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How much does industry matter in an emerging market economy?*

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Abstract

Theories of firm profitability make different predictions about the relative importance of firm, industry and time specific factors. We assess, empirically, the relevance of these effects over a sixteen year period in India, as a regime of control and regulation, pre 1985, gave way to partial liberalisation between 1985 and 1991 and to more decisive liberalisation after 1991. We find that firm effects are important throughout, when rent seeking opportunities proliferated, as well as when competitive forces were enhanced by institutional change. In contrast, industry effects significantly increased after liberalisation, suggesting that industry structure matters more within competitive markets. These findings help understand the relevance of different models over different stages of liberalisation, and have important implications for both theory and policy.

Key words: Firm profitability; Market structure; Firm and industry effects; Time effects; Institutional change; Transition economy.

JEL classification: D21; C33; L13; L16; L25.

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1 Introduction

There is general agreement across the disciplines of economics, finance and management, that firms attempt to maximise profits. At the same time, empirical studies highlight large variation in profitability, where some firms tend to be consistently more profitable than the others. Understandably, the literature contains a multitude of theoretical models that predict which firms will earn higher rates of return and what market and macroeconomic conditions support higher profitability. The predictions of these models are divergent, and in particular, differ in the extent to which firm, industry and time specific factors explain variation in firm level profitability.

In this paper, we study the determinants of profitability of Indian firms against the backdrop of economic reforms. Using a proprietary dataset on Indian firms, we evaluate the relative importance of firm versus industry effects, as well as time effects, in explaining the variation in profitability for a panel of firms over the sixteen year period from 1980-81 to 1995-96. The period under study straddles the most important epoch in the recent history of the Indian economy, as the opening up of markets took place with the liberalisation of industrial policies in 1991. Our analysis covers three well-defined institutional eras for contemporary India, where each sub-period covers a unique phase in the process of liberalisation. Thus, in addition to firm, industry and time effects, our study includes the effect of institutional change. The results support the predictions from some theoretical models but not others, and have important policy implications.

According to the mainstream Bain-Mason structure-conduct-performance (SCP) paradigm (Bain, 1951, 1956; Mason, 1939, 1957), an explanation for the empirical relationship between concentration and industry profits is market power. Higher concentration, predicated by industry specific factors (Sutton, 1991), facilitates the exercise of market power by large firms, thereby generating superior profits. This view posits that industry structure matter most, holding constant firm level factors such as minimum efficient scale and advertising and R&D intensities. Further, time effects embodied in demand conditions are also important (Rotemberg and Saloner, 1986).

An alternative perspective on industrial organization and performance (Stigler, 1950, 1968; Demsetz, 1973; Mancke, 1974) has suggested that the positive relationship between size, market structure and profitability arises because larger firms are more efficient. They earn higher profits, and thereby

contribute to increased industry concentration. This view constitutes the basis for theoretical models, like Jovanovic (1982), where firm effects reflecting productivity and efficiency constitute the main reason for profitability differences between firms, while the distribution of efficiencies and industry life cycle together determine market structure. A third view, arising from the financial economics literature (Sharpe, 1964; Lintner, 1965), particularly the Capital Asset Pricing Model (CAPM), predicts that firm effects are important in combination with aggregate market conditions or time effects.

In line with alternative perspectives, a large and rich empirical literature has evolved in industrial organisation. The mainstream literature (Bass et al., 1978; Cubbin and Geroski, 1987) has focussed on explaining firms' profitability levels by market structure related factors (industry effects), though Mueller (1977), reporting significant firm level profitability persistence over time, first highlighted the validity of the firm effect. On the other hand, theoretical foundations underlying firms' specific competencies that predicate profitability have been developed in the management literature, most prominently by Wernerfelt (1984), Rumelt (1991) and Nelson (1991). While early work of Schmalensee (1985) established industry effects to be dominant in explaining profit variations across firms, led by Rumelt (1991) a number of studies have pointed to firm effects as being the primary factor.

Yet, a balanced approach, that both firm and industry effects are important, is suggested in other work (Kessides, 1990; Waring, 1996; Wernerfelt and Montgomery, 1988). This literature has generated substantial debate, because of large variation between studies on the estimated importance of firm-effects, but also the related question of appropriate data and methodology (Schmalensee, 1989). In a relatively recent contribution closely related to the current paper, Slade (2004) puts to test four competing models of firm profitability, using panel data on large firms in 14 mining and refining markets over a five year period. She finds empirical support only for the mainstream market structure model.

Anecdotal evidence suggests that the causal effect of product-market structure on profitability may be somewhat more relevant for emerging markets. Indeed, while the SCP paradigm has lost prominence in mainstream IO research, such studies are relatively more common in economies that are in transition or in early stages of development (Slade, 2004). This is also consistent with the view that, in more advanced semi-industrial countries such as India, manufacturing sectors tend to be monopolistic (Singh, 2003).

Further, this hypothesis implies a potentially important role for institutional change, so that as the economy makes the transition towards a market economy, the importance of firm effects would start to dominate industry effects. If the performance of firms in an emerging economy are to be evaluated, assuming absence of institutional effects is untenable, given the rapid institutional changes taking place within these economies. Institutional factors matter greatly in influencing economic performance in emerging economy contexts (Hall and Jones, 1999), and the inclusion of these institutional effects is important in evaluating the long-run performance of firms in emerging or developing economies.

In this paper, we evaluate the importance of firm versus industry effects for an important emerging economy, India, against the backdrop of economic reforms in the 1980s and early 1990s. Our investigation of institutional effects in this context is new to the literature, and has important implications for theory and policy. We address the issues of whether industry effects are important in emerging markets such as India, the extent to which firm effects are significant, both in an absolute sense and relative to industry effects, and whether firm and industry effects have changed over the period of institutional transition. Institutional conditions have been extremely important in influencing industrial performance in India (Bardhan, 2005) and in shaping firms' strategic decision making (Marathe, 1989; Mohan and Aggarwal, 1990). We take into account the prevalent conditions and introduce institutions as a key element influencing returns.

The paper is organised as follows. In section 2, we briefly review the existing literature, describe the Indian context and state our expectations for the sub-periods studied. Section 3 describes our data and empirical model, and provides details of the econometric procedures. This is followed in section 4 by a discussion of our empirical results and their implications. Finally, section 5 concludes.

2 Literature and Institutional Backdrop

2.1 Models of firm profitability

We briefly discuss three theoretical models of firm profitability, each making different predictions about the main driver of corporate profitability. The

focus of our discussion lies in the implications of these models for the relative importance of firm, industry and time effects, and potential interactions between industry and time effects. Later in the paper, we evaluate empirically the magnitude of these effects, in absolute and relative terms, as well as changes over different stages of institutional transition. All the three models are discussed in further detail in Slade (2004).

2.1.1 Structure-Conduct-Performance paradigm

The SCP paradigm was the workhorse of the IO literature during the 1970s and 1980s. It posits that market structure (mainly size and concentration of the market) drives conduct (inter-firm interactions, mainly competition and collusion) which in turn determines firm performance (profitability). Following Mason (1939) and Bain (1951, 1956), the main channels for this causal relationship was held to be economies of scale and scope, closely related to structure, and that higher returns in a market were driven by monopoly power.

Under the model, profitability (π_i) for the i th firm in industry j is determined by concentration in the market (typically measured by the Hirschman-Herfindahl index, HHI_j) and firm level explanatory factors (x_i) such as minimum efficient scale and advertising and R&D intensities. Hence, the model places emphasis on industry effects and can potentially also include firm effects. Rotemberg and Saloner (1986) extend the model to include business cycle effects, where degree of collusion varies with demand and so does concentration and profit margin.¹ In this case, one would have additional time effects either on their own or interacted with industry effects.

For our purpose here, the main prediction of the SCP model is that industry effects should be large and further, a causal determinant for variation in profitability across firms. However, empirical research based on the model has been criticised on the grounds that the explanatory factors are all potentially endogenous, and therefore one can only hope to infer correlations, not causation as the model predicts. In our empirical study, we take the view that if correlation between HHI_j and π_i is not substantial, the possibility of a causal link can be rejected straightaway; see also Slade (2004).

¹There are other theoretical models with related predictions; see, for example, Green and Porter (1984), Slade (1989) and Kandori (1991).

2.1.2 “Chicago-school” view

The main criticism of the SCP model, however, was on theoretical grounds. Several “Chicago-school” economists argued that the direction of causality was wrong. In their view, profits drive market structure and not the other way round (Stigler, 1950, 1968; Demsetz, 1973). In competitive markets, the most efficient producers grow and capture market share. This implies that industries where variation in productivity is very high, the most efficient firms are large and dominate the market; this is the source of positive correlation between profitability and market share.

In the passive learning model of Jovanovic (1982), firms enter the market unsure of their quality, and learn their true efficiency or productivity levels by observing noisy cost and profit signals. If they are efficient, they grow over time and capture market share. In other words, the distribution of firm efficiencies determines market structure.

The main prediction of the above model is that market share of the firm is an important determinant of profitability. Empirically, the market share model implies a relationship between profitability (π_i) and market share ($SHARE_i$), where HHI_j and x_i may appear as additional explanatory variables. Further, since market share is determined solely by the initial efficiency draw, this implies a model where variation in profitability is mainly explained by firm effects, but industry effects may also be relevant.

There are many extensions and variations on the above model. Ericson and Pakes (1995) proposed the active learning model which is similar to Jovanovic (1982), except that firms can change their efficiency level by investments in human capital and R&D. Relatedly, in previous work by Bain (1956), the positive correlation between profitability and market share arises from the argument that small firms may not be able to fully exploit economies of scale, and therefore have lower profit margins. These variations suggest consideration of other firm specific variables, such as age and size, within the market share model. In our empirical setting, these additional factors encompassed within firm effects. Finally, Cowling and Waterson (1976) suggest a different model where the margin is directly proportional to market share, while industry average profitability is proportional to market concentration. This model highlights the possibility that both the market share and the market structure model may coexist.

2.1.3 Capital Asset Pricing Model (CAPM)

The third model considered in Slade (2004) is based on the CAPM (Sharpe, 1964; Lintner, 1965) developed in the financial economics literature. This model predicts that the rate of return (π_i) is a linear function of the beta factor of the firm times the excess current return on the market portfolio over and above the risk free rate, ($r_{mt} - r_f$). Since the beta factor is a function of the risk class to which the firm belongs ($RISK_i$) and ($r_{mt} - r_f$) is a time specific factor, the first order Taylor series expansion of the CAPM provides a simple model with firm and time effects, but no industry effects.²

2.1.4 Empirical evidence from western economies

The empirical literature on determinants of profitability is equally large and diverse. First, there is a substantial body of research in empirical IO that seeks to validate either the market structure or the market share model. Evidence in favour of either model is limited and, as the theoretical model in Cowling and Waterson (1976) demonstrates, both these models can hold simultaneously. However, the empirical literature is inconclusive in this matter.³ Further, while the SCP paradigm has become very unfashionable in the IO literature,⁴ it remains an important tool for antitrust authorities.

There is similarly a large literature in management science studying the relative importance of firm versus industry effects. Commencing with the contributions of Schmalensee (1985) and Rumelt (1991) several researchers have studied the determinants of corporate profitability in the United States. For one school of thought, inter industry differences constitute the main source of variation in performance, while firm specific characteristics are less important. For the other, the orientation of a firm's behavior towards making choices and firm characteristics, such as resources, capabilities and strategies, determine firm performance. Even in weak industries, stars consistently outperform the others, and in high-profit industries failures occur due to mis-

²We consider the above three models in this paper. Slade (2004) also considers a fourth model taken from the literature on natural resource economics. This model is not strictly relevant to our work here, but can also be simply represented in our setting by a combination of firm effects and a industry-time interaction effect.

³See Schmalensee (1989) for a summary of the empirical evidence.

⁴Slade (2004) argues that the main reason for this was persistent criticism on both theoretical and empirical fronts.

takes by firms. Over two decades of research based on US corporate data, general consensus has emerged that industry factors explain a relatively small proportion of the variations and a larger proportion of profit variations are attributable to firm or business specific characteristics. Macroeconomic factors, identified by time effects, and interaction between industry and time, representing different cyclical patterns in different industries, also contribute to profit variations. However, a substantial remainder of the variation in firm-level profitability cannot be attributed to any of these factors. Analysis for other OECD countries confirms this pattern (Schmalensee, 1989).

In a significant departure from both the above two strands of the literature, Slade (2004) put four alternative theoretical models of firm profitability to test. Using detailed business unit data on both market share and market structure for a number of markets, and including firms that potentially operate in several markets, she tests the main predictions of two of these models directly. There is evidence of a positive relationship between profitability and market structure, but not much empirical support for the hypothesis that high profits are an indication of monopoly power.

Like Slade (2004), we are interested in empirically evaluating the relevance of these alternative theories. However, our emerging economy context is very different, and further, we are primarily interested in understanding the impact of the economic liberalisation process on the industrial context in which Indian firms operate. Also, our data, accounting information on a sample of quoted companies, are very different. In line with the requirements of our research question and data, we follow Scott and Pascoe (1986) in replacing firm and industry variables, such as firm market shares and industry concentration ratios, with firm, industry and time fixed effects.⁵

Next, we discuss the institutional context of our empirical study.

⁵We are aware that this empirical approach precludes determining the sources of the differences between firm and industry effects. However, our approach is fit for the specific purpose of evaluating alternative models and further, is very robust to omitted variables, endogeneity, parametric distributional assumptions, and similar misspecifications.

2.2 Institutional backdrop

2.2.1 The Indian context

Our analysis covers the sixteen-year period from 1980-81 to 1995-96. We divide the period into three consecutive phases of five years, six years and five years respectively. The first five-year phase, one largely of command and control, notwithstanding a shift of regulatory policy in favour of private business, is from 1980-81 to 1984-85. The second six-year phase, one of partial liberalisation, runs from 1985-86 to 1990-91. The third five-year phase, one of full liberalisation, runs from 1991-92 to 1995-96.

The year 1980 is associated with the commencement of attempts to liberalise the Indian economy. In 1980, Mrs. Indira Gandhi returned to office and commenced liberalisation (Bhagwati, 1993; Rodrik and Subramanian, 2005). These reforms were largely probusiness, aimed at favouring the interests of incumbents rather than entrants or consumers (Rodrik and Subramanian, 2005). But severe political turmoil intervened and the period remained one of regulation and control (Marathe, 1989), with severe policy distortions (Srinivasan and Tendulkar, 2003), and she was assassinated in 1984.

In 1985, Rajiv Gandhi took office as head of government and commenced industrial reform activities on a fresh slate, but very soon the government was involved in scandal. Nevertheless, the probusiness stance of industrial policy continued, and there was modest progress in trade policy reform (Das, 2003); see also Rodrik and Subramanian (2005).

In 1991, a new government took office and had to react to a severe balance of payments crisis. Led by technocrats like Manmohan Singh, one its first acts was to liberalise the economy by removing past distortions, so as to promote economic growth (Srinivasan and Tendulkar, 2003). The reforms pursued in this period, focusing on trade liberalisation and reduction of entry barriers (Ganesh-Kumar et al., 2001; Kathuria, 2002), were largely promarket in nature rather than probusiness (Rodrik and Subramanian, 2005).

Thus, each phase was distinct in terms of its political economy and institutional features relating to industrial and financial policies. From a license-permit-quota focus prior to the 1980s, the economy moved towards ‘reforms by stealth’ in the first half of the 1980s, which gave way to ‘reforms with reluctance’ in the later half of the 1980s, and finally to ‘reforms by storm’ since 1991 (Bhagwati, 1993). Indeed, the above stages of economic liberali-

sation represent a natural experiment with significant ramifications for firms behaviours and market structure (Majumdar, 1996).

Further, theory suggests important roles for demand conditions in shaping the nature of inter-firm interactions and collusive behaviour (Machin and van Reenen, 1993). Therefore, in addition to controlling for time effects in our empirical analysis, we ensure that each of the above phases are broadly similar in terms of the economic cycle.⁶

2.2.2 Importance of institutional context

A fundamental driver of variation in economic experience between different countries has been the differences in institutions (Rodriguez and Rodrik, 2000). The microeconomic institutional infrastructure determines the distribution of resources within an economy, and shapes the outcomes feasible from organised activity.

In an institutional environment with strong barriers to entry and specification of detailed rules for the conduct of business, firm behaviour may be oriented towards political rent-seeking (Krueger, 1974) and politician management (Fisman, 2001). Resources may be directed towards political as opposed to efficiency enhancing activities (Becker, 1985). Firm effects picked up may predominantly relate to political and rent seeking tasks.

Thus, the importance of firm effects, in an economy such as India, will be strongly tempered by the degree to which firms will have operated within a controlled environment with strong barriers to entry, exit and conduct of business. Firm performance will be determined both by newly emergent market forces, economic factors and the legacy of economic planning and control (Mohan and Aggarwal, 1990; Bardhan, 2005).

The emergence of a promarket, rather than probusiness, institutional context could promote an industrial environment where margins for the average firm may get squeezed while competition enhances efficiency, and therefore profitability, of the leaders (Kambhampati and Parikh, 2003; Bhaumik and Dimova, 2004). Thus, firm effects may be important in both scenarios, at the same time as market structure may contribute to profitability differences. Studying the determinants of profitability differences between firms against

⁶Specifically, based on peak and trough dates of growth rate cycles (ECRI, 2010), the Indian economy spent approximately half of the time in growth and contraction phases during each of the three sub-periods considered here.

the context of institutional change in an emerging market economy is therefore an important counterpart to theory.

3 Data and Empirical Model

We now turn towards empirical validation of the theoretical models and evaluation of the role of institutions in the transition context of India. We discuss our data and present descriptive features, followed by our model and the econometric methods.

3.1 Data description

We use data drawn from the Reserve Bank of India (RBI) database on financial accounts of non-government public limited companies. The choice of the data is driven by two important factors. First, since the analysis spans sixteen years, we had to select a database with good and consistent coverage over this entire period. Second, it is necessary to use a database that paid attention to changes in accounting norms over this period.

The RBI database is an elaborate and consistent database on public limited Indian companies in the private sector maintained by the RBI since 1950–51 onwards. The data are based on balance sheets, profit and loss accounts and annual reports of companies.⁷ The overall dataset comprises a pooled cross-section, where a different sample of companies is surveyed each year. The data are widely perceived to have representative coverage of most sub-segments of the Indian corporate sector.⁸ It was important that the coverage was not only representative of the population in each year, but that it was consistent over the long period of time covered in the study.

⁷Aggregates based on these accounts inform policy and are used for compilation of national accounts. They are also used for estimating the growth and performance of the real sector of the Indian economy.

⁸The RBI public limited company data represents approximately 85 per cent of the paid-up capital of 86 3-digit industries (Feinberg and Majumdar, 2001). Additionally, the data are standardized into a common format across companies and time, maintaining consistency in accounting definitions. While proprietary, the RBI database has been commonly used for empirical work related to policy on the Indian corporate sector by government bodies and private researchers.

In our analysis, we exclude diversified firms, state owned enterprises and privately held limited companies. Further, we confine our analysis to the manufacturing sector. While some previous studies have attempted to distinguish between business, corporate parent and industry effects, our focus here is largely on firm and industry effects.⁹ SOEs are excluded because their operating business environment is very different from private sector firms, which constitute our main focus of analysis. Data on privately held limited companies are not publicly available on a consistent basis. These firms are typically much smaller than public limited companies, and their inclusion would introduce additional challenges in interpretation of firm effects; see also Slade (2004). Likewise, firms in service industries, including financial companies, are excluded because their behaviour over different stages of the economic cycle tend to be very different from manufacturing firms.

Between 1,600 and 3,500 companies are surveyed each year. However, while the RBI systematically collects data on large public limited firms, entries and exits in and out of the sample are a result of smaller firms that do not submit data rather than actual business attrition. Our core analysis is based on the balanced panel of 450 firms for the period 1980-81 to 1995-96, aggregating to a total of 7,200 firm-year observations. These data are classified into 22 industries, ensuring that each industry has at least 6 firms in each year.

Schamalensee (1989) discusses the relative merits of different accounting and economic measures for firm level returns. We main measure of profitability is return on assets (ROA), the ratio of profits net of depreciation, interest and tax to total assets. However, we also used operating profit margin (ratio of gross profits to sales) for robustness checks. Since the results for the latter measure are similar, we only report the results for ROA.

Table 1 presents a summary of the cross sectional distribution of ROA in 10 selected industries over the period of the study. There are substantial differences in profitability across industries and over time. We verify that the time-series of average ROA at the sectoral level is stationary.¹⁰ The

⁹Most of the firms in the sample are single business firms. While the RBI database includes several diversified firms, profits and financial characteristics for the different business units of these firms are not separately recorded. Hence, we omit diversified firms from our analysis. Therefore, we cannot consider business and corporate level effects separately.

¹⁰Panel unit root tests (Levin and Lin, 1993; Levin et al., 2002) reject the null hypothesis of non-stationarity at the 1 percent level of significance.

cross sectional distribution of ROA is negatively skewed for most industries and has high kurtosis. Therefore, the normality assumption, important for estimation of variance components, may be suspect. Hence, we pay attention to robust inference techniques.

3.2 Empirical model and tentative hypotheses

As discussed earlier, we follow Scott and Pascoe (1986) in working with a model where firm level profitability is explained by firm, industry and time specific effects, industry \times time interaction, and an idiosyncratic error term. Accordingly, the profitability π_{ijt} of firm i in industry j at time t is modeled as:

$$\pi_{ijt} = \mu + \alpha_i + \beta_j + \gamma_t + \delta_{jt} + \varepsilon_{ijt}, \quad (1)$$

where μ is the mean profitability, and α 's, β 's, γ 's, δ 's and ε 's denote firm effects, industry effects, time effects, industry \times time interaction effects and idiosyncratic errors respectively. This empirical specification captures the basic features of all the three theoretical models discussed in Section 2. The market structure model based on the SCP paradigm predicts the dominance of industry effects, while the market share ‘‘Chicago school’’ models predict the importance of firm effects. The simultaneous importance of both firm and industry effects is also consistent with the above models, and so are time effects or industry \times time interactions. The CAPM predicts the importance of firm and time effects, but not industry effects.

Admittedly, the model in equation 1 is not useful for causal analysis; see also Slade (2004). However, it has two important advantages. First, the model has a very elaborate specification, negating the plausibility of any omitted variable bias. Second, the empirical model is ideally suited for investigation of the relative importance of firm, industry and time specific factors, or industry-time interactions, in explaining variation in firm level profitability. However, because of potential endogeneity, the individual estimates of these effects cannot be assigned conceptual interpretation.

In the context of prior empirical evidence and the institutional setting discussed earlier, we now attempt to advance some tentative hypotheses regarding the validity of competing theoretical models in the transition context in India. Since the work of Mueller (1977), persistence in profitability has been a stylised fact consistently observed in corporate sectors around the

world. Further, Glen et al. (2001, 2003) find weaker persistence in developing countries, including India, supporting the counterintuitive hypothesis that intensity of competition in these countries may be comparable to, or even greater than, advanced economies. This suggests that firm effects may provide an important explanation for profitability differences in Indian industry, potentially increasing over the different stages of the liberalisation process with the emergence of a market economy. In the period of probusiness reforms, these firm effects could arise from abilities in rent-seeking and politician management (Krueger, 1974; Fisman, 2001), while in the promarket “reforms by storm” period, firm effects may truly reflect efficiency (Jovanovic, 1982).

In sharp contradiction to the above argument, the SCP paradigm is generally regarded as an useful model in developing countries, both for regulation and research. In the Indian context, for example, Kumar (1990) finds evidence in favour of an extended version of the SCP (Porter, 1979) where there are strategic groups within sectors with the possibility of mobility barriers between the groups. Further, Rodrik and Subramanian (2005) argue that promarket polices in the “reforms by stealth” and “reforms with reluctance” phases aimed at sustaining monopolistic advantages and entry barriers within Indian industry. This would suggest dominant industry effects during the first two phases of liberalisation. Industry effects may also be present in the post liberalisation promarket regime, perhaps in combination with firm effects, like in the Cowling and Waterson (1976) model.

Therefore, the implications for the relative importance of firm and industry effects in Indian corporate sector, based on prior evidence and research on the institutional setting, are ambiguous. The importance of the CAPM appears to be equally uncertain. In the context of the model in equation 1, CAPM implies that both firm and time specific factors should be important, but not industry effects. However, the prominence of an aggregate economic factor, representing return on the market portfolio, appears to be debatable in the Indian transition context. It has been observed that until the 1990s, there were no conventional business cycles in India, and fluctuations in economic activity were primarily due to weather conditions (Patnaik and Sharma, 2002).

The real test between alternate theories is, therefore, empirical. Our inferences on this question rest on relative importance of the different effects, and their changes over the three stages of the liberalisation process.

3.3 Econometric methods

To infer on the relative importance of the different effects, we assume independence between the effects, and between error and the effects. Unconditional independence may not be reasonable; therefore, we assume independence conditional on, or subject to, the inclusion of an adequate choice of interaction effects. In particular, it may be unreasonable to assume that the industry effects are independent of the year effects, because firms in different industries are potentially affected differently by changes in the economic environment. This dependence is incorporated in the model by including industry \times year interaction effects.

First, we estimated the above model with firm, industry and time fixed effects using the least squares dummy variables (LSDV) method, as well as a model with only firm and industry-time fixed effects. In either case, we also estimated a random effects specification, under the assumption that all the main and interaction effects included in the model, as well as the error term, arise randomly and independently of each other. The validity of this random effects assumption is judged by the Hausman test (Hausman, 1978), comparing the consistent fixed effects estimator with the random effects estimator, which is efficient when the random effects assumption holds. In both cases, we find overwhelming support for the random effects assumption, where the null hypothesis that the fixed effects and random effects estimates are the same cannot be rejected at the 5 percent level of significance. We, therefore, assume a random effects specification henceforth.¹¹ Under this model, the variance of π_{ijt} , denoted σ_π^2 , can be expressed as:

$$\sigma_\pi^2 = \sigma_\alpha^2 + \sigma_\beta^2 + \sigma_\gamma^2 + \sigma_\delta^2 + \sigma_\varepsilon^2. \quad (2)$$

This linear split of σ_π^2 into components corresponding to distinct sources of variation helps us assess the relative importance of the various effects in explaining overall variability in π_{ijt} .

Further, we assume Gaussian random effects. For the random effects model (equation 1) and the corresponding variance decomposition (equation 2), we choose methods that are robust to this distributional assumption for moderate sample sizes and allow the following kinds of inference:

¹¹The random effects model is useful for inferences on the relative magnitudes of different effects, but not on their specific values. In any case, estimates of the individual fixed effects are not meaningful in this case because of potential endogeneity.

1. Estimate the contribution of each factor to the overall variation in profitability, variance components, both in absolute terms (σ_α^2 , σ_β^2 , σ_γ^2 , σ_δ^2 and σ_ε^2) and in relative terms (for example, $\sigma_\alpha^2/\sigma_\pi^2$ or $\sigma_\alpha^2/(\sigma_\pi^2 - \sigma_\varepsilon^2)$).
2. Test for significance of each variance component: $\mathbb{H}_0 : \sigma_\theta^2 = 0$ against the alternative $\mathbb{H}_1 : \sigma_\theta^2 > 0$ for $\theta \in \{\alpha, \beta, \gamma, \delta\}$.
3. Assess the relative importance of different effects by testing hypotheses such as $\mathbb{H}_0 : \sigma_\alpha^2 = \sigma_\beta^2$ versus $\mathbb{H}_1 : \sigma_\alpha^2 > \sigma_\beta^2$.
4. Test for transition over the period of liberalisation by testing hypotheses such as $\mathbb{H}_0 : \sigma_{\alpha,t}^2 = \sigma_{\alpha,t-1}^2$ against the alternative $\mathbb{H}_1 : \sigma_{\alpha,t}^2 > \sigma_{\alpha,t-1}^2$.

Thus, in the context of understanding the relative importance of firm and industry effects within the dynamic Indian environment, we use a method to robustly estimate, and conduct hypothesis tests on, the variance components. In combination with the random effects model, the above model and methods provide a nice empirical framework to study the relative importance of various sources of variation in profitability, as well as to understand changes in these effects over different phases of reform.

We use maximum likelihood (ML) estimators under the assumption of Gaussian random effects.¹² This estimator of variance components has several merits. First, the ML method is asymptotically efficient under the maintained distributional assumptions, and the resulting estimators have standard Gaussian large sample distributions. Second, unlike some other competing variance component estimators, this method does not produce negative variance components estimates. Third, the ML estimator is quite robust to distributional assumptions (Brown and Mosteller, 1991).

Nevertheless, since the Gaussian distribution assumption is potentially violated in our data, we check robustness of our results in two ways. First, we consider the full unbalanced panel (which is much larger than the balanced panel) and compare our ML estimates with subsample estimates (Politis et al., 1999) based on the unbalanced data.¹³ In addition to efficiency, this subsampling approach has the advantage of allowing for random effects

¹²The ML estimator for the one way random effects model is discussed in Greene (2008, 547–549). We use a simple extension to our three way model with interaction (equation 1).

¹³We describe our subsampling procedure in the following section.

distributions that can be approximated by mixtures of the Gaussian distribution, which constitutes a very large class of distributions. Second, we use an alternative measure of profitability, the profit margin, and verify that inferences are qualitatively similar to those based on ROA.

Based on ML estimates of the variance components, we now describe our hypothesis tests. For testing the hypothesis $\mathbb{H}_0 : \sigma_\theta^2 = 0$ versus the alternative $\mathbb{H}_1 : \sigma_\theta^2 > 0$ for $\theta \in \{\alpha, \beta, \gamma, \delta\}$, we use the Breusch and Pagan (1980) test, which is asymptotically equivalent to the Lagrange multiplier test. Compared to the traditional Lagrange multiplier test, it is more robust to departures from normality (Koenkar, 1981).¹⁴

For the hypothesis that firm effects dominate industry effects, $\mathbb{H}_0 : \sigma_\alpha^2 = \sigma_\beta^2$ versus $\mathbb{H}_1 : \sigma_\alpha^2 > \sigma_\beta^2$, we use asymptotic normality of the maximum likelihood estimates. To study the effect of institutional change, we examine whether the effects have changed significantly between the different phases of liberalisation. This involves tests of hypotheses about the temporal stability of firm and industry effects, such as: $\mathbb{H}_0 : \sigma_{\alpha,t_1}^2 = \sigma_{\alpha,t_2}^2$ versus $\mathbb{H}_1 : \sigma_{\alpha,t_1}^2 > \sigma_{\alpha,t_2}^2$. These tests are also based on asymptotic normality of the ML variance component estimates.

4 Results and discussion

We obtain ML estimates of the variance components (equation 2) using on a balanced panel of 450 firms for the 16 years 1980-81 to 1995-96. These firms belong to 22 industries,¹⁵ each of which included at least 6 firms every year. Inferences were drawn on the relative importance of firm, industry and time (year) effects, and on the changes in variance components over the three phases of transition.

¹⁴Like the Lagrange multiplier test, the test exhibits local asymptotic efficiency and takes account of the fact that the null hypothesis lies on the boundary of the parameter space.

¹⁵Namely: Food products & beverages; Sugar; Tobacco; Cotton textiles; Man-made textiles; Silk and rayon; Jute & jute products; Paper & paper products; Chemical fertilisers & pesticides; Dyes; Paints & varnishes; Pharmaceuticals & medicines; Rubber & rubber products; Plastics and plastic products; Glass & ceramics; Cement; Metals; Fabricated metal products; Machinery & machine tools; Electrical machinery & apparatus; Radio, television & communication equipment; and Automobiles & transport equipment.

To check for robustness, we use the subsampling approach to draw similar inferences based on the full usable sample – an unbalanced panel of 2,030 firms.

4.1 Variance component estimates

The ML estimates of variance components separately for the three regimes are presented in the panel A of Table 2. In panels B and C, we report the variance components as percentages of the total variance in return on assets, and explained variance ($\hat{\sigma}_\pi^2 - \hat{\sigma}_\varepsilon^2$), respectively.¹⁶

Table 2 reveals that variance of firm level profitability has progressively increased over the three phases of liberalisation, from 62.98 in the ‘reforms by stealth’ regime to 79.6 during ‘reforms with reluctance’ and rose further to 138.7 in the five years from 1991. Firm effects were important determinants of differences in profitability during all the three regimes, accounting for 33 – 50 percent of total variation, while the share of industry effects ranged between 1 and 12 percent. Year and industry \times year effects were much smaller. The unexplained portion of the variance in profitability accounted for 45 – 57 percent of variations in profitability among the firms.

The dominance of firm effects is in agreement with the arguments of Glen et al. (2003) that corporate sectors in developing countries, including India, experience a high degree of competition. While the finding of competitive industry in a developing country context is somewhat counterintuitive, Singh (2003) lists several pro-competition structural contexts that fit the Indian case well; namely, (a) lower sunk costs of entry, which potentially leads to higher entry and exit and more competition (Hopenhayn, 1992), (b) faster growth of demand under imperfect competition and endogenous entry (Asplund and Nocke, 2006), (c) pro-competition industrial policies, such as price control, and (d) firm dynamics facilitated by economies of scale and scope, which in turn are promoted by large conglomerates. Thus, there appears to be good support for the market share model.

In contrast, support for the CAPM based model is weak, because year effects and industry-year interactions are practically nonexistent. This is not surprising, since conventional business cycles were absent in the Indian

¹⁶The results for the other profitability ratio, gross profit margin on sales, are very similar and not reported separately.

economy over the period under study, and financial markets functioned in very different ways.¹⁷ This also suggests that collusion may not have the cyclical patterns typical of western economies.

The estimates also clearly reveal the changing balance between firm and industry effects as the Indian economy moved from a regime of regulation pre-1985, to partial liberalisation, and finally to a phase of comprehensive liberalisation since post 1991. The proportion of variation in ROA explained by firm effects was higher in the ‘reforms with reluctance’ phase, at 49.5 percent, perhaps as firms learnt to function within a changing institutional environment, relative to the regulated period when it was 33.8 percent. At 38.7 percent, it was somewhat lower in the post 1991 period, mainly because the increase in total variance was driven by industry effects.

The share of industry effects was very small in the ‘reforms by stealth’ and ‘reforms with reluctance’ regimes, at 3.5 percent and 1.1 percent respectively. This provides evidence against the market structure model before promarket reforms were unleashed post 1991. It is possible that regulation prevented monopoly power in many sectors, particularly those where large state firms were not operating; see also Singh (2003). The size of industry effects, however, increased sharply to 11.8 percent in the ‘reforms by storm’ period. In a contestable markets environment, which the institutional changes brought about, variation in concentration across industries provided an important explanation for increased variation of firms’ profitability.

4.2 Absolute and relative importance

Statistical tests for the hypothesis that variance of firm effects and industry effects are zero are reported in Table 3. We also report on the test that firm effects and industry effects are equally important against the alternative that variation in firm effects is larger than industry effects. The tests are conducted separately for the three regimes.¹⁸

The tests for significance of firm effects, $\mathbb{H}_0 : \sigma_\alpha^2 = 0$ versus $\mathbb{H}_1 : \sigma_\alpha^2 > 0$, reject the null hypothesis of zero firm effects. The significant firm effects in all the three phases, suggest that firm capabilities have mattered at all times in Indian industry, both under a controlled regime when rent seeking was

¹⁷Singh (1997) provides a good discussion in the Indian context.

¹⁸Time (year) and industry-year effects are not significant in any phase. The corresponding tests are not reported.

rewarded, and under liberalisation, both partial and more comprehensive, when efficiency and productive performance was rewarded.

However, unlike firm effects, tests for the significance of industry effects, $\mathbb{H}_0 : \sigma_\beta^2 = 0$ versus $\mathbb{H}_1 : \sigma_\beta^2 > 0$, provide mixed evidence and demonstrate an important dimension of the liberalisation process. In line with inferences drawn from the proportions, the null hypothesis of zero industry effects is rejected in period post 1991, when the economy entered the ‘reforms by storm’ phase, but not before. These significant industry effects in the promarket liberalisation period, when industry factors began to influence firms’ profitability, show that in the controlled and regulated environment of Indian industry prior to liberalisation, it did not matter so much which industry a firm belonged to. In other words, our evidence would suggest that the SCP paradigm did not hold over either of these two probusiness regimes. Active antitrust regulation, combined with price controls and protection against external competition, ensured that there was negligible variation in rates of return across sectors. This contingency no longer held after the opening up of markets. The choice of industry, and subsequent positioning within it, started to matter significantly in influencing profits.

Finally, we evaluate whether firm effects and industry effects were equal or if firm effects dominated industry effects: $\mathbb{H}_0 : \sigma_\alpha^2 = \sigma_\beta^2$ versus $\mathbb{H}_1 : \sigma_\alpha^2 > \sigma_\beta^2$. We find that firm effects were larger than industry effects under all policy regimes. Thus, the firm’s ability to operate appropriately within the prevailing business environment has always been rewarded, whether this be rent-seeking and political behaviour in the earlier phases, or efficiency in the post-liberalisation period.

4.3 Change in effects over transition phases

Further, against the context of a transition, it is important to assess if firm and industry effects have changed significantly over different phases of liberalisation. Table 4 reports tests of the null hypothesis that the variances of firm effects, industry effects and the sum of industry random effects and industry-year interactions remained unchanged in the transition from the ‘reforms by stealth’ regime to ‘reforms with reluctance’, and subsequently to the ‘reforms by storm’ period. In each case, the alternative hypothesis is that the corresponding variance component has increased; for example, $\mathbb{H}_0 : \sigma_{\alpha,t}^2 = \sigma_{\alpha,t-1}^2$ versus $\mathbb{H}_1 : \sigma_{\alpha,t}^2 > \sigma_{\alpha,t-1}^2$.

Table 4 shows that firm effects have increased significantly as the Indian economy moved from a command and control to a partially liberalised regime, and again when that regime gave way to a promarket liberalisation regime. Remarkably, the increase in the variance of ROA in the first of the above two transitions was almost entirely due to increase in the firm-level variance component. In the second transition, from probusiness to promarket regime, about half of the increase was due to residual variance, while firm and industry effects split the other half almost equally.

Within the institutional context of Indian liberalisation, why might firm effects have become more important in the partial liberalisation regime? Previous research suggests that the stance of industrial reforms did not substantially change over the first two phases of liberalisation. Rodrik and Subramanian (2005) argue that over this period policy was probusiness, rather than promarket, while Srinivasan and Tendulkar (2003) claim that reforms based on fiscal expansionism during this period was ineffective. It would appear that, with time the population of firms was sorted according to their ability to earn higher returns through rent-seeking and political opportunistic behaviour. This contributed to the observed rise in the variation of firm effects and profitability.

In contrast, promarket reforms and competitive forces were unleashed in the third regime, leading to a rise in both firm and industry effects. Since causal patterns cannot be inferred from our study, it is as such unclear as to whether the market structure or the market share model holds in the post-liberalisation period, or whether a combination of both was active. However, in so far as firm effects continued to dominate industry effects, one may infer that efficiency was valued by higher profitability. At the same time, liberalisation supported the emergence of a competitive market in India where market concentration, entry barriers and other similar industry level effects may affect variation in profitability among firms.¹⁹

4.4 Subsampling

The assumption of Gaussian distributions for the random effects and the error term, which underscores the ML estimation method, is strong and unlikely

¹⁹We also tested whether industry effects and industry-year interactions together may have increased from the ‘reforms by stealth’ to the ‘reforms with reluctance’ regime. However, the null hypothesis of no change over these two phases could not be rejected.

to be supported by the data.²⁰ While maximum likelihood estimation of the random effects model is generally robust to such misspecification (Brown and Mosteller, 1991), we also verify the robustness of our main empirical findings by relaxing the distributional assumption. Specifically, rather than the balanced panel used above, we estimate variance components for the random effects model based on subsamples drawn from the fullest unbalanced panel data available in the RBI database. This approach offers three main advantages in our case.

First, the subsampling methodology (Politis and Romano, 1994; Politis et al., 1999) is powerful and simple to use, and can be readily applied to consistently approximate the sampling distribution of sample statistics under minimal assumptions. In our case, these sample statistics are ML estimates of variance components. Second, while the Gaussian assumption may be tenuous in our specific application, the subsampling methodology will still be valid so long as the unknown random effects distribution can be represented by a mixture of Gaussian densities. This class of mixture distributions is very large, and encompasses a very broad range of higher moments (including positive and negative skewness and excess kurtosis). While estimation of variance components by subsampling is consistent in this case, the convergence rate needs to be estimated by a preliminary round of subsampling (Politis et al., 1999). Third, since our model includes a wide collection of random effects (firm, industry and time effects, plus industry-time interactions), our model may not be susceptible to sample selection bias due to attrition within the population of firms. Nevertheless, one can imagine that if observations from the tails of the profitability (or firm effects) distribution were self selected out of the balanced sample, estimates of variance components or the total variation in ROA may be biased; the subsampling approach addresses any such potential selection issues.

We now turn to a brief discussion of the methodology. The idea underlying subsampling is simple, entailing computation of a statistic for subsamples of the data selected without replacement. The values of the statistic for the different subsamples are then used to estimate moments of the statistic and to construct an approximation to the sampling distribution. In particular, the sample mean based on a large number of subsamples can be used to

²⁰The cross sectional distributions of ROA, our measure of profitability, do not exhibit zero skewness (Table 1), and this clearly points to violation of this assumption.

estimate an unknown population mean, and the sample standard deviation provides an estimate of the standard error (Politis et al., 1999).

Our implementation of the methodology is based on drawing subsamples from the 2,030 firms have been in the dataset for at least six years.²¹ First, we draw 100 subsamples of 675 firms,²² ensuring that each of the 2,030 firms appears at least once in the sample. Second, for each of these 100 subsamples, we obtain ML estimates of variance components corresponding to firm, industry and time effects.²³ In addition to providing inference similar to usual bootstrap aggregation (bagging), this approach based on subsampling also vastly facilitates computation. In fact, the high computation intensity associated with the full bootstrap approach would render computation based on 2,030 firms nearly impossible.

The subsampling estimates of variance components, as well as other related inferences, are very similar to the balanced panel results. Specifically, magnitudes of estimated variance components corresponding to firm, industry and year effects are very similar to the ML estimates. In particular, firm effects cover 36.1 percent, 45.4 percent and 41.8 percent of the total variance of firm profitability in the three phases of liberalisations respectively; correspondingly, industry effects comprise 4.7 percent, 4.2 percent and 5.6 percent respectively, while year effects explain 4.0 percent, 1.1 percent and 0.5 percent of total variance respectively. Further, firm effects dominate year effects and the null hypothesis of no year effects is supported in all three phases, and tests on changes in firm and industry effects over the three phases provide very similar patterns to the balanced data case. The only major point of difference in inferences lies in significant industry effects in each of the three phases, which we interpret as the result of much larger sample size.²⁴

²¹The total number of firms that has ever appeared in the RBI database over the 16 year period under analysis is 3,187.

²²In the current case, a subsampling proportion of about one-third of the total firms ($2,030/3 \approx 677$) produces estimators with finite sample properties comparable to a full bootstrap.

²³The industry-year interactions were not included because the maximum likelihood procedure failed to converge for most subsamples. Further, iterations of the expectation-maximization algorithm indicate that the variance component for industry-year interactions was zero in the above cases.

²⁴Detailed tables of results are not reported in the interest of space.

5 Conclusions

We study variation in firm level profitability against the backdrop of economic reforms in India with a view to understand the relevance of several theoretical models of profitability. Using panel data on Indian public limited manufacturing companies over the period 1980-81 to 1995-96, we examine the relative importance of firm, industry and time effects, as well as industry-time interactions, in explaining profitability differences.

Our work highlights the importance of accounting for institutional factors in the analysis of profitability variations among firms. In transition economies and emerging markets, it is particularly important to understand the role of government policy in influencing the strength of the effects. We do so by conducting comparative analyses over three periods, each capturing a different institutional regime in Indian industry.

Starting a period of extensive regulatory controls, the Indian economy went through three stages of progressive liberalisation in the 1980s and early 1990s. Probusiness reforms initiated in the early 1980s were very slow and had minimal real impact. Then, hesitant and partial domestic reforms were instituted in 1985, but political difficulties intervened. Financial difficulties forced the administration into comprehensive promarket reforms only in 1991. We assess the shifts in the relative balance of firm effects and industry effects across the two distinctly separate liberalisation regimes that have unfolded in India.

We find evidence that liberalisation significantly affects the absolute and relative importance of firm and industry effects in shaping the profitability of Indian firms. Firm effects are always important, whether in a command and control regime, with potential benefits accruing from protectionism and political rent seeking, or in the competitive market environment where the firms' productivities and efficiencies are valued. Industry effects are important in the promarket reform phase, and time effects do not turn out to be important.

Further, we find that firm effects get stronger over time as the institutional forces enhance market contestability. As the market becomes more dominant in the resource allocation process, relative to the government, so does the role of efficiency, becoming more important in explaining profit variations. By contrast, industry effects are negligible in the first two phases, and start being important only once promarket reforms are initiated.

Our findings have important implications for theory. Though the main causal implications of the market structure or the market share models cannot be tested in our setting, some important conclusions can be drawn from the relative importance of firm, industry and time effects. The market structure model, on which the structure-conduct-performance paradigm is based, predicts a causal link from market structure to monopoly profits, and therefore to profitability. Since industry effects are negligible during the two phases in the 1980s, the market structure model appears not to hold before the full liberalisation regime begins in 1991. In contrast, since firm effects are always dominant, there is evidence consistent with the market share model over all the three phases of transition. This model posits the causal relationship to run in the opposite direction to the market structure model; firm efficiency leads to higher profitability and thereby to more concentrated markets. Further, since time effects are negligible, there is no evidence for a CAPM type model predicting a role for both firm and time effects.

The above evidences have crucial policy relevance. While antitrust and competition authorities in developed countries tend to balance anticompetitive and efficiency considerations (Mueller, 1996), those in developing countries often implicitly believe in a causal link from market structure to profitability (the market structure model). Our results, however, cast serious doubts on this assumption, particularly in the first two phases before pro-market reforms were undertaken. Rather, excess profitability in the ‘reforms by stealth’ and ‘reforms with reluctance’ regimes appear to be driven by firm capabilities in exploiting political rent-seeking opportunities. This demonstrates that the nature of competition in any market requires to be carefully examined before implementing antitrust regulations. Further, like Glen et al. (2003), our evidences support the view that developing country markets can sometimes be quite competitive. Since a poor competitive environment and disregard for profits in corporate investment decisions are often thought to be important causes for macroeconomic instability and crises, these findings have crucial importance for macroeconomic policy too.

Further, our results demonstrate that pro-market reforms enhance returns to efficiency, but also have the potential to introduce a concentration-profitability link. In other words, market contestability has enhanced industry effects, which is possibly indicative of firms in India choosing the right industries and segments to enter, do business in and enjoy industry-specific economic returns.

At the same time, major institutional changes, such as comprehensive liberalisation of the industrial economy, increases the volatility of the business environment. It is anticipated that increased volatility due to economic shocks will impact the decisions and performance of firms. Thus, the role of the time effect, capturing macroeconomic and cyclical strategic interaction effects, can also become important.

Understanding the causal relationships underlying the market share and market structure models will be an important area of further research. Likewise, more elaborate evaluation of the time effect within an industrial economy driven by conventional cycles, as well as decomposition of the time effect is potentially an important exercise within an industrial organisation research agenda in a post-liberalisation emerging economy context.

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Table 1: Average Return on Assets in Major Industries

Major industries are industries with at least 20 firms in each of the years. For each industry, we report average ROA, standard deviation and skewness in the years 1980-81 and 1995-96. These are the end points of our analysis. We also report the year in which average ROA were the maximum or the minimum of all years. Number of observations: 7,200 firm-years.

Industry	For the Year 1980-81			For the Year 1995-96			For the Entire Period	
	Mean	Standard deviation	Skewness	Mean	Standard deviation	Skewness	Minimum (Year)	Maximum (Year)
<i>Automobiles</i>	4.19	11.94	1.21	6.24	6.80	-1.77	-1.49 (87-88)	6.24 (95-96)
<i>Cement</i>	-0.12	10.65	-1.75	5.62	11.02	-0.52	-6.65 (88-89)	7.28 (95-96)
<i>Ceramics</i>	3.66	16.58	-2.61	2.76	9.94	-1.08	-6.36 (90-91)	7.01 (81-82)
<i>Cotton Textiles</i>	3.89	7.97	-1.50	-4.13	16.60	-5.15	-6.83 (84-85)	4.59 (90-91)
<i>Electrical Machinery</i>	4.71	8.57	-2.50	3.39	8.37	-1.32	-0.76 (84-85)	4.71 (80-81)
<i>Metals</i>	3.07	12.86	-1.41	3.67	15.38	1.67	-2.00 (87-88)	4.94 (81-82)
<i>Paper</i>	2.81	7.95	-1.38	8.42	9.94	2.17	-7.99 (87-88)	8.42 (95-96)
<i>Pharmaceuticals</i>	2.67	8.38	-2.33	4.88	12.40	-2.34	1.08 (88-89)	6.79 (94-95)
<i>Rubber</i>	0.82	11.79	-1.17	6.81	14.23	4.66	-0.52 (87-88)	6.81 (95-96)
<i>Sugar</i>	3.22	13.20	-0.36	-0.44	9.94	-2.29	-3.39 (84-85)	5.38 (93-94)
All industries	2.96	11.48	-0.50	3.44	12.87	-0.97	-1.41 (87-88)	3.92 (94-95)

Table 2: Statistics from the Components of Variance Analysis of Return on Assets – Balanced Panel (Number of firm-years: 7,200)

<i>Panel A. Estimates of the Variance Components (standard errors in parentheses)</i>							
Phases of liberalisation	Firm Effects	Ind. Effects	Year Effects	Ind.-Year Eff.	Res. Variance	Ind.-Year Eff.	Res. Variance
“Reforms by Stealth”: 1980-81 to 1984-85	21.2 (2.0)	2.2 (1.6)	2.2 (1.5)	1.7 (0.6)	35.5 (1.2)		
“Reforms with Reluctance”: 1985-86 to 1990-91	39.4 (3.1)	0.9 (0.8)	1.1 (0.8)	1.8 (0.7)	36.5 (1.1)		
“Reforms by Storm”: 1991-92 to 1995-96	53.7 (4.8)	16.3 (7.7)	0.5 (0.6)	3.1 (3.1)	65.1 (3.1)		

<i>Panel B. Share of Variance Explained by each Component Expressed as Percentage of Total Variance</i>							
Phases of liberalisation	Firm Effects	Ind. Effects	Year Effects	Ind.-Year Eff.	Res. Variance	Ind.-Year Eff.	Res. Variance
“Reforms by Stealth”: 1980-81 to 1984-85	33.8 percent	3.5 percent	3.5 percent	2.7 percent	56.5 percent		
“Reforms with Reluctance”: 1985-86 to 1990-91	49.5 percent	1.1 percent	1.4 percent	2.2 percent	45.8 percent		
“Reforms by Storm”: 1991-92 to 1995-96	38.7 percent	11.8 percent	0.4 percent	2.2 percent	46.9 percent		

<i>Panel C. Share of Variance Explained by each Component Expressed as Percentage of Explained Variance</i>							
Phases of liberalisation	Firm Effects	Industry Effects	Year Effects	Ind.-Year Eff.	Res. Variance	Ind.-Year Eff.	Res. Variance
“Reforms by Stealth”: 1980-81 to 1984-85	77.8 percent	8.0 percent	8.0 percent	6.2 percent			
“Reforms with Reluctance”: 1985-86 to 1990-91	91.3 percent	2.0 percent	2.6 percent	4.1 percent			
“Reforms by Storm”: 1991-92 to 1995-96	72.9 percent	22.1 percent	0.7 percent	4.2 percent			

**Table 3: Results of Tests of the Significance of Firms and Industry Effects -
Balanced Panel (Number of firm-years: 7,200)**

	Column (I)	Column (II)	Column (III)
	<i>Null Hypothesis:</i> Firm Effects are Zero $H_0: \sigma_{\alpha}^2 = 0$ vs. $H_1: \sigma_{\alpha}^2 > 0$	<i>Null Hypothesis:</i> Industry Effects are Zero $H_0: \sigma_{\beta}^2 = 0$ vs. $H_1: \sigma_{\beta}^2 > 0$	<i>Null Hypothesis:</i> Firm Eff. Equal Ind. Effects $H_0: \sigma_{\alpha}^2 = \sigma_{\beta}^2$ vs. $H_1: \sigma_{\alpha}^2 > \sigma_{\beta}^2$
Regime			
“Reforms by Stealth”:			
1980-81 to 1984-85	Reject H_0 (0.000)	Do not reject H_0 (0.166)	Reject H_0 (0.000)
“Reforms with Reluctance”:			
1985-86 to 1990-91	Reject H_0 (0.000)	Do not reject H_0 (0.279)	Reject H_0 (0.000)
“Reforms by Storm”:			
1991-92 to 1995-96	Reject H_0 (0.000)	Reject H_0 (0.029)	Reject H_0 (0.000)

Note: Figures in parentheses are p -values

**Table 4: Change over Time in the Magnitude of the Variance Components –
Balanced Panel (Number of firm-years: 7,200)**

	<i>Column (I)</i>	<i>Column (II)</i>
	<p>“Reforms by Stealth” Regime to “Reforms with Reluctance” Regime (1980-81 to 1984-85 period and 1985-86 to 1990-91 period)</p>	<p>“Reforms with Reluctance” Regime to “Reforms by Storm” Regime (1985-86 to 1990-91 period and 1991-92 to 1995-96 period)</p>
<p><i>Null Hypothesis:</i> No Difference in Firm Effects between One Period and the Next <i>Alternate Hypothesis:</i> Subsequent Period Firm Effects Larger than Prior Period Firm Effects</p>	<p>$H_0: \sigma_{\alpha,t}^2 = \sigma_{\alpha,t-1}^2$ vs. $H_1: \sigma_{\alpha,t}^2 > \sigma_{\alpha,t-1}^2$</p>	
Firm effects (α)	Reject H_0 (0.000)	Reject H_0 (0.006)
<p><i>Null Hypothesis:</i> No Difference in Industry Effects between One Period and the Next <i>Alternate Hypothesis:</i> Subsequent Period Industry Effects Larger than Prior Period Industry Effects</p>	<p>$H_0: \sigma_{\beta,t}^2 = \sigma_{\beta,t-1}^2$ vs. $H_1: \sigma_{\beta,t}^2 > \sigma_{\beta,t-1}^2$</p>	
Industry effects (β)	Do not reject H_0 (0.772)	Reject H_0 (0.023)
<p><i>Null Hypothesis:</i> No Difference in Industry and Industry \times Year Effects between One Period and the Next <i>Alternate Hypothesis:</i> Subsequent Period Industry and Industry \times Year Effects Larger than Prior Period</p>	<p>$H_0: \sigma_{\beta,t}^2 + \sigma_{\delta,t}^2 = \sigma_{\beta,t-1}^2 + \sigma_{\delta,t-1}^2$ vs. $H_1: \sigma_{\beta,t}^2 + \sigma_{\delta,t}^2 > \sigma_{\beta,t-1}^2 + \sigma_{\delta,t-1}^2$</p>	
Ind. and Ind.-Year eff. ($\beta + \delta$)	Do not reject H_0 (0.731)	Reject H_0 (0.023)

Note: Figures in parentheses are p -values