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**DETERMINANTS OF FIXED  
INVESTMENT: A STUDY OF INDIAN  
PRIVATE CORPORATE  
MANUFACTURING SECTOR**

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## ABSTRACT

This paper analyses the determinants of fixed investment in the Indian Private Corporate Manufacturing sector for the period 1973-2002, using Annual Survey of Industries Data. It is argued that economic policy of a nation is crucial in determining the investment behaviour in developing countries rather than the traditional factors like output and profit. Against the background of the financial sector deregulation initiated in India since 1991, this study makes an attempt to analyse whether the traditional factors or the economic policy variables plays a major role in determining investment behaviour. A reduced form equation derived from the neoclassical investment theory is used for the empirical analysis. Financial Liberalisation Index is constructed for India for the analysis. The results show that, the traditional determinants like output and profit still plays a major role in determining corporate investment rather than the policy variables. Though aggregate financial liberalisation, and more prominently domestic financial liberalisation produced an environment conducive for investment, it could not succeed in creating a sustained increase in capital formation in the post reform period. In other words, firms consider the demand factor, internal liquidity position and past investment decisions etc as the major indicators for future investment. Only index shows strong positive association with corporate investment is index of money market liberalisation. It is also found that there is significant negative association between index of capital account liberalisation and corporate investment. The negative and significant relationship with index of capital account liberalisation and investment raises many concerns over the credibility of external (international) financial reforms.

**Keywords:** Investment, Manufacturing

**JEL Classification:** E22, O14

## 1. Introduction

The empirical literature on economic growth consistently showed that the rate of accumulation of physical capital or investment is an important determinant of economic growth. More importantly, in developing countries, as evidenced by many studies, it is the private investment that plays a greater role than public investment in determining economic growth<sup>1</sup>. The studies on the determinants of private investment in developing countries, against the traditional theories of investment, focussed on the role of government policy and tried to derive an explicit relationship between the principal policy instruments and private investment (Blejer and Khan, 1984; Guncavdi et. al, 1998; Sioum, 2002). Recent theoretical and empirical studies have produced results consistent with the idea that the economic policy of a nation is crucial in determining the domestic investment behaviour (Blejer and Khan, 1984, Greene and Villaneuva, 1991, Sioum, 2002, de Melo and Tybout, 1990). These studies emphasised the role of financial sector development on private investment, and provide a framework for understanding the effects of changes in economic policies on private investment.

Like many developing countries, in 1991, India also, with an objective of promoting economic growth through higher savings and investment, as a part of the structural adjustment and macro economic stabilization programmes, adopted various macro economic, trade and

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1 As Galbis pointed out, it is necessary in the analysis of investment in developing countries to distinguish between private and public investment, as the latter is an important fraction of the total in many of them. Only private realized investment may be related positively (1) to the profit rate and (2) to the expected real interest rate within the range of low real interest rates observed in many developing countries (1979: 429). Also see Khan and Reinhart, 1990.

financial sector policies. The old controlled regime has been replaced by a liberal financial policy regime. These policy changes are expected to have significant effect on the investment performance in the economy. The broad objective of financial sector reforms and other macro economic policies in India was to ensure that a market oriented financial sector contribute positively to economic growth by providing access to external funds and by channelling investment towards growing profitable industries. In this context, increased reliance on market forces for determining the cost and availability of funds, *ceteris paribus*, will enable the corporate sector to make an optimum combination of efficient sources of funds for industrial investment and also determine its pace. In this paper, against the background of policy reforms in the financial sector, we analyse the determinants of fixed investment in the private corporate manufacturing sector in India.

The paper is organised as follows: After the introduction, various theoretical perceptions on the determinants of investment are discussed in section 2. In section 3 we provide a brief review of the policy reforms that could have an impact on investment behaviour. Section 4 gives the empirical framework, which also includes the discussion on variables and data used. Econometric analysis of the determinants of investment is carried out in section 5. This is followed by the interpretation of the results. A brief conclusion is provided in the sixth section.

## **2. THEORETICAL UNDERPINNINGS**

### **2.1 Traditional Theories**

A number of theories have emerged to explain private investment behaviour in developed countries<sup>2</sup>. The base of the majority of these approaches and the simplest among them was the accelerator theory of

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2 For an overview of traditional private investment theories see Serven and Solimano, 1992.

investment, also known as "acceleration principle"<sup>3</sup>. It says that, other things being equal, an increase in a firm's output will require a proportionate increase in its stock of capital equipment. The implication of accelerator theory is that, the level of output or the changes in aggregate demand determines investment or the change in capital stock<sup>4</sup>.

The Accelerator model was further modified by many studies<sup>5</sup>, by introducing the concept of flexible accelerator, which says that, the adjustment of the capital stock to be desired level is not instantaneous because of delivery lags and delayed response to changes in the level of demand. As argued by Eisner (1963), the relationship between current investment and current income or output is an oversimplification. Because, the current changes in the demand, output or sales is not enough to sustain an increase in investment. Thus the firms will opt for other ways of meeting the demand like running down the inventories in fixing their investment. The acceleration principle is based on a number of assumptions like full utilisation capacity, permanent character for sales change, constant sales-output ratio etc. It also assumes that firms are not on declining phase of their life cycle (Tanwar, 1978: 63). The major lacuna in this theory is that, it assumes the supply of financial resources to a firm to be perfectly elastic, so that financial factors do not influence the real capital formation in a productive unit (Sarkar, 1970)

There are theories hinging on total profits or profit rates earned by business units and industries instead of output. This analysis of profit-investment relationship has several variants, viz., the investment is

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- 3 The original idea of multiplier process was put forward by Keynes, that increments in investment could lead to larger increases in the level of output. J.M Clark, later brought the idea of accelerator, that investment too could depend on the level of output and income in an economy. Later the idea of accelerator was used in explaining the growth theories and business cycles theory.
  - 4 The basic assumption of any accelerator model is that the desired capital stock at any point in time is a constant multiple of output,  $Y$ , at that time. That is  $K_d = \alpha Y$ , where  $K_d$  is the desired capital stock.
  - 5 See for example, Koyck, 1954 and Chenery, 1952.

affected by current profits, the amount of retained profits, or by other variables like output, price and sales, which reflects the profits. The profit theory states that "greater the gross profits, greater will be the level of internally generated funds and in turn greater will the rate of investment". Meyer and Kuh (1958) observed that the recognition of the institutional changes led the theory of investment to change from profit maximisation to utility maximisation. This move represents a growing belief that profit-maximisation is too narrow to encompass the full scope of modern entrepreneurial motives for undertaking the new investment.

As against the accelerator model, Jorgenson (1967) developed a neo-classical flexible accelerator model incorporates the user cost of capital (interest rate, depreciation and price of capital goods) and also the accelerator effect to explain the investment behaviour. Jorgenson's model is based on the theory of optimal capital allocation. The theory of a profit maximising firm, subject to a production function through which a technical relationship between inputs and outputs get defined is central in neo-classical model. Jorgenson's basic assumptions for a firm to maximise its present value are: a) the rate of change of the input of capital services is equal to the rate of net investment; b) the relationship between levels of output and inputs of labour and capital services is constrained by a production function<sup>6</sup>. The production function also connects the capital stock to the relative price between capital and output. The model assumes flexible accelerator prices and perfect capital and other markets. It implies that, there are no liquidity constraints to adjust capital stock and a general equilibrium situation with full employment. The empirical evidence is consistent with this accelerator effect and shows

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6 The firm supplies capital services to itself through the acquisition of investment goods. The demand for capital is therefore a derived demand and is assumed to positively depend on expected output and negatively depend on the expected rental cost of capital. Assuming constant elasticity of substitution ( $\sigma$ ) between capital and variable inputs, we observe the relation between desired capital stock ( $K^*$ ), the expected level of output ( $Y$ ) and the expected rental cost of capital ( $C$ ) as  $K^* = \alpha Y_t C_t^{-\sigma}$



that high output growth is associated with high investment rates (Greene and Villanueva, 1991; Wai and Wong, 1982). However, the empirical tests have been less successful in establishing a robust negative relationship between the interest rate and investment. Neo classical theory suggests that high interest rates raise the cost of capital, which reduces the investment rate.

The above models reflect uncertainty about the appropriate form of the private investment model for developing countries. Though the empirical tests of various models including the most widely accepted neo classical flexible accelerator model, have been quite successful, its application in the developing countries context is rather difficult due to the inherent assumptions of the model and the inadequacy or non-availability of data for certain variables. As a result, investment research has moved in many directions with the objective of identifying the proper economic variables that might be expected to affect private investment. In recognising the limitations to adopt the above theoretical models in their context, developing countries moved from traditional theories to focus on the role of economic policies in determining investment. In what follows we discuss the links between various financial liberalisation policies and investment.

## **2.2 Financial Reforms and Investment**

Inspired by the influential works of McKinnon (1973) and Shaw (1973) and the structural adjustment programmes of the IMF and World Bank, the effects of various macro economic policies on private investment in developing countries have drawn much attention. Financial sector liberalization with interest rate reduction constituted an integral part of this new economic policy. It has been argued that, administered interest rate ceilings not only suppress the savings rate, thus reducing the availability of loanable funds and investments, but also lead to inefficient allocation of resources, and therefore, financial sector liberalisation has been recommended (McKinnon, 1973; world Bank,

1989). McKinnon (1973) and Shaw (1973) argued that the market clearing interest rates and reduced government intervention could raise allocative efficiency through higher savings and investment. The existence of a very low or negative real interest rate would result in the support and expansion of unproductive, non-viable projects, and the channelling of funds in to consumption rather than investment, which would be detrimental to the growth process. They advanced the hypothesis that private investment in developing countries is positively related to the accumulation of real money balances. Since real money balances is a positive function of real deposit rates, private investment is argued to have a positive relationship with real interest rate. This idea discards the negative effect of higher real rates of interest through increases in the user cost of capital as envisaged by the neo classical theory of investment. The theory of financial liberalization argues that raising real interest rates at the market clearing levels induces more saving and investment and therefore acts as a positive stimulus to economic growth.

It is argued that domestic financial sector liberalisation generally necessitates external sector liberalisation or the capital account liberalization to yield the best results. Domestic liberalization can lead to a re-flow of capital and improvements in capital accounts, especially if accompanied by external sector liberalisation<sup>7</sup>. Financial capital has become highly mobile across countries as a result of the gradual globalisation of financial markets. As capital mobility increases the flow of resources to a specific country increases providing for increased investible resources. External liberalization will increase the level of investment through foreign capital flows in terms of direct and portfolio foreign management. The case for foreign capital is based on the fact that, foreign investment can supplement domestic investible resources in a developing economy, enabling higher rates of growth. As pointed

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7 See Calvo, Leiderman, and Reinhart, 1993; Johnston and Ryan, 1994; and Schaldar, 1995.

out by Eichengreen, capital mobility is an engine of growth through the relaxation on resource mobilization for investment (2003: 13).

As in the case of capital account, changes in current account (trade) policies also affects investment behaviour through policies like sustained relaxation of import controls mainly for capital goods, reduction in customs tariff rates, abolishment of licences etc, since these policies aim at greater openness of the economy. According to McKinnon, "trade liberalization and financial liberalization are the two measures that will lead to increase in investment" (1981: 366). In other words, they are complementary. Financial liberalization complements trade liberalization on both the demand and supply side. On the demand side, interest rate deregulation gives opportunities for those earning increased income from a trade liberalization to hold financial assets as alternatives to non-tradable. Now, if we consider the supply side, financial sector reform augments the loanable funds stimulated by trade liberalisation<sup>8</sup>.

Trade liberalization sparks investment led growth by lowering the prices of goods and services to those of non-traded goods and services. This price change induces an inter-sectoral expenditure shift that favours the capital-intensive sector. As a result, rate of return to capital accumulation rises thus triggering investment led growth (Baldwin and Seghezza, 1996: 8). Trade liberalization affects investment also through the changes in the relative prices of capital. Global trade liberalization can lower the relative prices of capital goods in both countries, there by creating an incipient increase in the stock of capital. In this case trade liberalization lowers the marginal cost of investment goods by lowering the cost of input, and thereby lowers the price of capital<sup>9</sup>.

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8 For a detailed overview of this subject, see Athukorala and Rajapatirana (1993).

9 This trade openness and growth is related to the literature on imported capital, which played an important role in the trade-growth literature. See for example, Cairncross, 1962; Lee, 1992, 1994.

Against this background we analyse the determinants of fixed investment in the private corporate manufacturing sector in the context of these policy reforms. Before carrying out the empirical analysis, we will discuss the macro economic policy context in India. This will enable us to set the stage for analysis in the ensuing sections.

### **3. MACRO POLICY CONTEXT IN INDIA**

In this section, instead of giving a comprehensive discussion of Indian economic policies, we confine to particular aspects of the policy regime that could be argued to have had an impact on investment behaviour in India. Indian macro economic policy during 1950s to 1970s emphasised on a conservative stance with respect to monetary and fiscal policy and the consequent tight control on the budget deficit and the monetisation of deficit. However, towards the mid-1970s, this has resulted in fiscal erosion due to the change in the political economy of the country<sup>10</sup>. In 1980s, there was deterioration in government finances in terms of rise in centre's fiscal deficit to GDP ratio, growing size of liabilities and huge debt-service burden. Attempts at expansionary fiscal policies and limited measures of liberalisation in the mid 1980s, though resulted in increase in output (GDP), the widening budget deficit and rapid increase in imports without corresponding exports led to widening current account deficit and deterioration in external reserve position. Towards the end of 1980s, reduction in remittance inflows and increase in oil price due to Gulf War pushed the economy to face an unprecedented macro economic crisis in 1991. The result was the introduction of structural adjustment and macro economic stabilisation programmes

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10 For example, various socio-economic groups in the country such as public sector workers, small scale industrialists and medium and large farmers' claims became very assertive and they demanded greater share of government subsidies (see Kohli, 1991).

under the World Bank and international Monetary Fund (IMF) in almost all sectors of the economy in various degrees<sup>11</sup>.

Restructuring of the tax system<sup>12</sup> constituted a major plank of fiscal reforms in 1990s. The statutory corporate income tax rate (corporate tax rate + surcharge) was above 50 per cent during 1970s and 1980s. But in the 1990s, this was reduced drastically, except in 1992-93 and 1993-94. There was no surcharge in the later years of 1990s. Moreover, the depreciation allowance<sup>13</sup> in the late 1980s has increased compared to the previous decade. Though less compared to late 1980s (33.3 per cent), through out 1990s it remained at a reasonable level of 25 per cent<sup>14</sup>. This may help the corporate sector to find more internal resources for capital formation. In the case of investment allowance, it has been abandoned in the 1990s. To sum up, though the corporate income tax is reduced, the reduction in depreciation allowances and the abandonment of investment allowances may sometimes be detrimental to the stimulation of investment.

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11 It was argued that the BOP crisis and macro economic crisis originated from the structural inadequacies and problems within the economy. According to IMF-World Bank strategy, this can be corrected only through a long-term structural adjustment programme. Similar view is due to Bhagawati and Srinivasan (1993), who argued that the macro economic crisis in India basically originated from the 'micro economic' inefficiencies that distorted the structure of incentives to producers.

12 The main objective of the tax reforms was to simplify and rationalize both direct and indirect taxes. The basis of this was formed from the recommendations of the Tax Reforms committee in 1991 under the Chairmanship of Raja. J Chelliah.

13 While investment allowance is given as a proportion to new investment in fixed assets in the form of plant and machinery in the year of acquisition, the depreciation is a tax incentive in computing net profits for a year, with an appropriate reduction from gross receipts on accounts of depreciation of capital assets (GoI, 1992: 11-12)

14 Depreciation allowance rate is fixed by the Government of India according to the changing rules from time to time. Union budget 1991-92 fixed a rate of 25 per cent on the basis of the recommendations of Chelliah Committee (GoI, 1992).

Another major implication of the fiscal policy was the increase in non-development expenditure during 1990s. As a percentage of GDP, it has increased from 10.45 in the 1980s to 11.69 per cent during 1990-91 to 1996-97. It further increased to 13.35 per cent in 1997-98 to 2001-2002. This shows that the Indian public finance has led to a shift in the composition of government expenditure from investment to consumption (salary bills of government employees and subsidies) (Mundle and Rao, 1997)<sup>15</sup>. This is evident from the fact that, the public investment, especially public infrastructure investment as a ratio of GDP has drastically declined from mid 1980s onwards. Though the gross fiscal deficit improved both in terms of average growth and percentage of GDP in the first phase of the reforms, has sharply deteriorated in the second phase of the reform period. As a percentage of GDP it had declined from 8.03 per cent in the 1980s to 7.38 per cent during 1990-91 to 1996-97. But in the second phase of the reforms (1997-98 to 2001-2002) it has increased considerably to 9.13 per cent, which is greater than the level in 1980s. Thus keeping inflation at a low level with widening fiscal and revenue deficits in the 1990s, especially in the second half of the 1990s could adversely affect the long run economic growth by reduction in savings and investment rates through continuing high real interest rates. Thus the fiscal situation with decline in public investment and high fiscal deficit may be detrimental to the performance of private investment.

After financial repression in 1970s to mid 1980s and a period of mild reform up to 1991, financial sector liberalisation has been introduced, which shifted the focus of financial repression, from the

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15 The growth in central government spending on wages, salaries and pension was restrained during the period from 1990-91 to 1996-97. As a proportion to GDP, it dropped by around 0.8 percentage point. With the implementation of fifth pay commission award towards the late 1990s, the wage bill could not be kept constricted. Though the present expenditure on salaries and pensions for the central government employees as a percentage of GDP is still lower than it was at the end of the 1980s, the sharp rising trend is worrisome (RBI, 2002). See also Acharya (2001), Rao (2002) etc for the role of rising wage bill in fiscal deterioration in India.

'control of financial products prices' to prudential regulation, supervision and promotion of competition' (Joseph, Nitsure and Sabnavis, 1999). The thrust of these reforms was the deregulation of capital markets and banks, deregulation of interest rates, withdrawal of credit targeting and interest subsidies, introduction of stricter accounting norms in the banking sector and the integration of domestic financial markets with the international financial markets through external sector liberalisation of capital flows (Government of India (GoI, 1991; GoI, 1993). As a result, the CRR, which was 15 per cent in 1991-92, has been reduced to only 5.5 percent in 2001-02. The base SLR that stood at 38.5 percent in 1990-91 has come down to a uniform level of 25 percent from 1997-98 onwards. More importantly, almost all major interest rates have been set free with banks and financial institutions themselves determining their own lending rates and deposit rates, except the saving deposit rate, which is set by the RBI. Consequently, the nominal interest rate structure had undergone drastic changes, with all the rates showing a declining trend during 1990s. Internationally accepted prudential norms relating to income recognition, asset classification, provisioning and capital adequacy etc has introduced which are considered to be fundamental in ensuring the soundness and solvency of commercial banks. These initiatives have set the stage for the sectors having resource scarcity to augment investible resources for boosting the investment.

Apart from the money market reforms, policy changes in the capital market such as permission to raise partly convertible debentures and permission to public sector enterprises to raise resources through bonds led to substantial increase in total resource mobilisation from the primary market (Centre for Monitoring Indian economy (CMIE), 1995, p.7). The abolition of Controller of Capital issues (CCI) in May 1992 led to the increased channellisation of household savings in to shares and debentures, elimination of under pricing by CCI and the determination of price of issues by the companies themselves. Government had opened up the Indian securities market for foreign investment through FIIs, GDRs and

FCCBs. In 1992 SEBI was given the statutory status, which gave it necessary powers to supervise securities market in India. The requirement of prior government permission for accessing capital markets and for prior approval of issue pricing was abolished and companies were allowed to access markets and price issues freely, subject only to disclosure norms laid down by SEBI. In short, the deregulation of financial system during 1990s have led to a relatively easier access to capital markets, both domestically and internationally for firms and industries in India.

The earlier controls in the industrial sector through licensing and MRTP, inhibited competition and led to a wasteful misallocation of investible resources among alternative industries and also accentuated the under utilization of resources with these industries (Bhagawati and Srinivasan, 1975: 191)<sup>16</sup>. However, the removal of licensing policy and the resultant increase in capacity through increased output and investment followed by substantial opening of FDI and trade liberalization through the elimination of quantitative restrictions and reduction in custom tariffs, resulted in greater access to foreign technology and capital after 1991. From a high level of relative price of capital goods under protective trade regime (De Long and Summers, 1993; Jones, 1994), there was a tremendous fall in the relative price of machinery during 1980s and particularly in 1990s (Athukorala and Sen, 2002), which is indicative of the possibility for boosting fixed capital formation in India. Along with this, the share of capital goods in total imports has tremendously increased from 24.2 per cent in 1991 to 28.2 per cent in 1995-96 although it declined to 18.1 per cent in 2001-02.

The industrial and trade sector policies introduced in the 1990s resulted in a receptive attitude towards foreign investment and foreign

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16 The high relative price of capital goods under the restrictive trade policy was mainly due to the high level of custom tariffs and taxes levied on imported capital goods (Ettori, 1990) and the inefficiency of the public sector with majority in the capital and intermediate goods sector.



licensing collaboration<sup>17</sup> and as a positive response to the changed policy regime, the foreign investment flows in India has picked up sharply from Rs. 185 Crores in 1990-91 to Rs. 28, 258 Crores in 2001-02<sup>18</sup>. FDI, which was Rs. 316 Crores in 1991-92 has gone up sharply to Rs. 18, 619 Crores in 2001-02. FPI on the other hand, has shown variations in different years, but increased from Rs. 129 Crores in 1991-92 to Rs. 3,904 Crores in 2001-02. Evidence of strong complementarity with domestic investment suggests that capital flows brighten the overall investment climate and stimulate economic growth even when a part of the capital flows actually gets absorbed in the form of accretion to reserves (RBI, 2001).

There has been a boom in gross fixed capital formation (GFCF) or fixed investment in the registered manufacturing sector after the financial liberalisation. The average annual growth rate of GFCF has increased from 12.3 per cent per year in 1980s to over 15 per cent per year in 1990s<sup>19</sup>. The policy changes we discussed in this section have significant implications for investment behaviour. However, the complexity of the policy regimes and the occasional shifts in it provides a challenge in explaining the relationships between the policy variables and the investment behaviour. We now turn to the empirical examination of the determinants of investment in the manufacturing sector in India in the section that follows.

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17 India generally adopted a highly regulated regime in the arena of foreign investment. This policy was little eased first with the change in the industrial policy regime in India. The major policy decision regarding the foreign direct investment was made in the New Industrial Policy of 1991. Only after this, the norms and procedures regarding FDI have been declared to liberalise the foreign capital flows.

18 The years 1997-98 and 1998-99 are exceptions. In these years foreign capital flows faced an aberration. This may be attributed to the contagion effect in the aftermath of East Asian Crisis that affected the global capital flows.

19 1990s include only 1991-97. Many other studies also showed increase in investment during the post liberalisation period. See for instance Nagaraj (2002), Uchikawa (2002), Roy (2002), Ramaswamy (2002) etc.

#### 4. Theoretical Specification of the Model

Our specification of the private investment function will draw from the neoclassical model of investment with appropriate consideration to the structural and institutional features of the Indian economy<sup>20</sup>. The theory of a profit maximising firm subject to a production function through which a technical relationship between inputs and outputs get defined is central in neoclassical model. This production function connects the capital stock to the relative price between capital and output. Jorgenson's basic assumption for a firm to maximise its present value is that the rate of change of the input of capital services is equal to the rate of net investment. This means that the provision of capital to a firm is derived function of the acquisition of investment goods by that firm. The demand for capital is assumed to positively related to expected output (Y) and inversely related to the expected rental cost of capital (C). Assuming a conventional neoclassical model where a profit maximising firm is subject to constant returns to scale and a constant elasticity of substitution production function, the function optimal capital stock (K\*) can be represented as

$$K_t^* = \alpha Y_t C_t^{-\sigma}$$

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20 The selection of neoclassical investment theory generally produced certain criticisms. It is generally argued that the basic assumptions are not applicable to developing countries and there is lack of data on many variables like interest rates, depreciation etc. However it is also argued that these objections are not strong enough to invalidate the many useful insights provided by the neoclassical theory. Many of the assumptions like maximisation of rates of return by economic agents, existence of perfect capital markets for goods and well-developed financial markets etc are not essential to the propositions of the theory. Moreover, in recent times availability of data on interest rates and depreciation etc is reasonably well in many of the developing countries (Sundararajan and Thakur, 1980). The recent deregulatory policies helped the developing countries to assume that their markets are becoming well developed and the exchange rates are at market clearing levels. For an initial statement of Jorgenson's theory see Jorgenson (1963) and for later surveys refer Jorgenson (1971) and Clark (1979).

Where,  $K_t^*$  desired capital stock

$Y$  expected level of output

$C$  expected rental cost of capital

If expectations are static so that future changes in output are unanticipated, net investment can be represented as a distributed lag on past changes in desired capital stock.

$$I_t^n = \alpha \beta^j \sum_{j=0}^N \Delta K_{t-j}^*$$

The replacement component of the capital lost to depreciation is given as

$$I_t^r = \delta K_{t-1}$$

By combining both net and replacement investment and adding a stochastic error term ( $u_t$ ) we obtain the neo-classical model of investment as

$$I_t = \delta K_{t-1} + \sum_{j=0}^N \alpha \beta^j \Delta (Y_{t-j} C_{t-j}^{-\sigma}) + u_t$$

For empirically estimating this investment function we approximate  $K^*$  linearly on the assumption that expectations of the output and rental cost terms are based on extrapolations of past values. Thus the basic model for estimation becomes

$$I_t = \delta K_{t-1} + \sum_{j=0}^{j_1} \theta_{1j} \Delta Y_{t-j} - \sum_{j=0}^{j_2} \theta_{2j} \Delta C_{t-j} + u_t$$

Where the distributed lag coefficients are an amalgam of the delivery lag, expectational and production parameters.

#### 4. 1 Data and Variable Construction

For our analysis we use time series data of the manufacturing sector from Annual Survey of Industries (ASI). The period of analysis is from 1973-74 to 2001-02. The dependent variable is the fixed investment of the manufacturing sector reported in ASI. The construction of variables are explained below. All the variables except financial liberalisation indices are taken in logarithms.

*Output:* ASI data reports the value of output of the manufacturing sector. We have deflated value of output by the wholesale price index for the entire manufacturing sector. The base year is taken as 1993-94 = 100. This variable is implicitly included in our benchmark model, which is derived from the neo classical theory.

*User cost of capital:* This is also a variable in the neoclassical model which is also called cost of capital services (rental price of capital) which is calculated from many other variables like price of capital (investment) goods, bank lending rate, corporate tax, depreciation rate, expected rate of change in capital goods price (inflation), and the general price level.

Following Hebbel and Muller (1992), the user cost of capital is equal to:  $UCC = PK (r(1-t) + \delta - \pi^e) / P$ . Where, PK = price of capital (investment) goods, r = bank lending rate, t = corporate tax,  $\delta$  = depreciation rate,  $\pi^e$  = expected rate of change in capital goods price (inflation), and P = the general price level.

Price of Capital goods (PK) is measured in terms of the implicit deflators for private corporate fixed capital formation (1993 = 1.00). The lending rate charged by the State Bank of India is taken as bank lending rate (r). The corporate income tax (t) is directly collected from the budget documents, Government of India.  $\pi^e$  is the expected inflation of investment goods price PK, which is measured as the three year moving average of the rate of capital goods price measured by the implicit

deflators for private corporate sector, with a one year lag. The depreciation rate is calculated from the CSO's National accounts Statistics for the private corporate sector. Finally, the general price level, 'P' is captured by the term GDP deflator.

*Lagged Value of Investment ( $I_{t-1}$ ):* This is taken as one year lagged value of fixed investment in the manufacturing sector.

*Retained Profit (RP):* The value of retained profit is obtained from ASI. This is taken as a proxy for the internal liquidity of the firms.

*Real Bank Credit (RBC):* The real bank credit to the private sector (RBC) is included as an additional explicator to capture the credit constraints in the economy. This is based on the argument that availability of loanable funds may affect the investment decisions irrespective of the cost of capital. Moreover, the fundamental market problems centered on asymmetric information between buyers and sellers in markets that prevents some of the efficient exchanges that would occur in equilibrium if all agents were fully informed. The assumption of the neo-liberal view that individuals and firms can costlessly write and enforce richly detailed financial contracts can be questioned since the completeness of financial contracts is not possible, if information or the ability to enforce contracts is severely limited (Gertler and Rose, 1994, p.20). Then for a firm, internal resources like profits and retained earnings and external resources through bank loans no longer equivalent. Because, firms' managers have full information about the value of the existing assets than any external agent, raising external funds is more difficult for the firm than utilising its retained earnings. It is noted that the asymmetric information and incomplete contracts implies that the availability of finance, especially bank credit may constraints the investment decisions of firms.

*Financial Liberalisation Index (FLI):* FLI represents the effect of entire financial liberalisation undertaken in the economy. It is an aggregation of different sub indices constructed to represent the financial

liberalisation measures in the respective sectors of the economy. It consists of both deregulatory and institutional building reform measures. (see appendix 1 for detailed methodology). Different subindices like index of money market liberalisation (INMML), index of capital market liberalisation (INCAPML), index of current account liberalisation (INCUAL), index of capital account liberalisation (INCAL) etc are also used in alternative specifications.

## 5. Estimation and Results

We estimate the relationship between investment and its determinants over the period 1973-2002. The ordinary least squares (OLS) method was applied to the investment function. We have made three specifications of the model. Our benchmark model uses aggregate financial liberalisation index (FLI) along with other explanatory variables listed earlier. We have made two alternative specifications. While first one uses domestic (INDFL) and international (ININFL) financial liberalisation indices instead of FLI, the second one uses financial liberalisation indices at more disaggregate levels like money market (INMML), Capital market (INCAPML), current account (INCUAL) and capital account (INCAL).

We begin the estimation process by testing the time series properties of the data. The stationarity problem<sup>21</sup> of both dependent and independent variables is examined. For this, we used Augmented Dickey Fuller Test (ADF) for checking the unit roots of the selected variables. The results for the ADF test (table. 1) suggests that all variables were found to be non stationary and integrated of order 1. Since the variables are found to be non-stationary there may be a possibility for the

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21 In a time series, if the mean, covariance and auto covariances of the series are all constants, it is said to be weakly stationary. This means that, they are invariant with respect to time. If the time series is not stationary, then it is not possible to model the process with a single equation with fixed parameters estimated from the past data.

regressions with such variables to be spurious<sup>22</sup>. This requires making these variables stationary through differencing to solve this problem. While checked for cointegration with first difference, they became stationary. This means that they are integrated of order one, i.e, I (1) variables. However, use of these differenced variables instead of original ones may sometimes result in the serious loss of long run information. It is essential to keep the long-run information on the variables and to avoid the problem of spurious regression. These two problems have to be avoided simultaneously. For this, possible cointegration between the variables has to be checked. Since our specified model includes a number of variables, we carried out cointegration test in the framework of an unconstrained Vector Auto Regression (VAR) model of Johansen and Juselius (1990) cointegration (JJ) test.

There are two likelihood ratio tests for checking the co-integration relationships when there exists more than two variables (Johansen, 1988; Johansen and Juselius, 1990). The first one is trace test having null hypothesis there are utmost  $r(0 \leq r \leq n)$  cointegrating vectors against the alternative  $r+1$  cointegrating vectors. The second one is maximum eigen value test having null hypothesis, there are 'r' cointegrating vectors against alternative  $r+1$  cointegrating vectors. In order to obtain satisfactory size properties in small samples, these test statistics should be corrected for the number of estimated parameters (Reimers, 1992). This can be done by replacing  $T$  by  $T-np$  in the test statistic, where  $T$  is the number of observations,  $n$  is the number of variables and  $p$  is the lag length of the VAR. In our case, the interpretation of the cointegration results is based on the test statistics of the small sample correction.

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22 A regression is said to be spurious when  $R^2$  might appear very high even though there is no relationship between the corresponding variables (Granger and New Bold, 1974).

**Table 1: Results of Unit Root Tests**

Variables	Level				First Difference			
	With Constant	With Constant and Trend	Without Constant and Trend	Result	With Constant	With Constant and Trend	Without Constant and Trend	Result
GFCF	-1.30 (0)	-3.47(5)	-0.062 (1)	I (1)	-4.58** (7)	-2.55 ** (6)	-3.44 ** (0)	I(0)
Output	3.04 (4)	-2.39 (4)	4.69 (1)	I (1)	-0.94 *(6)	-5.00**(3)	-5.84** (1)	I(0)
Change in Cost of Capital	0.89 (1)	-0.96 (0)	-2.56 (7)	I (1)	-0.56* (7)	-4.23** (4)	-4.96 ** (1)	I (0)
Retained Profit	-1.46 (0)	-0.85 (0)	-0.57 (0)	I (1)	-4.71**(0)	-0.85*(0)	-4.78**(0)	I(0)
FLI	-1.25 (3)	-2.30 (3)	-1.16 (3)	I (1)	-1.25*(6)	-2.30 ** (2)	-0.70 *(2)	I(0)
INDFL	-0.19 (1)	-1.87 (1)	0.38 (1)	I (1)	-2.45 (0)	-2.01**(1)	-1.97*(0)	I(0)
ININFL	0.54(1)	-0.81 (0)	-1.64 (5)	I (1)	-2.61*(0)	-2.07*(0)	-0.81**(0)	I(0)
INMML	-0.99 (4)	-2.28 (4)	-0.75 (4)	I (1)	-2.72*(0)	-2.29*(4)	-1.31*(2)	I(0)
INCAPML	-2.79 (5)	-3.29 (5)	-2.82 (5)	I (1)	-4.31**(7)	-2.24 *(6)	-2.03*(0)	I(0)
INCAL	0.69 (3)	-0.69 (2)	-0.15 (3)	I (1)	-3.04*(1)	-1.45*8(2)	-0.69*(2)	I(0)
INCUAL	-1.91 (5)	-0.08 (4)	2.76 (0)	I (1)	-1.97*(4)	-0.07*8(4)	-0.42**(4)	I(0)
RBC	-4.88 (0)	-4.94 (0)	-3.50 (0)	I(1)	-5.47 ** (1)	-3.32 ** (6)	-4.78**(0)	I(0)



The maximum eigen value and trace tests indicates that there is only one cointegrating vector between the variables used in the first two specifications. However, in the third specification using four sub indices, both the maximum eigen value test and trace test suggests that there are two cointegrating vectors (Table. 2).

**Table 2: Cointegration tests Results with Small Sample Correction**

Null hypothesis	Maximum Eigenvalue test			Trace Test		
	Alternative	Statistic	95 per cent critical value	Alternative	statistic	95 per cent critical value
<b>Benchmark Specification</b>						
r=0	r=1	114.2**	51.4	r≥1	229.2**	156
r≤1	r=2	34.79	45.3	r≥2	114.9	124.2
<b>Alternative Specification with INDFL and ININFL</b>						
r=0	r=1	244.7**	192.9	r≥1	110.6**	57.1
r≤1	r=2	134.1	156	r≥2	36.29	51.4
<b>Alternative Specification with INMML, INCAPML, INCUAL and INCAL</b>						
r=0	r=1	371.2**	277.7	r≥1	121.8**	68.8
r≤1	r=2	249.3**	233.1	r≥2	69.14*	62.8
r≤2	r=3	180.2	192.9	r≥3	44.84	57.1

Note: \* and\*\* shows statistical significance at 1 per cent and 5 per cent level respectively

In JJ method, since all the variables are treated as endogenous, determining the direction of cointegrating vectors obtained or relationship is difficult. If the direction of the cointegrating vector obtained in all the cases is the intended one (investment as a function of all other variables) there may not any possibility for spurious regression. Therefore levels of variables can be used in the regression model instead of first difference. Here we do not know whether the direction of the obtained cointegrating

vectors in various specifications is the intended one. However, we carried out the regression on the basis of the assumption that the obtained cointegrating vector is the intended one. In order to check whether the assumption is valid, we carried out the analysis of the residuals obtained from the regression in each specification. The residuals obtained in each specification are subjected to unit root test using the standard Dickey Fuller procedure. This test is otherwise known as Augmented Engle-Granger test for cointegration (Engle and Granger, 1987). The results obtained from the unit root test for residuals from all specifications are given in table.3. It shows that residuals obtained in all the specifications are stationary (i.e., without unit roots). Thus our earlier assumption that the obtained cointegrating vectors are the intended ones is valid. Therefore we proceed with the level variables for our estimation. To test for possible structural instabilities in the model, Chow test using recursive estimation is carried out, which shows no structural instability in all the specifications at one percentage significance level (graphs are not shown due to space considerations). Thus our model is suitable for policy inferences. In other words, we can make conclusions for both pre and post liberalisation periods using the same model<sup>23</sup>.

**Table 3: Unit Root Test for Residuals-using indices**

Residuals from the model	ADF test statistic
	Without constant and trend
Benchmark specification (using FLI)	-2.9892**(1)
Using INDFL and ININFL	-3.1063** (1)
INMML, INCAPML, INCUAL & INCAL	-3.1412**(1)

Note: \*\* denotes significance at 5 per cent level

23 Since our model is a reduced form model, there is a possibility for parameter instability between pre and post reform periods. Because the coefficients are a combination of both expectational and structural parameters and are not invariant to policy changes. To guard against this, we tested for possible structural instability of the empirical model.

## 5.1 Determinants of Investment

In all the three specifications, model explains about 97 percentage of the variation in gross fixed capital formation rate as given by  $R^2$ . 'F' statistic shows that all model specifications are statistically significant. Results of Model adequacy tests also are satisfactory in all the specifications of the model (Table. 4). The Durbin Watson (DW) statistic and Auto Regression 'F' statistic shows that the residuals are not serially correlated over time. ARCH result shows constant variance for residuals. These two show that there is nothing predictable from the residuals. Normality assumption and reset results are not violated indicating no functional misspecification (no omitted variable bias) in the model. Since the Partial  $R^2$  is less than  $R^2$  for each variable in all the specifications it can be concluded that there is no multi-collinearity problem.

**Table 4: Model Adequacy Tests**

Tests	Statistic and probabilities		
	Benchmark specification	Alternative specifications with	
		INDFL and ININFL	INMML, INCAPML, INCUAL and INCAL
Auto regression	0.04 (0.96)	0.09 (0.90)	0.09 (0.92)
ARCH	1.09 (0.30)	0.84 (0.36)	0.98 (0.33)
Normality	0.72 (0.69)	0.52 (0.77)	2.08 (0.35)
Reset	0.20 (0.65)	0.57 (0.46)	0.05 (0.83)

Note: Figures in brackets show probabilities

The results obtained from the OLS regression which are estimated over the period 1973-2002, suggest that the findings reported in table.5 mask rather different effects of certain macro economic variables during the period. At the outset, it is clear that macro economic variables such as real bank credit to the private sector (RBC), change in user cost of capital (DCCP), index of current account liberalisation (INCUL) and

index of capital account liberalisation (INCAPML) does not have any significant impact on corporate investment for the period under consideration.

**Table 5: Ordinary Least Squares (OLS) Regression Results for Different Specifications**

Variable	Benchmark specification	With INDFL and ININFL	With INMML, INCAPML, INCUAL and INCAL
L It-1	0.52 (0.05**)	0.54 (0.04**)	0.56 (0.03**)
L O	0.56 (0.04**)	0.58 (0.05**)	0.87 (0.05**)
L RP	0.99 (0.002*)	1.08 (0.03**)	1.25 (0.03**)
DCCP	0.05 (0.46)	0.04 (0.35)	0.20 (0.96)
L RBC	0.06 (0.31)	0.07 (0.86)	0.12 (0.89)
FLI	-0.004 (0.08***)	-	-
INDFL	-	0.002 (0.07**)	-
ININFL	-	-0.007 (0.09***)	-
INMML	-	-	0.02 (0.05**)
INCAPML	-	-	0.08 (0.69)
INCUAL	-	-	0.15 (0.72)
INCAL	-	-	-0.01 (0.09***)
R2	0.96	0.97	0.97
DW	1.87	1.81	2.04

Note: Figures in brackets show t probabilities

\*, \*\* and \*\*\* denotes significance at 1, 5 and 10 per cent level respectively

The estimated coefficient for the level output is positive and significant in all the specifications. This shows that the standard accelerator mechanism is important in explaining corporate investment behaviour. The coefficient on output is positive and statistically significant at 5 per cent level in all the specifications. It suggests that increase in output lead to an increase in fixed investment. One interesting result is internal resources is a major determinant of corporate investment in all the specifications. Even after the introduction of financial sector liberalisation the firms depend on profit for investment. The coefficient of retained profit is positive and statistically significant in all models. There are studies show that internal financing has increased in the corporate sector after liberalisation (Singh, 1995). The large and significant coefficient of the profit variable suggests that profit strongly affects investment, a result that is consistent with the existence of a financing hierarchy, which result in the use of more internal funds for investment.

Among the variables one year-lagged value of dependent variable is the major contributing factor to corporate investment. A positive and highly significant estimated coefficient of in all the specifications considered, means that private fixed investment rates show inertia. That is overtime they are highly serially correlated even after controlling for all relevant variables. This implies that the effects of a change in a given investment decision may fully be realised only after a number of years.

**Policy Reforms and Manufacturing Investment:** Generally studies regarding the impact of structural adjustment programmes (SAP) on private investment showed a negative impact in developing countries (World Bank, 1988; Harrigan and Mosley, 1998; Greenway and Morrissey, 1992). But our analysis produced mixed results in the Indian policy context. As we have explained earlier, in 1991, following a balance of payments crisis, India Government introduced a comprehensive policy of macro economic stabilisation and structural adjustment programmes during nineties. It was also noted that there was a marked increase in

manufacturing investment in India during this period. The statistically significant and negative coefficient on the aggregate financial liberalisation index (FLI) in the estimated regression of the first specification is consistent with the view that, the financial liberalisation in general has had a negative impact on corporate investment. Our result shows that one unit increase in the aggregate financial liberalisation index leads to a decrease of 0.004 units of corporate investment. However, this significance may only be an indication that the corporate sector may have treated the liberalisation policies in general to be not credible in creating favourable environment for investment. Because the liberalisation policies adopted were of the nature of forceful and explicit interventions to make the system more competitive and efficient, in a number of sectors, in rapid succession (Bhagawati, 1993: pp 84-85).

However, the analysis using disaggregate level indices showed varying results. The results from the model using the domestic (INDFL) and international (ININFL) financial liberalisation indices show that, while the coefficient on INDFL is positive and statistically significant at 5 per cent level, ININFL is negatively affecting corporate investment, though the statistical significance is weak at 10 per cent level. The positive effect of INDFL on corporate investment could be seen as the result of regulatory and legal reforms in the domestic financial markets focused on removal of structural bottlenecks, introduction of new players and instruments, free pricing of financial assets, relaxation of quantitative restrictions, improvement in trading, clearing and settlement practices, more transparency etc which contributed to increased mobilisation and channelisation of investible resources by imparting liquidity in the financial system.

Further, in an attempt to investigate the impact of more disaggregate liberalisation indices on investment, it is clear that, while the coefficient of the index of money market liberalisation (INMML) in the domestic sector is positive and significant at 5 per cent level, the coefficient of index of capital market liberalisation is negative and significance at 10

per cent level. The index of current account liberalisation (INCUAL) does not show any relationship between investment. But the INCAL is negatively affecting at 10 per cent level. These results are interesting. The negative and significant relationship with INCAL and investment raises many concerns over the credibility of external (international) financial reforms. In theory, other things being the same, capital account liberalisation including an increase in foreign flows through capital account liberalisation increases foreign savings and so increases domestic investment. It is also possible that increases in foreign capital coincide with a reduction in debt inflows so that the total foreign savings remain constant or are accompanied by a fall in domestic savings (for example through a consumption boom). In both cases domestic investment does not rise. It is also possible that foreign capital and capital account liberalisation will enable more imports in the short run and this in turn will worsen the current account or result in accumulation of foreign exchange reserves. It is noted that much of the net capital inflow in to the Indian economy has been absorbed as foreign currency reserves. However, before concluding about the negative association between capital account liberalisation and corporate investment it is necessary to analyse the channels in which it adversely affects investment at a more disaggregate level.

## **6. CONCLUSION**

This paper examined the major determinants of manufacturing investment in India for the period 1973-2002. We found that the traditional determinants still play a major role in determining investment. The results show that the responsiveness of investment is more with output and profit than the financial liberalisation policy variables. Though the financial liberalisation produced a favourable environment for investment as is evident from the positive coefficient, it is rather difficult to conclude that, it had created a substantial impact on the investment behaviour. Only index shows strong positive association with corporate investment

is index of money market liberalisation. One disturbing result is the significant negative association between index of capital account liberalisation and corporate investment. What emerges from this is that, reforms aimed at creating liquidity and depth and an efficient price discovery process might not have created the desired impact in the international arena. Alternatively, it can be argued that, excessive liberalisation prior to the achievement of full-fledged domestic liberalisation might have adversely affected the investment decisions. Though the impact on INMML and INDFL is positive and statistically significant, its estimated effect is only marginal. As shown earlier its magnitude is quite small compared to output, profit and lagged investment variables. What does it imply for corporate investment? The major issue is that the liquidity constraints exist to prevent the efficient mobilisation and channellisation of resources even after the financial sector liberalisation. Though the domestic financial liberalisation produced an environment conducive for investment, it might not have succeeded in creating a sustained increase in capital formation in the post reform period. In other words, firms consider the demand factor, internal liquidity position and past investment decisions etc as the major indicators for future investment. Though our study gives an indication of the impact of major policy transitions occurred in India on corporate investment, these are preliminary and have to be analysed further to get robust conclusions. More micro level studies may give better insights in this regard.

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## Appendix. 1

### Description of Data and Methodology for Index of Financial Liberalisation

The liberalisation index of India for our study is an aggregation of different sub indices constructed to represent the liberalisation measures in the respective sectors of the economy. Financial liberalisation includes both domestic and international sectors. More over, it consists of both deregulatory and institutional building reform measures. Thus any attempt to construct a liberalisation index should capture both deregulatory and institutional building components of liberalisation/reform policies. To construct financial liberalisation index, we consider different dimensions of these components, which are likely to affect investment behaviour.

Policy variables are assigned dummy values, which cannot be otherwise determined quantitatively. The result will be a matrix X of dummies for entire financial liberalisation. Following Abiad and Modi (2003) policy changes are assigned a score on a graded scale, from zero to one, in a given year. Here, zero corresponds to being *fully repressed*, one to *partially repressed*, two to *largely liberalised*, and three to *fully liberalised*<sup>24</sup>. The main components of financial liberalisation included for index construction are given below<sup>25</sup>.

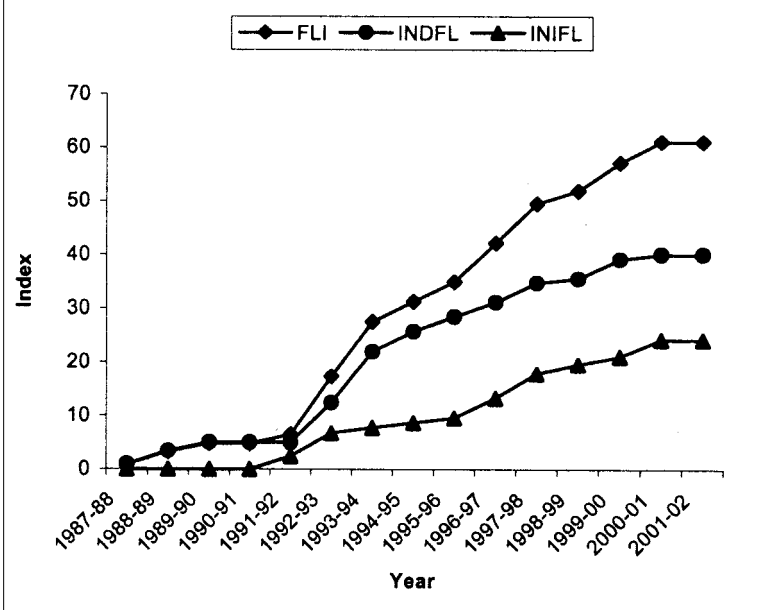
1. Domestic Financial Sector Liberalisation
  - a. Interest rate liberalisation
  - b. Reduction in Reserve Requirements

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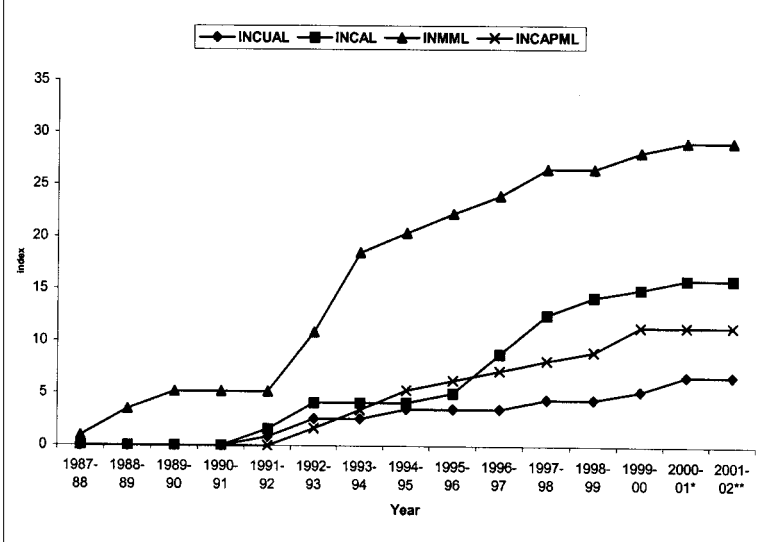
24 Though these are subjective, some guidelines were used as to reduce the subjectivity. For example, interest rates were considered fully repressed where the government set all interest rates, partially repressed where interest rates were allowed to vary within a band or subject to a ceiling or floor, largely liberalised if some interest rates were allowed to be completely market-determined (or if new floating rate instruments were introduced), and fully liberalised where all interest rate restrictions were removed (Abiad and Modi, 2003).

25 The details on the selection of variables, values for dummies, data on indices etc will be available from the author on request.

**Graph 1: Trends in Indices-FLI, INDFL, ININFL**



**Graph 2 : Trends in Sub Indices**



- c. Money Market reforms
  - d. Pro-Competition Measures
  - e. Capital Market reforms
  - f. Legal Reforms
2. External Sector Liberalisation
- a. Exchange Rate Regime/Current account  
(Trade Policy)
  - b. Institutional or Legal framework
  - c. Foreign Direct Investment
  - d. Foreign Equity Inflows (Foreign Institutional  
Investors (FIIs))
  - e. Capital Issues on foreign bourses
  - f. NRIs/OCBs
  - g. External Commercial Borrowing (ECB)

In our study, after putting dummy values, we obtained a matrix of 59 dummies. Each column represents a single dummy and each row represents a year. In order to reduce the dimensionality of the matrix, principal component has been used. We use the first principal component of the matrix obtained. Accordingly, we had constructed an aggregate financial liberalisation index (FLI). We also computed various sub indices. First we divide the aggregate financial liberalisation index in to domestic (INDFL) and international (ININFL). Further these two are divided in to various sub indices: domestic in to index of money market liberalisation (INMML) and index of capital market liberalisation (INCAPML) and international in to index of current account liberalisation (INCUAL) and index of capital account liberalisation (INICAL). The graph 1 and graph 2 shows that the degree of liberalisation has increased gradually over the years. Though the liberalisation started towards the end of 1980s, only from 1991-92 onwards, it got momentum because of the introduction of structural adjustment and macro economic liberalisation programmes.

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