NBER WORKING PAPER SERIES

# DEREGULATION, MISALLOCATION, AND SIZE: EVIDENCE FROM INDIA

Laura Alfaro
Anusha Chari

Working Paper 18650
http://www.nber.org/papers/w18650

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2012

Work on this paper has been supported by Columbia University's Program on Indian Economic Policies, funded by a generous grant from the John Templeton Foundation. The opinions expressed in the paper are those of the authors and do not necessarily reflect the views of the John Templeton Foundation. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Deregulation, Misallocation, and Size: Evidence from India
Laura Alfaro and Anusha Chari
NBER Working Paper No. 18650
December 2012
JEL No. F43,G31,G38,L10,O12,O14


## ABSTRACT

This paper examines the impact of the deregulation of compulsory industrial licensing in India on firm-size dynamics and the reallocation of resources within industries over time. Following deregulation, we find that the extent of resource misallocation declines and a considerable thickening of the left-hand tail of the firm-size distribution suggesting a significant increase in the number of small firms. However, the dominance and growth of large incumbents remains unchallenged. Quantile regressions reveal that the distributional effects of deregulation on firm size are significantly non-linear. The size distribution we observe—namely, a large number of small firms and a small number of large firms—can be characterized as the "missing middle" in Indian manufacturing and suggests that small firms may continue to face constraints in their attempts to grow.



Laura Alfaro
Harvard Business School
Morgan Hall 263
Soldiers Field
Boston, MA 02163
and NBER
lalfaro@hbs.edu

Anusha Chari
301 Gardner Hall
CB#3305, Department of Economics
University of North Carolina at Chapel Hill
Chapel Hill, NC 27599
and NBER
achari@unc.edu

## Introduction

The misallocation of resources across firms can have important effects on aggregate efficiency. Policy distortions can adversely impact the allocation of resources between firms with different productivities such that the more efficient firms produce less output or employment than they would in the absence of these distortions (Restuccia and Rogerson, 2008). Recent evidence also suggests that resource misallocation is a significant factor in explaining the aggregate productivity gap between the United States, China, and India (Hsieh and Klenow, 2009). The general consensus is that not only do developing countries have fewer productive resources they are also less efficient at allocating these resources across productive uses.[1]

The rapid transformation of India's economy presents a unique and important opportunity for economists to examine the causes and consequences of the accelerated development. While many institutions and policies can distort resource allocation, in our view, regulations governing free entry and firm size are a critical source of inefficiency. In this paper, we analyze the efficiency impact of the removal of a specific distortion: compulsory industrial licensing that regulated firm entry and imposed output capacity constraints on Indian firms prior to 1991.[2]

Theory suggests that the regulation of entry into an industry determines both the entry costs faced by firms and the degree of competition between firms (Blanchard and Giavazzi, 2003; Alesina et al., 2005; Ardagna and Lusardi, 2009, 2010). The deregulation of entry can therefore reduce and redistribute rents, leading to new distributions of firms within industries over time. Incumbent firms may either decline in the face of new competitors or consolidate their positions further if the economy and hence the size of the market grows. Episodes that involve

[1] Alfaro, Charlton, and Kanczuk (2009) find that differences in the allocation of resources across heterogeneous plants are a significant determinant of cross-country differences in income per worker in a sample with plant-level data for 79 developed and developing countries.

[2] An industrial license not only regulated whether a firm could enter an industry, it also specified the maximum amount a firm could produce.

massive deregulation therefore provide a useful setting to examine changes in resource allocation.

Pro-market reforms in the 1990s rapidly deregulated significant sectors of the Indian economy previously kept off-limits to private participation. Deregulation of entry and the end of industrial licensing (also known as the “License Raj”) in all but a small subset of industries had the capacity to transform the competitive environment in which firms operated. In fact, data from the Centre for Monitoring the Indian Economy (CMIE) show that thousands of new private firms were incorporated following deregulation.

In this paper we ask whether industrial delicensing in India, which relaxed entry barriers and capacity constraints on firm size, led to a change in firm size distributions within industries. We hypothesize that the wide-ranging restrictions on entry and the artificial constraints on capacity distorted the size distribution of firms in India. Delicensing provides a unique experiment to examine the impact on firm size distributions of removing these restrictions. In this paper we use firm-level financial statement information from the manufacturing sector to examine the distributional impact of deregulation on firm size and profitability. We also use this information to measure the extent of resource reallocation in the delicensed industries. In other words, did the degree of misallocation decline for industries that removed distortions on entry and capacity in comparison to the industries that continued to restrict entry?

Before 1991, wide-ranging regulation of industries placed numerous restrictions on free enterprise. First, entry licenses regulated the number of firms operating in an industry. Second, the government implemented capacity caps that prescribed the scale of production to prevent firms from getting too large. Third, small-scale reservations restricted industrial production in several industries to small firms only. Finally, several industries were reserved for state-owned

firms and kept off-limits to private participants. Policy-makers were particularly concerned about the distributional implications of the broad-based deregulation measures of 1991, specifically whether removing entry restrictions and small-scale industry reservations would drive out small firms unable to compete with large firms, thus destroying the small-firm style of development that was championed post-independence.

Models that employ selection mechanisms operate in distinct ways and offer predictions for changes in the distributions of firm size (Hopenhayn, 1992; Ericson and Pakes, 1995; Luttmer, 2007; Jovanovic, 1982; and Melitz, 2003). In the Indian context, there are two forces that can affect firm revenues and interact to determine the total impact of deregulation on firm size and profitability. First, free entry can lead to a reallocation of factor resources, from less efficient domestic firms to the more efficient firms. An erosion of domestic incumbent firm profits through tougher selection implies that the least efficient firms exit the market. Second, the period of deregulation in the early 1990s in India coincided with rapid economic growth. To analyze the redistributive effects on firm size and profitability of deregulating entry, we also have to take into account the effects of growth on market size.

With respect to profitability, theory suggests that through free entry the revenue distribution can become left truncated due to stronger domestic selection. At the same time, rapid economic growth can lead to an increase in market size, precipitating a rightward shift in the revenue distribution for the surviving domestic firms. Our estimations are designed to evaluate the effects of deregulation on the distributional properties of profitability in order to capture the selection effects induced by free entry and the size effects associated with a growing economy.

Regarding firm size, recall that the licensing policy in India regulated capacity as well as entry. This implies that we have to analyze the impact of relaxing constraints on two margins

that, in theory, could have opposite effects on firm size. Relaxing capacity restrictions could lead to increased average firm size due to expansion. Alternatively, an increase in the number of small firms could lead to a fall in the average firm size. Although the impact of deregulation on average firm size depends on the net effect of these two countervailing forces, an important advantage of panel data at the firm level is that it also allows us to analyze changes in the properties of the entire size distribution.

We use firm-level data from the Prowess database collected by the CMIE from company balance sheets and income statements. Prowess covers both publicly listed and unlisted firms from a wide cross-section of manufacturing, services, utilities, and financial industries from 1989–2005. About one-third of the firms in Prowess are publicly listed firms. The companies covered account for more than 70% of industrial output, 75% of corporate taxes, and more than 95% of excise taxes collected by the Government of India (CMIE). Prowess covers firms in the organized sector, which refers to registered companies that submit financial statements.[3]

The advantage of detailed balance sheet and ownership data at the firm level is that we have information on a number of variables such as sales, profitability, and assets for an average of more than 10,800 firms across our sample period (1989–2005). Unlike the Annual Survey of Industries (ASI),[4] which has been used in numerous studies on India (for example, Chari, 2011; Hseih and Klenow, 2009, 2012), Prowess is a firm-level panel dataset. The data are therefore particularly well suited for understanding how firms adjust over time and how their responses may be related to policy changes. Previous attempts at estimating the impact of the licensing

[3] Section 3 describes in detail the advantages and shortcomings of the dataset.
[4] The ASI is an annual census conducted on a sampling basis of factories employing 100 or more workers. In larger industries, 20% of the factories are sampled every year, so that any given factory is sampled once in five years. The data therefore consist of repeated cross-sections.

regime have been hampered by the fact that the ASI data on factories in India consist of repeated cross-sections, ruling out the possibility of observing growth at the firm level (Chari, 2011).

We focus on firms classified across 62 three-digit industries in the manufacturing sector. The data are also classified by incorporation year so that distinctions can be made across firms by age. As a result, the data contain rich detail to characterize changes in firm size distributions, as well as differentiate across types of firms such as incumbents and new entrants. The data also allow us to measure increases in competition in several ways—an increase in dispersion in firm size distributions, a reduction in concentration ratios, or a decline in average firm size. We also use quantile regressions to compare the pre- and post-reform distributional properties of firm size and profitability.

Our main findings are as follows. First, average firm size declines significantly in deregulated industries consistent with greater competition. Second, there are significant changes in the firm-size distribution particularly in the tails of the distribution. The left-hand tail of the size distribution thickens with more small firms in the sample and on the right-hand tail the largest incumbent firms get significantly bigger following the delicensing of entry and capacity constraints. Third, quantile regressions show that the U-shaped shift in the distribution of firm size is non-linear: average firm size increases until around the 15th percentile and then gets significantly smaller until the 90th percentile, while the largest percentile (95%) gets significantly bigger over the same time period. Finally, new entrant size increases at the lower tails of the distributions while incumbent size grows at the upper tails.

The marginal increase in the number of small firms is consistent with an increase in competition following deregulation, and the reduction in average firm size implies less monopoly power. These findings confirm the predictions in Blanchard and Giavazzi (2003). The

Herfindahl index of firm sales also shows a significant decline. Policy concerns that small firms would be driven out following the deregulation of entry are not borne out in our estimations.

The finding that large incumbent firms grew larger is consistent with licensing regime restrictions. Prior to deregulation, a license determined how much (above a minimum threshold) firms could produce and invest—effectively curtailing their size. The capacity caps may therefore have constrained the most successful firms by restricting expansion. Removing these restrictions through deregulation could allow the most dynamic and efficient incumbent firms to expand unhampered. Inputs imported thanks to trade liberalization may also have allowed the large incumbents to become more efficient and grow.

The U-shaped pattern observed in the post-liberalization firm size distribution suggests that deregulation may have created a winner-take-all environment where the largest firms drive out any competition.[5] So, while deregulation leads to more small firms in the sample, there appears to be a hollowing out in the middle of the size distribution. The size distribution we observe—namely, a large number of small firms and a small number of large firms—can be characterized as the "missing middle" in Indian manufacturing and points to constraints that small firms may continue to face in their attempts to grow.

We also find that the contribution of resource reallocation to growth in India increases in the years following deregulation, suggesting that distortions have decreased over time with higher gains for deregulated industries.[6] There is, however, substantial variance across years in

[5] The evidence of large incumbent dominance is consistent with the findings in Bollard, Klenow, and Sharma (2011) with respect to the acceleration in manufacturing sector productivity growth in the early 1990s for large incumbents in particular. Sharma (2008) and Chamarbagwalla and Sharma (forthcoming) also present evidence on the importance of large plants in raising levels of labor productivity and the demand for skilled workers, respectively.

[6] Our findings are consistent with international evidence that allocative efficiency improves following deregulation. Bertrand, Schoar and Themar (2007) show that the deregulation of the French banking industry led to improvements in allocative efficiency and promotes the process of "creative destruction." Similarly, Black and Strahan (2002), and Guiso, Sapienza, and Zingales (2004) find that competition in the banking sector and financial development fosters firm entry in the United States and Italy respectively.

the extent of reallocation. Most of the reallocation gains in the early period following deregulation can be attributed to the new entrants in the deregulated industries, while the later period shows substantial reallocation gains for the incumbent firms in those industries.[7] These findings are consistent with the view that competition effects and other gains from deregulation required time to materialize and start to have significant impact with a lag.

We conduct a number of tests to ensure the robustness of the findings. The firm size regressions are estimated for both assets and sales. We use a balanced panel of incumbent firms with and without fixed effects. The fixed effects specification controls for unobserved heterogeneity at the firm level. We use an unbalanced panel of firms to allow for new firms to enter the sample and to examine the distributional impact of deregulation. The specifications include a year trend variable to control for the overall growth in the economy. Finally, standard errors are clustered at the three-digit NIC level to allow for correlations in residuals across firms within an industry. We also control for other economic reforms such as trade or foreign direct investment (FDI) liberalization that could have a significant impact on the firm-size distribution and profitability, independent of any effects of delicensing. Our results are robust to the inclusion of these controls.

The paper is related to a large literature on the size and productivity distribution of firms in macro, trade, finance, and industrial organization. Recent theoretical attempts to explain the evolution of the size distribution of firms and resource reallocation focus on (i) selection mechanisms where unsuccessful firms decline and exit (Hopenhayn, 1992; Ericson and Pakes, 1995; Luttmer, 2004; Jovanovic, 1982; and Melitz, 2003); (ii) inefficiencies in financial markets

[7] Bollard, Klenow, and Sharma (2011) using the Indian Annual Survey of Industries, find evidence of a large acceleration in aggregate productivity growth in formal Indian manufacturing during the sample, for example, in the early 1990s. The acceleration can be seen in large incumbents in particular.

and their impact on small firms (Cabral and Mata, 2003; Clementi and Hopenhayn, 2006; Albuquerque and Hopenhayn, 2004; and Cooley and Quadrini, 2001); and (iii) managerial ability (Lucas, 1978; Garciano, LeLarge, and Van Reenen, 2012).

Briefly, some of this research predicts that the deregulation will lead to (i) more firms and less incumbent power (Blanchard and Giavazzi, 2003; Alesina et al., 2005); (ii) increases in average firm size and profits through reductions in capacity restrictions (Blanchard and Giavazzi, 2003; Alesina et al., 2005; Campbell and Hopenhayn, 2005); (iii) increasing dispersion in sales, assets, and profits (Campbell and Hopenhayn, 2005; Syverssen, 2004); and (iv) increasing turnover and firm age distributions tilting toward younger firms (Asplund and Nocke, 2006).

Recent work using dynamic models provides another strand of literature that highlights the point that lowering the cost of entry leads to reallocations of resources across firms within an industry. Jovanovic (1982), Hopenhayn (1992), and Melitz (2003) provide frameworks with monopolistic competition and heterogeneous firms that highlight the selection mechanisms and survival as inefficient firms are forced to exit and resources get reallocated to more productive firms. The models predict that lower entry costs or greater substitutability lead to changes in firm composition within industries along with improvements in aggregate industry productivity. Economic units in these models operate as if the discounted sum of their future profit stream is above the opportunity cost of operating, consistent with our focus on profitability in this paper.

The paper is also related to a vast literature that examines various aspects of the 1991 reforms in India. Most closely related however is Aghion et. al. (2008) who study the effects of the progressive elimination of the system of industrial regulation on entry and production on registered manufacturing output, employment, entry and investment across Indian states with different labor market regulations. The effects are found to be unequal depending on the

institutional environment. Our analysis focuses instead on the distributional consequences of deregulation and the non-linear evolution of the firm size distribution. Our results on large incumbent dominance and the "missing middle" are consistent with the findings in Bollard, Klenow, and Sharma (2011) with respect to the acceleration in manufacturing sector productivity growth in the early 1990s for large incumbents in particular.

It is also important to mention that while theory suggests that the number of firms operating within industries can change through entry and exit in the face of deregulation, most models assume that firms are able to efficiently allocate resources within the firm and that factor markets are frictionless.[8] In the Indian context, Panagariya (2008) notes that remnants of industrial regulation still affect the operation of Indian firms and may constrain their flexibility in adjusting to new economic conditions. Lingering restrictions, for example, can make it difficult for small firms to enter. India's reforms opened up parts of the economy for competition but left "an alliance of well-connected industrialists and public officials (dubbed as 'the Resource Raj') that between them carve up the permissions and licenses that have in the past underpinned India's growth."[9]

Evidence also suggests that despite the extensive industrial deregulation in the early 1990s, rigid labor market regulations may continue to affect the daily operations of Indian firms, potentially precluding them from eliminating unprofitable product lines. For example, an all-India amendment to the Industrial Disputes Act (1947) in 1982 required firms with more than 100 employees to seek government approval to dismiss workers (Kochhar et al., 2006). In

[8] The exception is Garciano, LeLarge, and Van Reenen (2012) who find that sharp increases in firing costs have a significant impact on the size distribution of firms (a "broken power law") and productivity and that the costs of the regulation are sizable.

[9] Raghuram Rajan, quoted in James Crabtree "India's Growth Threatened by Old Abuses," *Financial Times*, May 2012.

addition, liquidation procedures are cumbersome and long. As noted by Panagariya (2008), "India operates in a world with virtually no exit doors." India's bankruptcy rate was, according to the World Bank (2005), 4 per 10,000 firms, compared with 15 in Thailand and 350 in the United States.

The paper is organized as follows. Section 2 provides a description of the deregulation measures and Section 3 describes the data. Section 4 presents summary statistics about firm size distributions and profitability before and after deregulation, and by incumbent and new entrant status. Section 5 presents the empirical methodology and results. Section 6 presents robustness checks. Section 7 concludes.

## 2. The New Industrial Policy of 1991

We analyze the effects of deregulation policy in the manufacturing sector of India to examine the evolution of the size distribution of firms. We particularly emphasize industrial policy that required firms to obtain a license to enter an industry and also stipulated the amount of output a firm could produce once it was in operation. According to Kochhar et al. (2006), the licensing regime that imposed restrictions on entry and capacity resulted in relatively small firms such that in 1990, the average manufacturing firm in India was more than ten times smaller than one in the United States.

Following a balance-of-payments crisis in 1991, a new industrial policy was enacted that abolished the system of licensing for all but a few key industries, particularly those related to national security. In addition, private firms were allowed to enter industries previously reserved for state-owned firms—a policy commonly referred to as "de-reservation." The broad-based reform package of 1991 also included concurrent reforms that could impact entry, such as tariff reductions that could introduce import competition product markets and FDI liberalization that

allowed foreign firms into a subset of industries. To test for the robustness of our findings, our estimations control for the effects of the concurrent policy changes. In this section, we provide a broad overview of the reforms and refer the reader to studies that provide in-depth detail about specific measures.

The trend toward delicensing and de-reservation began with the industrial policy statements in 1985 that outlined many liberalization measures, including not restricting business houses to Appendix 1 industries as long as they moved to industrially backward regions and raised the minimum asset limit to define business houses. The pace of these policy trends accelerated with the new industrial policy outlined in the Industrial Policy Resolution of 1991.

An excerpt from the new industrial policy statement reads, "In order to achieve the objectives of the strategy for the industrial sector for the 1990s and beyond it is necessary to make a number of changes in the system of industrial approvals. Major policy initiatives and procedural reforms are called for in order to actively encourage and assist Indian entrepreneurs to exploit and meet the emerging domestic and global opportunities and challenges. The bedrock of any such package of measures must be to let the entrepreneurs make investment decisions on the basis of their own commercial judgment. The attainment of technological dynamism and international competitiveness requires that enterprises must be enabled to swiftly respond to fast changing external conditions that have become characteristic of today's industrial world. Government policy and procedures must be geared to assisting entrepreneurs in their efforts. This can be done only if the role played by the government were to be changed from that of only exercising control to one of providing help and guidance by making essential procedures fully transparent and by eliminating delays."[10]

[10] http://dipp.nic.in/English/Policies/Industrial_policy_statement.pdf.

As a result, compulsory industrial licensing was abolished for all except 18 industries specified in Annex II. The industries in Annex II were to continue to be subject to compulsory licensing for reasons related to "security and strategic concerns, social reasons, problems related to safety and over-riding environmental issues, manufacture of products of hazardous nature and articles of elitist consumption."[11] Finally, areas where security and strategic concerns predominate will continue to be reserved for the state-owned sector (listed in Annex I). The statement also iterated that the exemption from licensing was expected to make the manufacturing sector more competitive and efficient and be particularly helpful to the many dynamic small and medium entrepreneurs who had been unnecessarily hampered by the licensing system.

Large companies no longer needed Monopolies and Restrictive Trade Policies Act (MRTP) approval for capacity expansions. The number of industries reserved for the public sector in Schedule A (IPR, 1951) was cut from 17 to 8. Schedule B which listed industries open to the private sector with an increasing role for the state (particularly for new establishments) was abolished altogether. These industries included minerals, aluminum, and other non-ferrous metals not listed in Schedule A; machine tools; basic intermediate products required by the chemicals industries; antibiotics and other essential drugs; synthetic rubber; fertilizers; and road and sea transport.

A natural question that arises in the context of any policy change that is applied differentially across industries is why certain industries were deregulated and not others. It is important to note that the delicensing measures in 1991 were enacted under the auspices of an IMF structural program in response to a balance of payments crisis. Since the crisis and reforms

[11] http://dipp.nic.in/English/Policies/Industrial_policy_statement.pdf.

were largely unexpected, it is hard to make a case that certain industries may have anticipated and lobbied either in favor or against the reforms.[12]

Following Aghion et. al. (2008), we ran a cross-sectional regression of the year in which a three-digit industry was deregulated on sales growth in that industry during the 1990–1991 period (prior to deregulation) to see if the government deregulated industries according to their perceived growth potential. We find no evidence of a relationship between when an industry is deregulated and pre-reform sales growth (the estimated coefficient of interest is -0.0333, and the standard error is 0.0785). T-tests of means also confirm that sales growth was not statistically significantly different across the deregulated and restricted industries in the pre-reform period. Similar results are found using other measures of pre-reform industrial performance such as asset growth and firm profitability growth during 1988–1991. The absence of systematic differences in pre-reform economic performance between industries provides evidence that the deregulation decision was largely exogenous.

From the lists of industries in Annex I and II it is not also obvious that other usual suspects for selection bias such as optimal industrial structure were the drivers of the industries that were deregulated. For instance, the beverages industry was deregulated while the alcoholic beverages segment was kept restricted out of social concerns. Similarly, the manufacturing of refrigerators, dishwashers, washing machines, microwave ovens and air conditioners were kept restricted while the manufacture of TV, radios and other domestic appliances were deregulated. It appears that an arbitrary distinction was made by the government that certain domestic appliances were deemed elitest and others not. The main point is that it is not readily apparent

[12] Aghion et. al.(2008) advance a similar argument to make the case that the reforms constituted an exogenous shock,

from the list of industries that were not deregulated as to what observable industry characteristic formed the basis for selection and therefore potential selectivity bias in the sample.

The FDI reforms in 1991 reduced barriers to foreign entry in a subset of industries. According to the Industrial Policy Resolution of 1991, automatic approval was granted for foreign direct investment of up to 51% in 46 of 96 three-digit industrial categories (for industries listed in Annexure III of the Statement of Industrial Policy in 1991). In the remaining 50 industries, the state continued to require that foreign investors obtain approval for entry. The Industrial Policy Resolution of 1991 provides information about the list of manufacturing industries in which the state liberalized foreign entry and also a list of industries where domestic entry restrictions continued to be in effect.

In addition, trade liberalization led to a reduction in the level and dispersion of tariffs, a removal of quantitative restrictions on imported inputs and capital goods for export production, and elimination of public-sector monopoly on imports of almost all items. The government's export-import policy plan (1992–1997) dramatically reduced the use of quantitative restrictions, and tariff reductions took place in 77 industrial categories (See Topalova, 2007 for further details).

## 3. The Data

We use firm-level data from the Prowess database. The sample period is from the year of inception of dataset, 1989–2005.[13] The data are collected by the CMIE from company balance sheets and income statements and cover both publicly listed and unlisted firms from a wide cross-section of manufacturing, services, utilities, and financial industries. About one-third of the

[13] The Prowess database has now been used in several studies including Bertrand, Mehta, and Mullainathan (2002), Khanna and Palepu (1999), Fisman and Khanna (2004), Khanna and Palepu (2005), and Chari and Gupta (2008).

firms in Prowess are publicly listed firms. The companies covered account for more than 70% of industrial output, 75% of corporate taxes, and more than 95% of excise taxes collected by the Government of India (CMIE).

Prowess covers firms in the organized sector, which refers to registered companies that submit financial statements. According to the government, "The organized sector comprises enterprises for which the statistics are available from the budget documents or reports, etc. On the other hand the unorganized sector refers to those enterprises whose activities or collection of data is not regulated under any legal provision or do not maintain any regular accounts" ("Informal Sector in India: Approaches for Social Security," Government of India, p. 2, 2000). Indian firms are required by the 1956 Companies Act to disclose information on capacities, production, and sales in their annual reports. All listed companies are included in the database regardless of whether financials are available.[14]

The Indian National Industrial Classification (NIC) (1998) system is used to classify firms in the Prowess dataset into industries. The data include firms from a wide range of industries, including mining, basic manufacturing, financial and real estate services, and energy distribution.

An advantage of firm-level data is that detailed balance sheet and incorporation information allow us to analyze how incumbent firms are impacted by policy changes such as deregulation. In contrast, industry-level databases usually do not provide information about sales, assets, and profits by incorporation year and hence firm age.[15]

[14] Unlisted companies are not required to disclose their financials. CMIE asks their permission, but if they refuse, it cannot include these companies in Prowess.

[15] Since firms are not required to report employment in their annual reports, we observe employment data for only a more restricted sample of firms. Financial services is the only industry that is mandated by law to disclose employment information. Since the sample of firms that report employment is small, we do not focus on these numbers.

The data allow us to examine whether the ownership composition of firms changed by number and size of firms, fraction of sales, or assets and profits by age (incumbent status) and industry. We can also examine changes in firm activity and market dynamics in industries where entry restrictions, both foreign and domestic, were lifted. Appendix 1 provides a description of variables used in the data analysis.

One concern with the data may be related to new entrants versus improvements in the data coverage by CMIE. However, for all firms that Prowess covers, regardless of when the decision is made, financial data from 1989 onward—wherever available—is added to the database. We address the issue of improved coverage in the data versus new entry by making use of information about incorporation dates. We begin with a sample of firms in 1989 and allow firms to enter the sample only if the new firms enter with data coinciding with their incorporation date. Following 1991, a firm is identified as a new entrant only if its data coverage coincides with its incorporation date (also later than 1991).

A point about firm exit is worth noting. The dataset contains a code for firms that exited the data via mergers and acquisitions. However, the data do not contain a flag for firms that are shut down versus those with discontinued coverage. Therefore, when we no longer observe data for a firm, we assume firm exit. But again, this may also reflect discontinued coverage by Prowess or the failure of unlisted firms to provide data about their operations. To address this issue, we construct a balanced panel of incumbent firms we follow over the sample period and an unbalanced panel of incumbent and new entrant firms into which we only allow a new firm to enter if data availability coincides with the year of incorporation after 1991. We also classify firms that do not report data because of mergers and acquisitions as firms that exit the data due to consolidation.

Note that unlike the Annual Survey of Industries (ASI) which is a survey of manufacturing, the Prowess data is a panel of firms. The ASI is a repeated cross-section such that only a fifth of the total number of factories in any given industry in a given state are in the sample in any given year. The sampling design implies that any given factory appears in the ASI sample only once every five years so that the data are not of a panel nature. Prowess is therefore particularly well suited to examining how firm-characteristics including firm size and profitability distributions evolve over time and may respond to policy changes.

While Prowess is not a census of manufacturing firms, a number of papers use the data to exploit its panel nature. For instance, Goldberg et al. (2009) use the Prowess dataset to examine how firms adjust their product-mix over time. New products that are introduced into the market by firms not covered by Prowess are also excluded from their study.

## 4. Summary Statistics

Consistent with the rapid economic growth observed in India after the mid-1980s, firm activity measured by the number of firms grew substantially relative to the beginning of the sample period. The data show the incorporation of large numbers of new firms following the reforms. The acceleration in entry in the period following 1991 continued through the rest of the decade and by 2005, 4,800 new firms entered the market. The data also show evidence of lingering exit restrictions, however. While there is significant evidence of increased firm entry, we observe little firm exit.

Table 1 shows summary statistics for industry concentration (the Herfindahl index[16]), firm size, profitability, and dispersion measures (coefficient of variation calculated by assets and

[16] The Herfindahl index is an indicator of the degree of competition among firms in an industry. It is defined as the square of the market shares of each firm in an industry. The value of the Herfindahl index can range from zero in

sales). Underlying average market share values are calculated for a given firm across the years in a sub-period and then the Herfindahl index is calculated by industry for a given subperiod. The Prowess database provides four- and five-digit industry classifications for most firms. However, because the deregulation policies were enacted at the three-digit level, industry concentration is accordingly computed at the three-digit level. We present data for the full sample first and then by the year of incorporation and for the deregulated industries. Appendix Table 2 presents detailed information on the industries included in the data.

For the full sample, Table 1 (panel A) shows a reduction in market concentration for the average firm throughout the sample period. The Herfindahl indices suggest an increased degree of competition among firms in India. The coefficient of variation (for both sales and assets) also indicates increased dispersion. A picture emerges of the average manufacturing firm in India growing smaller—in terms of assets, sales, and profits—along with a substantial increase in heterogeneity over the period.

Panel B presents information by year of incorporation (between pre-1947, 1947–1985, 1985–2005) for firm size (assets, sales), profitability, and rate of return and their evolution over the sample period. The oldest firm in the sample (Howrah Mills Company Ltd.) was incorporated in 1825, and the sample begins with over 390 manufacturing firms that were incorporated before independence. Some firms from this group exit the sample through mergers. Many of these older firms (pre-independence), however, remain in operation following the reforms.

Panel C describes how firms evolved in the deregulated industries. Relative to the full sample in panel A, market concentration seems to have fallen significantly for the deregulated industries—the Herfindahl index declines from 0.33 to 0.24—consistent with declining

perfectly competitive industries to one in single-producer monopolies. All data are first expressed in constant rupees crore.

incumbent monopoly power. The market share, size, and profitability of the average firm in deregulated industries declined significantly five years following the policy change. Dispersion in firm size also increased following deregulation.

Panel D shows the corresponding statistics for the restricted industries. The numbers suggest that the restricted industries were significantly more concentrated than the deregulated industries and remained so over the sample period. T-tests of means show that these differences are statistically significant. Note that new firms could operate in restricted industries if they were granted a license. Further, in contrast to the pattern of declines in the deregulated industries, average firm size and profitability remain remarkably unchanged over time in the restricted industries.

In panels E and F, the total market share variable refers to the fraction of sales accounted by incumbent and new entrant firms relative to the total sales in a particular industry. It is interesting to note that the average market share of incumbent firms in total sales declined from 99% to 83% between 1989 and 2005. Mirroring this decline in average incumbent shares is the increase in the average market share of new entrants incorporated after 1991 from 1% to 22% over the same period.[17]

For the average firm, market shares declined significantly following the policy change in deregulated industries in panel C, as did average firm profits, sales, and assets. However, average incumbent firm profits in deregulated industries appear to have remained stable.

In brief, summary statistics suggest that industry concentration, average market shares, firm size, and profits all declined in deregulated industries. The coefficient of variation in

[17] Note that the market shares of incumbents and new entrants do not sum to exactly 100% for the following reason. The total market share measure for incumbents was constructed by taking the ratio of total incumbent sales to total industry sales by NIC3 industry and taking an average of this ratio across industries. Similarly, the total market share of new entrants was constructed by taking the ratio of total new entrant sales to total industry sales by NIC3 industry and then averaging this ratio across industries.

average firm sales and assets increased, suggesting that there is greater dispersion in firm size within deregulated industries.

### 4.1 Distributional Statistics

Table 2 presents detailed distributional statistics for firm size (log sales and log assets) before and after deregulation. For both assets and sales, the mean and median numbers (P50) suggest that firm size declined over the sample period; the pattern holds for incumbent firms as well. New entrants, on the other hand, experienced an increase in firm size, perhaps not surprisingly.

The average incumbent firm has grown smaller, more profitable, and somewhat more heterogeneous in firm size.[18] For the average incumbent firm, dispersion in firm size measured by the standard deviation and coefficient of variation has increased. While new entrants have also grown significantly in terms of sales and assets, the incumbent firms are considerably bigger than the new entrants. Consistent with international evidence, this suggests that young firms tend to be small. For new entrants, dispersion also increases during the sample period.

The tails of the size distribution in Table 2 reveal two distinct patterns. First, we see that the smallest firms in the left-hand tail of the size distribution have become smaller over time. The firms in the tenth percentile have grown considerably smaller since deregulation. The data also suggest that there are more small firms in the sample following deregulation, and perhaps not surprisingly the new entrants are much smaller than the incumbent firms in the lowest percentiles of size for both assets and sales.

[18] Note that the average firm profit, sales, and assets measures were constructed by taking firm averages by year and industry and then averaging these measures across industries and years with a given time period. For example the average firm asset size of Rs. (crore) 69.15 was constructed by taking the average of average firm assets by industry across industries and over the two-year period 1989–1990.

Second, the largest firms have grown bigger. For all three samples—the full sample, the incumbents, and the new entrants—the largest firms in the 99th percentile have grown larger over time. These two patterns from the distributional data (small firms getting smaller and big firms bigger) are consistent with an increase in the standard deviation in the size distribution. Consistent with the increase in the standard deviation of firm size and the fall in the average firm size, firm-size dispersion measured by the coefficient of variation rises.

With respect to averages, the preliminary findings from the size distribution data are not entirely consistent with the predictions of models with selection that result in a truncated distribution and predict that average firm size should rise. While the largest firms increase in size, the left-hand tail of the size distribution becomes considerably thicker. In addition, average firm size and average firm profits fall rather than rise as these models predict. The findings are at first pass consistent with Blanchard and Giavazzi (2003) and Alesina et al. (2005) where, on average, incumbent firms are predicted to lose monopoly power following deregulation. The marginal increase in the number of small firms is consistent with an increase in competition following deregulation.

The final column of Table 2 shows that the size distribution becomes negatively skewed over time. The pattern is more clearly seen in Figure 1a–d. The size distribution flattens and shifts in the direction of negative skewness following deregulation with the magnitude of skewness increasing over time. The size distribution in the early years following deregulation (1991–1995) is more skewed in comparison to the period prior to deregulation (1989–1990), and the size distribution in the later years (2003–2005) is more skewed in comparison to the early years (1991–1995) post-deregulation. The shift in the pattern of skewness holds for both log

assets and log sales, as well as for the incumbent firms. We do not conduct the analysis for the new entrants because by definition they did not exist before deregulation.

## 5. Empirical Methodology and Results

This section presents formal estimations of the impact of deregulation on firm size. We begin by considering a balanced panel of incumbent firms that existed before deregulation. Next, we present unbalanced panel estimates that allow for compositional effects to occur with new firms in the sample. Last, we present estimates of the extent of resource reallocation or the efficiency gains that take place in the post-reform period.

### 5.1 Deregulation and Size: Balanced Panel

To examine the impact of deregulation, a restricted sample panel of incumbent firms is better suited to analyzing pre- and post- deregulation effects on these firms. By restricting the sample to incumbent firms, we are able to parse out compositional effects that occur with new firms entering the sample. We first look at the impact of deregulation on incumbent firms without firm fixed effects to examine more simply what happens to incumbent firms. Second, we introduce compositional controls in the form of firm fixed effects to control for unobserved heterogeneity at the firm level. Third, we examine an unbalanced panel that allows for compositional effects to occur with new entrants to analyze distributional effects.

We begin with the following benchmark regression specification, for firm *i* in sector *j* and year *t*,

$$Y_{ijt} = a_i + Year_t + d\,Lib_{jt} + + e_{ijt}\,, \qquad (1)$$

where $Y_{ijt}$ represents different outcome variables such as sales or profitability. We also control for firm fixed effects and a year trend. Standard errors are robust and clustered at the three-digit industry level.

Since the sample period in this paper coincides with a period of rapid growth in the Indian economy, we incorporate a linear year trend in our estimations to more precisely isolate the impact of deregulation policy. We report estimates with and without the year trend to highlight the impact on the coefficient estimates and their interpretation.

Table 3 presents regression estimates for a balanced panel of firms from in columns 1–7 and column 9. The dependent variable is the logarithm of annual firm sales. *Delicense* is a dummy variable that takes a value of one if a firm is an industry that deregulated entry in 1991. Standard errors are clustered at the NIC three-digit level.

Columns 1 and 3 show the impact of deregulation on log sales and log assets for incumbent firms with industry fixed effects. To account for the rapid growth in the economy over this time period, we incorporate a year trend variable into the specifications. The coefficient on the *Delicense* dummy is negative and significant for both firm sales and assets. The coefficient on the year trend, on the other hand, is positive and significant. The results from the specification in columns 1 and 3 suggest that the impact of deregulation on firm size in the context of a growing economy can be decomposed into two effects: a competitive effect through firm entry and a growth effect. Competition through entry appears to reduce average firm size, while the growing economy lifts all boats, increasing average firm size. Incorporating the year trend variable is therefore important not only because it allows us to isolate the impact of deregulation on firm size but also because it suggests that a dynamic model is better suited to

examining the effects of deregulation on competition and firm size in a rapidly growing economy.

It is important to note that the negative and significant coefficient on the deregulation dummy (*Delicense*) is consistent with two alternative interpretations. The negative coefficient on the *Delicense* variable—along with the positive year trend coefficient—can be interpreted as either a decline in average firm size in deregulated industries or, alternatively—controlling for the overall growth of the economy—slower growth in the deregulated industries.

In addition to specifications that incorporate a simple linear trend (Columns 1 and 3), the specifications in Columns 2 and 4 include year fixed effects to allow for macroeconomic shocks that affected all industries in the same way. The coefficient on the *Delicense* dummy remains negative and significant.

Columns 5 and 6 present regression estimates in a specification where the dependent variables are firm profitability and the industry-level Herfindahl index of firm sales using an unbalanced panel of firms. Column 5 shows that average firm profitability rose among the deregulated industries. Consistent with an increase in competitiveness and with the summary statistics in Table 1, the Herfindahl index declines significantly in industries that were deregulated, as column 6 shows. The pattern of declining Herfindahl indices is also seen when we estimate a specification with a balanced panel of incumbent firms—although with a slightly smaller magnitude of coefficient estimates—suggesting a decline in the monopoly power of incumbent firms after deregulation consistent with the predictions from Blanchard and Giavazzi (2003). The Herfindahl index also shows a significant decline if we restrict the sample period to the immediate aftermath of the deregulation in 1991–1995. The magnitudes are smaller but significant. We do not include a year trend variable in the specifications in Columns 5 and 6 as

there is no obvious theoretical rationale for why profitability or industry concentration should be systematically affected by economic growth.

### 5.2 Deregulation and Size: Unbalanced Panel

With unbalanced panels we allow for compositional effects to occur with entry. We use quantile regressions to examine the distributional effects of deregulation on firm size. Quantile (including median) regression models, also known as least absolute value (LAV) models or minimum absolute deviation (MAD) models. In the median regression estimates version of the quantile regression model, the median of the dependent variable is analyzed conditional on the values of the independent variable. This is similar to least squares regression, which estimates the mean of the dependent variable. Alternatively, quantile regressions find the regression plane that minimizes the sum of the absolute residuals rather than the sum of the squared residuals.

Since we are interested in characterizing the entire distribution of firm size before and after deregulation, we specify a regression specification that estimates the regression plane for quantiles ranging from the 5th percentile to the 95th percentile of the distribution of the outcome variable of interest (size, profits) at intervals of 5%. Standard errors are bootstrapped.

As described by Koenker and Bassett (1978), the estimation is done by minimizing the following specification:

$$\underset{\beta \epsilon R^K}{Min} \sum_{t \epsilon \{t: y_t \geq x_t \beta\}} \theta |y_t - x_t \beta| + \sum_{t \epsilon \{t: y_t \geq x_t \beta\}} (1-\theta) |y_t - x_t \beta| \,, \qquad (2)$$

where *y* is the dependent variable, *x* is the *k* by *1* vector of explanatory variables, β is the coefficient vector, and *1* is the quantile to be estimated. The coefficient vector β will differ depending on the particular quantile being estimated.

Table 4 estimates the quantile regression specification with log sales as the dependent variable and with the deregulation dummy (*Delicense*) in panel A. A second specification in panel B includes the year trend variable. The coefficients on the deregulation dummies display considerable non-linearity and highlight the heterogeneous effects of deregulation on firms of different sizes.

The coefficient estimates suggest that the impact of deregulation on log sales for firms across firm-size quantiles is non-linear. There is an increase in the average firm size for firms in the 5th through the 15th percentile consistent with entry by small firms from the left-hand tail. There is, however, a significant decline for all quantiles from the 20th to the 90th percentile. Finally, the coefficient for the 95th percentile is positive and significant, consistent with large incumbents growing bigger. Adding a year trend shifts the quantile regression coefficients curve up.

Figure 2 depicts these findings graphically to highlight the non-linear impact of deregulation on firm size across quantiles. It also serves to highlight the varying magnitude of the coefficient estimates across quantiles. Adding a year trend shifts the magnitude of the coefficient estimates on the deregulation measure on firm size. Adding industry fixed effects absorb the time-invariant heterogeneity across industries in addition to a year-trend variable results in a similar pattern.

Panel C of Table 4 presents estimates of the quantile regression specification with the return on assets as the dependent variable and with the deregulation dummy (*Delicense*). The coefficients on the deregulation dummies display considerable non-linearity and highlight the heterogeneous effects of deregulation on firms of differing profitability. A note of caution is that the return on asset series is very noisy, with extreme outliers both negative and positive.

Therefore, it is not clear how much weight we can place on the patterns observed. The coefficient estimates indicate that the return on assets declined significantly in industries that were deregulated consistent with greater competition. Figure 3 displays these results graphically.

We also estimate the quantile regression specification for incumbent and new entrants with log sales as the dependent variable (with and without the year trend variable). We measure incumbents as firms that existed in the pre-reform period.

Table 5 presents the results. The coefficients on the deregulation dummies display considerable non-linearity and highlight the heterogeneous effects of deregulation on firms existing before 1991 and firms that entered in the post-deregulation period.

Analyzing the tails of the size distribution reveals several interesting patterns. First, in the right-hand tail of the distribution, the largest incumbents increase in size (measured by sales). Second, the new entrants also increase in size (measured by sales) in the left-hand tail of the size distribution. There is, however, a significant reduction in gains as we progress across the different quantiles of the distribution. Results with and without the year trend behave similarly, although the significance of the results is varied. Figure 3 depicts these findings graphically to highlight the non-linear impact of delicensing on incumbents and new entrants. (We show results only with the year trend.) Following deregulation, the size of new entrants size increase at the lower levels of the distributions, while incumbents grow at the upper tails of the distribution. We obtain similar results using incumbents defined as firms existing before 1985 (not shown, results available upon request). However, shrinking firm sizes in the middle quantiles is consistent with concerns about the “missing middle” in Indian manufacturing, indicating that small firms may be constrained in their ability to grow.

### 5.3 Deregulation and Misallocation

Recent research has shown that policy and institutional distortions can have a significant impact on the efficiency of resource allocation across productive uses. The deregulation policies implemented in India had the potential to have important effects on the reallocation of resources. In this section, we examine the effects of deregulation on the allocation of resources across firms. Our methodology follows Alfaro, Charlton, and Kanczuk (2008), who draw on the work of Restuccia and Rogerson (2008) and Hsieh and Klenow (2009). We use a monopolistic competition model to analyze the implications of deregulation for allocative efficiency in the post-reform period. Given the similarities with previous work, we briefly outline the model and methodology. (See references for further details.)

Final output is produced by a standard CES aggregate of a continuum of differentiated goods. This implies that demand for the differentiated good is given by price by the Lerner formula, *(p-c)/p*, where *p* is price and *c* is the marginal cost. In this economy, there exists a continuum of production units that share the same Cobb-Douglas functional form, but might differ in their productivity factors, which are indexed by φ:

$$y_\varphi = AA_\varphi k_\varphi^\alpha l_\varphi^{1-\alpha}, \qquad (3)$$

where $A$ is the economy-wide productivity factor; $A_\varphi$ is the plant-specific productivity factor; $k_\varphi$ and $l_\varphi$ are, respectively, the capital rented and labor hired by the firm; and α is the capital share parameter. Conditional on remaining in operation, the incumbent firm maximizes its period profit, which is given by:

$$\pi_\varphi = (1-\tau_\varphi)\, p_\varphi y_\varphi - rk_\varphi - wl_\varphi, \qquad (4)$$

where $\tau_i$ denotes a firm-specific distortion, and $r$ and $w$ denote the rental rates of capital and labor, respectively. Firm-specific distortions in this framework are akin to firm-specific

output taxes (or subsidies)[19] that alter the profit maximization decision across firms. As a result, these idiosyncratic distortions introduce a dimension along which firms within an industry can be heterogeneous and can lead to a reallocation of resources across firms. In our setting, distortions introduced by the licensing requirements and output caps, for example, can impact firm size distributions as a function of firm productivity.

We assume a large (unbounded) pool of prospective firms that could enter an industry. Entry is costly, however, and prospective entrants must make the entry decision (or expansion decisions) in light of a distribution of potential draws for firm productivity ($A_\varphi$) and the firm-specific tax ($\tau_\varphi$). Although for any given firm, productivity and the tax remain constant over time, each firm also faces a constant probability of exit (death) in any given period.[20]

In steady-state equilibrium, the consumer problem determines the rental rate of capital, which is a function of the time discount factor and capital depreciation rate. Given the rental rate of capital, the zero profit condition for firm entry determines the steady-state wage rate. Since labor supply is inelastic in equilibrium, total labor demand must equal one.

The calibration exercise involves matching India's firm profitability/sales distribution to the observed distribution in the United States, which we take as the benchmark economy. We find the distribution of firm-specific distortions needed to match the observed distribution of firm profitability/sales (histogram) in India, assuming that India faces the same productivity distribution as the United States. This enables us to estimate how much aggregate output is lost due to economic distortions that lead to a misallocation of resources across firms in an industry.

[19] In Restuccia and Rogerson (2008), the focus is on policies that create idiosyncratic distortions to plant-level decisions and hence cause a reallocation of resources across plants. While many different types of policies may generate such effects, the approach Restuccia and Rogerson (2008) take is to analyze a generic set of distortions. Specifically, they assume that each plant faces its own output tax or subsidy.

[20] This is similar to Restuccia and Rogerson (2008), who assume that in any given period after production takes place, each plant faces a constant probability of death. They argue that it would be easy to allow this value to depend on the plant-level productivity parameter.

For the U.S. data we use Dun & Bradstreet's (D&B) WorldBase and capital stock and other data from Penn Table 6.1. We borrow the technology parameters from the literature—we assume a capital share, $\alpha = 1/3$. We set the elasticity of substitution, $\sigma = 6$, consistent with 20% mark-up in price over marginal cost (Rotemberg and Woodford, 1992). The output and capital stock (*Y* and *K*) are from the 6.1 version of the Penn World Tables. Capital is calculated by perpetual inventory method, with the depreciation rate equal to 6% and the initial capital stock determined by the initial investment rate and its geometric growth over the period. Using the revenue data and assuming the U.S. economy represents the undistorted benchmark, we recover the impact of distortions on growth.

Figure 5 decomposes the contributions of various factors to growth in the misallocation model using the aggregated GDP per worker, $Y/L=AD(K/L)^{\theta}H^{(1-\theta)}$. We measure the contributions attributable to (i) technology/productivity (A), (ii) capital per worker (K/L), and (iii) the misallocation factor (D). As the figure shows, over the period of study (1989–2005) improvements in allocative efficiency via reallocation had, on average, a positive contribution on growth. In other words, the calibration exercise suggests that distortions decreased over the 1989–2005 period, although the figure shows substantial variance across years.

During the sample period, average GDP per worker growth was 4.4% per year. In the standard model (with no misallocation), productivity differences were responsible for 3.1% of this 4.4% growth (capital accumulation accounts for the remaining 1.3%). In the misallocation model, the pure productivity effect accounts for 2.0% of the growth and misallocation for 1.1% per year. That is, incorporating a role for reallocation, the misallocation model reduces the importance of pure productivity when accounting for the observed growth over the sample period.

In Figure 6, we compare the gains due to reallocation of resources in the restricted and deregulated industries. Consistent with our priors that deregulation leads to a removal of distortions, the observed gains from reallocation are higher in the deregulated industries. Between 1991–2005, the average change in allocation efficiency gains was 1.4% in deregulated sectors compared to 1.3% in restricted sectors. The figure depicts considerable variability throughout the sample period. In the first period immediately following delicensing restrictions, the gains due to reallocation in the deregulated industries was close to 3% per year from 1991–1995, 0.5% between 1996–2000, and 1.75% between 2001–2005.

**6. Robustness Checks and Additional Tests**

As discussed in Section 2, the domestic entry deregulation was enacted alongside other reforms such as trade and FDI liberalization in 1991. To control for the potentially confounding effects of these concurrent policy changes, we include dummies for trade and FDI liberalization in our regression estimates for a balanced panel of firms. The dependent variable is the logarithm of annual firm sales. *FDI_Lib* and *Trade_Lib* are dummy variables that take a value of one if a firm is in an industry the liberalized to FDI or Trade in 1991. Standard errors are clustered at the NIC three-digit level.

When we include dummies for the concurrent reforms along with the *Delicense* variable in column 7 of Table 3, the coefficient on the *Delicense* variable continues to be negative and significant and the year trend variable is positive and significant, consistent with the findings in column 1. The coefficients on both *FDI_Lib* and *Trade_Lib* are not significant, however. A similar pattern holds in a specification where the firm size measure is log assets instead of log sales.

Another issue that we address is that while there is a general consensus that the systemic reforms in the 1990s and 2000s were essential to bringing about changes in Indian manufacturing, Panagariya (2004) argues that piecemeal external liberalization, along with small spurts of domestic deregulation on a variety of margins and expansionary policies, combined to produce a small shift in the Indian growth rate in the 1980s. This is similar to the view that "pro-business" reforms instituted in the mid-1980s had an impact on the competitive environment in Indian industry. To take into account the possibility that the firms that entered the market between 1985–1990 may have been new entrants rather than incumbents, we re-estimated all our regression specifications, defining incumbents as firms incorporated before 1985 and all firms incorporated after this year as new entrants. Our findings are robust to the change in the year demarcating the classification of incumbent status. This is largely due to the fact that while some new firms were incorporated between 1985 and 1990, these numbers are dwarfed by the pace and acceleration in the birth of new firms following the reforms of 1991.

Another feature of the data related to the classification of incumbent status is that following deregulation, in some instances, incumbents particularly business groups expanded into newly deregulated industries. It can be argued that these firms are not new entrants in the traditional sense in that they were in operation prior to deregulation, albeit in different industries. To address this issue, we restrict new entrants to the subset of firms that are new in the true sense of the word and not affiliated to firms that existed prior to deregulation. Once again, since the number of instances where this occurs is relatively small, our pattern of findings remains robust.

## 7. Conclusion

Deregulation of entry can reduce and redistribute rents, leading to new distributions of firms within industries over time and improving resource allocation. Industries can go through a shakeout phase during which the number of producers decline in the industry, as incumbents and new entrants replace the firms that exit (see Caballero and Hammour, 1996).

India carried out wide-ranging deregulation policies in 1991. The end of the License Raj and implementation of pro-market reforms have far-reaching implications for the competitive environment in the Indian economy. Significant sectors of the economy were opened up for private participation through de-licensing and allowing entry to industries previously reserved exclusively for the state-owned sector.

We use firm-level data from CMIE's Prowess database to examine the efficiency impact of dismantling the compulsory industrial licensing regime that regulated firm entry and imposed capacity constraints on firm output before 1991. The evidence suggests several interesting patterns. Average firm size declines significantly in the deregulated industries. Small firms enter the sample from the left-hand tail of the size distribution while the incumbent firms get significantly bigger following deregulation.

Quantile regressions to examine the distributional impact of deregulation show that the shift in the firm size distribution is non-linear; average firm size increases up to around the 15th percentile and then gets significantly smaller until the 90th percentile, while the largest percentile (95%) gets significantly bigger over the same time period. We also find that the contribution of resource reallocation to growth in India increases in the years following deregulation, suggesting that distortions have decreased over time with higher gains for deregulated industries.

The distributional changes in firm size and profitability reveal a more heterogeneous impact of deregulation. While the data are not consistent with policy concerns that small firms would be forced out, and although we document improvements in the allocation of resources over time—particularly in deregulated industries—the dominance of large incumbents in India's manufacturing sector remains unchallenged. The "missing middle" in the firm size distribution suggests that small firms may continue to face distortions that constrain their ability to grow.

**References**


Aghion, P., R. Burgess, S. Redding and F. Zilibotti, 2008. "The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India," *American Economic Review*, 98(4), 1397-1412.

Albuquerque, R., and H. A. Hopenhayn, 2004. "Optimal Lending Contracts and Firm Dynamics," *Review of Economic Studies* 71(2), 285–315.

Alesina, A. et al., 2005. "Regulation and Investment," *Journal of the European Economic Association* 3, 791–825.

Alfaro, L., A. Charlton, and F. Kanczuk, 2008. "Plant-Size Distribution and Cross-Country Income Differences," in *NBER International Seminar on Macroeconomics*, edited by Jeffrey A. Frankel. Cambridge, MA: NBER.

Ardagna, S., and A. Lusardi, 2009. "Where does regulation hurt? Evidence from new businesses across countries," NBER Working Paper 14747.

Ardagna, S., and A. Lusardi, 2010. "Explaining International Differences in Entrepreneurship: The Role of Individual Characteristics and Regulatory Constraints," in "International Differences in Entrepreneurship," edited by Joshua Lerner and Antoinette Schoar, University of Chicago Press.

Asplund, M., and V. Nocke, 2006. "Firm Turnover in Imperfectly Competitive Markets," *Review of Economic Studies* 73, 295–327.

Bertrand, M., P. Mehta, and S. Mullainathan, 2002. "Ferreting out Tunneling: An Application to Indian Business groups," *Quarterly Journal of Economics* 117, 121–48.

Bertrand, M., A. Schoar and D. Thesmar, 2007. "Banking Deregulation and Industry Structure: Evidence from the French Banking Reforms of 1985," *Journal of Finance*, 62, 2, 597-628.

Black, S. E. and P. E. Strahan, 2002. "Entrepreneurship and Bank Credit Availability," *Journal of Finance*, 57, 6, 2807-2833.

Blanchard, O. J., and F. Giavazzi, 2003. "Macroeconomic Effects of Regulation and Deregulation in Goods and Labor Markets," *Quarterly Journal of Economics* 118, 879–908.

Bollard, A., P. Klenow, and G. Sharma, 2011. "India's Mysterious Manufacturing Miracle," mimeo, Stanford University.

Caballero, R., and M. Hammour, 1996. “On the Timing and Efficiency of Creative Destruction,” *Quarterly Journal of Economics* 446, 805–852.

Cabral, L., and J. Mata, 2003. “On the Evolution of the Firm Size Distribution: Facts and Theory,” *American Economic Review* 93(4), 1075–1090.

Campbell, J. R., and H. A. Hopenhayn, 2005. “Market Size Matters,” *Journal of Industrial Economics* 53, 1–25.

Chari, A., and N. Gupta, 2008. “Incumbents and Protectionism: The Political Economy of Foreign Entry Liberalization,” *Journal of Financial Economics* 88, 33–656.

Chari, A. V. 2011. “Identifying the Aggregate Productivity Effects of Entry and Size Restrictions: An Empirical Analysis of License Reform in India,” *American Economic Journal: Economic Policy* 3(2), 66–96.

Centre for Monitoring Indian Economy, Prowess Dataset. http://www.cmie.com/database/?service=database-products/firm-level-data-services/prowess-corporate-database.htm.

Clementi G. L., and H. A. Hopenhayn, 2006. “A Theory of Financing Constraints and Firm Dynamics,” *The Quarterly Journal of Economics* 121(1), 229–265.

Cooley, T., and V. Quadrini, 2001. “Financial Markets and Firm Dynamics,” *American Economic Review* 91(5), 1286–1310.

Ericson, R., and R. Pakes, 1995. “Markov Perfect Industry Dynamics: A Framework for Empirical Work,” *Review of Economic Studies* 62(1), 53–82.

Fisman, R., and T. Khanna, 2004. “Facilitating Development: The Role of Business Groups,” *World Development* 32, 609–628.

Garciano, L., C. LeLarge, and J. Van Reenen, 2012. “Firm Size Distortions and the Productivity Distribution: Evidence from France,” Centre for Economic Performance discussion paper No. 1128, February 2012.

Government of India, 2000. http://labour.nic.in/ss/INFORMALSECTORININDIA-approachesforSocialSecurity.pdf.

Guiso, L., P. Sapienza and L. Zingales, 2004. "Does Local Financial Development Matter?" *The Quarterly Journal of Economics*, 119, 3, 929-969.

Hopenhayn, H. A., 1992. “Entry, Exit, and Firm Dynamics in Long Run Equilibrium,” *Econometrica* 60(5), 1127–1150.

Hsieh, C.-T., and P. J. Klenow, 2009. “Misallocation and Manufacturing TFP in China and India,” *Quarterly Journal of Economics* 124, 1403–1448.

Industrial (Development and Regulation) Act, 1951. http://dipp.gov.in/English/Policies/Industries_act1951.pdf.

Industrial Policy Resolution, 1956. http://www.fipbindia.com/changes_files/changes/chap001.pdf.

Jovanovic, B. 1982. “Selection and the Evolution of Industry,” *Econometrica* 50(3), 649–670.

Khanna, T., and K. Palepu, 1999. “Policy Shocks, Market Intermediaries and Corporate Strategy: The Evolution of Business Groups in Chile and India,” *Journal of Economics & Management Strategy* 8, 271–310.

Khanna, T., and K. Palepu, 2000. “Is Group Affiliation Profitable in Emerging Markets? An Analysis of Diversified Indian Business Groups,” *Journal of Finance* 55(2), 867–891.

Khanna, T., and K. Palepu, 2005. “The Evolution of Concentrated Ownership in India: Broad Patterns and a History of the Indian Software Industry,” in *A History of Corporate Governance around the World: Family Business Groups to Professional Managers*, edited by Randall Morck. Chicago: University of Chicago Press.

Kochhar, K. et al., 2006. “India’s Pattern of Development: What Happened, What Follows,” *Journal of Monetary Economics* 53, 981–1019.

Koenker, R. W., and G. Basset, 1978. “Regression Quantiles,” *Econometrica* 46(1), 33–50.

Lucas, R. E., 1978. “On the Size Distribution of Business Firms,” *Bell Journal of Economics* 9(2), 508–523.

Luttmer, E., 2007. “Selection, Growth, and the Size Distribution of Firms,” *The Quarterly Journal of Economics* 122(3), 1103–1144.

Melitz, M. J., 2003. “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity,” *Econometrica* 71, 1695–1725.

Office of the Economic Advisor, 2001. *Handbook of Industrial Policy and Statistics*. Government of India, New Delhi.

Panagariya, A., 2008. *India, the Emerging Giant*. New York: Oxford University Press.

Restuccia, D., and R. Rogerson, 2008. “Policy Distortions and Aggregate Productivity with Heterogeneous Plants,” *Review of Economic Dynamics* 11, 707–720.

Syverson, C., 2004. “Market Structure and Productivity: A Concrete Example,” *Journal of Political Economy* 112, 1181–1222.

Topalova, P., 2007. “Trade Liberalization and Firm Productivity: The Case of India,” IMF Working Paper, WP/04/28.

World Bank, 2005. “Improving the Investment Climate in India,” South Asia Region and Investment Climate Unit. Washington, DC: World Bank.

World Bank, 2010. *World Development Indicators.* Washington, DC: World Bank.

ANNEX I

PROPOSED LIST OF INDUSTRIES TO BE RESERVED FOR THE PUBLIC SECTOR

1. Arms and ammunition and allied items of defense equipment, Defense aircraft and warships.
2. Atomic Energy.
3. Coal and lignite.
4. Mineral oils.
5. Mining if iron ore, manganese ore, chrome ore, gypsum, sulphur, gold and diamond.
6. Mining of copper, lead, zinc, tin, molybdenum and wolfram.
7. Minerals specified in the Schedule to the Atomic Energy (Control of Production and Use) Order, 1953.
8. Railway transport.

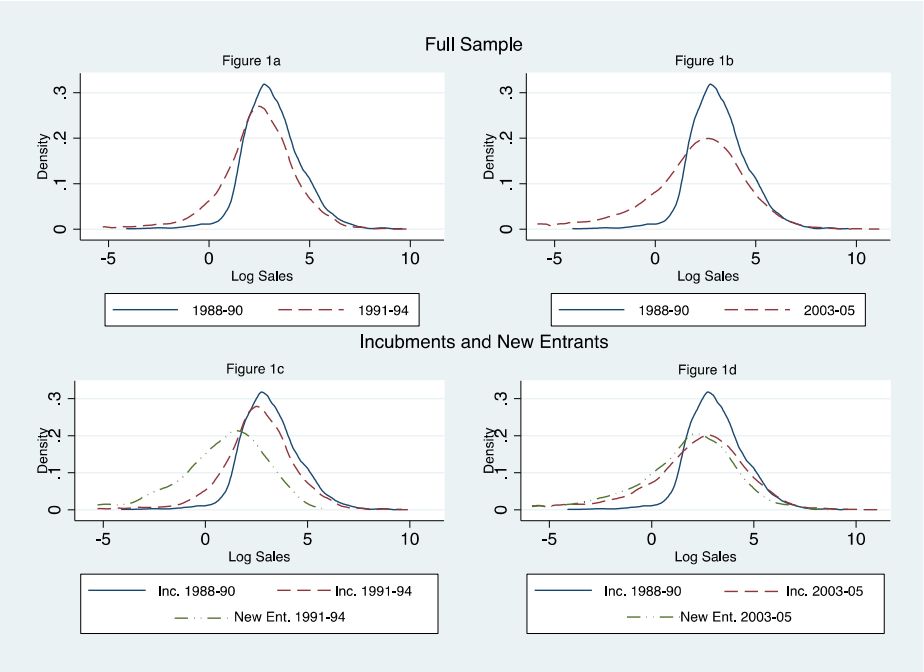
ANNEX II

LIST OF INDUSTRIES IN RESPECT OF WHICH INDUSTRIAL LICENSING WILL BE COMPULSORY

1. Coal and Lignite.
2. Petroleum (other than crude) and its distillation products.
3. Distillation and brewing of alcoholic drinks.
4. Sugar.
5. Animal fats and oils.
6. Cigars and cigarettes of tobacco and manufactured tobacco substitutes.
7. Asbestos and asbestos-based products.
8. Plywood, decorative veneers, and other wood based products such as particle board, medium density fiber board, block board.
9. Raw hides and skins, leather, chamois leather and patent leather.
10. Tanned or dressed fur skins.
11. Motor cars.
12. Paper and Newsprint except bagasse-based units.
13. Electronic aerospace and defense equipment; All types.
14. Industrial explosives, including detonating fuse, safety fuse, gun powder, nitrocellulose and matches.
15. Hazardous chemicals.
16. Drugs and Pharmaceuticals (according to Drug Policy).
17. Entertainment electronics (VCRs, color TVs, C.D. Players, Tape Recorders).
18. White Goods (Domestic Refrigerators, Domestic Dishwashing machines, Programmable Domestic Washing Machines, Microwave ovens,
Air conditioners).

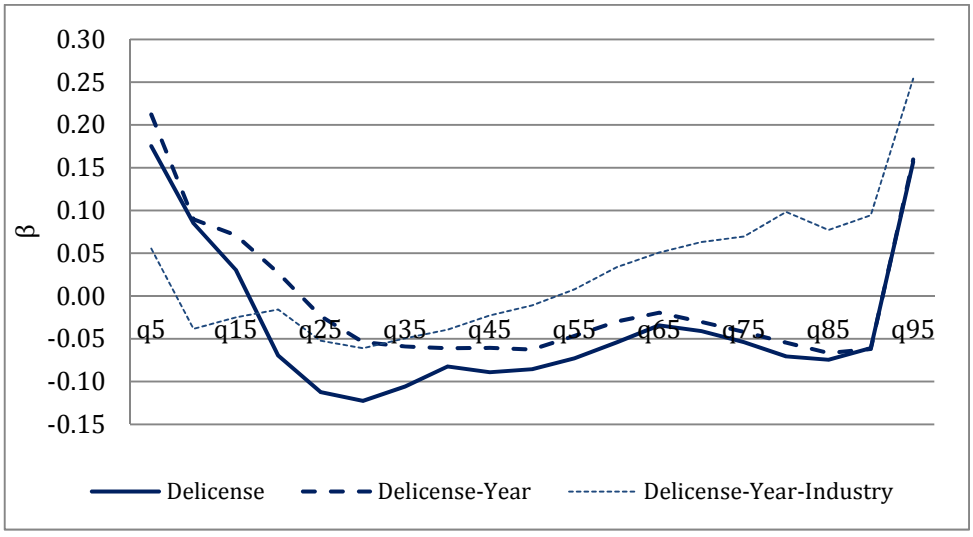
Notes: Available from http://dipp.nic.in/English/Policies/Industrial_policy_statement.pdf.

Figure 1: Log Sales by Type of Entrant and Period (Manufacturing)



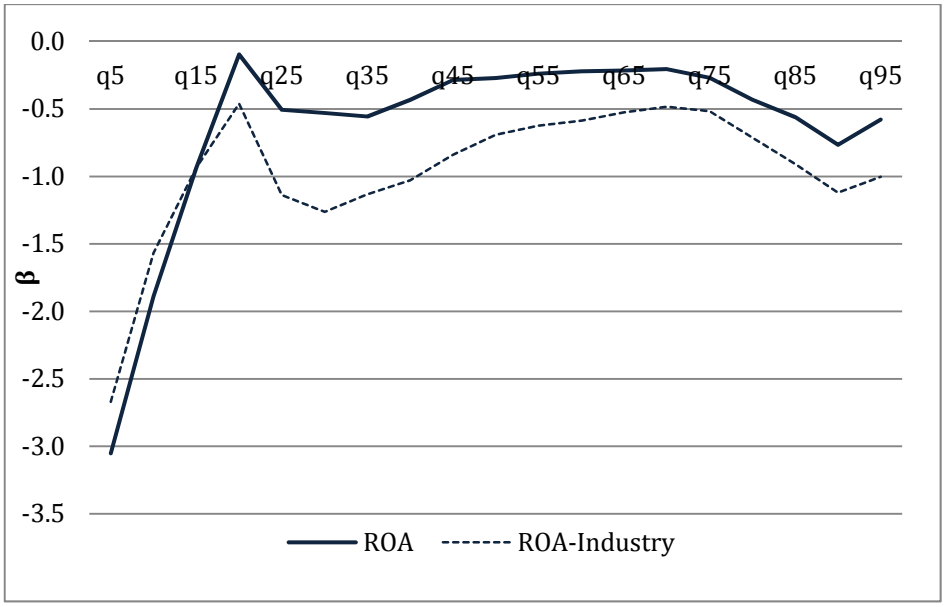

Source: Prowess Data Set

Figure 2: Quantile Regressions, Domestic Delicensing (Log Sales), 1989-2005



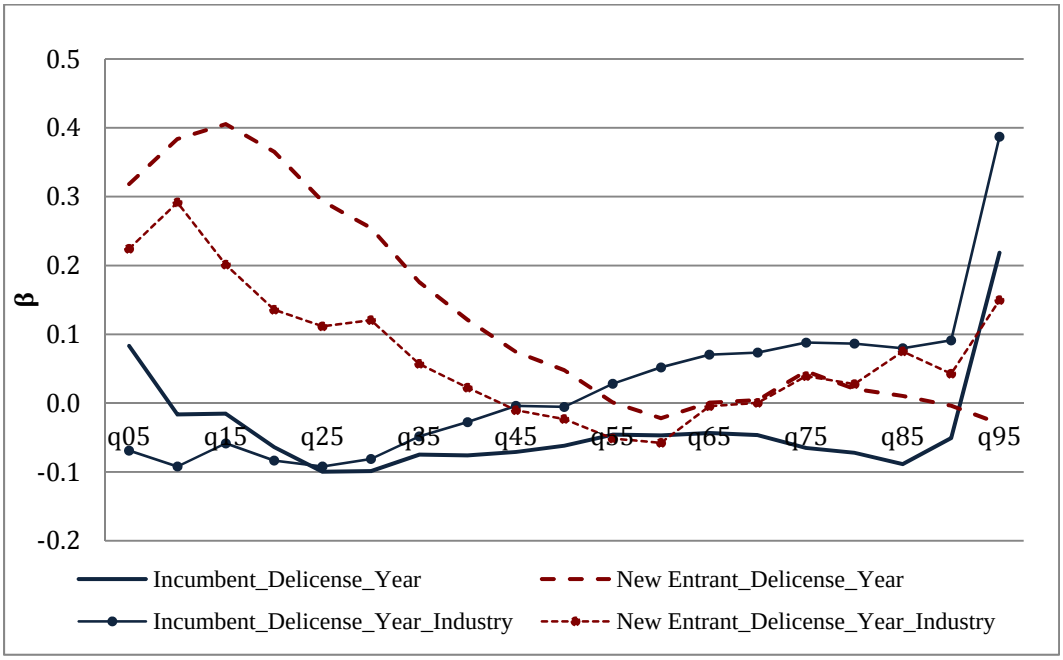

Source: Prowess Data Set

Figure 3: Quantile Regressions, Domestic Delicensing (ROA), 1989-2005



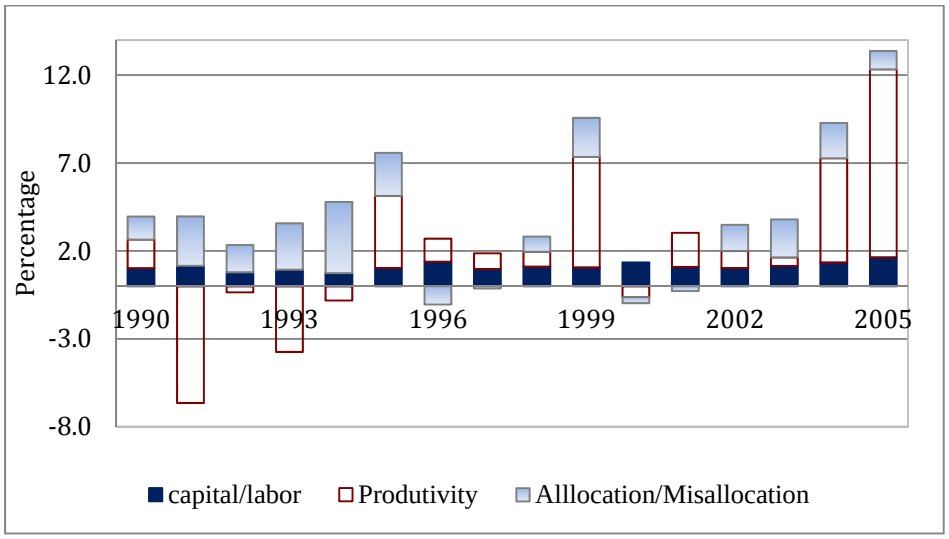

Source: Prowess Data Set

Figure 4: Delicense: Incumbent versus New Entrants, 1989-2005 (Manufacturing)



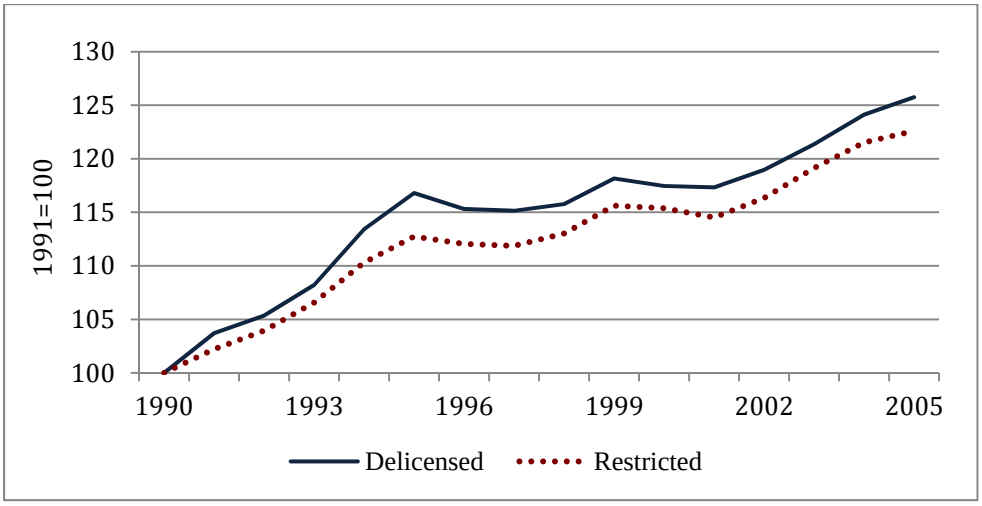

Source: Prowess Data Set

Figure 5: Efficiency Gains from Delicensing (Manufacturing)




Source: Author's calculation.

Figure 6: Efficiency Gains: Delicensed versus Restricted Sectors (Manufacturing)




Source: Author's calculation.

**Table 1: Firm Size, Firm Profits, and Market Concentration in Manufacturing–Summary Statistics (Constant Rs. Crore)**

| | 1989-1990 | 1991-1995 | 1996-2002 | 2003-2005 |
|---|---|---|---|---|
| **Panel A: Full Sample** | | | | |
| *NIC3 Herfindahl Index (sales)* | 0.33 | 0.28 | 0.25 | 0.24 |
| Average Firm Profits (Rs. Crore) | 10.02 | 7.96 | 8.01 | 11.24 |
| Average Firm Size (Assets Rs. Crore) | 83.98 | 69.66 | 75.71 | 90.73 |
| Average Firm Size (Sales Rs. Crore) | 83.97 | 55.33 | 59.91 | 81.07 |
| Coefficient of Variation of Firm Size (Assets) | 5.40 | 6.61 | 6.61 | 7.63 |
| Coefficient of Variation of Firm Size (Sales) | 5.49 | 6.66 | 9.90 | 11.31 |
| Observations | 3147 | 15741 | 33807 | 19353 |
| **Panel B: Year of Incorporation** | | | | |
| Pre-independence, pre-1947 | | | | |
| Assets (Rs. Crore) | 86.74 | 97.44 | 129.63 | 151.30 |
| Sales (Rs. Crore) | 103.20 | 97.63 | 111.95 | 131.13 |
| PBDIT (Rs. Crore) | 10.56 | 12.54 | 15.31 | 21.09 |
| ROA (%) | 11.52 | 12.26 | 7.26 | 6.31 |
| c1947-1985 | | | | |
| Assets (Rs. Crore) | 87.02 | 84.71 | 101.28 | 129.17 |
| Sales (Rs. Crore) | 83.15 | 66.70 | 87.33 | 131.19 |
| PBDITA (Rs. Crore) | 10.43 | 9.79 | 11.56 | 17.85 |
| ROA (%) | 13.90 | 13.21 | 7.60 | 10.30 |
| c1985-2005 | | | | |
| Assets (Rs. Crore) | 31.64 | 24.62 | 38.49 | 53.95 |
| Sales (Rs. Crore) | 18.58 | 11.43 | 21.18 | 37.39 |
| PBDIT (Rs. Crore) | 2.33 | 1.91 | 2.88 | 5.00 |
| ROA (%) | 10.17 | 9.10 | 6.01 | 4.56 |
| **Panel C: Deregulated Industries** | | | | |
| *Herfindahl Index* | 0.28 | 0.24 | 0.23 | 0.21 |
| *Market Share (sales)* | 3.07 | 1.53 | 1.29 | 0.86 |
| Firm Profits | 8.34 | 6.16 | 6.12 | 7.46 |
| Firm Size (Assets Rs. Crore) | 61.77 | 45.36 | 50.28 | 55.10 |
| Firm Size (Sales Rs. Crore) | 62.23 | 40.41 | 42.98 | 51.57 |
| CV Firm Size (Assets) | 2.90 | 3.25 | 3.48 | 4.05 |
| CV Firm Size (Sales) | 2.17 | 2.93 | 3.51 | 4.58 |
| **Panel D: Incumbents** | | | | |
| *TotalMarket Share (sales)* | 0.99 | 0.98 | 0.91 | 0.84 |
| Average Firm Profits (Rs. Crore) | 10.11 | 8.82 | 10.05 | 15.06 |
| Average Firm Size (Assets Rs. Crore) | 84.74 | 76.58 | 90.98 | 115.14 |
| Average Firm Size (Sales Rs. Crore) | 84.64 | 61.21 | 74.31 | 107.33 |
| **Panel E: New Entrants** | | | | |
| *TotalMarket Share (sales)* | 0.01 | 0.02 | 0.08 | 0.11 |
| Average Firm Profits (Rs. Crore) | 2.88 | 1.00 | 2.26 | 4.78 |
| Average Firm Size (Assets Rs. Crore) | 23.71 | 13.68 | 32.83 | 49.43 |
| Average Firm Size (Sales Rs. Crore) | 30.63 | 7.76 | 19.49 | 36.48 |

Source: Prowess Data Set. See Appendix Tables A2 for detailed explanation of variables.

**Table 2: Firm Sales and Assets for Full Sample, Incumbents, and New Entrants**

| | | | | Log Sales | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **p10** | **mean** | **p50** | **p99** | **max** | **sd** | **cv** |
| | | | | Full Sample | | | | |
| 1989-1990 | 3,110 | 1.64 | 3.15 | 3.04 | 6.86 | 9.59 | 1.43 | 0.45 |
| 1991-1995 | 14,794 | 0.24 | 2.43 | 2.52 | 6.49 | 9.91 | 1.84 | 0.76 |
| 1991-2005 | 63,524 | -0.48 | 2.14 | 2.33 | 6.58 | 10.81 | 2.12 | 0.99 |
| 1991-2007 | 73086 | -0.54 | 2.17 | 2.36 | 6.71 | 11.13 | 2.17 | 1.00 |

| | | | | Log Sales | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **p10** | **mean** | **p50** | **p99** | **max** | **sd** | **cv** |
| | | | | Incumbents | | | | |
| 1989-1990 | 3071 | 1.63 | 3.15 | 3.04 | 6.89 | 9.59 | 1.44 | 0.46 |
| 1991-1995 | 13577 | 0.53 | 2.56 | 2.62 | 6.55 | 9.91 | 1.76 | 0.69 |
| 1991-2005 | 55011 | -0.20 | 2.37 | 2.54 | 6.82 | 11.13 | 2.12 | 0.89 |

| | | | | Log Sales | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **p10** | **mean** | **p50** | **p99** | **max** | **sd** | **cv** |
| | | | | New Entrants | | | | |
| 1991-1995 | 1217 | -1.91 | 0.92 | 1.17 | 4.72 | 5.86 | 2.04 | 2.22 |
| 1991-2005 | 18075 | -1.35 | 1.54 | 1.79 | 6.26 | 9.33 | 2.20 | 1.43 |

| | | | | Log Assets | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **p10** | **mean** | **p50** | **p99** | **max** | **sd** | **cv** |
| | | | | Full Sample | | | | |
| 1989-1990 | 3,147 | 1.42 | 2.99 | 2.83 | 7.09 | 9.37 | 1.44 | 0.48 |
| 1991-1995 | 15,737 | 0.68 | 2.51 | 2.40 | 6.84 | 9.63 | 1.61 | 0.64 |
| 1991-2005 | 68,868 | 0.23 | 2.29 | 2.23 | 7.04 | 10.14 | 1.88 | 0.82 |

| | | | | Log Assets | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **p10** | **mean** | **p50** | **p99** | **max** | **sd** | **cv** |
| | | | | Incumbents | | | | |
| 1989-1990 | 3108 | 1.424891 | 2.996408 | 2.829065 | 7.085483 | 9.369019 | 1.437729 | 0.479818 |
| 1991-1995 | 14007 | 0.863827 | 2.638024 | 2.505937 | 7.006509 | 9.6295 | 1.568947 | 0.594743 |

| | | | | Log Assets | | | | |
|---|---|---|---|---|---|---|---|---|
| | **N** | **p10** | **mean** | **p50** | **p99** | **max** | **sd** | **cv** |
| | | | | New Entrants | | | | |
| 1991-1995 | 1730 | -0.387766 | 1.446897 | 1.484264 | 4.927455 | 6.998696 | 1.531464 | 1.058447 |
| 1991-2005 | 21937 | -0.746329 | 1.618087 | 1.707527 | 6.58951 | 8.92607 | 2.097078 | 1.296023 |

Source: Prowess Data Set. See Appendix Tables A2 for detailed explanation of variables.

**Table 3: Deregulation and Firm Size**

This table presents regression estimates for a balanced panel of firms from 1989-1995. The dependent variable is the logarithm of annual firm sales in (1), (2), and (7), the logarithm of annual firm assets in (3) and (4), return on assets in (5) and herfindahl (sales) in (6). Delicense, FDI_Lib and Trade_Lib are dummy variables that take a value of 1 if a firm is in an industry that deregulated, liberlized to FDI or Trade in 1991. Clustered standard errors in parentheses. *, ** and *** denote significance levels at 10%, 5% and 1%, respectively.

| | (1) | (2) | (4) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Dependent Variable | Sales | Sales | Assets | Assets | Profitability | Herfindahl (Sales) | Sales |
| Delicense | -0.1640*** | -0.1116** | -0.1398*** | -0.0687* | 2.7722** | -0.0548 | -0.1321*** |
| | (0.044) | -0.043 | (0.033) | -0.035 | (1.294) | (0.046) | (0.045) |
| Year Trend | 0.0666*** | | 0.0965*** | | | | 0.0763*** |
| | (0.007) | | (0.006) | | | | (0.008) |
| FDI_Lib | | | | | | | -0.0445 |
| | | | | | | | (0.037) |
| Trade_Lib | | | | | | | -0.0518 |
| | | | | | | | (0.038) |
| Constant | 2.4053*** | 2.5527*** | 2.2924*** | 2.4963*** | 9.6813*** | 0.2982*** | 2.4120*** |
| | (0.027) | -0.016 | (0.028) | -0.016 | (0.298) | (0.026) | (0.028) |
| Industry Dummies | Yes | Yes | Yes | Yes | Yes | No | Yes |
| Year Dummies | No | Yes | No | Yes | No | No | No |
| Observations | 16,648 | 16,648 | 17,115 | 17,115 | 14,347 | 47,536 | 16,648 |
| R-squared | 0.93 | 0.926 | 0.95 | 0.948 | 0.95 | 0.02 | 0.93 |

**Table 4: Quantile Regressions of Firm Size (Log Sales), 1989-2005**

This table presents quantile regressions for firm size for an unbalanced panel of firms. The dependent variable is the logarithm of annual firm sales in (1)-(2) and return on assets in (3). Delicense is is a dummy variable that takes a value of 1 if a firm is an industry that delicensed entry in 1991. Yeartrend is a trend variable. *, ** and *** denote significance levels at 10%, 5% and 1%, respectively. Bootstrapped standard errors in parentheses.

| Panel A: Delicense (Log Sales) | | | | | | | | | | | | Panel B: Delicense (ROA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | | | | | (2) | | | | | | | (3) | | | |
| Quantile | Delicense | (s.e.) | Constant | (s.e.) | Quantile | Delicense | (s.e.) | Yeartrend | (s.e.) | Constant | (s.e.) | Quantile | Delicense | (s.e.) | Constant | (s.e.) |
| q5 | 0.1752*** | (0.050) | -1.7117*** | (0.036) | q5 | 0.2123*** | (0.074) | -0.2188*** | (0.008) | 0.7077*** | (0.065) | q5 | -3.0519*** | (0.598) | -9.7113*** | (0.269) |
| q10 | 0.0850* | (0.046) | -0.4359*** | (0.022) | q10 | 0.0898** | (0.040) | -0.1639*** | (0.005) | 1.3393*** | (0.046) | q10 | -1.8887*** | (0.266) | -2.5932*** | (0.108) |
| q15 | 0.0305 | (0.031) | 0.2675*** | (0.015) | q15 | 0.0710* | (0.037) | -0.1305*** | (0.003) | 1.6406*** | (0.034) | q15 | -0.9336*** | (0.138) | 0.0000*** | 0.000 |
| q20 | -0.0697*** | (0.023) | 0.7922*** | (0.014) | q20 | 0.0271 | (0.032) | -0.1051*** | (0.003) | 1.8565*** | (0.025) | q20 | -0.0951* | (0.058) | 0.0951* | (0.058) |
| q25 | -0.1123*** | (0.022) | 1.1691*** | (0.012) | q25 | -0.0235 | (0.028) | -0.0863*** | (0.003) | 2.0339*** | (0.025) | q25 | -0.5054*** | (0.160) | 2.0856*** | (0.062) |
| q30 | -0.1226*** | (0.021) | 1.4856*** | (0.013) | q30 | -0.0540** | (0.024) | -0.0732*** | (0.002) | 2.2076*** | (0.024) | q30 | -0.5301*** | (0.161) | 4.0000*** | (0.065) |
| q35 | -0.1057*** | (0.024) | 1.7456*** | (0.010) | q35 | -0.0589** | (0.027) | -0.0626*** | (0.002) | 2.3633*** | (0.024) | q35 | -0.5553*** | (0.149) | 5.6551*** | (0.060) |
| q40 | -0.0824*** | (0.020) | 1.9703*** | (0.010) | q40 | -0.0611** | (0.026) | -0.0539*** | (0.002) | 2.5150*** | (0.022) | q40 | -0.4325*** | (0.121) | 7.0524*** | (0.053) |
| q45 | -0.0890*** | (0.019) | 2.1959*** | (0.009) | q45 | -0.0607** | (0.025) | -0.0476*** | (0.002) | 2.6687*** | (0.019) | q45 | -0.2847** | (0.127) | 8.2847*** | (0.059) |
| q50 | -0.0855*** | (0.020) | 2.4024*** | (0.009) | q50 | -0.0625*** | (0.021) | -0.0412*** | (0.002) | 2.8129*** | (0.018) | q50 | -0.2707** | (0.112) | 9.4522*** | (0.062) |
| q55 | -0.0729*** | (0.020) | 2.6097*** | (0.008) | q55 | -0.0467** | (0.020) | -0.0354*** | (0.002) | 2.9574*** | (0.018) | q55 | -0.2378*** | (0.090) | 10.5575*** | (0.053) |
| q60 | -0.0542*** | (0.015) | 2.8096*** | (0.008) | q60 | -0.0298 | (0.019) | -0.0309*** | (0.002) | 3.1228*** | (0.021) | q60 | -0.2215** | (0.086) | 11.6731*** | (0.051) |
| q65 | -0.0343** | (0.015) | 3.0274*** | (0.009) | q65 | -0.0196 | (0.021) | -0.0274*** | (0.002) | 3.3021*** | (0.019) | q65 | -0.2147** | (0.089) | 12.8000*** | (0.053) |
| q70 | -0.0410*** | (0.013) | 3.2607*** | (0.008) | q70 | -0.0303 | (0.022) | -0.0234*** | (0.001) | 3.4975*** | (0.018) | q70 | -0.2043** | (0.098) | 13.9928*** | (0.060) |
| q75 | -0.0539*** | (0.011) | 3.5259*** | (0.009) | q75 | -0.0419** | (0.019) | -0.0193*** | (0.002) | 3.7190*** | (0.022) | q75 | -0.2688* | (0.138) | 15.3365*** | (0.072) |
| q80 | -0.0706*** | (0.017) | 3.8154*** | (0.011) | q80 | -0.0544** | (0.022) | -0.0134*** | (0.002) | 3.9488*** | (0.025) | q80 | -0.4312*** | (0.139) | 16.9432*** | (0.064) |
| q85 | -0.0745*** | (0.017) | 4.1520*** | (0.013) | q85 | -0.0666** | (0.030) | -0.0101*** | (0.002) | 4.2537*** | (0.030) | q85 | -0.5600*** | (0.143) | 18.9560*** | (0.078) |
| q90 | -0.0608** | (0.025) | 4.5857*** | (0.013) | q90 | -0.0620* | (0.035) | -0.0084*** | (0.002) | 4.6727*** | (0.028) | q90 | -0.7654*** | (0.124) | 21.8362*** | (0.081) |
| q95 | 0.1567*** | (0.045) | 5.2373*** | (0.010) | q95 | 0.1596*** | (0.046) | -0.0012 | (0.003) | 5.2491*** | (0.031) | q95 | -0.5784** | (0.276) | 26.8781*** | (0.146) |

Number of Observations= 66,634

**Table 5: Quantile Regressions of Firm Size (Log Sales) Incumbent, New Entrants, 1989-2005.**

This table presents quantile regressions for firm size for an unbalanced panel of firms. The dependent variable is the logarithm of annual firm sales in (1)-(2) and return on assets in (3). Delicense is is a dummy variable that takes a value of 1 if a firm is an industry that delicensed entry in 1991. Yeartrend is a trend variable. *, ** and *** denote significance levels at 10%, 5% and 1%, respectively. Bootstrapped standard errors in parentheses.

| Panel A: Incubments (Log Sales) | | | | | | |
|---|---|---|---|---|---|---|
| Quantile | Delicense | (s.e.) | Yeartrend | (s.e.) | Constant | (s.e.) |
| q5 | 0.0832 | (0.069) | -0.2233*** | (0.008) | 1.0791*** | (0.068) |
| q10 | -0.0166 | (0.047) | -0.1581*** | (0.004) | 1.5608*** | (0.040) |
| q15 | -0.0153 | (0.033) | -0.1223*** | (0.003) | 1.8077*** | (0.024) |
| q20 | -0.0639** | (0.027) | -0.0920*** | (0.003) | 1.9684*** | (0.023) |
| q25 | -0.0997*** | (0.027) | -0.0770*** | (0.002) | 2.1549*** | (0.024) |
| q30 | -0.0988*** | (0.021) | -0.0654*** | (0.002) | 2.3169*** | (0.021) |
| q35 | -0.0748*** | (0.022) | -0.0549*** | (0.002) | 2.4604*** | (0.025) |
| q40 | -0.0761*** | (0.023) | -0.0460*** | (0.002) | 2.6057*** | (0.021) |
| q45 | -0.0710*** | (0.021) | -0.0387*** | (0.002) | 2.7421*** | (0.018) |
| q50 | -0.0619*** | (0.020) | -0.0317*** | (0.002) | 2.8749*** | (0.021) |
| q55 | -0.0459* | (0.024) | -0.0261*** | (0.002) | 3.0198*** | (0.021) |
| q60 | -0.0471** | (0.021) | -0.0221*** | (0.002) | 3.1906*** | (0.022) |
| q65 | -0.0435** | (0.021) | -0.0193*** | (0.002) | 3.3793*** | (0.022) |
| q70 | -0.0466** | (0.021) | -0.0138*** | (0.002) | 3.5601*** | (0.024) |
| q75 | -0.0652*** | (0.023) | -0.0068** | (0.003) | 3.7561*** | (0.023) |
| q80 | -0.0721*** | (0.026) | -0.0039 | (0.003) | 4.0092*** | (0.028) |
| q85 | -0.0886*** | (0.027) | -0.0018 | (0.003) | 4.3176*** | (0.038) |
| q90 | -0.0508 | (0.038) | 0.0007 | (0.003) | 4.7232*** | (0.029) |
| q95 | 0.2184*** | (0.040) | 0.0069* | (0.004) | 5.2993*** | (0.040) |

| Panel B: New Entrants (Log Sales) | | | | | | |
|---|---|---|---|---|---|---|
| Quantile | Delicense | (s.e.) | Yeartrend | (s.e.) | Constant | (s.e.) |
| q5 | 0.3182*** | (0.111) | -0.0236 | (0.016) | -2.3431*** | (0.221) |
| q10 | 0.3837*** | (0.086) | 0.0084 | (0.013) | -1.5836*** | (0.146) |
| q15 | 0.4053*** | (0.056) | 0.0280** | (0.012) | -1.0918*** | (0.135) |
| q20 | 0.3651*** | (0.036) | 0.0400*** | (0.008) | -0.7360*** | (0.095) |
| q25 | 0.2934*** | (0.041) | 0.0467*** | (0.009) | -0.3953*** | (0.105) |
| q30 | 0.2545*** | (0.037) | 0.0616*** | (0.006) | -0.2103*** | (0.067) |
| q35 | 0.1760*** | (0.033) | 0.0653*** | (0.007) | 0.068 | (0.085) |
| q40 | 0.1211*** | (0.032) | 0.0690*** | (0.005) | 0.3276*** | (0.073) |
| q45 | 0.0744** | (0.030) | 0.0702*** | (0.005) | 0.5694*** | (0.071) |
| q50 | 0.0479 | (0.032) | 0.0722*** | (0.005) | 0.7718*** | (0.068) |
| q55 | 0.0011 | (0.042) | 0.0695*** | (0.006) | 1.0248*** | (0.081) |
| q60 | -0.022 | (0.045) | 0.0712*** | (0.005) | 1.2394*** | (0.065) |
| q65 | 0.0007 | (0.039) | 0.0780*** | (0.005) | 1.3554*** | (0.072) |
| q70 | 0.0043 | (0.036) | 0.0830*** | (0.005) | 1.5134*** | (0.068) |
| q75 | 0.0461 | (0.048) | 0.0790*** | (0.006) | 1.8139*** | (0.091) |
| q80 | 0.0207 | (0.040) | 0.0768*** | (0.005) | 2.1186*** | (0.077) |
| q85 | 0.0103 | (0.051) | 0.0756*** | (0.006) | 2.4577*** | (0.085) |
| q90 | -0.0037 | (0.059) | 0.0832*** | (0.007) | 2.7755*** | (0.094) |
| q95 | -0.0297 | (0.089) | 0.0913*** | (0.008) | 3.3536*** | (0.108) |

Number of Observations= 51,922

## Appendix 1: Industry Classifications

| NIC Class | Description of Economic Activity | # Firms | NIC Class | Description of Economic Activity | # Firms |
|---|---|---|---|---|---|
| 151 | Production, processing and preservation of meat, fish, fruit vegetables, oils and fats | 452 | 289 | Manufacture of other fabricated metal products; metal working service activities | 202 |
| 152 | Manufacture of dairy products | 67 | 291 | Manufacture of general purpose machinery | 208 |
| 153 | Manufacture of grain mill products, starches and starch products, and prepared animal feeds | 126 | 292 | Manufacture of special purpose machinery | 327 |
| 154 | Manufacture of other food products | 459 | 293 | Manufacture of domestic appliances, n.e.c. | 67 |
| 155 | Manufacture of beverages | 176 | 300 | Manufacture of office, accounting and computing machinery | 82 |
| 160 | Manufacture of tobacco products | 23 | 311 | Manufacture of electric motors, generators and transformers | 94 |
| 171 | Spinning, weaving and finishing of textiles | 881 | 312 | Manufacture of electricity distribution and control apparatus | 45 |
| 172 | Manufacture of other textiles | 103 | 313 | Manufacture of insulated wire and cable | 107 |
| 173 | Manufacture of knitted and crocheted fabrics and articles | 49 | 314 | Manufacture of accumulators, primary cells and primary batteries | 35 |
| 181 | Manufacture of wearing apparel, except fur apparel | 197 | 315 | Manufacture of electric lamps and lighting equipment | 22 |
| 191 | Tanning and dressing of leather, manufacture of luggage handbags, saddlery & harness | 61 | 319 | Manufacture of other electrical equipment n.e.c. | 32 |
| 192 | Manufacture of footwear | 68 | 321 | Manufacture of electronic valves and tubes and other electronic components | 124 |
| 201 | Saw milling and planing of wood | 2 | 322 | Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy | 76 |
| 202 | Manufacture of products of wood, cork, straw and plaiting materials | 50 | 323 | Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods | 52 |
| 210 | Manufacture of paper and paper products | 266 | 331 | Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating and other purposes except optical instruments | 109 |
| 221 | Publishing | 71 | 332 | Manufacture of optical instruments and photographic equipment | 12 |
| 222 | Printing and service activities related to printing | 51 | 333 | Manufacture of watches and clocks | 18 |
| 223 | Reproduction of recorded media | 3 | 341 | Manufacture of motor vehicles | 20 |
| 231 | Manufacture of coke oven products | 16 | 343 | Manufacture of parts and accessories for motor vehicles and their engines | 422 |
| 232 | Manufacture of refined petroleum products | 90 | 351 | Building and repair of ships & boats | 15 |
| 241 | Manufacture of basic chemicals | 601 | 352 | Manufacture of railway and tramway locomotives and rolling stock | 11 |
| 242 | Manufacture of other chemical products | 993 | 353 | Manufacture of aircraft and spacecraft | 3 |
| 243 | Manufacture of man-made fibers | 208 | 359 | Manufacture of transport equipment n.e.c. | 40 |
| 251 | Manufacture of rubber products | 139 | 361 | Manufacture of furniture | 14 |
| 252 | Manufacture of plastic products | 428 | 369 | Manufacturing n.e.c. | 150 |
| 261 | Manufacture of glass and glass products | 67 | 401 | Production, collection and distribution of electricity | 230 |
| 269 | Manufacture of non-metallic mineral products n.e.c. | 317 | 402 | Manufacture of gas; distribution of gaseous fuels through mains | 15 |
| 271 | Manufacture of Basic Iron & Steel | 675 | 410 | Collection, purification and distribution of water | 3 |
| 272 | Manufacture of basic precious and non-ferrous metals | 158 | 452 | Building of complete constructions or parts thereof; civil engineering | 529 |
| 273 | Casting of metals | 125 | 453 | Building installation | 28 |
| 281 | Manufacture of structural metal products, tanks, reservoirs and steam generators | 83 | 970 | Misc. Manufactured Articles and Diversified Conglomerates | 733 |

**Appendix 2: Description of Variables**

| Variables | Definition |
|---|---|
| *Sales* | Sales generated by a firm from its main business activity measured by charges to customers for goods supplied and services rendered. Excludes income from activities not related to main business, such as dividends, interest, and rents in the case of industrial firms, as well as non-recurring income. |
| *Assets* | Gross fixed assets of a firm, which includes movable and immovable assets as well as assets which are in the process of being installed. |
| *Firm Size (Assets & Sales)* | Average firm assets and sales in an industry. For the full sample, the industry-level averages are averaged across industries. |
| *Market Share* | Ratio of Sales to Industry Sales for a firm. Also, ratio of Assets to Industry Assets for a firm. |
| *Herfindahl Index* | Sum of the squares of the *Market Share*of all firms in an industry in each 3-digit industrial category. |
| *Incumbent* | Firm incorporated before 1990. |
| *New Entrant* | Firms incorporated after 1991. |
| *Incumbent Share* | The ratio of total sales, assets, profits produced by incumbent firms (incorporated before 1990) in an industry to *Industry Sales, Industry Assets, Industry Profits* in that industry. |
| *New Entrant Share* | The ratio of total sales, assets, profits produced by new entrant firms (incorporated after 1991) in an industry to *Industry Sales, Industry Assets, Industry Profits* in that industry. |
| *Industry Sales* | Sum of *Sales*across all firms in an industry. |
| *Industry Assets* | Sum of *Assets* across all firms in an industry. |
| *PBITDA* | Excess of income over all expenditures except tax, depreciation, interest payments, and rents in a firm. |
| *Return on Assets* | Ratio of P*BITDA* to *Assets* in a firm, averaged across firms in that industry. |
| *Sales Growth* | (*Industry Sales*-Lagged *Industry Sales*)/Lagged *Industry Sales* in that industry. |
| *Coefficient of Variation* | Ratio of standard deviation to mean of assets, sales, return on assets at the industry level |
| *NIC Code* | Three-digit industry code includes manufacturing, financial, and service sectors. |