RESERVE BANK OF INDIA

OCCASIONAL PAPERS

VOL. 16 NO. 2 JUNE 1995

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VOL. 16 NO.2 JUNE 1995

Published by A. Vasudevan for the Reserve Bank of India and printed by him at Karnatak Orion Press, 17-18, Prospect Chambers Annexe, Dr. D.N. Road, Fort, Bombay - 400 001.

Reserve Bank of India Occasional Papers
Vol. 16, No. 2, June 1995

The Demand for Money in India: Stability Revisited

Himanshu Joshi and Mridul Saggar*

It is by now well known that an estimation of log linear Goldfeld type specification for explaining the demand for money is inappropriate in the light of the new concept of 'cointegration' propagated by Engle and Granger (1987). Consequently, evidence of stability assigned to these models needs to be re-examined. This paper purports to explain the demand for money in India using conventional explanatory variables as well as a measure of wealth for the period 1960-61 to 1992-93 by using multivariate cointegration analysis suggested by Johansen (1988). Empirical evidence on stability reported in this study are based upon theoretically robust parameters of unconstrained and parsimonious short run models estimated in one step. To operationalise stability tests we use kalman filter based standardised prediction errors derived from error-correction models and transform them appropriately to generate cubic sum of square (CUSUMSQ) test plots. Empirical results obtained in this study exhibit no **in-sample** evidence of instability in error correcting short run narrow and broad money demand functions for the period under consideration. Estimated short run models for real M1 and M3 are finally adjudged against their ability to produce acceptable **out of sample** forecasts. The performance appears to be reasonably good.

The link between the demand for money balances and aggregate income is one of the central themes in the theory and practice of monetary economics. Naturally, it is embedded as a recurring issue in the literature on money. The subject, however, has received inadequate attention in recent times in the Indian context. This is somewhat surprising as one would expect the on-going financial innovations and regulatory changes to re-open the question of stability of the money demand function.[1] Secondly, there is a recognition that money demand models of yesteryears, mainly based on the Goldfeld (1973) equation or one of its variants, suffers from the application of the least squares technique to non-stationary variables ignoring their time-series properties but this has hardly been adequately addressed. The least square technique leads to 'spurious infer-

* The authors are Assistant Advisors in the Department of Economic Analysis and Policy. They are grateful to Professor Ashok Parikh for the discussions they had on various aspects relating to application of the Johansen & Juselius (1990) procedure and to Dr.A.Vasudevan, Prof. Kunal Sen and Shri Madhu Mohanty for making a number of helpful suggestions on an earlier draft of this paper. The usual disclaimer applies.

ences' because the usual t-and F-statistics do not have exact limiting distributions (Phillips,1986). There is, therefore, a need to re-estimate the money demand relation in India by employing a co-integration framework. The efforts made so far in the direction have been limited, with only three studies available, viz, those of Moosa (1992), Nag and Upadhyay (1993) and Parikh (1994). But these fail to relate money balances to aggregate income leaving a number of questions unanswered from the policy-maker's viewpoint.

Our purpose in this paper is to examine if there exists an underlying equilibrium relationship between real money balances and a given set of variables that explain it, including the aggregate real income. We explore this question by studying the long-run monetary relationship and its short-run dynamic adjustments through application of co-integration, error-correction procedures. For this, the recent test procedure of Johansen and Juselius (1990) is preferred to Engle-Granger (1987) and Stock-Watson (1988) methodologies as not only its representation makes all variables endogenous leaving results insensitive to choice of dependent variable, the test statistics have exact limiting distributions as well.[2] Also, the chosen procedure allows for hypothesis testing through restrictions on coefficients in the cointegrating vector as well as on the corresponding weights.

Our work extends on the three previous efforts for the Indian case in three important ways. First, on the specification side, we incorporate aggregate real income instead of trying to proxy real activity through the Index of Industrial Production (IIP). In India, the share of industry in GDP averaged merely 20 per cent over the last three decades. Households engaged in farm and services activities exert a considerable influence over money balances and therefore, industrial production alone cannot be construed to drive the money demand. Besides, from the practioner's viewpoint, the use of IIP restraints policy-maker from obtaining important information content in the form of income-elasticity which provides the basis for monetary targeting. No doubt, the higher frequency of the data on IIP which is monthly compared to annual GDP series enables researchers to have a larger number of observations but the concern for correct specification should override this consideration.

Apart from the activity variable, our specification also differs in that it finds that the opportunity cost variable does not enter the cointegrating vector. We considered the rate of inflation as an opportunity cost variable

as the option available to most of economic agents is not between holding of money or placing it in the call market but between money and the cost of holding it. Most of the interest rates, including the call money rate, were regulated in one way or another in the past several years. Therefore, inflation rate becomes more meaningful as an opportunity cost. However, inflation rate, like interest rates, do not satisfy unit root properties.[3] Following Corker (1990) we also include, for the first time for India, a measure of the stock of financial wealth in the model to capture portfolio decisions effected by agents among financial assets and the national product. Secondly, we employ statistical procedures which would increase the credibility of the results even with a small sample as normality in distribution is established. Thirdly, we examine parameter stability through recursive estimation based on CUSUMSQ statistics. Examining the stability of money demand relationship is important as shifts in functional relationship has vital implications for monetary management.

The paper is organized as follows. Section I discusses the literature on money demand function against the backdrop of issues relating to monetary policy and financial liberalisation. Section II gives a description of the experimental design and the empirical results of the specified long run and short run forms. Section III reports on the dynamic tracking and the out-of-sample forecasts generated by our model, together with the conclusions following our exercise. Also, a summary discussion on test procedures related to cointegration and error correction modeling is provided in the technical appendix in the end.

SECTION I

The significance of a stable money demand function for monetary policy with aggregate activity as endogenous variable, lies in the fact that it facilitates the setting out of parameters which are useful for the central bank to control monetary aggregates to stabilise the economy. The test of a stable money demand function which has applied policy utility, to a great extent lies in its predictive power reflected in its out of sample forecasting performance. Under the IS-LM framework, the stable money demand translates into a stable positioning of the LM curve and if IS curve also turns out to be stable, it implies money supply can have a predictable influence on the level of activity. In practice, we live in a stochastic world in which random shocks disturb IS-LM relationship and following Poole's (1970) seminal analysis we know that the efficacy of targeting money supply rests mainly on the stability of money demand

function. Friedman (1968) strongly argued that the money supply cannot influence real output in the long-run and given this neutrality proposition, stable money demand functions provide credibility to the quantity theory with a predictable influence on the general price level.

Central banks, all over the world, have long recognised the existence of stable money demand functions as a key to effectiveness of monetary policy. Rangarajan (1989) argued that, "if one were to deny the existence of a reasonably stable demand function for money, there will be very little scope for monetary policy to play role in inflation management." Volcker (1978) acknowledged that evidence of a stable money demand function amidst rising inflation forced the Fed to focus more on control of monetary aggregates in order to check price level.

Evidence on demand for money by and large, supports the hypothesis of a stable relationship between money, output and prices in respect of a large number of countries. In the United States, the stability was considered an established fact following Goldfeld's (1973) examination of quarterly post-war data. The money demand function was found to be more stable based on a narrow definition of money and when current income rather than wealth, and interest rates on short-term instruments (like the treasury bill or commercial paper rates), alongwith the lagged dependent variable were incorporated as explanatory variables. However, out of sample forecasts from Goldfeld's equation began over-predicting real money balances since 1974 and this led to a veritable explosion of research across the globe to find out whether innovations, liberalisation and institutional changes in financial markets have caused shift(s) in the money demand relationships. Arango and Nadiri (1981) and Boughton(1981) found that with the exception of Canada, narrow money demand remained stable in the case of France, Germany, Japan and United Kingdom. The evidence on instability has been limited to a few periods - episodes - for a few countries. However, Granger and Newbold (1974) asserted that non-stationarity in the log-level or log-difference formulation of economic variables produce spurious regression results, throwing most of the findings on money demand into serious doubt and prompting researchers to revisit the money demand function. Hendry (1980,1985) demonstrated that parameter instability in the case of US and UK money demand functions could be explained by incorrect specification leading to spurious results. Recently, the co-integration and error correction model (ECM) framework has become a standard tool to determine money demand stability. Hafer and Jansen (1991) and Miller (1991) addressed the demand for money in US through such a framework and

found that unlike the earlier literature, broad money aggregate was more stable than the narrow money - a result which first gained credibility following the results of Hallman, Porter and Small (1989).

The empirical evidence on the demand for money in India also supports the hypothesis of a stable long-run relationship. While reviewing the earlier works, Vasudevan (1977) observed that the literature suggests that money demand in India responds more to income than interest rates and that broader definitions of money yields a more stable demand function. Singh *et.al* (1982), however, preferred a relationship with narrow money stock though they too found a predictable function of a limited number of explanatory variables using an approximation for activity at quarterly interval. Numerous other studies followed, confirming stable money demand while throwing a mix of evidence on the relative stability from different specifications and different money stock measures. Quite a few of them have continued to employ single-equation OLS model or a traditional simultaneous equation system in which money demand continues to be estimated through least squares. As late as in 1990, studies continued to rely on traditional econometric techniques that do not provide for unit root testing.

However, the money demand relationship is far from settled in the Indian case. The financial structure has undergone a considerable change over the years. The nationalisation of 14 commercial banks in 1969 has made the seventies different from the experience of the sixties. More importantly, the demand side could have been influenced more directly in the eighties with the developments in the capital markets having a profound bearing on the money markets. Portfolio substitutions appear to be pronounced in the eighties. One may cite the example of growing investments of households in shares and debentures. These instruments accounted for merely 3.7 per cent of the gross household saving in financial assets in 1980-81 but increased to 22.2 per cent by 1991-92.[4] Today, a host of mutual funds operate in capital market and provide portfolio management services to households as well as corporates. Also, available on tap are small saving instruments used by the government to finance fiscal deficits. A fledgling market for government debt, a buoyant market for primary issues in stock market, a number of new instruments in both these markets, the introduction of instruments such as Certificates of Deposits and Commercial Papers have brought about new elements in which money demand would have to be studied afresh with an eye on possible shifts in the function. Now that the framework for empirical testing has undergone a radical shift, it is essential to use the cointegration-

ECM framework- a discussion on which is presented in the Technical Appendix to this paper.

SECTION II

This study purports to develop and estimate not only a long run equilibrium money demand relationship for the period 1960-61 to 1992-93 but also a shorter term error correction model for India.[5] Real money demand as usual is expected to depend upon a set of proximate variables such as real income or GDP, a representative rate of interest (or opportunity cost), real wealth (proxied by outstanding financial assets held mainly by the household sector) and real exchange rate (to study the effects of exchange rate adjustments carried out either under policy judgments or by the market itself). In keeping with these set of variables we have chosen the following time series for estimating the money demand function: (i) real broad money (M3 deflated with WPI on average basis) and real narrow money (M1 deflated with WPI on average basis) (ii) wholesale price index (WPI),base 1981-82=100 (iii) 36 country trade weighted real effective exchange rate (REER) index published by the RBI (v) real GDP at factor cost (GDPR) at 1980-81 prices as an activity variable and (vi) real financial wealth (FINSVG) proxied by a sum total of outstanding market capitalisation in the capital market and small savings deflated with WPI. We exclude provident and life insurance funds, as amounts collected under this head are mainly involuntary and contractual, and are not amenable to portfolio shifts. As stated earlier in Section I, in this study we consider the rate of inflation (INFL) based upon WPI in preference to the rate of interest as a measure of opportunity cost.[6] It is expected that the demand for both real M1 and M3 should respond negatively to INFL. Our choice of the rate of inflation as a measure of opportunity cost is obvious in view of the existence of regulation on the rate of interest on deposits during the entire sample period chosen for this study. The aim of this paper is to identify pairs of variables that could be cointegrated in the standard function of money demand in order to identify and construct an empirical long term equilibrium relationship among these variables. Discovery of cointegrating vector(s) implies a concomitant existence of an error correction process which could be operationalised to decipher short run variations in money balances in response to changes in explanatory variables. Finally, it is also useful to set up a kalman filter based test to examine the stability of the estimated function(s). It may be noted that kalman filter based recursive residuals are transformed to develop statistics for the CUSUM and CUSUM-Square tests due to Brown *et al* (1975).

The first step according to the discussion in Section I is empirical testing of unit root for various data series. Among the various tests available, we have employed the Phillips-Perron (PP) test with a constant and time trend. The results are presented in Table I. An examination of test statistics in Table I shows that all data series are integrated of order one, except for the rate of inflation which is justifiably dropped in the rest of the analysis.

Table I : Phillips Perron (PP) t-test for Unit Root

Variable	PP-statistic	Integration
REER	-2.43*	I (1)
real M3	0.32*	I (1)
real M1	0.40*	I (1)
real GDP	-0.16*	I (1)
FINSVG	-2.67*	I (1)
INFL(inflation)	-4.27	I (0)

Notes

a) *PP t-tests are based upon having a time trend, an intercept and one lag of the differenced series in the model except for INFL where no trend was employed. The Phillips and Perron (1988) Z_t statistic-a modification of the ADF test statistic was chosen because it carries out non-parametric adjustments for any possible serial correlation or heteroscedasticity in the residual.*

b) *INFL is inflation rate based upon the WPI.*

c) *An asterisk indicates that the series are non-stationary. The critical 1 percent value for PP-statistic for the null is -4.38 when a trend is employed and -3.75 when there is no trend. For a series to be stationary the value of PP t-statistic should be less than the critical value.*

Models explaining demand for real narrow and broad money balances were set up by selecting appropriate explanatory variables (which include GDPR, REER, and FINSVG). Trace and Maximum eigenvalue tests, a' la Johansen and Juselius (1990), imply that both real narrow and broad money aggregates are cointegrated with real GDP, real effective exchange

rate (REER) and real financial wealth. Trace and maximum eigenvalue (Max-E) statistics for the these models are given in Tables II and III against the 95 per cent critical values given for the Johansen and Juselius (1990) procedure.[7] It may be mentioned that while the trace statistic (which is a likelihood ratio) tests the hypothesis of the existence of a r^{th} order rank of the long run impact matrix, the maximum eigenvalue statistic tests the existence of an $(r-1)^{th}$ order rank against an r^{th} order rank of the long run impact matrix. The distributions of these statistics are non-standard and are tabulated in Johansen and Juselius (1990).

Table II : Trace and Max-Eigenvalue Statistic for Real M1

Rank	Trace	Trace (0.95)	Max-E	Max-E (0.95)
r < = 3	0.281	3.962	0.281	3.962
r < = 2	9.498	15.197	9.217	14.036
r < = 1	29.439	29.510	19.941	20.778
r < = 0	68.172	47.181	38.732	27.169

Note: 95 percent critical values from Table A1 in Johansen and Juselius (1990) with an unconstrained constant.

Table III : Trace and Max-Eigenvalue Statistic for Real M3

Rank	Trace	Trace (0.95)	Max-E	Max-E (0.95)
r < = 3	0.714	3.962	0.714	3.962
r < = 2	13.518	15.197	12.804	14.036
r < = 1	30.486	29.509	16.967	20.778
r < = 0	77.014	47.181	46.528	27.169

Note: Explanation same as in Table II.

Trace and maximum eigenvalue tests for the chosen specifications for real M1 and M3 demand functions show that the hypothesis of zero cointegrating vector is rejected. In each case and according to each of the two different tests employed, the existence of cointegrating vector(s) is validated and this characterises stationary long term equilibrium relationship among money, output, effective exchange rate, and financial wealth.

However, while the trace test implies the existence of two cointegrating vectors in case of real M3, both the maximum eigenvalue and trace tests infer only one in case of real M1.

Operationalised models are found statistically adequate on the basis of residual diagnostics in M1 and M3 equations in the Jarque-Bera (1980) (J-B) sense. While the J-B test statistics (distributed as chi-square with degrees of freedom 2) turn out to be 3.9 and 3.5 in M1 and M3 specifications, these residuals also show very little skewness and serial independence vide Engle's ARCH test. In view of these properties, efficiency, consistency and unbiasedness of estimates of cointegrating vectors are guaranteed. Deviations from normality are, however, often detected in empirical studies (Johansen and Juselius,1990 and Parikh, 1994) and arise as a result of the smallness of sample size or production of some large residuals. The real effective exchange rate and financial wealth equations in our case however, show prominent non-normal characteristics which could be due to reasons alluded to earlier[8]. As a caveat it must be mentioned that the robustness of the ML cointegration procedure for deviations from normality has not been investigated so far (Johansen and Juselius, 1990).

The following cointegrating vectors or equilibrium relationships were obtained for the M1 and M3 models.

Real M1 = [0.005 (GDP), 1.404 (REER), -0.073 (FINSVG)]

and,

Real M3 = [0.031 (GDP), 6.226 (REER), -1.183 (FINSVG)]

Estimated equilibrium relationships show that all signs are in accordance with theoretical precepts[9]. In the M1 relationship, the coefficient on the income variable is positive. A positive sign on the real exchange rate variable implies that a depreciation of the domestic currency leads to a decrease in narrow cash balances. In terms of the postulates of Branson and Buiter (1983) this could mean that by raising the general price level, the exchange rate depreciation reduces real wealth and the demand for real balance. The effect more than offsets the absorption reducing effect of exchange rate depreciation through a rise in wealth on account of the net debtor position in terms of ownership claims on the rest of the world. Finally, agents reduce cash balances in the face of increasing financial wealth. It is understandable that in an economy characterised with limits on the degree of freedom of financial markets, the growth in financial innovations would lead to dominating substitution effects between money

balances and financial assets in keeping with the risk-reward perceptions of the agents. In the M3 relationship, results imply a positive income coefficient. As in the case of real M1, the coefficient of REER in the M3 function turns out positive which implies that a depreciation of domestic currency leads to an decrease in broad cash balances in the long run. This evidence is, however, contrary to the results obtained by Bahmani-Oskooee(1991) for the U.K and Bahamani-Oskooee and Pourheydarian(1990) for the U.S and Canada. However, though indicative of the efficacy of monetary policy in an open economy macro-economic framework, the result of the positive coefficient we obtain on the REER coefficient, needs to be interpreted with caution.

In an extension of this analysis we undertake hypothesis tests of weak exogeneity with respect to each of the variables included in the models. Table IV and V below contain likelihood ratio statistics for testing weak exogeneity for explanatory variables included in our chosen systems.

Table IV : Testing Weak Exogeneity in M1 System

Hypothesis	zero loading on	LR(2)-stat
alfa (1) = 0	GDP	6.98 (0.01)
alfa (2) = 0	REER	1.48 (0.22)
alfa (3) = 0	FINSVG	3.97 (0.05)

Note : Figures in parentheses in the fourth column show p-values or significance levels.

Table V : Testing Weak Exogeneity in M3 System

Hypothesis	zero loading on	LR (2)-stat
alfa (1) = 0	GDP	7.98 (0.00)
alfa (2) = 0	REER	0.47 (0.49)
alfa (3) = 0	FINSVG	5.61 (0.02)

Note : Figures in parentheses in the fourth column show p-values or significance levels.

Results in Tables IV and V imply that the hypothesis of weak exogeneity is upheld for REER in case of both real M1 and M3 functions while it is rejected for GDP and FINSVG. The significant adjustment coefficient associated with the FINSVG equation implies that the speed of adjustment towards its equilibrium state is indeed significant.

General short run dynamic error correction models for real M1 and M3 are constructed once the phenomenon of cointegration among a set of variables is observed. Symbolically, a simple short run model could be expressed as follows.

$$\text{dlog } Y = F(\text{dlog } X1_{t-1}, \text{ dlog } X2_{t-1}, \text{ dlog } Y_{t-1}, EC_{t-1}, \text{ constant}) + u_t$$

where, 'dlog' implies first difference in natural logs and Y and X_i denote dependent and explanatory variables, respectively. The error correction term denoted as EC_{t-1} incorporated in the short term equation is the equilibrium error. A significant presence of this component in error correction equation implies that the system is out of a long term equilibrium and that it has the ability to move towards the equilibrium state. Alternatively, the error correction model could also be specified unconstrained in which case we employ lagged values of all or some level form variables introduced in the long run equation.

Unconstrained empirical error correction models corresponding to cointegrating systems identified for real M1 and M3 are computed using the OLS through one-step estimation and are presented in Tables VI and VII, respectively. It should be mentioned that these models were obtained through an extended search under general to specific modeling strategy popularised by Hendry and are found to provide good out of sample forecasts in the short run. This approach towards 'hunting' models after a cointegrating relationship is discovered has gained widespread acceptability and is now commonly employed in applied economics (McDonald and Taylor, 1994).

From the unconstrained error correction models presented in Tables VI and VII, it could be observed that these are quite simple in content. In both models lagged level form variables are significant and with expected signs. In case of real M1 the signs on d-GDP and d-REER are positive even though not largely significant. In case of real M3 equation, in the short run, real GDP has a significant and positive impact. The sign observed on FINSVG is consistent even though not clearly significant. As mentioned earlier the choice of these models was predicated upon the

desire to have models which perform consistently well in out of sample forecasts. Also, the relative insignificance of some of the important short run variables could occur as a result of serial correlation in the residuals. In this regard, an application of say, Phillips and Hansen (1990) procedure would correct efficiency but in any case is unlikely to significantly alter the numerical estimates of the coefficients arrived without such a correction.

Table IV : Unconstrained Error Correction Model for Real M1

Variable	Coefficient	t-statistic
constant	-101.529	-2.74
d GDPR	0.001	1.16
d REER	0.298	1.25
M1-1	-0.421	-2.98
GDP-1	0.001	3.50
REER-1	0.339	2.00
DW stat = 1.32		Rbarsq = 0.61

Table VII : Unconstrained Error Correction Model for Real M3

Variable	Coefficient	t-statistic
constant	-132.520	-3.270
d GDPR	0.003	2.940
d FINSVG	-0.003	-0.320
M3-1	-0.259	-2.920
GDPR-1	0.002	3.310
d M3-1	0.507	2.410
$\rho^*=0$		Rbarsq = 0.75

Note: ρ^* *was found to be significantly not different from zero on the basis of test of autocorrelation with Durbin's alternative formula for cases where in presence of a lagged dependent variable. T. Var* (α) *is greater than unity, making h-statistics inapplicable.*

These short run models possess desirable goodness of fit statistics and have been subsequently subjected to stability and forecasting subroutines.

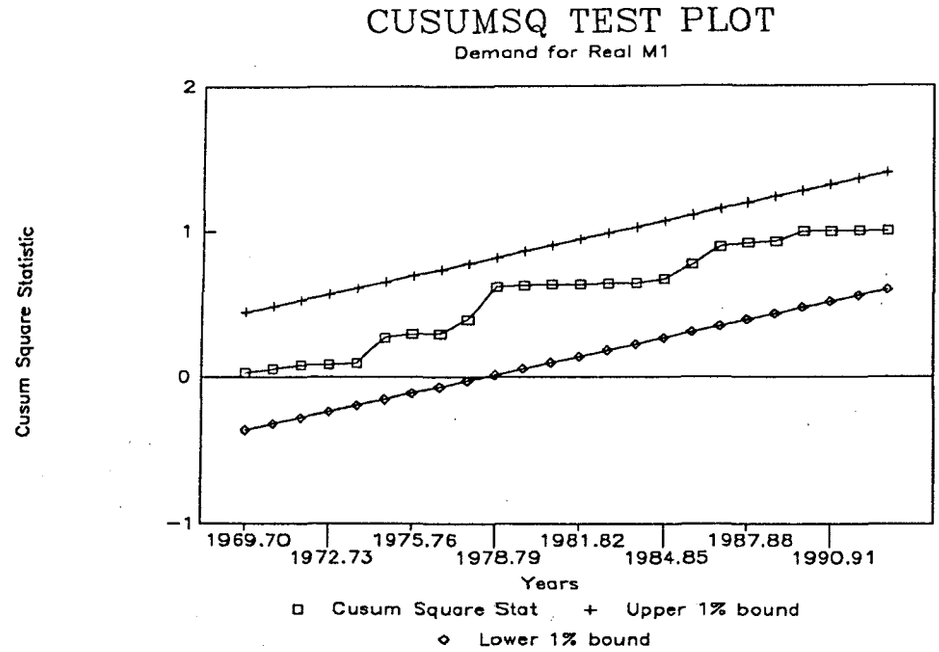
SECTION III

In this paper a robust demand for money function was estimated by employing Johansen and Juselius (1990) multivariate cointegration procedure. Long term cointegrating relationships for real M1 and M3 functions were identified and finally unconstrained error correcting forms were estimated. Empirical evidence in this study shows that real GDP, trade weighted real effective exchange rate and real financial wealth as a set are cointegrated with real M1 as well as with real M3. LR tests for weak exogeniety show that real effective exchange rate is weakly exogenous in the system. But this, as has been mentioned, is because the real effective exchange rate has been largely managed over almost the predominant part of the sample period under consideration. Also, capital mobility has been low during the same period.

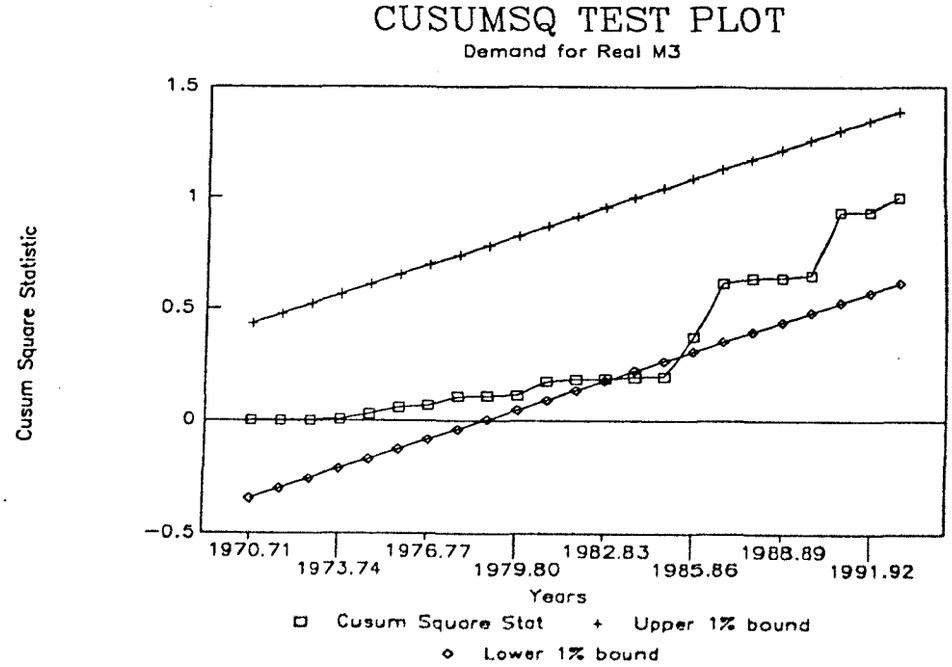
An interesting feature contained in the study is the effect of financial wealth upon the demand for narrow and broad real money balances which are found to be negatively related to the former in the long run. This is a clear reflection of portfolio substitution effects in the models posited here. Short run effects of real GDP are positive for both narrow and broad balances implying that these are important in explaining the short run demand. On the other hand, the short term path of broad balances is negatively affected *inter-alia* by real financial wealth implying portfolio shifts as real value of financial stocks increases mainly on account of rising share prices.

An investigation of the stability of specified error correction or short run models of demand for both real M1 and M3 for the period 1969-70 to 1992-93 confirm that there exists no significant **in-sample instability**. This evidence on stability is upheld at a significance level of 1 per cent since the CUSUM Square graph stays within 1 per cent bounds during the period under consideration, except for a brief episode of 1982-84 and that too in case of M3 alone, where CUSUMSQ in any case stay within the 5 per cent bounds. Finally, but not the least, the usefulness of this exercise must be judged against the in-sample dynamic tracking and out of sample forecasts produced by short run models. While tracking is based upon successive estimation and reapplication of dependent variable in the models over time, the out of sample forecasting is

Graph - A



Graph - B



the most stringent test of a model's stability and usefulness. In Table VIII below we report tracking beginning 1987-88 to 1992-93.

Table VIII : Dynamic Tracking

Year	M1 model		M3 model	
	Actual	Forecast	Actual	Forecast
1987-88	5.92	5.14	8.14	5.83
1988-89	6.68	6.61	9.60	8.24
1989-90	11.90	9.21	10.68	8.85
1990-91	6.55	6.87	5.74	7.16
1991-92	4.84	5.21	3.08	4.17
1992-93	4.80	4.63	7.51	8.50

Note: Numbers in the Table imply growth rates in real M1 and M3 quantities in corresponding years.

An examination of dynamic forecasts presented in Table VIII suggest that except for the year 1989-90 when these were underestimated, the forecasts for other years are good with the difference between the actuals and forecasted values generally turning out to be less than 1 percentage point in case of M1 model. In case of M3 model also, the turning points are adequately captured in the simulation.

Apart from the dynamic tracking of monetary growth rates reported here we also attempted a two period ahead *ex-ante* forecast for the years 1991-92 and 1992-93. In conducting this exercise, the sample was truncated at 1990-91 and the entire estimation procedure was replicated. Out of sample forecasts were then produced for the next two years. The forecast for the growth of real M1 for the years 1991-92 and 1992-93 turned out to be 5.37 and 4.72 per cent as compared with the actual figures of 4.84 and 4.80 percent during the same years, respectively. In case of real M3, for the years 1991-92 and 1992-93, growth rates were estimated at 2.65 and 6.23 per cent as compared with the actuals at 3.07 and 7.51 per cent, respectively. Parsimonious models set up in this study appear to perform well in capturing out of sample turning points, lending credence to the underlying long run and short run representations. While, the method of empirical estimation followed in this paper yield encouraging results, more intensive research effort will be necessary to see

if even more accurate forecasts can be generated for the purposes of better policy support. This might necessitate inclusion of new and missing information into models as well as an attempt to control errors of observation and noise which often disturb aggregate data to some extent.

Notes

1) A useful survey of empirical evidence on the impact of financial innovations and regulatory changes on the stability of money demand function in case of U.S. and some other OECD countries is presented in Judd and Scadding (1982). The impact of innovations and regulatory change has, however, not received similar consideration in empirical work on money demand in India.

2) Furthermore, Monte Carlo evidence of Gonzalo (1989) suggests that Johansen's maximum likelihood technique for empirical testing of a cointegration relationship performs better than single equation methods and alternative multivariate methods.

3) The incorporation of inflation rate as an opportunity cost measure when interest rates are regulated has also been underscored in Johansen and Juselius (1990). However, both term deposits and inflation rate fail to enter the cointegrating space in the Indian case.

4) These are inclusive of units of UTI and of other mutual funds.

5) The choice of the period has been dictated by the availability of reliable time-series for variables employed in the study. The time-period taken is smaller than in case of many similar studies for the developed countries, but is in line with the availability of data and past tradition for empirical work for India. The empirical work is based on annual data frequency. In somewhat similar approach Lothian and Taylor (1992) demonstrate that the total length of the sample period, rather than the frequency of observation, should be considered important when examining the long-run properties of time series and that higher frequency observations are unlikely to affect the results significantly. Gonzalo's work with the Johansen and Juselius methodology reinforces this view.

6) Wholesale Price Index (WPI) is widely used in the Indian case to measure the inflation rate in the economy as it has a large coverage of commodities and its computation is based on a well set reporting system. However, as the WPI is affected by changes in administered prices, the choice of Consumer Price Index (CPI) or a GDP deflator may not be discounted altogether, even though we preferred working with the WPI. It is also possible, that expected inflation rate than the inflation rate itself, serves as a better measure of opportunity cost for holding money. Furthermore, it is also possible that with a move towards a market determined interest rate structure, in times to come some benchmark interest rate - short or long, or the entire term-structure of interest rates could be serving as an opportunity cost for holding money balances. These could be useful lines of investigation in future research in this area.

7) The critical values were first presented in Johansen's (1988) paper for VAR without an intercept term. Johansen and Juselius (1990) reported critical values for VAR systems with a constant for systems upto 5 variables. These critical values have been extended by Osterwald-Lenum (1990) for system upto 11 variables.

8) This is hardly surprising as exchange rate are known to be lepokurtik in distribution with a high frequency data displaying strong ARCH effects.

9) The normalized real money cointegrating vector implies a short-run income elasticity of 1.215 for narrow money and 2.274 for broad money. While the broad money income elasticity is higher than has generally been found in case of conventional money demand functions, our narrow money income elasticity is closer to that found in such earlier studies.

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Technical Appendix

From a theoretical standpoint, the theory of cointegration implies the existence of a centre of gravity type linear attractor around which observations of some data series may be found to cluster along time. In other words, while an individual economic variable, viewed as a time series, could wander extensively, yet some series may be expected to move so that they do not drift too far apart. The concept of an attractor is notionally equivalent to a static long run economic equilibrium of variables that are 'cointegrated' in Granger sense. If, therefore, a system of variables is cointegrated, their drifting in relation to the attractor is not permanent and there is a tendency to come back to it. For instance, if money supply and prices are cointegrated then they will move together along the said attractor. A short run shock, however, could disturb either of these variables off the attractor and institute an equilibrium error. However, this disturbance will not be permanent because sooner or later corrections will need to be carried out by forces proposed by economic theory.

In order to concretise these ideas, Granger (1981) and Granger and Weiss (1983) proposed error-correcting models which allow long run components of variables to obey equilibrium constraints while short run components have a flexible dynamic specification. Granger also showed for the first time that a full error correction representation would exist if the variables in the system were 'cointegrable'. Given the cointegrability condition, consistent steady state parameters can be obtained by estimating the static 'cointegration' regression. Engle and Granger (1987) suggest a two-step method which allows a robust inference on cointegration. Formally, if each element of a vector of time series first achieves stationarity by differencing, but a linear combination $\alpha' x_t$ is already stationary, the time series x_t are said to be cointegrated with cointegrating vector α. There may be several such cointegrating vectors so that α becomes a matrix. Interpreting $\alpha' x_t = 0$ as a long run equilibrium, cointegration implies that deviations from equilibrium are stationary, with finite variance, even though the series themselves are nonstationary and have infinite variances (Engle and Granger,1987).

In empirical applications and in keeping with the above exposition, cointegration and error correction modeling involves the following steps. The first involves determining the order of integration of each of the variables under consideration by employing one of the battery of unit root tests. In this paper we employ the widely accepted Phillips-Perron (1988) t-test. The second step involves identification/existence of at least one

unique cointegration vector in a multivariate cointegrating relationship as suggested by Johansen and Juselius (1990). Finally, an error correction model is set up. An error-correction model displays long and short run effects of explanatory variables on the dependent variable and throws a good deal of information on the dynamics of the system. This paper follows standard Johansen and Juselius (1990) procedure for estimating multivariate cointegration relationship. Absolving from cumbersome notational algebra, this method could be described as follows: The procedure entails estimating parameters of a traditional first difference VAR (vector autoregression with similarly integrated variables) inclusive of a long run impact matrix that 'contains information about long-run relationships between the variables in the data vector (Johansen and Juselius, 1990). If the dimension of the impact matrix is less than its rank then it could be expressed as a multiple of two conformably dimensioned matrices, say, 'α' and 'ß'. In this case the vectors in matrix 'ß' are cointegrating vectors which in linear association with data vectors results in a stationary process. The alfa matrix on the other hand exemplifies coefficients of adjustment that reflect the speed of adjustment towards the equilibrium. In this framework it is desirable to obtain at least one cointegrating vector [so that r (rank) =1] that establishes the model. If for example, r = 2 then one could in principle assume that the system is stable in more than one dimension. Tests of hypothesis for the rank of the impact matrix is conducted using the likelihood ratio (Trace-test) and maximum-eigenvalue test (Lambda-max test).

However, before one begins testing for the rank of the long run matrix, residual diagnostics in the system ought to satisfy the assumptions of normality and serial independence. This is required because the distribution properties of test statistics under Johansen's procedure have not been investigated under departures from normality.

In a further extension of analysis the possibility of weak exogeneity of a single or a group of variables with respect to the long run coefficients α and ß is also usually tested within the above framework. A likelihood ratio (LR) test of weak exogeneity tests for the inclusion/exclusion of a variable in the cointegrating space. Specifically, in tests of hypothesis of weak exogeneity, zero restrictions or loadings are placed on the elements of the alfa matrix and LR tests carried out for purposes of inference. If the hypothesis of zero restriction is accepted then the variable is considered to be weakly exogenous and the dimension of the system stands appropriately reduced conditioned on that variable without affecting the estimates of ß vector. The Johansen and Juselius (1990) procedure

also allows hypothesis tests in case when the ß vector is assumed *a-priori*. This helps in reconfirming or rejecting prevalent notions about parametric estimates such as elasticities obtained through other methods.

Johansen and Juselius (1990) procedure entails estimating a traditional first differenced vector autoregression (VAR) which could be represented as follows

$$\delta X_t = \pi X_{t-1} + T Z_{1t} + \varepsilon \qquad \text{.....[1]}$$

where X are a system of fixed vector of variables included in the VAR and the ε are i.i.d Gaussian errors. Z_{1t} is the stacked vector of δX_{t-1} ,....., πX_{t-k}. π and T are coefficients appended to X_{t-1} and Z_{1t}, respectively. The system defined in equation (1) is an error correction model and is a transform of the VAR in levels if the series are non-stationary, say I (1), and the rank of matrix $\pi(=\alpha ß')$ is less than the dimension of the system. As already stated, the reduced rank of the long run matrix π is also the number of cointegrating relationships among the series and ß is the cointegrating vector. The solution for ß is found by solving the likelihood maximising condition obtained from the likelihood (concentrated on ß) corresponding to equation (1). This entails solving the eigenvalues ($\varnothing_i$) and vectors for the system

$$| \varnothing S_{11} - S_{10}S_{00}^{-1}S_{01} | = 0 \qquad \text{.....[2]}$$

where $S_{ij} = (1/T) \Sigma \hat{R}_{it} \hat{R}'_{jt}$ (for i,j=1,0) with $\hat{R}_{0t}$ and $\hat{R}_{1t}$ as residuals from regressions of δX and X_{t-1} on Z_{1t}. The likelihood ratio test of the null hypothesis of not more than r (the rank of π) cointegrating relationships against the alternative of stationarity of all series is the trace test. On the other hand if the null is posited against the alternative of at most r-1 stationary relationships then the statistic suggested is the maximum eigenvalue. These tests are based upon the significance of eigenvalues and distributions are non-standard and critical percentiles tabulated in Johansen and Juselius (1990) and extended for larger systems in Osterwald-Lenum (1990). Tests of linear restrictions on α and ß are conducted by employing the usual LR tests after restricting the free parameters and going back to the solution of restricted equation (2) and the eigenvalue routine. The LR tests are distributed as chi-square with degrees of freedom depending upon the number of restrictions.

Reserve Bank of India Occasional Papers
Vol. 16, No. 2, June 1995

State Government Lotteries

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The objective of the study is to present a simple economic framework for the evaluation of some of the aspects of the State Government lottery system in India. The (more) important issues of morality and operational complexities that are implicit in the lottery system are abstracted from, or at best, merely touched upon. The study concludes that State lotteries in India are a relatively high-cost instrument of resource mobilisation. However the primary concern is whether the prohibition of lotteries or the withdrawal of the State from lottery activity would be effective in curbing people's tendency to gamble and in leading to a proliferation of other illegal/criminal forms of activities.

Introduction

State Government lotteries, when first introduced were to serve socio-economic objectives. Over time, questions have been raised about the very rationale for State-sponsorship of lotteries in view of the social stigma attached to the element of gambling[2], associated with lotteries. The continued resort to lotteries by most State Governments gives, *prima facie*, an impression of an overt disregard for social ethics. This, however, may need to be evaluated in an objective manner with reference to some of the broader issues such as the irregularities in the lottery transactions, the binding budget constraints of the State Governments, the implicit transfers in the pattern of incomes or even expenditures, as well as the potential (social) costs of Government 'abstinence'. The purpose of this paper is to examine some of these issues essentially to gain some insights into the operation of the State Government lotteries in India.

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* The author is Assistant Adviser in the Department of Economic Analysis and Policy. The overall guidance of Dr. A. Vasudevan and the valuable suggestions of Sarvashri R.K. Pattnaik, M.S. Mohanty and S.M. Pillai are gratefully acknowledged. The views expressed are those of the author and not necessarily of the institution to which he belongs.

2 Some prefer to make a distinction between gambling and lotteries, based on their perception of the degree of human skill required for winning. But most dictionaries do not differentiate between these two terms. To gamble would mean to play any game of chance while a lottery is defined as an arrangement for the distribution of prizes by chance or lot (Chambers Dictionary).

THE STATE LOTTERY SYSTEM

Historical Backdrop

Lotteries were said to have been employed in Rome from the Middles Ages when Italian merchants used them to "sell" their merchandise (Johnson, 1976). Lotteries from there, spread on to other European countries including France, Germany, Spain and England. The first English lottery seems to have been approved in 1569 for a specific purpose, namely, for repairing harbours. After a short but rapid expansion during the late eighteenth/early nineteenth century, lotteries fell into disrepute mainly because of "irregularities" in their operation and by the middle of the nineteenth century they were prohibited in England, France and Sweden.

A more or less similar historical phenomenon existed in the case of North American colonies where lotteries were introduced in the early seventeenth century and their proceeds used for developmental purposes (for financing roads, canals, industries, cities, educational institutions and churches). After Independence in 1776, much of the lottery activity centred around Philadelphia. However, around the middle of the nineteenth century, lotteries were beset by irregularities in their operations which led to their prohibition by most States.

Recent Developments Abroad

In recent years, State sponsored lotteries seemed to have become popular in some States in the USA. In 1963, New Hampshire had one. By 1989, 32 States were operating different kinds of lotteries which had "quicker pay offs, bigger prizes and greater intrinsic play value" (Clotfelter and Cook, 1990). Conventional lotteries (in which players bought tickets and waited for days or weeks to see if their ticket was drawn) were replaced by "instant" games (which gives players a chance to discover immediately if they had won a prize), "daily numbers" game, (which lets players choose their own numbers, thus providing an opportunity to become actively involved in the gambling process) and the "lotto" (in which players selected 6 out of 44 numbers in the hope of winning prizes/jackpots). Prize money accounted for 45 per cent to 60 per cent of lottery revenues and averaged 50 per cent; operating expenses, including commissions paid to retail sales agents varied between 6 per cent and 30 per cent of the revenues and was placed at 10 per cent on an average while net revenue to the State constituted 23 per cent to 44 per cent of gross revenues and averaged 40 per cent.

Countries like Ireland, the erstwhile West Germany, Brazil, Japan and Australia introduced lotteries during the early thirties/mid-forties of this century. On the aggregate, approximately one-half of the gross revenues were usually paid out in prizes, but the payout ratio varied between 30 per cent (Italy) and more than 70 per cent (Brazil). Profits ranged from 15 per cent (Argentina) to 50 per cent (Sweden) with an average of about 30 per cent. In many countries, proceeds are earmarked for expenditures on charity, health, education and welfare. In a majority of countries, however, profits are channelled into general revenue funds. In relation to Central government revenue, lottery profits accounted for less than 1 per cent of revenues except in Spain (23 per cent) and Sweden (1.4 per cent).

There were no government operated lotteries in Canada prior to 1970, except for the one introduced by the provincial/local level government of Montreal in 1968, which was declared illegal by the courts by the end of that year. During 1970-76, lotteries were introduced by Quebec, Ontario, the Western provinces, the Atlantic Provinces and the federal government. The Olympic lottery was introduced in 1974 to defray expenses of the 1976 Olympics. Among the provincial lotteries, 'Loto Quebec' offers four lotteries with different ticket prices ($ 0.5 to $ 5), prize structures (maximum prize ranging from $ 5,000 to $ 1.5 million) and frequency of draws (weekly, monthly, bi-monthly). Nearly all of the profits from the lottery go to the consolidated revenue fund. The Ontario and Western Canada lotteries also have generally the same structure.

The Indian Experience

In India, lotteries were initiated by a few State Governments during the late 'sixties. The main objective of lotteries was to mobilise resources for the State Governments apart from serving other socio-economic goals including provision of employment for sale of lottery tickets and replacement of other forms of gambling by State-sponsored mechanisms. Subsequently, however, some State Governments like Gujarat and Madhya Pradesh, discontinued lotteries.

The lottery system in India is generally organised in two ways. First, there are Government-run lotteries in which the Government undertakes all relevant operations such as printing and selling the tickets and conducting the draw. The States which have this system include Karnataka, Maharashtra and Uttar Pradesh. The other method is Government-sponsored. This has two streams: (a) The Government prints the

tickets, decides upon the prizing pattern and then sells the tickets to wholesale agents at discounts. Normally, the major prizes are decided by the Government while the minor ones are left to the discretion of the agents. States adopting this method include Arunachal Pradesh and Delhi. (b) The agents decide the prizing pattern and remit a royalty to the Government depending upon their profits. Most of the eastern States have adopted this method. The Central Government and a number of State Governments have issued separate guidelines for the proper functioning of the State lottery system, the salient features of which are given in the Annexure. Three key elements of these guidelines, may however, need to be mentioned here: (i) The ceiling on the first prize is fixed between Rs.1 lakh and Rs.25 lakh, depending on the type of draw; the maximum price of a ticket is correspondingly placed at Re.1 and Rs.3. (ii) The total value of prizes for each draw should be at least 50 per cent of the gross value of the tickets for sale; and (iii) the net profit accruing from the lottery may be at least 15 per cent of the gross value of the tickets printed for sale.

THE ECONOMICS OF STATE LOTTERIES: AN OVERVIEW

The main theoretical considerations in respect of State lotteries revolve around the following three (inter-related) issues :

(A) The rationale for State sponsorship of lotteries;

(B) Implicit Taxation in State Lotteries, incidence of the tax and net welfare gains and

(C) Cost burden of State Lotteries.

The Rationale for State Lotteries

At the outset, presume that organized gambling (including lotteries) would be run on the basic economic premise that the price of the 'product' would be greater than the expected money value of the gamble. Given such a 'hopeless' investment for the consumer, it would appear irrational to find people who are otherwise risk-averse (i.e. apart from compulsive gamblers), still preferring to gamble. The explanation to such a situation has been usually given in terms of one or more of the following factors: (i) the pleasure/recreation that may be associated with the mere act of gambling (Stocker, 1967); (ii) the high premium attached to a chance for improving one's standard of living (Friedman and Savage,

1948); (iii) the 'availability' or the ease with which it is possible to visualise the prospect of winning (Tversky and Kahneman, 1974) especially when advertising could exploit this factor; and (iv) the tendency of an 'illusion of control' among gamblers which makes them feel that choosing winning numbers is partly a matter of skill even in purely chance games (Langer, 1978). Each of the above factors has the potential to raise the expected value of the gamble to make it worthwhile for the 'consumer' to play. It is the acknowledgement of this basic aspect that may prevent the demand for gambling from being termed irrational, from an economic point of view.

As against above, there are some equally convincing 'economic' arguments as to why gambling may have to be abhorred. These are: gambling erodes the moral foundations of the people, encourages attitudes that are not conducive to thrift and hard work, generates large (social) costs external to the gambler and has the danger of leading to overindulgence. It could be argued, therefore, that the State should, at least refrain from sponsoring such activities, if not completely prohibit them. It may be however, mentioned that the charge of overindulgence against lotteries is not always supported by definitive evidence. Moreover, it has been recognised that the tendency for overindulgence depends upon specific factors - the frequency of opportunity to gamble, the odds against winning, the extent to which the gambler thinks that he is exercising his skill in choosing the winning numbers, the element of entertainment or connection with some sporting event, etc. - which may not characterise all systems of lotteries (Kinsey, 1963). Therefore, to the extent State lotteries are devoid of these features, they may be absolved from the charge of abetting overindulgence.

The case for State sponsored gambling (lotteries) is usually put forward on the basis of the following two arguments: (i) the substitution effects of such a mechanism and (ii) the benefits that are inherent in this system. These need to be examined in depth.

On the assumption of a high likelihood of malpractices in privately organized gambling and the alleged nexus between some of these forms and various criminal activities, it is often contended that State sponsored lotteries are able to offer a 'safer' avenue to gamblers. The assumption of substitutability between lottery products themselves and between lotteries and other games, that is implicit in this line of argument, was examined by Clotfelter and Cook (1990). They, however, found that in the U.S., the introduction of a more popular State lottery (the Lotto), in fact,

simultaneously, increased the sales of other State lotteries implying the injection of 'new' money. While accepting that there was no reliable evidence for extending this conclusion to illegal games, they, nevertheless, observed that State lotteries had greatly broadened participation in commercial gambling both legal as well as illegal. Stocker (1972) has, in fact, pointed out that it is always possible for illegal lotteries to counter the State sponsored ones by offering slightly better odds or more frequent drawings. He also avers that the claim that the nationalisation of the lottery system is necessary in order to keep it honest and assure that the consumer gets what he wants, presupposes that competition in the industry is so weak as to fail to offer any consumer protection.

Once it is accepted that gambling, eventhough is regarded as a social evil, cannot be curbed appreciably, then the State may be justified in sponsoring it and raising a revenue therefrom, much on the same grounds as those advanced for levying taxes on alcohol and tobacco products. The resources thus mopped up from the public could be redirected towards developmental ends (like the provision of social and economic services) (Johnson, 1976). In effect, the State, by offering a lottery, provides a service which satiates the 'gambling urges' of the consumers. It is generally recognised that under the critical assumptions (a) that individuals are well informed and (b) that there are no externalities in consumption, the legalization and provision of lotteries by the State, even with a price greater than the average administrative cost, creates a potential consumer surplus (and hence an increase in economic welfare) when compared to the situation in which lotteries are prohibited (Clotfelter and Cook, 1987). However, this by itself also does not necessarily guarantee that lotteries provided by the State are unambiguously optimal as (a large) part of the welfare gains resulting therefrom could be usurped by way of the implicit tax in these lotteries.

Implicit Taxation and Net Welfare Gains

By appropriating a part of the sale proceeds from lottery tickets, the State implicitly levies an excise-like tax on the purchase of these tickets. It is often claimed that since lotteries are a non-essential purchase this appropriation should not be treated as a tax. This argument may not, however, hold, given the analogy to alcohol and tobacco products. Moreover, the lottery tax is fixed and is independent of the characteristics of the consumer, just as the case with any other excise tax. Furthermore, since the 'products' under the lottery system would be sold at a price considerably higher than the average cost, the net revenue from lotteries

may be labelled as an implicit tax. As a consequence, the average cost curve in respect of State lotteries, inclusive of the tax (or the State's profits), shifts upwards and intersects the demand curve at a lower level of 'quantity' (and a corresponding higher price) and thereby reduces consumer surplus which originated from the mere provision of the lottery.

The rate of such an implicit tax also has revenue and welfare implications. Total proceeds from lotteries (R) can be decomposed into (i) Prize money (P) (ii) Operating Expenses including advertising costs and commissions (C) and (iii) Net receipts to the State (N). The equivalent excise tax rate on lottery purchases is that which would yield an identical amount of revenue (N) to the State if lotteries were operated privately on a break-even basis (i. e. without profits) at the same overall cost (C + P) and the tax was levied on each purchase. The implicit tax rate is thus given by the ratio [N/(C + P)]. A change in the tax rate (via a change in the price of the lottery ticket) would affect the State's revenues, depending on the elasticity of demand. A higher price could, however, vitiate the misallocation of resources traditionally associated with any form of indirect taxation. On the other hand, it could well be justified as a sumptuary tax to discourage consumption of the lottery product. From the point of view of optimal taxation, it may be noted that, "the optimal excise tax rate on a commodity depends on its price elasticity, whether it produces externalities and the distribution of consumption over income. Ignoring externalities and distribution, the efficient assignment of excise tax rates requires minimisation of deadweight loss by taxing those items with elastic demand less heavily than those with inelastic demand. If the price elasticity of demand of lotteries is greater than unity, then lottery taxation generates greater deadweight loss than taxation of items with inelastic demand" (Clotfelter and Cook, 1990). On these grounds, therefore, a case could be made out for reducing the implicit tax rate (price) on State lotteries, depending, of course, on the elasticity of demand.

Taking into account distributional considerations, complicates the issue. Assume that the incidence of the implicit tax is regressive i.e. "tax revenue collected falls as a percentage of income as income rises. In the case of tax revenue derived from lotteries, since revenues are a constant proportion of the price of the ticket, the tax can be said to be regressive if expenditures on lottery rise less rapidly than income" (Brinner and Clotfelter, 1975). Then a higher rate, by itself, would have adverse welfare implications. Moreover, if lottery proceeds are earmarked for expenditures which largely benefit middle or high income groups, then the combined package of tax and expenditures, may be regressive (tend to widen

income differentials). On the other hand, if lottery proceeds flow into a general revenue fund with all expenditures increased proportionately, then the combined effect may be progressive (Johnson, 1976). One could pose an alternative here; for example, if lottery revenue is earmarked for a social project meant for poor, the welfare impact could be different. The dead weight loss of implicit lottery tax in this case could be counterbalanced against the welfare gain from the project and that might imply an improvement in overall social welfare. However, this conclusion is a matter of empirical verification and would depend on the type of social welfare function chosen for the purpose and the value of inequality aversion parameter.

Cost Burden of State Lotteries

From the revenue angle, the very first step in assessing State lotteries would be to determine whether net receipts (N) are positive. According to Johnson (1976), however, the operating expenses (administrative costs) (C) of lotteries can be evaluated (i.e. whether they are high or low) on the basis of the way in which lotteries are viewed. If lotteries are viewed entirely as a method of mobilising revenues for the State, then the relevant measure is given by the ratio [C/N]. This ratio can be compared to those in respect of other instruments of resource mobilisation, including taxes. On the other hand, if lotteries are operated to provide investment-recreational service to individuals, then one measure of the burden of administrative costs is the ratio [C/(R-N)] or [C/(C+P)]. The ratio derived in the case of lotteries may then be compared to those in respect of other Government investment (bonds/securities) or recreational services.

In sum, there does not seem to be any single yardstick by which State lotteries can be viewed as 'desirable' or otherwise. The specific policies in respect of State lotteries would depend upon the way in which lotteries are viewed and the objective these are meant to serve. This is particularly so in respect of the rate of the implicit lottery tax which may need to be fixed after taking into account a variety of factors such as the potential loss of consumer surplus, the elasticity of demand, the incidence of the tax, and the use of the tax proceeds.

ASSESSMENT OF STATE GOVERNMENT LOTTERIES IN INDIA

The functioning of State Government lotteries in India may be evaluated in terms of the following: (1) State lotteries as a source of

public revenues; (2) Operating costs of State lotteries; (3) The implicit lottery tax rate; (4) Incidence of the implicit tax and (5) Implications of State withdrawal from lottery activity.

State Lotteries as source of public revenues

The data on the receipts and expenditures[3] in respect of State lotteries are reported in State budget documents. These are presented in Statement 1. Receipts are taken to correspond to the sale proceeds from lottery tickets, while expenditures relate to allocations for prizes, commission and bonus to agents and other operating expenses. It has been, however, observed that for most States, establishment expenditures (wages and salaries) usually comprise not more than 2 to 3 per cent of total revenue expenditures, inclusive of allocations for prize money, commission, etc. These have, therefore, been ignored for purposes of our analysis. It is necessary to mention that data in some State Government budget documents (for some years) are neither complete (sometimes receipts are reported but expenditures are not and vice-versa) nor transparent. This lacuna is particularly seen in the case of some of the north-eastern States. For this reason, the analysis of the major aspects of lotteries, had to be restricted to only those States where the data are usually reported in a relatively systematic way. The data considered here relate to the years 1989-90 (Accounts) to 1993-94 (Budget Estimates).

Total receipts from lotteries comprise varying proportions of the State's own non-tax revenues (i.e. accruals from non-tax revenue resources available to the State Governments) in different State Governments. In recent years, in the case of Assam, Goa, Maharashtra, Tamil Nadu and West Bengal, these have usually accounted for between 1 and 3 per cent of their own non-tax receipts, while in the case of Haryana, Kerala, Rajasthan, Sikkim and Uttar Pradesh, the proportion is much higher and varies, on an average, between 14 per cent (Rajasthan) and 30 per cent (Uttar Pradesh). For Karnataka and Punjab, the ratio generally hovers between 4 and 6 per cent. On the other hand, revenue expenditures in respect of lotteries, usually form not more than 3 per cent of the non-developmental revenue expenditures of the States; the exceptions to this

3 Under the revised amounting framework effected since 1985-86, revenue receipts from lottories are reported under the budget head 0075 (103). Revenue expenditures, on the other hand, are looked under separate heads viz., 2075 (103) which gives the allocations for the sale of lottery tickets, commission for agents and distribution of prizes and 2070 [800] which books the establishment expenditure, mainly wages and salaries of the staff in respect of State lotteries.

being Haryana (more than 13 per cent), Rajasthan (around 6 per cent) and Uttar Pradesh (8 per cent).

Net receipt (i.e. receipts minus expenditures) from lotteries, while normally positive for most States, have been subject to drastic year-to-year fluctuations (Statement 2). For instance, in the case of Assam, net receipt which was placed at Rs.85.8 lakhs in 1989-90, dipped to (-) Rs.8.7 lakhs in 1991-92 and was estimated to accelerate to Rs.478.6 lakhs in 1993-94. A somewhat similar situation was found in the case of West Bengal, where net receipt turned positive (Rs. 92.5 lakhs) in 1992-93 after a spell of three consecutive years of deficit. The only States where net receipts have been relatively more stable, over the five year period under review, are Kerala, Maharashtra and Rajasthan.

The allocation from total receipts towards expenditure, mainly on account of (i) Prizes (P) (ii) Operating expenses, including commission and bonus to agents (C) and the balance or net receipts (N) to the State, in respect of six States for the three year period 1991-92 to 1993-94, are set out in Statement 3. It may be observed that the share of each component varies significantly across States and time. Furthermore, except in the case of Rajasthan and Maharashtra, the outgo on account of prizes has been generally lower than the minimum of 50 per cent stipulated in the Central Government guidelines. As a percentage of total receipts from lotteries, net receipts show an increase in the case of Karnataka, Kerala, Rajasthan and Tamil Nadu, while in the case of Maharashtra and Punjab, no definite trend is noticed. Except in the case of Karnataka and Tamil Nadu for some years, net receipt has been placed higher than the minimum stipulation of 15 per cent. On the average, the share of net receipts in total receipts varies between 12.4 per cent (Tamil Nadu) and 43.5 per cent (Punjab). The average ratio for six States reported on Table 3 works out to 23.9 per cent. This could be compared with the positions obtained in other countries. For example, data for 1989 in respect of 32 States in the U.S. show that net receipts from lotteries constituted 24 percent to 46 per cent of total receipts, giving an average ratio of 40 per cent for the sample States (Clotfelter and Cook, 1990).

Operating Costs of State Lotteries

Operating costs (including commission and bonus to agents) as a proportion of total receipts witnessed a steady decline in the case of Punjab, Rajasthan and Tamil Nadu. Notwithstanding the decline in case of few

States, operating costs for States such as Karnataka, Kerala and Tamil Nadu, were higher than the stipulated 35 per cent. Across the sample States, the ratio of operating cost to total revenue varied, on an average, between 8.7 per cent (Rajasthan) and 44.6 per cent (Tamil Nadu) with the mean ratio placed around 26.1 per cent. The comparable mean ratio in the case of the U.S., was 10 per cent. At the level of individual States, the ratio compares evenly poorly; barring one State, the ratio for all others in U.S. was below the average for six Indian States (26.1 per cent).

If the State lotteries were to be viewed as a resource of revenue mobilisation, the cost effectiveness of such a measure should be evaluated against the other commonly used instruments. The comparative picture of cost ratios [C/N] for State lotteries, Sales Tax, State Excise duties, and State's own (total)tax receipts is given in Statement 4. The ratios speak for themselves quite clearly and lead to the unambiguous conclusion that State lotteries in India are an expensive form of resource mobilisation compared to other State taxes. The averages for the six States over the three year period show that operating costs formed 1.3 per cent of the total collections in the case of Sales Tax, 4 per cent in the case of State Excise duties, 3.9 per cent in respect of total own tax revenues as against 26.1 per cent for lotteries. However, in none of the States (except Karnataka in 1991-92), the cost-ratio exceeded the maximum of 233.3 per cent as derived from the Central Government guidelines.

Implicit Tax Rate for Lotteries

The rates of tax implicit in the price of lotteries, as given by the ratio [N/(C + P)], in respect of the six Indian States are given in Statement 5. It may be observed that except in the case of Punjab, the rates have shown an increase in the other five States. On an average, the rate varied between 14.9 per cent (Karnataka) and 94.1 per cent (Punjab). These rates are generally higher than those of Sales Tax which usually varies between 2 and 15 per cent (State Excise duties are in many cases levied on specific basis). Furthermore, the lottery tax rates generally exceed the minimum of 17.6 per cent stipulated in the Central Government guidelines. The rates of implicit lottery tax in India are, however, found to be, in general, lower than those in the U.S. (where it varied between 29.9 per cent and 85.2 percent) which directly results from the lower profit (net receipts) ratios in respect of Indian (State) lotteries.

Incidence of the Implicit Lottery Tax

One of the ways by which the incidence of the lottery tax may be gauged is by estimating the income elasticity of the demand for lottery tickets at various income strata. A more popular methodology was developed by Suits (1977 a) in terms of an Index of Progressivity, a measure similar to that of the Gini Coefficient. The Suits Index (S) can be derived by plotting the cumulative percentage of tax burden against the cumulative percentage of total income and then obtaining the ratios of the relevant areas under the graph.'S' varies between -1 for a fully regressive tax (i.e. where the entire tax burden is borne by the lowest income fractile) and +1 for a fully progressive tax; S equals zero for a proportional tax.

A number of studies have attempted to measure the incidence of the lottery tax in the U.S. and Canada and these have generally concluded that it is regressive. Vaillancourt and Grignon (1988) calculated the Suits index for four provincial Canadian lotteries in 1982 and found that it varied between -0.18 and -0.13; for Canada as a whole S was placed at -0.18. They also found that among the three commodity taxes, tobacco taxes were the most regressive (S = -0.23), followed by lotteries (S = -0.18) and then taxes on alcohol (S = -0.09). Spiro (1974) concluded that the Pennsylvania lottery tax burden was on the average, regressive but there was an element of progressivity upto an initial income range. Suits (1977 b) found in the case of the U.S. that the lottery tax was more regressive than the sales tax. Clotfelter (1979) demonstrated that a daily "numbers" game was more regressive (S = -0.41) than the conventional weekly State lottery (S = -0.24).

In the case of India, it is hard to find a study or related information on the distribution of lottery expenditures across income classes. For want of this information, it has not been possible to quantify the incidence of the lottery tax. To the extent that expenditure in lotteries is an activity preferred mostly by the people in the low to middle income slabs in India, it would intuitively appear that this tax is likely to be regressive. The tax regressivity would have to be corrected somewhat due to income taxation of lottery prize winners. The slight correction is needed because prize winners are very few while lottery ticket purchasers are far too many and to some extent by the fact that net lottery proceeds are not earmarked but are part of the Consolidated Fund.

Implications of State Withdrawal

State lotteries at present seem to provide a comparatively 'safer' avenue to gamblers than private lotteries. Many of the perceived ills of the lottery system relate exclusively to the operation of privately -run lotteries rather than to State lotteries. These malpractices include the printing of fake/duplicate tickets, embezzlement of prize money, harassment to prize winners, a greater tendency of laundering of black income and a direct link to criminal activities. It may not be easy for the States to enforce total prohibition of lotteries. One could also argue that such a measure by itself, may prove to be counter-productive by leading to a widespread mushrooming of illegal gambling (lottery) outlets with all their attendant problems.

CONCLUDING OBSERVATIONS

The decision to persist with or terminate the existing system of State Government lotteries may need to take into consideration some of the issues which have been discussed above. The issue whether the prohibition of lotteries or the withdrawal of the State from lottery activity, would be effective in curbing people's tendency to gamble and in leading to a proliferation of other illegal/criminal forms of activities is an important one, for which there are no easy answers. To the extent State-sponsored lotteries are not perceived to be social evil, they could be allowed to be continued. But it is necessary to ensure that there are no irregularities in the system of State Government lotteriesand that there is transparency in their functioning so that the consumer feels a sense of safety.

Net proceeds from State lotteries in recent years have been generally rising, thus implying that purely from a financial angle, the State lotteries could be considered as revenue enhancing activity. The Central Government as well as the States also earn some revenue by subjecting the prize money to income tax. If the State lottery system is withdrawn, some States which extract a sizeable portion of their own non-tax revenues from this source (like Haryana, Kerala, Rajasthan, Sikkim and Uttar Pradesh) may have to seek alternative avenues of raising resources. A withdrawal without feasible alternatives may also have consequences in terms of lost employment.

Despite variations across States, when compared to U.S. State lotteries, Indian (State Government) lotteries, on an average, are less remunerative to the sponsorers (24 per cent of total receipts as against 40 per

cent for the U.S.) and imply high operating costs (26 per cent compared to 10 per cent for the U.S.). This implies that the implicit lottery tax rate in India is lower than that in the U.S. (37 per cent, on an average, as against 58 per cent in the U.S.). While, the implicit lottery tax rates in India are much higher than the Sales Tax rates, in terms of cost effectiveness, lotteries may be a less preferred way to mobilise revenue than tax instruments. Given that the target group for Indian lotteries by and large belong to the lower-income scale, a clear trade-off is evident between increasing profit ratios, on the one hand and making the implicit tax rate more progressive on the other. Therefore a quantitative exercise is required to ascertain an 'optimal' tax rate which would satisfy some normative constraints on incidence consistent with certain revenue requirement. This apart, an important aspect of State lotteries relates to improving their cost effectiveness to the Budget. This would need reduction of operating expenses from their existing levels.

In this context, a few measures for improving lottery sales and revenues suggested by Johnson (1976) may also be of some use in designing a specific policy-frame for State lotteries: (i) Increasing the frequency of draws to retain public interest and to encourage rechannelling of winnings; (ii) offering a larger number of lotteries with different prize structures; (iii) reducing the price of tickets and making them more convenient to buy; and (iv) devising a prize structure with a few very large prizes in order to capture the imagination of purchasers along with a large number of small prizes to ensure that most individuals would "know" someone who has won. The additional revenue thus mobilised could be earmarked for specific developmental programmes for the lower-income classes (instead of forming part of a general fund) which could partly redress the regressivity of the lottery tax.

ANNEXURE

LEGISLATIVE PROVISIONS IN RESPECT OF STATE LOTTERIES

Lotteries organized by the Central and State governments are covered by Item 40 of the Union List in the Seventh Schedule to the Constitution. State Governments, in turn, have been conferred the power to permit private organizations or individuals to organize lotteries by Item 34 of the State List of the same Schedule. With a view to imparting some uniformity and curbing the scope of malpractices in the running of State lotteries, the Central Government issued broad guidelines in June 1984, in respect of their operations. Some of these guidelines are reproduced below:

1. There may be no lotteries with draws at intervals of less than a week;

2. In the case of weekly lotteries, the maximum price for one ticket should be Re.1 while the first prize may not exceed Rs.1 lakh; there may be a separate prize for each series;

3. Any draw other than a weekly draw should be treated as a bumper draw, the maximum price of a ticket for which may not exceed Rs.3 while the ceiling on the first prize may be fixed at Rs. 25 lakhs; the first prize may be made common to all series. The maximum number of draws in a year may be 12;

4. The total value of prizes for each draws should be at least 50 per cent of the gross value of the tickets printed for sale;

5. The net profit accruing from the lottery may be at least 15 per cent of the gross value of the tickets printed for sale;

6. The printing of tickets should be got done by the Government.

Individual State Governments have formulated specific rules covering various aspects (modus operandi for sale, commission to agents, etc.) of lotteries organized by them. The main features of the Maharashtra and Uttar Pradesh State Lottery Rules are described below.

In the case of the Maharashtra government, it has been specified that:

(i) The lottery tickets will normally be made available through authorized agents who will be specifically appointed for this purpose.

The Government may, however, offer tickets directly to the public for sale;

(ii) It shall incumbent upon every agent to make the prescribed minimum purchase of lottery tickets for each draw in one lot or in prescribed number of instalments. Tickets sold to agents shall, under no circumstances, be taken back by the Government;

(iii) The agent appointed under the State Lottery Scheme shall be eligible for a commission of 15 per cent of the face value of the tickets purchased by him;

(iv) The lottery agents who happen to purchase, from the issuing offices, the lottery tickets which win any of the specified prizes, will be granted bonus.

(v) Tickets remaining unsold with the Government in a draw shall not be eligible for prizes of amounts exceeding Rs. 5,000 each (the draw will be repeated for such prizes till the number of a sold ticket is drawn). In the case of tickets winning prizes of Rs. 5,000 (if any) and below, tickets remaining unsold with the Government shall also be eligible for such prices;

(vi) Prizes not claimed within a specified time period as well as price amounts in respect of claims rejected by the concerned officials shall lapse and amounts shall automatically be forfeited to Government.

In the case of **Uttar Pradesh**, the following rules deserve mention:

(i) Agents will be allowed commission at rates fixed and notified from time to time by the Government.

(ii) (a) Out of every cash prize of more than Rs.1,000/- payable to a winner in respect of any ticket, an amount equivalent to 11 per cent of the prize money; and (b) out of every cash prize of Rs.10 lakhs and above in respect of any ticket an amount equivalent to 25 per cent of the prize money, respectively, shall be deducted and spent on commission, bonus, publicity, administrative expenditure or any other account as decided by the Government from time to time.

(iii) Ticket books shall be sold to agents only in the form of complete books. Ticket books once sold shall not be returnable.

(iv) Tickets may not be sold to anyone below 16 years.

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STATEMENT 1 : TRANSACTIONS IN STATE GOVERNMENT LOTTERIES

(Rs. Lakhs)

STATE	RECEIPTS					EXPENDITURE				
	1989-90	1990-91	1991-92	1992-93 (R.E.)	1993-94 (B.E.)	1989-90	1990-91	1991-92	1992-93 (R.E.)	1993-94 (B.E.)
ANDHRA PRADESH	99.5 (0.14)	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
ARUNACHAL PRADESH	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
ASSAM	395.8 (1.83)	26.2 (0.09)	12.4 (0.05)	1254 (3.8)	1412 (4.38)	310 (0.58)	6 (0.01)	21.1 (0.04)	1084 (1.51)	933.4 (0.91)
BIHAR	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
GOA	13.2 (0.22)	124.8 (1.79)	113.1 (1.31)	120 (1.07)	130 (1.06)	N.R.	N.R.	N.R.	N.R.	N.R.
GUJARAT	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
HARYANA	10361.4 (23.2)	13873.6 (27.14)	13230.6 (24.33)	3619.9 (7.68)	11826 (20.13)	9299.9 (16.99)	11899.9 (18.96)	12548.5 (16.4)	4073.4 (5.32)	11198.9 (11.45)
HIMACHAL PRADESH	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
KARNATAKA	1766.8 (3.52)	1127.8 (2.18)	2753.6 (6.58)	11450 (15.7)	2500 (4.33)	1344 (1.29)	841.2 (0.72)	2508.2 (1.76)	10275 (6.04)	2025 (1.08)
KERALA	4214.7 (24.16)	5140.2 (24.62)	5386.9 (22.95)	6300 (24.41)	6400 (23.24)	3319.7 (4.11)	4085.7 (4.13)	4507.9 (3.69)	4750 (3.5)	4750 (3.01)
MADHYA P RADESH	7.3	NEG.	N.R.	71 (0.05)	59 (0.04)	N.R.	N.R.	4	1	1
MAHARASHTRA	5214.3 (3.32)	5239.9 (2.92)	4969.9 (2.78)	4372 (2.19)	5083.2 (2.32)	3942.5 (1.72)	4043.2 (1.56)	3605.3 (1.13)	3447.8 (0.86)	3994.3 (0.8)
MANIPUR	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	10.9	13.7 (0.11)	16.9 (0.14)	17.6 (0.13)

CONTD..

STATEMENT 1 : TRANSACTIONS IN STATE GOVERNMENT LOTTERIES (CONTD.)

(Rs. Lakhs)

STATE	RECEIPTS					EXPENDITURE				
	1989-90	1990-91	1991-92	1992-93 (R.E.)	1993-94 (B.E.)	1989-90	1990-91	1991-92	1992-93 (B.E.)	1993-94 (R.E.)
MEGHALAYA	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
MIZORAM	N.R.	N.R.	N.R.	N.R.	N.R.	7.6	8.3 (0.09)	18 (0.23)	15 (0.15)	16 (0.15)
NAGALAND	N.R.	N.R.	N.R.	N.R.	N.R.	10 (0.07)	15 (0.10)	21 (0.12)	16.6 (0.09)	17.9 (0.1)
ORISSA	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.
PUNJAB	N.R.	1501.6 (5.89)	1453.9 (0.88)	1427 (3.69)	1771.6 (4.16)	N.R.	N.R.	775.7 (0.66)	531.6 (0.40)	1396.7 (0.80)
RAJASTHAN	4933.9 (10.49)	10728.9 (13.08)	1344.2 (18.38)	12518.8 (12.62)	12710.9 (13.55)	3766.9 (3.90)	8128.1 (7.13)	9679 (6.88)	8982.2 (5.44)	8672.9 (4.63)
SIKKIM	510.1 (24.83)	400 (14.99)	N.R.	750 (25.73)	800 (26.4)	N.R.	N.R.	N.R.	N.R.	N.R.
TAMIL NADU	1317.7 (3.35)	1872.4 (4.91)	1239.1 (1.11)	1204.2 (2.31)	1302 (2.58)	1051.1 (0.88)	1534.7 (1.06)	1280.5 (0.75)	960.5 (0.46)	1038.8 (0.43)
TRIPURA	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	3	N.R.	45
UTTAR PRADESH	13505 (16.4)	16247.7 (20.9)	39082.7 (36.07)	50493 (39.11)	50000 (37.95)	13145.2 (4.79)	14582.8 (4.45)	37895.4 (9.31)	50394 (10.81)	48693.8 (8.22)
WEST BENGAL	355.2 (1.67)	256.2 (1.63)	447.9 (1.85	600 (2.05)	650 (2.07)	450.7 (0.37)	459.7 (0.30)	466.1 (0.26)	507.5 (0.25)	563 (0.25)

Note : Figures in brackets under receipts are percengates to the State's non-tax revenues while those under expenditures are percentages to non-developmental revenue expenditures.

N.R. : Not Reported.
R.E.: Revised Estimates.
B.E.: Budget Estimates
Source : State Government budget documents.

STATEMENT 2 : NET RECEIPTS FROM STATE GOVERNMENT LOTTERIES

(Rs. Lakhs)

State	1989-90	1990-91	1991-92	1992-93 (R.E.)	1993-94 (B.E.)
1. ASSAM	85.8	20.2	-8.7	170	478.6
2. HARYANA	1061.5	1973.7	682.1	-453.5	627.1
3. KARNATAKA	422.8	286.6	245.4	1175	475
4. KERALA	895	1054.5	879	1550	1650
5. MAHARASHTRA	1271.8	1196.7	1364.6	924.2	1088.9
6. PUNJAB	N.A.	N.A.	678.2	895.4	374.9
7. RAJASTHAN	1167	2600.8	3765.1	3536.6	4038.7
8. TAMIL NADU	266.6	337.7	-41.4	243.7	263.2
9. UTTAR PRADESH	359.8	1664.3	1188	99	1306
10. WEST BENGAL	-95.5	-103.5	-18.2	92.5	87

N.A. : Not Available.
R.E. : Revised Estimates.
B.E. : Budget Estimates.

STATEMENT 3 : DECOMPOSITION OF STATE GOVERNMENT LOTTERY RECEIPTS

(Rs. Lakhs)

STATE	1991-92				1992-93 (R.E.)				1993-94 (B.E.)			
	Prizes	Operating Expenses*	Net Revenue	Total Receipts	Prizes	Operating Expenses*	Net Revenue	Total Receipts	Prizes	Operating Expenses*	Net Revenue	Total Receipts
KARNATAKA	853.0	1655.2	245.4	2753.6	8000.0	2275.0	1175.0	11450.0	1000.0	1025.0	475.0	2500.0
	(31.0)	(60.1)	(8.9)	(100.0)	(69.9)	(19.9)	(10.3)	(100.0)	(40.0)	(41.0)	(19)	(100.0)
KERALA	2510.9	1997.0	879.0	5386.9	2500.0	2250.0	1550.0	6300.0	2500.0	2250.0	1650.0	6400.0
	(46.6)	(37.1)	(16.3)	(100.0)	(39.7)	(35.7)	(24.6)	(100.0)	(39.1)	(35.2)	(25.8)	(100.0)
MAHARASHTRA	N.R.	N.R.	1364.6	4969.9	3029.9	417.9	924.2	4372.0	3481.2	513.1	1088.9	5083.2
			(27.5)	(100.0)	(69.3)	(9.6)	(21.1)	(100.0)	(68.5)	(10.1)	(21.4)	(100.0)
PUNJAB**	326.4	449.3	678.2	1453.9	329.0	202.6	895.4	1427.0	1277.5	119.2	374.9	1771.6
	(22.4)	(30.9)	(46.9)	(100.0)	(23.1)	(14.2)	(62.7)	(100.0)	(72.1)	(6.7)	(21.2)	(100.0)
RAJASTHAN	7629.0	2050.1	3765.1	13444.2	8262.0	720.2	3536.6	12518.8	8008.0	664.2	4038.7	12710.9
	(56.7)	(15.2)	(28.0)	(100.0)	(66.0)	(5.8)	(28.3)	(100.0)	(63.0)	(5.2)	(31.8)	(100.0)
TAMIL NADU	514.5	766.0	-41.4	1239.1	500.0	460.5	243.7	1204.2	600.0	438.8	263.2	1302.0
	(41.5)	(61.8)	(-3.3)	(100.0)	(41.5)	(38.2)	(20.2)	(100.0)	(46.1)	(33.7)	(20.2)	(100.0)

Note : Figures in brackets are percentage to total receipts.

* Includes Commissions and Bonus to Agents, Advertisement and Publicity, all reported under Budget Head 2075.

** In the case of Punjab, allocations for advertisement and publicity are, however, reported under Budget Head 2070. These have been included in operating expenses.

R.E.: Revised Estimates.

B.E.: Budget Estimates.

STATEMENT 4 : COST-BURDEN OF STATE LOTTERIES AS A SOURCE OF PUBLIC REVENUES — A COMPARISON WITH OTHER TAXES

(Per cent)

STATE	1991-92				1992-93 (R.E.)				1993-94 (B.E.)			
	State Excise	Sales Tax	All Own Taxes	State Lottery	State Excise	Sales Tax	All Own Taxes	State Lottery	State Excise	Sales Tax	All Own Taxes	State Lottery
KARNATAKA	2.4	1.4	3.5	674.5	2.7	1.3	3.2	193.6	2.8	1.3	3.2	215.8
KERALA	5.7	1.2	5.2	227.2	6.9	1.3	5.4	145.2	7.3	1.2	5.4	136.4
MAHARASHTRA	1.5	0.8	2.7	N.A.	1.8	0.8	3.0	45.2	1.8	0.9	2.6	47.1
PUNHAB	0.6	1.1	2.5	66.2	0.8	1.3	2.4	22.6	0.9	1.6	2.5	31.8
RAJASTHAN	10.6	1.7	7.3	54.5	12.5	1.7	8.2	20.4	14.7	1.7	8.8	16.4
TAMIL NADU	1.3	1.3	2.8	—	1.5	1.5	3.1	189.0	2.0	1.8	3.4	166.7

Note : Figures represent operating expenses/cost of collection as a percentage of net revenue to the States.

N.A.: Not Available.

R.E.: Revised Estimates.

B.E.: Budget Estimates.

STATEMENT 5 : IMPLICIT TAX RATE IN STATE LOTTERIES

(Per cent)

States	1991-92	1992-93 (R.E.)	1993-94 (B.E.)	Average
KARNATAKA	9.8	11.4	23.5	14.9
KERALA	19.5	32.6	34.8	29.0
MAHARASHTRA	37.8	26.7	27.2	30.6
PUNJAB	87.4	168.1	26.9	94.1
RAJASTHAN	38.9	39.4	46.6	41.6
TAMIL NADU	-3.2	25.3	25.3	15.8

R.E.: Revised Estimates.
B.E.: Budget Estimates.

Reserve Bank of India Occasional Papers
Vol. 16, No. 2, June, 1995

NOTE

Production Functions in the Manufacturing Industries in India : 1974-90

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This paper examines the sources of growth in various industries in the manufacturing sector in India using conventional production functions (Cobb-Douglas (C.D), C.E.S. and Translog) as well as a new production function recently introduced by Bairam. The study finds that CD and Bairam production functions perform better than other production functions and the results of the study confirms the validity of decreasing returns to scales for most of the industries in the manufacturing sector.

The upsurge in industrial growth in the eighties has brought about a renewed interest in the sources of industrial growth in India. Most of the production function studies[1] in India, with the exception of Ahluwalia (1985, 1991), were devoted to the analysis of the performance of manufacturing or industrial sector at the aggregate level and the analysis at the disaggregative level has remained relatively unexplored. In this paper, we attempt to empirically examine the sources of growth in various industries in the manufacturing sector in India using both the set of **conventional production functions** (Cobb-Douglas, C.E.S and Translog) as well as a new **production function** recently introduced by Bairam (1989). The study spans over a sample space of 17 years from 1973-74 to 1989-90 for which comparable industry-wise data are available from the Annual Survey of Industries (ASI) for the factory sector. The industrial classification in ASI was changed to National Industrial Classification (NIC) in 1973-74 and hence the data prior to that period are not strictly comparable with the data in the latter years. Hence the period of our study (1974-90) is dictated by the availability of comparable data. All the data used in the empirical analysis are in real terms. The list of the variables used and their corresponding deflators are given in Annexure I.

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For the purpose of analysis, the study is divided into four sections. Section I gives a brief overview of the structure of industries in the organised manufacturing sector along with the trends in capital and labour use and other broad productivity ratios for the period 1974-90. Section II outlines the theoretical framework for various production functions used in the study and Section III presents the empirical estimates of such production functions. Section IV summarises the conclusions emanating from the study.

SECTION I

Changes in the Structure of Manufacturing Industries and Factor Use

Table 1 presents an overview of the changes in the structure of various industries in the manufacturing sector during 1974-90. At the beginning of seventies i.e., 1973-74, agro-based industries such as food products, tobacco products, wool products and jute textiles absorbed nearly one-fifth of the fixed capital stock and one-half of the workforce in the organised manufacturing sector. These industries accounted for nearly two-fifths of manufacturing output (net value added). Engineering group (basic metals, alloy products, electrical machinery and transport equipment) constituted slightly more than two-fifths of the fixed capital stock and about one-third of employment in the manufacturing sector in 1973-74. Their corresponding contribution in manufacturing output was around 40 per cent. But by the end of eighties, their share in output, fixed capital and employment also witnessed a marginal decline (by 2 percentage points). The share of chemicals group (rubber, petroleum and chemical products), however, has shown an increasing trend in output, fixed capital and employment, with most of the increases in employment being confined to petroleum sector[2]. Their share in manufacturing output nearly doubled during 1974-90 (from 7 per cent in 1973-74 to 13 per cent in 1989-90). In most of the industries in the chemicals group, the share of fixed capital has shown an increasing trend. These trends are corroborated by the trends in factor use (Table 2).

Capital intensity in the manufacturing sector has increased quite sharply in the eighties; from an average of 0.23 in the seventies (1974-80) to 0.39 in the eighties (1981-90) (Table 2). Most of the industries in the manufacturing sector witnessed capital deepening in the eighties, with quite drastic increases in capital intensity in some of the traditional agro-based industries like wool and synthetic textiles (from 0.19 in the 1970s

to 0.40 in the 1980s), paper industry (from 0.26 in the 1970s to 0.51 in the 1980s). The increase in capital intensity in some of the capital goods industries can be attributed *inter alia* to the strategy of increasing investment in certain core sectors with a view to generating forward and backward linkages for other industries. Among the industries in the engineering group, transport equipment industry recorded a sharp increase in capital intensity in the eighties (from 0.26 in the 1970s to 0.40 in the 1980s). Reflecting this, capital productivity showed declines. And labour productivity has shown substantial improvements in the eighties in most of the industries, except some of the traditional industries like tobacco products and jute products industries. Most of the industries in the chemical group (including rubber products) and engineering group have recorded substantial improvements in labour productivity in the eighties. Labour productivity in the manufacturing sector as a whole increased from 0.17 in the seventies to 0.24 in the eighties. Against the backdrop of these trends in factor use and productivity ratios, we would now consider the estimation of the various production functions in the subsequent sections.

SECTION II

Production Function Specification : An Overview

(A) Conventional Production Functions

Since the theoretical framework for the conventional production functions is well documented in the literature, we would present only a brief description of such production functions. At the outset it may be mentioned that K would denote capital and L labour. Among the set of conventional production functions, the Cobb-Douglas (CD) production function is the most widely used and empirically tested mainly because of its attractive theoretical properties and easy empirical calibration. Besides, the CD production function is used to compute the Solow residuals or the Total Factor Productivity (TFP) which further serves as a shock vector in the literature on Real Business Cycle (RBC) models. The usual log-linear specification of CD production function is given by :

$$\ln Y = \ln A + \alpha \ln K + \beta \ln L + u \qquad (1)$$

where A is the efficiency parameter, α and β indicate the returns to a factor or the partial elasticities of output with regard to capital and labour, respectively. By imposing the unitary restriction ($\alpha + \beta = 1$), the CD production function can be transformed into :

$$\ln (Y/L) = \beta_1 + \beta_2 \ln (K/L) \qquad (2)$$

As is well known the C-D production function, despite its many attractive properties, restricts the elasticity of substitution between capital and labour to unity which may or may not be empirically valid. In order to estimate the elasticity of substitution and hence to test the validity of this assumption, we use the side relation equation, developed by Arrow *et al* (1961), of the following form:

$$\ln (Y/L) = \psi_1 + \psi_2 \ln (w) \qquad (3)$$

where ψ_2 is the elasticity of substitution parameter and w the wage variable.

The Kmenta's approximation of the Constant Elasticity of Substitution (CES) production function (u omitted) is given by:

$$In\ Y = \phi_1 + \phi_2 \ln K + \phi_3 \ln L + \phi_4 (\ln K/L)^2 \qquad (4)$$

For $\phi_4 = 0$, the CES production function reduces to CD production function.

A production function which imposes fewer restrictions is the translog production function [Christensen, Jorgensen and Lau (1971, 1973), Berndt and Christensen (1972)] and it can be specified by:

$$\ln Y = \gamma_1 + \gamma_2 \ln K + \gamma_3 \ln L + \gamma_4 (1/2)[\ln K]^2 + \gamma_5 (1/2)[\ln L]^2 + \gamma_6 \ln K^* \ln L \qquad (5)$$

In equation (5), γ_2 and γ_3 are the same as the parameters of the C-D production function. The quadratic and interactive terms provide information on the curvature of the production function or the substitution possibilities. When $\gamma_4 = \gamma_5 = -\gamma_6/2$, equation (7) becomes Kmenta's approximation to the C.E.S. production function and when $\gamma_4 = \gamma_5 = \gamma_6 = 0$, it reduces to the C-D production function. The nested and non-nested nature of the C.D, C.E.S. and Translog production functions were earlier discussed, in detail, by Monga and Tarlok Singh (1992).

(B) New Production Function

All the aforementioned production functions are specified on an *a priori* assumption about their functional form and hence are susceptible to the specification bias. Recently, **Bairam** (1989) has introduced a more generalised approach to the estimation of production function in which the data determine the appropriate functional form of the production function. The Bairam production function is specified as :

$$(Y^{\lambda} - 1) / \lambda = \prod_{o} + \prod_{1} [(K^{\lambda} - 1) / \lambda] + \prod_{2} [(L^{\lambda} - 1) / \lambda] + \varepsilon_{i} \quad (6)$$

where $-\infty < \lambda < +\infty$ and $\prod_1 > 0$, $\prod_2 > 0$

The Bairam production function given by equation (6) reduces to linear form when $\lambda = 1$ and log-linear form when $\lambda = 0$. The mean elasticities of output with regard to capital (K) and labour (L) can be computed as :

$$\eta_{yk} = \hat{\beta}_k (\bar{K} / \bar{Y})^{\hat{\lambda}} \text{ and } \eta_{yi} = \hat{\beta}_1 (\bar{L} / \bar{Y})^{\hat{\lambda}}$$

The elasticity of technical substitution (σ) between capital and labour is given by $\sigma = (1/1-\lambda)$. In equation (6), $\sigma \geq 0$ when $\lambda \leq 1$ and $\sigma \leq 0$ when $\lambda \geq 1$. So long as $\lambda \leq 1$, the Bairam production function (6) satisfies the properties of the Neo-Classical production function and hence approximates to the CES production function.

In our present study, equation (6) was estimated for the different values of λ and the value which minimises $\hat{\sigma}^2(\lambda)$ would maximise the log-likelihood function and the equation with such value of λ was selected. The concentrated log-likelihood function (L*) for the given λ is specified, except for a constant, as :

$$L^*(\lambda,\rho,Y,K,L) = -(N/2) \ln \hat{\sigma}^2(\lambda) + (1/2) \ln(1-p^2) + (\lambda-1) \sum_{i}^{N} \ln Yi \quad (7)$$

where $\hat{\sigma}^2$ is the constant variance of the error distribution and N is the sample size. The log-likelihood ratio (LR) test was carried out to decide as to which functional form (linear or log-linear) is more appropriate. The LR test statistics is given by:

$$L_{max}(\tilde{\lambda}) - L_{max}(\lambda) < (1/2)\chi^2(\alpha) \qquad (8)$$

It may be mentioned that in the specification of above mentioned form, it is implicitly assumed that the error distribution is homoskedastic across the observations of the dependent variable as transformed by the true λ value and such an assumption is based on convenience rather than on any apparent justification. However, such a discussion is beyond the scope of this paper.

SECTION III

Empirical Estimates of Production Functions

At the outset, it may be mentioned that the OLS estimates obtained for all the aforementioned production functions were corrected for the problem of auto-correlation [AR(1)] using the Cochrane-Orcutt (C-O) iterative procedure.

In the Cobb-Douglas production function, the regression co-efficients of capital carried the correct positive signs for all the industries in the manufacturing sector and were also statistically significant except for the sub-groups like cotton textiles, jute products, wood products, rubber products, chemical, basic metals, metal products and transport equipment industries (Table 3). The regression coefficients of labour were found to carry unexpected negative signs in industries such as beverages, tobacco and tobacco products, wood products, paper products, chemicals group, basic metal and alloy industries and other manufacturing industries. However, these can be ignored, as such coefficients are either statistically insignificant or are significant at only low (10 per cent) levels of significance. It is, however, important to note that in most of the traditional agro-based industries like cotton textiles, jute products and other textiles, the co-efficient of labour was prominent and was statistically significant. For the manufacturing sector as a whole, the partial elasticities of output with respect to capital was found to be 0.68, while that with regard to labour was virtually zero (0.04).

We also estimated the **unity constrained** ($\alpha + \beta = 1$) Cobb-Douglas production function (Table 4). The share of capital for the manufacturing sector as a whole at 0.64 was very close to the figure estimated in the unconstrained Cobb-Douglas production function (0.68). To test the validity of unity restriction (i.e., $\alpha + \beta = 1$), we conducted a F-test and found the F-value (11.49) to be statistically significant at 1 per cent level.

Thus, we rejected the null-hypothesis of constant returns to scale for the manufacturing sector and similar results were found for all industries at the disaggregative level except for food products and wood products. In the case of food products and wood products industries, the null of constant returns to scale was accepted. (Annexure II)

The assumption of unitary elasticity of substitution in CD production function was tested by estimating the side relation equation of Arrow *et al* and the results so obtained rejected the null-hypothesis of unitary elasticity of substitution[3] (Table 5). For the manufacturing sector as a whole, the elasticity of substitution between capital and labour was found to be dimensionally meagre at -0.07 and statistically insignificant. These results are somewhat inconsistent with those obtained at the disaggregative level. At the disaggregative level, most of the agro-based industries like cotton textiles, wool products, rubber products etc., showed markedly low elasticities of substitution between capital and labour. On the other hand, industries such as food products and the engineering group (items 12 to 17) showed fairly high elasticities of substitution ranging between 0.60 to 0.90. The industries which yielded estimates of elasticity of substitution between capital and labour closer to unitary include wood products.

The results obtained from the CES and Translog production functions were generally marked by the problem of multicollinearity and were found to be weak on the scores of different test statistics. For most of the industries, the estimated parameters of CES production function were not statistically significant except for the industries such as metal products (Annexure III). Similarly the estimates obtained from the Translog production function (Annexure IV) were also weak; given the limited degrees of freedom, they could be considered better than those obtained from the CES production function. One of the reasons for the poor performance of CES and Translog production functions can be the appearance of cross product and quadratic terms in a small sample size. However, we have reported the results for both CES and Translog production functions mainly for the purpose of reference and rough comparison with the estimates of other production functions [Annexures III and IV]. Moreover, we have used these results to test for the nested and non-nested nature of the CD production function. However, such test would only be a rough guide as the latter two production functions (CES and Translog) are not statistically sound. As mentioned earlier in equation (4), if one restricts the value of $\varnothing_4$ to be equal to zero, the CES production function collapses to Cobb-Douglas production function. The F-test showed that this restriction is valid for the manufacturing sector as a whole as

well as for most of the individual industries in the manufacturing sector (Annexure II).

The Cobb-Douglas production function is also nested in translog production function and to test the validity of the restriction that $\gamma_4 + \gamma_5 + \gamma_6 = 0$ in equation (5), we again performed the F-test which rejected the null-hypothesis of such restriction for the manufacturing sector as a whole (Annexure II). However, for most of the individual industries (eleven) the F-test showed that the restrictions are valid, while for some other industries (seven), the restrictions were found to be invalid.

The Bairam production function which is claimed as an alternative to the CES production function, requires the estimation of a **set of several equations for different values of λ for each industry group**. For each industry, we estimated **20 equations** for the **different values** of λ[-0.1, -0.2,....., 0, 0.1, 0.2,.....1.0] and we selected the equation with the value of λ that maximised the log-likelihood function. The selected equations and the corresponding values of λ which maximised the log-likelihood function are given in Table 6. Such selected equations were then subjected to the LR test so as to test for the restriction of $\lambda = 0$ and $\lambda = 1$. The LR test statistics computed for the test of such restrictions are also given in Table 6. The LR test indicated that the log-linear model is accepted, while the linear model is rejected for all the industries in the manufacturing sector at the aggregative as well as disaggregative levels. Thus, the Bairam production function confirms the conventionally accepted log-linear form of the production function. The results obtained from the Bairam production function were found to be tenable on the scores of different test statistics and were also remarkably better than those obtained from the CES production function. In view of this, for the manufacturing sector in India, we would prefer the use of Bairam production function to that of CES production function. The elasticity of technical substitution (σ) between capital and labour was found to be less than unity in the case of all the manufacturing industries at the aggregative as well as disaggregative levels (Table 6). The elasticities of output with respect to capital and labour derived from the Bairam production function were found to be quite close to those obtained from the CD production function for most of the industries (Table 7).

The returns to scale computed from the Bairam production function are given in Table 8. It can be seen from Table 8 that half of the industrial groups (nine) registered increasing returns to scale (IRS), while the remaining half recorded decreasing returns to scale (DRS). Broadly,

all the three production functions consistently indicated the same direction in respect of the returns to scale. Thus, all the three production functions consistently invalidate the assumption of constant returns to scale (CRS) for most of the industries in the manufacturing sector in India. Table 8 presents the comparative picture of the returns to scale estimated from Cobb-Douglas, C.E.S and Bairam production functions for various industries in the manufacturing sector during 1974-90. At the aggregative level, both the CD ($\alpha + \beta = 0.72$) and CES (0.91) production functions consistently showed the existence of decreasing returns to scale in the manufacturing sector in India during 1974-90. Similarly, the Bairam production function also showed the existence of decreasing returns to scale (0.76). For most of the industries, the results obtained from C.D and Bairam production functions were broadly in the same direction, except for the industries such as cotton textiles and rubber products. Most of the agro-based industries (industries 1 to 5 and 7) witnessed decreasing returns to scale. A notable exception was the performance of synthetic textile industry which recorded increasing returns to scale. Among the engineering industry group, except transport equipment, most of the industries showed increasing returns to scale. These results are in tune with the F-test results which invalidated the unity restrictions on the CD production function and hence contradicted the assumption of constant returns to scale (CRS) for most of industries in the manufacturing sector (Annexure II).

SECTION IV

Conclusions

The foregoing analysis brings into focus the changing structure of industries in the manufacturing sector; agro-based industries like food products, tobacco products, wool products, jute textiles have lost their shares not only in manufacturing output but also in fixed capital and employment during 1974-90. Similar trends were evident in engineering industries. However, the shares of chemical industries in manufacturing output, fixed capital and employment have shown improvements. The study also indicates that there has been an increase in the use of capital relative to that of labour in most of the industries in the manufacturing sector in India during 1974-90. Capital productivity recorded marginal improvements in the seventies followed by the gradual declines in the eighties. The labour productivity has shown steady improvements during 1974-90, with the signs of significant improvements in the eighties.

Among the production functions estimated, the CD and Bairam production functions performed better than the CES and Translog production functions. The poor performance of the latter two production functions (CES and Translog) can be attributed to the obvious problem of multicollinearity, accentuated by the appearance of quadratic and cross product terms. Moreover, in this study the limited degrees of freedom, also impinged upon the efficient estimation of the translog production function. The returns to scale and elasticities of output with respect to capital and labour derived from Bairam production function were, more or less, similar to those derived from the C.D production function. The study invalidates the proposition of constant returns to scale and confirms the validity of decreasing returns to scale for most of the industries in the manufacturing sector in India[4]. Thus in the context of productivity studies of manufacturing sector in India, use of the CD production function or Bairam production function could be considered as appropriate for analytical purposes.

Notes

1. Some of the studies which have analysed the performance of industries at the aggregate and disaggregated level using a production function framework by Sastri (1966), Diwan (1968), Banerji (1975), Gupta (1973), Narasimham and Falerary (1974), Mehta (1966), Goldar (1983, 1986, 1992), Ahluwalia (1985, 1991) and Jha, Murty, Paul and Rao (1993).

2. The share of chemical products (item 11 in Table I) in manufacturing employment has shown a decline from 6.25 in 1973-74 to 3.37 by 1989-90.

3. Some of the earlier studies by Banerji (1974) and Gujarati (1966) found the evidence of unitary elasticity of subsitution between capital and labour in India. But these studies related to fifties and early sisties only and since then there are drastic changes in the trends in the data.

4. These results are at variance with the results of increasing returns to scale obtained in our earlier study conducted at the aggregative level for the industrial sector for a larger sample space of 31 years (1960-90).

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Table 1 : Structure of Manufacturing Industries in India - Shares of Various Industries in Manufacturing Sector Output, Fixed Capital and Employment : 1974-90

Industries	Net Value Added			Fixed Capital			Employment		
	1973-74	1979-80	1989-90	1973-74	1979-80	1989-90	1973-74	1979-80	1989-90
1	2	3	4	5	6	7	8	9	10
1. Manufacture of Food Products	8.51	8.78	10.91	7.89	7.50	7.61	13.53	17.29	15.52
2. Manufacture of Beverages, Tobacco and Tobacco Products	5.24	2.75	2.86	0.99	0.82	1.08	4.31	5.93	7.42
3. Manufacture of Cotton Textiles	19.33	15.93	7.02	7.99	6.24	4.78	18.89	16.64	12.27
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	3.82	4.16	4.22	2.31	2.29	4.26	3.12	3.25	4.09
5. Manufacture of Jute, Hemp and Mesta Textiles	3.13	3.83	1.13	1.14	0.59	0.64	5.22	4.24	3.03
6. Manufacture of Textile Products (incl.wearing apparel other than footwear).	1.10	1.28	1.86	0.44	0.53	0.74	1.30	1.55	2.32
7. Manufacture of Wood and Wood Products, Furniture and Fixtures.	0.8	0.77	0.38	0.40	0.35	0.35	1.47	1.26	1.04
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	5.17	4.85	3.65	4.7	4.08	4.01	4.88	4.03	3.91
9. Manufacture of Leather, Leather and Fur Products (except repair)	0.68	0.87	0.85	0.23	0.46	0.43	0.87	0.89	1.47
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products	3.94	5.66	14.36	4.93	6.58	20.77	2.20	2.68	8.05
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	3.26	3.47	8.13	21.01	22.18	7.28	6.25	7.21	3.37
12. Manufacture of Non-Metallic Mineral Products.	3.79	4.16	4.46	5.04	3.54	8.45	5.51	4.98	6.23
13. Manufacture of Basic Metal and Alloy Industries.	11.60	12.44	11.91	22.83	24.78	21.03	8.90	8.18	8.45
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	3.64	3.83	2.70	1.98	1.48	1.48	3.42	2.97	3.10
15. Manufacture of Machinery, Machine Tools and Parts.	8.09	9.12	7.74	5.94	5.00	4.63	6.31	6.18	6.24
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	8.25	8.40	9.01	5.28	4.14	5.22	4.91	4.62	5.47
17. Manufacture of Transport Equipment and Parts.	8.38	8.82	7.51	6.04	8.86	6.33	7.61	7.09	6.77
18. Other Manufacturing Industries.	1.26	0.88	1.28	0.86	0.59	0.92	1.33	1.01	1.26
Manufacturing Industries (1 to 18)	100	100	100	100	100	100	100	100	100

Source: Government of India, Central Statistical Organisation, Annual Survey of Industries (Various issues).

Table 2: Trends in Factor Use and Productivity Ratios (averages) in Manufacturing in India : 1974-90

Industries	Capital Intensity (K/L)		Capital Productivity (Y/K)		Labour Productivity (Y/L)	
	1974-80	1981-90	1974-80	1981-90	1974-80	1981-90
1	2	3	4	5	6	7
1. Manufacture of Food Products	0.11	0.18	0.72	0.76	0.08	0.14
2. Manufacture of Beverages Tobacco and Tobacco Products	0.05	0.07	2.25	1.59	0.11	0.10
3. Manufacture of Cotton Textiles	0.10	0.18	1.33	0.77	0.13	0.13
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	0.19	0.40	1.01	0.59	0.19	0.23
5. Manufacture of Jute, Hemp and Mesta Textiles	0.04	0.07	2.34	1.62	0.10	0.10
6. Manufacture of Textile Products (incl. wearing apparel other than footwear).	0.08	0.13	1.61	1.38	0.13	0.18
7. Manufacture of Wood and Wood Products, Furniture and Fixtures.	0.07	0.13	1.20	0.90	0.09	0.11
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	0.26	0.51	0.71	0.41	0.18	0.20
9. Manufacture of Leather, Leather and Fur Products (except repair)	0.10	0.16	1.34	0.97	0.13	0.15
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	0.66	1.00	0.55	0.56	0.36	0.55
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	0.80	0.97	0.09	0.17	0.07	0.17
12. Manufacture of Non-Metallic Mineral Products.	0.20	0.48	0.62	0.43	0.12	0.18
13. Manufacture of Basic Metal and Alloy Industries.	0.75	1.10	0.31	0.28	0.23	0.31
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	0.13	0.21	1.27	1.08	0.17	0.22
15. Manufacture of Machinery, Machine Tools and Parts.	0.23	0.31	0.98	0.98	0.23	0.30
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	0.26	0.36	1.04	1.06	0.27	0.38
17. Manufacture of Transport Equipment and Parts.	0.26	0.40	0.81	0.66	0.19	0.26
18. Other Manufacturing Industries.	0.15	0.27	1.15	1.08	0.18	0.28
Manufacturing Industries (1 to 18)	0.23	0.39	0.75	0.61	0.17	0.24

Source:Same as in Table 1.

Table 3 : Estimates of Cobb-Douglas Production Function for the Manufacturing Industries in India: 1974-90

Industries	Dependent Variable ln(Y)			Tests Statistics				
	Constant	Ln(K)	ln(L)	$\bar{R}^2$	D.W	S.E.E	Mean Log L.F	
1	2	3	4	5	6	7	8	9
1. Manufacture of Food Products	-3.06	1.13*	0.08	0.92	1.75	0.1082	11.62	15.21
	(-0.92)	(9.78)	(0.36)					
2. Manufacture of Beverages, Tobacco and Tobacco Products	6.99*	0.64*	-0.22	0.63	1.87	0.1876	10.48	5.96
	(3.24)	(5.43)	(-1.11)					
3. Manufacture of Cotton Textiles	0.63	0.53	0.76*	0.88	1.56	0.1111	11.69	14.79
	(0.47)	(0.47)	(4.43)					
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	2.61	0.44**	0.26	0.90	1.52	0.1028	10.77	16.18
	(0.66)	(2.75)	(0.59)					
5. Manufacture of Jute, Hemp and Mesta Textiles	-6.90	0.17	1.23*	0.44	1.70	0.1379	10.10	11.76
	(-1.56)	(1.19)	(3.95)					
6. Manufacture of Textile Products(incl.wearing apparel other than footwear).	-5.15	0.41*	0.95*	0.93	1.95	0.1135	9.66	14.43
	(-0.53)	(2.63)	(2.41)					
7. Manufacture of Wood and Wood Products, Furniture and Fixtures.	5.98	0.43*	-0.08	0.64	1.72	0.0912	8.93	8.93
	(1.17)	(4.93)	(-0.19)					
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	18.07*	0.45*	-1.00***	0.63	1.98	0.1093	10.85	15.15
	(2.78)	(4.48)	(-1.69)					
9. Manufacture of Leather, Leather and Fur Products (except repair)	-4.37**	0.10	1.13*	0.93	1.80	0.1040	9.06	15.81
	(-2.21)	(0.51)	(3.49)					
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	0.23	0.86*	0.65	0.85	1.83	0.2377	11.28	1.94
	(0.08)	(3.48)	(0.15)					
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	10.27	0.81***	-0.77***	0.93	1.40	0.1055	10.65	14.89
	(1.55)	(2.07)	(-1.99)					
12. Manufacture of Non-Metallic Mineral Products.	-17.13*	0.10	2.09*	0.94	1.71	0.1015	10.91	16.35
	(-3.39)	(0.82)	(4.25)					

Contd..

Table 3: Estimates of Cobb-Douglas Production Function for the Manufacturing Industries in India: 1974-90 (Concld).

Industries	Dependent Variable ln(Y)			Tests Statistics				
	Constant	Ln(K)	ln(L)	$\bar{R}^2$	D.W	S.E.E	Mean	Log L.F
1	2	3	4	5	6	7	8	9
13. Manufacture of Basic Metal and Alloy Industries.	10.72	1.16*	-1.06	0.80	1.89	0.1412	11.93	10.81
	(1.49)	(3.95)	(-1.32)					
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	-4.71**	0.56*	0.77*	0.91	1.66	0.0639	10.53	24.28
	(-1.81)	(8.21)	(3.12)					
15. Manufacture of Machinery, Machine Tools and Parts.	-8.86*	0.63*	1.01*	0.95	1.57	0.0663	11.57	23.59
	(-4.00)	(7.71)	(4.44)					
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	-9.95*	0.50*	0.49*	0.96	1.86	0.0672	11.53	23.42
	(-3.92)	(4.52)	(4.35)					
17. Manufacture of Transport Equipment and Parts.	0.21	0.46*	0.45	0.90	1.30	0.1029	11.53	15.92
	(0.05)	(3.67)	(1.16)					
18. Other Manufacturing Industries.	2.11	0.85*	-0.06	0.88	1.89	0.1698	9.72	7.67
	(1.79)	(6.08)	(-0.31)					
Manufacturing Industries (1 to 18)	3.60	0.68*	0.04	0.96	1.73	0.0592	14.06	25.54
	(0.90)	(15.12)	(0.19)					

Notes: 1. Figures in brackets are t values.
2. *,**,*** indicate the statistical significance at 1, 5 and 10 per cent levels of significance, respectively.
3. Log L.F. implies the Log of Likelihood function.
4. All the equations have been corrected for auto-correlation, using Cochrane-Orcutt iterative procedure.

Table 4: Estimates of Restricted Cobb-Douglas Production Function for the Manufacturing Industries in India : 1974-90

Industries	Dependent Variable ln(Y/L)		Tests Statistics				
	Constant	ln(K/L)	$\bar{R}^2$	D.W	S.E.E	Mean Log L.F	
1	2	3	4	5	6	7	8
1. Manufacture of Food Products	-0.09	1.11*	0.93	1.66	0.1076	-2.25	14.78
	(-0.44)	(10.57)					
2. Manufacture of Beverages, Tobacco and Tobacco Products	-0.48	0.63*	0.55	1.66	0.2176	-2.32	2.81
	(-0.80)	(3.03)					
3. Manufacture of Cotton Textiles	-2.17*	-0.08	0.19	1.37	0.1220	-2.03	12.56
	(-8.98)	(-0.67)					
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	-1.19*	0.06*	0.56	1.60	0.1022	-1.55	15.70
	(-14.18)	(4.49)					
5. Manufacture of Jute, Hemp and Mesta Textiles	-2.04*	0.08	0.08	1.79	0.1389	-2.29	10.47
	(-6.04)	(0.76)					
6. Manufacture of Textile Products (incl. wearing apparel other than footwear).	-0.43**	0.64*	0.76	1.87	0.1175	-2.56	13.31
	(-2.57)	(8.69)					
7. Manufacture of Wood and Wood Products, Furniture and Fixtures.	-1.14*	0.49*	0.72	1.51	0.0934	-2.29	17.24
	(-6.64)	(6.70)					
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	-1.38*	0.27**	0.34	1.64	0.1291	-1.65	11.66
	(-10.71)	(2.25)					
9. Manufacture of Leather, Leather and Fur Products (except repair)	-1.26*	0.34*	0.45	1.39	0.1053	-1.95	15.21
	(-6.72)	(3.73)					
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	-0.65*	0.81*	0.61	1.81	0.2304	-0.81	1.89
	(-8.75)	(4.35)					
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	-1.97*	2.79*	0.49	1.32	0.3931	-2.28	-7.20
	(-17.90)	(4.38)					
12. Manufacture of Non-Metallic Mineral Products.	-1.41*	0.41*	0.78	1.45	0.1241	-1.88	12.30
	(-11.44)	(4.25)					

Contd..

Table 4: Estimates of Restricted Cobb-Douglas Production Function for the Manufacturing Industries in India : 1974-90 (Concld).

Industries	Dependent Variable ln(Y/L)		Tests Statistics				
	Constant	ln(K/L)	$\bar{R}^2$	D.W	S.E.E	Mean	Log L.F
1	2	3	4	5	6	7	8
13. Manufacture of Basic Metal and Alloy Industries.	-1.25*	0.75*	0.57	1.84	0.0222	-1.30	9.27
	(-30.79)	(4.52)					
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	-0.53*	0.62*	0.85	1.58	0.0658	-1.62	23.17
	(-4.09)	(8.38)					
15. Manufacture of Machinery, Machine Tools and Parts.	-0.22	0.85*	0.82	1.52	0.0858	-1.32	16.68
	(-1.46)	(7.52)					
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	-0.14	0.84*	0.85	1.76	0.0855	-1.11	18.67
	(-0.97)	(6.85)					
17. Manufacture of Transport Equipment and Parts.	-0.96*	0.45*	0.80	1.25	0.0999	-1.47	15.86
	(-6.78)	(3.99)					
18. Other Manufacturing Industries.	-0.63***	0.57**	0.70	1.81	0.1721	-1.52	6.70
	(-1.76)	(2.61)					
Manufacturing Industries (1 to 18)	-0.84*	0.64*	0.93	1.82	0.0615	-1.59	24.35
	(-15.93)	(14.89)					

Notes: Same as in Table 3.

Table 5: Estimates of Side Relation Equation of Arrow et al for the Manufacturing Industries in India : 1974-90

Industries	Dependent Variable ln(Y/L)		Tests Statistics				
	Constant	ln(W)	$\bar{R}^2$	D.W	S.E.E	Mean	Log L.F
1	2	3	4	5	6	7	8
1. Manufacture of Food Products	-11.78*	0.89*	0.83	1.71	0.1664	-2.24	6.91
	(-3.25)	(2.66)					
2. Manufacture of Beverages, Tobacco and Tobacco Products	0.96	-0.33	0.46	2.03	0.2382	-2.31	1.00
	(0.35)	(-1.18)					
3. Manufacture of Cotton Textiles	-0.98***	-0.09***	0.33	1.51	0.0128	-2.03	14.17
	(-1.83)	(-1.96)					
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	-4.82*	0.33*	0.44	1.65	0.1148	-1.55	13.74
	(-5.56)	(3.77)					
5. Manufacture of Jute, Hemp and Mesta Textiles	-8.25*	0.60*	0.33	1.71	0.1184	-2.30	13.15
	(-3.43)	(2.47)					
6. Manufacture of Textile Products (incl. wearing apparel other than footwear).	-7.85*	0.10*	0.70	1.90	0.1324	-1.87	11.30
	(-8.94)	(6.81)					
7. Manufacture of Wood and Wood Products, Furniture and Fixtures.	-11.05*	1.06*	0.64	1.97	0.1051	-2.29	15.24
	(-6.55)	(5.19)					
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	-6.85**	0.51***	0.33	1.85	0.1313	-1.65	11.33
	(-2.57)	(1.96)					
9. Manufacture of Leather, Leather and Fur Products (except repair)	-4.49*	0.30*	0.45	1.94	0.0969	-1.95	16.04
	(-6.41)	(3.66)					
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	-1.58	0.07	0.48	1.80	0.2645	-0.81	-0.73
	(-0.84)	(0.39)					
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	13.63*	-1.55*	0.92	2.19	0.1548	-2.28	7.82
	(8.44)	(-10.56)					
12. Manufacture of Non-Metallic Mineral Products.	-10.96*	0.89*	0.88	1.71	0.0921	-1.88	17.36
	(-8.20)	(6.79)					

Contd...

Table 5 : Estimates of Side Relation Equation of Arrow et al for the Manufacturing Industries in India : 1974-90 (Concld.)

Industries	Dependent Variable ln(Y/L)		Tests Statistics				
	Constant	ln(W)	$\bar{R}^2$	D.W	S.E.E	Mean	Log L.F
1	2	3	4	5	6	7	8
13. Manufacture of Basic Metal and Alloy Industries.	-9.52*	0.73*	0.41	1.80	0.1758	-1.30	6.49
	(-3.62)	(3.13)					
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	-10.00*	0.85*	0.82	1.95	0.0712	-1.63	21.85
	(-11.20)	(9.38)					
15. Manufacture of Machinery, Machine Tools and Parts.	-9.59*	0.76*	0.87	1.89	0.0716	-1.32	21.67
	(-8.31)	(7.17)					
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	-9.83*	0.81*	0.89	1.87	0.0767	-1.11	20.49
	(-8.51)	(7.55)					
17. Manufacture of Transport Equipment and Parts.	-9.09*	0.69*	0.78	1.24	0.1054	-1.47	14.99
	(-4.57)	(3.83)					
18. Other Manufacturing Industries.	-2.07*	0.06	0.70	1.61	0.1702	-1.53	6.47
	(-2.53)	(0.66)					
Manufacturing Industries (1 to 18)	-1.53	-0.07	0.82	1.58	1.58	-1.59	15.53
	(0.72)	(-0.50)					

Notes: Same as in Table 3.

Table 6 (a) : Estimates of Bairam Production Function for the Manufacturing Industries in India : 1974-90
(Dependent Variable : $(y^{\lambda}-1)$)

Industrial Group	Independent Variables			Test Statistics								
	Constant	$[(K^{\lambda}-1)/\lambda]$	$[(L^{\lambda}-1)/\lambda]$	$\bar{R}^2$	D.W.	S.E.E.	Mean	Log L.F.	[LR (λ=1)]	[LR (λ=0)]	λ	σ
1	2	3	4	5	6	7	8	9	10	11	12	13
1. Manufacture of Food Products	-1.62	1.21*	0.27	0.91	1.74	0.0316	119020	183.13	-4.04	-1.66	-0.30	0.77
	(-1.19)	(8.77)	(0.67)									
2. Manufacture of Beverages,	4.033**	0.41*	-3.44***	0.57	1.90	0.0005	37394	173.70	-3.21	-2.90	-1.00	0.50
Tobacco and Tobacco Products	(2.33)	(5.65)	(1.77)									
3. Manufacture of Cotton	-3.39**	-0.02	4.03*	0.96	1.59	0.0000	123730	182.48	6.73	2.82	-0.90	0.53
Textiles	(-2.85)	(-0.34)	(3.53)									
4. Manufacture of Wool, Silk and	0.37	0.44**	0.45	0.91	1.53	0.0105	50118	166.39	7.96	1.03	-0.20	0.83
Synthetic Fibre Textiles	(0.20)	(2.90)	(0.82)									
5. Manufacture of Jute, Hemp	-10.91*	0.11	11.81*	0.42	1.79	0.0001	24879	159.78	5.65	1.64	-1.00	0.50
and Mesta Textiles	(-4.05)	(1.27)	(4.41)									
6. Manufacture of Textile	-3.93***	0.41**	1.12**	0.94	2.02	0.0379	17411	149.34	16.84	1.12	-0.10	0.91
Products (incl. wearing apparel other than footwear)	(-1.87)	(2.95)	(2.64)									
7. Manufacture of Wood and Wood	4.22	0.44*	-0.13	0.65	1.76	0.0337	7685	133.64	1.10	0.67	-0.10	0.91
Products, Furniture and Fixtures	(1.22)	(5.40)	(-0.27)									
8. Manufacture of Paper and Paper	6.25*	0.70*	-3.46*	0.71	1.57	0.0001	52591	166.95	8.21	2.26	-0.60	0.63
Products, Printing and Publishing and allied industries.	(4.18)	(7.72)	(-3.55)									
9. Manufacture of Leather, Leather	-5.52*	0.17	5.80*	0.96	1.85	0.0002	9290	136.20	7.42	1.76	-0.90	0.53
and Fur Products (except repair)	(-5.68)	(2.38)	(6.20)									
10. Manufacture of Rubber, Plastics,	-0.44	0.88*	0.42	0.85	1.84	0.0697	96593	189.76	5.81	0.03	-0.10	0.91
Petroleum and Coal Products.	(-0.27)	(3.75)	(0.36)									

Notes : Same as in Table 3.

Table 6 (a) : Estimates of Bairam Production Function for the Manufacturing Industries in India : 1974-90
(Dependent Variable : $(y^{\lambda}-1)$)

Industrial Group	Independent Variables			Test Statistics								
	Constant	$[(K^{\lambda}-1)/\lambda]$	$[(L^{\lambda}-1)/\lambda]$	$\bar{R}^2$	D.W.	S.E.E.	Mean	Log L.F.	[LR (λ=1)]	[LR (λ=0)]	λ	σ
1	2	3	4	5	6	7	8	9	10	11	12	13
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal)	9.20* (9.69)	1.55** (2.30)	-2.59** (-3.92)	0.93	1.15	0.0139	51396	171.51	23.61	2.71	-0.20	0.83
12. Manufacture of Non-Metallic Mineral Products	-99.82* (-3.64)	0.09 (1.22)	1.15* (5.08)	0.94	1.75	2.4100	59463	168.99	2.51	0.36	-0.30	0.77
13. Manufacture of Basic Metal and Alloy Industries	2.19 (1.03)	1.83* (4.24)	-1.71 (-1.36)	0.81	1.89	0.0011	158890	191.64	6.83	0.72	-0.40	0.71
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment	-2.60** (-2.57)	0.53* (8.44)	1.77* (3.26)	0.91	1.61	0.0003	38449	155.72	-4.08	-1.88	-0.50	0.66
15. Manufacture of Machinery, Machine Tools and Parts	-6.03* (-4.74)	0.63* (8.66)	1.18* (5.14)	0.95	1.34	0.0193	110650	173.57	-7.13	-0.93	-0.10	0.91
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	-6.69* (-4.38)	0.48* (4.71)	1.42* (4.78)	0.96	1.86	0.0193	108660	172.68	4.22	-0.01	-0.10	0.91
17. Manufacture of Transport Equipment and Parts.	-0.13 (-0.11)	0.35** (2.78)	0.72 (0.99)	0.92	1.64	0.0001	106910	179.46	4.54	0.75	-0.60	0.62
18. Other Manufacturing Industries	1.49*** (1.82)	0.86* (7.24)	-0.09 (-0.47)	0.87	1.88	0.0578	19036	157.46	4.68	1.16	-0.10	0.91
Manufacturing Industries (1 to 18)	0.83 (1.12)	0.81* (17.49)	0.15 (0.45)	0.95	1.81	0.0021	1327995	214.57	4.68	1.16	-0.40	0.71

Notes : Same as in Table 3.

Table 7: Estimated Elasticities for the Manufacturing Industries in India as per Cobb-Douglas and Bairam Production Functions : 1974-90

Industries	Elasticity of output with regard to			
	Capital		Labour	
	As per C.D production function	As per Bairam production function	As per C.D production function	As per Bairam production function
1	2	3	4	5
1. Manufacture of Food Products	1.13	1.11	0.08	0.14
2. Manufacture of Beverages, Tobacco and Tobacco Products	0.64	0.68	-0.22	-0.34
3. Manufacture of Cotton Textiles	0.53	0.02	0.76	0.65
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	0.44	0.40	0.26	0.33
5. Manufacture of Jute, Hemp and Mesta Textiles	0.17	0.19	1.23	1.21
6. Manufacture of Textile Products (incl. wearing apparel other than footwear).	0.41	0.42	0.95	0.94
7. Manufacture of Wood and Wood Products, Furniture and Fixtures.	0.43	0.44	0.08	-0.10
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	0.45	0.44	-1.00	-1.30
9. Manufacture of Leather, Leather and Fur Products (except repair)	0.40	0.18	1.14	1.04
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	0.86	0.83	0.65	0.39
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	1.15	1.02	-2.01	-1.68
12. Manufacture of Non-Metallic Mineral Products.	0.10	0.07	2.09	0.67
13. Manufacture of Basic Metal and Alloy Industries.	1.16	1.12	-1.06	-1.04
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	0.56	0.56	0.77	0.80
15. Manufacture of Machinery, Machine Tools and Parts.	0.63	0.63	1.01	1.03
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	0.50	0.48	0.49	1.27
17. Manufacture of Transport Equipment and Parts.	0.46	0.33	0.45	0.62
18. Other Manufacturing Industries	0.85	0.86	-0.06	-0.07
Manufacturing Industries (1 to 18)	0.68	0.68	0.04	0.08

Source: Table 3 and 6.

Table 8: Returns to Scale in Manufacturing Industries in India : 1974-90

Industries	Returns to Scale					
	As per Cobb-Douglas production function	Status	As per C.E.S. production function	Status	As per Bairam production function	Status
1	2	3	4	5	6	7
1. Manufacture of Food Products	1.21	IRS	1.00	CRS	1.25	IRS
2. Manufacture of Beverages, Tobacco and Tobacco Products	0.42	DRS	0.67	DRS	0.34	DRS
3. Manufacture of Cotton Textiles	1.29	IRS	0.68	DRS	0.67	DRS
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	0.07	DRS	0.75	DRS	0.77	DRS
5. Manufacture of Jute, Hemp and Mesta Textiles	1.40	IRS	1.27	IRS	1.40	IRS
6. Manufacture of Textile Products (incl. wearing apparel other than footwear).	1.36	IRS	1.37	IRS	1.36	IRS
7. Manufacture of Wood and Wood Products, Furniture and Fixtures	0.35	DRS	0.33	DRS	0.34	DRS
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	-0.55	DRS	-0.81	DRS	-0.86	DRS
9. Manufacture of Leather, Leather and Fur Products (except repair)	1.23	IRS	1.21	IRS	1.22	IRS
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	1.51	IRS	0.78	DRS	1.22	IRS
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	0.04	DRS	-0.05	DRS	0.66	DRS
12. Manufacture of Non-Metallic Mineral Products.	2.19	IRS	2.21	IRS	0.74	DRS
13. Manufacture of Basic Metal and Alloy Industries.	0.10	DRS	0.29	DRS	0.08	DRS
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	1.33	IRS	1.31	IRS	1.36	IRS
15. Manufacture of Machinery, Machine Tools and Parts.	1.64	IRS	1.62	IRS	1.66	IRS
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	0.99	DRS	1.74	IRS	1.75	IRS
17. Manufacture of Transport Equipment and Parts.	0.91	DRS	0.91	DRS	0.95	DRS
18. Other Manufacturing Industries.	0.79	DRS	0.72	DRS	0.79	DRS
Manufacturing Industries (1 to 18)	0.72	DRS	0.91	DRS	0.76	DRS

Notes: 1. DRS indicate decreasing returns to scale, CRS : constant returns to scale and IRS :increasing returns to scale.
2. The negative values are due to the nagative signs and predominant magnitudes of the elasticities of output with regard to labour.

Annexure I

(I) Data Base: The data used in the study were taken from Annual Survey of Industries (ASI) (Various issues). The ASI is conducted every year since 1959 and is the principal source for detailed information in industrial characteristics like value added, value of output, employment, capital stock, wages, etc. The ASI data do not cover mining, defence factories, oil storage depots and technical training establishments and their coverage of electricity and gas is also inadequate. Hence the data can be considered comprehensive only for the manufacturing sector.

The ASI data covers all the units which employ more than 10 workers with the aid of power and those which employ between 10 to 49 workers without the aid of power. The ASI data consist of two series: (a) Census Sector and (b) Factory Sector. Census Sector consists of only those units which employ, on average, fifty or more workers with the aid of power and 100 persons or more without the aid of power. On the other hand, the 'Factory Sector' is more comprehensive in that it includes units which employ more than 10 workers as stated above. The present study is based on the data relating to the factory sector. The data relating to deflators used were taken from the Index Number of Wholesale prices published by Ministry of Industry, Government of India.

(II) Definitions of the Variables and Their Notations

Notation	Definition of the Variable
Y	Net Value Added (real) — Nominal net value added (in Rs. Lakhs) *deflated* by wholesale price index of manufactured products (Base: 1981-82=100; weight = 57.04)
K	Fixed capital stock (real) — Nominal fixed capital stock (in Rs. Lakhs) *deflated* by wholesale price index of machine and machine tools (Base: 1981-82=100; weight = 6.27)
L	Employees includes supervisory staff.
w	Emoluments (real) — Nominal emoluments (in Rs. Lakhs) *deflated* by consumer price index for industrial workers (Base: 1982 = 100, weight = 100).

Annexure II : F-Test For the Unity Restriction on Cobb-Douglas Production function and Its (CD) Nesting in the CES and Translog Production Functions

	Industries	F-Statistics		
		Cobb-Douglas Restricted Vs Unrestricted	Cobb-Douglas Unrestricted Vs C.E.S.	Cobb-Douglas Unrestricted Vs Translog
	1	2	3	4
1.	Manufacture of Food Products	0.95	0.62	1.70
2.	Manufacture of Beverages, Tobacco and Tobacco Products	7.34**	3.25**	2.22
3.	Manufacture of Cotton Textiles	82.69*	0.30	0.55
4.	Manufacture of Wool, Silk and Synthetic Fibre Textiles	52.27*	1.12	3.28***
5.	Manufacture of Jute, Hemp and Mesta Textiles	10.16*	2.06	4.02**
6.	Manufacture of Textile Products (incl. wearing apparel other than footwear).	37.96*	—	1.32
7.	Manufacture of Wood and Wood Products, Furniture and Fixtures.	2.83	2.16	3.76**
8.	Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	11.48*	2.25	4.46**
9.	Manufacture of Leather, Leather and Fur Products (except repair)	102.33*	16.74*	0.73
10.	Manufacture of Rubber, Plastics, Petroleum and Coal Products.	24.99*	1.41	1.59
11.	Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	63.29*	7.43*	7.05*
12.	Manufacture of Non-Metallic Mineral Products.	40.18*	0.02	0.73
13.	Manufacture of Basic Metal and Alloy Industries.	16.43*	0.16	0.43
14.	Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	13.31*	2.98	5.76**
15.	Manufacture of Machinery, Machine Tools and Parts.	36.61	*0.41	3.52***
16.	Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	43.92*	—	1.62
17.	Manufacture of Transport Equipment and Parts.	15.14*	0.41	0.93
18.	Other Manufacturing Industries.	28.19*	0.01	2.31
	Manufacturing Industries (1 to 18)	11.49*	0.81	4.60**

Note: 1. *,**,*** denote statistical significance at 1%, 5% and 10% levels, respectively.
2. -: Negligible.

Annexure III : Estimates of C.E.S. Production Function for the Manufacturing Industries in India : 1974-90

Industries	Dependent Variable [ln(Y)]				Test Statistics				
	Constant	ln(K)	ln(L)	(ln K - ln L)^2	$\bar{R}^2$	D.W	S.E.E	Mean	Log L.F
1	2	3	4	5	6	7	8	9	10
1. Manufacture of Food Products	1.60	2.93***	-1.93	0.47	0.91	1.36	0.2253	11.61	14.88
	(0.47)	(2.10)	(-1.33)	(1.28)					
2. Manufacture of Beverages, Tobacco and Tobacco Products	-3.59	-4.60	5.27***	-0.92**	0.69	1.86	0.1726	10.48	8.01
	(-0.60)	(-1.65)	(1.81)	(-1.89)					
3. Manufacture of Cotton Textiles	1.26	-1.24	1.92	-0.32	0.88	1.58	0.1139	11.69	15.00
	(0.72)	(-0.55)	(0.95)	(-0.57)					
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	2.48	1.14	-0.39	0.29	0.91	1.58	0.1020	10.77	16.95
	(0.68)	(1.76)	(-0.54)	(1.10)					
5. Manufacture of Jute, Hemp and Mesta Textiles	-2.21	2.47	-1.20	0.44	0.49	1.69	0.1322	10.10	12.49
	(-0.42)	(1.58)	(-0.71)	(1.48)					
6. Manufacture of Textile Products (incl. wearing apparel other than footwear).	-5.15	0.51	0.86	0.02	0.93	1.96	0.1177	9.66	14.43
	(-1.60)	(0.52)	(0.88)	(0.10)					
7. Manufacture of Wood and Wood Products, Furniture and Fixtures.	4.26	-1.30	1.63	-0.68	0.67	1.79	0.0871	8.93	19.64
	(0.91)	(-1.18)	(1.48)	(-1.58)					
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	21.29*	0.28	-1.09**	-0.10	0.66	1.53	0.1042	10.85	16.48
	(2.74)	(0.42)	(-2.39)	(-0.27)					
9. Manufacture of Leather, Leather and Fur Products (except repair)	-1.71	2.35	-1.13	0.52	0.93	1.94	0.1048	9.06	16.38
	(-0.44)	(0.86)	(-0.41)	(0.82)					
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	1.93	1.35*	-0.57	0.78	0.86	1.86	0.2333	11.27	2.90
	(0.66)	(3.40)	(-0.97)	(1.34)					
11. Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	15.71*	3.08*	-3.43*	-2.07	0.74	1.11	0.2606	10.70	1.01
	(3.43)	(3.32)	(-4.09)	(-0.36)					
12. Manufacture of Non-Metallic Mineral Products.	-17.35*	0.13	2.08*	0.02	0.94	1.71	0.1054	10.91	16.35
	(-2.87)	(0.30)	(3.83)	(0.07)					

Contd....

Annexure III : Estimates of C.E.S. Production Function for the Manufacturing Industries in India : 1974-90 (Concld.)

Industries	Dependent Variable [ln(Y)]				Test Statistics				
	Constant	ln(K)	ln(L)	(ln K - ln L)^2	$\bar{R}^2$	D.W	S.E.E	Mean	Log L.F
1	2	3	4	5	6	7	8	9	10
13. Manufacture of Basic Metal and Alloy Industries.	8.15	1.14*	-0.85	0.38	0.78	1.88	0.1456	11.93	10.92
	(0.85)	(3.82)	(-0.89)	(0.85)					
14. Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	-1.82	3.49*	-2.18***	0.84**	0.93	1.75	0.0575	10.53	26.58
	(-0.74)	(3.09)	(-1.99)	(2.56)					
15. Manufacture of Machinery, Machine Tools and Parts.	-8.95*	-0.29	1.91	-0.37	0.95	1.50	0.0676	11.58	23.88
	(-4.00)	(-0.20)	(1.34)	(-0.64)					
16. Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	-9.96	0.56	1.18	0.03	0.96	1.87	0.0697	11.53	23.42
	(-3.77)	(0.72)	(1.49)	(0.08)					
17. Manufacture of Transport Equipment and Parts.	0.24	0.44	0.47	-0.07	0.90	1.30	0.1068	11.53	15.92
	(0.05)	(0.60)	(0.60)	(-0.02)					
18. Other Manufacturing Industries.	2.13	-0.37	1.09	-0.41	0.87	1.87	0.1717	9.72	8.07
	(1.57)	(-0.31)	(0.92)	(-1.08)					
Manufacturing Industries (1 to 18)	0.73	1.16**	-0.25	0.22	0.95	2.10	0.0606	14.06	25.80
	(0.20)	(2.74)	(-0.64)	(1.17)					

Notes: Same as in Table 3.

Annexure IV (a) : Estimates of Translog Production Function for the Manufacturing Industries in India : 1974-90 (Dependent Variable : lnY)

Industrial Group	Independent Variables						Test Statistics				
	Constant	lnK	lnL	$(\ln K)^2$	$(\ln L)^2$	$(\ln K - \ln L)^2$	$\bar{R}^2$	D.W.	S.E.E.	Mean	Log. L.F.
1	2	3	4	5	6	7	8	9	10	11	12
1. Manufacture of Food Products	-333.1***	-4.04	52.55***	0.15	-1.95***	0.11	0.94	1.78	0.0994	11.62	18.78
	(-1.95)	(-0.22)	(2.11)	(0.38)	(-1.43)	(0.07)					
2. Manufacture of Beverages, Tobacco and Tobacco Products	34.52	-24.82***	14.83	-0.82***	-1.82	3.24**	0.72	1.92	0.1640	10.48	10.29
	(0.27)	(-1.65)	(0.53)	(-1.67)	(-1.23)	(2.42)					
3. Manufacture of Cotton Textiles	337.93	23.01	-67.88	-0.91	2.53	-0.11	0.87	1.75	0.1162	11.69	16.14
	(1.31)	(1.17)	(-1.26)	(-1.18)	(1.12)	(-0.08)					
4. Manufacture of Wool, Silk and Synthetic Fibre Textiles	115.23	42.07***	-54.86	1.39**	4.84	-5.86***	0.94	2.19	0.0824	10.77	21.98
	(0.34)	(1.50)	(-0.69)	(2.24)	(1.04)	(-1.75)					
5. Manufacture of Jute, Hemp and Mesta Textiles	889.03***	42.34***	-175.56**	-0.18	8.34*	-3.15***	0.68	2.16	0.1047	10.10	17.80
	(1.64)	(1.52)	(-2.45)	(-0.31)	(3.20)	(-2.17)					
6. Manufacture of Textile Products (incl. wearing apparel other than footwear).	-253.53	-42.09	78.03	-1.33	-5.67	5.82	0.94	2.01	0.1084	9.67	17.16
	(-0.78)	(-1.15)	(0.91)	(-1.35)	(-1.01)	(1.23)					
7. Manufacture of Wood and Wood Products, furniture and Fixtures	1413.9**	-47.56**	-213.49**	0.03	7.84**	4.23***	0.79	1.98	0.0705	8.94	24.66
	(2.89)	(-1.82)	(-2.61)	(0.11)	(2.16)	(2.09)					
8. Manufacture of Paper and Paper Products, Printing and Publishing and allied industries.	1016.50	64.13**	-219.50	0.80***	11.77	-6.57**	0.80	1.94	0.0806	10.86	21.60
	(1.13)	(2.39)	(-1.32)	(2.14)	(1.51)	(-2.45)					
9. Manufacture of Leather, Leather and Fur Products (except repair)	-64.62	-16.65	25.76	-0.80	-4.04	-2.19	0.93	2.01	0.1038	9.06	18.08
	(-0.37)	(-0.53)	(-0.45)	(-0.38)	(-0.46)	(-0.48)					
10. Manufacture of Rubber, Plastics, Petroleum and Coal Products.	50.79	27.32	-34.40	2.46	4.87	-7.01	0.88	2.09	0.2206	11.28	5.25
	(0.22)	(0.63)	(-0.43)	(1.27)	(0.71)	(-0.96)					

Note: Same as in Table 3.

Annexure IV (b) : Estimates of Translog Production Function for the Manufacturing Industries in India : 1974-90 (Dependent Variable : lnY)

	Industrial Group	Independent Variables						Test Statistics				
		Constant	lnK	lnL	$(\ln K)^2$	$(\ln L)^2$	$(\ln K \cdot \ln L)^2$	$\bar{R}^2$	D.W.	S.E.E.	Mean	Log. L.F.
	1	2	3	4	5	6	7	8	9	10	11	12
11	Manufacture of Chemicals and Chemical Products (except products of petroleum and coal).	489.27** (2.49)	67.51* (4.76)	-141.96 (-5.93)	3.35* (1.36)	11.29* (4.27)	-11.74*** (-2.14)	0.96	1.79	0.0990	10.70	18.87
12.	Manufacture of Non-Metallic Mineral Products.	-894.33 (-1.07)	-66.37*** (-1.63)	199.27 (-1.23)	-0.77*** (-1.36)	-10.69 (-1.30)	6.62*** (1.59)	0.94	1.95	0.1037	10.91	18.09
13.	Manufacture of Basic Metal and Alloy Industries	1101.00 (0.58)	125.13 (0.89)	-289.44 (-0.69)	3.50 (1.19)	19.04 (0.85)	-16.34 (-1.01)	0.77	1.96	0.1498	11.93	11.82
14.	Manufacture of Metal Products and Parts except Machinery and Transport Equipment.	-290.77 (-1.06)	32.45* (3.22)	19.94 (0.40)	1.06* (3.40)	1.14 (0.49)	-4.45* (-3.82)	0.96	2.19	0.0436	10.53	32.67
15.	Manufacture of Machinery, Machine Tools and Parts	-1062** (-2.29)	-28.78 (-0.86)	191.21*** (1.93)	-0.81*** (-1.53)	-9.07*** (-1.74)	3.74 (1.14)	0.97	1.80	0.0522	11.58	29.56
16.	Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts.	-1284** (-2.57)	-143.66** (-2.86)	332.93** (2.81)	-2.53** (-2.74)	-20.29 (-2.88)	15.94 (2.86)	0.97	1.77	0.0621	11.53	26.67
17.	Manufacture of Transport Equipment and Parts.	699.86 (1.12)	-6.87 (-0.32)	-100.99 (-0.89)	0.35 (0.79)	3.94 (0.74)	-0.06 (-0.03)	0.90	1.56	0.1027	11.53	18.24
18.	Other Manufacturing Industries	188.39** (2.70)	50.91*** (2.12)	-74.79** (-2.48)	0.70 (1.18)	5.69*** (2.16)	-5.66*** (-1.83)	0.91	2.49	0.1471	9.72	11.93
	Manufacturing Industries (1 to 18)	-1392.9* (-3.38)	-54.72** (-3.30)	229.37* (3.58)	-0.36*** (-1.72)	-9.26* (-3.59)	4.21** (3.02)	0.98	2.33	0.0432	14.05	32.93

Note: Same as in Table3.

Reserve Bank of India Occasional Papers
Vol. 16, No. 2 June, 1995

BOOK REVIEWS

The Changing Environment of International Financial Markets: Issues and Analysis, Edited by Dilip K. Ghosh and Edgar Ortiz, St. Martin's Press, New York, 1994, pp. XIV + 350, Price : Not stated

The rapid globalisation of financial markets and their ever changing structure has thrown up an enormous outpouring in the literature, the aspects studied ranging from the myriad influences upon markets, the speed and sophistication in market process brought on by the synergy with information technology to the esoteric world of derivatives and their prudential regulation. In a collection of 21 essays which were an outcome of a conference on 'International Trade and Finance in a Rapidly Changing Environment' under the auspices of the International Trade and Finance Association in Laredo, Texas in April 1992, the book under review highlights some of the recent concepts and issues that have gained considerable ground in the financial market jargon.

Following a review of the articles included in the volume, Part II deals with the economics of exchange rate markets and presents insights into the dilemma between long-run exchange rate equilibrium and market efficiency and that of unrestrained market fluctuations vis-a-vis government intervention. The article 'Foreign Exchange Market Efficiency: A look at London', by John P. Lajaunie, Bruce L. Memanis and Atsuyuki Naka, attempts to test for the Efficient Market Hypothesis (EMH) on the premise that there should not exist any long-run equilibrium relationship between nominal exchange rates of various currencies. The existence of such a relationship is a direct violation of the EMH and supports the existence of efficient speculative markets. The empirical examination is focussed on four currencies (Pound sterling, Japanese Yen, Deutsche Mark and the Canadian Dollar for the period October 1986 to April 1, 1991) in the London foreign exchange market. Based on tests of cointegrating regression, the authors conclude that the London market shows no sign of a cointegrating relationship between the different spot exchange rate series. Hence market processes are consistent with the EMH hypothesis. This implies that the spot markets for the individual foreign currencies were efficient as error correction model could not be employed to forecast future price movements.

The article 'Freedom of Free Floating Exchange rate : Empirical Analysis of Currency Fluctuation Patterns', by M. Anaam Hasmi examines fluctuations in 6 leading currencies between the period January 1987 to July 1989 and determines whether fluctuations are a result of market conditions or government intervention. It concludes that there is strong evidence (with few exceptions) that the selected six currency markets are not influenced by government intervention and market forces played a dominant role during the sample period. The author observes that perhaps the foreign exchange markets have become too complicated to be controlled by one or two central banks. There is enough evidence, however, that foreign exchange markets are influenced by the type of floating rate system (independent float or co-operative arrangement).

Part III of the book consists of three chapters on international interest rates and underscores their central importance in international financial markets. The article, 'Statistical Analyses of Eurocurrency and Treasury Interest Rates from 1975 to 1991', by Charles Maxwell and Larry Guin seeks to examine the statistical characteristics like the mean, the standard deviation, kurtosis and skewness of Euro currency and Treasury security interest rates to measure the relationship between the two types of securities. The findings of the chapter support the generally accepted financial proposition regarding interest rate movements. No major changes in the movements about the mean were found while examining sub periods of the total sample. Correlations between the two types of markets were very high, indicative of the money flows between the two markets.

'Cross Country Comparison of Consumer Discount Rates', by William V. Weber, Jannett K. Highfill and Mathew J. Morey, suggests a microfoundation of the macro approach for estimating the consumer discount rate from basic macroeconomic data and applies the method by deriving some international comparisons of discount rates. This method is based on an aggregated version of a simple Permanent Income Hypothesis (PIH) equation which shows that the discount rate depends on the marginal propensity to consume (MPC) and the difference between the real interest rate and the economy's real growth rate. The results, as shown by numerical examples calculated from OECD data, indicate that countries with high MPCs and the countries in which the real interest rate generally exceeds the real growth rate tend to have the highest consumer discount rates. 'The Interest Rate Parity, Covered Interest Arbitrage and Speculation Under Market Imperfection', an article by Dilip K. Ghosh, derives the expression of interest rate parity first in a perfect market, and then gives twelve additional expressions of interest rate parity under dif-

ferent scenarios of money market and foreign exchange market imperfections. The conditions for arbitrage profits and speculative opportunities are elucidated.

Part IV of the book consisting of three Chapters deals with balance of payments and international reserves. In an article by Anisul M. Islam, Moosa Khan and Muhammad M. Islam, 'An Empirical Test of the Demand for International Reserves', the authors estimate the demand function for international reserves for three Central American countries, viz.,Costa Rica, El Salvador and Panama using an econometric (behavioural) model and the Box- Jenkins (ARIMA) model. Four major explanatory variables were chosen which determine the demand for international reserves. First, the scale variable representing the level of transaction is proxied by the level of imports. Second, a variable representing the propensity to import or the degree of openness of the economy is proxied by the ratio of import to GDP. Third, a short-term US money market rate is used as a proxy for a measure of the opportunity cost of holding reserves. Finally, a variable measuring the disturbance or variability of BoP was constructed using Heller and Khan two-step procedure involving the Box-Jenkins ARIMA model. The results indicate that the reserve demand functions are quite stable for Costa Rica and El Salvador but somewhat unstable for Panama. It is worth noting, that contrary to some beliefs, the new international monetary system, based on flexible interest rates, had no impact on the reserves demand of the three Central American nations.

Eric Youngkoo Lee and Michael Szenberg in their article, 'An Intertemporal Interpretation of the US Current Account Deficit', dwell on the theme that in a world of capital mobility, shifts in national saving propensities relative to investment opportunities lead to corresponding shifts in the external current account. Fundamentally, current account deficits and corresponding capital inflows reflect macro imbalances. The persistent US current account deficits have merely reflected the excess of the nation's expenditures or absorption over its output or, equivalently, shortfall of national saving from investment, for the rising government budget deficit was not matched by an increase in private saving. As a result, the inflow of capital from abroad allowed continuing growth in the US capital stock. In the absence of foreign capital inflows, a drop in national saving would have to be accompanied by a drop in investment. Using a simplified intertemporal model of current account, in so far as the govemment budget deficit represents the deliberate choice of policy-makers and, as a result, the low domestic savings rate is taken as given, the alterna-

tives the US faces are either higher levels of investment and a current account deficit or low levels of investment and balanced trade. The authors conclude that the current account deficit should not be viewed as a problem of inadequate domestic savings to exploit productive investment opportunities. Only part of the increased output and income generated by the additional investment spending accrues to foreign investors in the form of interest and dividend payments. The net inflow of capital from abroad will allow a faster growth in the US capital stock and a higher future standard of living than would otherwise be.

Part V of the book examines foreign debt and country risk analysis, and sets forth some new lessons from the debt crisis. In chapter 10, 'Foreign Exchange dynamics, debt and the Peso Problem', Dilip K. Ghosh presents the picture of Mexico suffering under a gargantuan foreign debt, intractable rates of inflation and persistently plummeting value of the peso that has triggered a real and fundamental disequilibrium in which the policy makers and people have appeared totally helpless. Ghosh points out that since the relation between the sovereign borrowers and sovereign lenders is like that of the partners in a three-legged race in which both can run, limp or fall together, but cannot part company, it is necessary and expedient for both Mexico and its lenders to agree upon a new schedule for loan amortisation to their mutual benefit, if not for their immediate relief. The author prescribes that for debt management, Mexican authorities should strive for an indexing of debt amortization to its net foreign exchange earnings, and this needs the cooperation of both creditors and the debtors. This however is not a practical suggestion, looking at the experience of negotiations between Mexico and its creditors during the 'eighties. Christopher A. Erickson and Elliott Willman, in 'International Lending and Sovereign Debt in the Presence of Agency Costs: The case of Mexico', offer an analysis of foreign debt by introducing agency cost in their model. It is shown that as long as entrepreneurs are incompletely collateralized, the optimum government policy is to borrow the maximum possible amount from international lenders and transfer the proceeds to the private sector. It is further demonstrated that any reduction in the government borrowing capacity results in a decline in domestic economic activities, and that the decline continues till the government rehabilitates its maximal borrowing capacity. Within the ambit of this analysis, the author examines the Mexican economy.

In the article 'A New Look at Country Risk Analysis: An Analytical Approach to Judgemental Risk Scoring', Ramakrishnan S. Koundinya proposes an application of the analytic hierarchy process methodology to

structure the judgemental scoring of country risk and evaluation of country risk profile overtime. He suggests a framework of analysis that enables incorporation of qualitative assessment of economic/financial performance and expert judgment on other qualitative factors. The preliminary model focuses on selected economic/financial variables for the evaluation of risk profiles. Conceptual attributes considered relevant in firm expectations about country risk exposure are defined in three hierarchy levels. The relevance of the model is confirmed with a sample of selected developed and developing countries.

The next paper (Chapter 13), "Political Risk in Latin American Stock Markets: A Rational Expectation Approach", by Benoit Carmichael, Jean Claude Cosset and Klaus P. Fisher investigates in a rational expectation framework the impact of political risk on common stock returns and test the resulting model on a sample of Latin American Stock Exchanges. Based on the premise that the monetary and fiscal policies of Governments are among the most important elements in the political environment of firms, the authors attempt to establish the relationship between government policy variables and the performance of securities prices in four Latin American Countries: Argentina, Brazil, Columbia and Venezuela. The results imply that investors developed expectations about the future state of the world in terms of the Governments' fiscal and monetary policy, and price stocks accordingly. In other words this implies, consistent with an efficient market hypothesis, that prices of stocks fully incorporate expectations about policy changes introduced by the Government.

Part VI of the book takes an analytical look at capital markets and makes important extensions of modern investments, portfolio theory as well as agency theory to take into account increased international competition and globalisation of financial market. In their article, 'A Real Return Test of International Market Efficiency', Shahriar Khaksari and Neil Seitz aim at determining whether the mean-variance frontier available to an internationally diversified investor is effected by the choice of the country in which ultimate consumption is to occur. Limitations of previous studies are overcome by including dividends as well as price changes in computing equity returns, by including long and short term debt securities as well as equity, and by adjusting returns for inflation so that both real and nominal return efficient frontiers could be examined. This is an advancement over the traditional approaches in the area. Empirical evidence show that location of the mean variance efficient frontier is effected by the country in which ultimate consumption takes place. The article therefore provides evidence that international capital markets are not fully integrated.

In the article, 'Risk Management and Corporate Governance in Imperfect Capital Markets', the authors Klaus P. Fisher, Edgar Ortiz and A.P. Palasvirta, present a financial theory of corporate governance and organisations, and risk management by owner-managers from LDCs in the absence of well developed arm's length financial markets. The authors give an alternative paradigm to take into account the case of entrepreneurs taking their decisions in the absence of arm's length capital market. Based on this conceptual framework and previous empirical studies, the authors conclude that in the absence of developed financial markets where risk can be bundled and the price of the corporation is fair, owner-managers have no incentives to relinquish control and diversify risk through financial markets. The implications of this conclusion are well exemplified by the South Korean case in the article, 'Structural Changes in the Korean Financial Markets' by Joanna Poznanska where she analyses reforms implementation in the banking system and the securities markets, and identifies the nature of Korean financial internationalisation. These analyses lead her to assert that to sustain further growth, Korea will have to adopt various types of liberalisation policies. The essence of the needed reforms lies in the activation of market competition through divestment of state assets and deregulation of financial markets. By freeing interest rates in the financial markets the government hopes that the rate of interest will reflect availability of funds. To promote corporate growth, the government has opened the local stock market to foreign investors. Korean government intervention aims at strengthening the market to enable it to become the regulating force of the economy. However, the government intends to pursue reforms slowly in a gradual fashion, but market forces may overtake the process. The main target of the reform, the *chaebol*, the Korean family firm and the commercial banks are finding it difficult to adjust to proposed changes. In conclusion, the author argues that further financial and real reforms in Korea aim to ensure continued economic growth. This article is of much relevance in the context of the ongoing structural reform in India.

The final part of the book brings out tax issues and models of tax structure under closed and open economies, and examines various facets of this type of price distortion. In their article, 'Optimum Distortions in Closed and Open Economies: Some Aspects of the Theory of Second Best', Dilip K. Ghosh and Shyamasri Ghosh present optimum structure of distortions in different postulated set-ups, and discuss the issues on possible tax structure. The authors also attempt to ascertain when uniform rather than differentiated and when differentiated rather than uniform tax structure would be optimal for the taxing country. In this context, the

authors provide conditions for successful trade liberalisation and thus creation of trading blocs and customs unions. In the last chapter of the book, 'Offshore Banking Centre: Prospects and Issues', Emmanuel N. Roussakis, Krishnan Dandapani and Arun J. Prakash focus on the main issues surrounding this international banking practice. With increased integration of the global community due to advancements in telecommunications and technology, it is expected that international banking activity will gravitate to the financial centres wherein the banking operators and banking practices are highly regulated and supervised. A high level of competitiveness and internationalisation of banking will require that the OBCs be efficient and profitable and this in turn will strengthen the banking system worldwide.

While this book presents a wide spectrum of analytical as well as empirical examination of several developments in the changing environment of international financial markets, it would have been useful if some of the chapters had taken note of the present mood in financial markets in terms of development in derivatives, pervasiveness of the portfolio investment and capital movements from one financial market to the other.

On the whole, the papers included in the collection certainly bring into open some important emerging issues in international financial markets. The book would be read with great profit by specialist readers as well as policy makers since it provides necessary theoretical underpinnings to the various policy options that readers would encounter.

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Reserve Bank of India Occasional Papers
Vol. 16, No. 2 June, 1995

Stabilisation, Debt and Reform - Policy Analysis for Developing Countries, by Rudiger Dornbusch, MIT (1993), Prentice Hall, Englewood Cliffs, NJ 07632, pp. viii + 407, Price $51. 95

In the early 1980s, external imbalance in the form of large, unserviceable external debt positions and internal imbalances culminating in high inflation, in some cases hyperinflation, affected many developing countries. With financial assistance from the IMF, stabilization and reforms were sought to be implemented, to address the external imbalances problem. The IMF's approach is based on the neo-classical tradition of price-clearing markets as optimal mechanisms of resource allocation and on principles of 'sound money' as the foundation of economic policy. Rudiger Dornbusch, the author of the book under review, comes closest to this approach.

The book is a compilation of a number of articles, written in the years 1988-92, addressing the issues arising in Latin American and transition economies. Six of the articles are country studies. Latin America is perceived to be a 'test bed' for the problems of the next fifteen years in Eastern Europe. In fact, the author claims that there is a precedent for every episode of stabilization, debt and reform - both across history and across countries - notwithstanding the unique features of each experience. Accordingly, diverse historical episodes like the break-up of the Austro-Hungarian empire (1919-24), the European Payments Union (1950-58) and others have been introduced in various chapters.

The book is divided into five parts - "Inflation and stabilization", "Opening up and modernization", "Reform problems after communism", "Developing country debt problems" and "Country policy studies" - all with a macro-economic perspective as the central focus. Much of the material in the book - 14 out of the 18 chapters - has been previously published in various books and journals. This leads to a certain amount of avoidable overlap and repetition. Some of the chapters, especially 3, 6,11,12,15 and 17, could have been omitted or severely pruned in length without much loss of content as they merely provide variations on the themes discussed in earlier, core chapters in each part. Also, there could have been an improved ordering of the chapters.

Chapter 1 discusses "Lessons from experiences with high inflation" - both causes and cures - for Latin American countries in a bid to gauge the possibility and impact of hyperinflation in the transition economies suffering from large and increasing budget deficits. According to Dornbusch, "Budget deficits are the ultimate source of inflation,", which, worsened by the erosion of real value of taxation (the Olivera-Tanzi effect), the shortening of contracts, dollarization and exchange collapse, lead to hyperinflation. From the experience of 20 Latin American countries, Dornbusch draws, *inter alia*, the conclusions that inflationary experiences are similar across countries and that democratic countries require special procedures to implement hard measures necessary for stabilization. Inflation control measures and managed exchange rates can slow down the build-up of inflation but only temporarily. Dornbusch considers that a stabilization effort should consist of five elements - a low, non-zero inflation rate, fiscal stabilization, crawling peg for exchange rate, indexation and an incomes policy - all with extremely clear-cut prescriptions of timing and magnitude.

Chapter 2 - "Policies to move from stabilization to growth" - describes the adjustment process as consisting of three stages, of which recovery of growth is a culmination, the first two being successful recovery of macro-economic stability and liberalization and deregulation of the economy. However, the ways and means of achieving growth, in this chapter, are less clear-cut than those for stabilization. For example, it is said that, competitive pricing and adequate resource-mobilization - both domestic and external - can help revive growth. Again, domestic savings are reported to be interest-inelastic. The implications of this finding for an economy's incentive structure for resource mobilization need to be discussed in greater detail. Also, the stage of stabilization and the mode in which external support can be most effective in helping the return of flight capital and foreign direct investment to aid growth needs to be brought out in a more explicit fashion.

A cost-benefit analysis of stabilization in an uncertain world in Chapter 4, pinpoints the intuitively plausible characteristics which make stabilization more likely to succeed including *inter alia* higher reserves, higher responsiveness of trade and lower systemic volatility. However, this is a static model. Extension of the model to a two-period problem shows that policy-makers will have a strong incentive to do well on the first turn since every successive future attempt will involve higher adjustment efforts with a lower probability of success due to lowering of reserves and credibility.

In chapter 5 in Part II, Dornbusch examines "The case for trade liberalization in developing countries" where the benefits were broadly perceived as improved resource allocation in line with social marginal costs and benefits, greater domestic competition, availability of favourable growth externalities, like the transfer of know-how, and a restructured growth-oriented industry. Selective protection for infant industries, in Dornbusch's opinion, is better than general protectionism, and export-led growth is favoured. However, the chapter admits that systematic attempts at quantification have not succeeded in singling out trade policy as a major factor in growth.

In Part III, chapter 9 discusses the parallels between the break-up of Austro-Hungarian empire in 1919-24 and the experience of the Commonwealth of Independent States (CIS) now. Instability in CIS, in the author's view, stems from unstable politics, budget deficits, nationalism, lack of economic institutions and the withering interest of the West as it had in Czechoslovakia, Austria and Hungary in the 1920s. The usual lessons for stabilization as enumerated in Chapter 1 are repeated here. Additional suggestions, however, have been made: they include adoption of a Western currency (DM or dollar) as their money and conduct of trade through European Payments Union (EPU). The EPU had worked through the BIS between 1950-58, providing short-term credit lines and multilateral settlement to Western European countries (ch.8). The author apprehends that the imminent breakdown of trade in Eastern Europe due to lack of confidence in the system and weak rouble, massive trade restrictions, absence of price system, lack of trade credit and captive markets and emergence of bilateral barter may lead to a sharp fall in economic activity and public order. The author thinks that along with price liberalization, a body on the lines of the EPU, capitalized and guaranteed by the West, may provide a solution to the problems of conducting trade in the transition economies. The latter should undertake rapid radical change, by privatizing, decentralizing and depoliticizing decision-making, to form a social market economy with limited help from western countries. The CIS is also advised to service external debt selectively, an unusual suggestion considering that selectivity is never accepted by creditors.

In Part IV, there is an interesting discussion of the possible ways of restructuring LDC debts. Chapter 10 examines the data and causes of the debt problems (*viz.*, poor macro policies of debtors, world recession and initial overlending and subsequent credit denial by commercial banks), the problem of debt service for debtor countries (*viz.*, fall in real investment,

shortage of foreign exchange and budget deficits) and the implications of the debt crisis for US trade together with some solutions. All the points are illustrated by case studies of Mexico, Brazil, Chile and Argentina. An improvement in the world macro-economy, reversal of capital flight, various facilities for debt relief, *viz.*, swaps, buybacks, interest reduction and interest recycling are expected to reduce the magnitude of the problem. Dornbusch concludes that since the resumption of growth and full debt service is incompatible, international financial institutions must assume an increasing role in handling the major portion of debt service. Surprisingly, the question: "Why bail out banks and Latin America rather than provide poverty relief in Africa?" pops up, but remains unanswered, even though this is a very critical issue of importance for the international economy.

The fifth part comprises six country policy studies - three of them co-authored - of which two are on Brazil, two are on Mexico, one is on Argentina and one is on Chile and Peru together. The chapters are country-specific amalgamations of Parts I, II and IV.

In Chapter 13, Dornbusch finds that despite differences of political goals, there were remarkable similarities between the populist economic programmes of Chile during Allende's Unidad Popular (1970-73) and of Peru under Garcia (1985-1991), with respect to the expansionary 'growth with redistribution' policies and consequent economic instability.

In Chapters 14 and 15, the Brazilian debt history since the late 19th Century is explored, and faults in the muddling-through strategy initiated in 1982 examined and attempts are made to reconcile growth with debt service.

Chapters 16 and 17 describe the macroeconomic history of Mexico with regard to per capita income, recent hyperinflation (since mid-1970s), inequitable income distribution and a checkered debt history since 1910 which has worsened since 1982. Mexico's stabilization ups and downs are recounted in detail, including debt restructuring through swaps, buybacks, etc. and ends with an emphasis on indispensability of growth for permanency of stability.

Chapter 18 investigates the interaction between domestic macroeconomic instability and external constraints in Argentina focussing on the decade 1976-1986. Overvaluation of the exchange rate during the military rule from 1976 to 1981 led to the debt crisis in early 1980s and then to exchange depreciation and endemic inflation beyond 1500 per cent

in 1985 which could not be stemmed by the conventional IMF programs. A strict reform policy known as the Austral Plan was instituted to stop hyperinflation and was immediately successful. However, political and institutional instability in Argentina, resembling that of the Weimar Republic and Central Europe in the 1920s or the Fifth Republic in France, has introduced significant vulnerability into the stabilization process.

The book contains a thorough and consistent treatment of the international debt problem, which started in the 1980s, and stabilization policy issues, amply supported by graphs and tables collected from diverse sources. However, some discussion of the political economy of the scenario could have been provided for the benefit of the readers. In addition, a thumbnail sketch of the recent dimensions of the problem, at the very outset of the book, would have been helpful (since some articles end as early as 1986). Dornbusch, with his concern for practical problems, does recognize some of the limitations of the applicability of neoclassical assumptions to the developing countries; however, explicit recognition of the aspects emphasised by the structural development theory, *viz.*, specifying the institutional framework in which policies are implemented, sectoral (not only macroeconomic) imbalances, crowding-in effect of deficits in low-inflation LDCs etc. would have given a sense of balance to the book. More crucially, policies to foster growth and human resources (which determine growth) have not been spelt out. The book admits that growth and removal of poverty is necessary for permanency of stability and reforms. Simultaneously, it should be realized that appropriate policies for growth and development of human resources are necessary so that 'correct prices' and 'competitive markets' can perform their prescribed role as engines of growth.

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Reserve Bank of India Occasional Papers
Vol. 16, No. 2 June, 1995

Prospects of FDI in Post-Liberalisation Era, Ed. by S.P. Gupta and R.L. Chawla, ICRIER and IFO Institute for Economic Research, New Delhi, 1995, pp. 111, Price Rs. 150

Under the framework of structural reforms launched in India in 1991, external sector policies have topped the agenda. Under these, foreign investment policies have received sharp attention from policy makers. Till the end of 1980s, foreign investment flows remained at negligible levels and by and large, current account deficits were financed through debt creating capital flows. The rise in debt service ratios as well as a number of other indicators of external sustainability have led to a broad recognition of the positive role of FDI in the development of developing countries including India. Against this context, foreign investment policies in India have been liberalised considerably. The response of the investors in terms of the value of approvals granted for investing in India has so far been encouraging.

While a number of measures have been initiated to attract foreign investment, there is a need to review the entire gamut of policy measures, keeping in view the investors' perceptions. Towards this end, the book under review which is based on major country surveys, viz. USA, Germany and Japan serves a very useful purpose. The book is an outcome of the papers and proceedings of a seminar on 'Economic policy Reform and Foreign Direct Investment' held in New Delhi in December 1993. It has 5 papers in all.

In the paper, "Assessment of the Indian Economic Reform Programme", A. Halbach and H. Helmschrott provide an overall assessment of Indo-German co-operation in the areas of trade and investment. While Germany is the second most important trading partner for India, India's share in Germany's foreign trade remains low. With regard to collaborations, most of them did not have financial participation. The total volume of German capital participation in the existing agreements amounted to only DM 143 million. It is mentioned that the major reason for the historically low German investment is the Indian economic policy environment before 1991 and the overall structural change in German FDI wherein high priority has been assigned to Eastern Germany and Eastern Europe since the begining of 1990.

The paper presents the result of the business survey conducted in India and Germany in 1993. It shows that bureaucracy in India is a major barrier for FDI. However, more than one half of the German firms which are planning to invest in India expressed the view that the decision to invest in India was due to the present reforms programme. With regard to export oriented FDI, Southeast Asia was found to be more attractive. It was also revealed in the survey that the main interest of the companies lay in providing supplies to the domestic market. Nearly 90 per cent of the firms felt that there are barriers in India which relate to domestic policy and administrative constraints, economic and labour policy constraints and infrastructural constraints. The German firms suggested a controlled exit policy.

In the paper, "Inter-relationship between Trade and Foreign Direct Investment", Kebschull argues that FDI does not automatically lead to an increase in exports in the first round, only by gaining international competitiveness, a country can establish a positive link between export increase and FDI. The paper takes note of the lackluster nature of the FDI flows despite the efforts of the Indian Government as well as corporate sector in comparison with other developing countries. According to the author, the major motivation for German investors is provided by India's large domestic market and not so much by cheap labour. The paper highlights the need to effect changes in the production structure to reach the targeted growth rate in exports, taking into account several barriers which could come in the way. The author felt that DFI could make a crucial contribution in this regard. In his view, while the countries with large and growing markets, availability of skilled and low cost labour, reliable infrastructure and ancillary industries and a stable and predictable business environment would be in a better position to attract FDI inflows, investors are primarily interested in having the availability of a large domestic market. While India offers such a market, investors could look beyond it to develop India as a production base for meeting demand from other countries which would contribute in enhancing their earnings.

The paper, "Prospects of the Indo-Japan Investment Potential", by R.L. Chawla, deals with Japanese investment in India, its volume, sectoral and geographical distribution over the past four decades. The sectoral distribution shows that Japanese investment in ASEAN countries is dominated by mining, followed by commerce services, finance and services, agriculture, forestry, construction, real estate and transport. Another interesting feature is the involvement of large number of small and medium enterprises. India's share in the total Japanese investment has been negli-

gible. The paper examines the various aspects of Japanese investment in two sectors: automobiles and electrical/electronics. The paper points out that there is enormous scope for much greater Japanese involvement in India and goes on to examine the reasons for low Japanese presence in India. The paper noted that NIES and ASEAN have been receiving disproportionately large share of Japanese investment, which reflects more intense economic relationship between Japan and these countries. This has been rendered possible because of historical and cultural factors, geographical proximity and similarity in the economic systems, high wage costs in Japan and sharp Yen appreciation. However, by early 1990s, the growth of Japanese investment in these countries slowed down due to various factors and a number of Japanese companies in the last two years have increased their stake in India. The Japanese investors have expressed the view that they are not fully satisfied with the policy pronouncements and have pointed out a number of deficiencies. The area of change as seen by the Japanese relate to the existing gaps between Government's policy pronouncement and statutory enactment, inadequate information about policies and procedures, lack of special tax incentives for FDI, high rate of import and excise duties, lack of infrastructure, absence of exit policy and labour problems. The paper, thus, lends crucial clues to the low response from Japanese investors. While further changes in the policies with regard to privatisation, exit and labour policies could be helpful, the Japanese investors demands seem to be high especially since corporate employment in Japan has always been considered as a very long-term association with business units. Japanese investors also perceive export earnings as an indicator of India's ability for meeting repatriation of profit, dividend and royalties, but this is not very relevant as there had not been a single instance when India failed to honour the committed payment or remittance of dividend for want of foreign exchange.

The paper by Mahd. Saquib deals with prospects of US investment in India based on the primary survey of firms conducted in India and the USA. An attempt is made in the paper to analyse the problems and prospects of FDI flows into India, with special reference to US investments. The paper shows that the average rate of return on total US FDI abroad was 8 per cent in 1991, while it was as high as 16.4 per cent in India. The trade balance of the US MNCs in India with the US is negative for India. This was attributed to the relatively recent US FDI in India, but this may not be the only plausible explanation for the phenomenon. The past experience of many of the well established US MNCs in India have also shown that their trade balance has been negative in many

of the years. The R&D expenditure of US majority owned companies in India is also higher than that of majority owned US companies abroad. This is stated to be due to availability of inexpensive scientists and engineers and the need to adopt the technology to suit the local conditions. There is also a mention in the paper that US FDI is more labour intensive in India than in many other countries. The results of the questionnaire survey show that while US companies have generally recognised the positive developments in India, they have also pointed out certain difficulties which mainly relate to high corporate tax, poor infrastructure etc. The survey results have revealed that the important determinants of FDI were low wages, large size of domestic market, cheap skilled labour, local technology support and export to third country, while higher tax rates are considered as a deterrent. The survey of US multinationals revealed that the most important determinant of US investment in India is the size of the domestic market followed by the availability of skilled labour. Another important determinant is the cost of production. Further, currency convertibility and repatriation laws have also been mentioned as important factors. The US investors have suggested certain complementary steps such as reforming the price system and changing the public perception about investing in India. An analysis of the performance of 43 US manufacturing companies has revealed that the same was better than the performance of the Indian corporate sector. The paper concludes that prospects of US investment in India are quite bright.

In the concluding paper, "Summary Record of discussion", R.L. Chawla reviews India's foreign investment policy and foreign investors' perceptions. The Indian response in respect of the bottlenecks expressed by the investors has been summed up. While discussing certain strategic considerations for attracting FDI flows, the paper highlights the importance of marketing strategy. Foreign investors will try to cater to domestic markets in the initial years. But there is a need to take measures to ensure that they will have export competitiveness.

The book serves a valuable purpose as it, in addition to Indian perceptions, brings forth the viewpoints of foreign investors and suggests the areas where further policy changes are required. While the US companies appear to be generally satisfied with the reforms, Japanese and German investors have advocated further liberalisation. It is natural for the investing companies to seek better climate for achieving their objectives, the question is to what extent we can go to change the general economic framework to accommodate new FDI flows. The rates of return are

higher in India than the average returns in many other countries. Given the situation, the argument that higher tax rates in India inhibit the flows may not hold much water. Appropriate publicity measures regarding foreign investment policies and reforms as indicated in the papers are important and critical but here there is very little that has so far been undertaken.

The publication of the book is timely and the authors deserve compliments for the freshness of approach they have brought to bear on the subject. Surveys often give perceptions better than individual impressions and could serve as good inputs to policy makers.

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