	4	
SB of Indore	0.4322946	5		SB of S	0.6137662	5		OBC	0.5140069	5	
SB of S	0.3699565	6		Bank of Baroda	0.5304461	6		SB of H	0.5066166	6	
Vijaya Bank	0.3586673	7		SB of H	0.4742035	7		Corporation Bank	0.4918328	7	
Canara Bank	0.3251703	8		OBC	0.4562749	8		SB of Indore	0.3199694	8	
SB of P	0.3189234	9		SB of B and J	0.3537998	9		SB of M	0.229661	9	
Bank of Baroda	0.2808584	10	MIDDLE	Dena Bank	0.3411145	10	MIDDLE	Union Bank of India	0.2224534	10	MIDDLE
SB of M	0.163138	11		Vijaya Bank	0.2750564	11		PNB	0.0770787	11	
SB of H	0.0974632	12		SB of M	0.2548935	12		SB of T	-0.0090912	12	
SB of India	0.0295446	13		SB of P	0.2120715	13		Dena Bank	-0.0176055	13	
SB of B and J	-0.0620911	14		SB of Indore	0.1120883	14		CBI	-0.0325218	14	
Allahabad Bank	-0.1068645	15		Indian Bank	0.092768	15		Allahabad Bank	-0.037301	15	
Syndicate Bank	-0.1640927	16		SB of India	0.0891779	16		Bank of Baroda	-0.0826612	16	
Indian Bank	-0.2494268	17		SB of T	0.04205	17		Syndicate Bank	-0.1111718	17	
				CBI	-0.0385068	18		Vijaya Bank	-0.2138249	18	
				Allahabad Bank	-0.0573542	19		Bank of Maharashtra	-0.2282547	19	
SB of T	-0.3486594	18	BOTTOM	Syndicate Bank	-0.2464477	20	BOTTOM	P&S Bank	-0.3056555	20	BOTTOM
CBI	-0.3494654	19		Bank of India	-0.4317814	21		SB of India	-0.337421	21	
Bank of India	-0.3608435	20		Bank of Maharashtra	-0.653351	22		Andhra Bank	-0.3691699	22	
Andhra Bank	-0.5552053	21		Andhra Bank	-0.6641521	23		New Bank of India	-0.3957247	23	
P&S Bank	0.6277352	22		IOB	-0.9716289	24		United Bank of India	-0.4465747	24	
Bank of Maharashtra	0.6547395	23		United Bank of India	-1.020127	25		Bank of India	-0.5386387	25	
IOB	-0.7499269	24		New Bank of India	-1.121147	26		Indian Bank	-0.6157839	26	
Uco Bank	-0.8994278	25		P&S Bank	-1.123167	27		Uco Bank	-0.6159301	27	
United Bank of India	-1.035848	26		Uco Bank	-1.17657	28		IOB	-0.7774565	28	

Table 5: Bankwise Rank in Profitability

1993-94				1992-93				1991-92			
BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY
Bank of Baroda	2.248709679	1	TOP	SB of P	4.349627972	1	TOP	SB of P	12.7311554	1	TOP
SB of P	2.036489487	2		Canara Bank	4.34957552	2		SB of B and J	8.295681	2	
Corporation Bank	1.908886075	3		SB of H	4.171424866	3		SB of S	8.115504265	3	
SB of H	1.765917063	4		SB of S	3.39359355	4		SB of H	7.433345795	4	
SB of S	1.47610116	5		SB of India	3.377051115	5		Canara Bank	7.035609722	5	
OBC	1.340616822	6		Corporation Bank	2.621964693	6		OBC	6.498121262	6	
Canara Bank	1.273588419	7		SB of T	2.550750256	7		SB of Indore	6.481276512	7	
SB of Indore	1.267135382	8		Bank of Baroda	2.367878675	8		Union Bank of India	4.355235577	8	
SB of T	1.22453618	9		SB of B and J	2.246967077	9		SB of M	4.050344467	9	
SB of India	1.084511757	10	MIDDLE	OBC	1.974377513	10	MIDDLE	SB of India	3.363546133	10	MIDDLE
SB of M	0.990748524	11		PNB	1.836655617	11		Corporation Bank	3.331245422	11	
SB of B & J	0.697719812	12		SB of M	1.769840479	12		SB of T	1.993825197	12	
Union Bank of India	0.532674670	13		SB of Indore	1.635377407	13		Vijaya Bank	1.364076495	13	
Bank of India	-0.09057407	14		Union Bank of India	0.763965010	14		Bank of Baroda	0.576440036	14	
Vijaya Bank	-0.20427283	15		Indian Bank	0.450961679	15		Dena Bank	-0.21925178	15	
Dena Bank	-0.40518429	16		Bank of India	-0.26911479	16		Syndicate Bank	-2.37784218	16	
Indian Bank	-0.49079045	17		Vijaya Bank	-0.68562310	17		Bank of Maharashtra	-3.93423175	17	
				Dena Bank	-0.88663059	18		CBI	-4.52287387	18	
				Allahabad Bank	-1.27197027	19		P&S Bank	-4.66636467	19	
Allahabad Bank	-0.84205240	18	BOTTOM	CBI	-1.99212598	20	BOTTOM	PNB	-4.72895574	20	BOTTOM
IOB	-0.91118454	19		IOB	-2.18809938	21		Andhra Bank	-4.92013025	21	
Syndicate Bank	-1.40362227	20		Andhra Bank	-2.80243110	22		New Bank of India	-6.08227157	22	
Andhra Bank	-1.67490613	21		Uco Bank	-3.45168709	23		Bank of India	-6.28060865	23	
P&S Bank	-1.83329391	22		Syndicate Bank	-3.48776292	24		Indian Bank	-6.69529867	24	
CBI	-1.87618434	23		Bank of Maharashtra	-3.99907827	25		Allahabad Bank	-6.90509605	25	
Bank of Maharashtra	-2.10050892	24		United Bank of India	-5.30451393	26		IOB	-7.66780662	26	
Uco Bank	-2.86942911	25		P&S Bank	-5.31669473	27		United Bank of India	-7.94654655	27	
United Bank of India	-3.14563155	26		New Bank of India	-6.20427942	28		Uco Bank	-8.67812824	28	

Table 6: Bankwise Rank in Growth

1993-94				1992-93				1991-92			
BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY	BANK	SCORE	RANK	CATE-GORY
SB of T	7.90286	1	TOP	SB of T	2.335888	1	TOP	Bank of Baroda	3.006754	1	TOP
Corporation Bank	6.811736	2		SB of S	1.965755	2		Corporation Bank	2.523748	2	
OBC	6.337577	3		Allahabad Bank	1.828308	3		OBC	2.383707	3	
Union Bank of India	6.173965	4		IOB	1.537706	4		SB of India	1.883395	4	
Vijaya Bank	5.366603	5		OBC	1.464447	5		Canara Bank	1.646685	5	
SB of Indore	4.303326	6		Corporation Bank	1.447613	6		SB of H	1.419086	6	
P&S Bank	3.460519	7		Vijaya Bank	1.18688	7		Indian Bank	1.253513	7	
Dena Bank	3.068605	8		SB of M	1.178699	8		SB of T	0.7767845	8	
Bank of Baroda	3.002301	9		SB of H	0.7174411	9		Bank of India	0.7067992	9	
SB of H	2.512655	10	MIDDLE	Union Bank of India	0.6519887	10	MIDDLE	IOB	0.2527748	10	MIDDLE
SB of S	1.923575	11		P&S Bank	0.581968	11		PNB	0.0772696	11	
SB of P	1.905762	12		SB of P	0.4789936	12		Union Bank of India	-0.01589	12	
SB of M	0.7843806	13		PNB	0.2348685	13		SB of M	-0.1081712	13	
SB of B and J	0.7509581	14		Indian Bank	0.1057078	14		Allahabad Bank	-0.131285	14	
Canara Bank	0.3517715	15		SB of B and J	-0.0505212	15		United Bank of India	-0.2268452	15	
Andhra Bank	-0.3310263	16		SB of Indore	-0.1661998	16		Andhra Bank	-0.3468941	16	
IOB	-1.170023	17		Bank of Maharashtra	-0.2403685	17		Uco Bank	-0.3908086	17	
				Dena Bank	-0.4213558	18		P&S Bank	-0.8205315	18	
				Syndicate Bank	-0.6287314	19		Dena Bank	-0.8738624	19	
Bank of Maharashtra	-2.303136	18	BOTTOM	SB of India	-1.078387	20	BOTTOM	CBI	-0.9796134	20	BOTTOM
Bank of India	-3.624163	19		Canara Bank	-1.110356	21		SB of S	-1.057485	21	
Syndicate Bank	-3.830054	20		Andhra Bank	-1.211786	22		Syndicate Bank	-1.170485	22	
Allahabad Bank	-4.076997	21		Bank of Baroda	-1.224012	23		Vijaya Bank	-1.191517	23	
CBI	-6.359131	22		CBI	-1.3052	24		New Bank of India	-1.41712	24	
Indian Bank	-6.988212	23		Uco Bank	-1.342811	25		SB of Indore	-1.521172	25	
SB of India	-7.182862	24		United Bank of India	-1.851257	26		Bank of Maharashtra	-1.604865	26	
United Bank of India	-7.332699	25		New Bank of India	-2.137963	27		SB of B and J	-2.010309	27	
Uco Bank	-11.45829	26		Bank of India	-2.947316	28		SB of P	-2.063661	28	

Annexure Table : 1 Labour Productivity Indicators

1993-94 (principal components; 5 components retained)				
Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.44063	0.39030	0.8758	0.8758
2	0.05034	0.03919	0.1000	0.9758
3	0.01115	0.01013	0.0222	0.9980
4	0.00102	0.00102	0.0020	1.0000
5	0.00001		0.0000	1.0000

	Eigenvectors				
Variable	1	2	3	4	5
dpe	0.38133	0.36063	0.62323	-0.21822	0.53712
ape	0.46369	0.31385	-0.75854	-0.21905	0.25123
bpe	0.40765	0.34166	0.17940	-0.19207	-0.80500
ipe	0.41583	0.04907	0.01866	0.90773	0.01898
nipe	0.54817	-0.80765	0.06054	-0.20866	-0.00192

1992-93 (principal components; 5 components retained)				
Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.37556	0.29215	0.8037	0.8037
2	0.08341	0.07659	0.1785	0.9822
3	0.00682	0.00531	0.0146	0.9967
4	0.00151	0.00150	0.0032	1.0000
5	0.00001	.	0.0000	1.0000

	Eigenvectors				
Variable	1	2	3	4	5
dpe	0.33609	0.37325	0.68037	-0.11225	-0.52175
ape	0.47585	0.33478	-0.68891	-0.32783	-0.28181
bpe	0.38461	0.35904	0.19970	-0.18688	0.80521
ipe	0.43475	0.05504	-0.09794	0.89352	-0.00053
nipe	0.56893	-0.78528	0.11413	-0.21594	-0.00001

(Contd.)

Annexure Table : 1 Labour Productivity Indicators (Concld.)

1991-92 (principal components; 5 components retained)				
Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.29139	0.22975	0.7986	0.7986
2	0.06164	0.05137	0.1689	0.9676
3	0.01026	0.00870	0.0281	0.9957
4	0.00156	0.00155	0.0043	1.0000
5	0.00001		0.0000	1.0000

	Eigenvectors				
Variable	1	2	3	4	5
dpc	0.41869	-0.25739	0.70462	0.01108	-0.51171
apc	0.54932	-0.23108	-0.61758	-0.42084	-0.29382
bpc	0.46433	-0.24534	0.22314	-0.15034	0.80735
ipc	0.42912	0.07415	-0.23907	0.86787	0.00341
nipc	0.35099	0.90259	0.12312	-0.21674	-0.00197

Annexure Table : 2 Branch Productivity Indicators

1993-94 (principal components; 4 components retained)				
Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.50918	0.47085	0.9118	0.9118
2	0.03833	0.02858	0.0686	0.9804
3	0.00974	0.00856	0.0174	0.9979
4	0.00118	0.00118	0.0021	1.0000

	Eigenvectors			
Variable	1	2	3	4
dpb	0.35860	0.33975	0.65722	-0.16225
apb	0.45324	0.39249	-0.71659	-0.26025
bpb	0.39067	0.36217	0.22771	-0.15004
ipb	0.42378	0.01414	-0.04176	0.90413
nipb	0.57774	-0.77405	0.03090	-0.25686

(Contd.)

Annexure Table : 2 Branch Productivity Indicators (Concld.)

1992-93	(principal components; 5 components retained)			
Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.59662	0.52020	0.8748	0.8748
2	0.07642	0.06888	0.1121	0.9869
3	0.00754	0.00614	0.0111	0.9979
4	0.00139	0.00139	0.0020	1.0000
5	0.00001	.	0.0000	1.0000

	Eigenvectors				
Variable	1	2	3	4	5
dpb	0.33392	0.36828	0.68674	-0.08757	-0.52305
apb	0.45149	0.38804	-0.68057	-0.32441	-0.27779
bpb	0.37438	0.37204	0.21093	-0.16643	0.80576
ipb	0.43505	0.03270	-0.11707	0.89216	-0.00231
nipb	0.59601	-0.75783	0.08375	-0.25187	-0.00096

1991-92	(principal components; 5 components retained)			
Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.52716	0.45720	0.8662	0.8662
2	0.06996	0.06001	0.1150	0.9811
3	0.00995	0.00843	0.0163	0.9975
4	0.00153	0.00152	0.0025	1.0000
5	0.00001	.	0.0000	1.0000

	Eigenvectors				
Variable	1	2	3	4	5
dpb	0.38070	0.29109	0.71152	0.06626	-0.50959
apb	0.50572	0.33593	-0.58042	-0.45253	-0.29955
bpb	0.42680	0.30645	0.23627	-0.13248	0.80657
ipb	0.44576	-0.04166	-0.29623	0.84367	0.00530
nipb	0.46739	-0.84069	0.11524	-0.24799	-0.00239

Annexure Table : 3 Financial Management Indicators

1993-94 (principal components; 5 components retained)

Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.37315	0.16159	0.6240	0.6240
2	0.21157	0.20347	0.3538	0.9778
3	0.00809	0.00383	0.0135	0.9914
4	0.00426	0.00337	0.0071	0.9985
5	0.00089	.	0.0015	1.0000

Variable	Eigenvectors 1	2	3	4	5
dd	0.69747	-0.71638	-0.01543	-0.00302	-0.00958
ya	0.11249	0.10914	0.47477	0.27240	-0.82209
yl	0.12781	0.10364	0.81800	-0.41074	0.36756
yi	0.06759	0.05152	0.22431	0.86866	0.43347
sp	0.69281	0.67933	-0.23435	-0.05016	0.03302

1992-93 (principal components; 5 components retained)

Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.45142	0.26111	0.6894	0.6894
2	0.19031	0.18025	0.2906	0.9800
3	0.01006	0.00752	0.0154	0.9954
4	0.00254	0.00204	0.0039	0.9992
5	0.00050	.	0.0008	1.0000

Variable	Eigenvectors 1	2	3	4	5
dd	0.35783	0.93354	-0.00208	0.01882	-0.00985
ya	0.12883	-0.06622	0.41642	0.48684	-0.75406
yl	0.17321	-0.05595	0.88046	-0.22352	0.37642
yi	0.07853	-0.04138	-0.03553	0.83744	0.53810
sp	0.90509	-0.34535	-0.22386	-0.10662	-0.00750

(Contd.)

Annexure Table : 3 Financial Management Indicators (Concld.)

1991-92	(principal components; 5 components retained)			
Component	Eigenvalue	Difference	Proportion	Cumulative
1	0.20102	0.12864	0.7075	0.7075
2	0.07238	0.06592	0.2547	0.9622
3	0.00646	0.00339	0.0227	0.9849
4	0.00307	0.00186	0.0108	0.9957
5	0.00121		0.0043	1.0000

	Eigenvectors				
Variable	1	2	3	4	5
dd	0.23821	0.97044	-0.02086	0.02005	-0.02577
ya	0.13291	-0.04257	0.66623	0.34059	-0.64858
yl	0.13154	0.00593	0.69497	-0.53888	0.45747
yi	0.08212	-0.01602	0.18091	0.76890	0.60750
sp	0.94950	-0.23694	-0.19995	-0.04456	-0.01866

Annexure Table: 4 Profitability Indicators

1993-94	(principal components; 6 components retained)			
Component	Eigenvalue	Difference	Proportion	Cumulative
1	2.55158	2.39059	0.9252	0.9252
2	0.16099	0.12482	0.0584	0.9835
3	0.03617	0.02816	0.0131	0.9966
4	0.00801	0.00681	0.0029	0.9995
5	0.00120	0.00113	0.0004	1.0000
6	0.00007		0.0000	1.0000

	Eigenvectors					
Variable	1	2	3	4	5	6
oprwf	0.84123	0.51974	0.10173	-0.10891	-0.00144	-0.00024
nprwf	-0.45810	0.63715	0.60904	0.06995	0.09123	-0.00640
nitwf	0.25766	-0.56593	0.78270	0.02046	0.00641	0.01599
incAast	0.12226	0.01964	-0.05207	0.98864	0.06507	-0.01744
oprOex	0.03365	-0.05551	-0.05731	-0.07161	0.99364	-0.00776
nprEq	-0.00446	0.01317	-0.00995	0.01679	0.00933	0.99967

(Contd..)

Annexure Table: 4 Profitability Indicators (Concld.)

1992-93 (principal components; 6 components retained)

Component	Eigenvalue	Difference	Proportion	Cumulative
1	10.02177	9.49917	0.9380	0.9380
2	0.52260	0.39582	0.0489	0.9869
3	0.12678	0.11460	0.0119	0.9988
4	0.01218	0.01187	0.0011	1.0000
5	0.00031	0.00015	0.0000	1.0000
6	0.00016		0.0000	1.0000

	Eigenvectors					
Variable	1	2	3	4	5	6
oprwf	0.94429	-0.25301	0.20598	-0.04201	0.00519	-0.00909
nprwf	-0.21380	-0.00662	0.97652	0.02068	-0.01519	-0.00201
nitwf	0.24477	0.96716	0.06078	-0.02804	0.00090	0.01435
incAast	0.05140	0.01613	-0.01020	0.99752	-0.03217	0.03022
oprOex	0.00483	-0.01628	-0.00055	-0.03795	-0.27489	0.96058
nprEq	-0.00561	-0.00376	0.01377	0.02312	0.96080	0.27584

1991-92 (principal components; 6 components retained)

Component	Eigenvalue	Difference	Proportion	Cumulative
1	37.99570	30.81356	0.8348	0.8348
2	7.18214	6.91658	0.1578	0.9926
3	0.26557	0.19590	0.0058	0.9984
4	0.06967	0.06664	0.0015	0.9999
5	0.00303	0.00293	0.0001	1.0000
6	0.00010		0.0000	1.0000

	Eigenvectors					
Variable	1	2	3	4	5	6
oprwf	0.09276	0.00159	-0.30221	0.93441	-0.16395	0.00755
nprwf	0.78486	-0.60925	0.10488	-0.04251	0.00247	-0.00161
nitwf	0.07493	0.23586	0.92538	0.28360	-0.04477	-0.00081
incAast	0.01324	0.00824	-0.00767	0.16883	0.97857	-0.11658
oprOex	0.00230	0.00030	0.00228	0.01285	0.11608	0.99315
nprEq	0.60795	0.75704	-0.20318	-0.12637	0.00559	-0.00019

Annexure Table : 5 Growth Indicators

1993-94 (principal components; 4 components retained)				
Component	Eigenvalue	Difference	Proportion	Cumulative
1	26.27789	24.93739	0.9389	0.9389
2	1.34051	1.04225	0.0479	0.9868
3	0.29825	0.22798	0.0107	0.9975
4	0.07027	.	0.0025	1.0000

	Eigenvectors			
Variable	1	2	3	4
d	0.08081	-0.00800	0.44389	0.89239
a	0.98480	-0.14579	-0.07940	-0.05099
i	0.05425	0.03765	0.89156	-0.44805
o	0.14383	0.98857	-0.04207	0.01677

1992-93 (principal components; 4 components retained)				
Component	Eigenvalue	Difference	Proportion	Cumulative
1	1.84648	1.23246	0.6178	0.6178
2	0.61402	0.14890	0.2054	0.8233
3	0.46512	0.40206	0.1556	0.9789
4	0.06306	.	0.0211	1.0000

	Eigenvectors			
Variable	1	2	3	4
d	0.21002	0.16487	0.01226	0.96362
a	0.48848	0.80562	-0.23262	-0.24134
i	0.04796	0.23213	0.96949	-0.06250
o	0.84557	-0.51952	0.07635	-0.09638

(Contd.)

Annexure Table : 5 Growth Indicators (Concld.)

1991-92 Component	(principal components; 4 components retained) Eigenvalue	Difference	Proportion	Cumulative
1	1.99869	1.37266	0.6330	0.6330
2	0.62603	0.24152	0.1983	0.8313
3	0.38451	0.23641	0.1218	0.9531
4	0.14810		0.0469	1.0000

Variable	Eigenvectors 1	2	3	4
d	0.79545	-0.48424	-0.29470	-0.21432
a	0.49197	0.86616	-0.03753	-0.07946
i	0.21813	-0.03711	-0.05819	0.97348
o	0.27865	-0.11789	0.95308	-0.00996

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BOOK REVIEWS

Agricultural Growth, Rural Poverty and Environmental Degradation in India, by C. H. Hanumantha Rao, Oxford University Press, 1994, Pp. 274, Price : 340

The development strategy of the post-independent India is surprisingly enough characterised by the absence of a well-defined comprehensive agricultural policy, notwithstanding some earnest efforts in the mid sixties for making a breakthrough in foodgrains output via a technological package. This does not mean that there was a dearth of literature on agricultural development of the country. In fact a number of pertinent issues were discussed, debated, and analysed: most of these relate to agricultural growth, land reforms, pricing policies, terms of trade, balance between agricultural and industrial development,rural poverty, environmental degradation and participatory rural development. Hanumantha Rao's preoccupation in the book under review is to present an integrated view of the growth, poverty and environmental issues involved in Indian agriculture, in the context of the economic reforms being undertaken since the middle of 1991. His basic intention is to convey the contours of effective policy formulation in the given developments in agriculture in the recent past.

Most observers are aware that the compound growth rate in agriculture was higher in the eighties than in the first decade of the Green Revolution (GR). The encouraging performance is often attributed to the spread of GR to crops and regions that were lagging behind in the past years. Nevertheless there remains the enigma of the gross fixed capital formation in agriculture at 1980-81 constant prices both by the public and private sectors showing a significant decline in the 1980s. The author tried to explain the decline in capital formation through the complementarity hypothesis where the decline in private investment is a consequence of deceleration in investment by the public sector. This has not been effectively proved, as a recent study by S.N. Mishra and Ramesh Chand shows that there is no uniform complementarity between public investment and private capital formation. Other things remaining equal, a rupee of public investment in agriculture induces private sector to invest by a value that is substantially higher than a rupee. If this is true,the fall in investment should have caused a decline in agricultural growth. This has not happened because the gains in agricultural output in

the eighties have come essentially from an improved utilisation of the available infrastructure, through the spread of new technology and particularly the enormous increase in use of fertilisers, as the author points out irrigation turns out to be an important factor influencing the consumption of fertilisers. Between one-fifth to one-fourth of the rise in output of foodgrains in the post-green revolution period can be attributed to the increase in total factor productivity. While this has a ring of plausibility, it is not clear why the decline in public investment during the 1980s should be attributable to the rising subsidies, both open and hidden, for agriculture in the same period, as the author has attempted.

While foodgrains output has increased sharply under the impact of the new technology, there has also been output volatility arising mainly from diverse agro-climatic conditions. Droughts, when they occur, have become severe in impact on account of ecological degradation.

When it comes to the question of distribution of gains from agricultural growth, unlike in the first decade of the GR, the experience has been that GR is spreading to new areas, particularly to the western and eastern regions, as Hanumantha Rao points out. The real wages have also started rising in the less developed regions, partly due to the shift of labour from agriculture to non-agricultural occupations and partly due to productivity gains. The consumers appear to have benefitted more than producers, especially in the case of rice and jowar. Yet it is important to recognise that there has been no rise in the employment elasticity with respect to output in agriculture. There are in fact suggestions in some studies of a fall in this elasticity.

The spread of GR is limited due to the nature of available technology and the uneven development of infrastructure (physical as well as institutional). The author finds a peaceful transformation in areas experiencing GR and believes that the development of capitalism has been constrained due to the existence of ceilings on land holdings. The existence of ceilings on land holdings however might not impede the development of capitalism, since only 8.8 per cent of the total number of operational holdings cultivate 44.6 per cent of the total area operated in 1990-91. It is in this context one sees insight in Hanumantha Rao's emphasis on the spread of bio-technology besides GR since it leads to possible saving on chemical inputs and land augumenting or land saving technologies. Moreover the pro-poor bias of the bio-technology arises from its scale neutrality at the farm level, saving on chemical inputs, stability in yields, and improved prospects for crops grown in unfavourable areas.

Poverty and agricultural development are closely inter-related. Three factors provide a reasonably good explanation for the regional variations in rural poverty (1) the extent of ownership of land holding (2) growth rate of output and (3) the price of cereals. One of the important statistical facts relating to the rural population below the poverty line for 1982-83 and 1987-88 is that there has been a significant reduction in the proportion of poor in the eastern and central regions. While this is a kind of an achievement, it must be recognised that poverty alleviation depends a great deal on resource allocation for agriculture, and that poverty alleviation programmes represent top down ventures depending on the effectiveness of the bureaucracy. In general the observed decline in rural poverty during the eighties has much to do with the operation of poverty alleviation programmes, despite the leakages. It is also generally recognised that the IRDP has better prospects in infrastructurally developed regions where awareness level and bargaining power of the beneficiaries are higher. In these regions nearly two-thirds of income from IRDP assets represent net addition to household incomes.

The author seems to convey the feeling that given the nature of the Indian polity and the political will, restructuring of rural institutions through redistribution of land could well mean a tour to an unknown and perhaps quixotic destination. As a result, poverty eradication has to be achieved, as Hanumantha Rao aspires, through a judicious mix of growth and poverty alleviation programmes. Infrastructure development, integration of rural employment programmes with augumented farm productivity and liberal assistance from financial institutions to the poor would have to constitute, part of the strategy for poverty eradication.

While the inter-connection between rural poverty and agricultural development are generally well articulated in the literature, there is very little focus on the environmental degradation that takes place in the pursuit of strategies for development and poverty eradication. Deforestation and chemicalisation of agriculture, population pressure and extensive cultivation have resulted in considerable environmental degradation. The proportion of population below the poverty line is much higher than the national average in the dry or unirrigated areas where rainfall is low and highly variable. Technological changes of land augumenting type such as irrigation and the use of HYV seeds and fertilisers may reduce pressure on the expansion of area under cultivation, and reduce the deleterious effects on environment.

Decentralisation, through the involvement of local level institutions in the formulation of plans for development as well as their implementation has been advocated by a number of economists including the author of the book under review in the interest of efficient utilisation of resources and for ensuring equitable share of benefits from development. Decentralised planning at the district level appears to have yielded good results in so for as land reforms are concerned in the case of Karnataka, West Bengal and Jammu and Kashmir. But the serious limitation of district level planning viz., its failure to reduce disparities of development in different regions, still remains to be addressed effectively.

As far as participatory rural development is concerned the author makes a correct observation that constitutional provisions alone would not be adequate and could work as substitute for the appropriate political will. A formal delegation of power to local institutions is therefore not sufficient unless measures are taken simultaneously to bring about structural changes to reduce the skewness in socio-economic power and to provide for adequate representation to the weaker sections. In order to make decentralised planning effective action may be required in five areas, as the author points out. Of these areas, modifications in centrally sponsored programmes, electoral reforms to ensure adequate representation to the poor at the local level and people's participation through voluntary organisations are important ones. But the question still remains as to whether all these could be implemented in the medium term.

The author has explored the perspectives for agriculture in the light of the on going economic reforms in India. The issues dwelt upon are the rising subsidies both open and hidden, and the restrictions on the export of agricultural commodities and the farm size and tenure. The subsidies on fertiliser, irrigation, electricity and credit combined together constituted around one-third of total plan expenditure on agriculture, irrigation and special area programmes incurred by the Centre as well as State Governments in 1980-81. The figure rose steeply to around 90 per cent of plan expenditure towards the close of the eighties. It is economically prudent to prune the subsidies and divert the same to raise investment in order to enhance the future growth prospects of agriculture. When it comes to the question of credit, the important point is the ability of formal credit institutions to meet the demand for credit rather than provide subsidies in the form of concessional lending or debt write-offs. On the exports of agricultural goods relaxations have been made since the publication of the book. With regard to the ceiling on land holdings, Hanumantha Rao's own view is that there is no case for removing ceiling

on land holdings on efficiency grounds. There is a case for flexibility of operation in this area. Freeing the lease market for land for efficient utilisation of land and augumenting the operational holdings of small and marginal farmers would be of help.

The book is highly readable and meticulously researched. It provides the stamp of authority of the author whose reputation as an agricultural economist is well established.

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Dynamics of Monetary - Fiscal Policy : An Indian Perspective, by D.M. Mithani, Himalaya Publishing House, Bombay, 1993, Pp. xvi+368, Rs. 450

The issue of supremacy of fiscal policy over monetary policy formed the core of an animated debate in the sixties between the two groups of economists, i.e., the Keynesians and monetarists. During the fifties and the sixties, the issues relating to economic development and post-war reconstruction brought the Keynesians to the forefront; as a result, monetary policy took a passive role subservient to fiscal policy. However, high unemployment and high inflation ultimately led to the demise of Keynesianism. Monetarists were successful in explaining the inflationary phenomena of the sixties and the seventies, with the attack on Keynesianism and the Phillips curve first initiated by Milton Friedman and later by other monetarists. The prolonged debate between the two schools of thought is reflected in the proliferation of theoretical and empirical research on this subject in the last three decades or so.

In developing countries, on the other hand, monetary policy has tended to be subdued because of development requirements which, given the limited private initiative, were addressed by enlarging the scope of the Government in economic activities. The problems that fiscal deficits leave on the economy and on the conduct of monetary policy are very important and require to be carefully addressed.

It is against this background, the book under review "Dynamics of Monetary-Fiscal Policy: An Indian Perspective" by D.M. Mithani needs to be seen. The book has two parts. The first part includes a theoretical discussion on the conflict and coordination of monetary and fiscal policy while the second part of the book is devoted to the experience of monetary-fiscal policy in India during the period 1970-71 to 1989-90.

Chapter 1 analyses the concept of "monetarism" in relation to the main postulates of the monetarists and outlines the various strands of "fiscalism". In Chapter 2 the author highlights the dimensions of the major policy framework and attempts to resolve the conflict between monetary and fiscal policies. The author is of the view that the nexus between the Central bank and the fiscal authorities stems essentially from

the former's role in the management of Government borrowings. In the author's view, the policy makers in India have expressed blind faiths in the Keynesian prescription, which underscores the subordination of monetary policy to fiscal policy. However, as it has evolved, the near segregation of practice of monetary policy and fiscal policy in India has, according to the author, created serious macro imbalances in the economy. The author, therefore, suggests that a fresh look needs to be given to monetary fiscal policy nexus in India.

In the Chapter on 'monetary-fiscal policy coherence' the author has discussed various instruments for targeting optimal monetary-fiscal policy mix in a developing country. The prime objective of promoting development with price stability necessitates coherence and proper coordination among a set of policies viz., tax and public expenditure policies, public debt policy and monetary management. Under such an environment it is possible to choose a budget deficit target which would be consistent with a target growth in money supply. In fact, the very concept of monetary-fiscal policy 'mix' presupposes that the central bank and the Government enjoy some freedom of choice, and some discretionary power within some limit, so that even while they set monetary and fiscal instruments independently, these two policies complement each other in attaining the desired macroeconomic objectives. This condition however, is not often met in practice in most developing countries. The author has made a candid presentation of the policy coherence in India in reviewing the working of monetary and fiscal policies.

No study on the subject would be complete without a discussion on inflation. Monetarists hold the view that in a developing economy inflation is a consequence of an excessive growth of money supply in relation to demand, while the structuralists hold inflation as the outcome of structural disequilibrium in the growth process of a developing economy. In Chapter 4 the author has cited the major empirical studies on approaches to study inflation in India. The author observes that the long run elasticity of wholesale price index (WPI) with respect to broad real money supply is higher than that of narrow money supply. Taking cue from the structuralist approach, the author also finds that the wholesale price index is largely influenced by variations in prices in manufacturing sector and not so much by food prices. But his empirical analysis seems to suggest that inflation in India has been primarily a monetary phenomenon. The author has followed an unusual approach in modeling the functional relationship between the wholesale price index and money supply. By regressing the ratio of money supply to GDP on wholesale price

index, the author concluded that lagged money supply growth has a positive impact on inflation in India. However, the demand for money function of the Cambridge Cash-Balance Approach shows that money supply-GDP ratio is nothing but the inverse of velocity of money. Thus, the regression model could be reflecting the relationship between price and velocity of money instead of price and money supply.

The book raises certain conceptual issues on the definition of money stock in India. Two additional measures of money supply have been introduced by the author. They are;

M5 = M3 + CDs, and M6 = M1 + TB1 + TB2 + TB3.

The proposed M5 raises some double counting problem as Certificates of Deposits (CDs) are already included under time deposits. In the case of the proposed M6, the inclusion of various Treasury bills (TBs) suffers from a further misconception. Treasury bills form the assets of the banking system whereas money supply should reflect the liabilities of the banking system.

In the Chapter on the review of interest rate policy in India, the author has observed that interest rate did not contribute significantly to the growth of aggregate savings in India. In a developing country, bank deposits are preferred by households because of their advantage in terms of liquidity, safety, provision of contingency, social security etc., rather than on the consideration of return. Households' preference for contractual assets, for reasons of social security, could be a major reason for lack of interest sensitivity of savings in India. This may be a statistical problem since interest rate is 'administered'. As is to be expected the book shows a negative impact of inflation on the savings rate which implies that inflation adversely affects savings performance in developing countries.

In Chapter 8 the author has explored the emerging trends of fiscal imbalances in India and the adverse consequences of rising fiscal imbalance for the economy. In the author's view, the monetised debt has been a significant factor contributing to inflation in India. In order to ensure price stability, the author suggests that emphasis should be placed on monetised deficit rather than Gross Fiscal Deficit (GFD) in ensuring coordination between monetary policy and fiscal policy. While the monetary concept of Government deficit is somewhat broader than the conventional deficit, the focus on monetised deficit alone, even from the view point of maintaining price stability, could be misplaced, in the absence of proper emphasis on the overall magnitude of borrowings of the Govern-

ment. If the overall borrowings of the Government, or fiscal deficit remains high and proves unsustainable in the medium to long run, a low monetised deficit may simply imply trade-off between the short run and long run price stability. This may raise the familiar credibility problem as high fiscal deficits can be taken as a signal for future monetisation of public debt and higher rates of inflation. It is in this context that a view needs to be taken on the desirable level of fiscal deficit, which could be sustained with proper coordination between fiscal and monetary policies. This is a major area which the author has left uncovered in his book.

Discussing the supremacy of 'fiscalism' over 'monetarism' in India the author has rightly observed that for a long time monetised deficit was treated a residual item in the budget which in some sense assumed exogenity of inflation from fiscal policy. A rational strategy, according to the author, would be to target the inflation rate first and then regulate the growth of money supply in proper coordination with fiscal policy. The author has tried to establish a relationship between inflation rate and debt creation through market borrowings, on one hand, and borrowings from the Reserve Bank, on the other, and found that bond-financed deficit is anti-inflationary whereas money-financed deficit is pro-inflationary. There is a broad agreement in the literature on the view that money-financed deficit is more expansionary than bond-financed deficit in the short-run. Bond-financed deficit may not necessarily lead to low inflation if the resources so mobilised are used to finance government consumption.

Despite some of the analytical shortcomings, the study has successfully raised certain key research issues, which need to be further probed into by future researchers.

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