FINANCIAL FRAGILITY, ASSET BUBBLES, CAPITAL STRUCTURE AND REAL RATE OF GROWTH - A STUDY OF THE INDIAN ECONOMY DURING 1970 -2000

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Table of Contents

CHAPTER I

INTRODUCTION

We have long been aware of the beneficial impact of a well functioning financial infrastructure on the real sector of the economy. Conversely, the economic turmoil in the recent East Asia crisis have once again brought into sharp focus the key role of financial fragility in aggravating crises through the banking, currency and securities markets in particular, hampering investor confidence operating in such markets and thus seriously impeding the ability of securities markets in performing the intermediary role between the savers and investors.

Given the intertwined financial and real sectors, the conduct of proper macroeconomic management and attainment of macro-objectives is dependent in a large measure on the health – in respect of both width and depth – of the financial system as well. The lack of this or financial fragility has been identified as a major source in the periodic crises within the last couple of decades and the recent East Asian Crisis in 1997 with problems in the banking sector, deepening of the currency crisis and an almost meltdown in the stock markets, with one setting the crisis in motion and the other exacerbating the others.

In this study, the first part (Chapter II) deals with an analysis of the intertwining of the financial and real sectors, following the frameworks of (1) Beck, Demirgiic-Kunt and Levine (BDL), (2) King and Levine (K-L) and (3) Rangarajan identifying the major variables and measures of the nexus between the two. The plan of this part of the study is as follows: Section I presents the introduction; Section II surveys the existing literature; Section III discusses the financial and growth indicators; Section IV attempts an empirical analysis in the context of the Indian financial structure and Section V presents the conclusion.

The next part of our study delves into a detailed empirical analysis of the stock markets, in particular, looking into the existence of (larger than normal) deviations and their persistence over time, i.e., presence of asset bubbles, and as such presents findings on extent of financial fragility or the lack of it in the stock markets. In order to investigate the extent to which the stock markets are linked to the fundamental variables, we look at (1) an assortment of basic financial/real variables, e.g., net worth per share (book value per share), profit per share (EPS), dividend per share and debt-equity ratio; (2) dynamic variables, like rate of growth of net worth per share, profit per share, dividend per share and debt-equity ratio as surrogates for expectations; and (3) macroeconomic policy variable, like prime lending rate. We have attempted both cross-section and time-series analyses on (1) and (2) and a time-series analysis on (3).

The cross-sectional study (Chapter III) is discussed in six sections. Section I is the introduction. Section II discusses the dataset; Section III discusses the model; Section IV analyses the results of goodness-of–fit; Section V analyses the results of volatility and Section VI presents the conclusion.

The time-series study (Chapter IV) is discussed in six sections. Section I is the introduction. Section II discusses the dataset; Section III discusses the model; Section IV analyses the results of goodness-of–fit; Section V analyses the results of volatility and Section VI presents the conclusion.

The macro-monetary policy analysis (Chapter V) is discussed in six sections. Section I is the introduction. Section II discusses the dataset; Section III discusses the time-series model; Section IV analyses the results of goodness-of–fit; Section V analyses the results of volatility and Section VI presents the conclusion.

The sources of financial fragility can be traced, among others, in the banking, currency and asset markets as has been mentioned earlier. Solvency of banks may be threatened by the factors operating at both the global and national levels. The existing literature (Allen and Gayle (2000), Kaminsky and Reinhart (1999, 1996), Kiyotaki and Moore (1997), Rakshit (1998), Stiglitz (1981)) has expressed concern over the inherent tendencies in the banking sector towards fragility, arising out of institutional characteristics with respect to norms / rules and inadequate controls. Further, our study and empirical analysis brings out three significant tendencies. First, NPAs (as a ratio of loans and advances) are significantly sticky over time. Second, larger NPAs are associated with larger advances and vice-versa; and third, NPAs do not seem to be spiraling out of control, rather shows signs of a slight reduction. The policy initiated during the 90s of classifying bad debts as NPAs after two installment defaults, seems to have brought some amount of control on the bad debts situation.

With the collapse of the Bretton-Woods fixed exchange rate system and introduction of freely floating exchange rates from 1973 practically by all industrialised countries, it was observed that exchange rates exhibited considerable volatility, prolonged periods of overvaluation and undervaluation in both size and duration, all indicating currency markets not being satisfactorily determined by fundamentals leading to financial fragility in such markets, thus, further compounding the task of macroeconomic management in general and balance of payments adjustment in particular.

In case of India, the switch to a floating exchange rate regime (at least on current account) from the prior multi-currency peg (adopted in 1975) was accomplished gradually between 1991-93. There was significant variability in the rupee exchange rate vis-à-vis major currencies like the U.S. dollar. Further and more importantly, when we look at the exchange rate movements and their relationship with fundamental variables, like the price level, with the theory of purchasing power parity (PPP), for example, it provides the theoretical basis of the belief that changing exchange rate under floating system would offset inflation differentials. However, particularly after 1993 given the increased flexibility of the exchange rate regime, when nominal exchange rate movements are expected to reflect changes in the price levels, we consistently find the exchange rate movements to exceed the changes in price levels, suggesting exchange rate movements in currency markets not being adequately explained by fundamental explanatory variables like relative inflation rates.

In the limited scope of our present investigation, we have not attempted to study the impact of the currency markets on financial fragility, though a preliminary study of the health of the banking sector, namely (1) a brief review of the institutional and almost endemic fragility in the banking industry and (2) some areas of specific concerns, particularly in respect of the NPAs have been attempted. Section I is the introduction. Section II discusses the model; Section III discusses the dataset; Section IV analyses the time-series results; and Section V presents the conclusion.

Our framework of research identifies a functional (i.e. fundamentals based) analysis of the extent of fragility in the banking sector and the currency markets as areas for further research.

CHAPTER II

Financial Sector-Real Sector Inter-relationship: A Study of Theories and Indicators with Reference to the Indian Economy

2.1 INTRODUCTION

In this chapter, we intend to study the importance of financial sector development and its relationship with the real variables and their growth. It is only in very recent times that economists are beginning to believe in this linkage. For a long time, notwithstanding the influence of Phillips curve in between (whose long run effect was anyway found to be ineffective), economists in the Walrasian tradition have trenchantly believed in the classical dichotomy: financial sector does not matter for real sector development and its growth. Still, a large segment of economists believe strongly in that tradition (the real business cycle school, for example). However, the Walrasian framework is built on the critical assumption that all markets clear. In recent times economists have challenged this assumption and subsequently adopted capital market imperfection as their point of departure. Using this new framework, they demonstrate that financial sector development matters for the development of the real sector and is growth-enhancing.

We will begin this chapter by reviewing the literature in substantial details explaining the basic ideas of the models that seek to demonstrate the relevance of financial development for the real sector. Thus one of the central programs in this chapter is in finding out indicators pointing to the development of the financial sector. In the next section, we will review the financial and growth indicators as developed by economists, especially the former in the context of certain issues. These issues concern the depth of the financial sector, activity of the financial sector, stock and bond market development, success of the financial sector reforms and the linkage between the financial development and growth. Subsequently, in the section "The Indian Financial Structure: An Empirical Analysis", we intend to use some of these indicators to study the development of the financial sector and touch on its linkage with the real sector in the context of the Indian economy. This will give us considerable insight into the state of the Indian financial system, its depth and size as well as the success of the economic reform and whether the financial development is significantly correlated with the real sector. Finally, there will be a conclusion.

2.2 LITERATURE SURVEY

It is only in very recent times that economist started looking for indicators of financial sector that will capture its development, structure and performance. The reason for this historical delay lies in the discomfort of economist regarding the relation between the financial sector and the real sector as well as its growth. Till the early 1980s there was a general absence of models that could explain the relationship between the two sectors.

From the 1980s onward things started to change. Now there are a large section of economists who believe that the financial sector does matter for the real variables and their growth. Their arguments as to how it matters are also diverse but there is also a thread of similarity in all these different viewpoints. And it has to do with credit market imperfection. Credit market imperfection makes financial intermediation matter for the real variables.

The seminal paper to highlight the role of financial institutions in matters of investment and output was written by Stiglitz & Weiss (1981). They pointed out that with asymmetric information and interest rate serving as a screening device for separating out bad borrowers (with higher probability of default) from good borrowers, credit rationing is produced. Credit rationing, by reducing the amount of available loanable funds, produces under-investment and hence output is adversely affected. So they concluded that financial institution matters.

Friedman and Schwartz (1963), Bernanke (1983) and Bernanke and Gertler (1989) pointed out that fluctuations in the real variables are caused by financial dislocation. In these cases the financial intermediation role of the bank is again critical. The model by Bernanke and Gertler has been especially influential. It is assumed in the model that firms cannot fund their project through internal funds only. But then in case of firms relying also on outside funds, the problem of asymmetric information arises for financial institutions. This involves monitoring costs and subsequently leads to a selected number of firms getting loans and consequently to the restriction of credit. Thus only a limited number of better projects get funded. In such a framework, a shock to the economy may end up increasing the monitoring cost thereby restricting credit and reducing investment. Thus financial fragility will affect the real sector.

Kiyotaki and Moore (1997) and Franklin and Gale (2000) extended the spirit of the above approach to include the financial contagion effect. They pointed out that crisis originating in one point of the financial sector has the capability to spread to other points thereby becoming contagion and producing a crisis of the entire financial sector. The mechanism through which the contagion happens is some form of asset-based claims that overlap between agents or regions or banks. Franklin and Gale (2000) showed that a banking crisis originating in one region spreads to other regions because of the overlapping claims of banks or regions. If a region suffers a loss then the claim on the suffering region falls in value, which if of higher magnitude, is capable of producing a crisis in the adjoining regions. Hence crisis in one point move from region to region becoming a contagion.

Kiyotaki and Moore (1997) showed that asset–based collaterised borrowing (especially stock market and real estate based) has the capacity of producing extreme financial fragility with its subsequent disastrous effect in the real sector. During boom time, asset prices shoot up and potential borrowers buy these assets at inflated price. Now either bank give loans to the borrowers against these assets or the borrowers may use part of the loans in buying the assets. Either way, a shock to the economy may see lenders recalling asset based collaterised loans thereby producing extreme reductions in asset price. The bubble bursts. Those borrowers (firms & agents) who bought assets at inflated prices default with the collapse of those prices. Firms start closing down and banks stop lending. Thus in both Kiyotaki and Moore, and Franklin and Gale, banks behave procyclically lending less during recession. This finding has also been supported by Kaminsky and Reinhart (1996;1999) who looked at figures of crisis in 20 countries. They found that at times of high expectation and growth, the asset prices rose way over the average and its expansion was to a large extent supported by borrowings from banks. When the bubbles burst and the asset prices collapsed, financial institutions with overexposure to those asset markets ran into crisis with a lag.

While the above models have significantly articulated the relationship between the financial sector and the real sector, the problem of associating financial sector with neo-classical style growth still remained. This was ultimately addressed by King and Levine (1993a, 1993b) who extended the endogenous growth theory (Aghion and Howitt 1992; Romer 1990) to demonstrate that financial development is growth enhancing.

Thus economists are presently in a position to believe in certain results. Namely, that financial sector is closely linked with real sector and that financial development is growth enhancing.

After the relationship between the financial sector and real sector as well as its growth has been secured, the process of constructing financial indicators as well as growth indicators began. Of special interest are the financial development indicators for revealing the extent of this development, which should tell us something about its effect on the real sector.

2.3 FINANCIAL AND GROWTH INDICATORS

For long the International Monetary Fund's International Financial Statistics and International Finance Corporations have been the source of financial development indicators used by economists. But in recent times, complementary studies on financial indicators have proliferated. Theoretical models on financial sector have been complemented by a search by economists for indicators designed to capture the size, activity and efficiency of the financial sector as a whole as well as specific financial markets such as the bond and stock market. While the literature on financial indicators is by now substantial, we will focus on three papers - Beck, Demirgiic-Kunt and Levine (2000) henceforth called BDL, King and Levine (1993) called K-L and Rangarajan (1997). We believe that the list of indicators presented by the three papers is comprehensive and that these three papers more or less encapsulate the development in this field thus far.

Depending upon the issues posed, we will be charting out the indicators as given by BDL, KL and Rangarajan. Before we begin, let us distinguish between the groups of financial institutions as presented by BDL. BDL divided financial institutions into three groups -- *Central Bank* under the control of monetary authorities, *deposit money banks* comprising of financial institutions with liabilities in checkable form or otherwise for making payments and *other financial institutions* such as non-bank financial institutions or of any other type who do not incur liabilities that require payments. BDL further makes a distinction between private credit and assets where the former refers to total claims on the private sector and the latter is understood as the total claims on domestic non-financial sectors.

Let us now pose the issues and the financial indicators designed to address them.

Depth of the Financial Development

We study the depth of the financial structure by looking at the financial indicators measuring the relative importance of the three financial groups and that measuring the size of financial structure relative to GDP.

Relative Size Measures

Rangarajan	B-D-L	K-L
Intermediation Ratio = $\frac{\text{Secondary Issue}}{\text{Total Issue}}$ Or Proportion of claims issued to financial institutions to the issues of non-financial sectors.	$\frac{\text{Central Bank Assets}}{\text{Total Financial Assets}}$ $\frac{\text{Deposit Money Bank Assets}}{\text{Total Financial Assets}}$ $\frac{\text{Other Financial Institution's Assets}}{\text{Total Financial Assets}}$	BANK = $\frac{\text{Deposit Money Bank Domestic Assets}}{\text{Deposit Money Bank Domestic Assets + Central Bank Domestic Assets}}$
	Alternative Measure $\frac{\text{Deposit Money Bank Assets}}{\text{Central Bank Assets + Deposit Money Bank Assets}}$	

The only point to note here is that of the alternative measure of finding the relative size of the financial groups mentioned by BDL. BDL points out that the first three indicators may not be available. In that case, it is useful to use the alternative measures that captures the relative size of deposit money bank assets to the central bank. This alternative measure is the same as BANK used by K-L. Increase in BANK means more financial services and higher levels of financial development.

Absolute Size Indicators

Rangarajan	B-D-L	K-L
Financial	Liquid Liabilities	DEPTH = $\frac{\text{Liquid Liabilities}}{\text{GDP}}$ Liquid Liabilities = Currency held outside of the

Ratio=Total Financial Issues / GDP	GDP Liquid Liabilities = Same as in K-L	banking system + demand and interest bearing liabilities of banks and non bank financial intermediaries

In this case increase in DEPTH will indicate an increase in the depth of financial development and growing role of financial intermediaries.

Activity of the Financial Intermediaries

The focus is on the financial intermediaries' claims on the private sector. The set of indicators is designed to capture the role of financial sector in allocating credit.

Rangarajan	B-D-L	K-L
Financial interrelationship = Increase in the stock of financial claims / Net capital formation	Private Credit by deposit money banks / GDP Private Credit by deposit money banks and other financial institutions / GDP	PR1V = Credit issued to private enterprises / GDP PRIVATE = Credit issued to private enterprises / Credit issued to central and local government + credit issued to private and public enterprises

Increases in these indicators mean that the non-central bank intermediaries are playing an increasingly important role in allocating credit to the non-government and non-public enterprises. And it is assumed here that financial services is more productivity enhancing in case of the financial sector reform with the private sector than in its interaction with the public sector.

Efficiency Measure of the Financial Sector

DBL consider net interest margin as a measure of the efficiency – competitiveness of the financial sector. Declining net interest margin points to the functional level efficiency of the commercial banks and the movement towards the market price.

Stock Market Development

The indicators as used by DBL suffice in capturing the size, activity and efficiency of the stock market.

Size of the stock Market

$$\frac{\text{Stock Market Capitalization}}{\text{GDP}} = \frac{\text{Value of Listed Shares}}{\text{GDP}}$$

Increase in the ratio will indicate an increase in the size of the stock market vis-à-vis the rest of the economy.

Activity of the stock market

$$\frac{\text{Stock Market Total Value Traded}}{\text{GDP}}$$

This indicator measures the degree of liquidity provided by the stock market to the economy.

Efficiency of the stock market

Stock Market Turnover ratio = <u>Value of Total Shares Traded</u>

Market Capitalization

This is a measure of the liquidity of the stock market relative to its size. Higher turnover ratio means an active stock market.

Bond Market Development

We want to capture the size of the private and public bonds relative to the economy. The two together will capture the size of the domestic bond market. The two ratios then are

$$\frac{\text{Private Bond Market Capitalization}}{\text{GDP}}$$

and,

$$\frac{\text{Public Bond Market Capitalization}}{\text{GDP}}$$

Success of the Financial Sector Reform

We divide the time period between the pre-reform and the post-reform period. Then changes in indicators as indicated in the direction below will capture the success or failure of reform. We lump together the indicators as put forward by BDL, K-L and Rangarajan.

Success of Reforms	Financial Development Indicators
↑	BANK
↑	PRIVATE
↑	PRIV/Y

↑	DEPTH
↓	CURRENCY = Currency held outside of banks / Bank Deposits
↑	REAL RATE = Real Interest Rate
↑	Finance Ratio
↑	Intermediation Ratio
↑	Financial Interrelations
↑	Stock Market Capitalization / GDP
↑	Stock Market Total Value traded / GDP

Relations of Financial Development with Real Variables

Here we take off from K-L who were the first to articulate a possible relationship between financial development and economic growth. They took financial and growth indicators and then found the correlation between the two. A strong correlation would indicate a close relationship between financial development and economic growth. While we have already studied the financial indicators, K-L constructed a few growth indicators.

The first growth indicator is akin to the Solow residual with the assumption that it mostly captured productivity growth. K-L takes the aggregate production function:

$$Y = \kappa^{\propto} x$$

where Y = Real per capita GDP

k = Real per capita physical capital stock

x = Other determinants of per capita growth

α = Production function parameter.

Taking log of the production function and differentiating, we get

$$\frac{\dot{y}}{y} = \alpha \frac{\dot{k}}{k} + \frac{\dot{x}}{x}$$

$\Rightarrow$ GYP = α GK + PROD

$\Rightarrow$ PROD = α GK – GYP

Where = $\frac{\dot{y}}{y}$ GYP = Growth rate of real per capita GDP

$\frac{\dot{k}}{k}$ = GK = Growth rate of the real per capita physical capital stock

$\frac{\dot{x}}{x}$ = PROD = Growth rate of everything else

Once we know GYP and GK, and specifying α, we can find out PROD. As we have already pointed out, PROD is assumed to capture productivity growth.

K-L also takes a measure of physical capital accumulation, which they call INV.

$$\text{INV} = \frac{\text{Gross Domestic Investment}}{\text{GDP}}$$

We are now in a position to chart out the growth indicators and the already derived financial indicators.

Growth Indicators	Financial Indicators ala BDL, K-L and Rangarajan
GYP GK PROD INV	Already defined and discussed before.

In this study we will check the following:

1) if each financial indicator is positively and significantly correlated with each growth indicators, and

2) If the financial indicators are highly correlated with one another.

If a) and b) holds then we say that financial development is strongly linked to economic growth.

To conclude, in this section we have built a general framework for measuring the extent of financial sector development and its relationship with the real sector growth. In the subsequent section, using BDL measures (which is quite comprehensive) we will mainly concentrate on the extent of financial sector development in India. While inability to access the data on growth in time (this itself is huge task which we hope would be done elsewhere using the methodology presented here) is a handicap, we will construct two alternative indicators of credit allocation to reveal whether the Indian real sector (represented essentially by the private sector) is making use of the financial sector development in India.

2.4 THE INDIAN FINANCIAL STRUCTURE: AN EMPIRICAL ANALYSIS

We will use the set of indicators, developed earlier in this chapter, to study the size, activity and efficiency of financial intermediaries in India. We will also look at indicators that measure the stock and bond markets to reveal the extent of its size, growth and efficiency. The focus of this chapter is to explore the extent of financial development in India. The sources used for the study are CMIE Monthly bulletins, RBI – Annual Reports, Report on Currency & Finance and Handbook of Statistics on Indian Economy for the respective years.

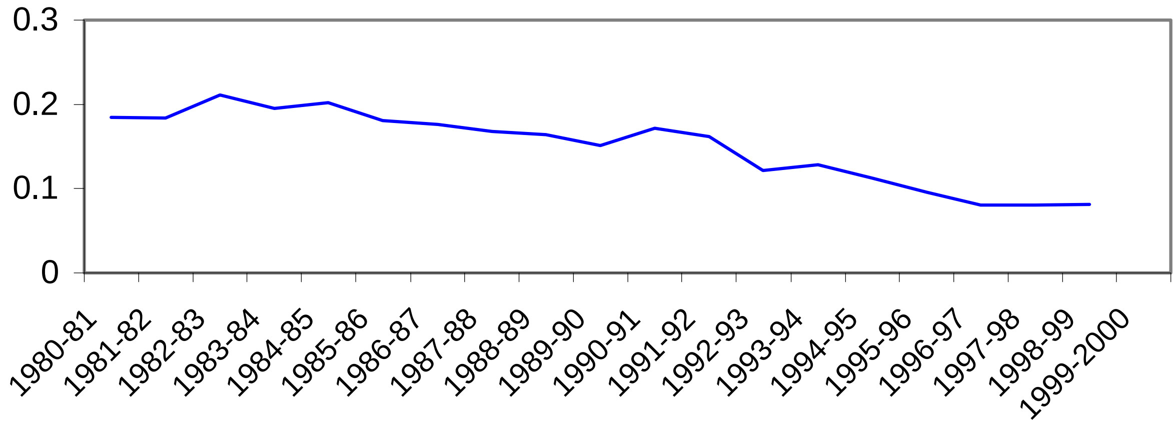
The findings are fairly unambiguous. Firstly, there is a steady deepening of the financial development in India. Indicators of financial intermediaries – measuring its size, growth and activity – all point to this deepening process. Secondly, there are clear indications that non-banking sector has grown faster than banking sector. This is also supported by clear indication about the diminishing role of RBI as a player in the financial markets even as its role as a regulator has increased.

Thirdly, while the results unambiguously point to a deepening of the financial development in India, the question remains as to the allocation of credit. For that, we take indicators of credit portfolio allocation and show that the allocation of credit to government sector relative to private sector is increasing. This should indeed be considered disturbing to planners since one of the central aims of liberalization was to achieve the reverse. But results show that, in vying for investment, the government sector have outsmarted the private sector.

Size and Activity of the Financial Sector in India

The relative size indicators measure the importance of three broadest segments of the financial sector (defined in section II) relative to each other. These are the ratio of central bank assets to total financial assets, ratio of deposit money bank assets to total financial assets and the ratio of other financial institutions' assets to total financial assets, where total financial assets are the sum of the assets of central bank, deposit money banks and other financial institutions. As figure 1 shows, the time series movement in the ratio of central bank assets to total financial assets shows a very interesting feature; it is gradually decreasing since the last decade. It is also clear from the diagram that the rate of decrease is faster in the post liberalization era. If one looks at the asset side of the RBI, it can be observed that it comprises primarily of foreign exchange assets and credit given to the banking sector and the government. The decline in the above ratio indicates the reduction in direct credit by RBI to the government sector and the efficacy of replacement of the ad hoc T-Bills system by Ways and Means Advances. This ratio increased in 1998-99 and is indicative of improvement in the forex reserves position through Resurgent India Bonds. This also indicates the move away by the RBI from that of a player to the regulatory body.

Fig 1. RATIO OF CENTRAL BANK ASSETS TO TOTAL FINANCIAL ASSETS



Yearly movement of ratio of deposit money bank assets to total financial assets (figure 2) is showing a mixed result. After a reasonable fall during 1991-95 it is now in a slightly increasing trend. If we observe the time series movement of the ratio of other financial institutions' assets to total financial assets (figure 3) it is very clear that the extent of financial disintermediation is much more dispersed in total asset creation. We can notice a significant jump just after liberalization and it was increasing till 1997-98. After that it is slightly decreasing which is indicative of the inactivity in the equity market. A lot of projects that were conceived and funded by DFIs, which had an equity component, could not access the market for equity and either had to be abandoned or equity had to be replaced by high cost debt thereby adversely affecting the financial viability of the projects.

Fig 2. RATIO OF DEPOSIT MONEY BANK ASSETS TO TOTAL FINANCIAL ASSETS

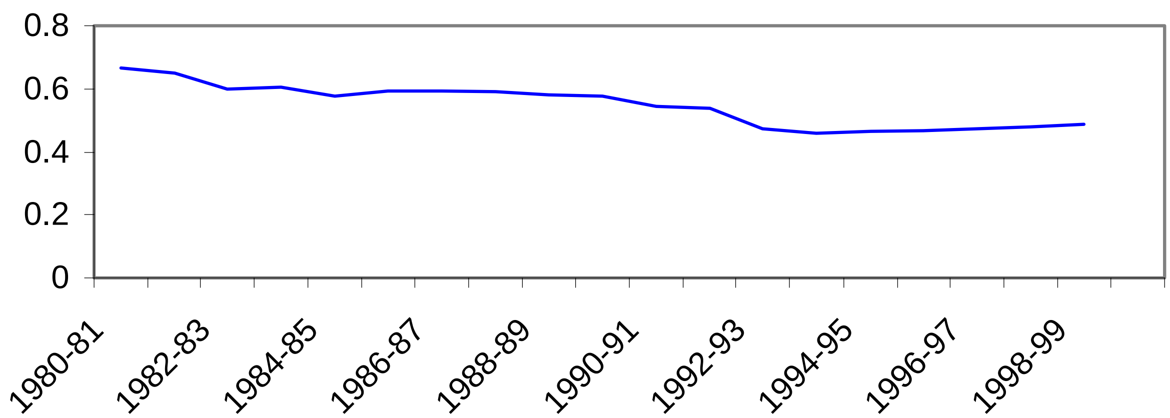


Fig 3. RATIO OF OTHER FINANCIAL INSTITUTIONS' ASSETS TO TOTAL ASSETS

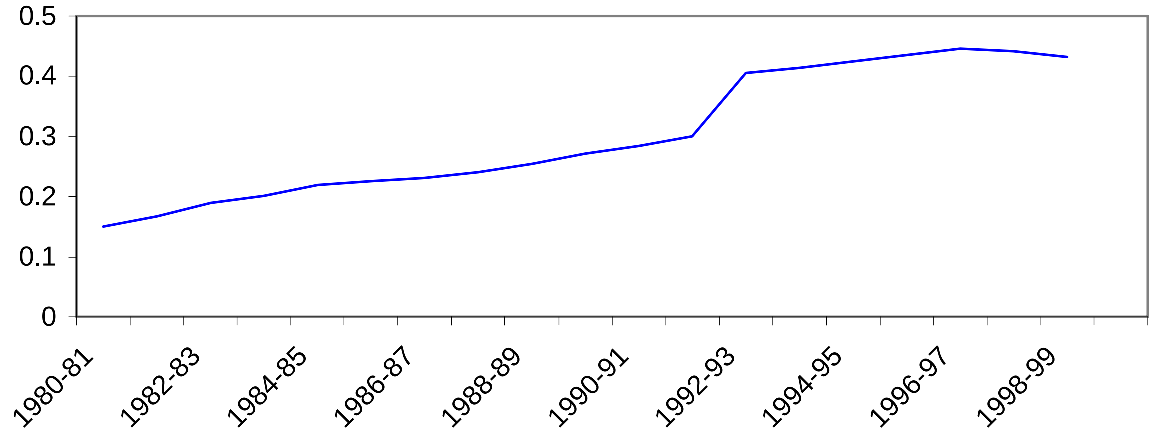
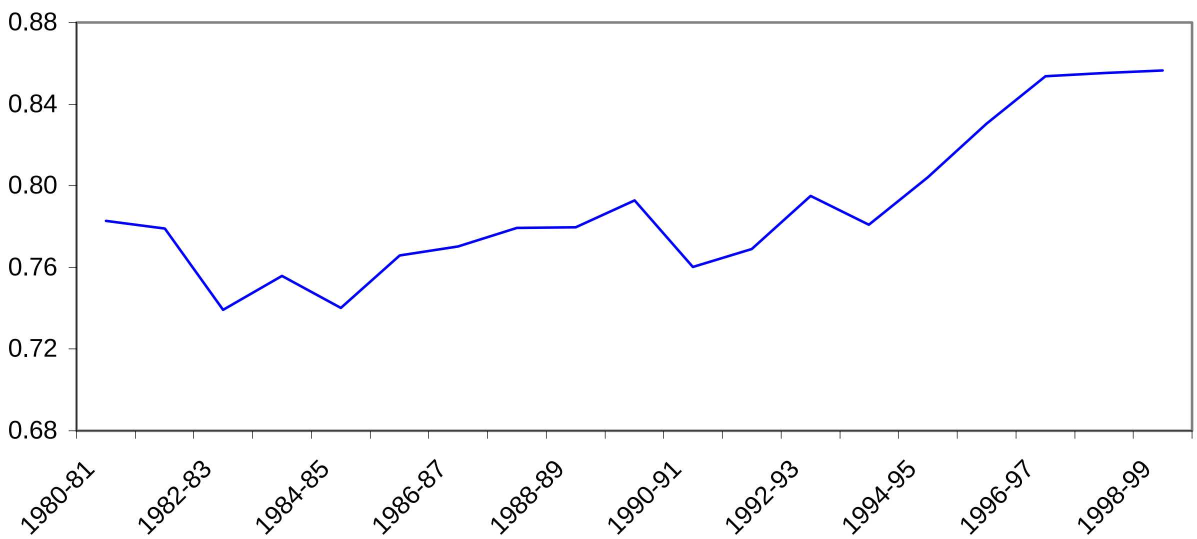


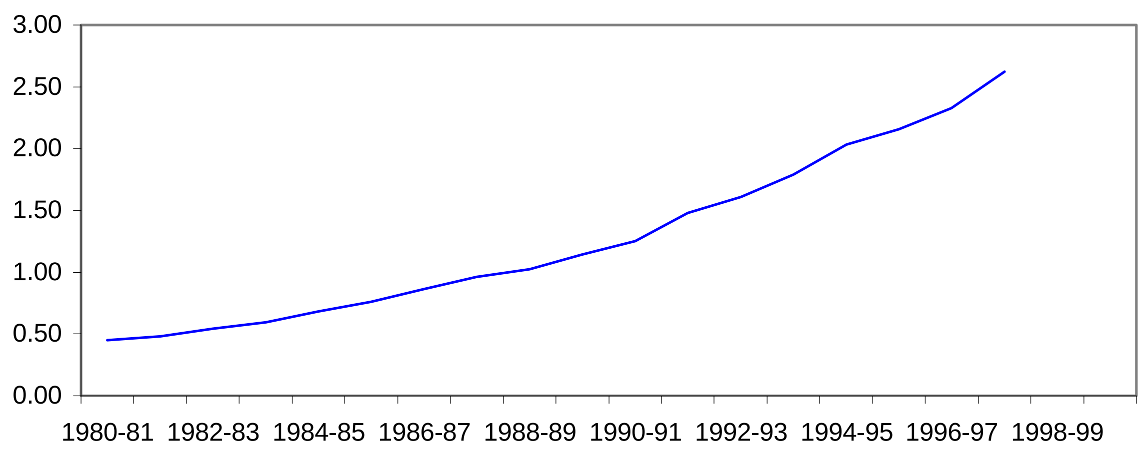
Fig 4. RATIO OF DEPOSIT MONEY BANK ASSETS TO CENTRAL BANK AND DEPOSIT MONEY BANK ASSETS (SINCE 1980)



The alternative measure captured in figure 4, which is defined as ratio of deposit money bank assets to central bank and deposit money bank assets leads to the same conclusion that the central bank is gradually withdrawing (not in terms of supervision) itself from being a player. But, this is a relative measurement, not absolute one. So it is not to be understood that the total assets of central bank is decreasing year after year.

The ratio of liquid liabilities to GDP (figure 5) is an absolute size measure based on liabilities. Liquid liability is currency plus demand and interest bearing liabilities of banks and other financial intermediaries. The ratio of Liquid liability (components are given in Section I) to GDP is increasing systematically during the last two decades. Basically that implies Money Supply (M3) with respect to GDP is gradually increasing. If we consider the relation MV=PY, where M stands for money supply during a given period, V the velocity of circulation, P the price level for that particular period and Y physical output, then it is very clear that as M/Y is increasing, P/V has to increase to maintain the equality. This indicator determines the depth of financial development and the growing role of financial intermediaries. This is the broadest available indicator of financial intermediation, since it includes all the three financial sectors.

Fig 5. RATIO OF LIQUID LIABILITY TO GDP (SINCE 1980)



The ratio of central bank assets to GDP (figure 6) has shown an overall increase since 1980-81, even though its volatility has increased significantly in the post liberalization era. It may be readily observed that the ratio of deposit money bank assets to GDP (figure 7) and the ratio of other financial institutions' assets to GDP (figure 8) are steadily increasing throughout the period we have considered. Of special significance is the dramatic increase in the ratio of other financial institutions' assets to GDP in the post liberalization era where the rate of change of this ratio peaked during 1992-94.

Fig 6. RATIO OF CENTRAL BANK ASSETS TO GDP (SINCE 1980)

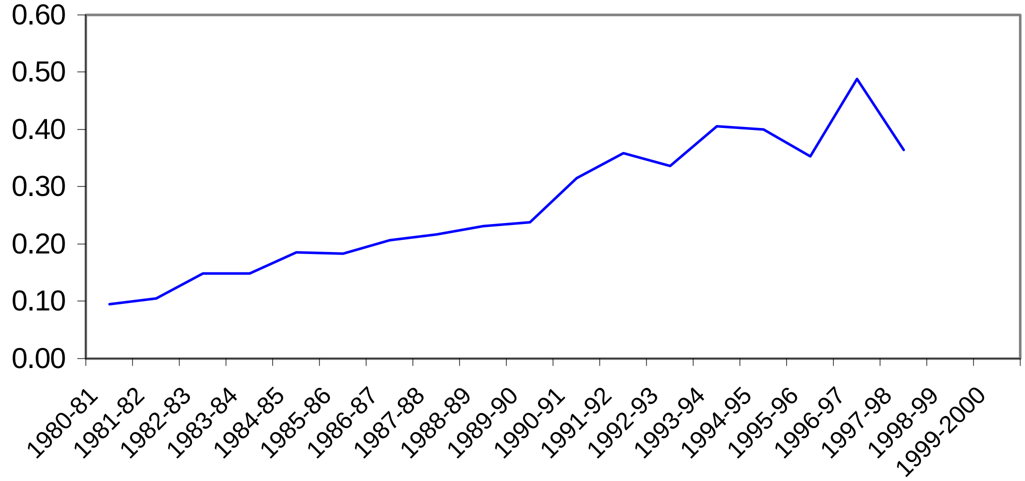


Fig 7. DEPOSIT MONEY BANK ASSETS TO GDP

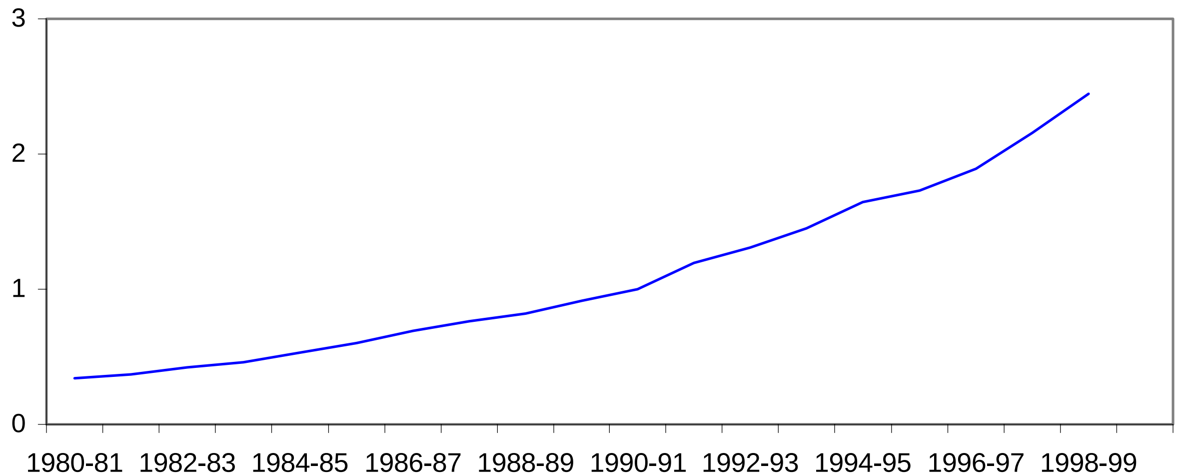
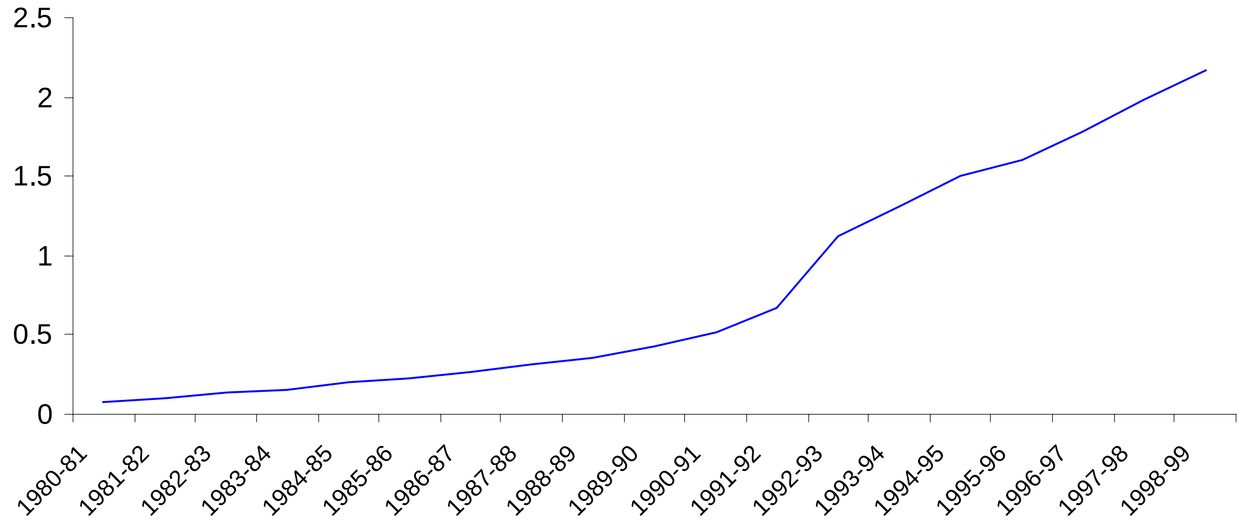


Fig 8. RATIO OF OTHER FINANCIAL INSTITUTIONS ASSETS TO GDP



There is another point to be observed. The ratio of deposit money bank assets to GDP and the ratio of other financial institutions' assets to GDP reached almost the same level in 1998-99 but the path of reaching that position were different. Starting from a relatively lower value, the ratio of other financial institutions' assets to GDP has undergone a faster change after the post liberalization period as compared to the ratio of deposit money bank assets to GDP.

The next two indicators reflect the measures of the activity of financial intermediaries and focus on intermediary claims on the private sector. The ratio of private credit by deposit money banks to GDP (figure 9) and the ratio of private credit by deposit money banks and other financial institutions to GDP (figure 10) -- both measures isolate credit issued to the private sector as opposed to credit issued to government and public enterprises. They concentrate on credit issued by intermediaries other than the central bank and measure one of the main activities of financial intermediaries, i.e., channeling savings to investors. The ratio of private credit by deposit money banks to GDP and the ratio of private credit by deposit money banks and other financial institutions to GDP shows an increasing trend through out the period. This indicates that the non-central bank intermediaries are playing an increasingly important role in allocating credit to the non-government and non-public enterprises.

Fig 9. RATIO OF PRIVATE CREDIT BY DEPOSIT MONEY BANKS TO GDP

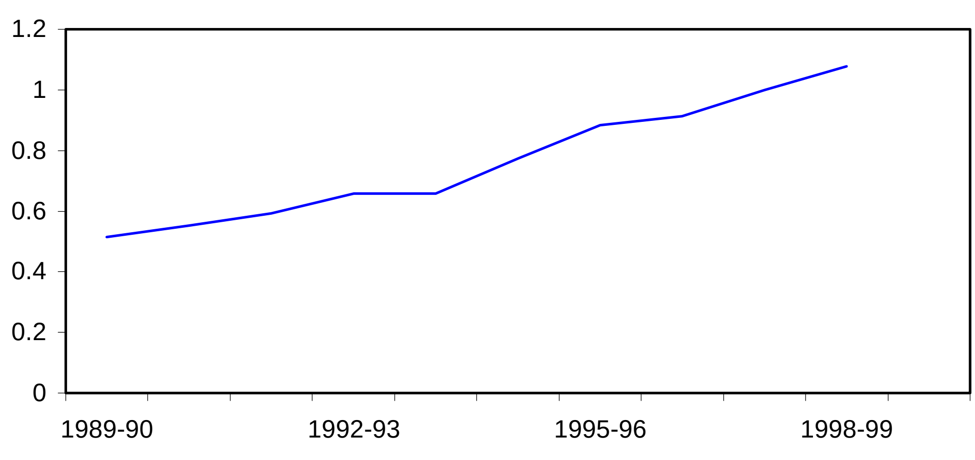
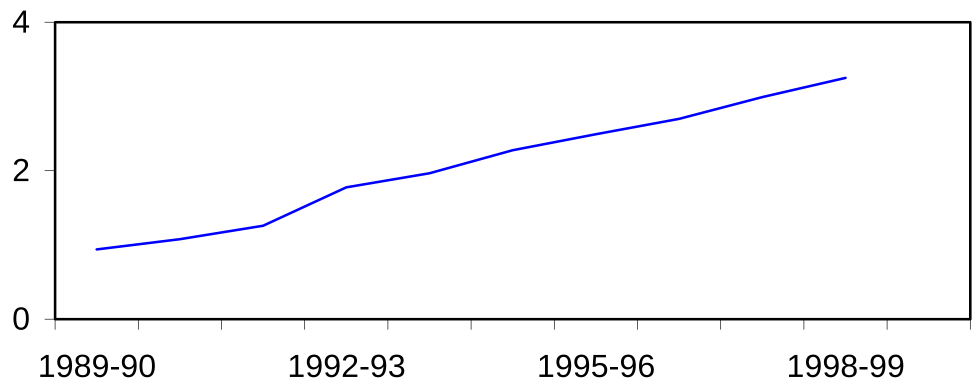
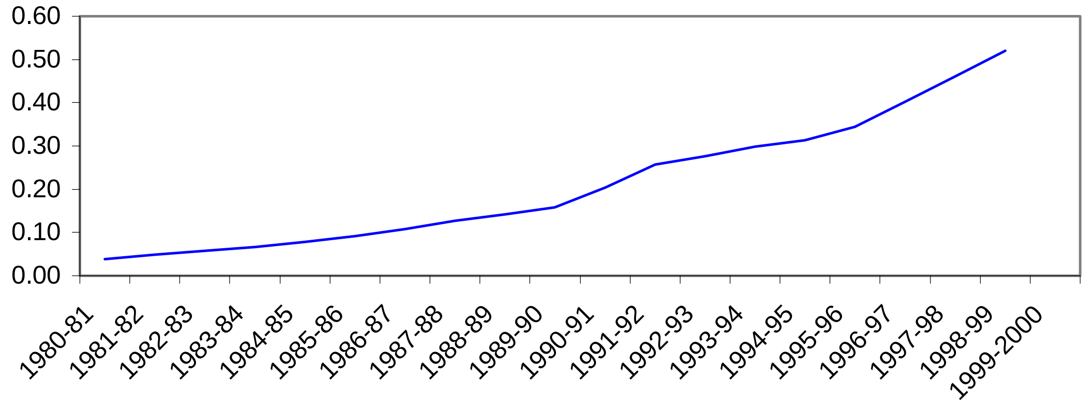


Fig 10. RATIO OF PRIVATE CREDIT BY DEPOSIT MONEY BANKS AND OTHER FINANCIAL INSTITUTIONS TO GDP



We have already noticed that the ratio of other financial institutions' assets to GDP is increasing in general. The ratio of total assets of development banks to GDP actually measures the pace of economic development of nation. Our diagram (figure 11) suggests that though the ratio is increasing, changes are more significant after liberalization. But what should concern us is that after 1997-98 the rate of increase of the ratio shows a considerable decline.

Fig. 11 RATIO OF TOTAL ASSETS OF DEVELOPMENT BANKS TO GDP

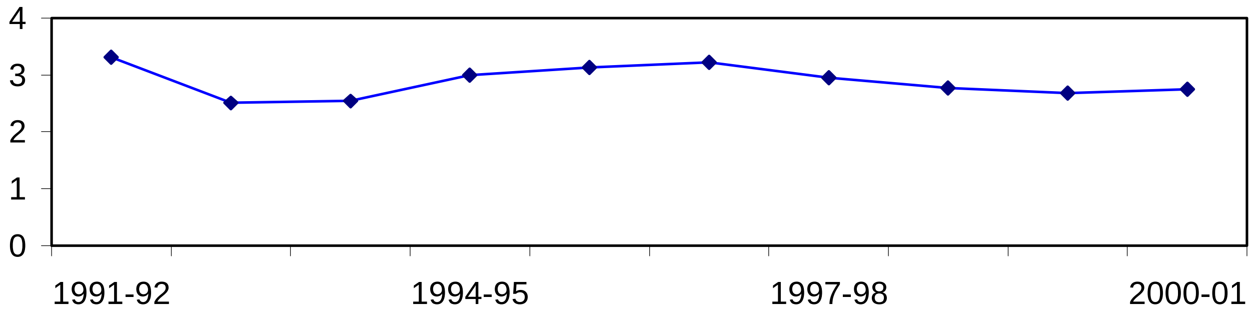


Efficiency of the Financial Sector in India

Interest rate margin is an indicator of efficiency of the commercial banks. Declining net interest income (figure 12) captures the fact that the Indian financial markets are becoming competitive. This is indicative of the process of deregulation of interest rates reflecting movement towards market rates. The yield curve is becoming a reality. Compartmentalisation of players in different markets and products has broken down and players can play in all markets bringing about a reduction in interest rate across sectors. For example, financial institutions are giving working capital loans and commercial banks are giving term loans. Furthermore, institutions are also getting into export credit, commodity credit, etc. However, resulting from a general industrial slowdown accompanied by inactivity in the capital market due to lack of investor confidence, there has been also relatively less demand for credit which has kept interest rates down and kept margins under pressure.

In an environment where accounting was on accrual basis, the thrust of the banking sector was on growth in terms of sanctions, disbursements and asset base. Irrespective of the interest rate regime, financial sector players were borrowing at high rates and also lending at high rates, keeping the margin constant. Over time, with accounting on actual basis and RBI guidelines on income recognition, asset classification, provisioning and capital adequacy, the financial sector players have come to terms with the fact that high rates of interest is also associated with high default rates and the effective rate of return is much lower than what the banks originally presumed. With the current income recognition norms, financial sector players have come to realise the importance of asset quality and not size. The reduction in net interest margin mentioned above is an indicator of the fact that with provisioning associated with non-performing assets, a lower margin may lead to a better asset quality, a healthier balance sheet, better capital adequacy levels and enhanced shareholder value.

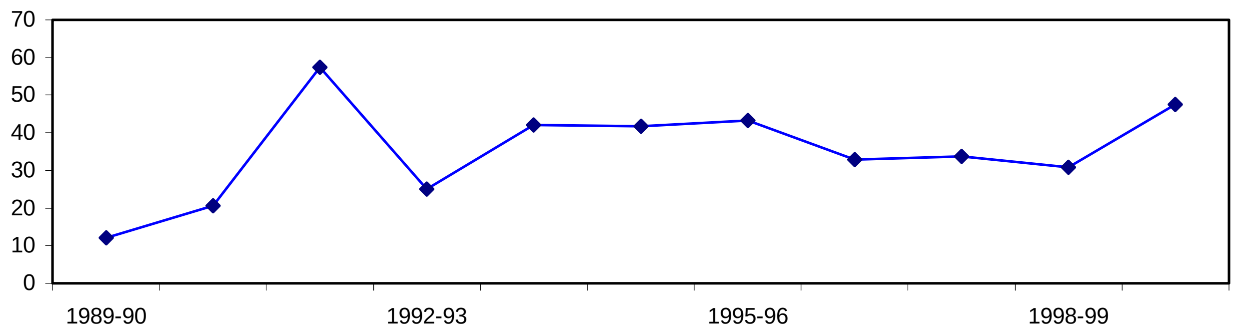
Fig. 12 NET INTEREST INCOME(SPREAD) AS % OF TOTAL ASSETS OF SCB (SINCE 1991-92)



Stock and Bond Market Development in India

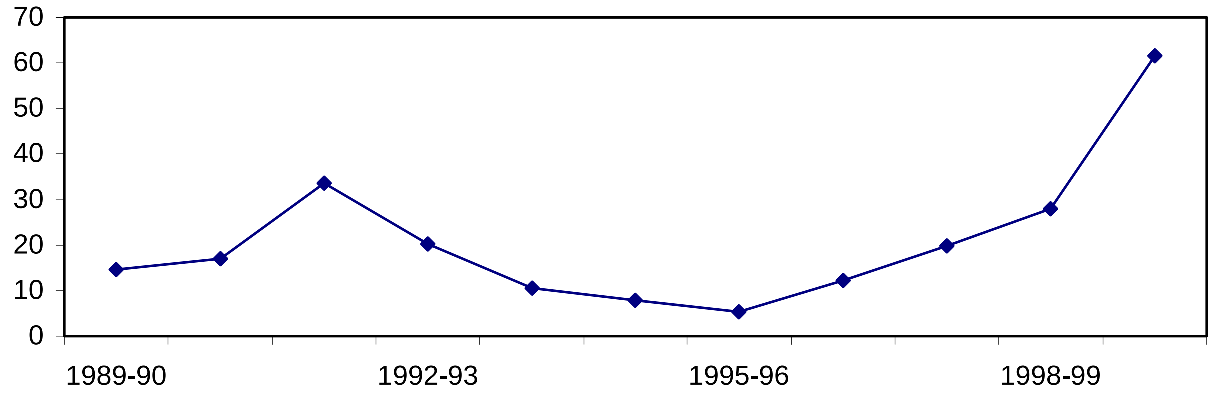
The following indices are the indicators of stock market size, activities and efficiencies. The ratio of stock market capitalization (i.e. value of listed shares) to GDP measures the size of the stock market relative to the size of the economy. It is a measure of financial penetration. Figure 13 indicates that the movement of this ratio is fluctuating but the changes are not very enormous from one period to another, which indicates that private equity participation to GDP is more or less constant. In fact the increase from 1990 has not been that significant. In other words, the extent of penetration of the financial market has not been that intense and is reflected in the extent of inactivity in the capital market.

Fig 13. PERCENTAGE OF MARKET CAPITALISATION TO GDP



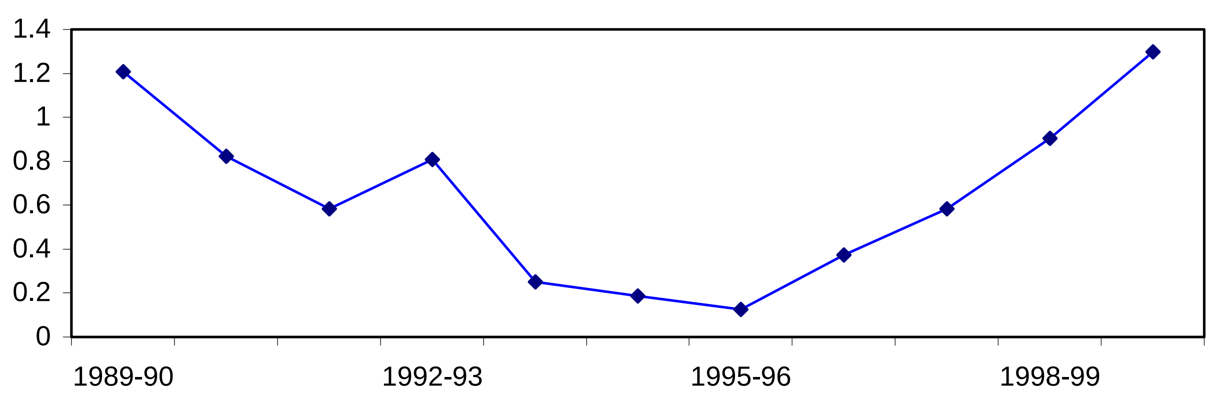
The ratio of stock market total value traded to GDP measures the trading volume of the stock market as a share of national output and reflects the degree of liquidity that stock market provides to the economy. Ratio of total trading volume of BSE (figure 14), the largest stock exchange in India, to GDP has made a "U shaped recovery", touching lowest in 1995-96 and increasing thereafter.

Fig 14. TRADING VOLUME of BSE / GDP (%)



The stock market turnover ratio is the ratio of the value of total share traded to market capitalization. It is a measure of activity or liquidity of a stock market relative to its size. A larger but less liquid stock market will have a lower turnover ratio than a small but active stock market. Our diagram (figure 15) on this is identical to the ratio of stock market total value traded to GDP as the penetration ratio is a constant - touching highest in 1991-92 and lowest in 1995-96, and showing a rapid ascent after 1995-96. It may be observed that not only did prices increased, this was accompanied by an increase in the volume of transactions. So, this period observed a considerable extent of activity.

Fig 15. STOCK MARKET TURNOVER RATIO



The following indicators measure the size of primary stock market and bond market as against secondary market trading in equity and debt. The ratio of equity issue to GDP (figure 16) is quite fluctuating and is on a declining trend since 1991-92 whereas the ratio of debt issue to GDP (figure 17) shows a “U” shaped recovery. So it can be noted that the debt market is growing in a systematic manner whereas the equity market is not maintaining that kind of pace. The same picture is again reflected if we study the yearly movement of the ratio of public sector capital issue to GDP (figure 18) and private sector capital issue to GDP (figure 19). The yearly movement of the ratio of private sector capital issue to GDP shows a declining trend since 1991-92 whereas the ratio of public sector capital issue to GDP is maintaining a “U” shape. This is indicative of a growth in the capital market driven by debt issues and that too of the public sector.

Fig 16. EQUITY ISSUE / GDP (%)

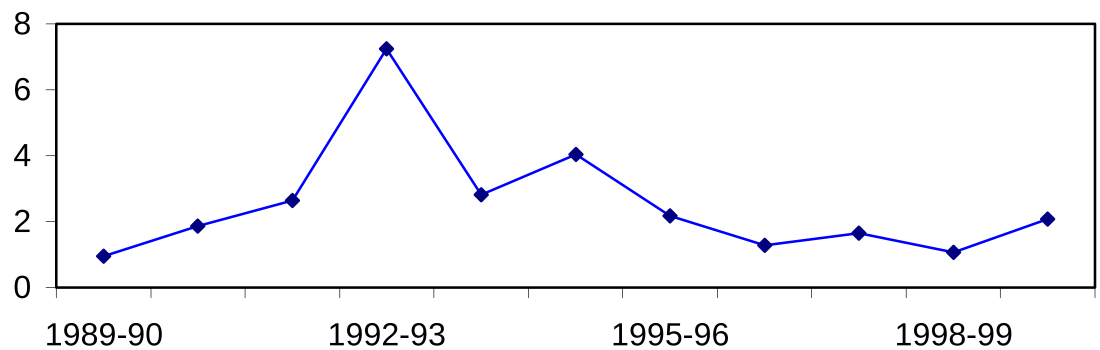


Fig 17. DEBT ISSUE / GDP (%)

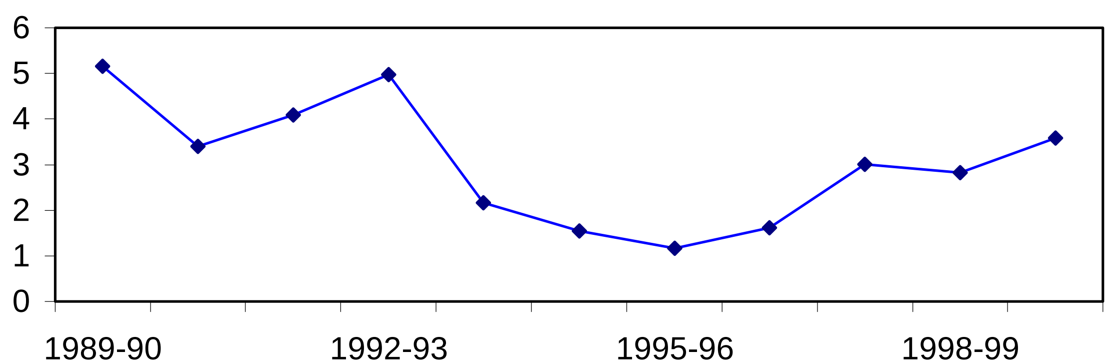


Fig 18. PUBLIC SECTOR CAPITAL ISSUE / GDP (%)

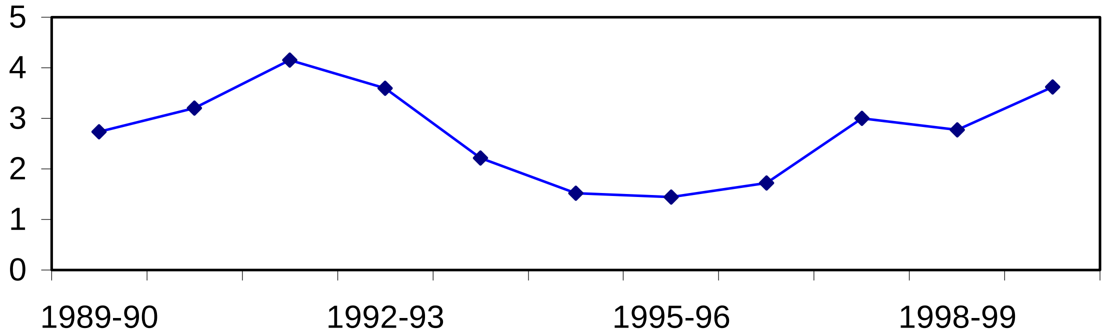
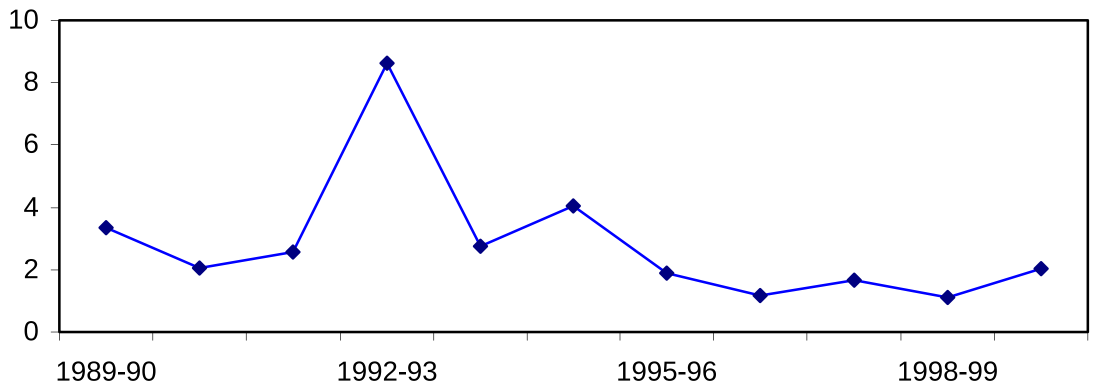


Fig 19. PRIVATE SECTOR CAPITAL ISSUE / GDP (%)



Financial Deepening and Credit Allocation in India

While financial deepening and increased efficiency did happen in India, there remains serious doubt as to whether the private sector was able to take advantage of it. In fact, as figures 20 and 21 show, credit portfolio has been moving in favor of government sector with the percentage of non-food credit to total credit falling distinctly. This is in sharp contrast to the increase in percentage of investment in GOI to total credit. In terms of investment, the government sector seems to be catching up with the private sector. When the professed aim of liberalization is to reduce the role of government in investment avenues, this result sounds very disturbing.

Fig 20. YEARLY DATA ON NON-FOOD CREDIT AS % OF SCB's CREDIT FROM 1989-90 TO 1999-2000

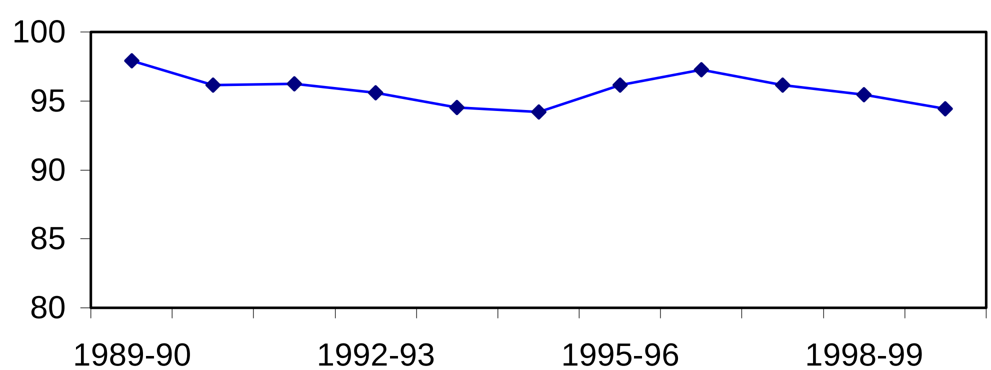
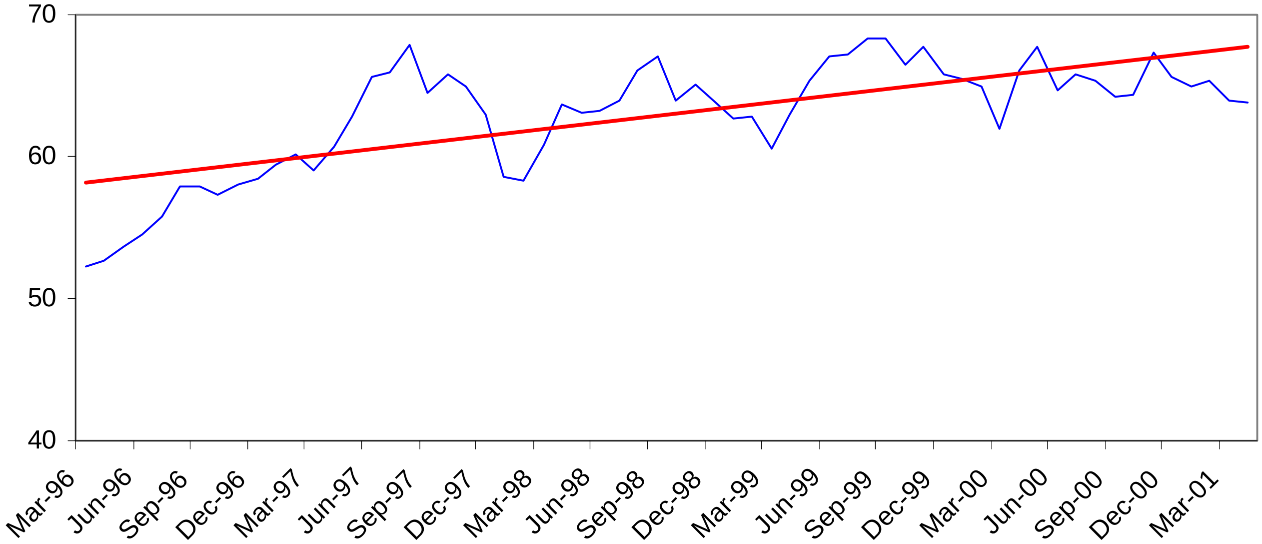


Fig 21. INVESTMENT IN GOI SECTOR AS % OF TOTAL CREDIT



Liberalization and the Financial Sector

We did not explicitly do any analysis regarding the extent of financial development in the pre- and post-liberalization period. The reason is that figures 1 to 11 are clearly indicative of the growth of financial sector as well as the qualitative changes that have taken place since liberalization. This is not surprising since before the liberalization period, financial sector – like most other sectors – was highly regulated, and the financial markets did not fulfil its basic functions such as pooling resources and splitting shares, transferring resources across time and space, managing risk, providing price information to help co-ordinate decentralized decision making, and dealing with incentive problems. That financial sector blossomed after the liberalization period shows that the Indian financial intermediaries have achieved certain level of maturity.

2.5 CONCLUSION

Presently discussions regarding the success and failure of the reform process in India are taking place at length. Our analysis clearly reveals that in so far as the financial sector is concerned, the size, activity and efficiency of the financial intermediaries have improved considerably since financial reforms were adopted. Financial development is a reality in India. In other words, in playing the role of channeling savings to investors, which is its primary function, financial intermediaries have considerably increased their capability in all fronts. And most importantly the quality of that role has significantly improved. However, what should be extremely worrying for the reformers is the result showing that the allocation of credit (savings) is not favouring the private sector. The ratio of government credit to private credit has been increasing since mid 1990s. With the increasing withdrawal of government from activities in the real sector, this investment tendency clearly indicates relative inactivity of the private sector in the real economy. This is not to say that the reforms in the financial sector and its subsequent development are of no consequence. One should realize that without the improvement in the financial sector, India's capability of handling crisis and business cycle fluctuations would have been considerably reduced. The role of financial sector in a closed and controlled economy and its role in an open and liberalized economy are not the same. Without financial reforms and its development, India, in an open, complex and liberalized economy, certainly would have faced grave problems. The reason for the relative inactivity of the real sector lies not with the financial sector but probably in problems pertaining to the real economy supply and demand constraints.

CHAPTER III

FINANCIAL FRAGILITY IN STOCK MARKETS : CROSS-SECTIONAL STUDY

3.1 INTRODUCTION

A major plank in a non-fragile financial infrastructure is obviously a stock market performing in the best possible manner. Optimal stock market operations imply among others stock prices moving in accordance with fundamentals which simultaneously ensure optimal returns (i.e. risk free rate plus premium for risk borne) for investors and raising required capital at optimal cost for borrowing firms. At any given point in time or during any given period of time, stock price will move in an attempt to find levels commensurate with fundamental explanatory variables. The fundamental explanatory variables include financial as well as economic variables, which determine the value of a stock. Thus, the deviation between actual market price and fundamentally explained price of a stock should be random. Conversely, the larger than normal deviations, deviations not petering out quickly – i.e., non-random behavior, points to existence of and building up of bubbles (with possibilities of boom and subsequent bust) leading to financial fragility.

Fama's (1970) early original work indicated that stock prices moved according to fundamentals. However, empirical researches since then have raised serious doubts about this observation. Shiller (1981) found stock prices to be more volatile than what would be warranted by economic events. Summers (1986) opined that financial markets were not efficient in the sense of rationally reflecting fundamentals. Fama and French (1988) in their paper on permanent and temporary components of stock prices found returns to possess large predictable components casting doubts about the efficiency of the stock market. Dwyer and Hafer (1990) examined the behavior of stock prices in a cross-section of countries and found no support for either 'bubbles' in or the fundamentals in explaining the stock prices. Froot and Obstfeld (1991) study on 'Intrinsic Bubbles – the Case of Stock Prices' once again doubts about the stock prices being determined by the fundamentals.

If the changes in stock prices or return can be significantly explained by an appropriate set of financial and economic variables, then we may say that stock prices are being determined by fundamentals. In case the bubbles dominate the stock prices, stock price behavior may be explained more appropriately by incorporating variables accounting for speculative elements of the market. Dwyer and Hafer (1990), in this direction, present a theoretical basis leading to formulation of model incorporating fundamentals and bubbles. As the return received on stock basically relates to dividends, they argue that the value of a stock should relate to the stream of expected dividends. For, at the time of purchasing a stock, the investor expects a dividends $E_t d_t$ and a post dividend price $E_t P_{t+1}$, so that the fundamental price of a stock P_t^f in period t, will be

$$\mathbf{P_t^f = (1+r)^{-1} E_t P_{t+1} + E_t d_t}$$

Assuming expected real interest rate r to be constant and the transversity condition

$$\mathbf{\lim_{t \to \infty} (1+r)^{-i} E_t P_{t+i} = 0}$$

holds, then

$$\mathbf{P_t^f = E_t (d_t) + (1+r)^{-1} E_t (d_{t+1}) + \ldots\ldots\ldots\ldots\ldots\ldots}$$

With the implication that the expected growth rate of dividends is assumed to be constant, then the proportional changes in stock prices should be constant as well, and fluctuation in stock prices should be random.

In this context, Blanchard and Watson (1982) assume that actual stock prices in period t deviates from the fundamental price by an amount of bubble, b_t , such that price including bubble is

$$P_t^b = P_t^f + b_t$$

They show that when the bubble is present, the proportional change in stock prices is an increasing function of time and therefore predictable; further, as time increases, the bubble starts dominating fundamentals, which can be tested by regressing the proportional change in stock prices on time.

For Indian stock markets, there have been a number of studies on the question of efficiency. Studies by Barua (1981), Sharma (1983), Gupta (1985) and others indicate weak form of market efficiency. For example, Sharma (1983) uses data of 23 stocks listed in the BSE between the period 1973-78 and his results indicate at least weak form of random walk holding for the BSE during the period. There were also tests by Dixit (1986) and others, which primarily regress stock prices on dividends to test the role of fundamentals. These tests also found support for efficiency hypothesis. However, evidence in the recent period, particularly in the 1990's, Barua and Raghunathan (1990), Sundaram (1991), Obaidullah (1991) raise doubt about this hypothesis. For example, Barua and Raghunathan (1990) used (BSE) 23 leading company stock prices. They estimated P/E ratio based on fundamentals and compared them with actual P/E data. The result indicated shares to be over- valued. Obaidullah (1991) used sensex data from 1979-1991 and found that stock price adjustment to release of relevant information (fundamentals) is not in the right direction, implying presence of undervalued and overvalued stocks in the market. Barman and Madhusoodan (1993) in their RBI Papers found that stock returns do not exhibit efficiency in the shorter or medium term, though appear to be efficient over a longer run period. Barman (1999) study finds that fundamentals rather than bubbles are more important in the determination of stock prices in the long run; however, discerns contribution of bubbles, mild though it is, in stock prices in the short run.

Besides, it is the 90s which has seen significant structural changes with the opening up of the financial markets through privatising a large part of the public sector and the opening of the national stock exchange with the introduction of online trading. The purpose of this study is to bring out the long run properties of the Indian stock market by relating a) the relation of stock prices to fundamentals and b) by estimating the extent to which bubbles are present in the stock market data. It is to be emphasized that this study differs from other studies from another direction. This study analyses the properties of the stock prices as opposed to returns in the section on cross-sectional analysis. Since financial capital is to a large extent independent of the political structure of the firm, cross-sectional analysis can estimate the stationary properties of stock prices at least around that date. In the other section on time series analysis, we analyse price differentials over various time periods.

3.2. CROSS-SECTIONAL DATASET

Data for the regression estimates is obtained from the Prowess database of Centre for Monitoring Indian Economy. It is a pooled database covering the period 1988-2001. Prowess provides information on around 7638 companies. The coverage includes public, private, co-operative and joint sector companies, listed or otherwise. These account for more than seventy per cent of the economic activity in the organised industrial sector of India. It contains a highly normalised database built on disclosures in India on over 7638 companies. These data has been compiled from the audited annual accounts of all public limited companies in India which furnish annual returns with Registrar of Companies and are listed on the Bombay Stock Exchange. The database provides financial statements, ratio analysis, funds flows, product profiles, returns and risks on the stock markets, etc. Besides, it provides information from scores of other reliable sources, such as the stock exchanges, associations, etc.

In our cross-sectional study we have used the year 2000 as the benchmark case as it not only is the first year in the decade following the 90's but also the most recent full year. The share price P_t was considered as the closing price on 31st December of 2000, while the other figures were the balance sheet and profit & loss accounts figures, as the case may be, as was available from the Annual Returns and is provided in the Prowess dataset.

The following variables were considered :

Adj. price = adjusted closing price at 31.12.00 , closing price is adjusted for stock splits, bonus shares to reflect the true price per share.

Net worth per share = Net worth/no. of outstanding equity shares both at 31.12.00

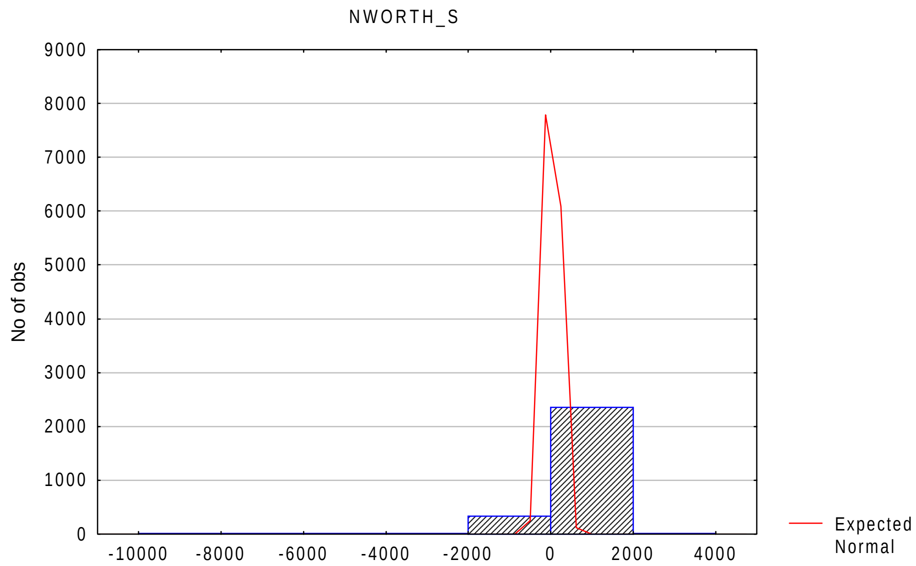
Debt Equity Ratio = Debt / Equity at 31.12.00

Net Profit per share (as on 31.12.00) = $\dfrac{\text{Net Profit after tax + extraordinary expenses – extraordinary income}}{\text{No. of outstanding equity shares}}$

Dividend per share (as on 31.12.00) = $\dfrac{\text{Total dividend paid during 2000}}{\text{No. of outstanding equity shares}}$

Market Data

The total number of companies available in the dataset was 2698. This was left after deleting cases with missing data, which never exceeds 5% of the total dataset. The distributions of the raw variables are shown in figures 1.2.1.1, 1.2.1.2, 1.2.1.3, 1.2.1.4 and 1.2.1.5.



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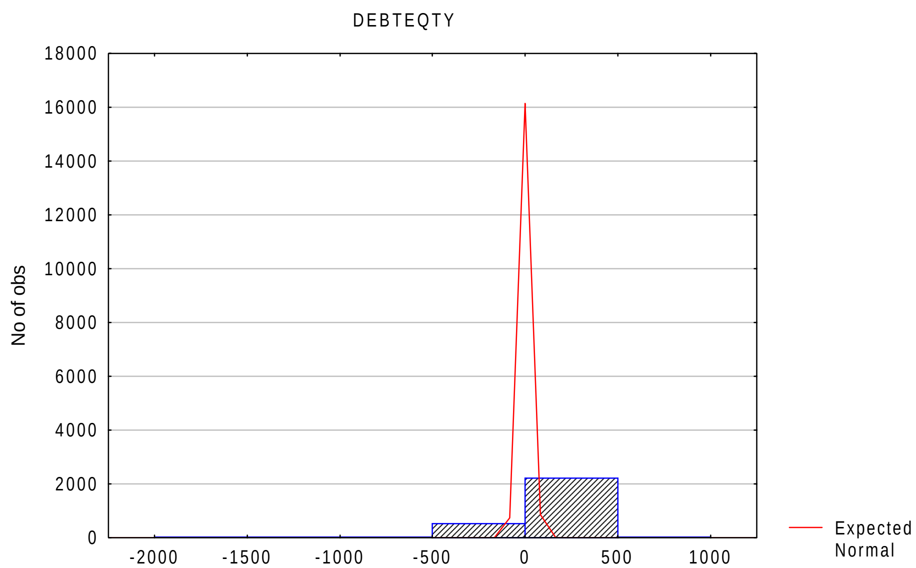

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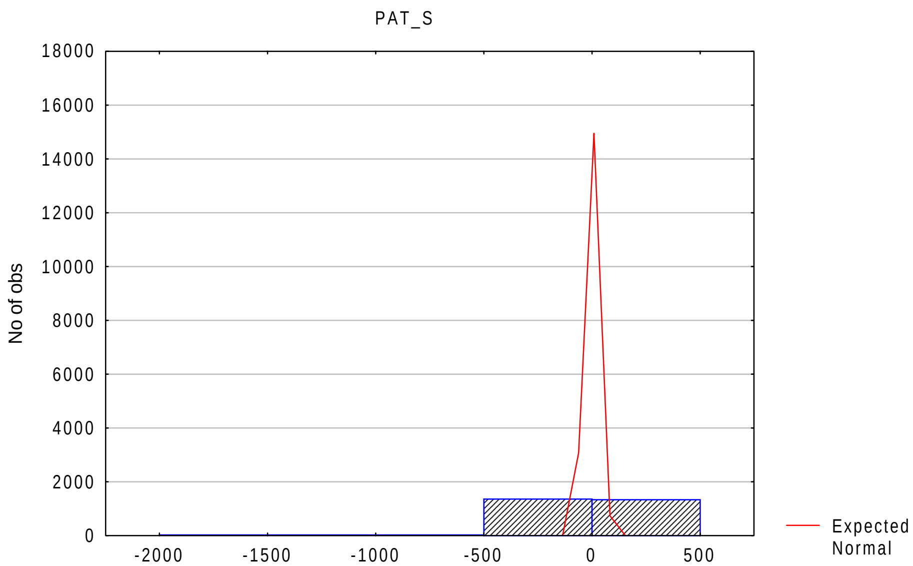

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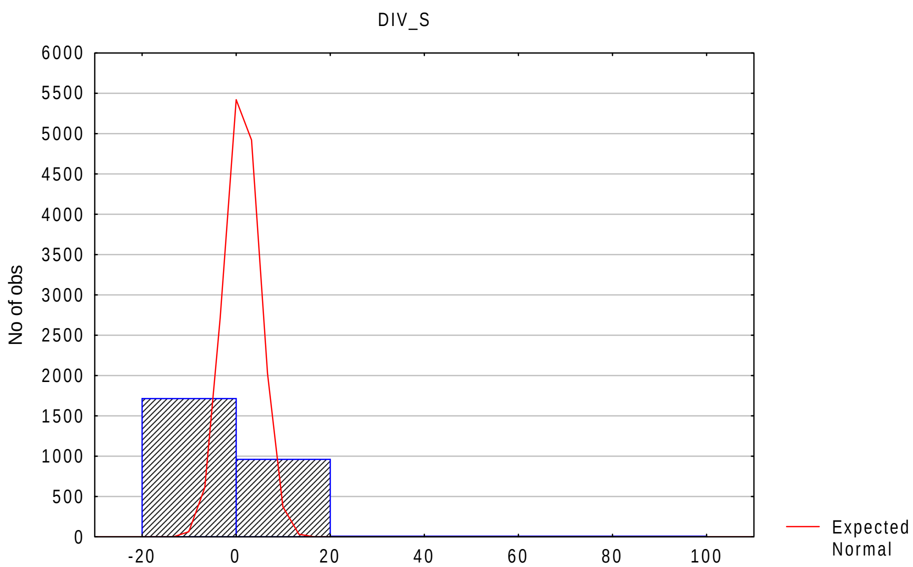


Figure 1.2.1.4

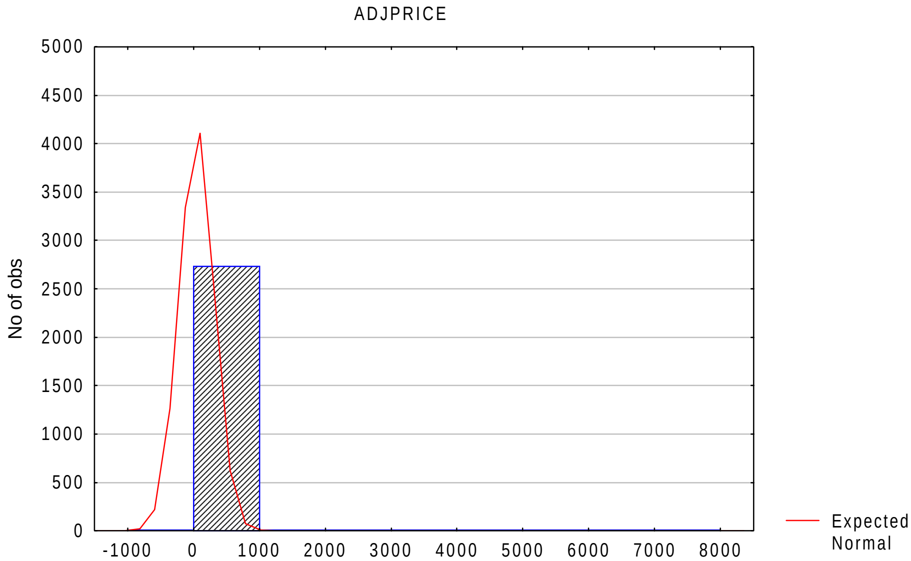


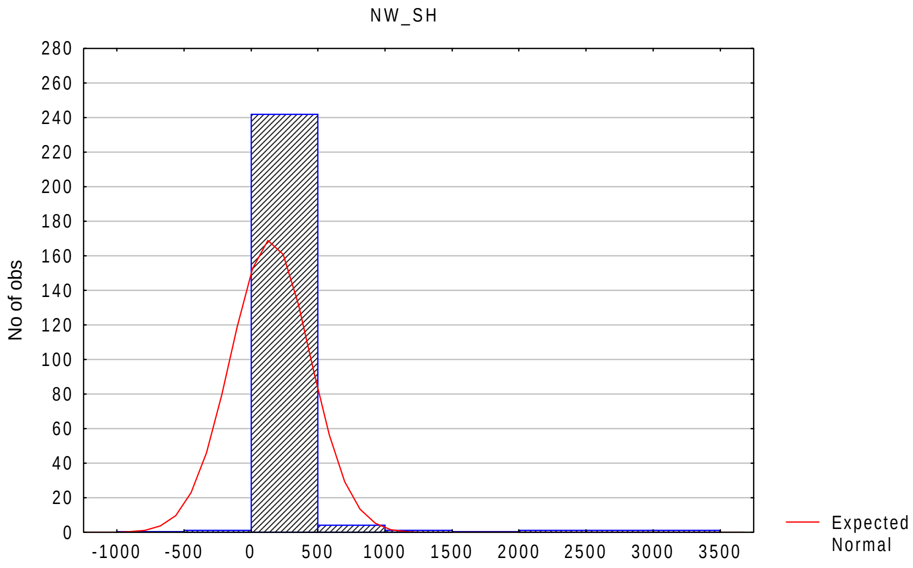
Figure 1.2.1.5

Control Market Data

The total market dataset was partitioned into two datasets by the adj. closing price / face value ratio.

This divides up the companies into two subsets on the basis of $\frac{\text{adj. closing price}}{\text{face value}} >= 10$

Thus, those companies whose shares were trading at over 10 times their face value are considered to be the blue chip companies while the others are the medium and poorly performing companies, especially so far as the stock market is concerned. The first subset consisted of 251 companies after correcting for missing data and the medium to poorly performing companies ended up with 2447 companies after deleting the missing data. The data fields were as in previous cases. The distributions of the variables in the datasets are plotted in figures 1.2.2.1, 1.2.2.2, 1.2.2.3, 1.2.2.4, 1.2.2.5, and 1.2.2.1.1, 1.2.2.2.2, 1.2.2.3.3., 1.2.2.4.4 and 1.2.2.5.5.



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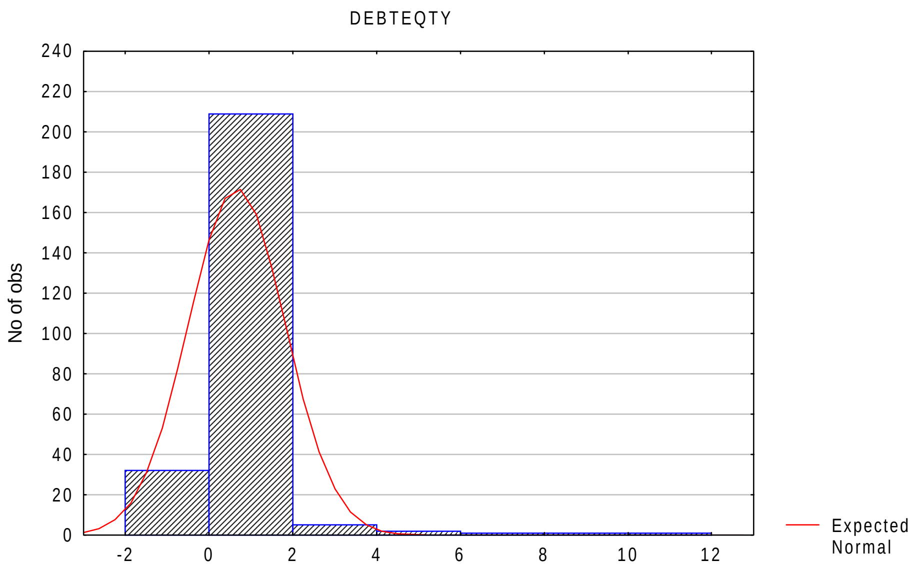

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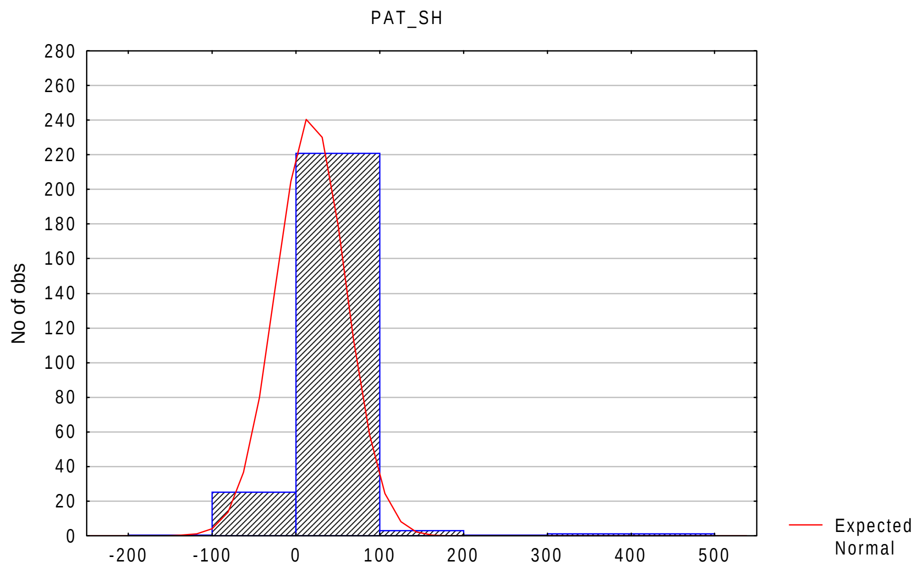

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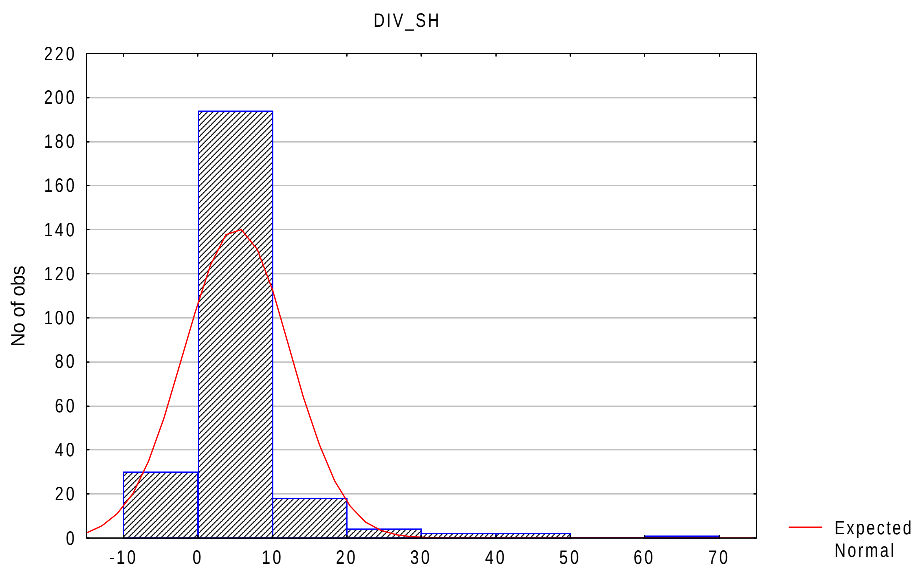

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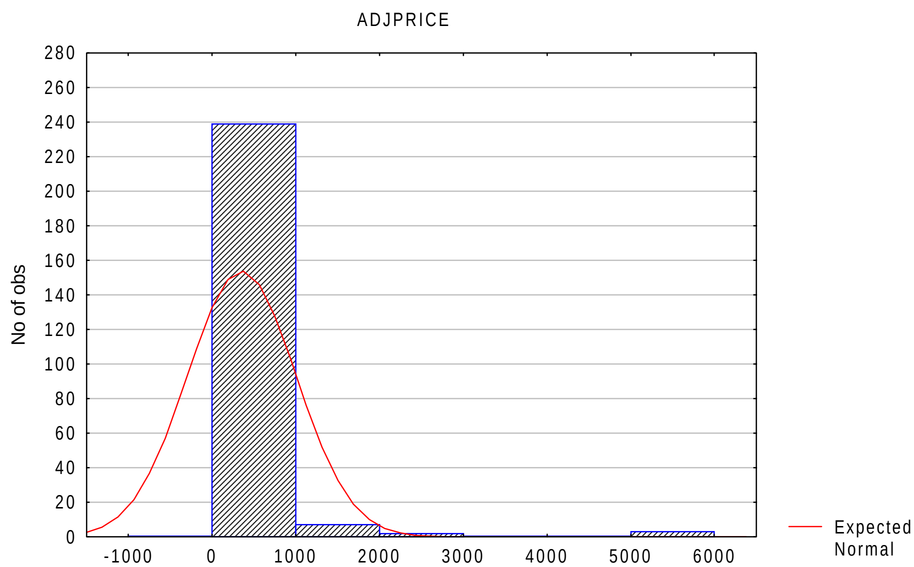

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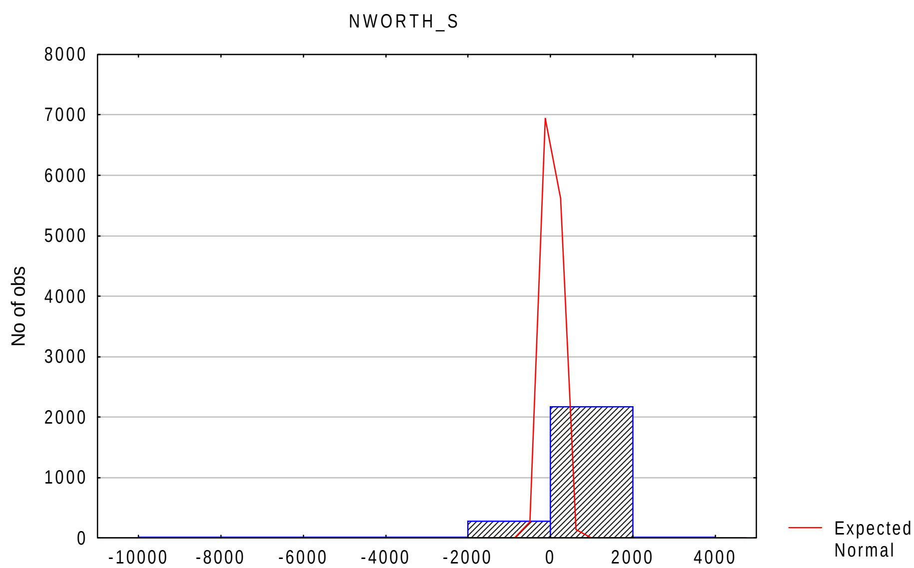

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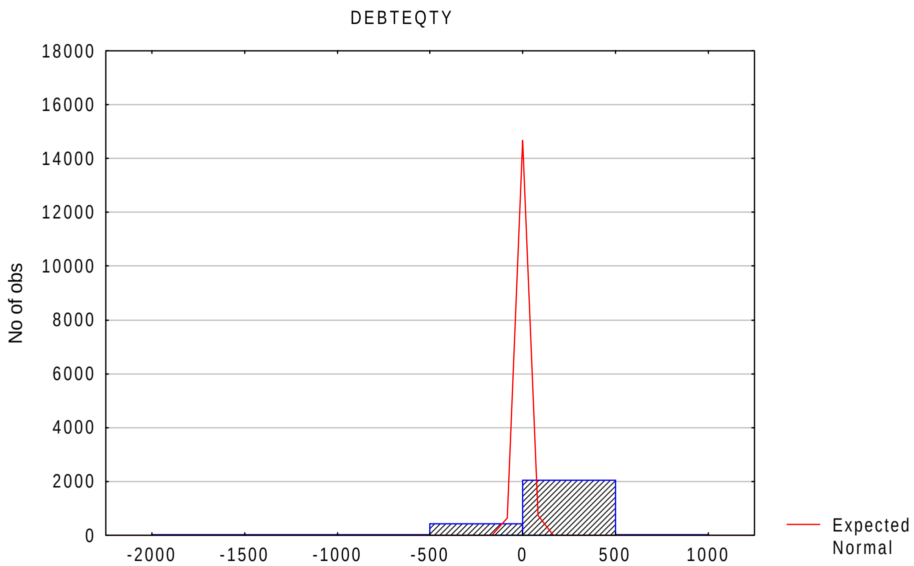

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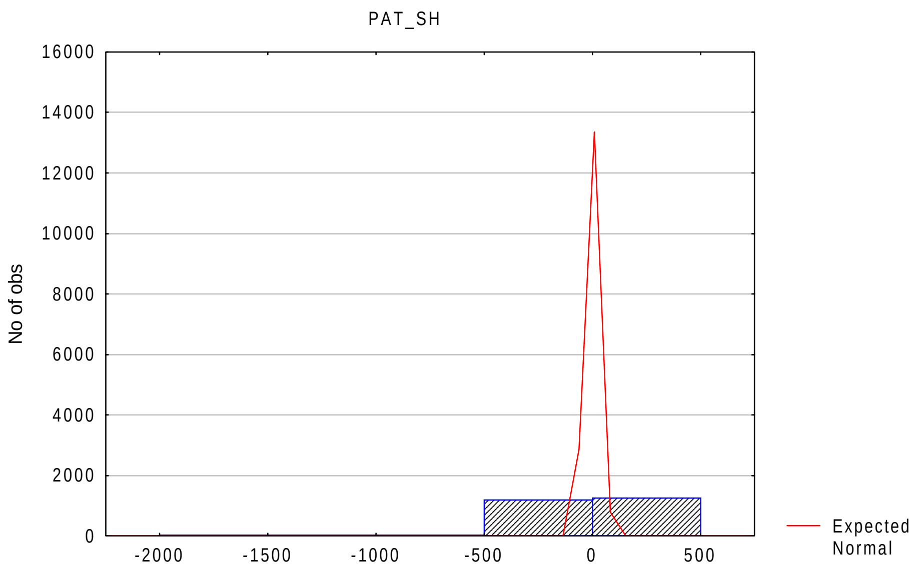

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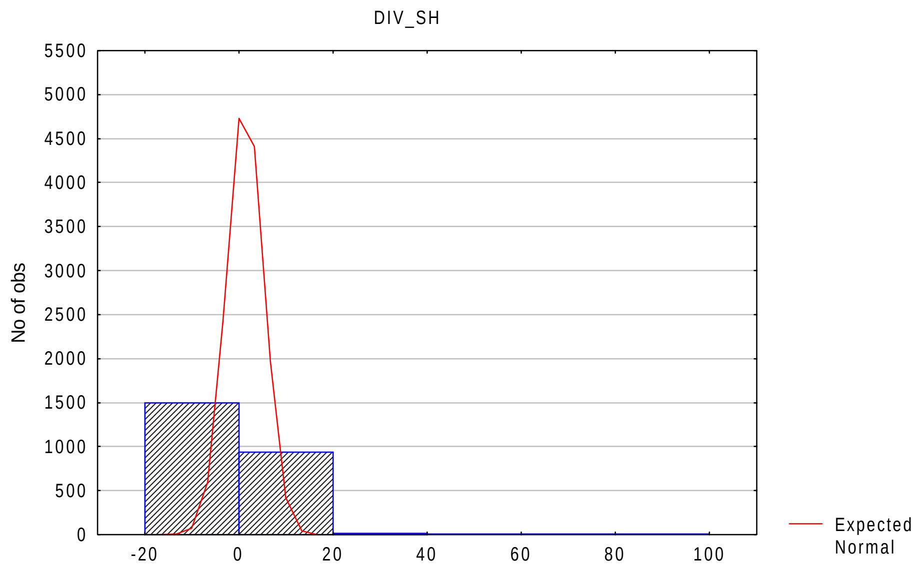

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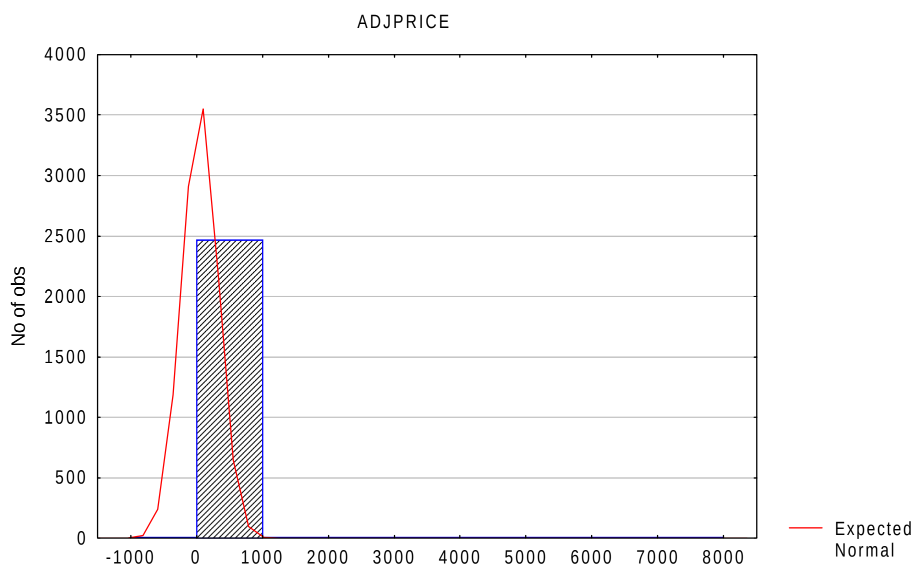
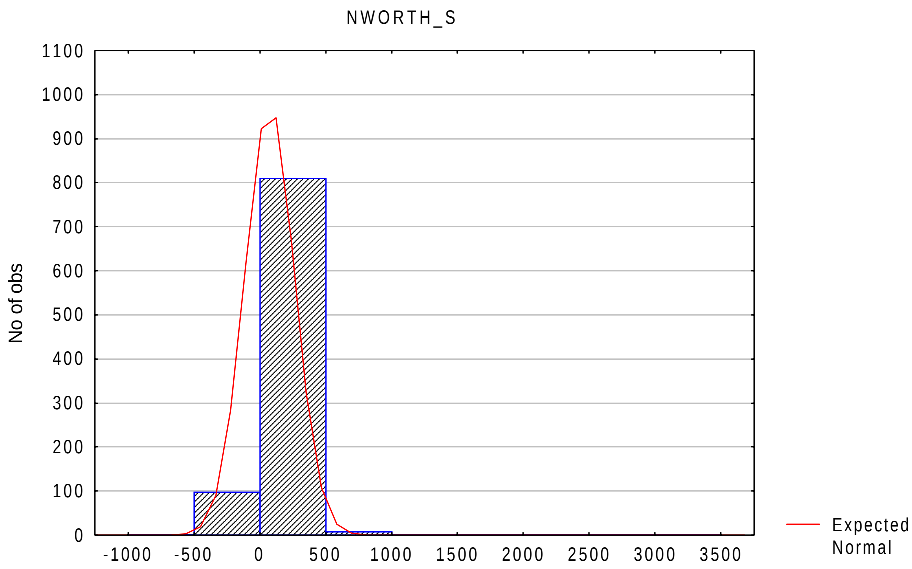


Figure 1.2.2.5.5

Manufacturing Sector Data

The manufacturing sector dataset consists of a set of 923 companies. In selecting this datasets we have applied the "survival" assumption; that is, only those manufacturing companies, which have survived the ten years 1990-2000 have been considered within the dataset. Regression run on this dataset will thus not only be a test on the fit of the model, but also on the conditional properties of the model subject to the ten year survival assumption. The distribution of the raw data are plotted in figures 1.2.3.1., 1.2.3.2., 1.2.3.3., 1.2.3.4 and 1.2.3.5.



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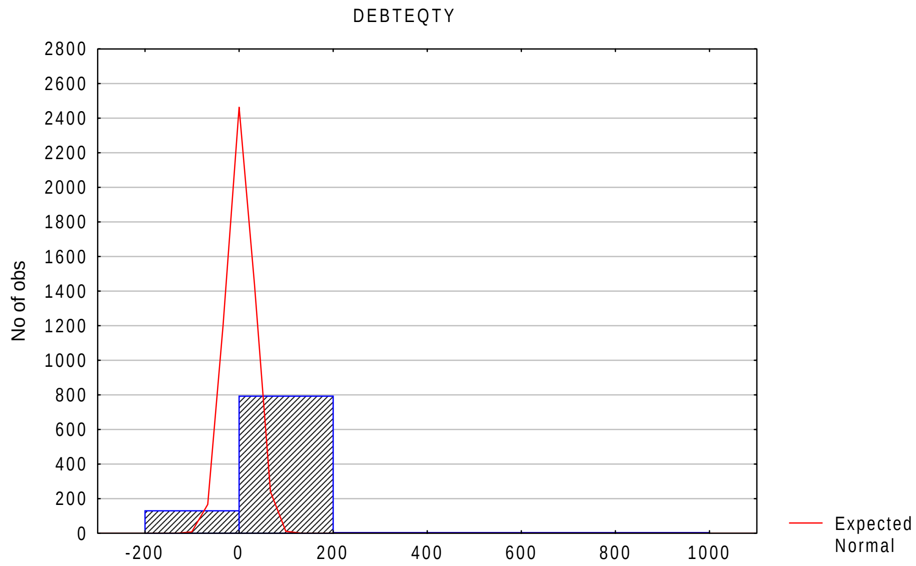

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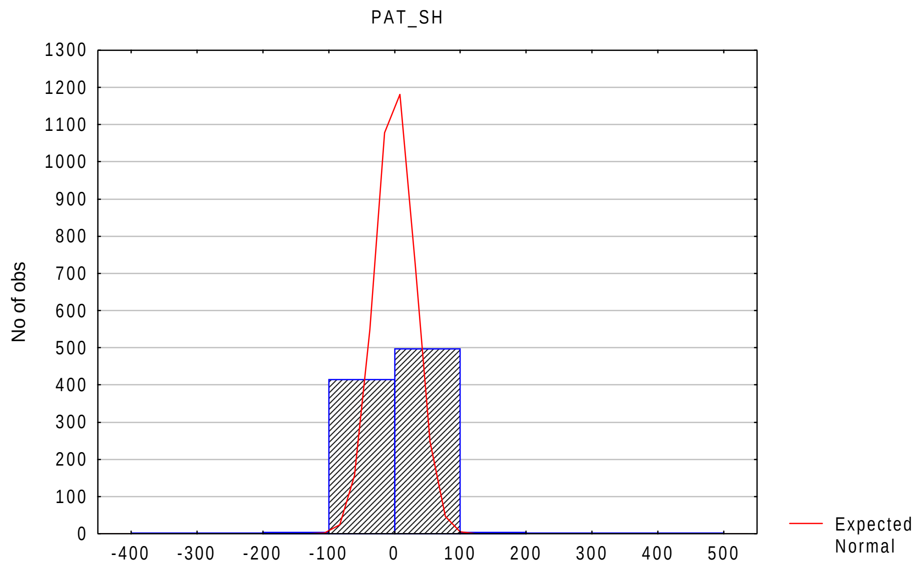

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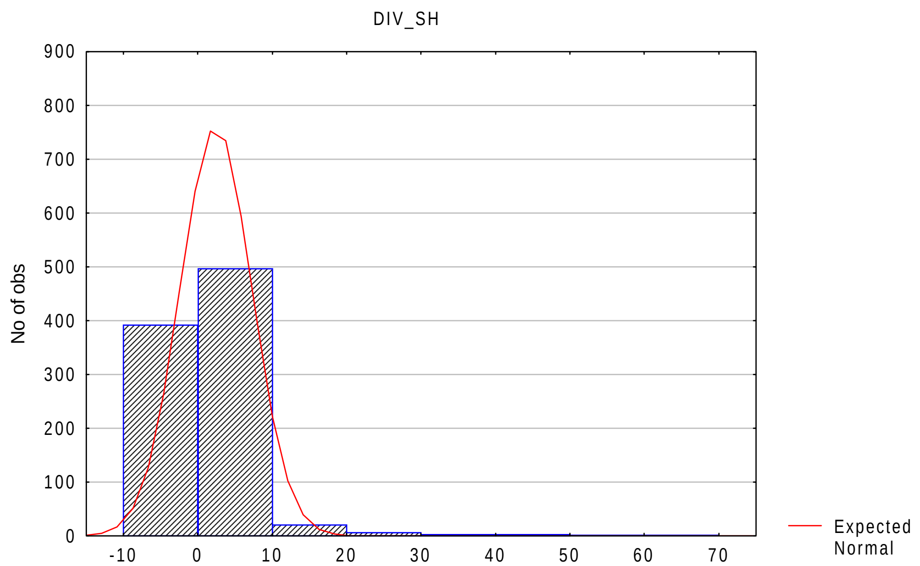

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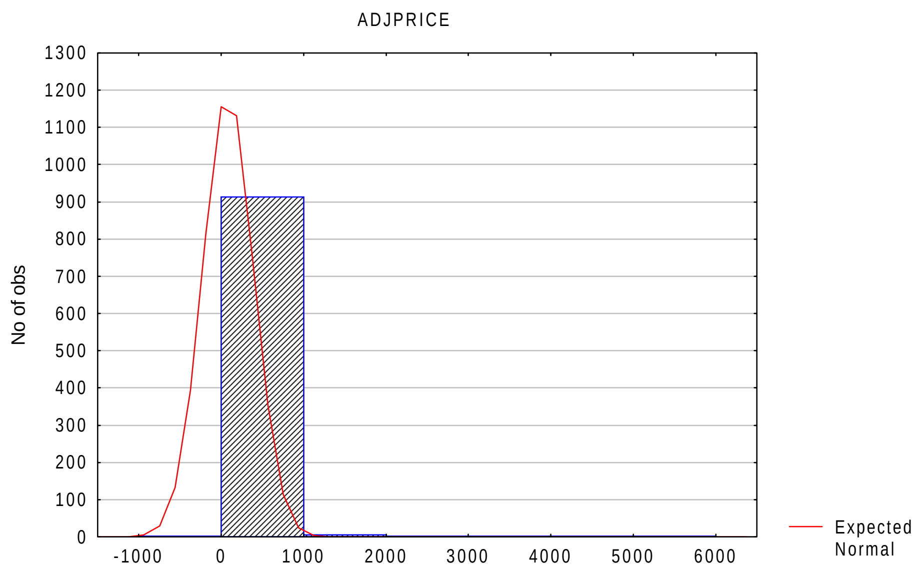


Figure 1.2.3.5

BSE 30 set of Companies

The BSE 30 set of companies at 31.12.2000 was chosen and the data for the model was set aside for this set. Out of the 30 companies, full data were available for only 22 companies. The distributions of the raw data are shown in figures 1.2.4.1, 1.2.4.2, 1.2.4.3, 1.2.4.4 and 1.2.4.5.

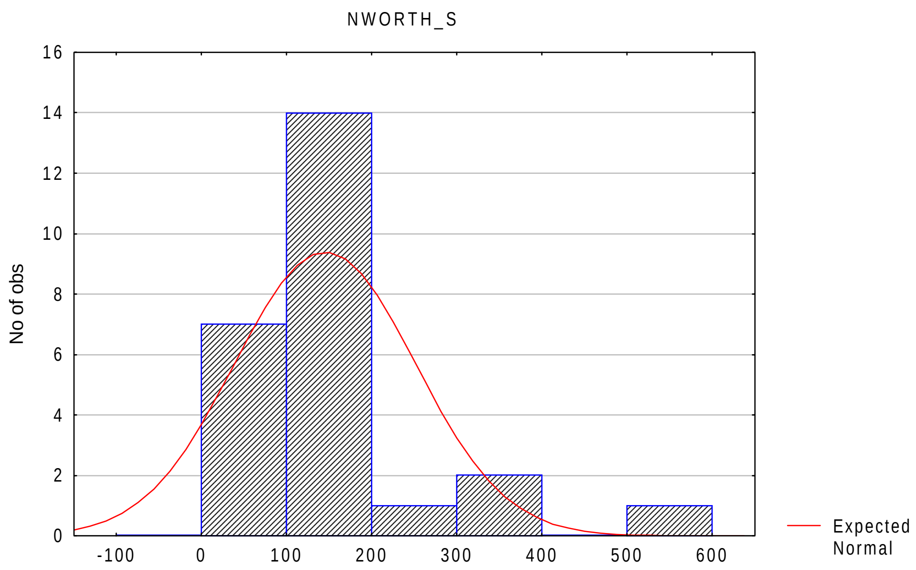
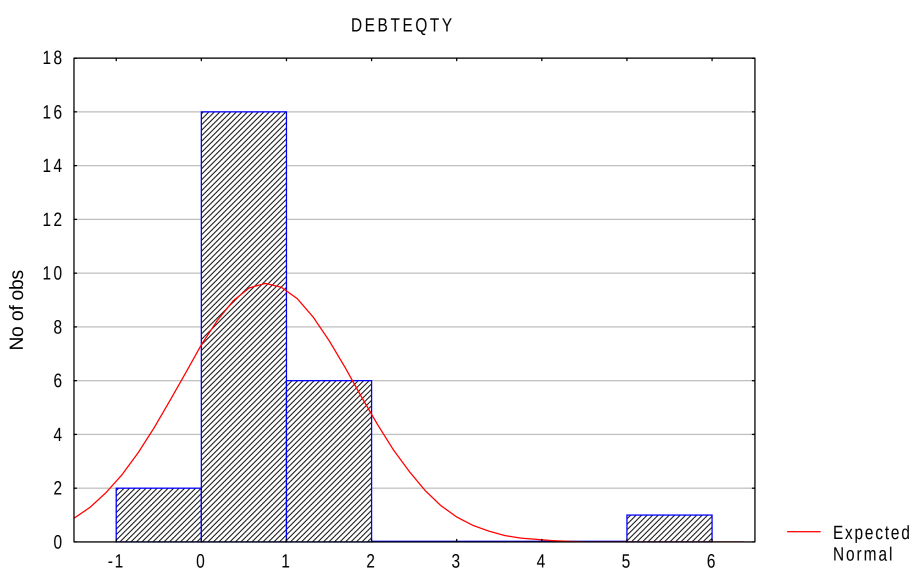


Figure 1.2.4.1



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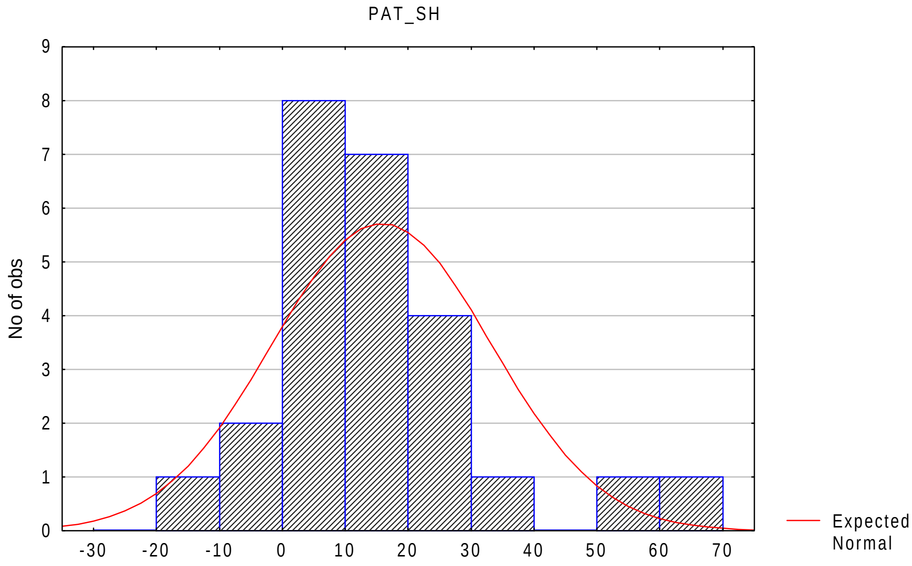

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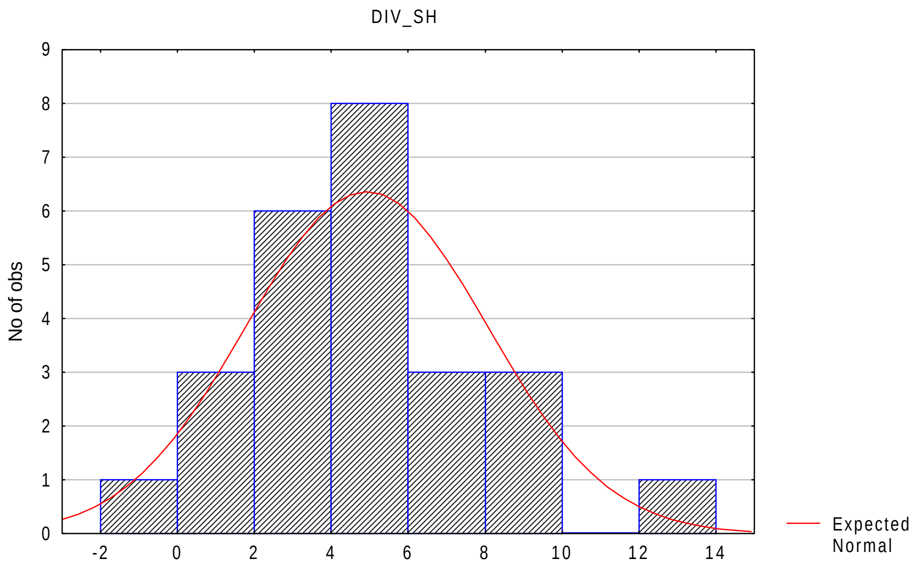

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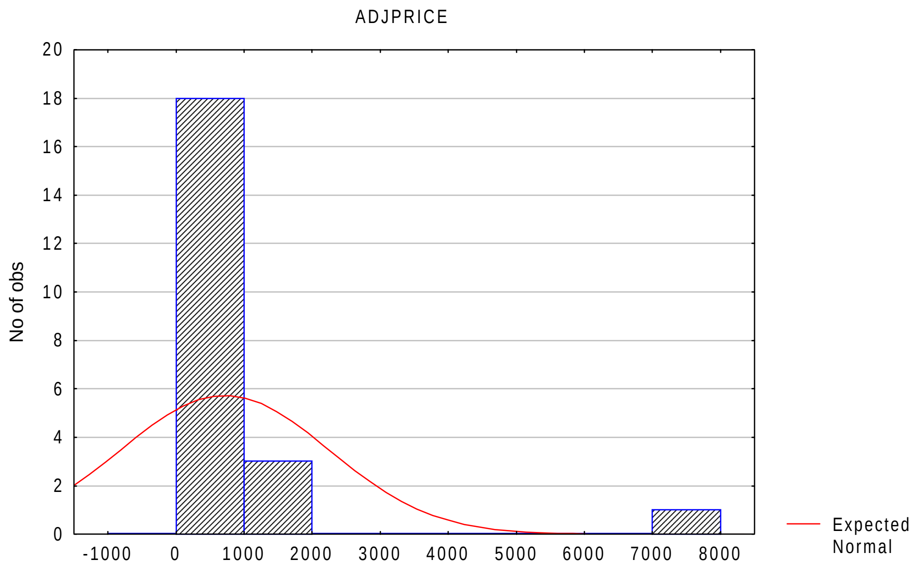


Figure 1.2.4.5

BSE 200 set of Companies

The BSE 200 set of companies at 31.12.2000 was chosen and the data for the model set aside for this set. Out of the 200 companies in the set all data were available for 166 companies. The distributions of the raw data are shown in the figures 1.2.5.1., 1.2.5.2., 1.2.5.3., 1.2.5.4 and 1.2.5.5.

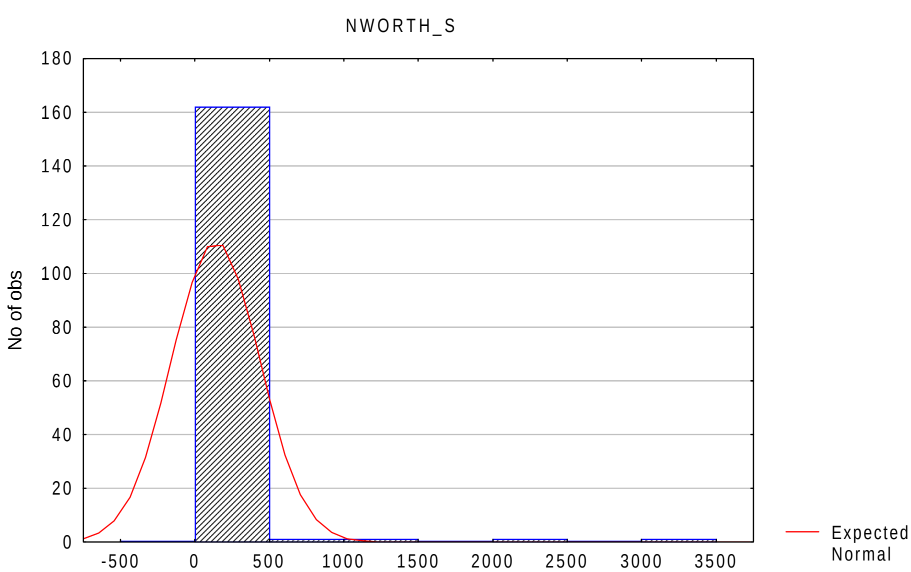
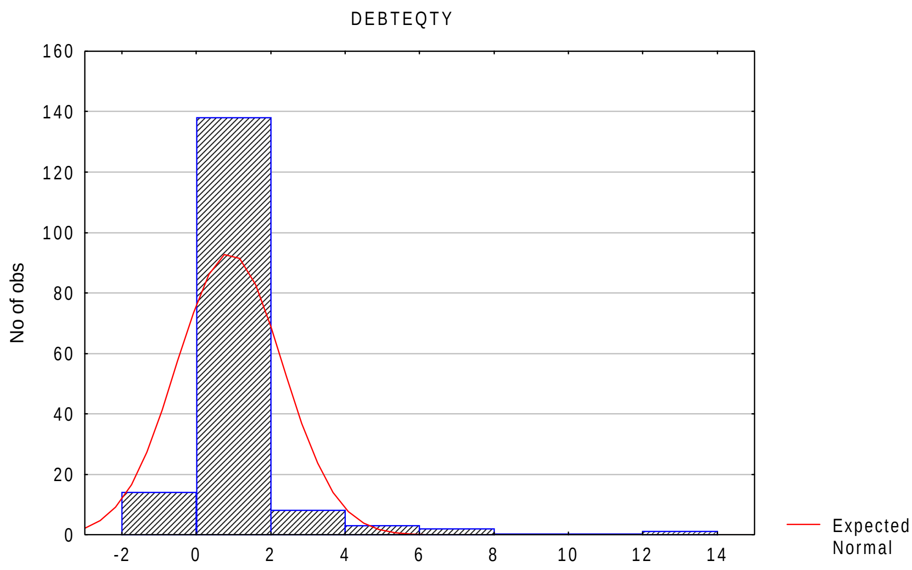


Figure 1.2.5.1



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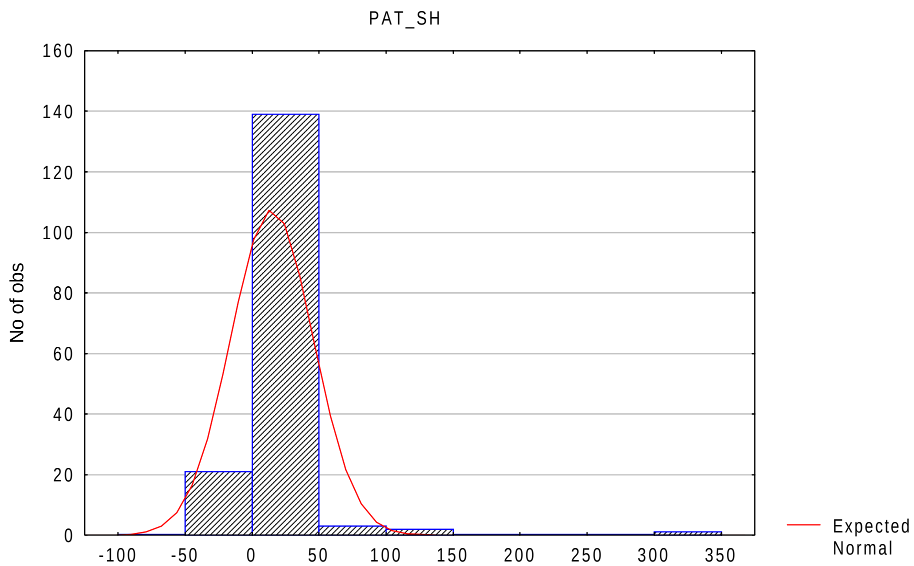

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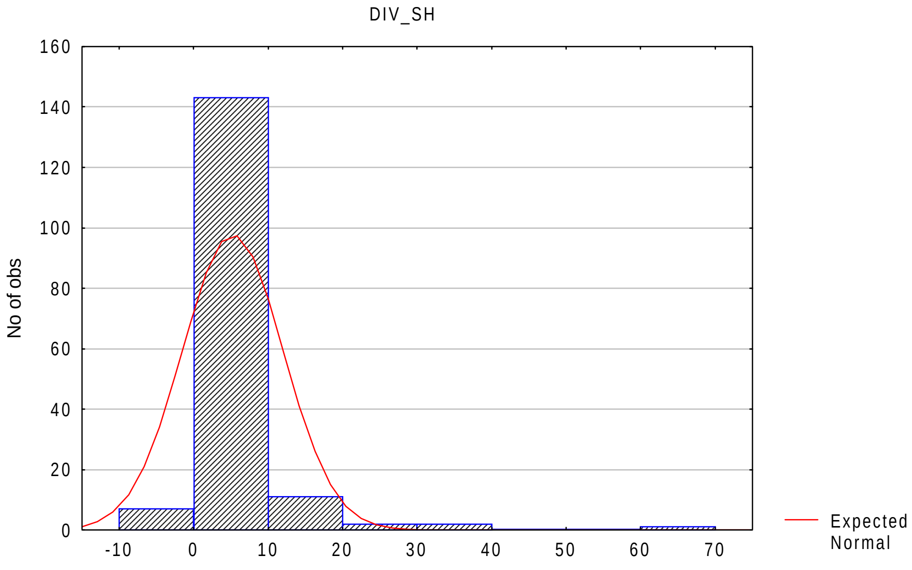

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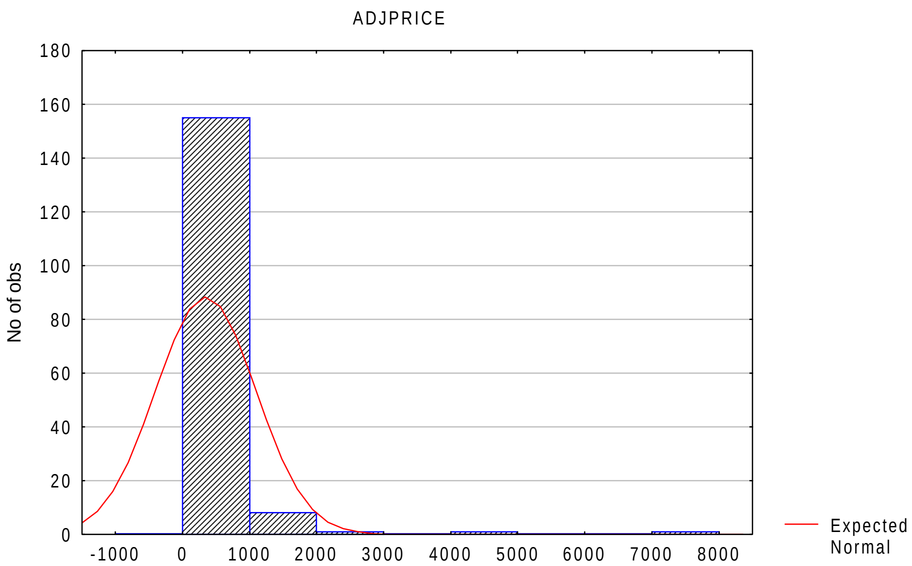


Figure 1.2.5.5

BSECG set of Companies

The BSECG set of companies (i.e., the set of companies in the BSE's Consumer Goods Index) at 31.12.2000 was chosen and the data for the model set aside for this set. Out of the 50 companies, full dataset was available for 41 companies. The distributions of the raw variables are provided in figures 1.2.6.1., 1.2.6.2., 1.2.6.3., 1.2.6.4 and 1.2.6.5.

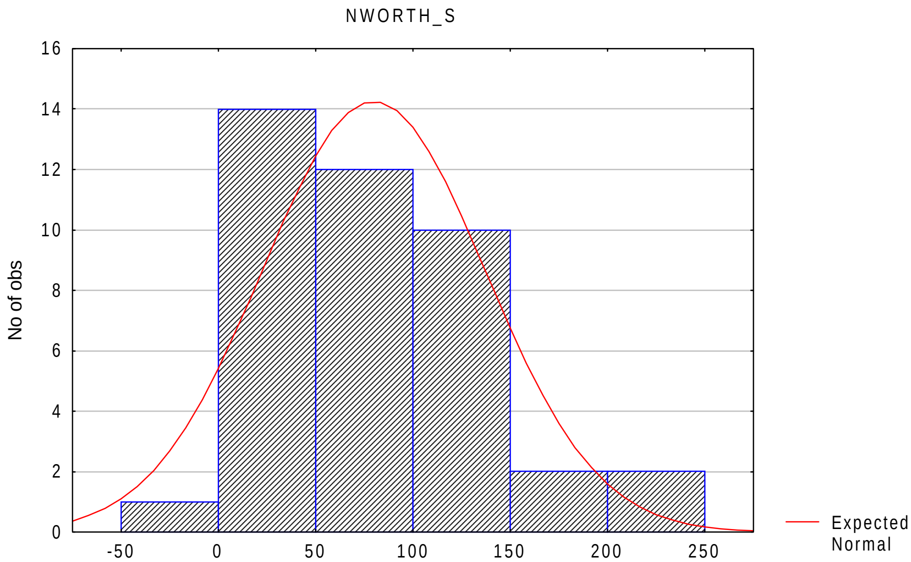
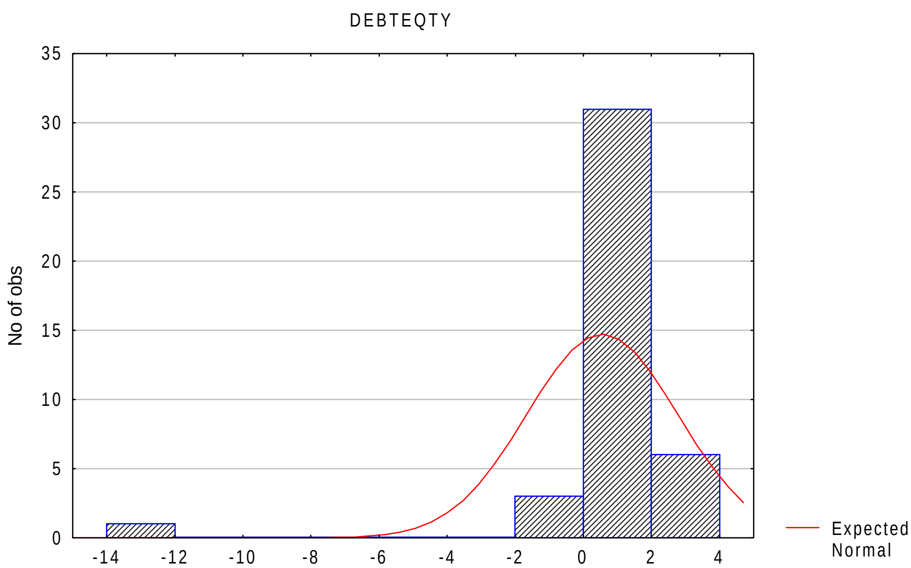


Figure 1.2.6.1



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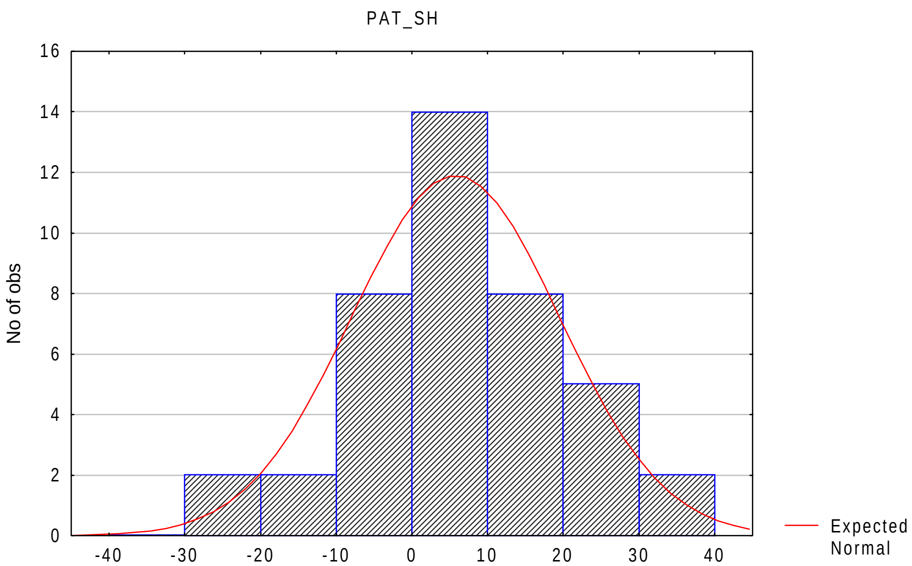


Figure 1.2.6.3

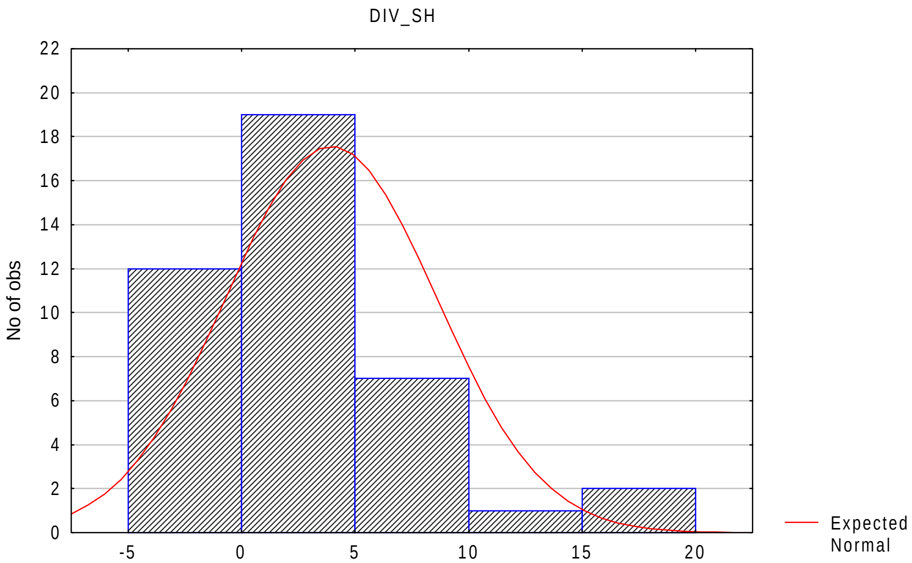


Figure 1.2.6.4

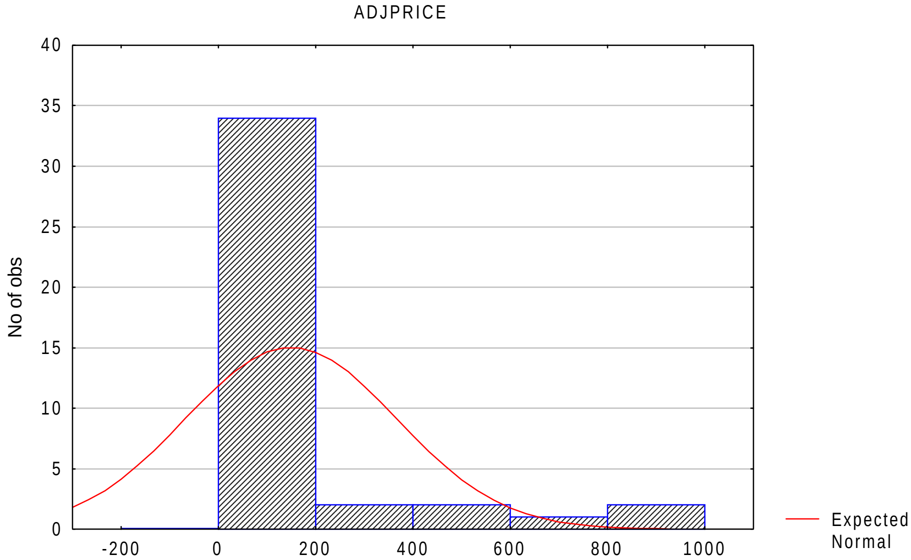


Figure 1.2.6.5

3.3. THE MODEL

We consider the following linear model for price information,

$$P = A + B_1\,NW + B_2\,DE + B_3\,PT + B_4\,DIV + \tilde{\varepsilon}\,, \qquad \tilde{\varepsilon} \sim N\,(O,\ \sigma_{\varepsilon}^{2})$$

Where, P = closing price of equity share on 31st December, 2000

NW = Net worth per share on 31st December, 2000

DE = Debt-Equity Ratio of the firm as on 31st December, 2000

PT = Net profit earned during the year and excludes income tax and non-ordinary items of income and expenditure in calculating the tax.

DIV = Dividend distributed during the year on each outstanding equity share at

31st December, 2000

ε = cross sectional error term which is a white noise and assumed to be distributed normally with mean 0 and variance σ_{ε}^{2} >0.

Dividend = equity dividend distributed during year 2000 divided by the no of outstanding shares at 31.12.2000

Debt - equity =debt - equity ratio as is reflected in the Annual Returns at 31.12.2000

Profit after tax = Net profit - extraordinary income + extraordinary expenditure - other income tax.

NW describes the capital accumulated by the firm per share and is a measure of its capital stock per share at t, which is also owner's equity per share; DE represents the debt-equity ratio and is a measure of the financial risk associated with its capital structure; DIV represents the dividend payments made by the firm during the year and is usually a reflection of both the profit distribution policy of the firm as well as its liquidity situation. Although according to the Modigliani-Miller theorem neither debt-equity ratio nor dividend distributions should affect the valuation of shares of a firm, yet as has been argued in the literature, the ideal conditions required for Modigliani-Miller theorem to hold do not realize in practice. For example, there are differential rates of taxes on dividend income obtained from holding equity shares as opposed to interest income holding debt instruments. Besides, as has been shown by Polemarchakis (1990) degree of risk aversion amongst different participants in the financial markets should affect share pricing when one integrates the financial and economic variables, at equilibrium. Besides, who owns debt and who owns equity should also matter, hence bringing in questions of distribution of ownership of firms. Dividends also have a number of reasons as to why they should affect equilibrium price of shares. Firstly, in developing countries such as India financial markets are incomplete (on this see Polemarchakis (1990). This may arise due to variety of reasons like asymmetric distribution of wealth, costs of private technology and lack of information including technical expertise. Hence, not all equity shares can be actively traded even amongst the participants in the stock market. In fact it has been observed that, on average, more than 80% of the trading in financial markets happens with respect to a select few shares of large companies and the rest of the market is passive, not to mention shares of newly floated firms, small firms and those who cannot list themselves with the stock exchange. Thus there is a difference in realizability between distribution of profit in cash and trading on shares to realize capital gains. Besides, taxes on dividends and taxes on capital gains are different. Bhattacharya (1979) has also brought out the importance of the signaling property of dividends, i.e., medium and small companies want to signal liquidity to go in for a history of dividend payouts. Thus inherent in dividends is the rationale for signaling of profit, liquidity for investment and signaling of historically sound performance. In fact, some old partial equilibrium finance models in the U.S., like the Gordon model (Gordon (1959)), had provided justification for valuing the equity shares of a company on its dividend payments history alone.

The importance of profit per share on the price per share does not require much argument. Investment in shares by shareholder is done because the firm will produce profit on the investment, which will increase the value of wealth in the form of shares, and which will be distributed in accordance with the future contingent consumption plan of the equity holders.

Thus, the price of equity shares at equilibrium is derived from its equilibration between the demand and supply of shares, demand being derived from NW, PT, DIV in its historical context and supply being derived from NW, DE. The dual importance of NW is derived from the fact that NW is both shareholders' wealth as well as firm's capital base. Since demand for shares (future contingent consumption) is derived from the wealth per share owned by an equity holder, it drives the demand for shares. At the same time, the NW is the capital base of the company, hence its ability and necessity to attract financial capital depends on the capital it already has accumulated in the form the net worth. Thus, the supply side of the share market is also made dependent on NW. The capital structure composition also determines the value of shares, which a company decides to issue or call back or split or offers as options. Of course, the supply side of the share market is not only composed of new shares, but also from negative demand by existing shareholders.

3.4. RESULTS OF GOODNESS-OF-FIT

The result of GLS regressions on the various datasets are as follows :

The Market Model

The regression results for the market model is summarised in the following table 1.4.1.1.

Table 1.4.1.1

Variable	B	t (2689)	Level of significance
Intercept	14.845	3.606	0%
NW	0.124	2.840	0%
DE	-0.007	-0.062	INSIGNIFICANT
PT	0.466	2.022	4%
DV	23.714	20.001	0%

The fitted line for price is presented in diagram 1.4.1.1., adjusted R^2 = 0.253. The F-statistic of 229.09 with 4 d.o.f. is significant at the 1% level, therefore rejecting non-zero error. The DW-statistic is small implying serial correlation of the residuals to be 0.026. Hence, the equilibrium pricing equation is obtained from the fixed-point equation.

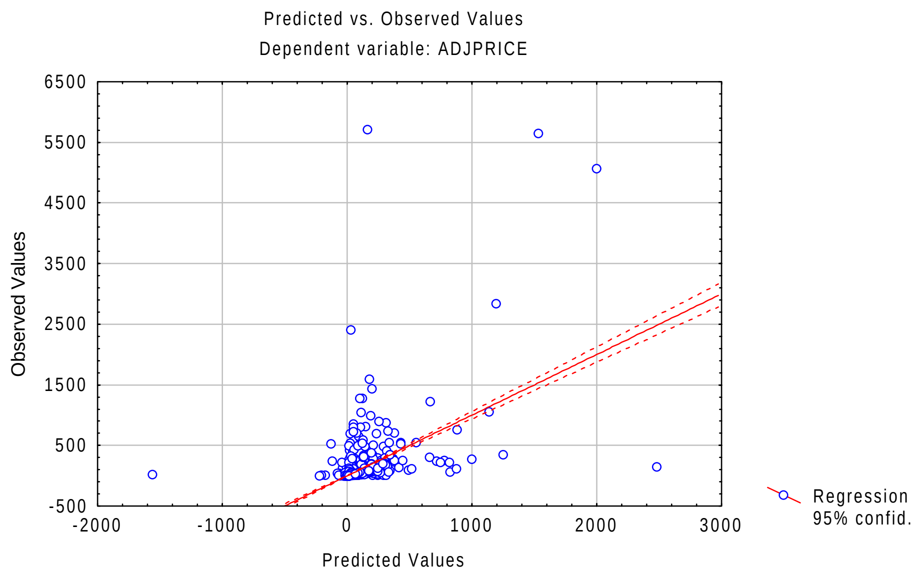


Figure 1.4.1.1

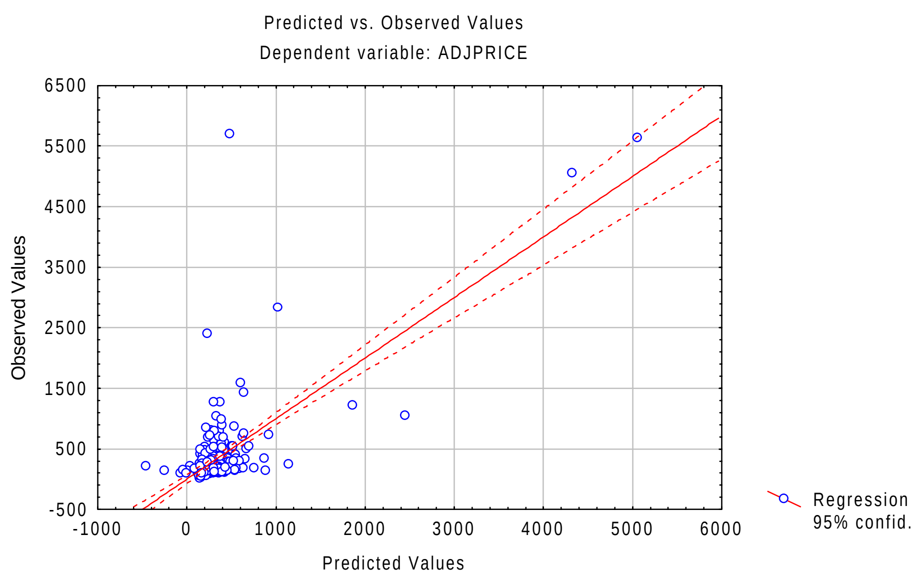


Figure 1.4.1.2

The stratified sampling procedure is applied to partition the market dataset into two subset of companies based on the price / face value (price markup) ratio. For companies whose markup ratio is greater than or equal to 10 we have a control of the large companies set and for the others we have a set of medium and small-scale companies. It so happens that more of the best-heard names in the market like Wipro, Zee Telefilms, Reliance, NIIT etc. are contained in the first group. By benchmarking we sought to compare the "subadditive" properties of the market model, i.e. to what extent the regression estimates are stable across the two sets. It may also be noted that the high prices at which these shares are traded indicates enhanced financial activities with respect to these scrips. The results of the control set are presented in table 1.4.1.2., and the fitted price line is plotted in diagram 1.4.1.2.

Variable	**B**	**t (246)**	**Level of significance**
Intercept	134.367	3.294	0%
NW_t	0.603	2.856	5%
DE_t	-10.309	-0.405	-
PT_t	6.608	4.638	0%
DIV_t	4.129	0.650	-

The adjusted R^2 obtained is 0.4879, and F-statistic is 2.03. This complies that the model fits well, non-zero mean hypothesis of the error distribution is rejected at the 0% level of significance and the serial correlation among independent variables has a low value of -0.016. Hence, in this control group of high markup shares the model fits very well in every respect, and the equilibrium pricing equation becomes:

$$\hat{P} = 134.367 + 0.603\,N\hat{W} - 10.309\,D\hat{E} + 6.608\,P\hat{T} + 4.129\,D\hat{V}$$

(3.294) (2.856) (-0.405) (4.638) (0.650)

The t-statistic is given in brackets. The insignificance of the DE coefficient suggests that the capital structure plays an insignificant role although the sign is negative, while the DIV coefficients have insignificant t-statistic. The other weights are significant and positive suggesting that the contribution of NW to demand dominate its influence on supply according to the model.

The results of the general subset are summarized in table 1.4.1.3 and are as follows:

Table 1.4.1.3

Variable	**B**	**t (2442)**	**Level of significance**
Intercept	15.355	3.394	0%
NW	0.115	2.371	2%
DE	-0.007	-0.055	-
PT	0.519	2.015	5%
DIV	23.632	18.85	0%

The adjusted R^2 =0.247, F-statistic is 201.268 and Durbin-Watson statistic is 1.948. This implies that the model fits well with these companies too, although the R^2 diminishes, while the non-zero mean of error is rejected at 0% level and the serial correlation is low at 0.026. Hence, the equilibrium pricing equation becomes:

$$\hat{P} = 15.355 + 0.1151\,N\hat{W} - 0.007\,D\hat{E} + 0.519\,P\hat{T} + 23.632\,D\hat{V}$$

(3.394) (2.371) (-0.055) (2.015) (18.850)

The B on DE remains insignificant and so does the negative sign. Apart from the intercept, three other Bs become significant, including that on dividend. The scales of the Bs are lowered as the Ps in this case are of a lower scale.

The fits of the predicted and actual values of $P^{\wedge}$ are given in diagram 1.4.1.3.

The "subadditivity" of stock price work in this case with respect to sign except so far as dividend is concerned.

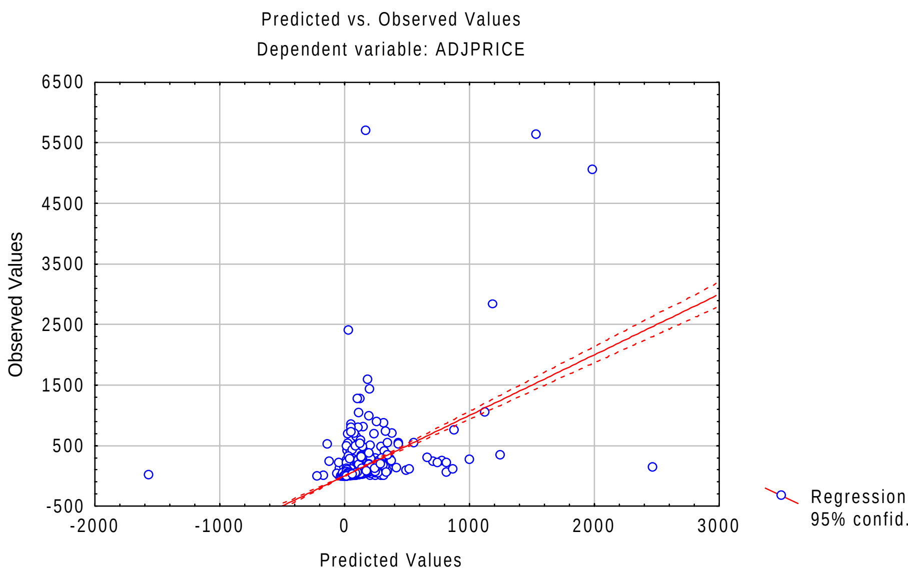


Figure 1.4.1.3

3.5. RESULTS OF VOLATILITY

The Market Model

The residual of the cross-sectional regression model for the market database is analysed. The R^2 of 0.25 suggests that the percentage of the total variability explained by the error variability is above 75%. The null hypothesis that the mean of the error is not 0 is rejected by the F-statistic of 201.27 which is significant at the 1% level. Therefore residual term is a white noise. Beside, the serial correlation of errors is low at 2.6%, suggesting that the price variable is fairly uncorrelated with the errors. The speculative component contained in the error is volatile but has mean 0, which suggests a white noise structure. Distribution of error is plotted in diagram 1.5.1.

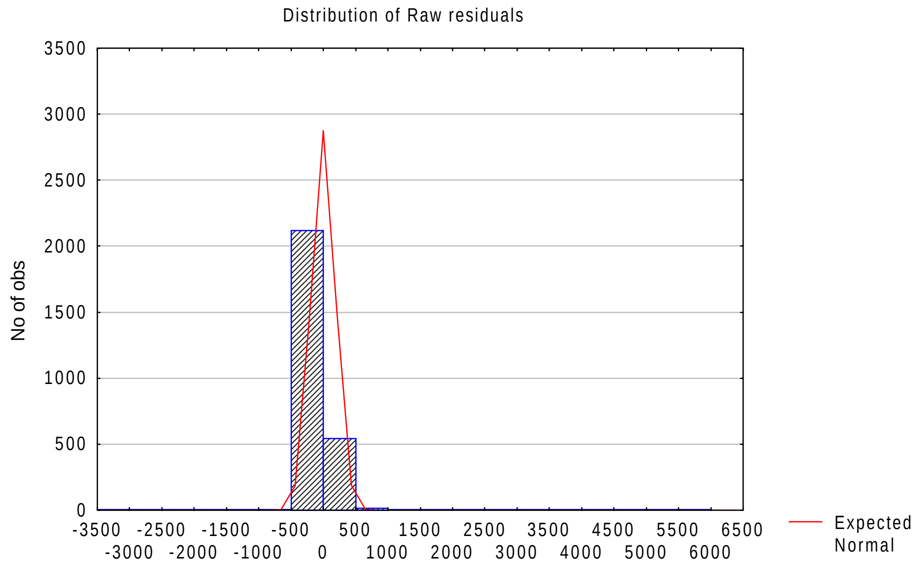


Figure 1.5.1

Control Market Data

The blue chip companies dataset gives an adjusted R^2 statistic of 0.49 suggested that the percentage of the total variability explained by the error variability is about 51%. The null hypothesis of non-zero error is explained by the F-statistic of 60.556 at the 1% level. Therefore, the residual term is a white noise, besides, the serial correlation is -1.5%, qualitatively replicating the properties of the market dataset. The variance of the error term is high at 533834×10^2

suggesting that there is significant scope for analysing and reducing risk. The distribution of the errors is plotted in diagram 1.5.2.

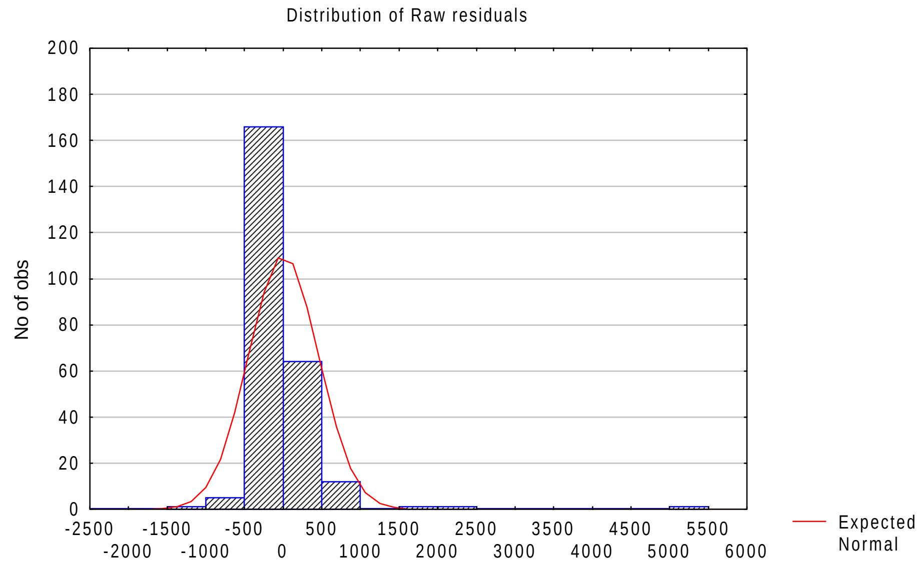


Figure 1.5.2

Manufacturing Sector Data

The manufacturing sector dataset, which has been obtained by historically conditioning on the survival path, consists of 920 companies. The high R^2 of 0.564 suggested that a significant part of the risk in prices is explained by the variables of the model so that the residual is only about 43%. The high F-statistic at 301.147 convincingly rejects the non-zero mean of error. Therefore the residual term is a white noise, given the model. However, the residual sum of squares is 375290×10^2 which suggests significant risk residual. The serial correlation of variables is 1.5% suggesting that the errors are white noise and therefore arises due to speculation or unfounded variables called "sunspots". The residuals are plotted in diagram 1.5.3.

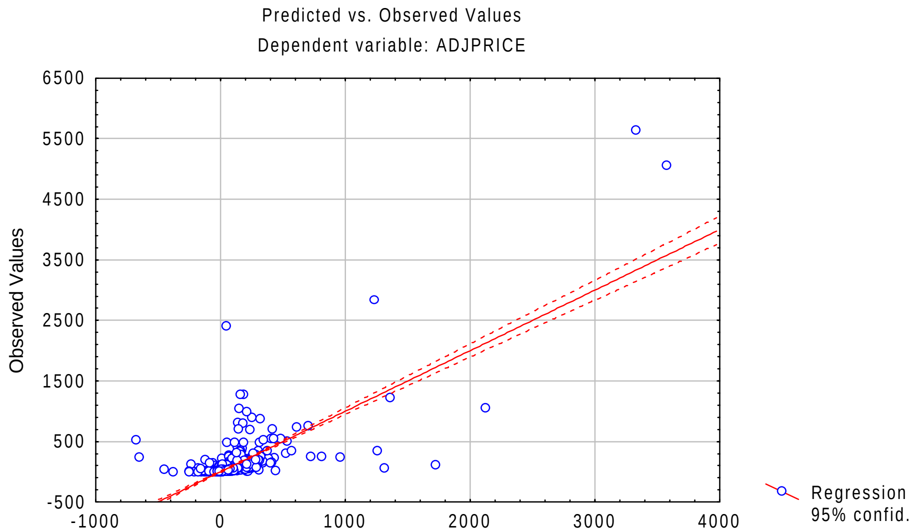


Figure 1.5.3

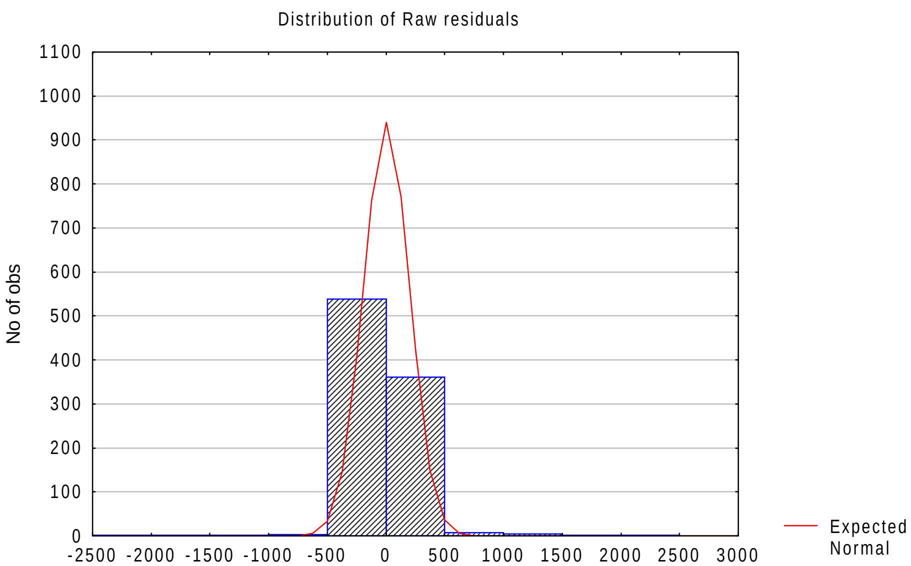


Figure 1.5.3

BSE 30 set of Companies

Out of the 30 companies in the dataset, full data is available on 31.12.2000 for 22 companies. The R^2 is 0.15. This means that about 85% of the total sum of squares and hence the risk in the price variability are to be explained and controlled. The magnitude of the residual sum of squares is 416845x10^2. The F-statistic is also low at 0.77, therefore the mean different from zero hypothesis cannot be rejected. The serial correlation is -3%. However, this dataset requires a lot to be explained. It is possible that the small size of the sample is causing the misfit. The distribution of residuals is plotted in diagram 1.5.4.

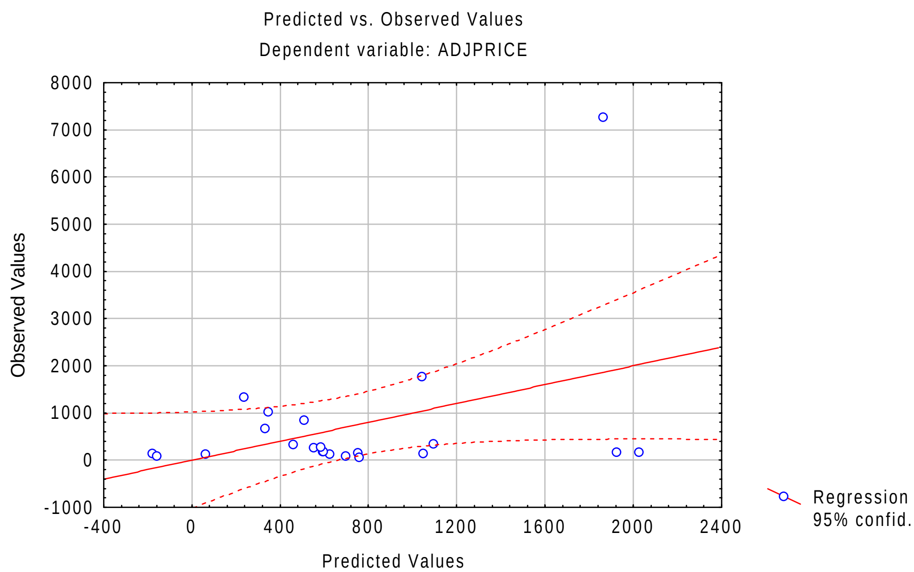


Figure 1.5.4

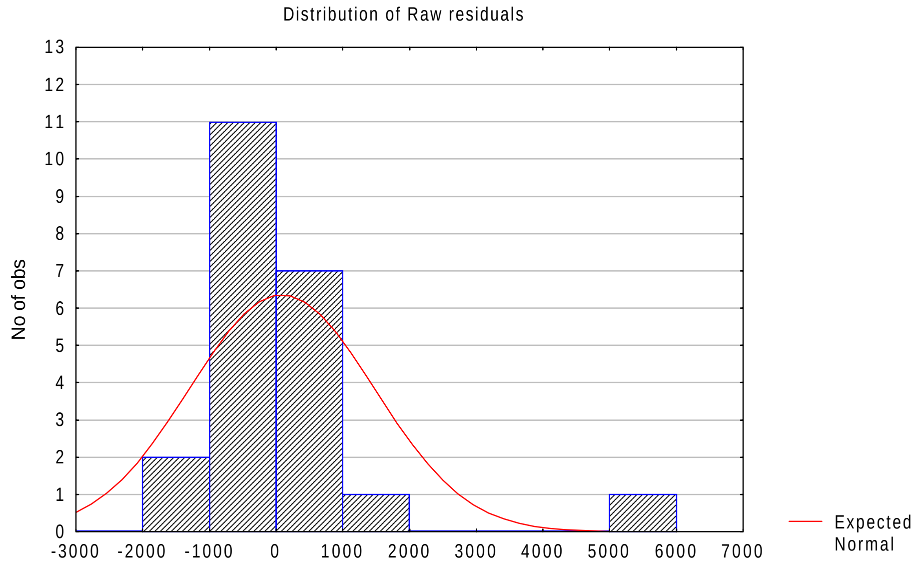


Figure 1.5.4

BSE 200 set of Companies

The BSE 200 set of companies contained 166 companies after deleting missing entries. The adjusted R^2 stands at 0.324 leaving about 67% of the volatility in prices in the errors. The magnitude of the residual sum of squares is $612932x10^2$ which means a lot of the variability remains to explained and controlled. The F-statistic is high at 20.747 therefore the error distribution has mean 0 at 99% level of significance. The serial correlation is low at 1%. These suggest a white noise error whose volatility could be speculative or at best unscientific. The distribution of residuals is shown in diagram 1.5.5.

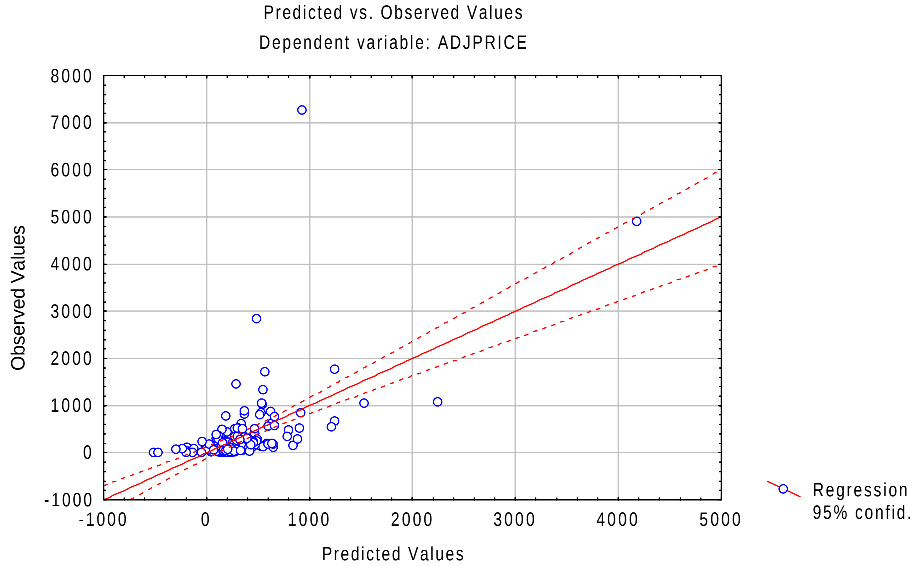


Figure 1.5.5

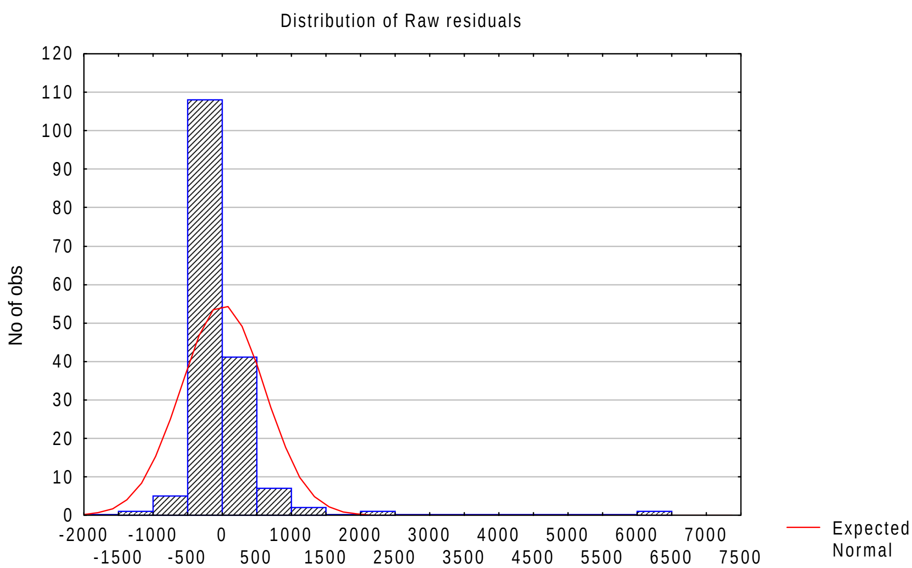


Figure 1.5.5

BSECG Set Of Companies

The third portfolio considered as the dataset is the set of companies in the BSE's Consumer Goods Index. The model fits the dataset that consists of 41 companies with an adjusted R^2 of

0.194, which leaves about 80% of the volatility in prices to be explained and controlled. Considering that the entire market's R^2 is 0.25 and that of the blue chip companies controlled for size is 0.566, there seems to be significant speculative and/or unsystematic component in this portfolio. This could also be said of the BSE 30 portfolio although that portfolio has small size. The F-statistic is low at the 1% level but significant for the 2% level. Besides, the serial correlation is about 20%, which is reasonable high. The predicted and actual residuals are plotted in diagram 1.5.6.

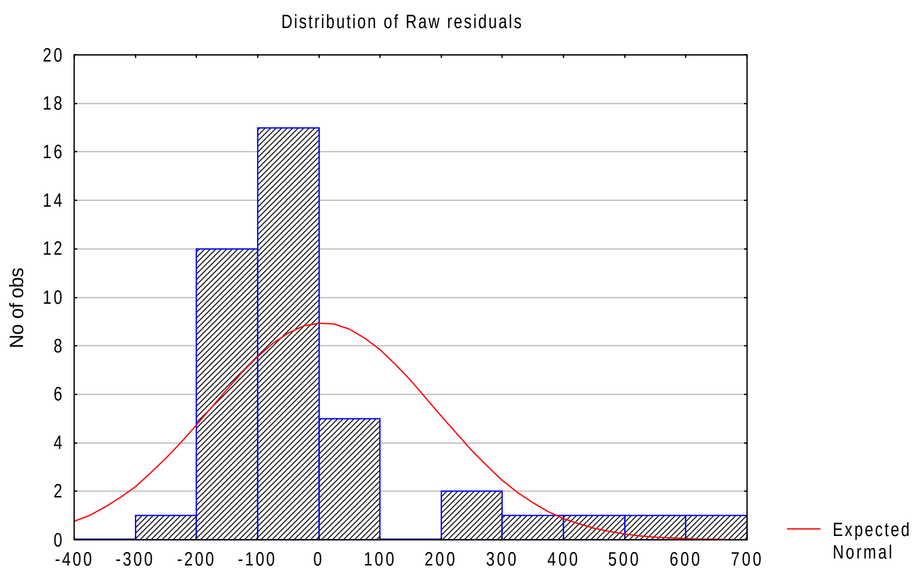


Figure 1.5.6

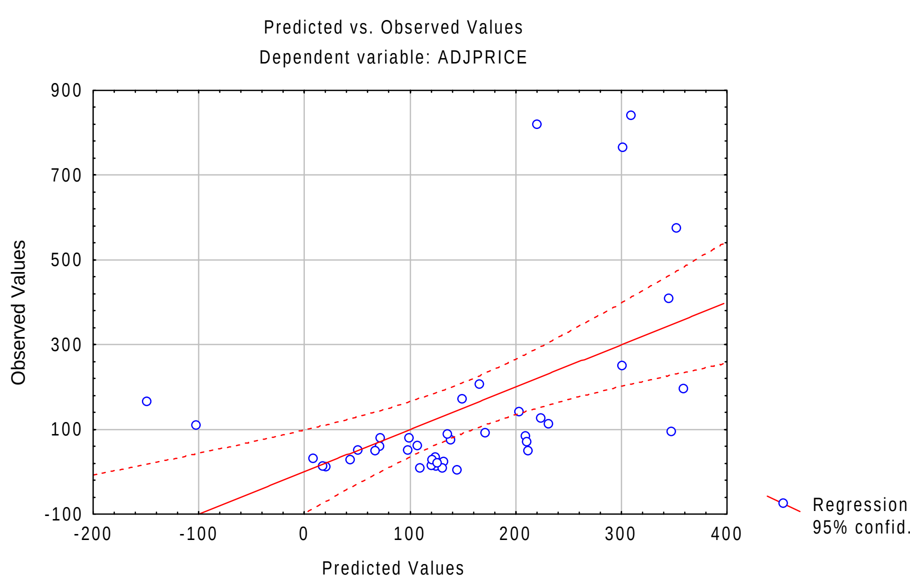


Figure 1.5.6

3.6. CONCLUSION

The cross-sectional model of price formation in Indian stock market at the present time is significantly corroborated over all the datasets of companies studied. The market dataset, the historically conditioned manufacturing sector dataset as well as the BSE 200 and BSECG portfolios perform fairly well with respect to the model. This shows conclusively that price formation in Indian stock markets is significantly dependent on net worth of companies as well as their profitability and dividend payouts. However, capital structure in the form of debt/equity ratio never gets significant weightage although the weightage is negative. It is also observed that the B's on Net worth per share is negative. This can be explained by the decomposition of excess demand in that the supply of share capital as well as demand depends on this variable in opposite ways. Dividend is found to have significant weightage through demand for share capital. It corroborates both liquidity preference and “short-sightedness" (myopia) amongst the participants of the Indian stock market. The signaling rationale for dividends is probably rejected due to the insignificance of Dividends in the case of "blue chip" companies where Net worth and Profit get significant weightage. There seems to be an anomaly with respect to risk perception of participants if debt-equity ratio and dividend payments are considered side by side for the rest of the data sets.

The Indian stock market is however significantly described by "bounded rationality", as has been discussed in the model section, through myopia, liquidity preference and significant volatility of the error terms when compared within the ratio of unexplained to total sum of squares. The ratio is reasonably high in all cases, and is significantly high in some cases, although the power of the model and of the tests is demonstrably high. This leaves a lot of controls and long run policies with respect to the stock market to be desired.

Side by side with a good explanation of the mean of share prices, is found excess volatility which in most cases is significant suggesting presence of speculation and non-fundamental driven activities as are referred to as "sunspot" in the Rational Expectations literature. This opens the way for time series analysis of historical stock prices incorporating expectations into the model.

CHAPTER IV

FINANCIAL FRAGILITY IN STOCK MARKETS : TIME SERIES STUDY

4.1 INTRODUCTION

In estimating the Time Series properties of Price formation in stock markets, the historical data can be divided into instantaneous, short-run, medium-run and long–run. Instantaneous analysis requires data generated in continuous time for all variables whether relating to price formation or fundamentals. This study however, uses discrete time data organised annually into a decade. Hence, this study is both a short-run, as well as, a medium-run study of the stock market system. Long-run analysis of stock market data however, requires analysis of historical epochs, which in a semi-planned economy such as India ought to cover more than two consecutive plan periods. This study covers a segment of the 7^{th} Five Year Plan Period, the 8^{th} Five Year Plan Period in full and the first portion of the 9^{th} Five Year Plan Period. This period also witnessed two significant stock market crashes in the years 1993 and 1997 and the "Harshad Mehta scam" in 1992. The time series results have to be analysed against these sets of contemporary history along with the economic causalities outlined in the model (Bagchi(1998)).

4.2 TIME SERIES DATASET

Data for the time series regression are obtained from the Prowess database of the centre for Monitoring Indian Economy. The database contains data for the years 1988-2000. The data have been compiled from the audited annual accounts of public limited companies in India which furnish Annual Returns with the Registrar of Companies and are listed on the Bombay Stock Exchange.

In our time series analysis we have used annual series of all the variables, described below, for the period 2000-1990. While higher frequency series for some of the variables are available, since matching series for all the variables are not contained in the database, we have analysed data for years ending 31st December for all variables.

"Average Growth" Data

The total market set of companies has been pooled for 10 years from 2000-1990, working backwards. The common set of firms which have "survived" between 1990-2000 (see Chapter **III**) number 582 which after adjusting for missing data is left with 573 firms. This is the "bootstrap" average growth data set. The graphs for the raw variables are presented in figure 2.2.1.1. to 2.2.1.9.

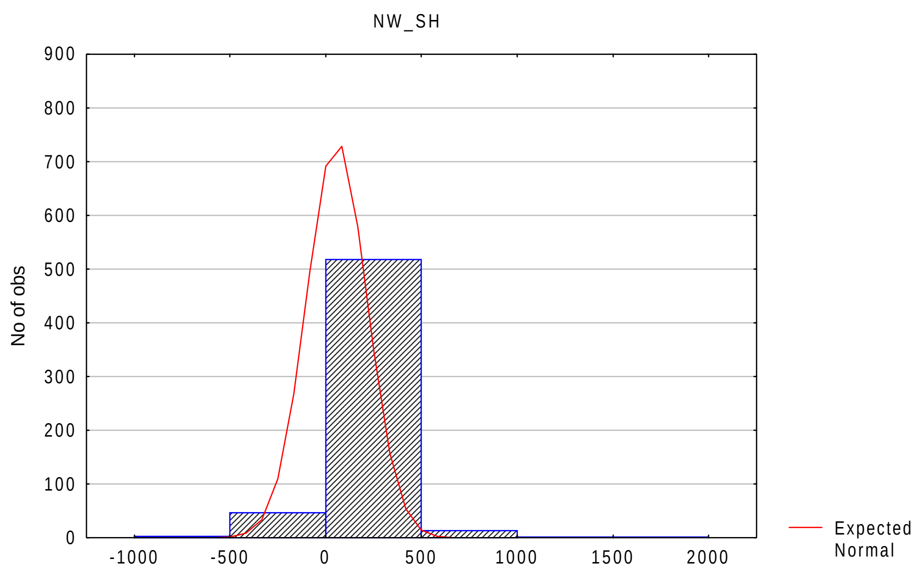
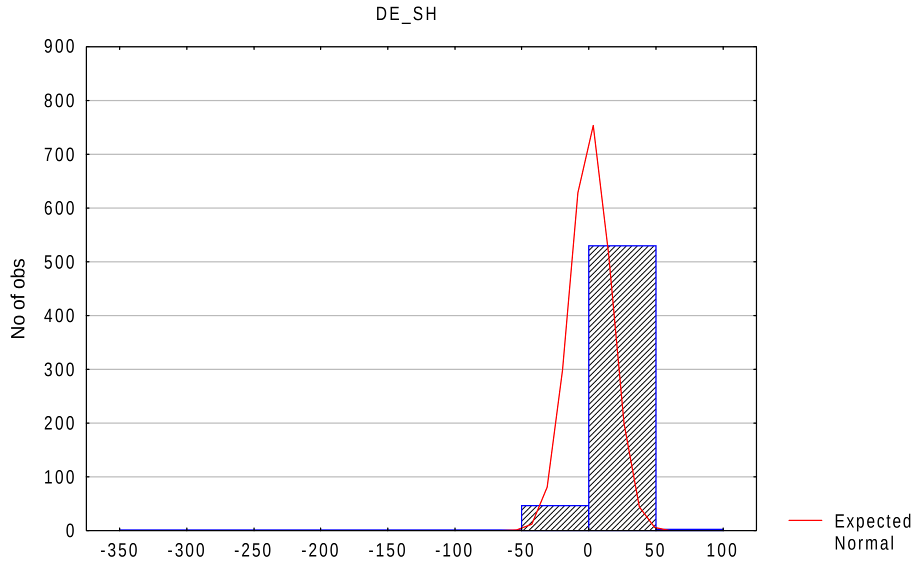


Figure 2.2.1.1



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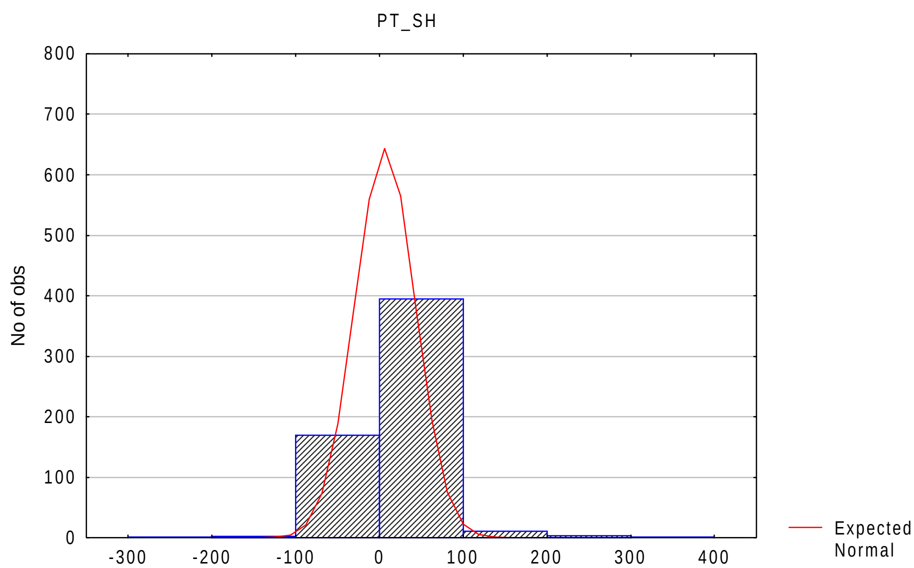


Figure 2.2.1.3

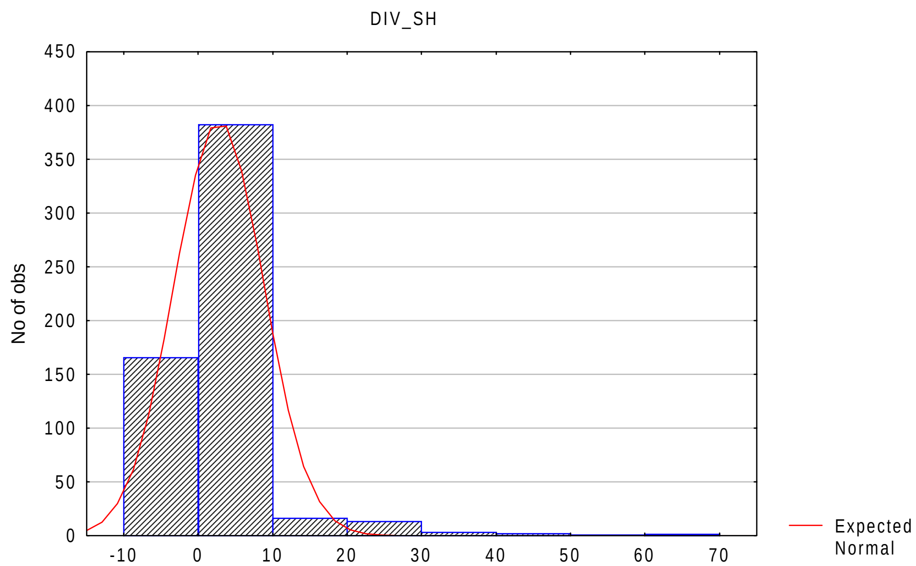


Figure 2.2.1.4

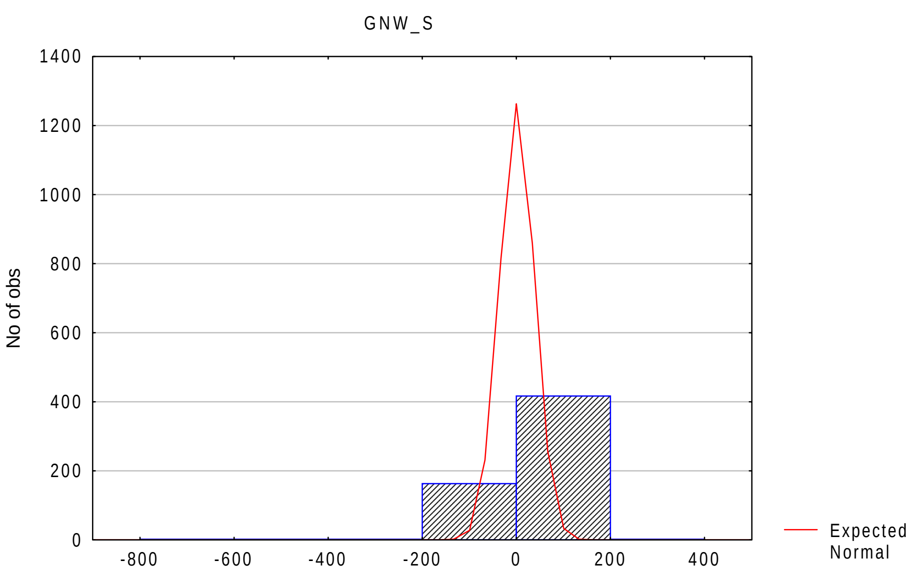


Figure 2.2.1.5

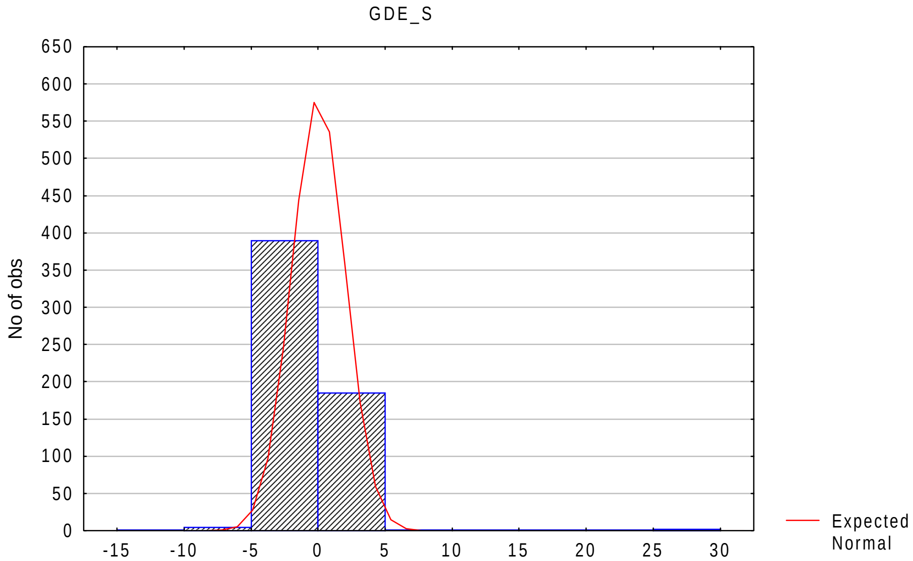


Figure 2.2.1.6

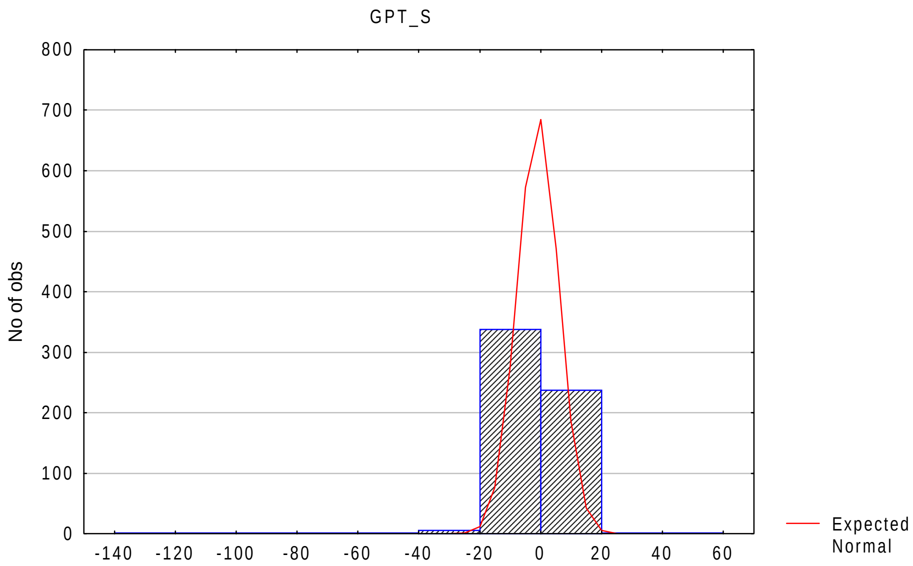


Figure 2.2.1.7

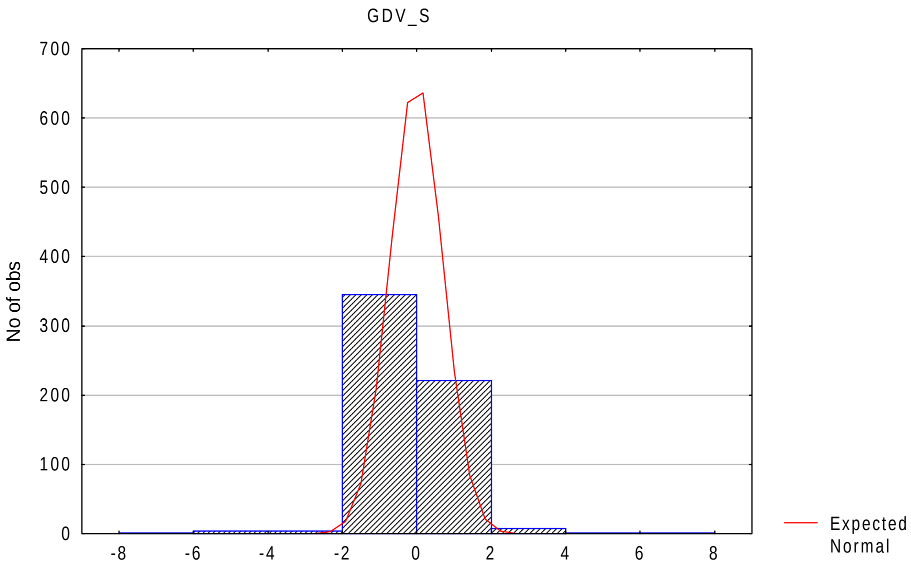


Figure 2.2.1.8

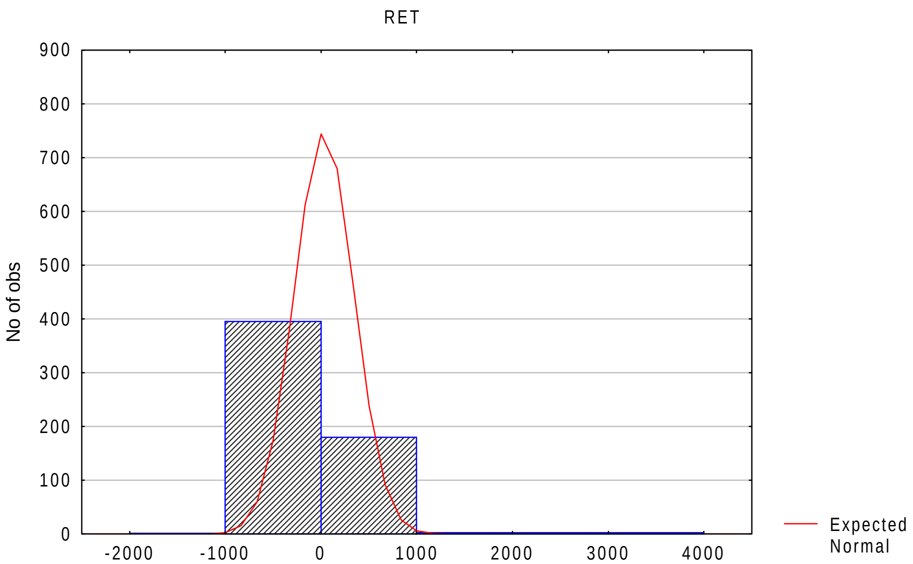


Figure 2.2.1.9

Annual Price Differential Data

One period annual price differential (Return) datasets for the annual growth models 2000 –1999 to 1991-1990 are presented in the form of correlation matrix in table 2.2.2.1. A casual look at the correlation gives an approximate idea of the nature of relationship existing between the various variables over the annual partitions of the 10-year period.

Table 2.2.2.1

	RET_1Y	RET_2Y	RET_3Y	RET_4Y	RET_5Y	RET_6Y	RET_7Y	RET_8Y	RET_9Y	RET_10Y
RET_1Y	1.00	-.04	.00	.02	-.01	-.01	.01	.00	.01	.00
RET_2Y	-.04	1.00	-.05	.01	.01	.02	-.00	-.01	-.01	-.03
RET_3Y	.00	-.05	1.00	.03	-.02	.01	.02	.05	.02	-.01
RET_4Y	.02	.01	.03	1.00	.01	-.02	.01	.01	-.01	-.04
RET_5Y	-.01	.01	-.02	.01	1.00	-.03	.00	-.02	.00	.05
RET_6Y	-.01	.02	.01	-.02	-.03	1.00	.02	.02	.04	.01
RET_7Y	.01	-.00	.02	.01	.00	.02	1.00	-.00	-.01	-.01
RET_8Y	.00	-.01	.05	.01	-.02	.02	-.00	1.00	-.03	-.01
RET_9Y	.01	-.01	.02	-.01	.00	.04	-.01	-.03	1.00	-.01
RET_10Y	.00	-.03	-.01	-.04	.05	.01	-.01	-.01	-.01	1.00

No correlations are significant at p < .05000

Manufacturing Sector Data

The only industry that has been considered in isolation from the market dataset is the manufacturing sector. The reason being that the only sector that has a large number of surviving firms between 1990 & 2000 is this sector. Three stages in the algorithm are carried out with respect to this dataset. The 2000 – 1990 average growth model is fitted as also the 2000 –1999 annual growth model is fitted. The fits, as well as the errors, are then compared to ensure that the errors are uncorrelated. The total number of firms in the first data set is 517 and in the other case is 1925. The correlation matrices with respect to the two growth models are given in tables 2.2.3.1 and 2.2.3.2.

Table 2.2.3.1

	NW_SH90	DE_SH90	PT_SH90	DIV_SH90	GNW_S10Y	GDE_S10Y	GPT_S10Y	GDV_S10Y	RET10Y

NW_SH90	1.000000	.025183	.740111	.851955	.114692	-.032914	-.100677	-.429485	.210495
DE_SH90	.025183	1.000000	.018750	.010412	.019033	-.777652	.012947	.008249	.014449
PT_SH90	.740111	.018750	1.000000	.706037	.139353	-.038373	-.218449	-.450747	.071874
DIV_SH90	.851955	.010412	.706037	1.000000	-.113054	-.009213	-.306639	-.658594	.062606
GNW_S10Y	.114692	.019033	.139353	-.113054	1.000000	-.008633	.881516	.413916	.355693
GDE_S10Y	-.032914	-.777652	-.038373	-.009213	-.008633	1.000000	.006541	-.015088	-.016135
GPT_S10Y	-.100677	.012947	-.218449	-.306639	.881516	.006541	1.000000	.463758	.339531
GDV_S10Y	-.429485	.008249	-.450747	-.658594	.413916	-.015088	.463758	1.000000	.439172
RET10Y	.210495	.014449	.071874	.062606	.355693	-.016135	.339531	.439172	1.000000

Table 2.2.3.2

	NW_SH99	DE_SH99	PT_SH99	DIV_SH99	GNW_S1Y	GDE_S1Y	GPT_S1Y	GDV_S1Y	RET_1Y
NW_SH99	1.000000	.006132	.732348	.440819	.618084	-.000103	.285385	-.010703	-.212520
DE_SH99	.006132	1.000000	.014161	-.001055	.012673	-.339267	.004004	.000673	.003175
PT_SH99	.732348	.014161	1.000000	.289349	.526261	-.008514	-.206490	-.017957	-.157580
DIV_SH99	.440819	-.001055	.289349	1.000000	.035746	-.001292	-.072465	-.565834	-.382219
GNW_S1Y	.618084	.012673	.526261	.035746	1.000000	-.007056	.427272	.287532	-.107605
GDE_S1Y	-.000103	-.339267	-.008514	-.001292	-.007056	1.000000	-.002271	-.000435	.001055
GPT_S1Y	.285385	.004004	-.206490	-.072465	.427272	-.002271	1.000000	.163399	.063614
GDV_S1Y	-.010703	.000673	-.017957	-.565834	.287532	-.000435	.163399	1.000000	-.019667
RET_1Y	-.212520	.003175	-.157580	-.382219	-.107605	.001055	.063614	-.019667	1.000000

4.3 TIME SERIES MODEL

We consider the following time series model for dynamic price formation in Indian stock markets.

$$P_{t+1} - P_t = A_t + B_{1t}\,NW_t + B_{2t}\,DE_t + B_{3t}\,PT_t + B_{4t}\,DIV_t$$

$$B_{5t}\,E_t\,\Delta\,NW_t + B_{6t}\,E_t\,\Delta\,DE_t + B_{7t}\,E_t\,\Delta\,PT_t + B_{8t}\,E_t\,\Delta\,DIV_t$$

$$+\ \tilde{\eta}_t\,,\ \tilde{\eta}_t \sim N\,(0, \sigma^2_{\eta_t})$$

where, P_t = closing price of shares at 31st December of the year t,

NW_t = Net worth per outstanding equity share at 31st December of the year t,

PT_t = Profit for the year t per outstanding equity share at 31st December of the year t,

DE_t = Debt Equity ratio at 31st December of the year t,

DIV_t = Dividend declared during year t per outstanding equity share at 31st December of the year t

$\Delta NW_t = NW_{t+1} - NW_t$, is the first forward difference in NW,

$\Delta PT_t = PT_{t+1} - PT_t$, is the first forward difference in PT,

$\Delta DE_t = DE_{t+1} - DE_t$, is the first forward difference in DE,

$\Delta DIV_t = DIV_{t+1} - DIV_t$ is the first forward difference in DIV

E_t is the forward looking Rational Expectations operator with respect to 31st December of year t.

η_t is a random error term normally distributed with mean 0 and variance matrix $\sigma^2_{\eta_t} > 0$

We shall jointly test for the fit of the model as well as the properties of the error terms hypothesized, with annual data over the period 1990-2000.

The econometric testing of a time series model of this form, which consists of a large cross–section of companies at any given t, can be carried out along two directions. The first method is the traditional Vector Auto Regression method of the Box–Jenkins type. In such a method the entire panel data pooled across firms and time periods has to be studied in integrated form to give GLS estimates by the ARIMA model. This has the potential dimensionality cost of there being around 2500 firms for each of the years 1990 –2000 with twelve variables, which could become a 2500 X 10 X 12 matrix requiring high computing time and memory costs. Besides, with a linear model specification such as ours the nonlinearity involved in the historical behavior of stock prices would not be readily evident till we change our specification and fit a nonlinear model all over again. This prompts us to carry out the Time-Series GLS regression in a " nested" procedure similar in many respects with that suggested by Granger & Newbold (1977) and consists of the following algorithm. This algorithm uses the residual matrix of nested models to set up an objective function based on correlations amongst nested residuals. While this procedure helps in time series estimation of the parameters along the Granger et. al. approach, it also provides a procedure for estimating TVP (Time Varying Parameter) problems as discussed in Rao (2000), without using any exogenous cost minimisation objectives.

In the first step we break up the pooled time series ARIMA model into nested models, identified by years, as follows:

$$[\,P_{t+1} - P_t\,] = [\,A_t + \sum_{i=1}^{4} B_{it} \text{ historical variable}_{it} + \sum_{i=5}^{8} B_{it} \text{ expectation variable}_{it} + \eta_t]_{C \otimes T}$$

where C is the no of companies in the data set, T is the time " horizon" which in this case is 1990-2000 and B_{it} is the coefficient on historical variable i at time t where i is the indicator as follows:

i=1 ⇒ NW

i=2 ⇒ DE

i=3 ⇒ PT

i=4 ⇒ DIV

The historical variables are as given above, the expectation variables follow exactly the same identification i.e.

i=5 ⇒ E_t Δ NW

i=6 ⇒ E_t Δ DE

i=7 ⇒ E_t Δ PT

i=8 ⇒ E_t Δ DIV

This is the basic time series model.

The next step we break up this general ARIMA (1,1,1) specification into first a "bootstrap" average growth model as follows :

$$P_{2000} - P_{1990} = A + B_1\, NW_{1990} + B_2\, DE_{1990} + B_3\, PT_{1990} + B_4\, DIV_{1990} + B_5\, E_{1990}\, \Delta\, NW_{2000\text{-}1990}$$

$$+ B_6 E_{1990} \Delta DE_{2000\text{-}1990} + B_7 E_{1990} \Delta PT_{2000\text{-}1990} + B_8 E_{1990} \Delta DIV_{2000\text{-}1990} + \tilde{\eta}$$

Where, $E_{1990}\ \Delta NW_{2000\text{-}1990} = NW_{2000} - NW_{1990}$,

$E_{1990}\ \Delta DE_{2000\text{-}1990} = DE_{2000} - DE_{1990},$

$E_{1990}\ \Delta PT_{2000\text{-}1990} = PT_{2000} - PT_{1990}$

$E_{1990}\ \Delta DIV_{2000\text{-}1990} = DIV_{2000} - DIV_{1990}$

Thus, here the dependant variable is the total price differential over the decade. Any of the coefficients B_5 to B_8 is the "average growth" coefficient in the sense for e.g.

$$B_5\ E_{1990}\ \Delta NW_{2000\text{-}1990} = 10\ B_5\ E_{1990}\ \frac{\Delta NW_{2000\text{-}1990}}{10}$$

This model seems as the benchmark "bootstrap" model for the decade of the 90s.

In the third step the linear growth assumption along with the 10-year horizon assumption is relaxed to test a set of ten "nested" models, one for each year as follows :

$$Ret_n = A_n + \sum_{i=1}^{4} B_{in} \text{ historical variable i} + \sum_{i=5}^{8} B_{in} \text{ expectation variable i}$$

$$+ \tilde{\varepsilon}_n \ ,\ \tilde{\varepsilon}_n \sim N(0, \sigma_{\varepsilon_t}^2), \quad n = 1999 \ldots.. 1990.$$

and growth is taken over 1 year periods working back from 2000 for each n , and expectations is forward looking over the one year.

For example,

$$B_{15}\ E_1\ \Delta NW_1 = B_{1999,5}\ (NW_{2000} - NW_{1999}) \text{ and so on}$$

$$Ret_n = P_{n+1} - P_n$$

Granger & Newbold (1977) argue, this is a valid procedure for obtaining the Time Series properties of Stock Price, provided the residual matrix [ϵ_n] does not show significant serial correlation. Therefore the final step in this algorithm is to check for the correlation in the [ϵ_n] matrix from the ten nested models obtained in step 3. If the significance of serial correlation is low then this is also a algorithmic procedure for cointegration of stock price variables. We test these hypotheses in the following sections.

4.4 TIME SERIES RESULTS (GOODNESS-OF-FIT)

The "Average Growth " Model

The average growth model for the ten year period 2000 - 1990 is presented. The dataset consists of the entire market data and the partitioned manufacturing data. Both the set of results serve as a bootstrapping benchmark for the linear model specification in the stage 1 of the modeling algorithm.

The Market Data

The total number of "surviving" firms between the decade 31.12.90 and 31.12.2000 is 573 in the total market dataset. The average growth model was run on the set taking annual series as has been discussed. The results are summarised in the following table:

Variable	B	t (573)	Level of significance
Intercept	-16.47	-1.298	Insignificant
NW_{1990}	- 0.165	-1.225	Insignificant
DE_{1990}	0.085	0.079	Insignificant
PT_{1990}	2.819	4.33	1%
DIV_{1990}	23.30	6.823	0%
$GNW_{2000-1990}$	-2.909	-3.227	1%
$GDE_{2000-1990}$	0.875	0.106	Insignificant
$GPT_{2000-1990}$	21.355	4.415	1%
$GDV_{2000-1990}$	326.194	14.356	0%

Thus, the estimated equation becomes:

$$P_{2000} - P_{1990} = \underset{(-1.298)}{-16.47} - \underset{(-1.225)}{0.165}NW_{1990} + \underset{(0.079)}{0.085}\, DE_{1990} + \underset{(4.33)}{2.819}\, PT_{1990} + \underset{(6.823)}{23.30}\, DIV_{1990}$$

$$\underset{(-3.227)}{-2.909}\, GNW_{2000-1990} + \underset{(0.106)}{0.875}\, GDE_{2000-1990} + \underset{(4.415)}{21.355}\, GPT_{2000-1990} + \underset{(14.356)}{326.194}\, GDV_{2000-1990}$$

The R^2 is high at 0.36 and the F-statistic is high at 42.09366 which is significant at the 0% level and the serial correlation of the residuals is low at 0.05 suggesting a good fit for the model.

The signs of the significant weights on the initial profit (PT_{1990}), initial dividend (DIV_{1990}) and in their growth is substantiated by the model, while the negative weightage on $GNW_{2000-1990}$ seems to be arising due to the predominance of the supply factors over demand in the fixed point equation of the model. The fitted "price differential" line is plotted in fig. 2.4.1.1. as RET 10Y.

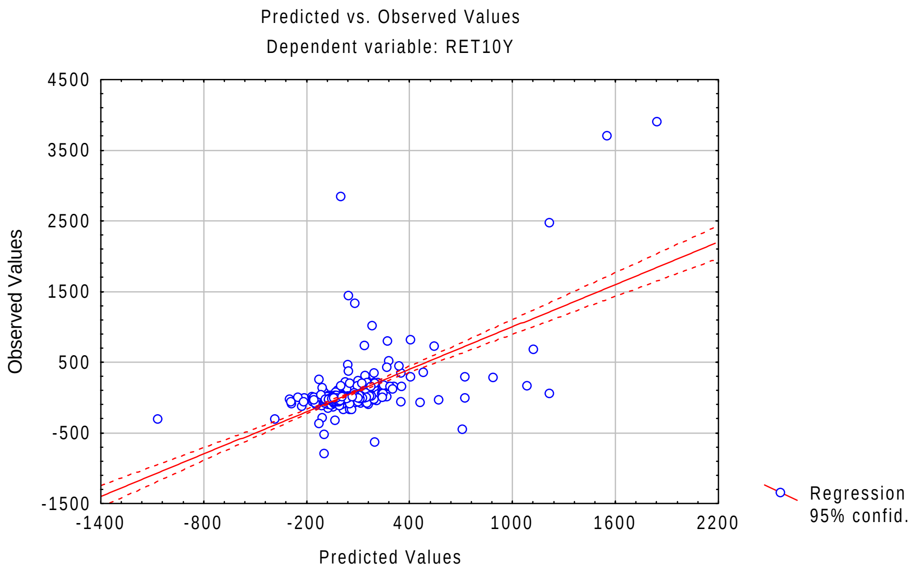


Figure 2.4.1.1

Manufacturing Sector Data

The total number of "surviving " firms in the manufacturing sector dataset over the period 2000 - 1990 is 517. The average growth linear model was run on the dataset taking annual series, as has been discussed, to obtain the GLS estimates. The results are presented in the following table:

Variable	B	t (573)	Level of significance
Intercept	-20.47	-1.425	Insignificant
NW_{1990}	0.215	1.003	Insignificant
DE_{1990}	0.069	0.061	Insignificant
PT_{1990}	2.967	4.04	1%
DIV_{1990}	30.885	6.504	0%
$GNW_{2000-1990}$	-5.987	-5.586	0%
$GDE_{2000-1990}$	1.273	0.146	Insignificant
$GPT_{2000-1990}$	37.317	6.716	0%
$GDV_{2000-1990}$	441.713	16.69	0%

The R^2 is high at 0.46.

The graph of the plot of the fitted price differential is shown in figure 2.4.1.2.

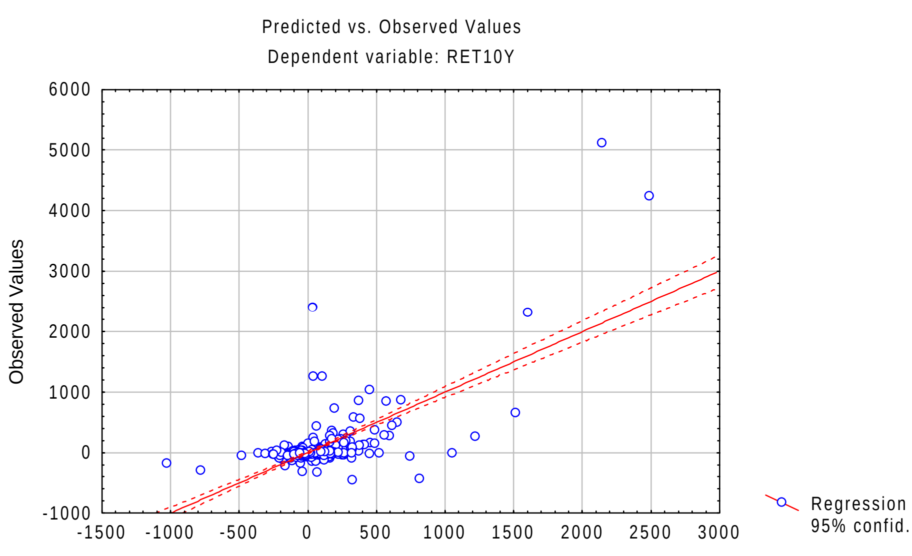


Figure 2.4.1.2

Annual Price Differential Data

In keeping with the algorithmic approach to the time series analysis of this paper we regress the model on annual data for the periods 2000-1990. The results of the regression for the various periods within the decade are summarized in the following table 2.4.1.3.1.

Table 2.4.1.3.1

period	Inter-cept	NW	DE	PT	DIV	GNW	GDE	GPT	GDIV	R^2	F	DW
00-99	-4.2 (-1.39)	-0.021 (-0.46)	0.023 (0.163)	0.419 (2.30)	-16.87 (-19.14)	-0.33 (-3.54)	0.01 (0.11)	0.977 (5.01)	-13.49 (-11.40)	0.19	73.24	1.80
99-98	22.88 (5.74)	0.098 (2.79)	-0.05 (-0.14)	1.02 (7.15)	7.54 (6.78)	0.21 (3.44)	-0.04 (-0.24)	1.15 (6.45)	6.29 (5.04)	0.08	34.38	1.76
98-97	3.38 (3.84)	0.019 (4.57)	-0.01 (-0.11)	0.18 (3.47)	-3.16 (11.86)	0.34 (-8.14)	0.00 (0.08)	0.61 (8.4)	1.28 (4.07)	0.08	39.18	1.97
97-96	7.52 (5.72)	0.04 (6.08)	-0.15 (-1.06)	-0.39 (-8.02)	-11.21 (-28.23)	-0.56 (-25.18)	0.01 (0.17)	-0.5 (-5.3)	7.02 (9.03)	0.34	226.20	1.97
96-95	3.01 (1.71)	-0.31 (-11.24)	-0.00 (-0.001)	1.13 (9.61)	-7.52 (-10.20)	-0.55 (-8.23)	-0.01 (-0.05)	-0.63 (-6.92)	4.04 (3.03)	0.27	147.86	2.02
95-94	-13.15 (-3.45)	-0.68 (-11.48)	0.01 (0.07)	1.35 (6.19)	-5.13 (-3.54)	-0.53 (-7.21)	-0.02 (-0.16)	2.14 (11.78)	-14.11 (-6.73)	0.24	89.38	1.99
94-93	37.6 (3.75)	1.19 (8.85)	-0.07 (-0.11)	-1.58 (-3.61)	-14.11 (-4.61)	0.13 (0.68)	-0.05 (0.09)	0.36 (0.85)	-11.4 (-1.99)	0.09	19.29	1.97
93-92	6.55 (2.50)	0.07 (2.44)	-0.16 (-0.44)	-0.07 (-0.66)	0.699 (1.16)	-0.06 (-1.71)	-0.005 (0.06)	0.323 (4.23)	4.962 (3.385)	0.07	11.67	2.02
92-91	0.79 (0.26)	0.058 (1.957)	-0.273 (-0.805)	0.52 (4.37)	5.82 (6.926)	0.008 (0.157)	-0.293 (-0.861)	1.251 (9.167)	8.552 (6.187)	0.26	42.55	2.12
91-90	20.12 (3.86)	0.09 (1.67)	0.04 (0.07)	-0.53 (-2.43)	8.84 (6.36)	-0.29 (-2.33)	0.034 (0.07)	0.64 (3.074)	2.883 (2.98)	0.14	17.40	2.11

The fit of the ten annual models never perform better than the average growth model over the 10-year horizon in terms of R^2, which has a significantly high R^2 at 0.36. Besides, the F-statistic is significant for the average growth rational expectations model over 10 years and the serial correlation of residuals is also low, rejecting a non-linear fit to the pricing equation through annual series in favour of a linear fit. This inference is correct based on the comparison of the two sets of models, because as required by Granger & Newbold (1977), the error correlation matrix among the nested residuals as given in table 2.4.1.3.2 does not show significant serial correlation.

Table 2.4.1.3.2

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
E1	1.00	-.04	-.01	.01	-.07*	.01	.04	.07*	-.01	-.00
E2	-.04	1.00	-.03	-.04	-.04	.01	.02	-.02	-.00	-.00
E3	-.01	-.03	1.00	-.01	-.01	-.03	-.03	-.02	-.00	.04
E4	.01	-.04	-.01	1.00	.00	.00	.01	-.02	.01	.02
E5	-.07*	-.04	-.01	.00	1.00	-.03	.02	.02	-.02	.00
E6	.01	.01	-.03	.00	-.03	1.00	.02	.05	-.01	-.01
E7	.04	.02	-.03	.01	.02	.02	1.00	.03	.01	.16*
E8	.07*	-.02	-.02	-.02	.02	.05	.03	1.00	-.04	-.02
E9	-.01	-.00	-.00	.01	-.02	-.01	.01	-.04	1.00	.00
E10	-.00	-.00	.04	.02	.00	-.01	.16*	-.02	.00	1.00

Marked correlations are significant at $p < 0.05000$

This rejects the hypothesis of significant correlation with only 3 out of 45 correlations being significant and that too with a maximum magnitude of 0.16. This inference is also true when one compares the manufacturing sector for its fit over 2000-1990 with 2000-1999 the most recent one year. The results for the 2000 -1999 period are given in table 2.4.1.3.3.

Variable	B	t-statistic	Level of significance
Intercept	-3.91	-1.057	Insignificant
NW_{99}	0.007	0.183	Insignificant
DE_{99}	0.02	0.129	Insignificant
PT_{99}	0.327	1.564	Insignificant
DIV_{99}	-21.09	-19.967	0%
GNW	-0.27	-2.483	2%
GDE	0.005	0.065	Insignificant
GPT	0.832	3.733	1%
GDV	-18.197	-13.214	0%

Adjusted R^2 is 0.23.

Here also the average growth ten-year model obtains a better fit, suggesting that the longer term linear rational expectations model performs better. In other words, the cointegrated price variables fit better in both cases with a linear average growth trend. Both these observations are somewhat incongruous with a high and significant weightage on historical dividends and dividend growths, which suggest high liquidity preference and therefore "myopia".

The fitted lines for the ten year average growth model and for the 2000-1999 model for the entire market data set are presented in figures 2.4.1.3.1 and 2.4.1.3.2.

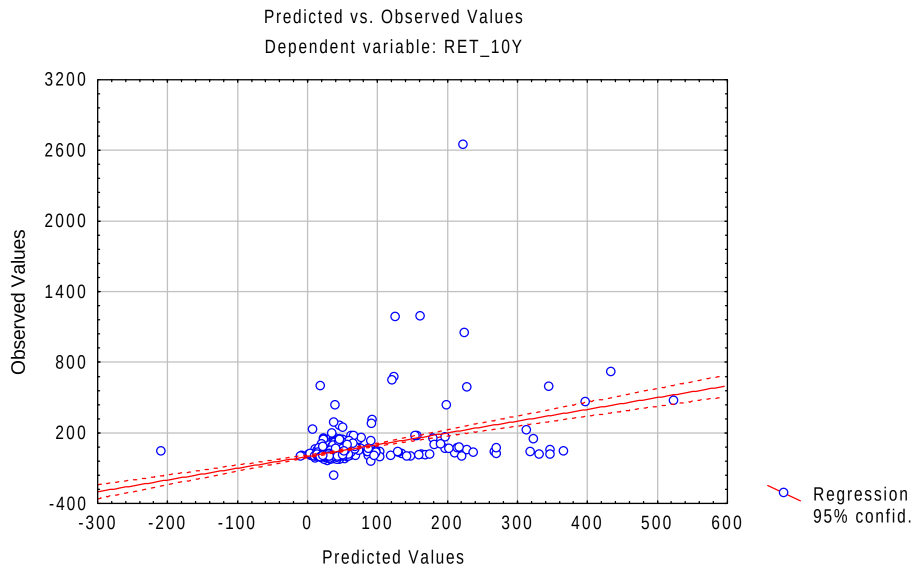


Figure 2.4.1.3.1

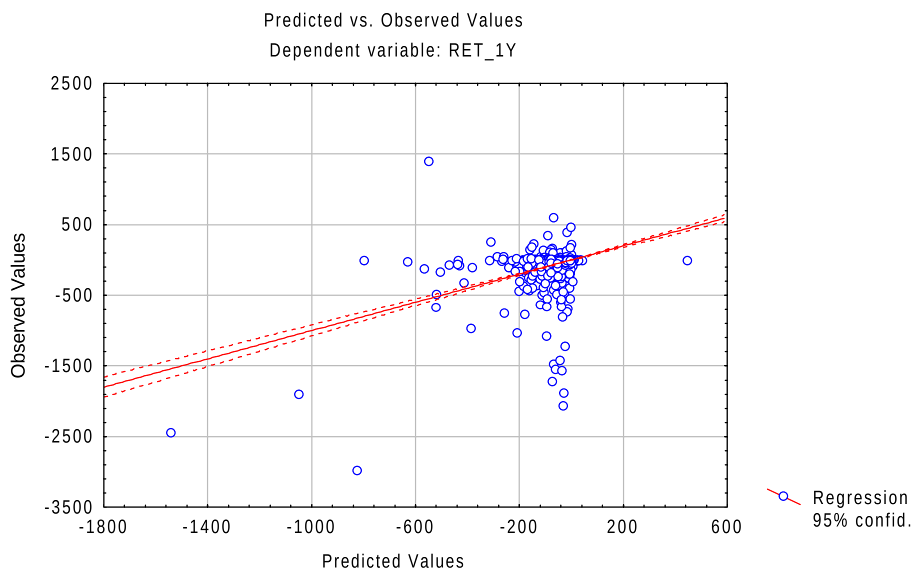


Figure 2.4.1.3.2

4.5 TIME SERIES RESULTS (VOLATILITY)

An analysis-of-fit of the model to the time series data reveals that on average a good part of the dynamic price differential is explained by the set of historical and rational expectations variables.

The result shows an overall R^2 (adjusted for serial autocorrelation and heteroskedasticity) of 0.36 with significant t-statistic on all but the debt-equity variables. The fit of the model is more striking in the case of the manufacturing sector. However, it still leaves a lot of volatility to be explained.

When it comes to an analysis of the volatility in the residuals it is observed that as was true in the cross-section data the F-statistic and DW-statistic are both significantly high, leaving therefore the variance to be analysed only. Further an analysis of the correlation matrix across the various "nested " models of annual duration suggest that the across the period serial correlations are insignificant. This not only points to the existence of a ten year set of data cointegrated with the price differentials but also to the fact that residuals are "random walks" over time at least within this ten year history. However, after the conditioning on the variables of the model the errors do follow a "random walk" pattern. Variability reducing policies targeted at the short-term annual performances are necessary in this respect. What type of instruments co-vary with these annual residuals so as to reduce them is a question which requires consideration.

Behaviourally speaking "myopia" through dividend and expected dividend dependence operates in contrast to the overriding performance of the longer term "average growth " model. This is an anomaly like the “Hindu” rate of growth in India. However, the significant variance of the residual sum of squares does certainly point direction to speculative "gambling" and "sunspot"

components in the stock market. The plot of the distribution of residuals in the ten year average growth model for the total market and manufacturing sector datasets are presented in figures 2.5.1 and 2.5.2.

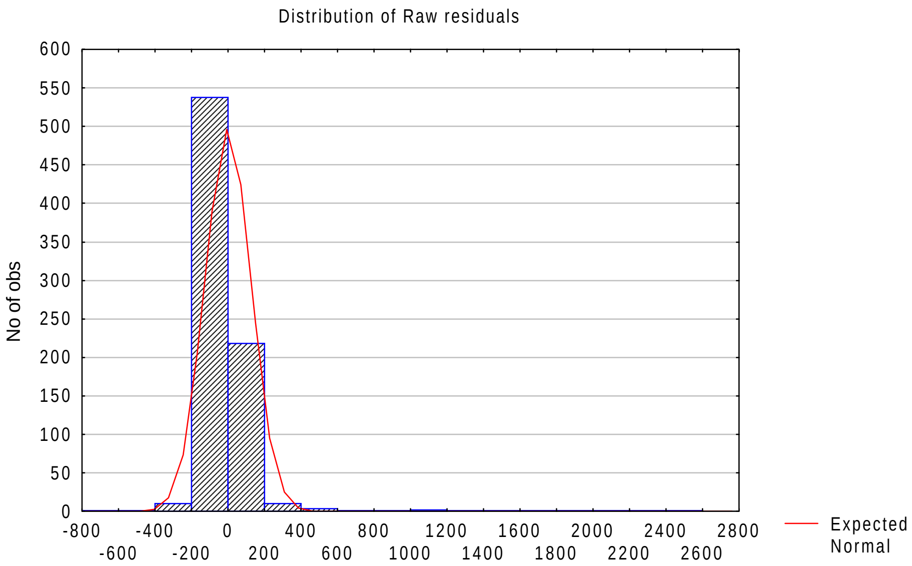


Figure 2.5.1

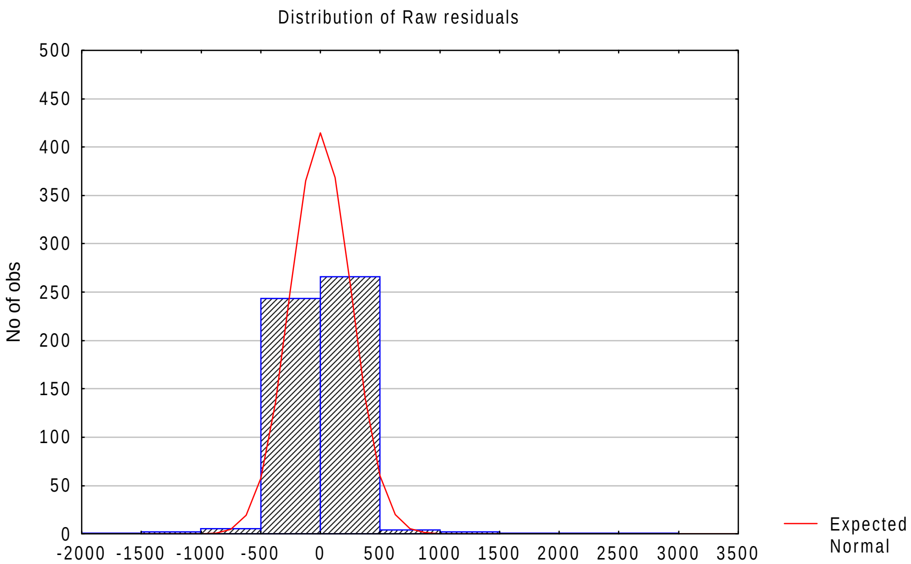


Figure 2.5.2

4.6 CONCLUSION

The structure of the financial markets in India is described by the presence of historical real (net worth per share, profitability per share) and financial (debt-equity ratio, dividend distributed per share) variables as well as their rationally expected growth values over the future. This structure is cointegrated with the stock price so that it may be said that in corporate governance, price is an important consideration in making decisions on the above explanatory variables at the corporate level. This is in the light of the fact that although there is a lot of residual volatility, lack of explosive components makes cointegration possible. If one compares it with the fact that the relationships within the model are stronger in the annual data in periods distant from 1993 and 1997, the two periods of crashes and other significant events, as discussed in the beginning (which therefore opens up areas of further analysis of structural breaks), then the linear fit, on average, suggests that, albeit a high degree of volatility, "planned competition" has been responsible in preventing markets from crashing more often, and changing the overall structure of the interplay between price formation, history and expectations along with it.

CHAPTER V

FINANCIAL FRAGILITY IN STOCK MARKETS:
MACRO-MONETARY POLICY ANALYSIS

5.1. INTRODUCTION

The previous chapters were involved with the estimation of the extent of financial fragility in Indian financial markets. In this chapter, the possible impact of monetary policy in controlling the fragility through price formation is sought to be estimated. As monetary policy operates through interest rates mainly, in so far as the stock market is concerned, this chapter estimates the impact of monetary policy on stock prices through the estimation of interest cost sensitivity of stock prices. Interest cost has two components, viz. interest rate and the volume of debt. In estimating sensitivity to monetary policy changes, both the components of interest as mentioned above can be controlled by the Reserve Bank of India through various policy tools, for example, altering the PLR, changing the interest rate on lending by commercial banks to companies which are bank financed. Since a change in the nature of priorities in granting loans alters the volume of term loans available for various types of projects by such borrowing companies, it is sought justified to consider the entire interest cost component of corporate expenditure separately as an explanatory variable in its own right in estimating the pricing equation of the stock market over time. While debt does not consist of borrowings from banks only, which is under the direct control of the Reserve Bank of India, debt costs operating through competitive debt markets are indirectly controlled by the Reserve Bank of India and the Ministry of Finance through its monetary policy and the operation of the money multiplier.

In estimating the time series properties of price formation in stock markets with interest cost as an explanatory variable, interest cost is differentiated from the profit term by addition and identified separately. The historical data has been, as in the previous chapter, divided into instantaneous, short-run, medium-run and long–run data. Instantaneous analysis requires data generated in continuous time for all variables whether relating to price formation or fundamentals. This study, however, uses discrete time data organised annually into a decade. Hence, this study is both a short-run, as well as, a medium-run study of the stock market system, including interest cost as a fundamental variable. Long-run analysis of stock market data however, requires analysis of historical epochs, which in a semi-planned economy such as the Indian economy, ought to cover more than two consecutive plan periods. This study covers a segment of the 7th Five Year Plan Period, the 8th Five Year Plan Period in full and the first portion of the 9th Five Year Plan Period. This period also witnessed two significant stock market crashes in the years 1993 and 1997 and the "Harshad Mehta scam" in 1992. The time series results have to be analysed against these sets of contemporary history along with the economic causalities outlined in the model (Tobin (1972), Bagchi (1998)).

5.2. TIME SERIES DATA

Data for the time series regression are obtained from the Prowess database of the Centre for Monitoring Indian Economy. The database contains data for the years 1988-2000. The data have been compiled from the audited annual accounts of public limited companies in India, which furnish annual returns with the Registrar of Companies and are listed on the Bombay Stock Exchange.

In our time series analysis we have used annual series of all the variables, described below, for the period 2000-1990. While higher frequency series for some of the variables are available, since matching series for all the variables are not contained in the database, we have analysed data for years ending 31st December for all variables.

"Average Growth" Data

The total market set of companies has been pooled for 10 years from 2000-1990, working backwards. The common set of firms, which have "survived" between 1990-2000 (see Chapter IV), numbers 582 which after adjusting for missing data is left with 571 firms. This is the "bootstrap" average growth dataset. The graphs for the raw variables are presented in figure 3.2.1.1 to 3.2.1.11

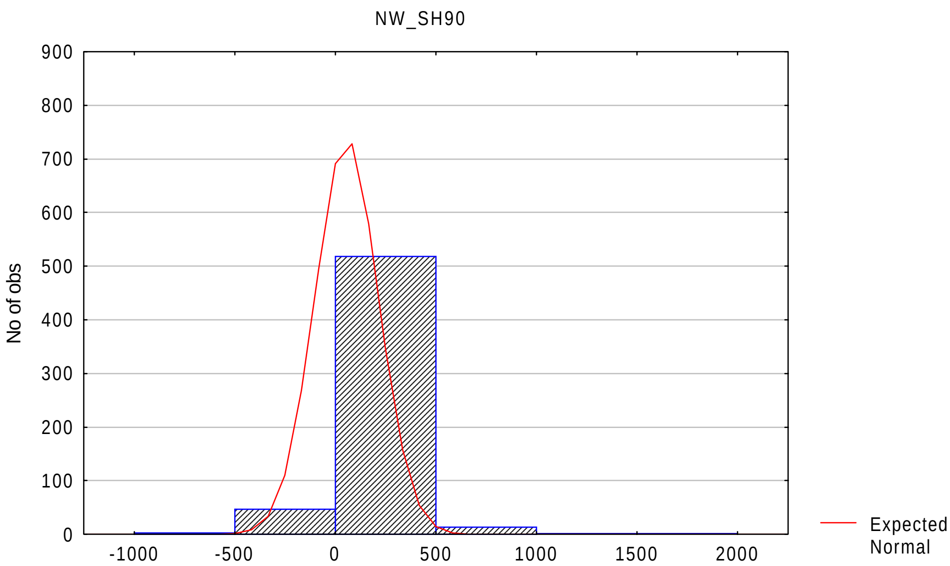


Figure 3.2.1.1

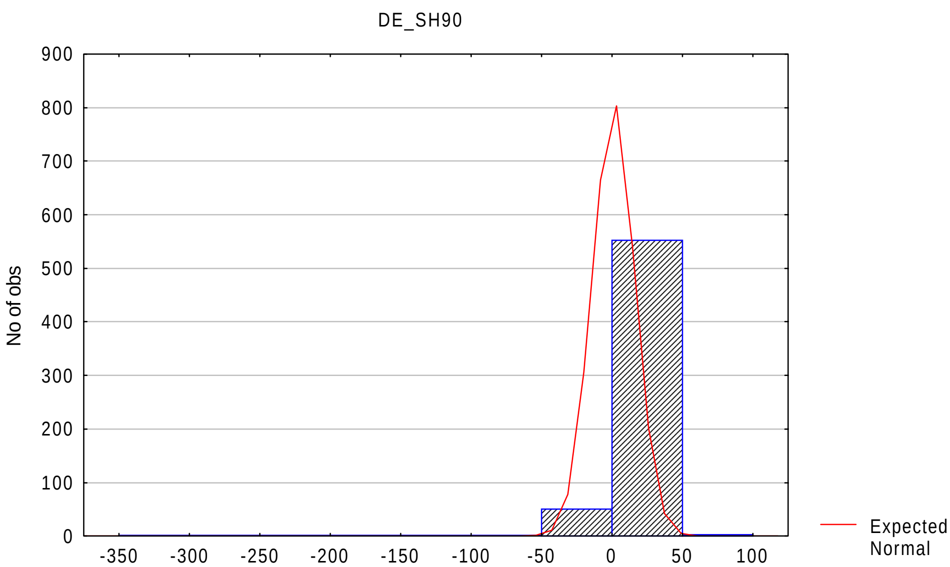


Figure 3.2.1.2

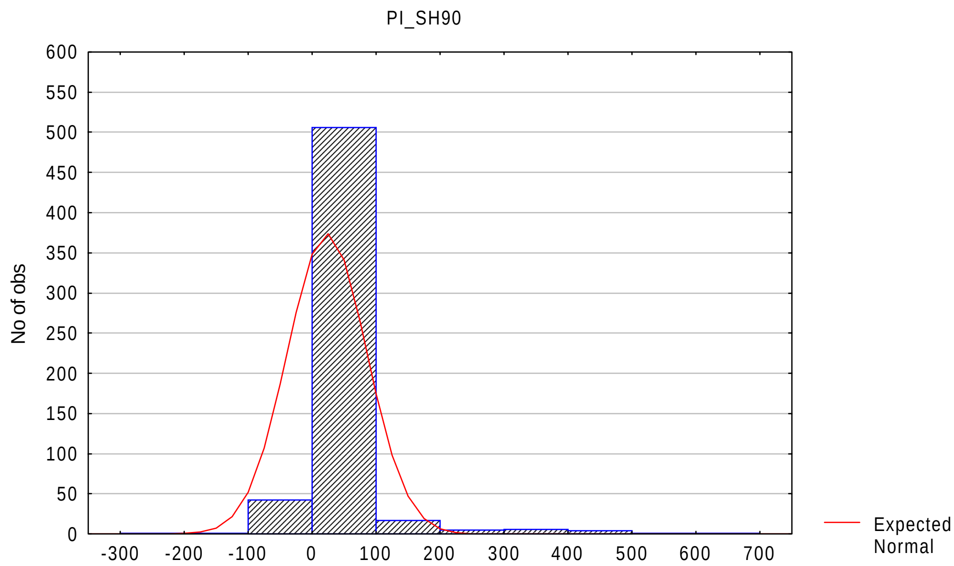


Figure 3.2.1.3

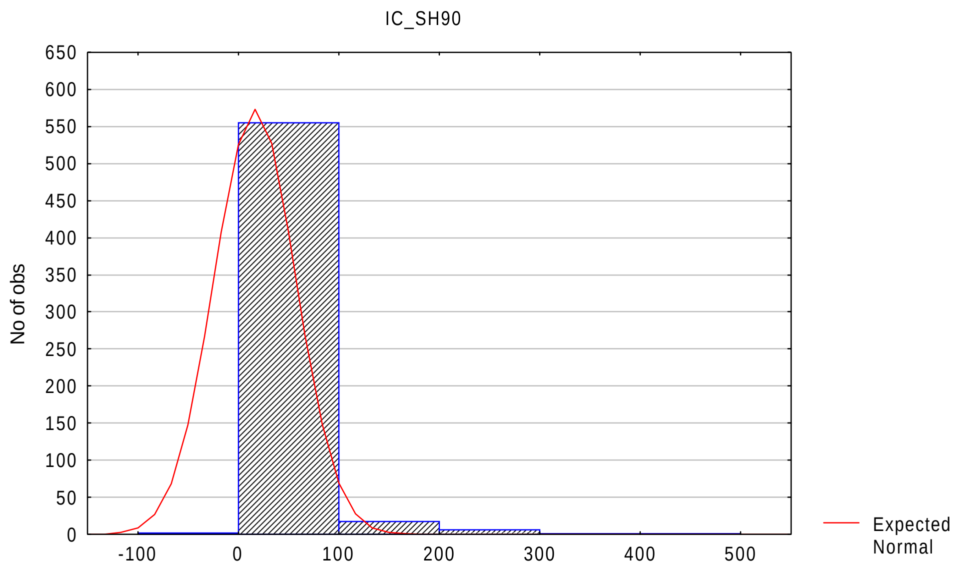


Figure 3.2.1.4

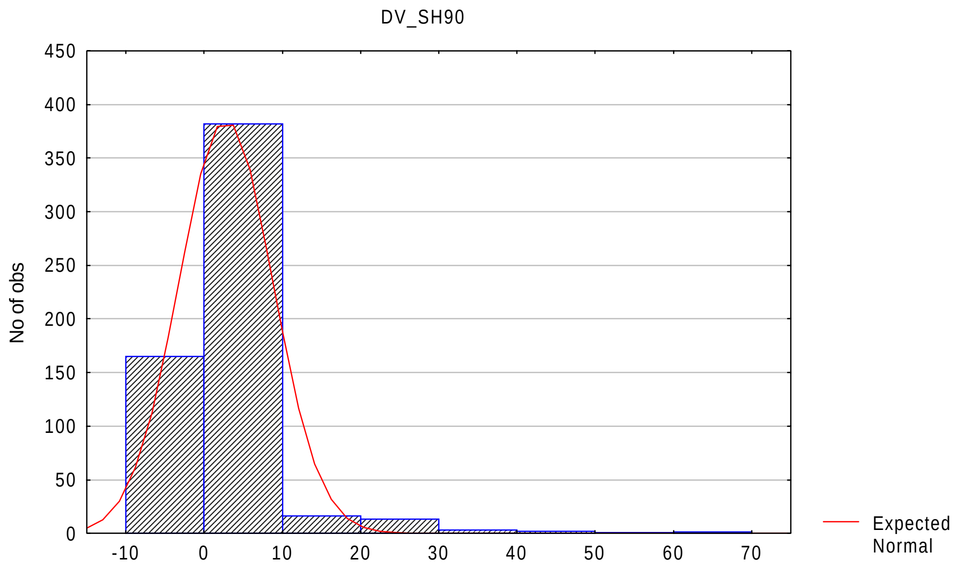
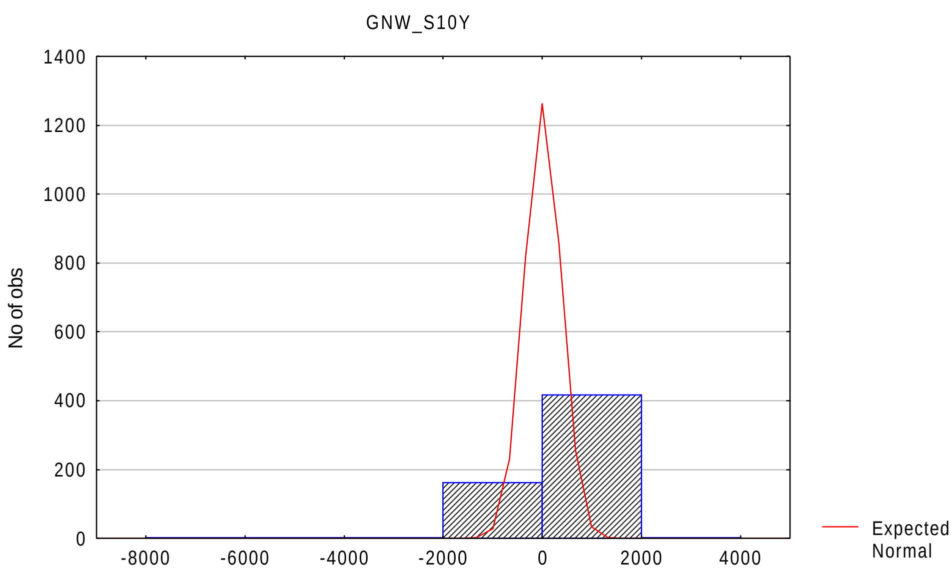


Figure 3.2.1.5



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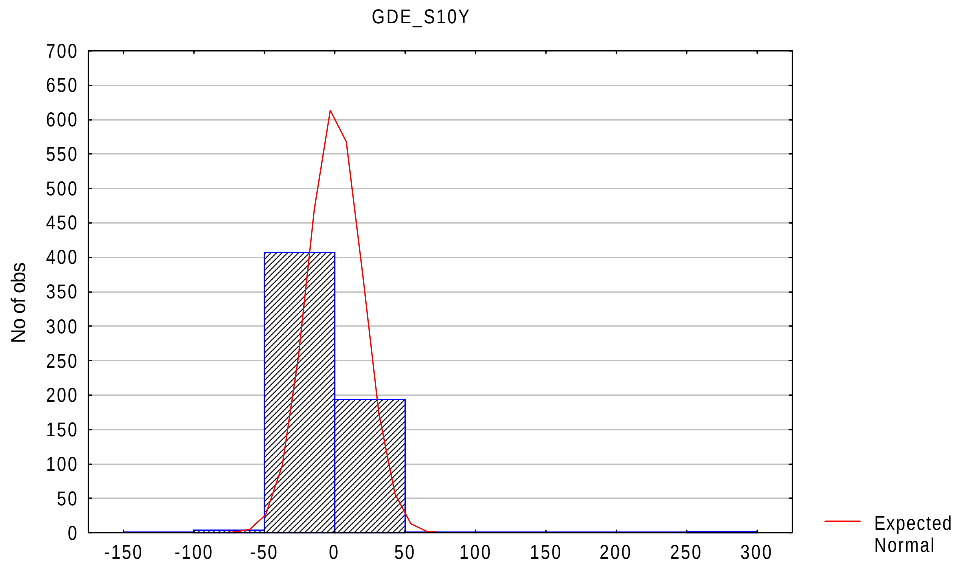


Figure 3.2.1.7

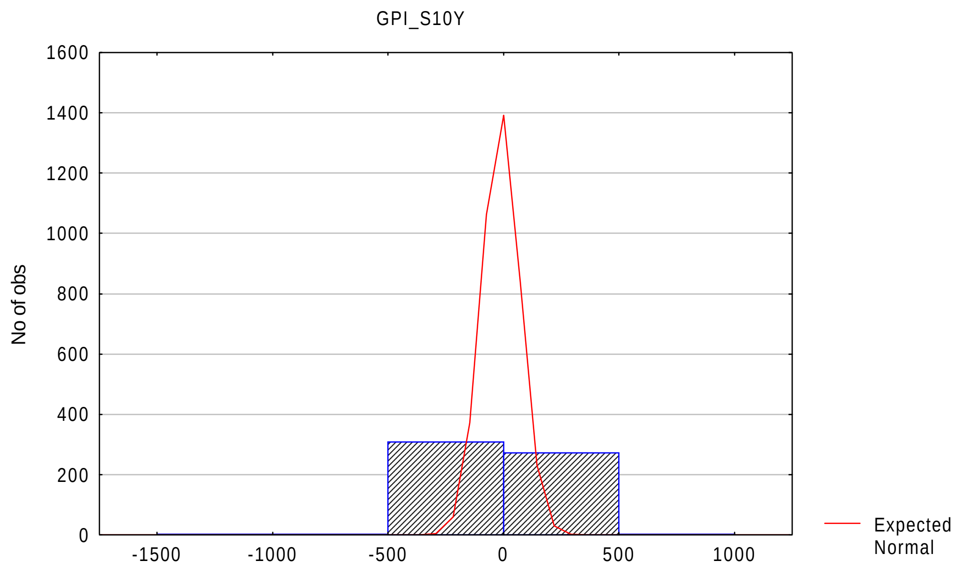


Figure 3.2.1.8

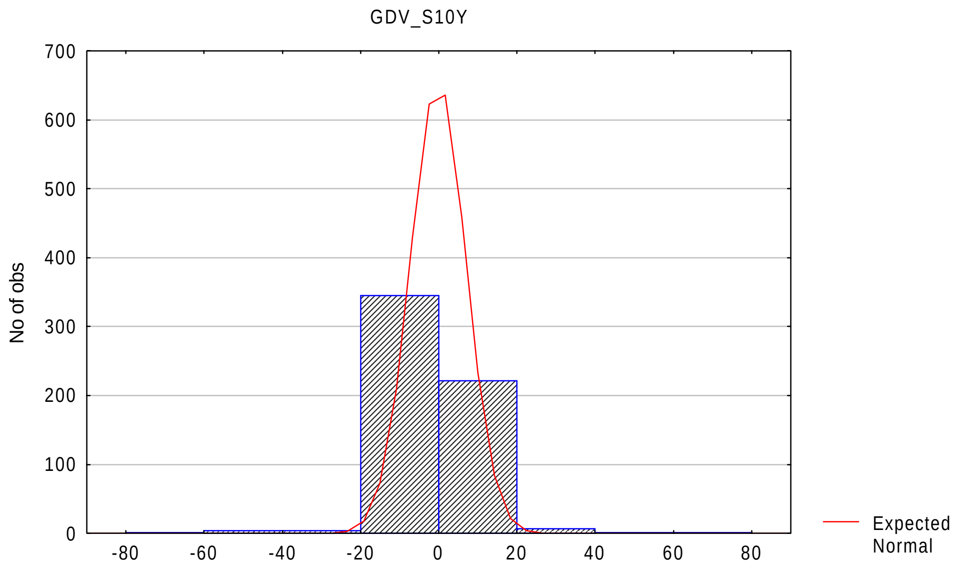


Figure 3.2.1.9

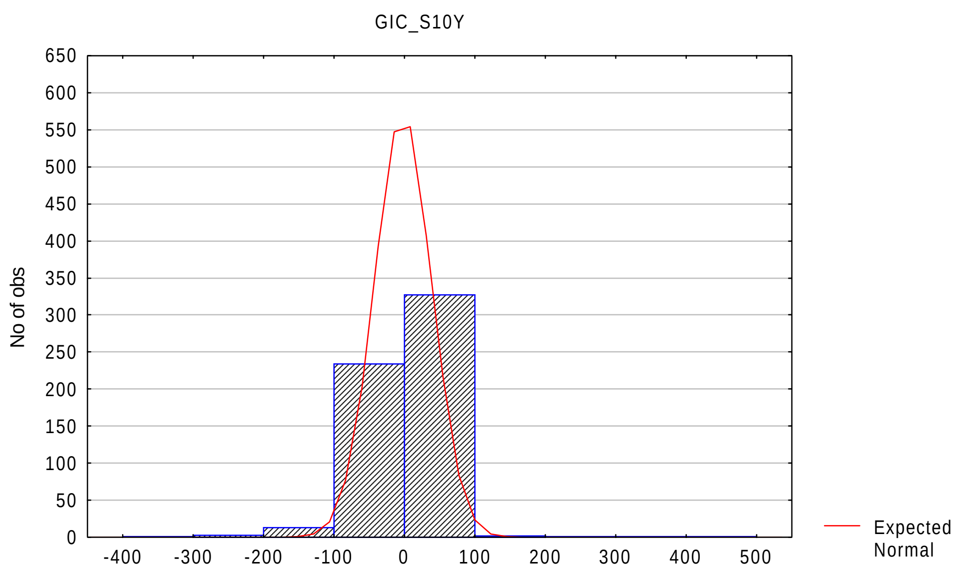


Figure 3.2.1.10

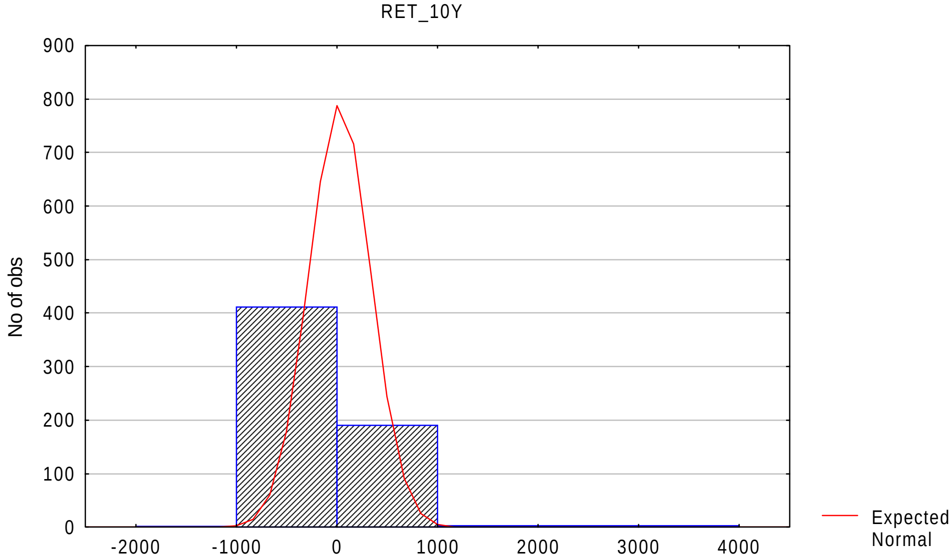


Figure 3.2.1.11

Manufacturing Sector Data

The only industry that has been considered in isolation from the market dataset is the manufacturing sector. The reason being that the only sector that has a large number of surviving firms between 1990 and 2000 is this sector. Three stages in the algorithm are carried out with respect to this dataset. The 2000–1990 average growth model is fitted as also the 2000–1999 annual growth model is fitted. The fits as well as the errors are then compared to ensure that the errors are uncorrelated. The total number of firms in the first dataset is 392 and in the other case is 2031. The correlation matrices with respect to the two growth models are given in tables 3.2.3.1 and 3.2.3.2.

Table 3.2.3.1

	NW_SH90	DE_SH90	PI_SH90	IC_SH90	DIV_SH90	GNW_ S10Y	GDE_ S10Y	GPT_ S10Y	GDV_ S10Y	GIC_ S10Y	RET10 Y
NW_SH90	1.00	.02	.81*	.43*	.84*	-1.00*	-.03	-.42*	-.51*	-.22*	.22*
DE_SH90	.02	1.00	-.01	-.03	.00	-.02	-.73*	.03	.01	.03	.01
PI_SH90	.81*	-.01	1.00	.70*	.72*	-.81*	-.01	-.59*	-.39*	-.30*	.31*
IC_SH90	.43*	-.03	.70*	1.00	.39*	-.42*	.03	-.43*	-.13*	-.29*	.36*
DIV_SH90	.84*	.00	.72*	.39*	1.00	-.84*	-.01	-.54*	-.68*	-.28*	.10
GNW_S10Y	-1.00*	-.02	-.81*	-.42*	-.84*	1.00	.10	.42*	.51*	.22*	-.22*
GDE_S10Y	-.03	-.73*	-.01	.03	-.01	.10	1.00	-.00	-.01	-.02	-.02
GPT_S10Y	-.42*	.03	-.59*	-.43*	-.54*	.42*	-.00	1.00	.61*	.22*	.21*
GDV_S10Y	-.51*	.01	-.39*	-.13*	-.68*	.51*	-.01	.61*	1.00	.30*	.41*
GIC_SH10Y	-.22*	.03	-.30*	-.29*	-.28*	.22*	-.02	.22*	.30*	1.00	.05
RET10Y	.22*	.01	.31*	.36*	.10	-.22*	-.02	.21*	.41*	.05	1.00

*Marked correlations are significant at $p < .05000$ N=392

Table 3.2.3.2

	NW_SH90	DE_SH90	PI_SH90	IC_SH90	DIV_SH90	GNW_S1Y	GDE_S1Y	GPT_S1Y	GDV_S1Y	GIC_SH1Y	RET1Y
NW_SH90	1.00	.01	.69*	.24*	.42*	.43*	-.00	.24*	-.01	.14*	-.21*
DE_SH90	.01	1.00	.02	.00	-.00	.01	-.34*	-.00	.00	-.01	.00
PI_SH90	.69*	.02	1.00	.47*	.46*	.31*	-.01	-.27*	-.01	.03	-.22*
IC_SH90	.24*	.00	.47*	1.00	.32*	-.30*	.00	-.11*	.01	.38*	-.12*
DIV_SH90	.42*	-.00	.46*	.32*	1.00	.04	-.00	-.09*	-.56*	-.05*	-.38*
GNW_S1Y	.43*	.01	.31*	-.30*	.04	1.00	-.01	.43*	.27*	-.13*	-.10*
GDE_S1Y	-.00	-.34*	-.01	.00	-.00	-.01	1.00	.00	-.00	.01	.00
GPT_S1Y	.24*	-.00	-.27*	-.11*	-.09*	.43*	.00	1.00	.19*	.13*	.10*
GDV_S1Y	-.01	.00	-.01	.01	-.56*	.27*	-.00	.19*	1.00	.09*	-.02
GIC_SH1Y	.14*	-.01	.03	.38*	-.05*	-.13*	.01	.13*	.09*	1.00	.10*
RET1Y	-.21*	.00	-.22*	-.12*	-.38*	-.10*	.00	.10*	-.02	.10*	1.00

* Marked correlations are significant at $p < 0.05$ N=2031

5.3. TIME SERIES MODEL

We consider the following time series model for dynamic price formation in Indian Stock Markets.

$$P_{t+1} - P_t = A_t + B_{1t} NW_t + B_{2t} DE_t + B_{3t} PI_t + B_{4t} DIV_t + B_{5t} IC_t$$
$$B_{6t} E_t \Delta NW_t + B_{7t} E_t \Delta DE_t + B_{8t} E_t \Delta PI_t + B_{9t} E_t \Delta DIV_t + B_{10t} E_t \Delta IC_t$$
$$+ \tilde{\kappa}_t, \qquad \tilde{\kappa}_t \sim N(0, \sigma^2_{\kappa_t})$$

where, P_t = closing price of shares at 31st December of the year t,

NW_t = Net worth per outstanding equity share at 31st December of the year t,

PI_t = Profit for the year t after adding back the interest cost, per outstanding equity share at 31st December of the year t,

DE_t = Debt-Equity ratio at 31st December of the year t,

DIV_t = Dividend declared during year t per outstanding equity share at 31st December of the year t,

IC_t = Interest cost for the year t,

$\Delta NW_t = NW_{t+1} - NW_t$, is the first forward difference in NW,

$\Delta PI_t = PI_{t+1} - PI_t$, is the first forward difference in PI,

$\Delta DE_t = DE_{t+1} - DE_t$, is the first forward difference in DE

$\Delta DIV_t = DIV_{t+1} - DIV_t$ is the first forward difference in DIV

$\Delta IC_t = IC_{t+1} – IC_t$ is the first forward difference in IC,

E_t is the forward looking Rational Expectations operator with respect to 31st December of year t

κ_t is a random error term normally distributed with mean 0 and variance matrix $\sigma_{\kappa_t}^2 > 0$

We shall jointly test for the fit of the model as well as the properties of the error terms hypothesized, with annual data over the period 1990-2000.

The econometric testing of a time series model of this form, which consists of a large cross–section of companies at any given t can be carried out along two directions. The first method is the traditional Vector Auto Regression method of the Box–Jenkins type. In such a method the entire panel data pooled across firms and time periods has to be studied in integrated form to give GLS estimates by this ARIMA model. This has the potential dimensionality cost of there being around 2500 firms for each of the years 1990–2000 with twelve variables, which could potentially become a 2500 X 10 X 12 matrix requiring high computing time and memory costs. Besides, with a linear model specification such as ours, the nonlinearity involved in the historical behavior of stock prices would not be readily evident till we change our specification and fit a nonlinear model all over again. This prompts us to carry out the Time Series GLS regression in a "nested" procedure similar in many respects with that suggested by Granger & Newbold (1977) and consists of the following algorithm. This algorithm uses the residual matrix of nested models to set up an objective function based on correlations amongst the nested residuals. While this procedure helps in time series estimation of the parameters along the Granger et. al. approach, it also provides a procedure for estimating TVP (Time Varying Parameter) problems as discussed in Rao (2000), without using any exogenous cost minimisation objectives.

In the first step we break up the pooled time series ARIMA model into nested models identified by years as follows:

$$[\ P_{t+1} - P_t\ ] = [\ A_t + \sum_{i=1}^{5} B_{it} \text{ historical variable }_{it} + \sum_{i=6}^{10} B_{it} \text{ expectation variable }_{it} + \kappa_t]_{C} \otimes_{T}$$

where C is the number of companies in the data set T is the time " horizon" which in this case is 1990-2000. B_{it} is the coefficient on historical variable i at time t where i is the indicator as follows:

i=1 $\Rightarrow$ NW

i=2 $\Rightarrow$ DE

$i=3 \Rightarrow PI$

$i=4 \Rightarrow DIV$

$i=5 \Rightarrow IC$

The historical variables are, as given above, the expectation variables follow exactly the same identification, i.e.,

$i=6 \Rightarrow E_t \Delta NW$

$i=7 \Rightarrow E_t \Delta DE$

$i=8 \Rightarrow E_t \Delta PI$

$i=9 \Rightarrow E_t \Delta DIV$

$I=10 \Rightarrow E_t \Delta IC$

This is the basic time series model.

In the second step, we break up this general ARIMA (1,1,1) specification into first a "bootstrap" average growth model as follows:

$$P_{2000} - P_{1990} = A + B_1 NW_{1990} + B_2 DE_{1990} + B_3 PI_{1990} + B_4 DIV_{1990} + B_5 IC_{1990} + B_6 E_{1990} \Delta NW_{2000\text{-}1990}$$
$$+ B_7 E_{1990} \Delta DE_{2000\text{-}1990} + B_8 E_{1990} \Delta PI_{2000\text{-}1990} + B_9 E_{1990} \Delta DIV_{2000\text{-}1990}$$
$$+ B_{10} E_{1990} \Delta IC_{2000\text{-}1990} + \tilde{\kappa}$$

where, $E_{1990}\ \Delta NW_{2000\text{-}1990} = NW_{2000} - NW_{1990}$,

$E_{1990}\ \Delta DE_{2000\text{-}1990} = DE_{2000} - DE_{1990,}$

$E_{1990}\ \Delta PI_{2000\text{-}1990} = PI_{2000} - PI_{1990}$

$E_{1990}\ \Delta DIV_{2000\text{-}1990} = DIV_{2000} - DIV_{1990}$

$E_{1990}\ \Delta IC_{2000\text{-}1990} = IC_{2000} - IC_{1990}$

Thus, here the dependent variable is the total price differential over the decade. Any of the coefficients B_6 to B_{10} is the "average growth" coefficient in the sense that

$$B_6\ E_{1990}\ \Delta\ NW_{2000\text{-}1990} = 10\ B_6\ E_{1990}\ \frac{\Delta NW_{2000\text{-}1990}}{10}$$

This model seems as the benchmark "bootstrap" model for the decade of the 90s.

In the third step, the linear growth assumption along with the 10-year horizon assumption is relaxed to test a set of four "nested" models, one for each year as follows:

$$Ret_n = A_n + \sum_{i=1}^{5} B_{in} \text{ historical variable i} + \sum_{i=6}^{10} B_{in} \text{ expectation variable i}$$

$$+ \tilde{\varepsilon}_n', \quad \tilde{\varepsilon}_n' \sim N(0, \sigma_{\varepsilon'_n}^2), \quad n = 2000 \ldots.\ 1990.$$

And growth is taken over 1-year periods working back from 2000 for each n=1,2 and 3, and expectations is forward looking over the one year. Thus for e.g.

$$B_{16}\ E_1\ \Delta NW_1 = B_{1999,6}\ (NW_{2000}\text{-}NW_{1999}) \text{ and so on}$$

$$Ret_n = P_{n+1} - P_n$$

Granger and Newbold (1977) argued that this is a valid procedure for obtaining the Time-Series properties of Stock Price, provided, the residual matrix $[\varepsilon_n']$ does not show significant serial correlation. Therefore the final step in this algorithm is to check for the correlation in the $[\varepsilon_n']$ matrix from the four nested models obtained in step 3. (Since the overall fit will not change much due to the presence of interest cost along with profit in the time series analysis of chapter IV, we only explore the first three annual data sets, taking on faith as before that the long run average growth model will fit better. This may remain as a weakness of the present study.) If the significance of serial correlation is low then this may also be considered as an algorithmic procedure for cointegration of stock price variables. We test these hypotheses in the following sections.

5.4. TIME SERIES RESULTS (GOODNESS - OF - FIT)

The "Average Growth " Model

The average growth model for the ten-year period 2000-1990 is presented. The dataset consists of the entire market data and the partitioned manufacturing data. Both the set of results serve as a bootstrapping benchmark for the linear model specification in the stage one of the modeling algorithm.

The Market Data

The total number of "surviving" firms between the decade of 31.12.90 and 31.12.2000 is 571 in the total market dataset. The average growth model was run on the set taking annual series as has been discussed before. The results are summarised in the following table:

Variable	B	t (571)	Level of significance
Intercept	-12.69	-1.15	Insignificant
NW_{1990}	-0.688	-5.103	0%
DE_{1990}	-0.156	-0.168	Insignificant
PI_{1990}	6.088	9.804	0%
IC_{1990}	-1.659	-2.88	1%
DIV_{1990}	10.044	3.211	1%
$GNW_{2000-1990}$	-0.615	-7.46	0%
$GDE_{2000-1990}$	-0.204	-0.284	Insignificant

$GPI_{2000-1990}$	4.762	10.209	0%
$GDV_{2000-1990}$	18.407	8.157	0%
$GIC_{2000-1990}$	-1.092	-2.245	3%

Thus, the estimated equation becomes:

$$P_{2000} - P_{1990} = \underset{(-1.15)}{-12.69} - \underset{(-5.103)}{0.688}\, NW_{1990} - \underset{(-0.168)}{0.156}\, DE_{1990} + \underset{(9.804)}{6.088}\, PI_{1990} - \underset{(-2.88)}{1.659}\, IC_{1990} + \underset{(3.211)}{10.04}\, DIV_{1990}$$

$$-\underset{(-7.46)}{0.615}\, GNW_{2000-1990} - \underset{(-0.284)}{0.204}\, GDE_{2000-1990} + \underset{(10.209)}{4.762}\, GPI_{2000-1990} + \underset{(8.157)}{18.407}\, GDV_{2000-1990}$$

$$-\underset{(-2.245)}{1.092}\, GIC_{2000-1990}$$

The R^2 is high at 0.52 and the F-statistic is high at 63.36 which is significant at the 0% level and the serial correlation of the residuals is low at 0.08 suggesting a good fit for the model. In fact, the fit of the model improves significantly with the inclusion of the interest cost separately.

The significant weights on the initial net worth (NW_{1990}), initial profit (PI_{1990}), initial interest cost (IC_{1990}), initial dividend (DIV_{1990}), and in their growth is substantiated by the model, while the signs of the coefficients are suggestive of the predominance of the supply or demand factors over the other, as the case may be. The fitted "price differential" line is plotted in fig. 3.4.1.1 as Ret 10Y.

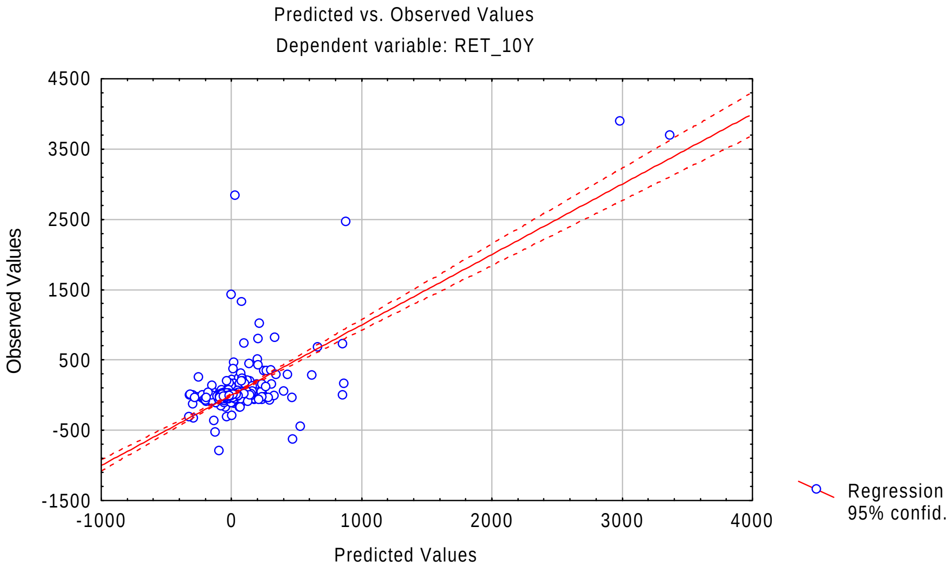

Predicted vs. Observed Values
Dependent variable: RET_10Y
Observed Values
4500
3500
2500
1500
500
-500
-1500
-1000
0
1000
2000
3000
4000
Predicted Values
Regression
95% confid.

Figure 3.4.1.1

Manufacturing Sector Data

The total number of "surviving " firms in the manufacturing sector dataset over the period 2000 - 1990 is 392. The average growth linear model was run on the data set taking annual series, as has been discussed, to obtain the GLS estimates. The results are presented in the following table:

Variable	B	t (381)	Level of significance
Intercept	-49.98	-2.17	4%
NW_{1990}	3.75	0.0	Insignificant
DE_{1990}	-3.89	-0.0	Insignificant
PI_{1990}	2.691	3.95	1%
IC_{1990}	2.184	3.75	1%
DIV_{1990}	25.5	4.91	1%
$GNW_{2000-1990}$	3.81	0.0	Insignificant
$GDE_{2000-1990}$	-4.04	-0.0	Insignificant
$GPI_{2000-1990}$	1.96	5.7	0%
$GDV_{2000-1990}$	35.35	10.59	0%
$GIC_{2000-1990}$	0.61	1.57	Insignificant

The R^2 is high at 0.53.

The graph of the plot of the fitted price differential is shown in figure 3.4.1.2.

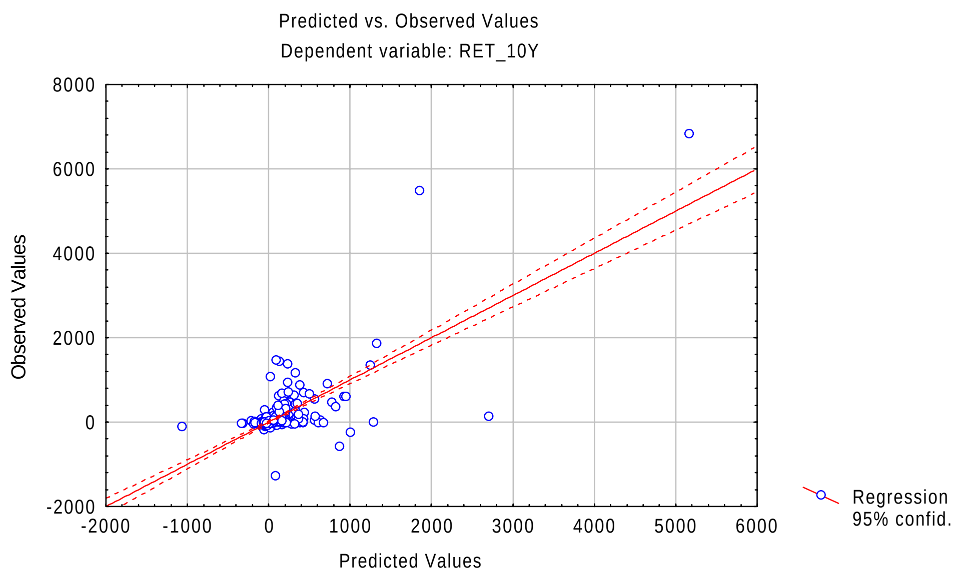


Figure 3.4.1.2

Annual Price Differential Data

In keeping with the algorithmic approach to the time series analysis of this paper we regress the model on annual data for the periods 2000-1997. We only consider three annual data as they comprise the most recent three years and extrapolate our results on the basis of the results obtained in this section as well as chapter IV. The results of the regression for the various periods within the decade are summarized in the following table 3.4.1.3.1.

Table 3.4.1.3.1

Period	00-99	99-98	98-97
Intercept	-3.12 (-1.11)	22.83 (5.76)	3.76 (4.24)
NW	-0.07 (-2.92)	0.07 (1.91)	0.02 (3.56)
DE	0.02 (0.15)	-0.06 (-0.16)	-0.001 (-0.01)
PI	0.87 (5.79)	1.09 (7.33)	0.123 (2.35)
IC	-0.73 (-4.45)	-0.94 (-6.16)	-0.33 (-5.37)
DIV	-18.12 (-20.79)	7.04 (6.24)	-2.23 (-7.31)
GNW	-0.51 (-5.47)	0.25 (3.92)	-0.32 (-7.49)
GDE	0.006 (0.08)	-0.05 (-0.25)	0.00 (0.09)
GPI	1.42 (8.23)	1.16 (6.37)	0.58 (7.28)
GDV	-14.36 (-12.25)	6.91 (5.40)	1.39 (4.42)
GIC	0.42 (1.41)	-1.78 (-6.27)	-0.64 (-6.75)
R^2	0.21	0.09	0.09
F	71.21	28.84	35.68
DW	1.84	1.76	1.98

The fit of the three annual models never perform better than the average growth model over the 10-year horizon, in terms of R^2, which has a significantly high R^2 at 0.52. Besides the F statistic is significant for the average growth rational expectations model over 10 years and the serial correlation of residuals is also low, rejecting a nonlinear fit to the pricing equation through annual series in favour of a linear fit, as was the case in Chapter IV. This inference is correct based on the comparison of the two sets of models, because as required by Granger & Newbold (1977), the error correlation matrix among the nested residuals shown in table 3.4.1.3.2 do not show significant serial correlation.

Table 3.4.1.3.2

	E1	E2	E3
E1	1.00	-0.09*	-0.00
E2	-0.09*	1.00	0.01
E3	-0.00	0.01	1.00

Marked correlations are significant at $p < 0.05000$

This rejects the hypothesis of significant correlation, as the maximum magnitude is 0.09. This inference is also true when one compares the manufacturing sector for its fit over 2000-1990 with 2000-1999 the most recent one year. The results for the 2000-1999 period are given in table 3.4.1.3.3.

Table 3.4.1.3.3

Variable	B	t statistic (2020)	Level of significance
Intercept	-1.69	-0.49	Insignificant
NW_{99}	-0.21	-6.57	0%
DE_{99}	0.01	0.04	Insignificant
PI_{99}	1.83	8.7	0%
IC_{99}	-0.85	-3.84	1%
DIV_{99}	-22.12	-20.84	0%
GNW	-0.6	-5.29	0%
GDE	0.002	0.03	Insignificant
GPT	2.31	10.05	0%
GDV	-20.46	-14.49	0%
GIC	1.95	4.45	1%

Adjusted R^2 is 0.27

Here also the average growth ten-year model obtains a better fit, suggesting that the longer term linear rational expectations model performs better. In other words the cointegrated price variables fit better in both cases with a linear average growth trend. Both these observations are somewhat incongruous with a high and significant weightage on historical dividends and dividend growths, which suggest high liquidity preference and therefore "myopia". Associated with this, is a significant positive sensitivity of returns with interest cost, both in levels as well as in growth. Positive elasticity with interest cost suggests that demand effect for manufacturing shares is outweighed by the supply effect (Tobin (1972) for example). This implies that the monetary authority, by adjusting the interest rate, can have a significant positive effect on returns in manufacturing shares. This is true whether the annual 2000-1999 dataset is being discussed or the average growth 10-year 2000-1990 dataset is being considered.

The fitted lines for the ten-year average growth model and for the 2000-1999 model for the entire market dataset are presented in figures 3.4.1.3.4 and 3.4.1.3.5.

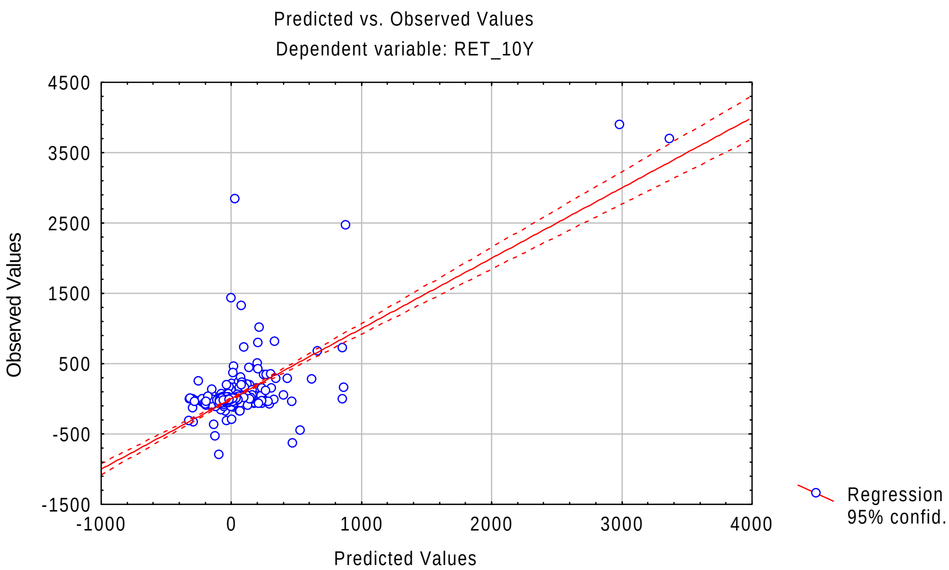


Figure 3.4.1.3.4

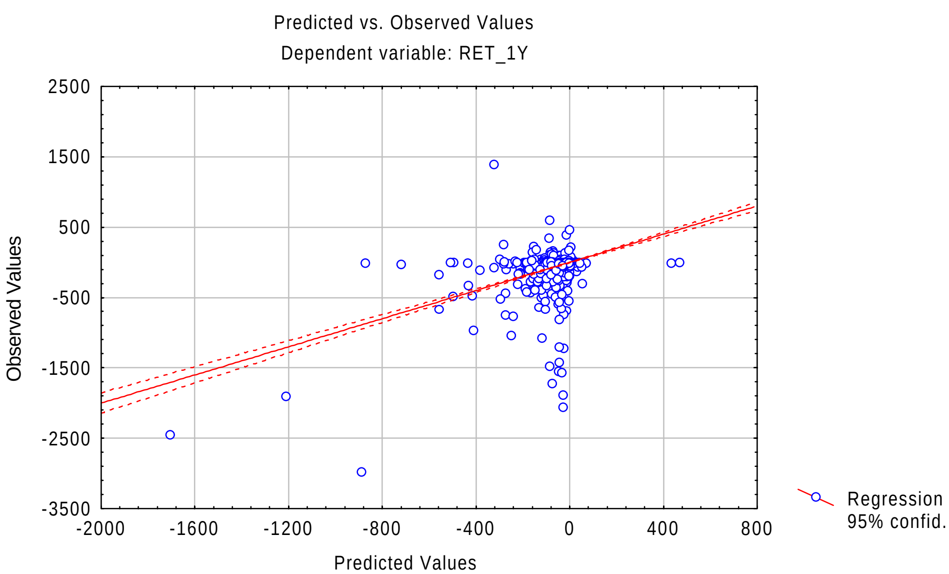


Figure 3.4.1.3.5

5.5. <u>TIME SERIES RESULTS (VOLATILITY)</u>

An analysis of fit of the model to the time series data reveals that, on average a good part of the dynamic price differential is explained by the set of historical and rational expectations variables considered, giving an overall R^2 (adjusted for serial autocorrelation and heteroskedasticity) of 0.52 with significant t-statistic on all but the debt-equity variables. The fit of the model in the case of the benchmark set of companies, having market price/face value ratio >=10 (consisting of 93 companies), is significantly higher with an adjusted R^2 = 0.77 and significant t-statistic for all but the interest cost and dividend variables. The fit of the model is also striking in the case of the manufacturing sector with an adjusted R^2 of 0.53. However, it still leaves a lot of volatility to be explained.

When it comes to an analysis of the volatility in the residuals it is observed that as was true in the case with no interest cost variable, the F-statistic and DW-statistic are both significantly high, leaving therefore the variance to be analysed only (in the general dataset, F = 63.36 and DW= 1.83; in the benchmark dataset, F = 30.99 and DW= 2.02; and in the manufacturing sector data set, F = 44.69 and DW= 1.93). Further an analysis of the correlation matrix across the various "nested " models of annual duration suggest that the across period serial correlations are insignificant. This not only points to the existence of a ten-year set of data cointegrated with the price differentials but also to the fact that residuals follow "random walk" over time at least within this ten-year history. However, after the conditioning on the variables of the model, including the monetary policy variables of interest cost and growth in interest cost, the errors do follow a "random walk" pattern. The reduction in residual variance consequent to the treatment of the interest cost variable in terms of increase in R^2 over the ten-year dataset are given in the following table.

	Adjusted R^2 without monetary policy variables	Adjusted R^2 with monetary policy variables
Total Market	0.36	0.52
Benchmark Data Set	0.62	0.77
Manufacturing	0.46	0.53

It has already been noted in previous chapters that "myopia" through dividend and expected dividend dependence operates in contrast to the overriding performance of the longer-term average growth model, which is an anomaly found in this study. However, the significant variance of the residual sum of squares does certainly point direction to speculative "gambling" and "sunspot" components in the stock market. The elasticities of the variances in returns as is captured by the B coefficients in the regression equations are given below for the three datasets in the ten-year average growth model.

	B for Interest Cost	B for Growth in Interest Cost
Total Market	-1.66 (2.88)	-1.09 (-2.24)
Benchmark Data Set	4.21 (1.11 - insignificant)	8.95 (2.41)
Manufacturing	2.18 (3.95)	0.61 (1.57 – insignificant)

Thus, the variability reducing power of the interest variables in all the above three categories of industries is corroborated by the significance of at least one t-statistic in all the cases (as originally suggested in, for example, the Tobin (1972) paper). However, the signs and magnitudes of the coefficients are not uniform even within this ten-year time series analysis. In the overall market data, the Bs lie between 1 and 2 with negative signs. Since interest rates and therefore interest costs are profit-reducing elements for companies, hence, the demand side of the capital market ought to be negatively related to interest (law of demand). On the other hand, supply of capital ought to have a positive relation with interest by savings theories. Hence, a negative net effect on price differentials suggests that the demand for capital (supply of shares) effect dominates the supply of capital (demand for shares) effect.

5.6 CONCLUSION

From our discussions above, it can be discerned that, in the case of major blue chip companies, pursual of a "cheap money" policy by the Reserve Bank of India may lead to an increase in the net demand for capital thereby increasing returns on capital through the stock market.

However, other classifications of company groupings do not result in similar observations. In these cases, the supply side of the capital market (i.e. the demand side of the share market) dominates the demand side as it is reflected in a positive interest sensitivity. In more specific terms, as interest (cost) increases, the supply of capital increases as savings increases, part of which is mobilised by financial institutions and channelised into equity markets, leading to increase in demand for shares, resulting in increase in share prices and thus returns. Alternatively, another possible explanation for this may be derived from the positive income effect on demand for shares derived from increase in interest income to savers and the resultant upward pull on share prices resulting from the demand increase. However, on average interest income constitutes a much smaller portion of the income of financial institutions (who are the major investors) compared to income from securities, dividends and capital gains. Hence, this marked shift in the signs of the coefficients is somewhat anomalous, pointing to a possible presence of short-term myopia exacerbating fragility, requiring further in-depth study.

CHAPTER VI ªÉ

FINANCIAL FRAGILITY IN THE BANKING SECTOR:
A TIME SERIES ANALYSIS OF NON-PERFORMING ASSETS

6.1 INTRODUCTION

The beneficial impact of a well functioning financial system, particularly the banking sector, on the real sector is well known. As such, the existence or lack of fragility or vulnerability or "proneness" to random shocks or unforeseen events assumes a critical dimension. Allen and Gayle (2000), Kaminsky and Reinhart (1999, 1996), Kiyotaki and Moore (1997), Rakshit (1998), Stiglitz (1981) and others have examined the factors that make the banking sector particularly fragile. The existing literature has expressed concern over the inherent tendencies in the banking sector towards fragility, arising out of institutional characteristics with respect to norms / rules and inadequate controls. We discuss a combination of macroeconomic, microeconomic and rules/norms based factors – all contributing to this fragility of the banking system. Further, our study and empirical analysis brings out three significant tendencies. First, NPAs (as a ratio of loans and advances) are significantly sticky over time. Second, larger NPAs are associated with larger advances and vice-versa; and third, NPAs do not seem to be spiraling out of control, rather shows signs of a slight reduction. The policy initiated during the 90s of classifying bad debts as NPAs after two installment defaults, seems to have brought some amount of control on the bad debts situation. However, this study also shows that the real and asymmetric information problems associated with bad debts formation needs serious attention.

On the macroeconomic side there are national economy wide and even global economy wide factors, which are essentially beyond the control of the banking sector or individual banks. Large cyclical fluctuations in the level of economic activity, high and variable inflation and interest rates, large and unforeseen shocks in world demand and supply conditions of the country's exportables and importables, volatility in foreign exchange and capital markets raise the degree of risk to be confronted by producers (borrowers) and hence by banks (and lenders) as well. The macro-impact becomes more critical in less developed economies with relatively undeveloped stock markets and where, as such, firms are compelled to resort to borrowings.

On the microeconomic side, there are several factors that tend to make the system "inherently" fragile. There is the major problem of collecting information pertaining to the solvency of the bank, which in turn depends on the solvency and creditworthiness of the borrowers. Depositors generally have very little means or ability to monitor the activities of the banks or to judge the quality of the bank assets. Further, there is the inherent distortion under little or no regulation of the banking sector resulting in the high ratio of deposits to own funds of banks; and as we know under the law of limited liability total loss of banks cannot exceed their own funds invested.

These factors result in two types of distortion in banking, viz., *adverse selection* and *moral hazard*. As Akerlof and Roemer (1993) have pointed out, the difficulty of monitoring the activity of banks by depositors and control over large funds of which bankers themselves own a small fraction put great temptation in their own way to indulge in shady deals for personal gains and siphon off bank's resources.

Further, as Rakshit (1998) has demonstrated, under the free play of market forces, banks inherently tend to choose (a) projects that are high risk and have low expected returns; and (b) the deposit rate tends to exceed the expected return on the projects chosen. Even when banks are risk averse, banks' management of risk, when left to themselves, tend to be both inadequate and inefficient.

Further, we have observed in all too many instances, an inherent tendency for troubles specific to individual banks, leads to serious contagion and precipitate a sector-wide and systemic crisis.

Hence, there is a need for public intervention (regulation or supervision) in banking at both the macro and micro levels.

In addition to basic contra-cyclical macro-stabilisation policies (which alone cannot do away the fragility of the banking sector), one suggested way out for averting run on banks and systematic crisis in the banking sector is deposit insurance or some form of government guarantee. However, it is widely held that such measures create and compound serious moral hazard problems by way of inducing bankers to finance high risk projects and removing all incentives for depositors to gather necessary information, monitor bank's activities and assess bank's performance.

This highlights the importance of effective bank regulation and supervision for ensuring the viability of the banking sector. One such step towards regulation involves restricting competition, as discussed in Caprio and Summers (1998), through some form of licensing (scrutinizing record of applicants seeking entry into the banking sector) – thus 'preventing entry of entrepreneurs' of doubtful ability and integrity. Another measure or instrument of regulation will be to administer the own capital to total investment ratio, though there is a clear dilemma in the exercise of this instrument for regulation of banks. As Rakshit (1998) has shown, a low own-capital ratio tends to undermine viability of the banking sector through gross distortion in bank's choice of assets; on the other hand, fixing the ratio at a very high level severely limits the financial intermediation, especially in a developing economy.

Although attainment and maintenance of macroeconomic stability is necessary for avoiding financial crisis, the task of attaining macro balance is frequently seen to be beyond the capability of many a country. As Rakshit (1998) has shown, with the lack of built-in flexibility of the tax system particularly in a developing economy and the difficulty of counter-cyclical adjustment of normal government expenditure, it is argued that macro-stabilisation may require public debt backed by public assets in commercially run enterprises. Monetary measures being flexible are more effective than fiscal measures, in the short run, in countering cyclical fluctuations, though mobility of international capital has put serious constraints on the policy options before the Central Bank.

In such contexts, the need for adequate regulation and effective supervision of banks becomes paramount. The Bank of International Settlement (BIS) has been engaged in developing appropriate norms to be observed by banks and formulating principles for their regulation. The recommendations of both the 1991 and 1998 Narasimhan Committee (Reserve Bank of India) are primarily based on successive reports of the Bank Committee on Banking Supervision, that are set up by the BIS. The "core principles" set forth in the 1997 Basle Committee report (BIS, 1997) constitute the minimum requirements for effective banking supervision, licensing, prudential requirements, information requirements and cross border banking. The Basle Committee report recommends necessary supplements by other measures in the context of specific conditions and risks in the financial system of particular countries. For example, prudential requirements relate to capital adequacy, asset quality and related provisioning norms, asset liability management and accurate accounting. The most crucial of the prudential norms is capital adequacy which under the Basle Capital Accord of 1988 is set in terms of a minimum Capital to Risk Assets Ratio (CRAR) of a bank, set at 8%. The Narasimhan Committee had recommended that Indian Banks should attain a minimum CRAR of 9% by the year 2000 and 10% by the year 2002.

However, there are at least two major limitations of the capital adequacy and related norms. In the first place, in the context of the observations made above, the norms on their own are quite inadequate in preventing moral hazard. Secondly, as discussed in Rakshit (1998), they tend to produce macro-instability (and thus fragility or vulnerability) both through pro-cyclical behaviour of credit and changes in its composition during the course of the cycle. During the upward phase of the cycle, there is rapid increase in the capital base of the banks with accumulation of reserves out of profits boosted through (a) booming business conditions, and (b) sharp fall in provisioning requirements with improvement in quality of bank assets and a decline in NPAs. The result is sharp growth in bank credit, while macro-stabilisation requires its containment during this period. Similarly, it can be shown that the Basle norms will add to the credit crunch during a depression. Finally, it is also important to recognise and give effect to inherent interrelationships between regulatory measures and monetary policies so as to ensure proper coordination of the two types of policies towards achievement of stability in the financial sector in general and the banking sector in particular.

The organisation of this chapter is as follows. In section 6.2 we discuss the outline of the model used for analysis. In section 6.3 we discuss the dataset. In section 6.4 we provide a time series ARIMA (1,0,1) Maximum Likelihood analysis and the results. In section 6.5 we conclude.

6.2 THE MODEL

The banking sector in India, since the nationalisation in the late 60's and early 80's, is largely state-owned in the form of nationalised banks. Since, till recently, shares of nationalised banks were not traded in the stock market, financial performance of banks is to be measured with respect to criteria different from that of companies listed on the stock exchange and as discussed in the previous chapters. Besides, banking companies being financial institutions, belong to a different industrial sector and hence measures of performance have to differ. Such discussions can be traced to the literature on the economics of banking in such papers as Gurley and Shaw (1960), Rakshit (1998), Bagchi (1998).

The purpose of this study, in keeping with the overall purpose of this project, is to assess the extent of financial fragility in the banking system over the period covering the 1980s and the 1990s. This period has witnessed the significant structural change involving the opening up of the stock markets and the trading of portions of shares of certain nationalised banks notably the State Bank of India, in the stock market. However, since the significant nature of operations of the banks remains the inflow and outflow of credit through the mechanism of interest rates (i.e.

commercial banking), therefore financial performance of banks have to be measured in terms of the efficient intake and maturity of deposits and efficient provision and recovery of loans and advances. The two essential variables in this circulation mechanism are interest and bad debts. Interest received on loans and advances forms the major part of the income of the banking sector, while interest paid and bad debts (technically renamed as non-performing assets) forms the major part of the costs of the banking sector. On comparison of the nationalised as opposed to private banks, as will be discussed in the data section in detail, it is evident that NPA forms a formidable problem for the nationalised banks as opposed to private banks. However, since nationalised banks constitute a majority portion of the banking sector's total deposits as well as loans and advances, because of its historical priority on small savings and prioritised lending, NPA forms a significant cost to the efficient functioning of the banking sector as a whole and the key factor in the financial fragility of the banking system.

Explanations for the level of NPAs are not hard to find. To a large extent, as is the case with any industry, bad debts arise due to an inefficient system of management and recovery of debt along with the real economic causes of business failure. When applied to the banking sector, lending gets coupled with bad debts as possible explanations for the incidence of NPA costs. Thus, lending to bad quality projects both in terms of technology and risk, asymmetric information giving rise to imperfect screening and monitoring which results in adverse selection of projects and terms of lending, and moral hazard in the monitoring and recovery of loans (Stiglitz & Weiss (1981)), lead to the large incidence of NPA costs. According to the definition of NPA given by the Reserve Bank of India, non-performing assets are those loans and advances on which interest payment is in default for more than two quarters. Hence, it includes not only bad debts but also other loans and advances which fall in the risky category with respect to debt servicing. Thus, the broad definition of risk assets in the adverse selection and moral hazard literature coincides more or less with the NPA definition.

An interpretation of the asymmetric information literature as discussed above, can proceed as follows. Banks, which had lent in the past to high default risk category of firms due to priority reasons or the adverse selection and moral hazard reasons, find it difficult to recover interest income as well as the principal. This reduces the debt-service-coverage-ratio of bank deposits inducing thereby to lend to higher return higher risk category of customers. This, due to the dynamic operation of the adverse selection and moral hazard problems, accumulates further NPAs. By this argument, the aggregate implication is that, "NPAs give rise to further NPAs" in the Indian banking sector. In this chapter, we pursue this line of reasoning to test the time series properties of NPAs. Hence, as will be seen, NPAs expressed as a function of outstanding loans and advances are self-driven over time and this stickiness has given rise to a vicious cycle of bad debts in the banking sector, which makes the entire financial system fragile by impeding the operation of the multiplier.

6.3 THE DATASET

The dataset comprises the period 1995–2000 for which full data is available in the Prowess database of the Centre for Monitoring the Indian Economy, and consists of a maximum of 188 banking companies in 1998 and a minimum of 121 banking companies in 1995. The variables that are considered for the purpose of the present study are as follows: provision for bad debts (NPA) for the year, closing balance of loans and advances, and the year of operation. With these variables, we construct a composite variable 100 * bad debts / loans & advances = ratio_p to express bad debts as a function of loans and advances. As has been already discussed in the previous section, bad debts and NPAs will be used interchangeably. The graphs of the variables are given below. Figure 6.1 describes the plot of the Bad Debts (NPAs) over time ranging from first half of 1995 to second half of 2000. Figure 6.2 describes the plot of the NPA to loans and advances ratio (ratio_p) over time. Figure 6.3 describes the plot of Bad Debts against advances. This shows a significant clustering at small advances and low bad debt levels. Besides, there seems to be a linear trend that we estimate in the next section. Figure 6.4 describes the plot of ratio_p against advances. This again shows a significant clustering close to the origin. Besides, there seems to be a constant relation across level of advances. Figures 6.5 and 6.6 are three-dimensional graphs, plotting the Bad Debts and the ratio_p against advances and across time. While a clear picture does not seem to emerge graphically, a clustering of points at the low advance - low bad debt and low bad debt - advance ratio levels are clearly discernible. How these relations change (or remain sticky) over time are analysed in the M-L estimation in the next section.

Figure 6.1

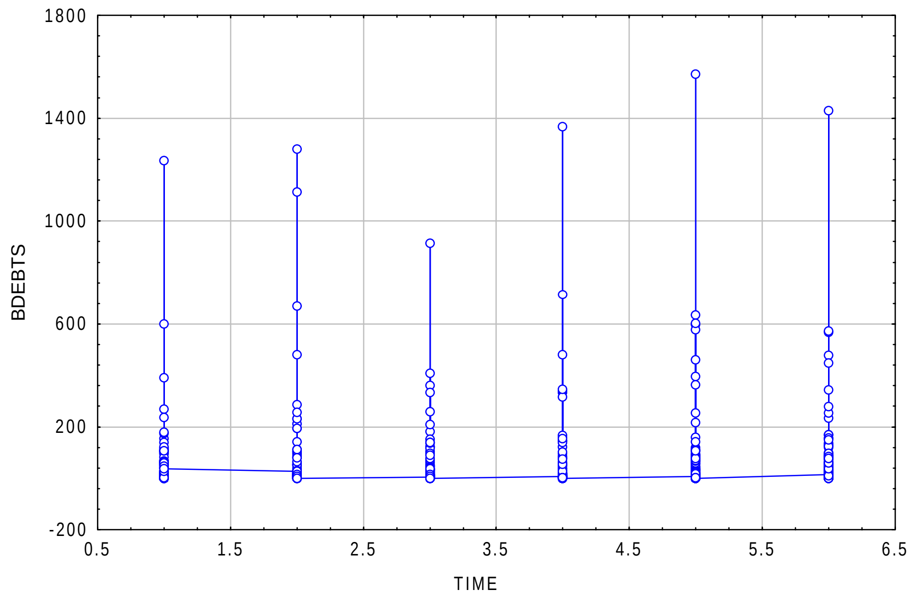
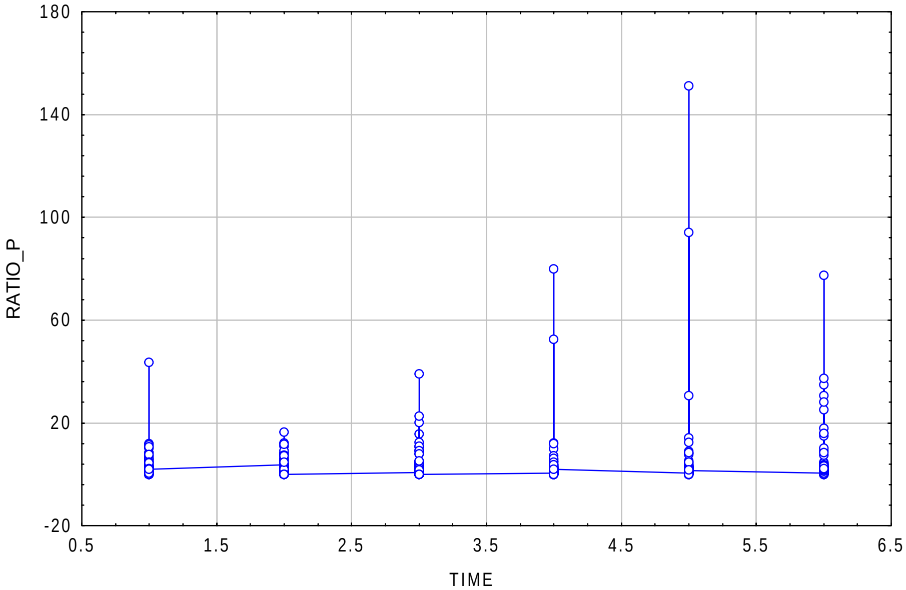


Figure 6.2



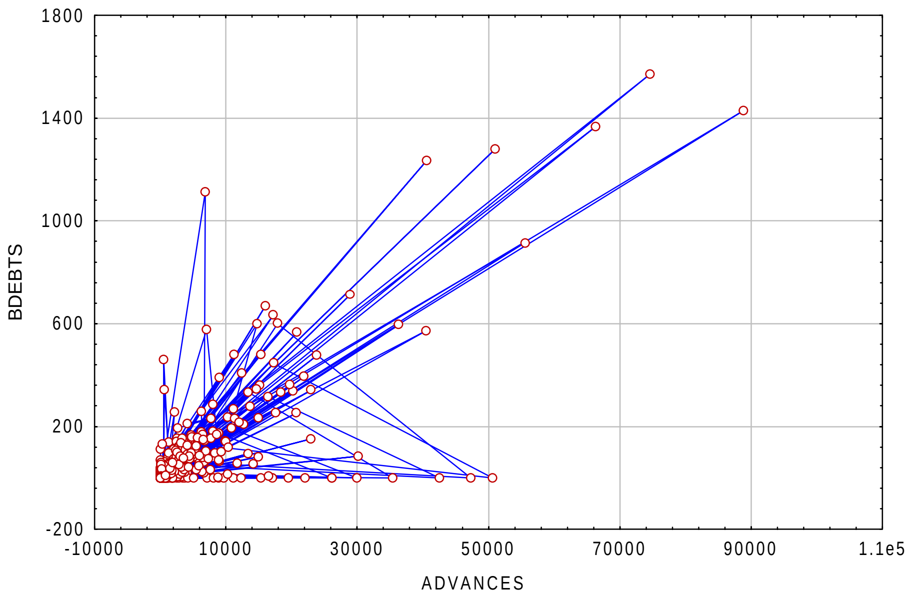
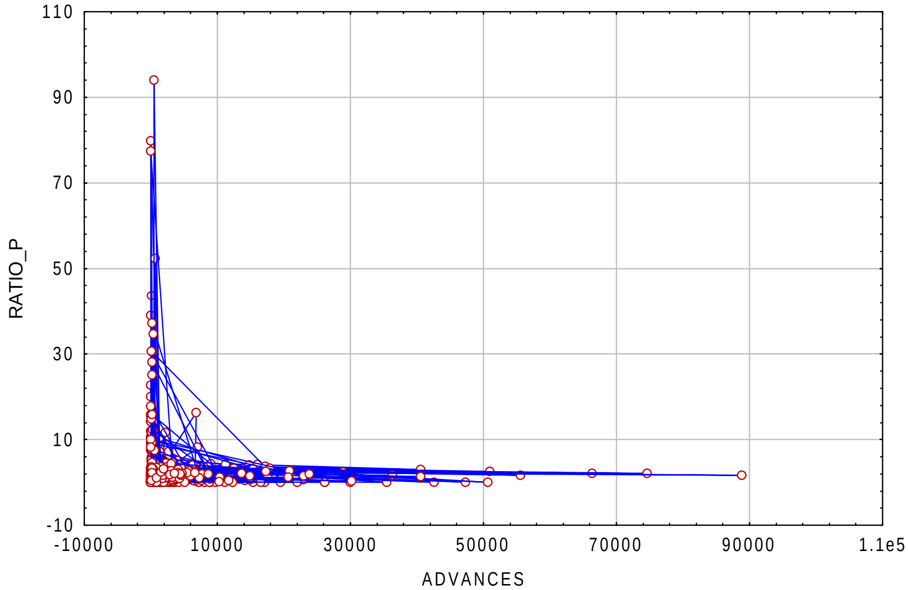


Figure 6.3

Figure 6.4



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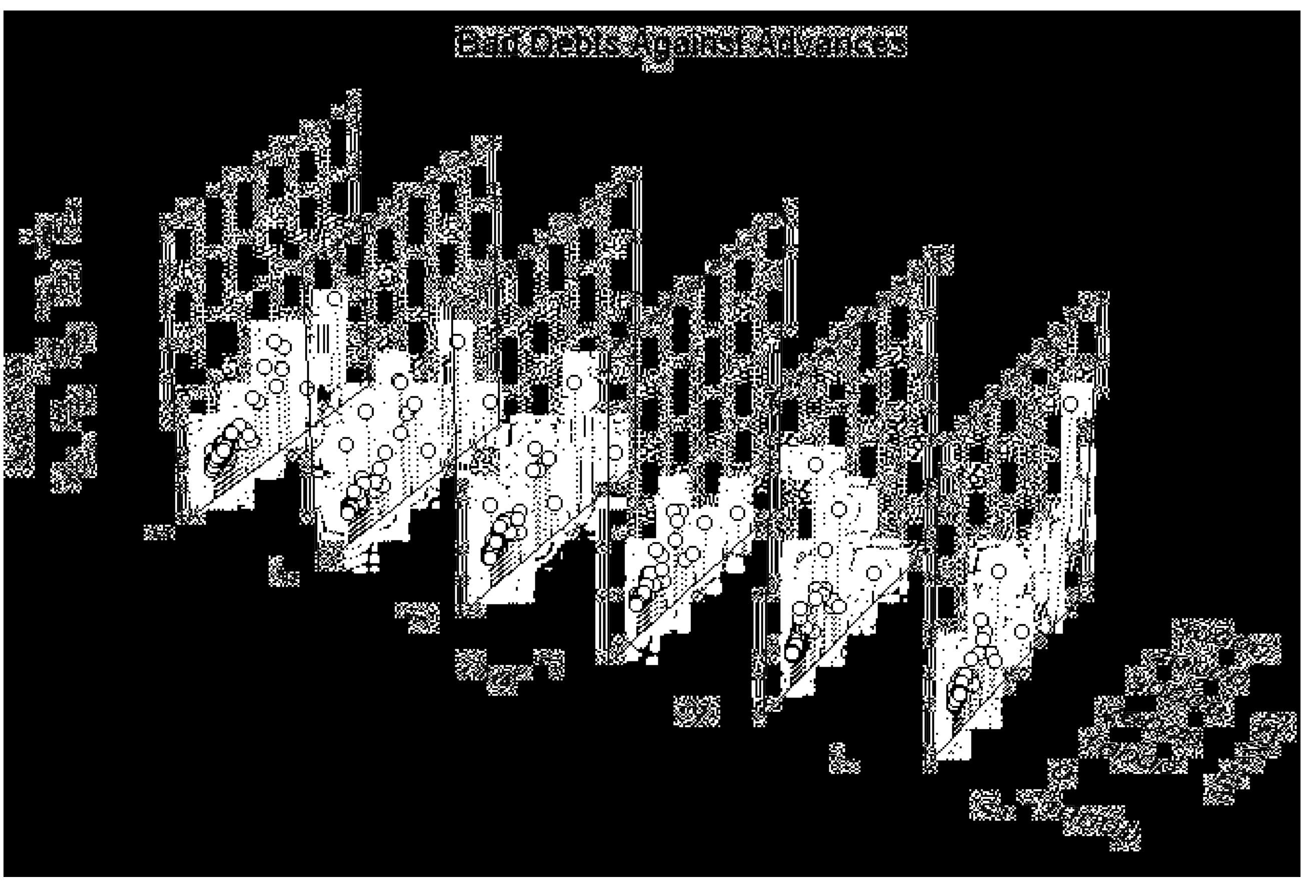

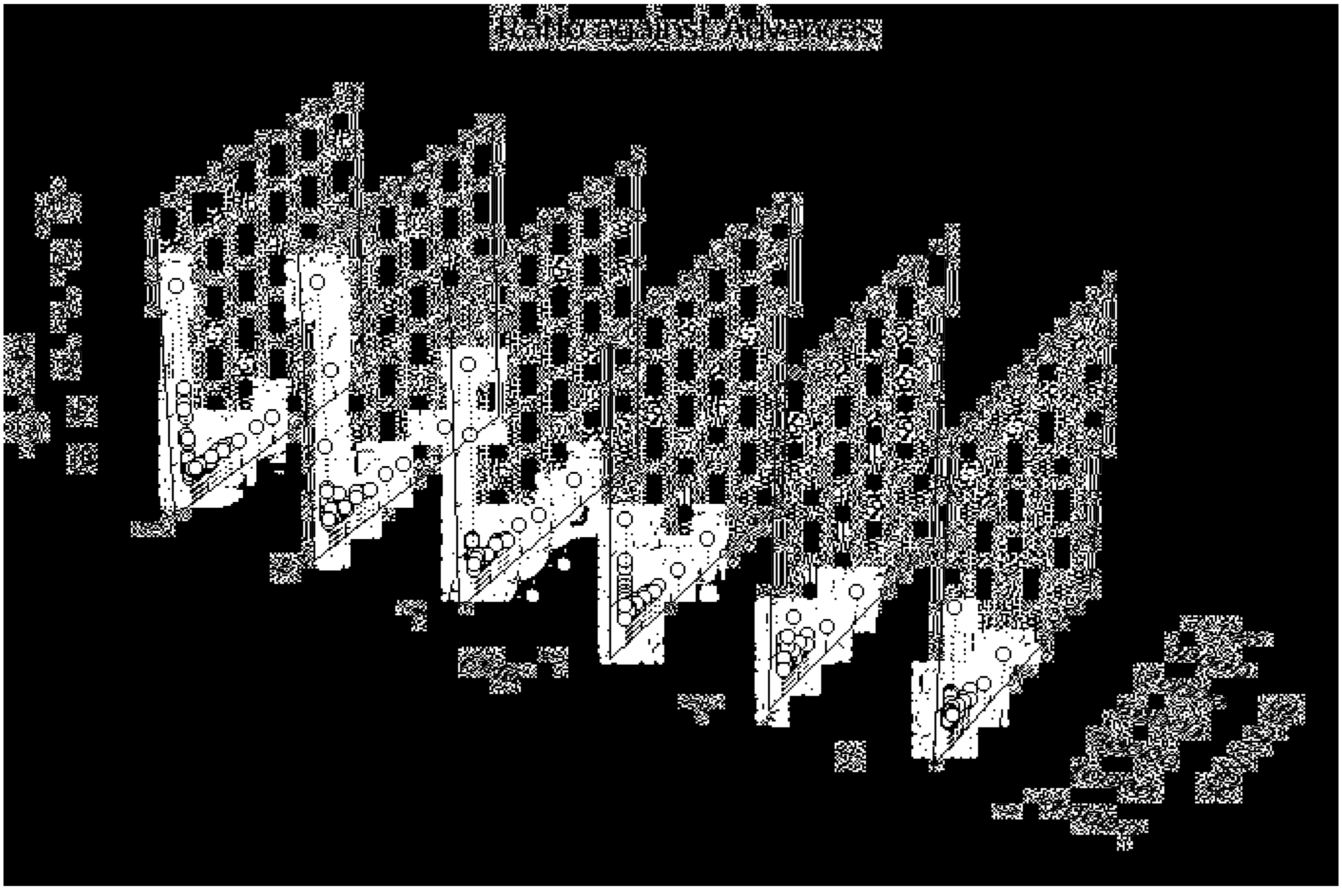

Figure 6.6

6.4 TIME SERIES RESULTS

The ARIMA (1,0,1) results of the single series (ratio_p) time series are presented in table 6.1. The ratio_p variable is regressed on itself 1 period lagged and 1 period led. The model is of the following nature:

$ratio\_p_t = A + B_1\, ratio\_p_{t-1} + B_2\, ratio\_p_{t+1} + \tilde{\varepsilon}_t, \quad \tilde{\varepsilon}_t \sim N(0, \sigma^2_{\varepsilon_t})$

The parameters of the model are estimated using maximum likelihood estimation procedure.

Table 6.1

Model:(1,0,1) MS Residual=40.730

	Param.	Asympt. Std.Err.	Asympt. t (914)	p	Lower 95% Conf	Upper 95% Conf
Constant	2.564742*	.259974*	9.86537*	.000000*	2.054526*	3.074958*
p(1)	.941871*	.063173*	14.90940*	0.000000*	.817890*	1.065852*
q(1)	.928103*	.069250*	13.40221*	0.000000*	.792195*	1.064010*

Marked entries are significant.

Table 6.2 Parameter Covariances
Model:(1,0,1) MS Residual=40.730

	Constant	p(1)	q(1)
Constant	.067587	.004796	.000373
p(1)	.004796	.003991	.004306
q(1)	.000373	.004306	.004796

Table 6.3 Parameter Correlations
Model: (1,0,1) MS Residual=40.730

	Constant	p(1)	q(1)
Constant	1.000000	.291996	.020696
p(1)	.291996	1.000000	.984292
q(1)	.020696	.984292	1.000000

As was evident from the graphical analysis, the time series shows a significant secular trend and a significant intercept. The p coefficient (autoregressive) takes on a value of 0.94 and the q coefficient (autoregressive) is 0.93. Both these estimates are less than 1, thereby predicting stability in the long run. Besides, the coefficients are close to 1, although decaying slowly at around 1%. Thus, the ratio of NPA to Total Loans and Advances can be taken to be constant over the short run. An inference which directly follows is that bigger value of advances are likely to be associated with bigger default, while smaller advances are less likely to be in default.

There is a significant constant intercept of 2.6, thereby signifying a chronic bad debt problem which does not change over time and therefore with the volume of advances by the banks. This requires suitable policy controls. However, the redeeming feature is that, as discussed above, the series is stable and therefore does not predict immediate signs of spiraling out of control.
The estimated equation obtains as follows:

$$\text{ratio\_p}_{t} = 2.56 + 0.94\ \text{ratio\_p}_{t-1} + 0.93\ \text{ratio\_p}_{t+1}$$

$$\qquad (9.87) \quad (14.91) \qquad\quad (13.40)$$

The graph of the predicted variable for the first 500 cases is given below.

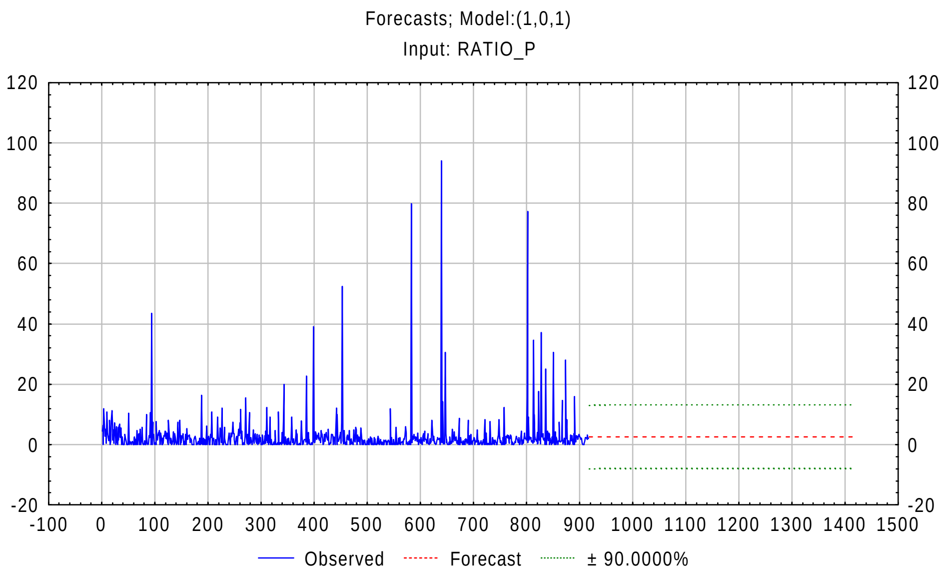

Figure 6.7

6.5 CONCLUSION

Two significant tendencies emerge from the above analysis. First, NPAs are significantly sticky over time. Second, larger NPAs are associated with larger advances and vice-versa. However, optimism can still prevail – NPAs do not seem to be spiraling out of control and shows signs of a slight reduction. The policy initiated during the 90s of classifying bad debts as NPAs after two installments' default, seems to have brought some amount of control on the bad debts situation. However, whether such a policy, which is more accounting in nature, can address the real economic problems associated with bank loans going bad is another question. As this study shows, the real and asymmetric information problems associated with bad debts formation needs serious attention. Till then, the vicious cycle of NPAs giving rise to further NPAs continues.

Fragility of the banking system, which largely enjoys the insurance of State support due to it being nationalised to a large extent, is thus more complex than that of the stock market. For, in spite of there being infusion of working capital consequent to nationalisation, mobilisation of savings from the grassroot level by the safety offered by State guarantee, and a well organised trade union movement covering the banking sector, the NPA / Advances ratio has observations as high as 90%.

The mean of this ratio is 2.54%, which although is not high in percentage terms, can primarily translate into two implications. Firstly, since the total advances is Rs. 6,06,151.04 crores in 2000, the predicted NPA would be around Rs. 15,396 crores, which comes to around Rs. 150 per capita. This figure is significant if confidence in the banking system is perturbed somehow. Secondly, since according to the accounting system followed in banks this 2.54% is a charge on profits, therefore assuming rational decision making in the banking sector, interest rates charged can be expected to be inflated by at least this figure of 2.54%, which has its own spiraling depressing effects on growth.

Thus, while policy attention seems to be overtly fixed on the stock market with the globalisation regime, cumulative effects of history on the operation of the current banking system requires appropriate attention. This attention probably has to draw upon the interaction of the banking sector with the real economy as well as the interaction of the banking sector with the stock market.

CHAPTER VII

CONCLUSION
AREAS OF FURTHER RESEARCH

In conclusion, our research entitled "Financial Fragility, Asset Bubbles, Capital Structure and Real Rate of Growth – A Study of the Indian Economy During 1970 –2000" has led us to an in-depth study of critical relationships, first, between the real and financial sectors, and second, in respect of financial markets in general and equity markets and the banking sector in particular.

Our analysis clearly reveals that in so far as the financial sector is concerned, the size, activity and efficiency of the financial intermediaries have improved considerably since financial reforms were adopted. However, what should be extremely worrying for the reformers is the result showing that the allocation of credit (savings) is not favouring the private sector. The ratio of government credit to private credit has been increasing since mid 1990s. With the increasing withdrawal of government from activities in the real sector, this investment tendency clearly indicates relative inactivity of the private sector in the real economy. The reason for the relative inactivity of the real sector lies not with the financial sector but probably in problems pertaining to the real economy supply and demand constraints.

Our cross-sectional study shows conclusively that price formation in Indian Stock Markets is significantly dependent on net worth of companies as well as their profitability and dividend payouts. However, capital structure in the form of debt/equity ratio never gets significant weightage although the weightage is negative. It is also observed that the beta coefficients (B's) on Net worth per share is negative. This can be explained by the decomposition of excess demand in that the supply of share capital as well as demand depends on this variable in opposite ways. Dividend is found to have significant weightage through demand for share capital. It corroborates both liquidity preference and "short-sightedness" (myopia) amongst the participants of the Indian stock market. The signaling rationale for dividends is probably rejected due to the insignificance of Dividends in the case of "blue chip" companies, whereas Net worth and Profit get significant weightage. There seems to be an anomaly with respect to risk perception of participants if debt-equity ratio and dividend payments are considered side by side for the rest of the data sets.

The estimated equation for the control dataset consisting of the blue chip companies is as follows:

$$\hat{P} = 134.367 + 0.603\,N\hat{W} - 10.309\,D\hat{E} + 6.608\,P\hat{T} + 4.129\,D\hat{V}$$

(3.294) (2.856) (-0.405) (4.638) (0.650)

The estimated equation for the market dataset is as follows:

$$\hat{P} = 15.355 + 0.1151\,N\hat{W} - 0.007\,D\hat{E} + 0.519\,P\hat{T} + 23.632\,D\hat{V}$$

(3.394) (2.371) (-0.055) (2.015) (18.850)

The Indian stock market is however significantly described by "bounded rationality", through myopia, liquidity preference and significant volatility of the error terms when compared within the ratio of unexplained to total sum of squares. The ratio is reasonably high in all cases, and is significantly high in some cases, although the power of the model and of the tests is demonstrably high. This leaves a lot of controls and long run policies with respect to the stock market to be desired.

Side by side with a good explanation of the mean of share prices, is found excess volatility which in most cases is significant suggesting presence of speculation and non-fundamental driven activities as are referred to as "sunspots" in the Rational Expectations literature.

The time-series study in respect to the stock market, reveals that the structure of these markets in India is best described by the presence of historical real (net worth per share, profitability per share) and financial (debt-equity ratio, dividend distributed per share) variables as well as their rationally expected growth values over the future. This structure is cointegrated with the stock price so that it may be said that in corporate governance, price is an important consideration in making decisions on the above explanatory variables at the corporate level. This is in the light of the fact that although there is a lot of residual volatility, lack of explosive components makes cointegration possible. If one compares it with the fact that the relationships within the model are stronger in the annual data in periods distant from 1993 and 1997, the two periods of crashes and other significant events, as discussed in the beginning (which therefore opens up areas of further analysis of structural breaks), then the linear fit, on average, suggests that in spite of a high degree of volatility, "planned competition" has been responsible in preventing markets from crashing more often, and changing the overall structure of the interplay between price formation, history and expectations along with it.

The estimated time series equation incorporating stock prices and growth for the market dataset is as follows:

$$P_{2000} - P_{1990} = \underset{(-1.298)}{-16.47} - \underset{(-1.225)}{0.165} NW_{1990} + \underset{(0.079)}{0.085} DE_{1990} + \underset{(4.33)}{2.819} PT_{1990} + \underset{(6.823)}{23.30} DIV_{1990}$$

$$- \underset{(-3.227)}{2.909} GNW_{2000-1990} + \underset{(0.106)}{0.875} GDE_{2000-1990} + \underset{(4.415)}{21.355} GPT_{2000-1990} + \underset{(14.356)}{326.194} GDV_{2000-1990}$$

From our inferences drawn from the estimation including macroeconomic variables (interest cost), it can be discerned that pursual of a “cheap money” policy by the Reserve Bank of India, in the case of major blue chip companies, may lead to an increase in the net demand for capital, thereby increasing returns on capital through the stock market.

The estimated time series equation including macroeconomic policy variable for the market dataset is as follows:

$$P_{2000} - P_{1990} = \underset{(-1.15)}{-12.69} - \underset{(-5.103)}{0.688} NW_{1990} - \underset{(-0.168)}{0.156} DE_{1990} + \underset{(9.804)}{6.088} PI_{1990} - \underset{(-2.88)}{1.659} IC_{1990} + \underset{(3.211)}{10.04} DIV_{1990}$$

$-0.615\ GNW_{2000\text{-}1990} - 0.204\ GDE_{2000\text{-}1990} + 4.762\ GPI_{2000\text{-}1990} + 18.407\ GDV_{2000\text{-}1990}$

(-7.46) (-0.284) (10.209) (8.157)

$-\ 1.092\ GIC_{2000\text{-}1990}$

(-2.245)

However, other classifications of company groupings do not result in similar observations. In these cases, the supply side of the capital market (i.e. the demand side of the share market) dominates the demand side as it is reflected in a positive interest sensitivity. In more specific terms, as interest (cost) increases, the supply of capital increases as savings increases, part of which is mobilised by financial institutions and channelised into equity markets, leading to increase in demand for shares, resulting in increase in share prices and thus returns. Alternatively, another possible explanation for this may be derived from the positive income effect on demand for shares derived from increase in interest income to savers and the resultant upward pull on share prices resulting from the demand increase. However, on average, interest income constitutes a much smaller portion of the income of financial institutions (who are the major investors) compared to income from securities, dividends and capital gains. Hence, this marked shift in the signs of the coefficients is somewhat anomalous, pointing to a possible presence of short-term myopia exacerbating fragility requiring further in-depth study.

The existing literature has expressed concern over the inherent tendencies in the banking sector towards fragility, arising out of institutional characteristics with respect to norms / rules and inadequate controls. Our study and empirical analysis brings out three significant tendencies. First, NPAs (as a ratio of loans and advances) are significantly sticky over time. Second, larger NPAs are associated with larger advances and vice-versa; and third, NPAs do not seem to be spiraling out of control, rather shows signs of a slight reduction. The policy initiated during the 90s of classifying bad debts as NPAs after two installment defaults, seems to have brought some amount of control on the bad debts situation. However, this study also shows that the real and asymmetric information problems associated with bad debts formation needs serious attention.

The Maximum Likelihood estimated time series equation for the banking sector data set is as follows:

$$\underset{(9.87)}{\text{ratio\_p}_t = 2.56} + \underset{(14.91)}{0.94\ \text{ratio\_p}_{t-1}} + \underset{(13.40)}{0.93\ \text{ratio\_p}_{t+1}}$$

As we have observed, solvency of banks may be threatened by the factors operating at both the global and national wide levels. The existing literature has highlighted the institutional aspects of the financial fragility in the banking sector with a look into the efficacy of Bank for International Settlements (BIS) norms and other policy programmes in reducing financial fragility. There is, however, need and scope for a comprehensive fundamentals–based analysis of the fragility in the banking sector.

With the collapse of the Bretton-Woods fixed exchange rate system and introduction of freely floating exchange rates from 1973 practically by all industrialised countries, it was observed that exchange rates exhibited considerable volatility and prolonged periods of overvaluation and undervaluation in both size and duration, all indicating currency markets not being satisfactorily determined by fundamentals leading to financial fragility in such markets.

In case of India, the switch to a floating exchange rate regime (at least on current account) from the prior multi-currency peg (adopted in 1975) was accomplished gradually between 1991-93. There was significant variability in the rupee exchange rate vis-à-vis major currencies like the U.S. dollar; particularly after 1993 given the increased flexibility of the exchange rate regime, when nominal exchange rate movements are expected to reflect changes in the price levels, we consistently find the exchange rate movements to exceed the changes in price levels, suggesting exchange rate movements in currency markets not being adequately explained by fundamental explanatory variables like relative inflation rates.

Our framework of research, therefore, identifies a functional (i.e., fundamentals based) analysis of the extent of the fragility in the banking sector and the currency markets as areas for further research.