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Firms, Markets, and the State: Institutional Change and Manufacturing Sector Profitability Variances in India

UTD AUTHOR(S): Sumit Kumar Majumdar

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Sumit K. Majumdar
Jindal School of Management, University of Texas at Dallas, Richardson, Texas 75080, majumdar@utdallas.edu
Arnab Bhattacharjee
School of Management and Languages, Heriot-Watt University, Edinburgh EH14 4AS, United Kingdom, a.bhattacharjee@hw.ac.uk

We assess absolute magnitudes, relative importance, and intertemporal differences in firm, industry, and business group effects in explaining the variance of Indian manufacturing firms’ profitability over the 26-year period between 1980–1981 and 2005–2006. We stratify the data by institutional phases to place emphasis on the role of changing institutional factors in an emerging economy: first as a regime of command and control transits to partial liberalization (between 1985 and 1991) and then to an open competitive market economy (after 1991); thereafter, financial reforms occur, followed by legal reforms. We find that liberalization significantly affects and alters the relative importance of firm, industry, and group effects. Firm effects are always important, whether in a command and control regime, with benefits accruing from protectionism and political rent seeking, or in liberalized periods where firm-specific capabilities and dynamic efficiencies are valued. Industry effects are significant in the command and control regime, when mandatory sector placement benefits firms in industries with superior profits, and in the liberalized period, when the choice of the industry segment in which to operate is open to firms. Thereafter, industry effects dissipate. Business group effects matter in explaining profitability variances. Group effects’ magnitudes, however, do not change significantly over time.

Keywords: firm effects; industry effects; group effects; institutional change; Indian industry; liberalization; manufacturing sector; profitability variance analysis; reforms

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1. Introduction

The strategic management and industrial organization economics literatures have focused on firm performance as a key outcome (examples of the former include Wiggins and Rueflı 2002, Hawawini et al. 2003, Bou and Satorra 2007; Slade 2004 exemplifies the latter). Writing in both disciplines has evaluated firm average profitability levels. In one view, industry effects matter more in explaining average profitability differences between firms; firms are lucky to have entered a profitable industry by chance or politics. Having entered, they take advantage of opportunities for exploiting market power. Market structure-related factors influence firms’ profitability levels. Higher concentration, driven by industry-specific factors (Sutton 1991), facilitates market power exercise by large firms, thereby generating superior profitability (Slade 2004).

Alternatively, firm effects are posited to matter the most in explaining profitability differences. Firms have idiosyncratic skills, generating endogenous efficiencies that enable them to become profitable. This perspective on industrial organization and performance (Mancke 1974) suggests that the positive relationship between size, market structure, and average profitability arises because larger firms are more efficient as a result of endogenous factors. This increases industry concentration and enables firms to earn higher profits. Mueller (1977), reporting significant firm-level profitability persistence over time, was among the first to highlight the empirical validity of the endogenous firm effect.

A literature has since evolved that gauges the relative importance of firm versus industry effects in explaining firm performance. Starting with Schmalensee (1985), this literature focuses on the decomposition of profitability variance so as to understand the magnitude of various effects. Schmalensee (1985) seeks to determine whether firm or industry effects play a larger role in describing the variance in profitability between firms; he finds that industry effects are more significant in explaining profitability variances. In this line of research, Rumelt (1991) points to firm effects, encapsulating a variety of endogenous competencies, as being larger in explaining profitability variances, a conclusion Scott and Pascoe (1986) also arrive at and a finding supported by other scholars’ views (see Lippman and Rumelt 1982, Prahalad and Hamel 1990, Nelson 1991, Wernerfelt 1984).

The analysis of variance in firms’ profitability as a research area has numerous contributions in the management literature (see Powell 1996, Brush and Bromiley 1997, Mauri and Michaels 1998, McGahan and Porter 2002, Misangyi et al. 2006, Short et al. 2006). The
literature has generated debate about which effects are primary because there have been large differences between studies on the size of firm effects and on methods questions. Several contributions have established either industry or firm effects as being more significant in explaining profitability variations across firms. Yet both firm and industry effects are important (Chang and Singh 2000). The resource and competence bases of industries differ, whereas structural environment differences give rise to firm effects (McGahan 2004).

Recent analyses of average profitability-level differences exist for emerging markets (see Glen et al. 2001, Chacar and Vissa 2005, Chen and Lin 2006, Diaz Hermelo and Vassolo 2010). In the profitability variance decomposition-based literature, recent extensions have incorporated corporate (Chang and Singh 2000), business group (Chang and Hong 2002), host country (Makino et al. 2004), and home country (McGahan and Victer 2010, Diaz Hermelo and Vassolo 2012) effects. The context for much of the work based on profitability variance decomposition has been Western economies. McGahan and Porter (2002, p. 849) state that “[t]he most direct opportunities for further research reside in exploring new data. Reliable and comparable data on the accounting profits of firms in other parts of the world yield insight on questions about the relationships between the national economic environment and industrial performance.”

Across economies, institutional factors vary. Institutions are generative forces defining the context. The role of political factors is important across national domains (de Figueiredo 2002). Along with economic environment heterogeneity, political environment heterogeneity exists (Murtha and Lenway 1994). The state directly influences firms’ behavior (Henisz and Zelner 2005, Spencer et al. 2005). Nonmarket objectives support business strategies (Hillman and Hitt 1999), and the role of political factors is enhanced in emerging markets (Mudambi et al. 2002, Mudambi and Navarra 2003, Henisz et al. 2005, Majumdar 2012). Profitability variance analyses have been extended to South Korea (Chang and Hong 2002) and Taiwan (Lieu and Chi 2006). Recent analyses of Latin American countries (Brito and Vasconcelos 2006; Diaz Hermelo and Vassolo 2010, 2012) take different institutional environment issues into account.

For emerging economies, a business group contingency arises. Business groups are confederations of legally independent firms. Although they play a role in Western economies (Whitley 1992), they are an especially important feature in emerging economies (Leff 1978, Goto 1982). Groups’ roles allow affiliated firms to overcome obstacles caused by missing markets and adequate institutions characterizing emerging economies (Leff 1978). For India, conflicting findings of positive (Khanna and Rivkin 2001) and negative outcomes (Chacar and Vissa 2005) to group affiliation exist, warranting group inclusion as an attribute explaining profitability variance. In similar literature, there is one other study of business group effects (Chang and Hong 2002).

We report the results of a study examining the profitability variance of Indian firms. Using an extensive data set on Indian firms, we evaluate the importance of firm effects versus industry effects versus group effects in explaining profitability variances for a substantial panel of manufacturing firms over the 1980s, 1990s, and 2000s. Our study adds to a corpus of recent articles on Indian firms (see Feinberg and Majumdar 2001, Chittoor et al. 2009, Kumaraswamy et al. 2012) and contributes to the literature by evaluating variances in firms’ profitability, given changing institutional conditions.

Four recent studies (Makino et al. 2004, Brito and Vasconcelos 2006, McGahan and Victer 2010, Diaz Hermelo and Vassolo 2012) evaluate profitability variances across countries and differing institutional contexts. In these analyses, data are stratified to parse different factors to explain the findings. Data stratification is a key characteristic, permitting nuanced interpretation of factors giving rise to effects. In evaluating Indian firms’ profitability based on stratification, our analysis is in the same spirit. We stratify our data temporally, according to the changing institutional conditions.

Our article contributes to the evaluation of the importance of firm effects versus industry effects versus group effects in India against the backdrop of economic reforms in the late 1980s, the 1990s, and the 2000s. We evaluate the extent to which firm effects are significant, in an absolute sense and in relation to other effects; whether industry effects are important; the extent to which group effects are important; and whether the magnitudes of firm, industry, and group effects have changed over the periods of institutional transition.


In the literature involving the decomposition of business-unit profitability variance, when apportioning variances to firm, industry, corporate, group, or other effects, conclusions are based on the estimated effects size. Analyses are descriptive (Schmalensee 1985). Only one other study (Chang and Hong 2002) to our knowledge
undertakes statistical inference. The statistical significance of the magnitude of the different effects—whether each effect is pronounced, whether any of the effects vary over time, and whether one component is significantly larger than another—is generally untested. We test for the statistical significance of the estimated effects and also statistically test for the effects’ differences over time.

The rest of this paper is organized as follows. Section 2 contains a synopsis of the ideas presented previously in research. Section 3 discusses why shifts in Indian policy impact firms’ underlying behavior and how these shifts relate to the different effects that explain profitability variance; several short hypotheses are developed. Section 4 contains our analyses, and §5 presents our results. We present a discussion in §6 and conclude in §7.

2. Literature

Starting with Schmalensee (1985) and Rumelt (1991), researchers have tried to explain variances in firms’ profitability in the United States. In one school of thought, interindustry differences are the main sources of performance variance (Schmalensee 1989), and firm-specific characteristics are regarded as less important. Industry-specific factors encapsulate features such as the industry concentration level; industry consolidation versus fragmentation; minimum capital requirements, an important entry barrier in some industries, and product differentiation, also an entry barrier. Firm-specific characteristics encapsulate firm resources, capital, technology and human resources, marketing, service, management, and production skills.

In the other school of thought, the orientation of a firm’s behavior toward making choices and firm characteristics such as resources, capabilities, and strategies determine performance (Nelson 1991). Even in weak profit-potential industries, star firms consistently outperform others. In high-profit industries, failures occur as a result of firms’ mistakes. Two decades of research have led to the consensus that industry factors explain a small proportion of profitability variances. A larger proportion of profitability variances is attributable to firm characteristics. Theoretical developments postulate that the firms’ underlying competencies that predicate higher profits also lead to changes in industry conditions. Differences in the resource and competence bases of industries arise, influencing profits; structural environment differences and country-specific factors give rise to firm effects (McGahan 2004).

Institutions define the atmosphere for activity conduct for several generations. They vary across contexts and time (de Figueiredo 2002). These variations are pronounced in emerging markets (Mudambi et al. 2002). The political economy environment is altered if the state plays a direct role in influencing firms’ behavior (Henisz and Zelner 2005). Institutions influence human behavior (Barley and Tolbert 1997) by their logics, shaping behavior via effects on individuals’ cognition (Friedland and Alford 1991). Institutions influence firms’ responses to pressures (Oliver 1991), and institutional changes significantly influence how firms handle economic situations (Thornton and Ocasio 1999). Institutional changes alter property rights (North and Thomas 1973), and firms’ performance variations occur because of behavioral influences of different regimes (Fukuyama 2011).

Institutions shape competitors’ incentives (North 1991). Governments control key economic sectors, permitting the exercise of material power over the lives of people (Earle 1997). Institutional barriers influence investments in capital, technology, and the organization of production (Parente and Prescott 2002). In addition, government agencies use institutional review boards to oversee the day-to-day activities of firms or provide facilitating processes (Evans 1995). In an environment with strong specifications of detailed business conduct rules, including decisions about the explicit industry segment in which firms should participate (Marathe 1989, Das 2002), firm behavior is oriented toward political rent seeking (Bhagwati and Desai 1970) and politician management (Fisman 2001, Das 2002). Resources are directed toward political versus commercial activities (Hillman and Hitt 1999). Firm effects identified in such a regime can substantially relate to rent-seeking tasks (Schuler et al. 2002).

An institutional context hindering efficiency in inputs and outputs markets could generate increasing returns to political behavior. Industry effects may be immaterial in such a milieu. Hence, profitability variance explanations in an economy such as India could tempered by the degree to which firms have operated in a controlled environment with strong barriers to entry and detailed government control of business. If conditions change, then profitability variances could be affected by both newly emergent market forces and a command and control regime legacy (Jalan 2005).

Although we are concerned with firm versus industry effects, we also address issues related to business groups because these are consequential in emerging markets (Khanna and Rivkin 2001). Business groups form in such markets because of imperfect institutions (Leff 1978). They appropriate scarce resources for group firms, permit diversification via the use of group company funds, and create upstream and downstream vertically related activities. Business groups are important in controlled regimes (Chang and Hong 2002, Majumdar and Sen 2007). According to Granovetter (2005), groups do not emerge to solve problems, but rather because of special skills and abilities of entrepreneurs, families, and alliances to mobilize resources. Group membership can be consequential. We account for business groups in our analyses of profitability variances.
3. Hypotheses

To understand how India’s policy changes during our period of study affected firms’ underlying behavior and how such shifts relate to the different effects that explain profitability variance, we now examine the characteristics of each phase.

3.1. Phases

Phase 1: Command and Control (1980–1981 to 1984–1985). In India, the institutional framework until the mid-1980s was one of detailed administrative day-to-day direction of all aspects of firms’ operations and strategy (Marathe 1989). Controls over firms’ operations of activities such as pricing and acquisition of raw materials, distribution of the final product, and allocation of foreign exchange within projects were pervasive, as were controls over strategic issues such as whether firms could enter certain industries (Bhagwati 1993).

Government policy during a control regime dictates presence and competition in a given industry (Murtha and Lenway 1994), creating important entry barriers (Spencer et al. 2005). We expect industry effects to be stronger, not weaker, in such controlled periods. By managing entry, firms can enter and secure a position in the industry rent chain. The government can mandate that totally inexperienced firms enter a particular sector. Available above-average industry rents may be enjoyed by many firms by virtue of mere industry presence. Economic control means that a marketing orientation and efficient supply infrastructures are not required of firms (Patel 2002), and inappropriately scaled firms are allowed to operate (Little et al. 1987).

With price, quantity, and technology controls in place, the impact of efficiency in influencing firm performance disappears. Closed markets and supply policies influence firms to engage in rent seeking (Bhagwati 1993). The competencies firms develop are in political and government activities management (Haksar 1993). A focus on such activities by firms is consistent with the findings of the literature (de Figueiredo 2002). Managing the political economy is more important than managing market or industrial processes (Hillman and Hitt 1999), ensuring that returns to relationship management, which firm effects capture, are larger than those for positioning, which industry effects encapsulate.

Between 1980–1981 and 1984–1985, control policies were dominant institutional features of the Indian economy. Rent seeking, an important phenomenon in Indian business history (Roy 2006), has been for firms an all-important and all-consuming activity to preempt licensed capacity by manipulating the approval process and by acquiring resources in short supply so as to undertake business activities (Das 2002). Managing the political economy is an important activity managers have to undertake in a controlled regime. Top managers focus on dealing with the senior personnel of various government departments and agencies rather than on managing a business (Haksar 1993). Industry-related factors, although consequential, would relate to placement in an appropriate sector by institutional authorities based on the rent-seeking abilities of firms with political abilities to be well positioned. We therefore hypothesize the following.


Business groups are an important feature of a controlled economy landscape (Leff 1978). Much of the institutional management activities of Indian firms have been conducted out of business group offices. In line with Granovetter’s (2005) findings, these business group offices have undertaken numerous activities to mobilize resources and smooth the path of group companies in getting operational mandates from the bureaucratic agencies (Das 2002). Companies wanting to succeed in a control era have devoted substantial resources and their best people to institutional management tasks. These tasks have been undertaken via business group office establishments, including full-fledged teams given solely to institutional liaison work and manned by the senior-most staff of the business group or even senior and trusted family members (Das 2002).

In the profitability variance explanation study similar to ours (Chang and Hong 2002), large business group effects are found not to be material for South Korean firms, probably because group effects pick up residual endogenous effects not picked up by firm effects. In an absolute sense, such group effects can be material. They may not, however, dominate other effects, including exogenous effects, as an explanatory factor for profitability variances. We expect the following.


Phase 2: Transition (1985–1986 to 1990–1991). Indian liberalization policy after 1985 involved creating industrial capabilities, granting limited permissions to purchase foreign technologies, allowing the establishment of plants at economic scale, and encouraging the establishment of sunrise industries (Government of India 1985, paragraph 7.42). These policies could trigger behavioral changes (Barley and Tolbert 1997) and encourage strategic adaptation (Kumaraswamy et al. 2012) such that both firm and industry effects could be important profitability variance explanatory factors. Capacity restrictions were to be relaxed, permitting firms to enjoy scale economy benefits. The ability of firms to shape industry structure, via appropriate investment and
market development activities, was to be enhanced by institutional changes.

Transitions from a controlled environment to a liberalized environment require credible commitments by governments (Henisz and Zelner 2005) so that firms can alter their strategies. Adaptation to a new environment requires some certainty (Kumaraswamy et al. 2012). The initial implication of institutional transition for firms is that past practices of managing the bureaucracy are less critical than skills needed in making appropriate industry entry choices; managing operations, production, and marketing processes; and facing competitors’ pressures. In other words, proper strategic management can take place.

In India, this institutional transition phase quickly turned to one of confusion. Firms faced both a controlled regime and one where they were exhorted to alter behavior so as to make Indian industry modern. This process created a premium and additional requirements for firm-specific skills in managing greater political and economic complexities (Sengupta 1992). Attempts at liberalization floundered (Tomlinson 1993). The uncertain institutional climate could negate the benefits of an industry presence so that industry effects might not materially explain profitability variances.

Constraints on firms’ freedom to enter interesting market segments remained. The domestic market remained protected. Entry continued to be restricted by the licensing system. Imports and capital issues controls remained. These benefited entrepreneurs successful at managing the political environment through business group offices. Credible commitments to be made by government, required for a successful transition, did not come forth (Lal 1999). Indian markets were not made contestable (Das 2002). We hypothesize the following.


**Phases 3–5: Liberalization, Financial Reforms, and Legal Reforms from 1990–1991 to 2005–2006.** The next 15 years—that of Phases 3, 4, and 5—resulted in a liberalized free market economy. Radical reforms were initiated in 1991. The initial industrial reforms were put through between 1991–1992 and 1995–1996. This is called the liberalization phase. In the next phase, between 1996–1997 and 2000–2001, financial sector reforms, including tariffs, were initiated (Lal 1999). This is called the financial reforms phase. Tariff and trade reforms are a positive motivating factor for firms (Baggs and Brander 2006). Between 1996 and 1998, there was a certain amount of political uncertainty, and India had three prime ministers in those years. Such uncertainties may have impacted positive outcomes from earlier liberalization (Guha 2007). After 2001–2002, and until 2005–2006, in the fifth phase, several vital legal and sector-specific reforms were implemented in property rights, foreign exchange rules (Majumdar 2008), competition policy, and industry regulations. This is called the legal reforms phase. These reforms provided investment incentives (Panagariya 2008).

The reforms have been an institutional discontinuity (Majumdar 2012). Placing limits to entrepreneurs’ aspirations had important consequences. Unless a desire to increase material wealth was felt, businessmen would not engage in activities yielding advantages with available opportunities because the psychological barriers placed by institutions were so great (Nair 1962). The reforms have made markets contestable (Bhagwati 1993), altered the psychological climate (Das 2002), and motivated strategic adaptation and capability building by firms (Kumaraswamy et al. 2012); a component of economic freedom is enterprise freedom, the right to start and support one’s own business initiatives, which permits exploiting organizational idiosyncratic capabilities (Majumdar 2012).

The enhancement of market contestability increases customer choosiness (Fernandes 2006). A contestable market permits firms’ initiatives to flourish rather than be guided by a bureaucracy (Patel 2005). These processes alter industry structure (Sutton 1991). The choice of an industry segment to participate is an important dynamic capability (Teece et al. 1997); an appropriate industry segment choice can enhance industry effects in explaining profitability variance in a liberalized environment. In an industry relieved of artificial constraints, leading to conduct of operations in relevant ways, liberalization reestablishes a natural industry-specific economic rhythm (Reid 1987). Specific industry-level forces, created by firms’ cumulative actions (McGahan 2004),
assert themselves, and their impact is felt on firms’ performance. Thus, industry effects are consequential in profitability variance explanations.

Indian economy characteristics after the 1991 liberalization have included self-confidence recovery and an entrepreneurship surge, which influenced investments by firms in capability building to be efficient (Majumdar 2012) and in identifying industry niches yielding superior profits (Teece et al. 1997). Under such conditions, success logic is dominated by economic forces and not regulation. Both firm and industry effects matter in explaining profitability variances after liberalization. It is likely that the size of both effects would be larger than during a control regime because positive motivations are at play.

In such a milieu, group effects may wax and wane. The role of government agencies as arbiters of all firms’ activities might disappear. The necessity of a group structure for conducting activities (Khanna and Palepu 2005) might decay. As the burden of strategic choice falls on firms, the role of government could be reduced, making group presence for political activity irrelevant. With strategic choices allowed, the laying at firms’ doors of the cause–effect relationship in transactions could engender business model rationality. This can promote active engagement with the outside economic world rather than engagement with the world of government ministries and agencies, thus requiring a business group structure (Majumdar and Sen 2007).

Economic freedom influences the exercise of human agency (Sen 1999). Robust business models, based on the capability to choose industries for participation, generate organizational success. This can imply that, similar to Korean chaebols (Amsden 1989) and Japanese keiretsus (Fruin 1994), in a liberalized era business groups can act as resource allocators (Lamont 1997) over many businesses and engender interbusiness skills leverage and capabilities transfer. After transition, business group effects can reemerge as an explanation for profitability variances. We expect the following.


### 4. Analyses

#### 4.1. Data

To evaluate the above hypotheses, we use data from the Reserve Bank of India (RBI) database on financial accounts of nongovernment public limited companies. The analysis spans 26 years from 1980–1981 to 2005–2006. The RBI database on Indian companies has been maintained by the RBI since 1950–1951 and is based on companies’ financial statements. The data relate to public limited companies, defined by the Indian Companies Act of 1956. Some are stock exchange listed. The corporate sector accounts for most of industrial value addition in India (Mazumdar and Sarkar 2008). The companies represent 85% of the paid-up capital of 86 three-digit industries (Feinberg and Majumdar 2001). The data are presented in a common format across companies and time (Augustine 2009).

Previous studies distinguish between business, corporate parent, and industry effects. We additionally evaluate time effects. The RBI database includes a small number of diversified firms. Profits and other financial characteristics for the different business units of these firms are not separately reported in financial statements for recording in the database. Data on business group affiliation are collected from a separate database produced by the Centre for Monitoring Indian Economy.
The changing composition of the number of observations shows the decline of some industries, validating the use of linear models. The time series of average profitability is stationary across the industries, confirming the use of linear models.

In our data there is information on 11 industries that have more than 1,000 firm-year observations in total. The changing composition of the number of observations shows the decline of some industries in India and the relative rise of others in terms of economic importance. Some of these 11 industries are foods, oils, and fats; accounting in total for 1,697 observations and for 245, 396, 335, 359, and 362 observations over the five phases, respectively; cotton textiles, accounting in total for 3,946 observations and for 1,030, 1,066, 717, 639, and 494 observations over the five phases, respectively; and pharmaceuticals, accounting in total for 2,007 observations and for 290, 416, 357, 363, and 581 observations over the five phases, respectively.

The cross-sectional distribution of profitability is negatively skewed for most industries and has high kurtosis. Therefore, the Gaussian assumption, relevant in estimating variance components, may be strong. We validate our random effects estimates against fixed effects models that are robust to non-Gaussian probability distributions.

4.3. Estimation
We evaluate our hypotheses using variance decomposition analysis and nested data models. Hierarchical modeling is appropriate for organizational research (Klein et al. 1994, Griffin 1997, Hofmann et al. 2000). We assess the performance of firms nested within groups. For firms belonging to a group, the firm effects are modeled hierarchically as being nested within the corresponding group effects. Firms not belonging to a group are nested within the category for non-group firms. We test our hypotheses using variance decomposition based on the following hierarchical linear model of profitability \( r \) of company \( c \) in group \( g \) and industry \( i \) at time \( t \):

\[
r_{gci} = \mu + \alpha_g + \beta_{g} + \gamma_i + \delta_t + \varepsilon_{gci},
\]

where \( \mu \) is the overall mean, and \( \alpha_g, \beta_{g}, \gamma_i, \delta_t, \) and \( \varepsilon_{gci} \) are the group effects, firm effects nested within groups, industry effects, time effects, and random errors, respectively.

To infer the importance of the different effects, a random effects assumption of independence between the different effects and between the error and the effects is made. Assuming unconditional independence may be unreasonable. Independence can be conditional on the inclusion of adequate interaction effects, as in the components of variance (COV) or nested analysis of variance (ANOVA) approaches, or adequate regressors or fixed effects, as in the regression approach (Gelman 2005).

We test the validity of the random effects assumption using the Hausman (1978) test, comparing random effects estimates for each of the above effects with corresponding fixed effects estimates. The null hypothesis—that the random effects assumption is valid for each of the four effects—is not rejected at the 5% significance level. Consequently, we use the Gaussian random
### Table 1  Average Industry Profitability and Its Variation Over Regimes

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Overall period</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
<th>Phase 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of observations</td>
<td>Avg. profit (%)</td>
<td>No. of observations</td>
<td>Avg. profit (%)</td>
<td>No. of observations</td>
<td>Avg. profit (%)</td>
</tr>
<tr>
<td>Overall average</td>
<td>37,642</td>
<td>3.96</td>
<td>6,462</td>
<td>2.96</td>
<td>9,034</td>
<td>2.53</td>
</tr>
<tr>
<td>Sugar</td>
<td>936</td>
<td>2.45</td>
<td>251</td>
<td>0.25</td>
<td>230</td>
<td>3.01</td>
</tr>
<tr>
<td>Food, oils, and fats</td>
<td>1,697</td>
<td>5.39</td>
<td>245</td>
<td>5.68</td>
<td>396</td>
<td>5.66</td>
</tr>
<tr>
<td>Tobacco</td>
<td>169</td>
<td>11.48</td>
<td>34</td>
<td>2.57</td>
<td>48</td>
<td>5.84</td>
</tr>
<tr>
<td>Cotton textiles</td>
<td>3,946</td>
<td>0.93</td>
<td>1,030</td>
<td>0.88</td>
<td>1,066</td>
<td>1.07</td>
</tr>
<tr>
<td>Artificial fibers</td>
<td>1,652</td>
<td>1.47</td>
<td>146</td>
<td>2.53</td>
<td>330</td>
<td>2.40</td>
</tr>
<tr>
<td>Jute</td>
<td>475</td>
<td>–1.96</td>
<td>135</td>
<td>–4.99</td>
<td>120</td>
<td>–7.35</td>
</tr>
<tr>
<td>Mixed textiles</td>
<td>860</td>
<td>1.58</td>
<td>116</td>
<td>0.84</td>
<td>188</td>
<td>3.57</td>
</tr>
<tr>
<td>Leather</td>
<td>255</td>
<td>2.18</td>
<td>31</td>
<td>0.73</td>
<td>68</td>
<td>3.15</td>
</tr>
<tr>
<td>Breweries</td>
<td>544</td>
<td>0.10</td>
<td>93</td>
<td>4.93</td>
<td>150</td>
<td>2.56</td>
</tr>
<tr>
<td>Metals</td>
<td>1,137</td>
<td>4.06</td>
<td>64</td>
<td>3.38</td>
<td>98</td>
<td>4.54</td>
</tr>
<tr>
<td>Metal products</td>
<td>3,942</td>
<td>0.51</td>
<td>753</td>
<td>1.66</td>
<td>1,210</td>
<td>1.79</td>
</tr>
<tr>
<td>Automobiles</td>
<td>1,719</td>
<td>5.56</td>
<td>230</td>
<td>5.70</td>
<td>402</td>
<td>3.71</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>316</td>
<td>9.97</td>
<td>72</td>
<td>3.67</td>
<td>66</td>
<td>4.56</td>
</tr>
<tr>
<td>Electrical goods</td>
<td>3,454</td>
<td>2.61</td>
<td>570</td>
<td>3.94</td>
<td>828</td>
<td>1.65</td>
</tr>
<tr>
<td>Machine tools</td>
<td>3,747</td>
<td>4.05</td>
<td>749</td>
<td>3.42</td>
<td>898</td>
<td>2.01</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>633</td>
<td>3.13</td>
<td>65</td>
<td>6.65</td>
<td>130</td>
<td>2.12</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>2,007</td>
<td>8.04</td>
<td>290</td>
<td>4.47</td>
<td>416</td>
<td>4.98</td>
</tr>
<tr>
<td>Dyes</td>
<td>325</td>
<td>0.75</td>
<td>64</td>
<td>1.98</td>
<td>90</td>
<td>1.69</td>
</tr>
<tr>
<td>Paints</td>
<td>437</td>
<td>5.87</td>
<td>73</td>
<td>4.23</td>
<td>84</td>
<td>5.32</td>
</tr>
<tr>
<td>Plastics</td>
<td>318</td>
<td>3.35</td>
<td>56</td>
<td>2.77</td>
<td>52</td>
<td>6.03</td>
</tr>
<tr>
<td>Industrial chemicals</td>
<td>3,483</td>
<td>6.46</td>
<td>616</td>
<td>4.72</td>
<td>902</td>
<td>4.84</td>
</tr>
<tr>
<td>Coment</td>
<td>975</td>
<td>2.61</td>
<td>111</td>
<td>4.86</td>
<td>232</td>
<td>–0.33</td>
</tr>
<tr>
<td>Glass and ceramics</td>
<td>957</td>
<td>2.52</td>
<td>155</td>
<td>1.90</td>
<td>222</td>
<td>1.72</td>
</tr>
<tr>
<td>Rubber products</td>
<td>741</td>
<td>2.32</td>
<td>116</td>
<td>1.78</td>
<td>182</td>
<td>2.99</td>
</tr>
<tr>
<td>Plastic products</td>
<td>894</td>
<td>1.61</td>
<td>72</td>
<td>4.37</td>
<td>112</td>
<td>1.38</td>
</tr>
<tr>
<td>Paper</td>
<td>1,471</td>
<td>1.87</td>
<td>253</td>
<td>–0.31</td>
<td>410</td>
<td>0.09</td>
</tr>
<tr>
<td>Wood products</td>
<td>368</td>
<td>1.10</td>
<td>63</td>
<td>3.07</td>
<td>104</td>
<td>0.15</td>
</tr>
<tr>
<td>Diversified</td>
<td>184</td>
<td>5.73</td>
<td>25</td>
<td>4.83</td>
<td>30</td>
<td>1.91</td>
</tr>
</tbody>
</table>
effects model with Gaussian errors for statistical inference. We estimate a hierarchical mixed effects model, where regressors or fixed effects in the base model can be conveniently combined with random effects decomposition for the composite error (Searle et al. 1992). Estimation is based on specialized software (Hofmann et al. 2000, Rabe-Hesketh and Skrondal 2008).

The variance of \( r_{\text{eit}} \), denoted by \( \sigma^2_r \), is represented as

\[
\sigma^2_r = \sigma^2_{\alpha} + \sigma^2_{\beta |\alpha} + \sigma^2_{\gamma} + \sigma^2_{\delta} + \sigma^2_{\epsilon}.
\]

(2)

This linear split of \( \sigma^2_r \) into components corresponding to different sources of variation enables us to assess the importance of the various effects in explaining overall variability in \( r_{\text{eit}} \). The restricted maximum likelihood (REML) approach (Rao 1997, Chang and Hong 2002) is used for our analyses. Efficient iterative algorithms provide REML estimates (Hartley and Rao 1967, Gilmour et al. 2000, Rabe-Hesketh and Skrondal 2008). The method is robust to sampling fluctuations and violations of assumptions (for moderate sample sizes), and it allows the following kinds of inference: First, we estimate the contribution of each factor to the overall variation in profitability, variance components, both in absolute terms (\( \sigma^2_{\alpha}, \sigma^2_{\beta |\alpha}, \sigma^2_{\gamma}, \sigma^2_{\delta}, \) and \( \sigma^2_{\epsilon} \)) and in relative terms (e.g., \( \sigma^2_{\alpha}/\sigma^2_r \) or \( \sigma^2_{\beta |\alpha}/(\sigma^2_r - \sigma^2_{\epsilon}) \)).

Second, we evaluate the significance of the magnitude of each variance component by testing hypotheses of the form \( H_0: \sigma^2_k = 0 \) against the alternative \( H_1: \sigma^2_k > 0 \) for \( k = \alpha, (\beta |\alpha), \gamma, \) or \( \delta \). Third, we test for transition over the period studied by testing hypotheses such as \( H_0: \sigma^2_{\alpha,t} = \sigma^2_{\alpha,t-1} \) against the alternative \( H_1: \sigma^2_{\alpha,t} > \sigma^2_{\alpha,t-1} \). These tests enable validation of the hypotheses. Fourth, we assess the relative importance of different effects by testing hypotheses such as \( H_0: \sigma^2_\epsilon = \sigma^2_\beta \) versus \( H_1: \sigma^2_\epsilon > \sigma^2_\beta \) (see Brush and Bromiley 1997, McGahan and Porter 2002).

A concern is the nonindependence of firm, industry, and group effects (Misangyi et al. 2006). This is important when general linear approaches such as COV or ANOVA are used, because these have limitations (Searle et al. 1992). The REML approach negates the problems associated with general linear approaches. The method allows for the robust estimation of the variance components while permitting hypothesis testing on components’ magnitudes.

5. Results

5.1. Basic Findings

The REML estimates of the magnitudes of the different effects and their standard errors for the entire period (1980–1981 to 2005–2006) and for each of the five phases—(a) command and control (1980–1981 to 1984–1985), (b) transition (1985–1986 to 1990–1991), (c) liberalization (1991–1992 to 1995–1996), (d) financial reforms (1996–1997 to 2000–2001), and (e) legal reforms (2001–2002 to 2005–2006)—are presented in Table 2(a). The magnitudes of the firm effects are the largest, in common with other studies, as an explanation for profitability variances in Indian industry. This is true whether the results for the entire period or for each of the separate periods are assessed. For the overall data, the magnitude of industry effects is not large. When separate data for the five phases are evaluated, the industry effects magnitudes are larger than those noted for the full data set. The variance of group effects is small overall as well as for the five separate phases’ results. The year effects’ magnitudes are similar to those of the industry effects for the full data set as well as for the five separate phases. In Table 2(b), we report the variance component estimates for the five regimes as percentages of the explained variance (\( \hat{\sigma}^2_r - \hat{\sigma}^2_\epsilon \)).

5.2. Firm and Industry Effects

Table 2(b) shows that of the explained profitability variance, firm effects account for most of the explanation. The estimates, however, reveal an altering balance between firm and industry effects as the Indian economy moved from a regime of regulation before 1984–1985 via a transition phase between 1985–1986 and 1990–1991 to a free market system between 1991–1992 and 2005–2006. The role of industry effects in explaining
profitability variances in a command and control regime, at more than 8.0%, has been partially driven by special regulations for selected industries. With transition, these special regulations have been eroded, and the share of industry effects becomes 3.0%. The share of industry effects increases to more than 5% in the liberalization period. In a competitive marketplace—which institutional changes have brought about in India—the choice of industry has an impact in explaining profitability variances. As markets become contestable, industry effects play a larger role in explaining profitability variations. Firm effects and possession of endogenous capabilities remain important. This result is consistent with others in the literature. Correct industry choice by firms (McGahan 2004) is equally important for sustainable profitability.

5.3. Group Effects
Group effects are small in magnitude. Prior research on business groups (Khanna and Rivkin 2001, Majumdar and Sen 2007) has established positive business group impacts, but these studies have been based on regression-based models evaluating profitability levels and not on an evaluation of profitability variances. The other group effects analysis using variance decomposition of profitability (Chang and Hong 2002) finds group effects to be large for smaller South Korean business groups. Conversely, for the top 30 business groups, popularly called the chaebols and considered important participants in the South Korean economy (Amsden 1989), business group membership provides limited explanation for profitability variances.

A methods issue may explain not finding large group effects magnitudes. Not all firms in India belong to groups. In fact, a relatively small number of firms in an economy are group firms, though these firms account for a large proportion of assets and revenues. We have two categories of firms: group and non-group firms; we nest firms in either of these categories. In our hierarchical modeling, all observations will have a firm and an industry identifier, but only a few observations will have a group identifier. Thus, in a second-order variance decomposition exercise, these relatively fewer group effects will have been swamped by the numerous firms that do not belong to any industry group.

We carry out additional procedures evaluating robustness of group effects. Specifically, we conduct analyses based on a selection model where our sample is restricted only to group firms, together with a sample selection correction based on the propensity of each firm to belong to a business group. We first estimate a probit model for a firm’s affiliation to any business group, using as covariates firm specificity and industry affiliation variables. Next, we conduct the components of variance mixed effects analysis focusing on group firms only. We include the inverse Mills ratio from a probit analysis as an additional covariate to account for the selective sampling of group firms (Heckman and Todd 2009). This approach allows our analyses to obviate the crowding-out effect of non-group firms and places focus on the variation in group effects between different business groups, retaining the effect of non-group firms in the coefficient on the inverse Mills ratio. Our main findings of significance in firm, industry, and group effects; inter se differences; and intertemporal changes in the effects are all confirmed. The variance of business group effects is found to be important, relative to the effect of non-group firms. For details, see Table 3.

Our findings are consistent with a portion of the Chang and Hong (2002) findings. A part of the group effects can be subsumed within firm and industry effects. In India’s command and control regime, business group offices will have managed government relationships and the licensing process for particular industry sectors and engaged in resource acquisition tasks with government agencies (Das 2002, Haksar 1993). An acquired industrial license will have been at the group level, but implementation would occur in a specific industry, and requisite operating resources would lie in a specific firm. If the license acquired by the group office has been for a profitable industry, and the business managed well, these impacts will be picked up by firm and industry effects as explanations for profitability variances.

Chang and Hong (2002) find that group effects dissipate with time. Given what we know of India’s business groups’ behavior, we expect them to redefine themselves and start acting like corporate conglomerate offices in undertaking resource allocation tasks and leveraging corporate capabilities across group businesses, as occurs in Japan (Fruin 1994) and South Korea (Amsden 1989). Thus, group effects may be reasserted. As the Indian economy has entered a free market regime, the government relationship work carried out by business groups is irrelevant. Both established entities and new businesses individually undertake the tasks of sensing the environment, acquiring resources, and choosing appropriate sectors to enter. Although profitability variances are explained by firm and industry effects, enhanced group effects can imply that group offices change to accommodate intragroup resource allocation and corporate capabilities leverage roles.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Share as a % of explained variance</th>
<th>Overall explained variance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm effects</td>
<td>Industry effects</td>
<td>Group effects</td>
</tr>
<tr>
<td>Overall period</td>
<td>63.4</td>
<td>9.9</td>
</tr>
<tr>
<td>Phase 1</td>
<td>71.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Phase 2</td>
<td>88.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Phase 3</td>
<td>87.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Phase 4</td>
<td>71.1</td>
<td>8.2</td>
</tr>
<tr>
<td>Phase 5</td>
<td>90.2</td>
<td>0.5</td>
</tr>
</tbody>
</table>
5.4. Evaluating Magnitude of Different Effects

Past analyses of firm and industry effects compare the magnitudes of different elements explaining profitability variance. We test the significance of the estimated magnitudes of the effects. This reveals whether a process of random sampling, with zero variance, of the respective effects has contributed to estimate values. Testing for the significance of variance components is statistically challenging because the null hypothesis (that a component is zero) places the true value of the parameter on the boundary of the parameter space (Stram and Lee 1994). Hence, the lack of inference procedures is a literature lacuna.

In the REML method (Rao 1997), standard error estimates for the variance components are easily computed. We test the hypothesis $H_0: \sigma^2_k = 0$ versus the alternative $H_1: \sigma^2_k > 0$ for $k = \alpha, (\beta | \alpha), \gamma, \text{or} \delta$, which is asymptotically equivalent to the Lagrange multiplier test (Breusch and Pagan 1980). The test is robust to departures from normality compared with the traditional Lagrange multiplier test (Koenkar 1981). This test exhibits local asymptotic efficiency, and its asymptotic distribution can be adjusted for the null hypothesis lying on the boundary of the parameter space. We test the statistical significance of the size of the different effects explaining profitability variance. Test details are in the appendix. The results—that the magnitudes of firm effects ($\sigma^2_{\alpha}$), industry effects ($\sigma^2_{\beta}$), and group effects ($\sigma^2_{\gamma}$) are zero versus the alternative hypothesis of positive effects—are presented in Table 4.

Hypotheses 1A, 2A, and 3A evaluate whether the firm effects’ magnitudes are greater than zero in the command and control, transition, liberalization, financial reforms, and liberal reforms periods. The “Firm effects” column in Table 4 shows that we reject the null hypotheses ($\sigma^2_{\alpha} = 0$) and accept the alternative that firm effects are positive and significant. The significant firm effects in the five periods suggest that managerial capabilities matter at all times in India: under a controlled regime, when rent seeking has been rewarded, under transition, and under all liberalization phases when productive and market-oriented performance is to be rewarded.

Hypotheses 1B, 2C, and 3C state expectations for the magnitude of industry effects, in which we posit industry effects to be positive in the command and control, liberalization, financial reforms, and legal reforms regimes, but not in the transition regime. The “Industry effects” column in Table 4 shows that we reject the null hypothesis ($\sigma^2_{\beta} = 0$) for the command and control, liberalization, financial reforms, and legal reforms regimes. Per Hypothesis 2C, we do not expect to reject it for the transition regime. We do so, however, at a 5% level of significance. At a lower level of significance, we would not reject the hypothesis. These results support our expectations that industry effects are also of material magnitude in explaining profitability variances at different points in time.

Hypotheses 1C, 2E, and 3E relate to the magnitude of group effects. We expect these to be nonzero and positive for all of the five phases or regimes. We reject the null hypothesis ($\sigma^2_{\gamma} = 0$), as shown in the “Group effects” column in Table 4. These results imply that group effects are consistently significant in magnitude in explaining profitability variances. Hypotheses 1C and 2E are supported at a 5% level of significance, but Hypothesis 3E is supported at the 10% level. In the liberalization and legal reforms phases, if we set a significance acceptance limit of 5%, we reject the null hypothesis. We do accept the null hypothesis at the 10% level. These tests show that the group effects are material explained profitability variances.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Firm effects $(H_0: \sigma^2_{\alpha} = 0$ vs. $H_1: \sigma^2_{\alpha} &gt; 0)$</th>
<th>Industry effects $(H_0: \sigma^2_{\beta} = 0$ vs. $H_1: \sigma^2_{\beta} &gt; 0)$</th>
<th>Group effects $(H_0: \sigma^2_{\gamma} = 0$ vs. $H_1: \sigma^2_{\gamma} &gt; 0)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.000)$</td>
</tr>
<tr>
<td>Phase 1</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.000)$</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.010)$</td>
<td>Reject $H_0$ $(0.019)$</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.098)$</td>
</tr>
<tr>
<td>Phase 4</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.009)$</td>
</tr>
<tr>
<td>Phase 5</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.000)$</td>
<td>Reject $H_0$ $(0.099)$</td>
</tr>
</tbody>
</table>

Note. Figures in parentheses are $p$-values.
significantly over time periods. This involves testing the temporal stability of firm, industry, and group effects (e.g., $H_0$: $\sigma^2_{a,t_1} = \sigma^2_{a,t_2}$ versus $H_1$: $\sigma^2_{a,t_1} > \sigma^2_{a,t_2}$).

Table 5 reports tests of the intertemporal differences in the magnitude of the different effects. Hypotheses 2B and 3B state that the magnitude of firm effects will rise steadily over the first three periods ($\sigma^2_{a,t_1} > \sigma^2_{a,t_2}$).

From Hypothesis 2D, we do not expect to find an increase in the magnitude of industry effects between the command and control and transition regimes. In Hypothesis 3D, we expect the magnitude of industry effects in the liberalization, financial reforms, and legal reforms regimes to be larger than those in the previous two regimes. In Hypothesis 2E, we expect group effects not to differ between the command and control and transition phases; in Hypothesis 3F, we expect group effects to wane and wax between the initial phase of liberalization and the subsequent phases of financial and legal reforms.

To test Hypothesis 2B, we note that the firm effects magnitude in the transition period is significantly larger than that in the command and control period, and we reject the null hypothesis ($\sigma^2_{a,t_1} = \sigma^2_{a,t_2}$); see row A under the “Firm effects” column in Table 5. In testing Hypothesis 3B, we note that, unexpectedly, the firm effects magnitude in the liberalized period is significantly smaller than that in the transition period, rejecting the null hypothesis but in the opposite direction; see row B. As we continue testing for Hypothesis 3B, we find a rise in the magnitude between the liberalization and financial reforms periods (see row C). In the financial reforms to legal reforms period, there is no material change in magnitude; see row D. In further testing Hypothesis 3B, we note the firm effects magnitude in the liberalized period is not significantly smaller than that in the command and control period; thus the null hypothesis is accepted; see row E. From rows F to J, we note that for the last two phases, financial reforms and legal reforms, firm effects’ magnitudes are significantly larger than all other previous phases, and we reject the null. The results indicate significant waxing and waning in the magnitudes of firm effects in explaining profitability variances. They rise, fall, and rise again in their impact in providing supporting explanations for firms’ profitability variances. The process of adaptation implicit in the waxing and waning pattern reflects the impact of the removal of constraints on commercial activity with the advent of a free market economy.

The industry effects magnitude in the transition period is significantly smaller than that in the command and control period, and we reject the null ($\sigma^2_{y,t_1} = \sigma^2_{y,t_2}$); see row A under the “Industry effects” column in Table 5. We had hypothesized no effect, but the steep rise in the firm effect in the same period has been counterbalanced by the significant industry effect decline. The magnitude of the industry effects in the liberalized period is significantly larger than that in the transition period, and

<table>
<thead>
<tr>
<th>Table 5 Summary Results of the Intertemporal Changes in Magnitude Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Firm effects</strong></td>
</tr>
<tr>
<td>$(H_0$: $\sigma^2_{a,t_1} = \sigma^2_{a,t_2}$) vs. $(H_1$: $\sigma^2_{a,t_1} &gt; \sigma^2_{a,t_2}$)</td>
</tr>
<tr>
<td>A: Phase 1 to Phase 2</td>
</tr>
<tr>
<td>(0.002)</td>
</tr>
<tr>
<td>B: Phase 2 to Phase 3</td>
</tr>
<tr>
<td>(0.000)**</td>
</tr>
<tr>
<td>C: Phase 3 to Phase 4</td>
</tr>
<tr>
<td>(0.000)</td>
</tr>
<tr>
<td>D: Phase 4 to Phase 5</td>
</tr>
<tr>
<td>(0.553)</td>
</tr>
<tr>
<td>E: Phase 1 to Phase 3</td>
</tr>
<tr>
<td>(0.649)</td>
</tr>
<tr>
<td>F: Phase 1 to Phase 4</td>
</tr>
<tr>
<td>(0.000)</td>
</tr>
<tr>
<td>G: Phase 1 to Phase 5</td>
</tr>
<tr>
<td>(0.000)</td>
</tr>
<tr>
<td>H: Phase 2 to Phase 4</td>
</tr>
<tr>
<td>(0.000)</td>
</tr>
<tr>
<td>I: Phase 2 to Phase 5</td>
</tr>
<tr>
<td>(0.000)</td>
</tr>
<tr>
<td>J: Phase 3 to Phase 5</td>
</tr>
<tr>
<td>(0.000)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are p-values.

*Null hypothesis of no change in effect is not rejected against an alternative of increased effects from one regime to the next but is rejected against the alternative hypothesis of a decrease in the effect.
we reject the null; see row B. The results indicate an increase in the magnitude of the industry effects after liberalization. Industry choice matters in a changed institutional climate, highlighting that liberalization leads to the emergence of a competitive market structure where market concentration, entry barriers, and other industry-level effects can affect firms’ profitability variances. Moreover, we find no rise in the industry effects’ magnitude between the liberalization and financial reforms periods (see row C). In the financial reforms to legal reforms period, there is no material change in magnitude (see row D). The industry effects magnitude in the liberalized period is not significantly smaller than that in the command and control period, and we accept the null; see row E. From rows F and G, we note that for the last two phases (that of financial reforms and legal reforms), industry effects magnitudes are significantly smaller than in the command and control phase, and we reject the null hypothesis at a 10% level of significance. From rows H–J, we note no material differences in industry effects for the periods covered in these cells. The results indicate a significant drop in the magnitudes of industry effects in explaining profitability variances, then a later recovery that is not enough to get back to the magnitude of the effect in the earlier command and control phase.

Hypotheses 2E and 3F relate to intertemporal differences in group effects, in which we have suggested a waning and waxing effect. Rows A–J under the “Group effects” column in Table 5 display the various test results. There are no significant differences in the magnitude of the group effects between one period and the next. Although the waning and waxing effects are notable for the size of the magnitudes, these effects are not statistically significant.

5.6. Evaluating Inter Se Differences in Magnitude of Different Effects

We test whether the firm, industry, and group effects are equal in magnitude. The alternatives are that the magnitude of firm effects is larger than that of industry effects, the magnitude of firm effects is larger than that of group effects, and the magnitude of industry effects is larger than that of group effects in explaining profitability variances. Tests are conducted separately for the five phases. We test hypotheses about the equality of the firm and industry effects against the alternatives: $H_0: \sigma_{\beta|\alpha}^2 = \sigma_{\alpha}^2$ versus $H_1: \sigma_{\beta|\alpha}^2 > \sigma_{\alpha}^2$. The results are shown in Table 6.

We evaluate whether the firm effects’ magnitudes are greater than industry effects in the overall period as well as the five separate phases. The “Firm vs. industry effects” column in Table 6 shows that we reject the null hypothesis ($\sigma_{\beta|\alpha}^2 = \sigma_{\alpha}^2$) and accept the alternative that firm effects’ magnitudes are larger than industry effects in all periods. We test whether firm effects are larger than group effects and whether industry effects are larger than group effects. The null hypothesis that firm effects equal group effects ($\sigma_{\beta|\alpha}^2 = \sigma_{\gamma}^2$) is rejected for all periods. Firm effects are always more significant than group effects. The null hypothesis—that industry effects’ magnitudes are larger than group effects ($\sigma_{\beta}^2 = \sigma_{\gamma}^2$)—is not rejected overall but is rejected for the command and control regime at a 10% significance level. The null hypothesis is not rejected in the transition period but is rejected for the liberalization phase at a 10% significance level. For the financial and legal reforms phases, the null hypothesis is not rejected.

Summing up, firm effects are always larger than industry and group effects, a result consistent with the literature. Industry effects are more significant in the command and control phase, when institutional placement in specific industry sectors might have mattered, and in the liberalization phase of early free market economy dynamics, when firms would have maneuvered for initial favorable industry positions.

6. Discussion

6.1. Contributions

Our research makes several contributions. In the analysis of firms’ profitability variances, we account for
intertemporal institutional factors. We account for how institutional changes may impact the various explanatory effects of firms’ profitability variances. In transition economies, the role of government policies influences the strength of various effects. We analyze this possibility by separating out data for Indian firms into five periods, each capturing a different institutional phase in Indian industrial history. We find evidence from India that liberalization significantly affects the relative importance of firm, industry, and group effects in explaining firms’ profitability variances. Firm effects are always important, whether in a command and control regime with benefits accruing from protectionism and political rent seeking or in fully liberalized periods where firm-specific capabilities and dynamic efficiencies are valued above others.

Intertemporally, we find firm effects rise, fall, and rise again as institutional forces change conditions and enhance market contestability. As markets become dominant in resource allocation relative to government, the role of managerial competencies, an implicit factor encapsulated by firm effects, becomes more important in explaining profitability variances. Firm idiosyncratic factors are vital in managing complex market economies (Teece et al. 1997) compared with managing the political economy, not that they are or have been unimportant in a controlled regime.

With respect to industry effects in India, these matter when we analyze profitability variances in a command and control regime. During this period, mandatory sector placement by government licensing authorities places some firms in industries with superior profits. These profits are enjoyed by firms, resulting in industry effects’ magnitudes being a significant explanation for profitability variances. The impact of industry effects is reduced in significance in the transition period, perhaps because the firm effects become more important in managing a confused institutional situation. These industry effects reappear significantly in a liberalized regime, when a complete policy shift makes entry fully free. In such a regime, the choice of which industry segment in which to operate is open to firms and carries a premium in explaining firms’ profitability variances. As transition gives way to financial and trade policy reforms, followed by legal and sector-specific regulatory reforms, the industry effects dissipate. This dissipation indicates that firms in India, having chosen an appropriate industry segment to enter, have started leveraging endogenous capabilities, as denoted by significant firm effects, to enjoy sustainable performance. Also, latter-period microeconomic incentives influence firms deeply.

There is a mutually reinforcing interplay between firm and industry effects. Both firm and industry factors can be important as explanations for profitability variances (Chang and Singh 2000). Because the resource and competence bases of industries differ, these differences may generate large-magnitude firm effects. Because structural environment differences arise, these differences give rise to firm effects as firms employ endogenous capabilities to position themselves within industry structures differing from one another (McGahan 2004). In a contestable market (which India experienced after 1991), mutually reinforcing interplays between firm and industry effects are intensified.

We find business groups also matter in explaining profitability variances. Although we do not note significant intertemporal magnitude differences, the group effects are significant in each phase. In India, business group formation has occurred because of close political ties formed by business leaders and politicians. The business group phenomenon in India reflects such groups’ emergence in a command and control era, not for handling economic problems but for mobilizing resources via the abilities of entrepreneurs to exploit family ties and alliances (Granovetter 2005). We observe a positive magnitude for group effects during the command and control regime; these effects ought to be trivial in a liberalized regime. One reason is that during the command and control regime, groups engage in resource appropriation, rent seeking, politician management, and non-market activities. After liberalization and reforms, such activities are curtailed.

We observe positive group effects even after liberalization. This might occur because the nature of Indian business groups may have changed. In a free market economy, business group offices have taken on the tasks of intrabusiness resource allocation and the leverage of corporate capabilities, which are tasks taken on by the corporate central offices of conglomerates in Western economies and in the headquarters of South Korean chaebols and Japanese keiretsus. These speculations about the changing role business groups play in India and their influence on firms’ profitability variances can be evaluated in subsequent research.

A notable feature of our study is analyses based on stratified data. Such stratifications highlight the ways in which firms have behaved over the different phases of institutional change. The institutional changes may not have affected all firms similarly. Recent research stratifies the data to understand the factors giving rise to the different effects in non-Western environments. Stratification has been based on variables such as industry type (Brito and Vasconcelos 2006), performance (Diaz Hermelo and Vassolo 2012), country identity and stage of development (Makino et al. 2004), and multinationality (McGahan and Victer 2010). We stratify the data by institutional phases, and robustness tests support our findings across the various phases of institutional change.

6.2. Other Issues
To retain focus on a discussion of firm, industry, and group effects, we avoided going into detail about time
effects. Nevertheless, they do matter. The year effect explains more, then less, and then more of the profitability variance over time. Time effects encapsulate the properties of the generic business environment affecting all firms. They capture several elements related to business cycles, macroeconomic factors, and political events affecting the whole economy, but they are not firm or industry specific. Major institutional changes, such as the one that India has experienced, increase environment volatility and generate shocks.

With greater economic volatility, firms may not be able to handle the exigencies; hence, time effects can explain a greater amount of the profitability variance as institutional changes unfold. Such a finding helps support a proposition that dynamic capabilities are firms’ abilities to deal with rapidly changing environments (Teece et al. 1997). Economic conditions have been cyclical for India, with increased volatility impacting the decisions and performance of firms. Indian firms’ endogenous capability pools may have been augmented, but the capabilities that have been so engendered have not always been leveraged, as reflected by the waning and waxing of time effects.

Other than Schmalensee’s work (1985), to our knowledge, the industrial organization economics field has not analyzed profitability variances. Conversely, management scholarship has taken the profitability variance approach to undertake analyses. Profitability variance decomposition permits assessment of how much each effect matters (Schmalensee 1985) versus undertaking analysis in levels and evaluating significance of the structural coefficients. The literature has asked whether firm effects, industry effects, or other effects are important. We explain why the estimated firm, industry, or group effects have arisen; assess the magnitude of these effects; and conduct statistical inference tests. In conducting statistical assessment of magnitudes over unique time periods, we augment the procedural dimensions of contemporary analysis.

6.3. Literature Comparison

The recent literature focuses on stratification to assess what factors give rise to variances. We compare the quantum and nature of variances for some studies and ours. In Table 7, we provide a chart in which we review six studies. We consider firm, industry, group, and year effects, but not foreign capital effects. A consideration of foreign capital effects on firms’ profitability patterns is an important topic in its own right and is left for future coverage. In their analyses, Chang and Hong (2002), Makino et al. (2004), and Brito and Vasconcelos (2006) evaluate country, foreign capital, and business group effects but do not consider firm effects. Lieu and Chi (2006) evaluate business unit, corporate, industry, industry-year, and year effects. Makino et al. (2004) consider foreign capital and country effects in their analysis; McGahan and Victer (2010) consider country, country-industry, and country-year effects as profitability variance explanatory factors; and Diaz Hermelo and Vassolo (2012) consider firm, industry, country, and year effects, but not business group effects, as explanatory factors.

The results point to varieties of effects that span geographies, industries, and time periods. The magnitudes of comparable effects are consistent across the studies. There have been no dramatically diverse results, and hence scope for controversy has abated. Our analyses are temporally extensive. India has gone through fundamental institutional transitions over the 26 years we study. A conclusion of our analyses is the waxing and waning of different effects, contingent on changing institutional conditions. This contingency can be the subject of additional research. As other countries undertake institutional changes, how these play out in shaping firms’ profitability variance determinants across countries remains a fertile research area.

6.4. Future Research

Research on the relationships between the national economic environment and industrial performance is important. In transition economies, the capabilities required by firms to manage the market economy are considerably different from those required to manage the political economy. Firm effects are always important. As the environment changes, so too will firms’ capabilities. Follow-up research tracking the changes in specific capability investments within firms, and then evaluating their impacts on firms’ profitability variances, will provide granular facts for major contexts. Indian performance change patterns can be generalized in understanding performance change in similar emerging economies as these economies become globally dominant.

As countries reform their economies, profitability rates across countries may converge. Whether convergence occurs is an important question at the heart of cross-country performance research, as countries such as China, India, Malaysia, and Vietnam become global economic players. Dynamic aspects of performance analysis in transition contexts lead to several questions on emergent industrial performance. Market forces unleashed by liberalization can accelerate a shakeout of businesses unable to adapt. Thus, profitability may converge to the industry-specific returns level. This means that industry effects can lessen or become insignificant with liberalization and economic reforms as competitive markets emerge and concentrated market structures disappear.

Our analyses found the waxing and waning of effects. Important questions arise: Do all effects dissipate over time? Do they stay similar across time periods? If they dissipate, what is the decay rate? Theory is needed to address these questions, as firms and countries catch up, forge ahead, and then leapfrog other firms and countries in economic performance. One issue relates to analysis...
## Table 7  Comparison of Effects for Studies Evaluating Profitability Variances in Various Economies

<table>
<thead>
<tr>
<th></th>
<th>Overall study</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
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<tr>
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<tr>
<td>Variance explained</td>
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<td>58.1</td>
<td>57.9</td>
<td>57.8</td>
<td>55.5</td>
<td>45.9</td>
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<td>Variance explained</td>
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<td>Years covered</td>
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<td>6</td>
<td>5</td>
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</table>

- Full sample data.
- Across all sectors in model 1.
- Mean across sectors.
across sectors. Emphases have shifted from manufacturing to services and from developed economies to emerging economies. Sector-oriented profitability variance analysis, conditioned on institutional factors evaluating the importance of firm, industry, and time effects, is important because underlying sector economics are distinct. How linkages between the services and manufacturing sectors influence firm profitability variances is also germane.

7. Conclusion

Using a data set of Indian firms, providing in aggregate 37,462 observations and spanning a 26-year period between 1980–1981 and 2005–2006, we assess the relative importance of firm, industry, and business group effects in explaining manufacturing firms’ profitability variances. Our analyses emphasize the role of institutional factors against the backdrop of different stages of economic reforms and liberalization. We evaluate the changing balance between firm, industry, and group effects as a regime of command and control transits to partial liberalization, between 1985 and 1991, to a competitive market after 1991; thereafter, financial reforms occur, followed by legal reforms. We test the significance of the magnitude of the different effects, the inter se differences between various effects, and the changes in magnitudes of different effects over time as institutional change unfolds in India.

We find evidence that liberalization significantly affects the importance of firm, industry, and group effects in explaining firms’ profitability variances. Firm effects are always important, whether in a command and control regime with benefits accruing from political rent seeking or in liberalized periods where firm-specific capabilities and dynamic efficiencies are valued. In terms of magnitude, the industry effect is statistically significant in the command and control regime. Industry choice also matters in the liberalized period, when entry is free. The choice of the right segment to operate in carries a premium in explaining firms’ profitability variances. Thereafter, industry effects dissipate as firms, having chosen appropriate entry segments, leverage endogenous capabilities to enjoy sustainable performance. Business groups consistently matter in explaining profitability variances, but there are no significant intertemporal differences in group effects. The results, which are in a stream of contemporary work on emerging economy firms, are important in understanding the process of institutional changes and how they lead to industrial performance and structure transformation in emerging economies.

Acknowledgments

The authors are grateful to the referees and the senior editor for their detailed comments on the paper.

Appendix. Statistical Tests Details

This test statistic to evaluate the significance of the size of the different effects is given by

\[ LM = \frac{(\partial \ln L / \partial \sigma^2) ^2}{-\partial^2 \ln L / \partial (\sigma^2)^2} \bigg|_{\sigma^2=0} \sim \frac{1}{2} \chi^2(1) + \frac{1}{2} I(0), \]

where \( \ln L \) is the logarithm of the restricted likelihood function and \( I(0) \) is the distribution of a random variable that takes the value of 0 with probability 1. A standard likelihood ratio test (LRT) cannot be applied here since the null hypothesis lies on the boundary of the parameter space. The above test is a modification of the LRT, the \( \chi^2 \) test. Such a test is valid in this situation; see Self and Liang (1987) and Gutierrez et al. (2001) for further discussion.

The test statistic to evaluate the inter se differences between the different effects is given by

\[ T = \frac{f(\hat{\sigma}^2_a) - f(\hat{\sigma}^2_{a,t})}{\sqrt{I_{1}^{11} + I_{2}^{11} + 2I_{1}^{12}}} \sim N(0, 1), \]

where \( f(x) = \ln(\sqrt{x}) \) is a variance stabilizing transformation for the variance components, \( \hat{\sigma}^2_a \) and \( \hat{\sigma}^2_{a,t} \) are the REML estimates of the respective parameters, and \( I = [I^{11} I^{12}; I^{12} I^{22}] \) is the asymptotic variance covariance matrix for \( f(\hat{\sigma}^2_a), f(\hat{\sigma}^2_{a,t}) \).

The test statistic to evaluate the intertemporal differences in the size of each of the effects is given by

\[ T = \frac{f(\hat{\sigma}^2_{a,t_1}) - f(\hat{\sigma}^2_{a,t_2})}{\sqrt{I_{1}^{11}} + I_{2}^{11}} \sim N(0, 1), \]

where \( \hat{\sigma}^2_{a,t_1} \) and \( \hat{\sigma}^2_{a,t_2} \) are the REML estimates of the firm effect variance components for periods \( t_1 \) and \( t_2 \), respectively.

Endnotes

1. Macroeconomic factors and interaction between industry and time, representing different cyclical patterns in different industries, can contribute significantly to profitability variations.

2. Although proprietary, the database has been used for empirical works on the Indian corporate sector. Two examples include Cobham and Subramaniam (1998) and Feinberg and Majumdar (2001).

3. A standard LRT cannot be applied here since the null hypothesis lies on the boundary of the parameter space. We use a modified LRT, the \( \chi^2 \) test, which is valid in this situation.

4. The REML estimators are robust estimators for variance components analysis (Rao 1997, Pinheiro and Bates 2000). They have a lower small-sample bias compared with other approaches, such as ANOVA, COV, and maximum likelihood estimation; the asymptotic standard errors of REML estimators are easy to compute; and the approach does not produce negative variance components estimates. The independent Gaussian random effects assumption can be validated using the Hausman (1978) test, which we carry out.

5. The results for another profitability ratio, gross profit margin on sales, are similar and not reported.

6. The standard error estimates are used for hypotheses tests on the variance components when the null hypothesis lies away from the boundary of the parameter space. Testing for significance of random effects is a nonstandard problem since the null hypothesis of zero variance of one or more random effects...
lies on the boundary of the parameter space. Standard hypo-
theses testing techniques such as the LRT and Wald’s test break
down as the asymptotic χ² distributions of the test statistics
do not hold. Standard package p-values are not accurate for
these estimates (Verbeke and Molenberghs 1997).

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Sumit K. Majumdar is a professor of technology strategy at the Jindal School of Management, University of Texas at Dallas. He received his Ph.D. from the University of Minnesota. His research interests include evaluations of the impact of public policies on corporate strategy, competition policy, regulatory economics, and technology strategy, with a focus on the telecommunications sector and on Indian industry.

Arnab Bhattacharjee is a professor of economics at the School of Management and Languages, Heriot-Watt University, United Kingdom. He obtained Ph.D.’s from the University of Bombay and the Indian Statistical Institute. His research covers topics in applied statistics, with applications to industrial organization, corporate strategy, and spatial economics. His substantive interests are in the microeconometrics of data analyses for the economics and management science fields.