Competing or Collaborating Siblings? Industrial and Trade Policies in India

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February 22, 2008
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Abstract

We investigate the link between industrial deregulation, trade reform and unit-level productivity using two unique microeconomic data sets from India. We use disaggregated data on the dismantling of the the "License Raj" in India (operating from the 1950s onwards) and find that removal of microeconomic constraints (that accompanied a license to produce) as well a rise in the threat of potential entry raised output per worker by 8.5%-17%. We also exploit the chronology of reforms in India and find that industries and firms that were de-licensed in the 1980s tend to perform better vis productivity after trade liberalization in 1991. We use an administrative requirement of the "Licensing Raj" to identify the impact of de-licensing – size-based exemption from licensing requirements. This institutional feature provides within-industry variation as well as a specification test – we conduct the analysis for hypothetical thresholds (that is, we falsely assign firms to the treatment) and find that there is no size-based response to de-licensing around these artificial thresholds. We also create a psuedo-panel of firms and find that our results are robust to firm-fixed effects.

JEL classification: F12, F14, D21, D42, L12, L51, O14, O38, O41 **Keywords:** Trade reforms, India, firm-level productivity, industrial licensing, market structure, complementarity, firm-level incentives

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I would like to thank Roger Betancourt, Nuno Limao and Deborah Minehart for their immense support and guidance. Thanks to Peter Klenow and Emek basker for extensive comments.

1 Introduction

> *I cannot decide how much to borrow, what shares to issue, at what price, what wages or bonus to pay and what dividend to give. I even need government permission for the salary I pay to a senior executive.*

In recent years there has been intense research interest about the impact of trade liberalization on growth, innovation and productivity as well as the channels through which this impact can occur (for example, Tybout (1992), Sachs and Warner (1995), Frankel and Romer (1999), Tybout (2000), Dollar and Kraay (2001), Melitz (2003), Tybout (2001)). Since the entry of China, India and Brazil into the mainstream of the world economy, research effort has also focused on the impact of trade reforms on enhancing competition, productivity, growth and measures of socio-economic well-being (Krishna and Mitra (1996), Delong (2001), Epifani (2003), Panagariya (2002; 2004)) in these large, developing countries. But questions about the role of domestic conditions, institutions and policies in realizing the benefits from trade reforms are relatively new (for example, Rodrik (2000), Rodrik and Rodriguez (2001), Rodrik and Subramanian (2004), Rodrik (forthcoming)). The statement above was made by a prominent Indian industrialist in 1969[1], at the hey day of the "License Raj" - a regime of close control of private enterprize as well as the use of resources in the Indian economy. The quotation illustrates the extent of control that a government can exercise and makes it imperative to ask whether and how domestic policies affected economic outcomes.

In this paper, we study the impact of domestic economic conditions and of trade reforms on unit-level productivity for the case of India. Using a unique plant-level database and a detailed policy database spanning both industrial and trade reforms, we measure the first, proximate impact of the dismantling of the Indian "License Raj" on (plant-level) output per worker. Then, using the chronology of industrial and trade reforms, we are also able to assess the impact of trade reforms on plants that were de-regulated in an earlier period. Broadly speaking, we ask the question, can the benefits from trade reform be enhanced by encouraging a more market-driven environment within domestic industry?

The main finding is that piece-meal industrial deregulation that took place in India during the 1980s has a positive and significant impact on labor productivity of 8.5-17%. Further, results using import penetration ratio data suggest that there exists strategic complementarity between trade liberalization in 1991 and industrial deregulation. That is, plants in industries that were deregulated tended to fare better after the trade liberalization episode, even after controlling for

[1] Source: Das (2000), page 168

potential endogeniety of policy changes.

This paper contributes to the literature by being one of the first microeconomic investigations of the impact of the "License Raj" in India - a rigid and stern licensing regime, in operation for 40 years. This regime restricted entry into manufacturing industry (i.e. entry was not based on market forces) and this in turn lead to monopolistic distortions in almost all sectors. It also put several onerous microeconomic restrictions on licensed firms. The sheer scope and longevity of the "License Raj" in India make it an interesting program to study. We are able to measure the joint impact of two mechanisms through which de-licensing in India affected firm-level productivity. The first mechanism is the removal of direct, microeconomic constraints on the firm (for example, output limits) which impacted the ability of a firm to become more productive while the second mechanism is the removal of entry restrictions on the industry as a whole which impacted the incentives of firms to become productive.

Secondly, this paper exploits the chronology of reforms in India to investigate the relationship between trade and industrial reforms. The chronology of industrial deregulation in the 1980s, and trade reforms in the 1990s allows us to distinguish between the two types of reforms and to assess the relationship between them. Our industrial policy data (to our knowledge, the only comprehensive data set on industrial policy) allows econometric estimation of the impact of deregulation at the four-digit level of industry (the most disaggregated level of the industrial classification). It allows us to identify which 4-digit industry was deregulated in which year of the 1970s, 1980s and 1990s.

Thirdly, this is one of the first papers to take advantage of the availability of a plant-level data set for the 14 year period 1980-1994. This is a census of firms in India and has only recently been made available to researchers. The span of this data allows us to capture the impact of the reforms of the 1980s and the 1990s and I am able to conduct the analysis at the most disaggregated level possible.

Use of plant-level data also allows us to use institutional features of the "License Raj" itself to identify the impact of de-licensing. Plants with assets below a certain defined rupee threshold were exempt from licensing requirements. Thus in any industry, some firms are "non-licensed" or "exempt" (since they are below the licensing threshold). So in industries that were "de-licensed" by the government, a firm is treated by de-licensing reform only if it was large enough to be under licensing at the time of the reform. This institutional feature provides within-industry variation that allows me to identify the interaction between de-licensing and size.

As a test of an implication of the identifying assumption, we conduct the analysis for hypothetical thresholds (that is, we falsely assign firms to the treatment) and find that there is no size-based response to de-licensing around these artificial thresholds. Only the official threshold seems to matter, providing evidence that our results capture the impact of de-licensing, not size.

We also test whether the results are derived from size-based trends in productivity (for example, large firms may grow faster) by including dummy variables for the percentile in which each firm is located around the threshold, interacted with year dummies. We find that even after controlling for these size-specific trends in productivity, there is a differential impact of de-licensing on affected, large firms. [2]

Since the data does not allow us to follow a firm over time, we use certain firm-level identifiers to create a pseudo-panel. We are able to identify several cross-sections of very similar firms in our sample. Using the pseudo-panel we check the robustness of the results to the inclusion of firm-level fixed effects.

Deregulation can change investment decisions and productivity by many different mechanisms. The most intuitive mechanism is a reduction in the price-cost margin of the firm due to (potential) entry of new firms. Nickell (1996) and Djankov and Murrell (2002) review studies linking product market competition with firm performance and find a generally positive impact of competition). Competition can also increase managerial incentives (Schmidt (1997)) to become more productive or to innovate/adopt new technologies (Aghion and Howitt (1992), Aghion et al. (1999)). Recent papers show that distance from the technological frontier matters – more advanced firms increase innovation in the face of competition (for example, via deregulation) while backward firms reduce innovation since their probability of keeping out entrants is low anyway (see Aghion et al. (2003), Aghion et al. (2004), Aghion et al. (2005)). Other mechanisms through which deregulation can impact productivity include a rise in capacity utilization if the firm had excess capacity prior to deregulation, a change in the capital to labor ratio in case regulation involved restrictions on the level of capital a firm could use in production, a decline in corruption that releases resources to be used for productive purposes etc.

There have been many careful studies of productivity in Indian manufacturing during the 1980s notably Goldar (1986), Ahluwalia (1991), Balakrishan and Pushpangadan (1994), Balakrishan et al.

[2] Our results are also robust to the inclusion of a wide variety of firm-level controls (ownership, organization, location (urban/rural and state) and wage to rental ratio) as well as industry-level controls (industry fixed effects, entry for firms belonging to large houses etc) that may affect firm-level productivity and/or be correlated with size. We also control for industry-level time-varying factors (by including industry-year fixed effects).

(2000), Srivastava (1996), Goldar and Kumari (2002). Some of these papers compare productivity estimates for the 1970s, 1980s and 1990s. However, none of them directly estimate the impact of policy changes in the 1980s (using an industry-level policy change dataset) on unit-level productivity. Interest in these reforms has been awakened due to a puzzling empirical result. As Panagariya (2002), Panagariya (2004) and Delong (2001) point out, reliable productivity measures show a sharp rise in productivity levels and rates of growth prior to the 1991 sweeping reforms. In a recent paper, Rodrik and Subramanian (2004) argue that the structural break in Indian growth came in the early eighties because there was an "attitudinal shift" on the part of the government toward a pro-business approach rather than due to actual policy changes like de-licensing. However they do not use data on policy reform to prove this hypothesis. In an empirical exercise that is complementary to our study, Aghion et al. (2005) and Aghion et al. (2006) assess the impact of entry liberalization on the productivity of Indian industry during the 1980s and find evidence of increasing inequality across Indian states. Further, they provide evidence at the industry-level that de-licensing of Indian industry lead to higher real output. Due to data constraints they assume that a 3-digit industry is de-licensed if all or part of it was de-licensed in any year. According to the industrial policy documents that we use to gather data on de-licensing, policy was set at a very disaggregated level implying that use of a 4-digit classification of industries might provide new insights, along with the use of firm-level data that we use (as opposed to industry-level).

As with deregulation, trade reforms can theoretically impact the firm through various mechanisms (pressure on the price-cost margin, incentives to innovate, availability of new/better inputs etc). Empirically, recent surveys (Tybout (2000), Epifani (2003)) show a generally positive impact of trade reform on productivity. Micro-level studies of the the Indian trade reform episode, however, provide mixed results. Krishna and Mitra (1996) use firm-level data for the period 1986-1993 from several industries and find strong evidence of an increase in competition (as reflected in the reductions in price-marginal cost markups) and some evidence of an increase in the growth rate of productivity. Balakrishan et al. (2000) use a sample of 2300 firms over the period 1988-89 to 1997-98 to find no evidence of acceleration in productivity growth as a result of the 1991 reforms. Das (2003) uses standard growth accounting on manufacturing industries during 1980-2000 and finds no evidence of change in TFP growth following the 1990Šs reforms. More recently, Topalova (2003) has used a more sophisticated methodology for calculating productivity and concludes that reductions in trade protection lead to higher levels of productivity in Indian manufacturing over the period 1989-2001. In a recent study Sivadasan (2006) uses the same firm-level data as we do

and finds an 30 to 35% increase in mean intra-plant productivity level in tariff liberalized industries. There is also a 25% increase in aggregate output growth and a 20% increase in aggregate productivity growth following tariff liberalization.

We contribute to this broad literature by addressing the question of the interaction between domestic reforms and trade policy. That is, what happens to firms that faced domestic deregulation and then faced foreign competition?

It is worth mentioning that while any full story about the impact of a deregulation or trade reform episode should include details of the mechanism through which the reform affects the firm, in this paper we focus on the impact of a particular set of reforms, not on the mechanisms through which this impact might occur.

The paper is organized as follows. Section 2 provides details about industrial licensing in India. Section 3 describes our industrial policy data set and the chronology of reforms as well as the firm-level data. Section 4 presents the empirical strategy. Sections 5 and 5.4 present the empirical results. Section 6 concludes the paper.

2 Background on Indian Industrial Policy

2.1 The System

The licensing of industries was one of the major methods to control private enterprise in India. The mixed economy framework (adopted after independence from Great Britain) mandated a role for the private sector . However, it was felt that the private sector would need encouragement to invest in the desirable areas. Hence industrial licensing evolved as a method to direct investment in desirable directions.

A license was a document that permitted a firm to continue/begin production in an industry. It was issued by the Ministry of Industry in New Delhi. Under the Industries (Development and Regulation) Act 1951 (henceforth referred to as IDRA), all factories [3] that were already operating or wished to operate in a specified list of industries were required by the government to obtain a license. Licenses were issued only by the Central government. All applications for license were debated upon by the Licensing Committee consisting of officers from the administrative ministry (Ministry of Industry), the Planning Commission and representatives of other government

[3] Defined as enterprizes that did not use power but employed more than 100 workers or enterprizes that used power and employed more than 50 workers.

departments and the Director General of Technical Development (DGTD). This was the nodal body for technical recommendations.

The scope of a license was fairly broad especially from the late 1960s onwards. Almost by definition, the licensing regime controlled entry into the industry and hence the amount of competition faced by a firm. The considerations of the licensing committee while debating a license were mainly macro-economic in nature and had little to do with the merits of the project. Conversations with former officials of the DGTD reveal that the most important concern for the licensing committee while debating a particular case was the "demand-supply situation" of the good–if it was felt that there was enough existing capacity to satisfy projected demand[4] then the application was rejected, irrespective of the quality of the proposed good and the nature and productivity of the technology that was proposed to be used. That is, the new project was not assessed on the merit of its efficiency, productivity or quality. Another important facet was the type of the good. There was a disdain for variety in policy-makers of the time and competition was thought to be wasteful.[5] Another important consideration was import and foreign exchange requirements. A large number of applications were rejected because they required "too" much foreign exchange.

A license also specified the amount of output that a firm could produce. It was conditional on the proposed location of the project. Permission would be required to change location. The exact nature of the item to be produced was also specified and the firm needed to take permission or another license to change his product mix. Even the kind of technology and inputs that the firm could use in production (though not specified on the license) was determined because the most crucial raw materials (steel, cement, coal, fuel, furnace oil, railway wagon movements, licenses to import inputs etc) were controlled by the government and the firm needed to get annual allotments of these for production.

This allocation of important inputs to the firm by the licensing authority was also the main way in which licensing requirements were implemented. Each and every firm was allotted a certain amount of these inputs each year based on the output limits specified on their license. Thus, it was very difficult for the entrepreneur to produce over the limit on his license since basic raw materials were allotted to him based on the licensed amount. [6]

[4]Detailed information on monthly production, capacity utilization and demand projections were collected by the Ministry of Industry, the Planning Commission and other agencies.

[5]Nehru once remarked "Why do we need nineteen brands of toothpaste?" as reported by Das (2000)(page 153)

[6] Conversations with former officials reveal that this method was thought to be an even more potent force than physical inspections by bureaucrats. For example, licensing officials reveal that during the actual licensing process there was almost no verification of the details provided by the entrepreneur. If he stated that his plant was located in

Another unique feature of the license regime in India was its complexity. There were numerous clauses, conditions and exceptions under which firms/industries could gain exemption from licensing provisions or even exemption from exemption of licensing provisions. The most important clause at the firm level, which we use in our identification strategy, was that firms with book value of assets in plant, machinery, land and building below a specified rupee threshold were granted exemption from licensing. That is, they would not need to apply to the licensing committee and could produce without any constraints on output, location, technology etc. All other firms were under the burden of licensing.

2.2 The Effect

The effect of a permanent license to produce (combined with a low threat of potential entry) on firm-level incentives to reduce costs, modernize technology, improve quality and engage in monopolistic practices was raised by one committee after another starting from 1965, a mere 15 years after licensing was implemented. One of the earliest observations were made by the *The Monopolies Inquiry Commission 1965* chaired by K. C. Dasgupta. "*.....the requirement of law that new industries with capital over a specified amount.....could not be started without a license is a formidable obstacle in the way of new entrepreneurs freely entering the lists.*" [7]

Further, "*The system of controls on the shape of Industrial licensing however necessary from other points of views, has restricted the freedom of entry into industry and so helped to produce concentration*".[8] The Committee also mentioned the issue of high costs of production in Indian manufacturing and averred that "*... The cost of production remains high due to the fact that top firms have not exerted themselves sufficiently.....secure in the belief that in the absence of competition from abroad there was little risk of losing their market dominance*".[9]

The *Hazari Committee 1967* (Hazari (1967)) also found evidence of industrialists pre-empting licenses. That is, a firm would send multiple applications for the same product. This ensured that it would be granted at least some of the planned capacity in that item, keeping out rivals. In no uncertain terms the committee remarked that "*The obligation on all units have fixed assets*

district A then this was taken as given. However once the license was granted and the entrepreneur was petitioning the DGTD to allot him his quota of raw materials for the year, each and every aspect of the project was thoroughly scrutinized to check whether conditions were satisfied. Further any direct assistance from the government (in the form of inputs, credit etc) legally obligated the firm to send detailed monthly production reports to the DGTD. These reports were also scrutinized for discrepancies.

[7] Dasgupta (1965), page 7

[8] Dasgupta (1965), page 8

[9] Dasgupta (1965), page 142

more than Rs. 25 lakhs to take out a license for new articles-applications which can be rejected out of hand on the ground of sufficient ***licensed*** *(not necessarily actual) capacity keeps at bay existing large undertakings which might have the capacity to offer competitive products by feasible diversification. Enterprize plus imaginative understanding of licensing formalities thus enables the [name of large industrialist] to foreclose the market."*[10]

Thus, the licensing regime in India affected firm-level productivity and costs through its control on both the firm's *ability and incentives* to innovate, reduce costs, adopt new technology etc. The direct controls on outputs and inputs affected ability and the indirect control of entry affected incentives. Even if the direct controls were not implemented fully due to corruption etc, the effect of the indirect controls on incentives was very large. Licensing restricted entry into most sectors and created artificial monopolies and oligopolies. The average four-firm concentration ratio in Indian manufacturing in 1981 was 54.2% compared to 32% for the US in 1977. Even among developing countries, India seems to be closer to Poland (64.8% in 1988) than Brazil (32% in 1988).

2.3 The two phases of reforms

In the 1980s, the government started relaxing the licensing regime by "de-licensing" certain industries. From the late 1960s onwards it was starting to get clear that the strangle hold of regulation on Indian industry was fatal for it and many assessments of the system in the 1960s and 1970s advocated relaxation of regulations. Certain attempts were made in the 1970s.[11] But it was in the 1980s that any significant change in the working of the system occurred. Table 1 shows the percentage of manufacturing output and value added that was de-licensed in each year of the 1980s and 1990s. We also show the percentage of factory output and value added that was de-licensed

This piece-meal approach to reforming industrial policy continued through the 1980s. In 1991, the Indian economy faced a balance of payment crisis and was forced to take loans from international organizations. Under pressure from these organizations, the biggest de-licensing episode occurred. Almost all industrial licensing was removed (other than for 16% of manufacturing output). Along with this, there was across the board reductions in tariffs and rationalization of non-tariff

[10] Hazari (1967), paragraph 13.5

[11] The first "de-licensing" of firms was done in 1966 and by 1969, 41 items were de-licensed. However in 1973, these industries were licensed again and it was only in 1975 that the second phase of de-licensing began when 21 industries accounting for 3% of manufacturing output were de-licensed. I tried using this reverse de-licensing episode as a specification test but the magnitude of the episode is too small to provide enough variation to identify the impact of de-licensing.

trade barriers. The rupee was de-valued by 22% (from Rs. 21.2 against the dollar to Rs. 25.8). The sheer scale and scope of the reforms were so large that this reform episode has been the one that has caught the imagination of policy-makers and researchers alike.

3 Data

The data used in this paper comes primarily from two sources. In order to measure changes in the competitive environment faced by a firm (the right hand side explanatory variable), we have collected a detailed data set of industrial policy in India (to our knowledge, the only one existing) from the 1970s onwards. Using this data, we can identify which four-digit industry underwent reform (freedom from licensing requirements) in each year from 1970-1990.

The main source of data was internal government publications and notifications issued to adminstrative minstries. Some commonly available publications like the Economic Survey were also used. Common publications, however, do not reveal the level of detail about the conditions under which firms were eligible to avail of certain policies (for example, size-based exemption from licensing at the firm-level). In several cases, important instances of reforms are not mentioned in common publications or are disguised as administrative changes (rather than the outright reforms that they were). Due to lack of political consensus on the need for reforms, reforms in the 1980s were white washed and it is hard to get a sense of just how far-reaching these were from publications like the Economic Survey. Study of government notifications, memos etc provided insight into the ideology of policy-makers and provided rich detail that we exploit in our identification strategy.

The relative obscurity of the sources and publications needed to assess the true impact of the reforms, as well as the perception (carefully fostered by the government) amongst academics, journalists and politicians that these reforms were small, scattered administrative changes that had no real impact are reasons for why there has not been a single detailed empirical study of these early reforms. They have been referred to as "reforms by stealth" in recent writings. Table 1 shows the quantum of de-licensing that took place on various years in the 1980s and 1990s and brings forward two important points that challenge the predictions of other studies on India. The first is that with respect to the percentage of manufacturing output that they affected, the reforms of the 1980s were quite significant. Cumulatively, 23% of output and 22.8% of employment had been de-licensed as of 1990. Hence, studies that ignore pre-1991 changes in the licensing regime

provide misleading estimates of the impact of the 1991 crisis. Secondly, de-licensing in 1991 was not "across the board" as is the common assumption in most studies. 16% of manufacturing output and value added were still under compulsory licensing post-1991. Some of these industries were gradually de-licensed in 1993 and 1994. But studies that ignore the actual chronology of de-licensing post-1991 also overstate the impact of the 1991 crisis.

To measure the left-hand side variable—-productivity of the firm—- we use a rich and rarely used establishment-level database. The source for establishment-level data for this study is the Annual Survey of Industries conducted by the Central Statistical Organization (CSO), a department of the Ministry of Programme Planning and Implementation, Government of India.[12] We obtained this data for the 14 year period 1980-81 to 1994-95. The length of our data allows us to cover all the reforms of the 1980s as well as the major reform episode of 1991.

The survey covers all factories registered under the Factories Act 1948. Note that the survey covers only the formal sector in Indian manufacturing. The ASI frame can be classified into 2 sectors-the census sector and the sample sector. Units in the census sector are covered with a sampling probability of one while units in the sample sector are covered with probabilities one-half or one-third. For our analysis, we use data on all establishments as defined by the Industries (Development and Regulation) Act 1951 since these units were the ones that came under the ambit of industrial licensing. These are units that employ 50 or more workers and use power in the production process or units that employ 100 or more workers without the aid of power[13]. Since we use log of output per worker, observations for which the output or worker figures are less than or equal to zero are excluded from the analysis . Further, 42000 firms are listed as being closed in the year of the survey and these are also excluded from the analysis. The data is reported on a financial year basis. That is, 1980-81 refers to the period between 1 April 1980 and 31 March 1981.

The sampling probability of the data that we use for our analysis are summarized in Table 2. Nearly 80% of our data has a sampling probability of one. On average there are around 15000 units a year corresponding to a population of 20000 units. Note that the sampling scheme changed in 1987. In all our analysis, we weight observations using the multiplier or the inverse sampling probability to adjust for sampling frequency.

[12] A recent paper that has utilized this database is Sivadasan (2006) who calculates the impact of the trade and foreign investment reforms that were done in 1991 on total factor productivity in Indian manufacturing. Most other papers (for example, Aghion et al. (2006)) use ASI data at the industry-state level.

[13] The non-factory units that we exclude are large in number (an average of 30% over our time period) but account for only 14% of total output and 18% of employment in registered manufacturing. I did run some of the basic regressions on the main sample and the results are unaffected. These are available upon request.

Trade data are obtained from Das (2003). Das computes the tariffs and import penetration ratio for 3-digit Indian manufacturing industries, for the four phases 1980-81 to 1985-86, 1986-87 to 1990-91, 1991-92 to 1994-95, and 1995-96 to 1999-00. [14] Das (2003) defines the import penetration rate in industry j, year t as $IPR_{jt} = Imports_{jt}/(Production_{jt} + Imports_{jt} - Exports_{jt})$. Thus, this measure captures both tariff and non-tariff barriers. As Das (2003) points out, the latter were quite important in the Indian trade regime.

Summary statistics of our key variables are presented in Table 3. Real output is the value of total output measured in 1993-94 prices. The deflator used is the sector specific wholesale price index at the three-digit level of industry classification. [15] Labor is measured as the number of employees. We present summary statistics for two types of firms – firms with assets less than a certain threshold level (exempt firms) and firms with assets above this threshold (not exempt firms). As we detail in Section 4, these two types of firms are important to our identification strategy. Further, we show the summary statistics for three important sub-periods. The period 1980-83 is pre-reform with no industrial or trade policy changes. During 1984-90 there was industrial deregulation and the 1991-94 period was characterized by industrial deregulation and trade reforms. The table brings to attention the sheer number of small (exempt) firms in the economy and large ex ante differences between large and small firms. It also shows us that while both small and large firms become more productive over time (average log of real output per employee and real output are rising over time while average employment is falling), the difference between exempt and not exempt firms is increasing over time. For example, from sub-period 1980-83 to 1984-90 to 1991-94, the difference in real output of not exempt and exempt firms rose from Rs. 10 million to Rs. 11.2 million Rs. 14.1 million while the difference in employment fell from 2000 to 1500 to 1342. Thus, this table provides a crude illustration of our empirical strategy.

4 Identification Strategy and Estimation Equation

4.1 Estimation Equation

The prediction that we want to test is that a more competitive, deregulated, market-driven domestic environment forces firms to raise their investment in productivity-enhancing technology and hence

[14] Das (2003) calculates these measures of trade for 72 three-digit industries. In order to be able to use all industries in our analysis, we use the average of the trade measure for the corresponding two-digit industry and in some cases, the economy average.

[15] Source: Various issues of the Reserve Bank of India Bulletin

leads to higher productivity. A removal of licensing requirements (that lead to free entry and removed microeconomic constraints on licensed firms) from an industry led to a more competitive, market-driven environment and allows us to test the prediction. After controlling for industry and year effects, the estimation equation that this translates into is given by

$$y_{ijts} = \beta_0 + \alpha_j + \delta_t + \beta_1 Delicense_{jt} + \gamma Trade_{jt} + \eta X_{ijts} + \varepsilon_{ijts} \quad (1)$$

Here Y_{ijts} is the log of output per worker for a factory i producing in industry j, located in state s at time t. $Delicense_{jt}$ is an indicator that takes in a value of one in all years starting in year t if industry j was de-licensed in year t. Coefficients α_j, δ_t are industry and year effects respectively. The variable $Trade_{jt}$ is a variable measuring openness to international trade (we use negative log tariffs as well as import penetration ratio). The vector X_{ijts} contains other firm, industry and state level controls. We explain these controls in detail in Section 4.2.

For several reasons the OLS estimation of Equation 1 may give biased, inconsistent estimates. The main explanatory variable $Delicense_{jt}$ varies at the 4-digit industry level. Political economy factors like political affiliation, lobbying power are also at the industry-level and these might affect whether industry j gets de-licensed. Industry-year fixed effects may capture some of these unobservables, but in order to get reliable estimates we need within-industry variation.

The other reason has to do with the nature of the reforms in the 1980s. The reforms of the 1980s have been characterized by some as "reforms by stealth". There was no consensus for economic reforms in the 1980s. It is clear from policy documents that the government was at pains to portray the changes of the 1980s as a continuation of the existing system even though these were dramatic changes that veered away from the high-regulation, socialist paradigm in operation. Under these circumstances it is possible that the government was choosing industries for deregulation based on certain characteristics that either raised the chances of the success of the reforms (for example, picking high productivity industries) or that minimized social costs in case of failure (for example, picking high technology industries to minimize employment effects).

We use an institutional feature of the licensing regime in India to get estimates of the impact of de-licensing. The most important variation was size-based difference in application of licensing provisions. In particular, firms that had assets in plant and machinery, land and building less than a certain amount were exempt from industrial licensing requirements. We define the variable $NotExempt$ to describe firms that were under the burden of licensing provisions.

$$NotExempt_i = \begin{cases} 1 & \text{if firm } i \text{ has assets greater than Rs. 30 million between 1980-81 and 1982-83} \\ 1 & \text{if firm } i \text{ has assets greater than Rs. 50 million between 1983-84 and 1989-90} \\ 1 & \text{if firm } i \text{ has assets greater than Rs. 150 million after 1990-91} \\ 0 & \text{otherwise} \end{cases}$$

The criterion for exemption was in terms of the original rupee value of assets in plant and machinery, land and building owned (or proposed to be owned) by the firm. This definition was constant for all industries. That is, an exempt firm in industry *A* would face the same threshold as an exempt firm in industry *B*. Over our sample period 1980-1994, the rupee value of this definition was changed twice-in 1983-84 and 1990-91.[16] Note that inflation in the price of land or machinery would not change the exempt/not-exempt status of the firm since this was based on the original or book value of assets (not current value).

This size-based exemption from licensing was an important component of the government's strategy to promote the growth of smaller firms that would be main engine of employment generation in the manufacturing sector. These firms would also satisfy consumption needs of the economy and would be a mechanism to spread economic growth to far-flung regions of the country. Further, this was also a pragmatic decision so that the administrative burden of the licensing regime did not grow too large. By the late-1960s, as the manufacturing sector took off, there were reports of long delays in the grant of licenses. By giving exemption to some firms, the intent was to lessen the sheer volume of applications that the licensing authority had to process.

Note that these exempt firms could enter and operate in any industry and without restrictions on output or investment as long as they stayed below the threshold *even though their industry of operation was under licensing.*[17] So pre-reform, there were two types of firms within the same industry – exempt and not exempt. After de-licensing reform, all firms were de facto exempt from licensing.

[16] In May 1990, in an Industrial Policy statement the government raised the exemption limit to Rs. 500 million. However, in November 1990 a new government came to power and by April-May 1991, the foreign exchange crisis was taking hold. Given these two factors, the implementation of the May 1990 statement in actual practice is in doubt.

[17] In some cases, certain additional conditions like upper limits on foreign exchange requirements for the project needed to be fulfilled in order for the firm to be "exempt". But these conditions were by and large easy to fulfill and according to officials, a large number of firms were able to take advantage of this scheme.

Thus the actual equation that we estimate is

$$\begin{aligned} y_{ijts} &= \beta_0 + \alpha_j + \delta_t + \beta_1 Delicense_{jt} + \beta_2 NotExempt_{it} \\ &\quad + \beta_3 Delicense_{jt} NotExempt_{it} + \gamma Trade_{jt} + \eta X_{ijts} + \varepsilon_{ijts} \end{aligned} \tag{2}$$

This identification strategy allows us to deal with the problem that industry-level un-observables may make $Delicense_{jt}$ correlated with the error term. Further, the estimation equation takes account of the possibility of spillovers and the importance of size on a firm's productivity by including $Delicense_{jt}$ and $NotExempt_{it}$ separately. The working of the licensing regime was such that *all* firms within an industry were affected by it. That is, even small, exempt firms would be affected – directly or indirectly – by licensing and hence by de-licensing. A small firm might gain productivity after the de-licensing of its industry from being able to produce at any scale (and not have to be small in order to maintain its "exempt" status), but also due to the entry of large firms that make it necessary to become more productive. The equation allows for these spill-over effects. That is, it is possible that the productivity of both small(exempt) firms as well as large (not exempt) increased after de-licensing of their respective industry. All that the identification assumption requires is that the *gap* in productivity between large and small firms rise. We might expect this to happen given that licensing protected $NotExempt = 1$ firms from entry as well as constrained them in output and that small firms that did not have either the protection or the constraints.

Size is a very important determinant of firm productivity as well as other characteristics and it is very likely that there are immense size-based differences in the characteristics of firms. That is, small firms might be systematically different than large firms. The estimation equation allows for these size-based differences (by including exemption status as a separate variable, rather than just the interaction of exemption status and de-licensing).

One potential concern remains that we might simply be capturing size-based differences in absolute (or trends) in productivity. Graphically, Figures 1, 2, 3, 4 and 5 show trends in productivity of exempt and not exempt firms that are in the 10th, 20th, 30th and 40th percentiles around the threshold for licensing. The figure shows that for the closest deciles (the 10th and 20th), trends in real output per worker are quite similar in the pre-reform period (1980-84). Further for all the deciles, there are no sudden jumps in the productivity of exempt firms though the general trend is increasing. This implies that even very large, close-to-the-threshold exempt firms do not see any sudden or major jumps in productivity in the post-reform period. These figures suggest that our results are due to a differential response to de-licensing around the threshold rather than the

response to some factor that might have affected *all* large firms irrespective of whether they are exempt or not exempt from licensing.

Interpretation of Coefficients

The industrial licensing regime in India affected both the ability as well as the incentives of a firm to invest in productivity. The controls on the amount of output, the location of the plant, the technology used etc directly controlled the ability of a firm while controls on entry into an industry affected incentives. When an industry was de-licensed, both these controls were removed simultaneously. In this context, the coefficient β_3 captures the impact of the relaxation of both direct and indirect controls on firms. That is, β_3 measures the impact of de-licensing on a non-exempt firm's productivity because of relaxation of output, locational and other constraints as well as the impact on productivity due to more competition and a higher threat of potential entry.

The first mechanism–relaxation of direct controls on the ability of a firm–makes sense since only the not exempt firms were under the burden of fulfilling onerous conditions on output, location etc while exempt firms were not (as long as they maintained assets below the government definition). Thus, there is differential impact on these two types of firms within an industry of de-licensing.

The argument with regard to the second mechanism–higher threat of potential entry–is more nuanced. One might argue that if there were no barriers to entry as a small, exempt firm while there were huge barriers to entry as a large, not exempt firm (in the form of the cost of procuring a license) then no firm would want to enter as a not exempt, large firm in the pre-reform period. All firms would enter small and would grow until they reach the threshold amount of assets. This means that de-licensing will not increase entry into the ranks of not exempt firms while exempt firms have free entry both pre- and post-reforms. If this were the case then our identification strategy does not capture the impact of entry deregulation on the productivity of firms.

However, the argument above assumes that there are no costs to entering as a small, exempt firm. This assumption is not likely to be true because a license to produce was only one in a whole package of permissions and permits that a firm needed to get in order to commence production. For example, in order to get exemption firms needed to agree to an upper limit on foreign exchange requirements. Further, on the basis of the recommendations made by the licensing committee, the firm had to get allotments of essential raw materials from another committee that was in charge of allocations. Similarly, the firm needed to go through a separate procedure to get permission to

procure foreign exchange and to import any raw materials or machines. Further, the firm needed to get financing for its project but applied to financial institutions *after* getting all the required permits and licenses. All these procedures and permissions were more likely to be more difficult and costly for a small firm. So if a firm decided to enter the industry as small, the firm not only suffered the loss of economies of scale but also faced additional costs of being small. Thus, while there were no explicit entry barriers into the exempt category of firms, the other accoutrements of the licensing and trade regime created entry barriers and it is by no means obvious that a firm would always want to enter small in size, pre-reforms. This means that de-licensing of an industry reduced entry barriers for both of exempt as well as not exempt firms.

4.2 Controls

In this section we talk about the controls that are included in the X_{ijt} variable in Equation 3. We use our industrial policy database to control for policies that may affect the ability and/or incentives of the firm to raise its productivity.

Policies regarding **dominant firms and firms belonging to large and/or foreign owned industrial houses**. Control of large private industry was an important objective of policy in India. The main objective was to prevent the concentration of economic power in a few private hands. Since the inception of the licensing system, certain large industrial houses were considered dangerous and hence all licensing proposals from these houses were treated with suspicion. In 1973, the government streamlined its policies regarding large industrial houses and announced a list of industries in which large and/or foreign owned houses were allowed to operate[18]. We control for this list of industries in which large and/or foreign owned houses were allowed to operate. We define

$$Large_{jt} = \begin{cases} 1 & \text{if industry } j \text{ was open for large houses in year } t \\ 0 & \text{otherwise} \end{cases}$$

We also include controls for **ownership and organization structure** and **location** of the firm. Controls for these are included since the ability to take productivity enhancing decisions and the flexibility that a firm has in adapting to a changed policy environment may depend on whether the firm is for example, owned by the government or by the private sector or if it has access to urban infrastructure. [19]

[18] Even in these industries, the stated policy was one of preference for non-large firms. If a large house wanted to set up a firm in an industry not on this list then it would have to undertake an export obligation of 60-75% of output.

[19] For ownership, there are 6 categories-owned by central government, owned by state government, jointly owned

We include the **average price of capital relative to price of labor** in a state s in year t in the controls. This is a proxy for the capital-labor ratio and is included because we are concerned with the relationship between the size of the firm and the productivity of the firm. In particular, productivity of the firm as measured by output per worker may be determined by its size. If we were to measure size by output then this would be true by definition. Our definition of size however, is based on the assets of the firm in plant and machinery. But it is still possible that output per worker (our measure of productivity) is affected by capital per worker (for example, in any linear homogeneous production function) and so size (and hence exemption status) and productivity are directly related. We cannot directly put the capital-labor ratio in our estimation equation (since the variable Ne_{it} is a function of capital). So we need a proxy for the capital to labor ratio in our estimation equation. [20]

5 Results

5.1 Main Results

In Table 5 we present our baseline results for the estimation of Equation 3. In each specification we have included all the controls mentioned in the previous section. These regressions are within-industry. That is we are estimating a firms performance relative to the average performance of the 4-digit industry to which the firm belongs. We have also included year and state fixed effects. Standard errors are clustered around four-digit industry.

Column 1 of Table 5 shows the results of our main specification on the sample of factories. Thus we see that on average, firms that were not exempt from licensing and were in de-licensed industries had 17.2% higher labor productivity. Our estimate is significant at the 1% level. That is, industrial deregulation leads to a significant rise in the firm productivity. The coefficient on tariffs is positive but is not significant.

by state and central government, wholly privately owned, joint sector firm with majority private ownership and joint sector firm with majority public ownership. Organization includes individual proprietorship, joint family run, other partnership, public limited firm, private limited firm, public corporation, co-operative society and other. For location there are three categories - urban, rural and metropolitan.

[20] We use the deflator for net fixed capital formation (with base 1993-94)(Source: National Account Statistics) as a proxy for the price of capital. In our unit-level data we have the wage bill as well as the number of workers employed by each unit. So we are able to impute the annual wage rate that a firm has to pay. Since this wage rate is in nominal terms we deflate it so that it has base 1993-94 (similar to our measure for price of capital). The reason why we use state-year averages of this cost ratio is because firm level cost ratios might be endogenous with technology and productivity choices of the firm. Further, labor laws (for example, minimum wage) and their implementation is at the state level. So the average cost ratio captures the major institutional features of the labor market in India.

In Column 2 of the table we present regression results for the period 1980-90. An important point of our analysis is that the reforms of the 1980s have been unfairly ignored by the literature. So it would be interesting to see the impact of those piece-meal reforms on productivity, not the path-breaking reforms of 1991. We find that the average firm that was treated with de-licensing during the 1980s did better than a non-treated firm. However this effect is significant only at the 18% level. The total impact of de-licensing on Not Exempt firms ($\beta_1 + \beta_3$) is very small for the period 1980-90. One possible rationalization for this small impact on productivity during the 1980s could be the lack of an enabling environment. That is, a rise in domestic competition can change the incentives of the firm to raise its productivity but this effect is reinforced by other factors. One such important factor that we will investigate is competition from abroad i.e. trade reform.

In Column 3 of the table we subject these baseline results to a strict robustness check. We are worried that there may be industry specific time trends in productivity and that is the reason for the positive coefficient on β_3. So we include 2-digit industry-year fixed effects in our base model. Since de-licensing policy was decided and implemented at the 4-digit level of industry and so we can still identify the coefficient on De_{jt}. We find that the coefficient on the interaction of exemption and de-licensing is positive and significant. In an even stricter test of our identification strategy, in Column 4 we include 4-digit industry-year fixed effects in the estimation and find our results robust. However, we can not identify the coefficient on De_jt. Thus even after correcting for industry-specific time trends we still find an effect of de-licensing on not exempt firms.

That our results are robust to industry-year fixed effects becomes important because in all the specifications, the average impact of de-licensing on exempt firms in the industry (the coefficient on De_{jt}) is negative. This may point toward the fact that government was choosing low productivity industries for de-licensing.

Our results also show that ($\beta_1 + \beta_3$) is positive for all the specifications. That is, the average impact of de-licensing is large and positive for firms that were not exempt from licensing. This is expected given that non-exemption from licensing meant that these firms had to pay higher entry costs (in the form of obtaining the license) as well as onerous microeconomic constraints that were imposed on them.

From Table 5, the role of exemption status also becomes clearer. In all the specifications the coefficient on $NotExempt_{it}$ is large and positive. That is, not exempt firms had higher productivity than exempt firms in licensed industries. This could be a reflection of the economies of scale enjoyed by larger firms.

5.2 Controlling for trends in productivity

One concern with the analysis so far is that the industry-year fixed effects basically capture the trends in productivity of small, exempt firms (since these firms are large in number and are likely to heavily influence average productivity of an industry). So we are worried that a positive coefficient on β_3 simply captures an upward trend in the productivity of large firms. Further, the negative coefficient on De_{jt} also raises the possibility that the trends in productivity of small firms might diverge from those large firms and that this gives rise to our results.

In Column 5 of Table 5 we subject our results to a very strict robustness check. In order to capture these size-based trends in productivity, we include size percentile effects interacted with year in the estimation of Equation 3. We define a variable $Size^x{}_i$ as follows.

$$Size^x{}_i = \begin{cases} 1 & \text{if firm } i \text{ is in the x-th percentile of firms around the threshold} \\ 0 & \text{otherwise} \end{cases}$$

Thus each size category includes firms above and below the threshold, in a band around the threshold. This allows us to identify the coefficient on Ne_{it} and capture any other size-based trends in productivity. We see that even after correcting for size-specific trends in productivity, there is an 11% higher productivity for Not Exempt firms in de-licensed industries.[21]

5.3 Do arbitrary thresholds matter?

An implication of our identification assumption is that if we choose arbitrary thresholds for exemption from licensing, then we should not find any variation in the response of firms to de-licensing around these arbitrary thresholds. That is, if the true threshold matters then randomly chosen thresholds should not. We find that this is true in our data. The significance level of the interaction coefficients when plotted against distance from the actual threshold takes a bell-shape. That is, the interaction between de-licensing and the random threshold (both above and below the actual threshold) is insignificant far from the actual threshold and rises in significance as we approach the true threshold.

[21] When we control for industry-year effects (Table 5), we are worried that the time paths of growth might be highly dissimilar across industries and we wish to control for that. An additional concern might be that that industries in different states may have different time paths of growth. This could be due to different growth paths of infrastructure, financial markets, labor laws, wage to rental ratios etc in different states. These factors may affect the incentives and the ability of firms located in different states differently. If de-regulated industries are disproportionately located in states that have higher growth rates of these variables then we maybe falsely attributing this to the reforms (rather than to the growth of these variables). We find that after controlling for three-way 3-digit industry, state, year effects the average affected firm (with $Ne_{it}De_{jt} = 1$) still has higher productivity than others. These results are available upon request.

In order to conduct this specification test we use the following methodology. The actual exemption threshold is in nominal rupees and this nominal value was changed twice over our time period. Given the span of the data and possibility of inflation, we can not use absolute deviations from the actual threshold to generate our hypothetical thresholds.

We generate our hypothetical thresholds in the following way. For each year and conditional on actual exemption status, we sort firms according to their assets in plant, machinery, land and building. Then we take the rupee amount below which there are 10% of the firms in that year and assume those firms are Exempt from licensing requirements. That is, we take the 10^{th} percentile as our first threshold. This means that 10% of actually Exempt firms are treated as Exempt and 90% of actually exempt firms are treated as Not Exempt. Similarly, the next threshold is defined as the rupee amount of the 20^{th} percentile and hence 20% of actually Exempt firms are treated as Exempt and the other 80% are shifted into the Not Exempt category. Thus at the 90^{th} percentile, we treat 90% of actually Exempt firms as exempt and 10% of actually exempt firms as Not Exempt.

Similarly we sort the firms above the actual threshold in each year according to their assets and take the various percentiles as our cut-off points. Thus the first cut-off above the actual threshold shifts 10% of the actually Not Exempt firms as Exempt, the second cut-off shifts 20% of actually Not Exempt firms into the Exempt category etc.

Thus we continually shift firms from the Not Exempt category into the Exempt category as we approach the actual threshold and then go beyond it.

We define $NE(x)_{it} = 0$ if firm i is in the x^{th} percentile in year t, 1 else and estimate the equation below for different values of x

$$y_{ijts} = \beta_0 + \alpha_j + \delta_t + \beta_1 De_{jt} + \beta_2 NE(x)_{it} + \beta_3 De_{jt} NE(x)_{it} + \eta X_{ijts} + \varepsilon_{ijts} \tag{3}$$

We conduct this specification test on the years 1980-91. Size-based exemption from licensing was completely removed during the 1991 reforms. That is, all firms in licensed industries were licensed and all firms in de-licensed industries were de-licensed. This means that this robustness test is valid only for the period in which exemption from licensing is an issue for firms.

In Table 6 we present the coefficients, standard errors, t-statistics and z-statistics for the interaction term $De_{jt} NE(x)_{it}$. If our identification strategy is valid then the interaction terms should be insignificant far from the actual threshold and should become more significant as we approach the threshold from either side. As can be seen the interaction coefficient is not significant at either

extremes and rises in significance as we approach the threshold. Further as can be seen in Figure 6 where we plot the coefficient estimates and their confidence interval on distance from the actual threshold, the confidence interval of the coefficients is very large at the extremes and narrows as we approach the actual threshold. That is, the coefficients are much more precise near the actual threshold than away from it.

This specification test confirms that we are capturing actual variation in productivity around the threshold for exemption due to de-licensing reform, rather than size-based differences in productivity. If the official threshold matters only because it separates large (productive) firms from small (unproductive) firms, then this should be true for other hypothetical thresholds too. However, this is not the case with our data.

5.4 The Relationship between Trade and Industrial Reforms

The chronology of reforms in India allows us to analyze the relationship between industrial and trade policy reforms. In the 1980s, policy was geared toward deregulating industry to reduce administrative burden as well as unnecessary checks on firm-level decision making. There was little interest in trade reforms and the changes in trade policy that occurred were primarily of the nature of streamlining of the system, rationalization of administrative procedures etc. It was only in 1991, under pressure from international organizations, that the first steps were taken towards trade reforms. Following the industrial policy statement of August 1991, there were across-the-board tariff cuts bring down the average un-weighted tariff to 60%.[22]

Given this chronology of events an important question that arises is what happened to the industries that were deregulated in the 1980s post-trade reform? In this section we will try to assess the impact of the 1991 changes in industrial and trade policies on firm-level productivity.

In Column 1 of Table 7 we present a simple estimate of the post-1991 performance of firms in industries that were de-licensed in the 1980s .

$$D80_{jt} = \begin{cases} 1 & \text{if industry } j \text{ was de-regulated in year } s \leq t \text{ of the 1980s} \\ 0 & \text{otherwise} \end{cases}$$

That is, the $D80_{jt}$ variable is the same as the De_{jt} variable. We simply don't include the industries

[22]The strength of pre-reform trade barriers and hence the scope of the reforms can be gauged from the fact that according to Panagariya (2004), in 1990-91 the highest tariff rate stood at 355%, the simple average of all tariffs at 113% and the import-weighted average of tariff rates at 87%.

that were deregulated in 1991 and 1993. Our estimation equation is

$$\begin{aligned} y_{ijts} &= \pi_0 + \delta_t + \alpha_j + \beta_0 D80_{jt} + \beta_1 NotExempt_{it} + \beta_2 Post91_t \\ &\quad + \beta_3 D80_j NotExempt_{it} + \beta_4 D80_j NotExempt_{it} Post91_t \\ &\quad + \eta X_{jts} + \varepsilon_{jts} \end{aligned} \tag{4}$$

The coefficients β_0, β_1 and β_3 have similar interpretations as in Equation 3. The coefficient on $NotExempt_{it}D80_{jt}$ is the impact of de-licensing, pre-1991, on the firms that were affected by it . The coefficient β_4 then measures impact of deregulation (conducted in the 1980s) on the affected population of firms in the post-trade reform period (Post-1991). Column 1 of Table 7 shows that this estimate is positive and significant. That is, the average productivity of affected firms (not exempt from licensing and in de-licensed industries) in the post-trade reform period was 8.8% higher than that of firms that were not deregulated during the 1980s. In the second column of the table, we include the variable $D80_j * Post91_t$. We are worried that without this term, the coefficient on $Notexempt_{it}D80_jPost91_t$ might be capturing differential trends in productivity in de-licensed industries, post 1991. As Column 2 shows, the coefficient β_4 declines in magnitude after we control for this and significant at the 16% level.[23]

We also use two measures of trade reforms which vary at the industry level. In Columns 3 and 4 of Table 7 we present the results of estimating the following equation. Column 3 uses $Trade_{jt} = -Log(Tariffs)_{jt}$ while Column 4 uses $Trade_{jt} = IPR_{jt}$.

$$\begin{aligned} y_{ijts} &= \pi_0 + \delta_t + \alpha_j + \beta_0 D80_{jt} + \beta_1 NotExempt_{it} + \beta_2 Post91_t \\ &\quad + \beta_3 D80_j NotExempt_{it} + \beta_4 Trade_{jt} + \beta_5 D80_{jt} NotExempt_{it} Trade_{jt} \\ &\quad + \beta_6 D80_{jt} NotExempt_{it} Trade_{jt} Post91_t + \eta X_{jts} + \varepsilon_{jts} \end{aligned} \tag{5}$$

The coefficient on $D80_{jt}NotExempt_{it}Trade_{jt}$ captures the marginal effect of trade reforms on not exempt firms that were de-licensed in the 1980s. Since major trade reforms took place only in 1991, the coefficient of interest is β_6. It captures the marginal effect of trade reforms on not exempt firms, de-licensed in the 1980s, post 1991. Column 3 shows that this impact is negative - not exempt firms in de-licensed industries had lower gains in productivity if they were exposed to lower tariffs during the 1991 reforms. However, an increase in the import penetration ratio (which

[23] We do not include an interaction of $NotExempt_{it}$ and $Post91_t$ since size-based exemption of firms from licensing provisions was no longer a government policy after the reforms of 1991.

captures lower tariff and non-tariff barriers) leads to higher productivity gains in firms de-licensed in the 1980s. That is, once we take into account non-tariff barriers we find that domestic and trade reforms are strategic complements.

Several studies of the pre-reform Indian tariff regime have pointed out that there were significant instances of "water in the tariff". That is, tariff-inclusive prices were much higher than autarky prices. Also, non-tariff barriers were a very important component of the "Tariff-Quota-License Raj". Thus it is possible that the initial declines in nominal tariffs that took place in August 1991 do not capture the extent of foreign competition to which Indian firms were exposed and that this might be one explanation of the difference in results between tariffs and import penetration ratio.

It is also important to note that these results hold even after we control for differential trends in productivity of de-licensed industries, post-1991 and trends in productivity of trade-reformed industries, post 1991. Columns 5 and 6 of Table 7 show that the coefficient on β_6 is negative when we use tariffs and positive when we use import penetration ratio.

5.5 Controlling for firm-level un-observables

A very important source of bias in our co-efficient estimates may be due to reverse causality. The main causal story that we want to tell is that the productivity of a firm that was under licensing requirements ($NotExempt_{it} = 1$) and was in an industry that was de-licensed by the government will be affected by de-licensing. However, it may be that a firm of a particular productivity may chose to be exempt from licensing. That is, firms that have low productivity may have a systematic tendency to stay exempt from licensing requirements since that keeps them protected from the larger, licensed firms. Then, since low productivity firms are choosing to be "non-treated" firms, we will see a large effect of de-licensing even if it did not have a large impact. That is, our estimates of the impact of de-licensing are biased upwards.

On the other hand, it is also possible that low productivity firms chose to be under licensing even though there are constraints. This is because a license to produce was permanent and entry into an industry was not governed by market conditions. Thus there would be a high chance of a low productivity firm surviving and even making super-normal profits without inducing entry from competitors. In this case, treated firms in our sample are systematically low productivity and this will bias our estimates downwards.

Another story we can think of is that firms with low managerial ability chose to be under licensing since they know they will not be able to compete in a more competitive environment.

Again, if we are not able to control for these firm-level effects then our estimates may suffer from omitted variable bias.

Ideally, we would like to verify that the results reported above are robust to the inclusion of firm-level fixed effects. That is, we would require information on firm identity and the ability to follow a firm over time. In our data we can theoretically identify 200,000 observations over time (those belonging to the census sector). However, we have not been provided with firm identity numbers by the ASI. But we do have rich data on a variety of firm identifiers and we try to use those data to construct a firm identity number.

We use information on 6 firm-level identifiers:

1. Four-digit industry of production;
2. State where firm is located;
3. Whether located in rural, urban or metropolitan area;
4. The year that the firm started production;
5. The ownership structure of the firm (government owned, wholly privately owned or joint sector)
6. The area in which a firm is located.

There are other firm-level identifiers that could be used like the organization structure of the firm (proprietorship, co-operative society, private corporation etc). However we do not use these since they might change over time for a given firm. Thus, it is possible that a firms organization changes over time from a joint family proprietorship to a private limited company or that a wholly central government owned firm becomes a joint partnership with the state government. However, it is unlikely that a government owned firm (either state or central government) will change to a wholly private firm over time.

The six variables that we have chosen are available for 182,111 observations. These observations include firms that were closed during the accounting year. We cannot use these firms in our estimation since output and employment figures are not available however we include closed firms while creating the firm-level identifier. This means that the same identifying number is assigned to a firm that is in the data and producing in year t, is closed for production in year $t+1$ but enters production again in year $t+2$.

Using these identifiers, we are able to uniquely identify approximately 40,000 odd firms. For the other firms, there are multiple identity numbers within each year and we drop those firms. Further note that each of these firms does not exist every year. The average age of a firm in the sample is 5.6 years. Our total sample size is 122,000 including closed firms and 118,000 excluding closed firms.

We are still concerned whether we are capturing the same firm over time. It may be that another firm with very similar characteristics existed in the same region and in later years we are capturing that firm. To check for this we use two pieces of information from our data set- the opening and closing stock of fixed capital owned by the firm. Suppose that firm 1 ended year 1980 with Rs. 1 million of capital stock. Then we check whether the firm identified as 1 in 1981 started with capital stock close to Rs. 1 million. This cross-check supports our firm identifier.

Our main concern is that this may not be a random sample. So we provide some descriptive statistics of our panel of firms as compared to all factories. Figure 8 shows the distribution of productivity in exempt and not exempt firms for the pseudo-panel and the full sample firms. The black solid line represents unique firms while the red dashed line represents the all firms. As we can see that the distribution of productivity is very similar for both types of firms over exemption status. Any difference between unique firms and all factories are constant over exemption status and hence will get canceled out. For example, the sample of unique firms has higher productivity for both types of firms-exempt and not exempt from licensing requirements. In Figure 9 we investigate the distribution of assets (in plant, machinery, land, building) for exempt firm over de-licensing reform in the full sample and in the pseudo-panel. Within each graph the solid line represents the year 1988 while the dashed line represents the year 1983. Comparing this graph to Figure 7 (that was drawn for the full sample) we can see that the behavior of exempt firms over licensing reform and over time is the same for the full sample as for the pseudo-panel.

The results of the estimation of Equation 3 on uniquely identified firms are presented in Column 1 of Table 8. We estimate a within-firm regression with year dummies and standard errors clustered around 4 digit industry. The coefficient on the interaction of exemption status with de-licensing is positive and significant at the 1% level. That is, firms that were treated with de-licensing reform (they were not exempt from licensing and were in industries that were de-licensed) performed 11.4% better on average than non-treated firms, conditional on firm-level factors. In Column 2 of Table 8 we include 2-digit industry-year fixed effects to capture different growth paths of different industries and we find that similar to our baseline results, the coefficient on the interaction term is

lower in magnitude. The average treated firm did 8.5% better than a non-treated firm, even after controlling for firm-specific factors and for industry-year interactions. In Column 3 of the table we present the results for the year 1980-90. The coefficient on the interaction if 0.105 and is significant at the 1% level. That is, after controlling for firm-specific factors, we find that the reforms of the 1980s had a positive and significant impact on the firms that were affected by these reforms.

In Columns 4 to 6, we present the results of Equations 5 and 6. All key results are robust to the inclusiong of firm fixed effects - there is 8% higher productivity for not exempt firms in industries that were de-licensed in the 1980s, post-1991. We still find that affected firms (de-licensed, not exempt) in industries that recieved lower tariffs post-1991 did worse. However, similar to what we found earlier, these results reverse when we use import penetration ratio as a measure of trade.

5.6 Further Concerns

Another source of bias in the estimates of Equation 3 arises from the possibility that firms may be endogenously choosing their exemption status (i.e. the size of their assets in plant, machinery, land and building) based on anticipations of de-licensing. Suppose that the main benefit to a firm for choosing a low level of capital comes from the fact that the firm is free from licensing requirements. Then if the firm is truly constrained by the threshold and is anticipating de-licensing of its industry (when it will loose its privileged status) it will increase its capital even if that means that it is above the threshold. However, investigation of the data do not reveal any evidence of this. If firms were anticipating then we should find that industries that were de-licensed should have a lower proportion of exempt firms (as these firms raise their assets in plant, machinery, land and building because they no longer stand to gain from having low assets). Further, the rates of growth and levels of assets of exempt firms should be higher in de-licensed industries post-reform [24].

In the industries that were de-licensed during the 1980s, the proportion of exempt firms was 0.95 pre-reform (1980-83) and it fell to an average of 0.93 during the reforms (1984-89). This pattern was identical to that in industries that were not de-licensed in the 1980s (here the proportion of exempt firms fell from 0.97 to 0.95). That is, there was no sudden inexplicable decline in the

[24]There are several reasons why an exempt firm will want to increase its capital if it anticipates de-licensing. The first is that if the main reason why the firm is keeping a low capital stock is to escape from licensing then as soon as this privilege is removed, the firm will no longer benefit from constraining its capital and hence will want to expand. Another reason is that de-licensing means that the firm will be competing in an environment of free entry for larger firms (remember that exemption was only for "smaller" proposals). In order to compete it might be necessary to take advantage of economies of scale and that might entail increasing its assets. Another sufficient condition might be convex adjustment costs to capital.

proportion of exempt firms post-reform. Similarly, the average annual rate of growth of the number of exempt firms also maintained its pattern across industries (It rose from 1.6% to 2.4% in the de-licensed industries and from -1.5% to 0.5% in the still-licensed industries.).

In Table 4 we investigate the pattern of the average annual rates of growth of assets in plant, machinery, land and building across exempt firms. We see that while the rate of growth of the mean is higher in de-licensed industries as compared to licensed industries, the top 25% of firms grew faster in licensed industries than in de-licensed industries during 1984-89 (12.97% as compared to 10.53%). This is contrary to what we would find if firms were choosing their assets based on reforms. Similarly in the top 50% of firms, the rate of growth of assets is slightly higher for exempt firms in licensed industries. Thus, in firms that were closer to the threshold-and hence more likely to be endogenously choosing size- there is little or no difference in the behavior of growth of assets.

In Figure 7 we investigate the distribution of exempt firms over assets in industries in two year-1983 (the year preceding the first deregulation episode) and 1988 (the year immediately after the reforms of the 1980s). Within each graph the solid line represents the year 1988 while the dashed line represents the year 1983. We see that the distributions are very similar in de-licensed industries as compared to licensed industries. This is especially true towards the end of the distribution i.e. nearer to the threshold.

6 Conclusions

In this paper we use two unique data sets, the institutional features of Indian policy and the interesting chronology of reforms in India to address two issues. The first is whether industrial deregulation that increases the level of competition that a firm has to face affects firm-level productivity. We find the answer to this is affirmative. Confirming our intuition we find that firms that were affected by de-licensing had higher labor productivity than non-affected firms. Thus more competition spurs firms to perform better. We solve the problem of industry-level omitted variables that may bias our estimates by estimating a difference-in-difference specification.

The second issue that we address is whether there is a relationship between industrial deregulation and trade reform. Given the chronology of reforms in India, what happened to the productivity of the firms that were in industries deregulated during the 1980s *after the trade reforms of 1991*? We find that firms in industries that were de-licensed in the 1980s and had higher productivity as a result of that tended to have higher productivity post-1991. The availability of detailed trade policy

data may allow us to draw richer conclusions and we hope to conduct that analysis in the future.

Our results are robust to the inclusion of a wide variety of firm- and industry-level controls and fixed effects. One implication of using fixed-effect methods to assess the impact of reforms is that we can test an implication of our identification assumption. We check for the significance of randomly chosen thresholds for licensing and find that *only the official threshold matters* with respect to differential performance in exempt and not exempt firms. We also construct a panel of firms to test the robustness of our estimates to the inclusion of firm fixed effects.

Our results have various policy implications. An important one is that domestic competitive environment can be used to prepare firms in the economy for trade reforms. Under competition from high-productivity foreign firms, domestic firms that are not productive may want to cut their losses and not invest in productivity-enhancing technology. However a rise in the level of domestic competition can spur these firms to make investments in technology prior to facing competition from abroad and hence prepare them for an even more competitive environment.

Tables

Table 1: Percentage of Output and Value Added De-licensed in each year

Year	All Output	Factory Output	All Output -Cumulative	Employment - Cumulative
1984	7.0	7.1	7.0	7.6
1985	18.3	20.3	14.0	15.1
1986	3.8	3.6	20.0	17.9
1987	26.5	27.9	25.0	23.5
1990	0.0	0.0	23.0	22.8
1991	60.0	58.3	84.2	90.1
1992	0.0	0.0	83.7	90.3
1993	2.6	2.8	84.5	91.0

Note that to compute these figures we use de-licensing and unit-level data at the four-digit level of NIC.

Table 2: Characteristics of the data

Year	Inverse of Sampling Probability		
	1	2	3
1980	13,345	2,880	0
1981	13,746	2,910	0
1982	14,771	2,913	0
1983	13,883	2,319	0
1984	13,398	2,240	0
1985	13,785	2,439	0
1986	13,747	2,236	0
1987	11,080	2	2,786
1988	11,183	1	2,804
1989	11,195	186	2,880
1990	10,894	321	2,801
1991	11,202	353	2,752
1992	11,739	289	3,183
1993	11,915	312	3,413
1994	12,607	349	3,380

Table 3: Summary Statistics for All Factories

	All Firms		**Not Exempt Firms**		**Exempt Firms**	
	Obs=194056		**Obs=2542**		**Obs=191514**	
1980-83	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Log(Real output per worker)	6.80	1.47	6.74	1.50	8.11	1.11
Real Output (1993-94 Rs.)	7.61E+05	5.28E+06	4.18E+05	1.02E+06	1.08E+07	2.67E+07
No. of Employees	301.27	1115.57	2.30E+02	8.28E+02	2.39E+03	3.63E+03
Tariffs (%)	100.04	18.4				
Import Penetration Ratio (%)	0.037	0.094				
	All Firms		**Not Exempt Firms**		**Exempt Firms**	
	Obs=321814		**Obs=6336**		**Obs=315478**	
1984-90	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Log(Real output per worker)	7.37	1.36	7.31	1.35	8.57	1.05
Real Output (1993-94 Rs.)	1.12E+06	7.01E+06	5.81E+05	1.24E+06	1.18E+07	2.94E+07
No. of Employees	289.07	960.45	215.25	529.08	1739.76	3367.33
Tariffs (%)	112.60	22.40				
Import Penetration Ratio (%)	0.041	0.094				
	All Firms		**Not Exempt Firms**		**Exempt Firms**	
	Obs=189851		**Obs=3636**		**Obs=186215**	
1991-94	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Log(Real output per worker)	7.63	1.43	7.56	1.41	9.02	1.07
Real Output (1993-94 Rs.)	1.37E+06	7.30E+06	7.63E+05	1.65E+06	1.49E+07	3.14E+07
No. of Employees	271.33	939.89	213.64	634.50	1555.16	3140.63
Tariffs (%)	83.75	13.53				
Import Penetration Ratio (%)	0.045	0.096				

Note: Not exempt firms are those that were under licensing, exempt firms are those that were granted an exemption from licensing based on the size of their assets.

Table 4: Average Annual Rates of Growth of Assets(%)

	Exempt Firms in Licensed Industries		
	Mean	Median	75^{th} Percentile
1980s	16.99	17.13	17.77
1980-83	26.26	29.73	23.81
1984-89	6.70	11.52	12.97
	Exempt Firms in De-licensed Industries		
	Mean	Median	75^{th} Percentile
1980s	15.45	14.09	15.96
1980-83	20.04	16.96	19.39
1984-89	7.05	10.88	10.53

Note: Assets refers to the book value of assets in plant, machinery, land and building.

Table 5: Baseline Results

	Baseline	1980-90	NIC2-Year	NIC4-Year	Size-year effects
NotExempt	0.610***	0.624***	0.624***	0.637***	0.576***
	[0.079]	[0.080]	[0.078]	[0.080]	[0.076]
De	-0.044	-0.056	-0.026	0	-0.064**
	[0.030]	[0.040]	[0.027]	[0.000]	[0.023]
De*NotExempt	0.172***	0.129	0.148**	0.134**	0.117*
	[0.064]	[0.094]	[0.059]	[0.063]	[0.071]
-Log(Tariff)	0.33	0.155	0.242**	-0.007	
	[0.235]	[0.162]	[0.119]	[0.118]	
Rent-Wage Ratio	-0.170*	-0.270**	-0.137	-0.132	-1.317***
	[0.098]	[0.119]	[0.098]	[0.105]	[0.409]
Constant	5.989***	4.616***	5.798***	5.166***	6.709***
	[1.201]	[1.071]	[0.875]	[1.341]	[0.202]
Observations	226349	166183	226349	226349	172329
R-squared	0.52	0.52	0.52	0.54	0.53
Industry-Year FE (2-digit)	No	No	Yes	No	No
Industry-Year FE (2-digit)	No	No	No	Yes	No
Size-Year FE	No	No	No	No	Yes
Industry FE (4-digit)	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Note: *** refers to significance at the 1% level, ** to 5% and * to 10% level. Standard errors are clustered around 4-digit industries. Controls are ownership, organization, location of the firm, whether large firms were allowed to enter the industry, wage to rental ratio. The dependant variable is log(Output per worker). Each observation is weighted by its inverse sampling probability.

Table 6: Coefficient on Interaction for Various Thresholds

% of actually Exempt firms treated as Not Exempt	Coefficient on Interaction	Standard Error	z-statistic	t-statistic
90	0.13987	0.08183	1.709286	1.71
80	0.0328603	0.056206	0.584645	0.58
70	-0.0035671	0.040994	-0.08702	-0.09
60	-0.01859	0.036891	-0.50392	-0.5
50	-0.0031225	0.035701	-0.08746	-0.09
40	0.0197247	0.036726	0.537079	0.54
30	0.0452736	0.033586	1.347974	1.35
20	0.0713353	0.031008	2.300567	2.3
10	0.1040062	0.043816	2.373698	2.37
Actual threshold	0.1489872	0.08268	1.801976	1.8
110	0.1189155	0.079071	1.503915	1.5
120	0.1238649	0.077874	1.590587	1.59
130	0.1161601	0.078147	1.486438	1.49
140	0.0997598	0.077873	1.281056	1.28
150	0.113357	0.077358	1.465358	1.47
160	0.1195946	0.081337	1.470359	1.47
170	0.1067452	0.083844	1.273135	1.27
180	0.0878918	0.092328	0.951953	0.95
190	0.0876862	0.108197	0.81043	0.81

Table 7: Results for Trade Reforms

	Post91	Post91	Tariffs	IPR	Tariffs	IPR
Not Exempt=1	0.662***	0.661***	0.662***	0.662***	0.661***	0.662***
	[0.077]	[0.077]	[0.077]	[0.077]	[0.077]	[0.077]
D80=1	0.086**	0.067*	0.083**	0.085**	0.063*	0.067*
	[0.042]	[0.035]	[0.042]	[0.042]	[0.035]	[0.035]
D80*NotExempt	0.055	0.065	-1.474	0.067	-1.43	0.07
	[0.093]	[0.093]	[1.211]	[0.092]	[1.213]	[0.093]
D80*NotExempt*Post91	**0.088***	**0.066**				
	[0.047]	**[0.047]**				
Post91	0.933***	0.930***	0.825***	0.865***	-0.007	0.862***
	[0.183]	[0.183]	[0.178]	[0.177]	[0.675]	[0.177]
Trade			0.224**	0	0.223**	0
			[0.114]	[0.001]	[0.106]	[0.001]
Trade*D80*NE			-0.328	-0.002	-0.321	-0.001
			[0.261]	[0.003]	[0.261]	[0.003]
Trade*D80*NE*Post91			**-0.040****	**0.505***	**-0.034***	**0.466***
			[0.020]	**[0.265]**	**[0.020]**	**[0.257]**
D80*Post91		0.048			0.05	0.048
		[0.037]			[0.037]	[0.036]
Trade*Post91					-0.187	-0.017
					[0.148]	[0.175]
Constant	4.680***	4.680***	6.554***	5.522***	6.549***	5.522***
	[0.619]	[0.619]	[0.550]	[0.089]	[0.511]	[0.089]
Observations	226333	226333	226333	226333	226333	226333
R-squared	0.52	0.52	0.52	0.52	0.52	0.52

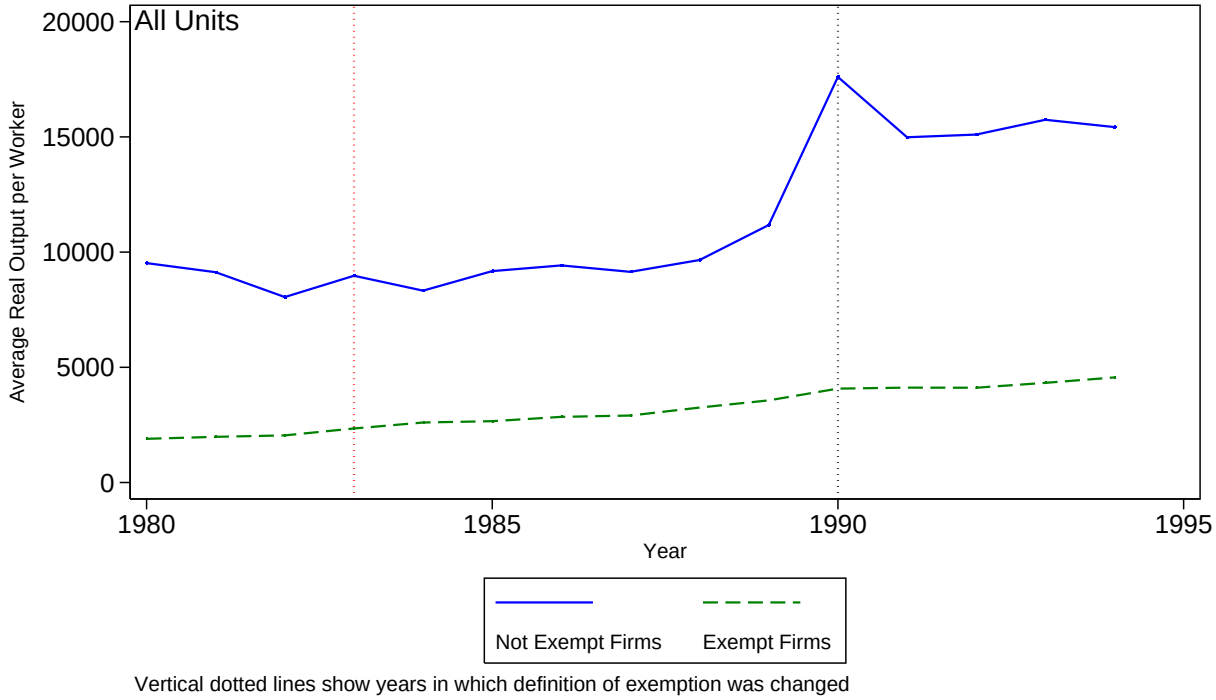
Note: All regressions include year, state and 4-digit industry fixed effects, as well as 2-digit industry-year fixed effects. † represents significance at the 16% level. *** refers to significance at the 1% level, ** to 5% and * to 10% level. Standard errors are clustered around 4-digit industries. Controls are ownership, organization, location of the firm, whether large firms were allowed to enter the industry, wage to rental ratio. The dependant variable is log(Output per worker). Each observation is weighted by its inverse sampling probability.

Table 8: Results for Pseudo-Panel of firms

	Base-Panel	NIC2-Year	1980-90	Post 1991	Tariffs	IPR
NotExempt=1	0.090***	0.108***	0.072**	0.115***	0.115***	0.116***
	[0.025]	[0.022]	[0.031]	[0.022]	[0.022]	[0.022]
Delic=1	-0.04	-0.028	-0.034			
	[0.031]	[0.025]	[0.029]			
Delic*NotExempt	**0.114*** **	**0.085*** **	**0.105*** **			
	[0.026]	**[0.024]**	**[0.034]**			
-Log(Tariffs)	0.096	0.184**	0.019			
	[0.110]	[0.088]	[0.107]			
De80=1				-0.025	-0.028	-0.027
				[0.028]	[0.028]	[0.028]
De80*NotExempt				0.079***	0.269	0.093***
				[0.029]	[0.465]	[0.030]
Post91				0.912**	0.890**	0.911**
				[0.366]	[0.362]	[0.365]
De80*NotExempt*Post91				**0.080*** **		
				[0.031]		
Trade					0.177**	0.0003
					[0.085]	[0.0004]
Trade*D80*NE					0.041	-0.003***
					[0.101]	[0.001]
Trade*D80*NE*Post91					**-0.016** **	**0.277** **
					[0.008]	**[0.132]**
D80*Post91				0.058*	0.060**	0.062**
				[0.030]	[0.030]	[0.030]
Trade*Post91					-0.049	0.013
					[0.113]	[0.102]
Constant	7.703***	8.097***	7.297***	7.263***	8.073***	7.262***
	[0.498]	[0.402]	[0.488]	[0.033]	[0.390]	[0.032]
Observations	118752	118752	87026	121601	121601	121587
Number of Firms	41664	41664	32800	42748	42748	42741
R-squared	0.05	0.07	0.07	0.07	0.07	0.07
Industry-Year FE (2-digit)	No	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

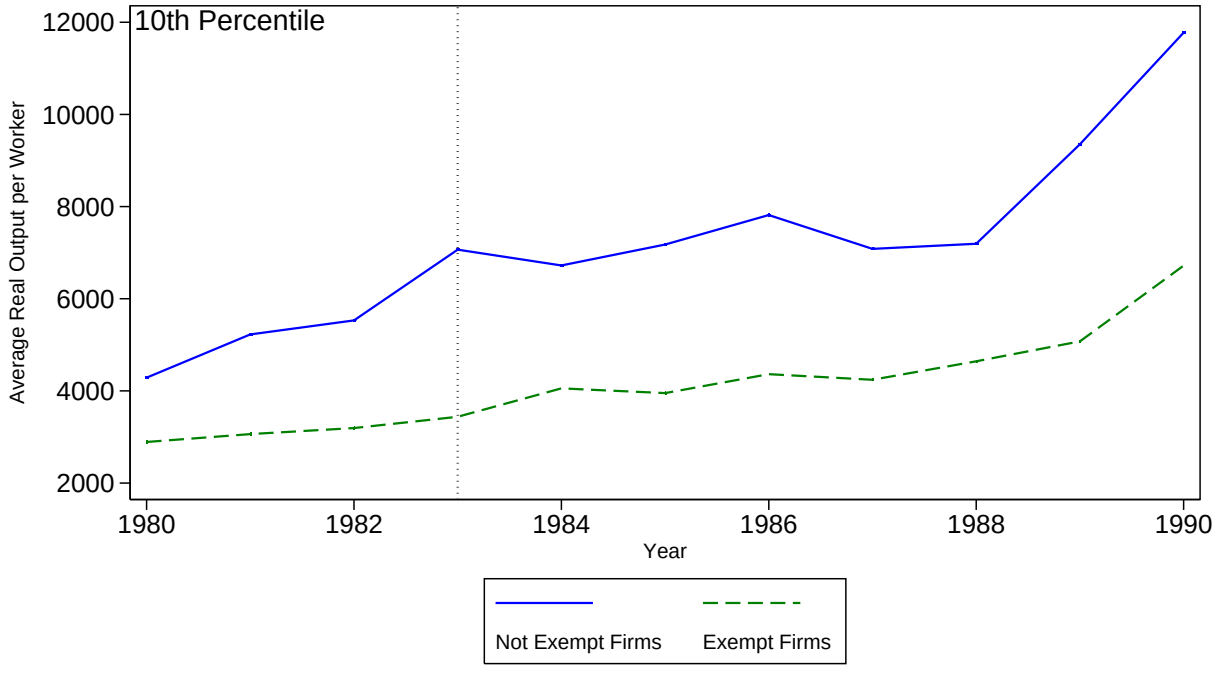
Note: *** refers to significance at the 1% level, ** to 5% and * to 10% level. Standard errors are clustered around 4-digit industries. Controls are organization of the firm, whether large firms were allowed to enter the industry and wage to rental ratio. The dependant variable is log(Output per worker). Each observation is weighted by its inverse sampling probability.

Figure 1: Trends in Productivity-Exempt and Not Exempt Firms



Vertical dotted lines show years in which definition of exemption was changed

Figure 2: Trends in Productivity-10th Percentile

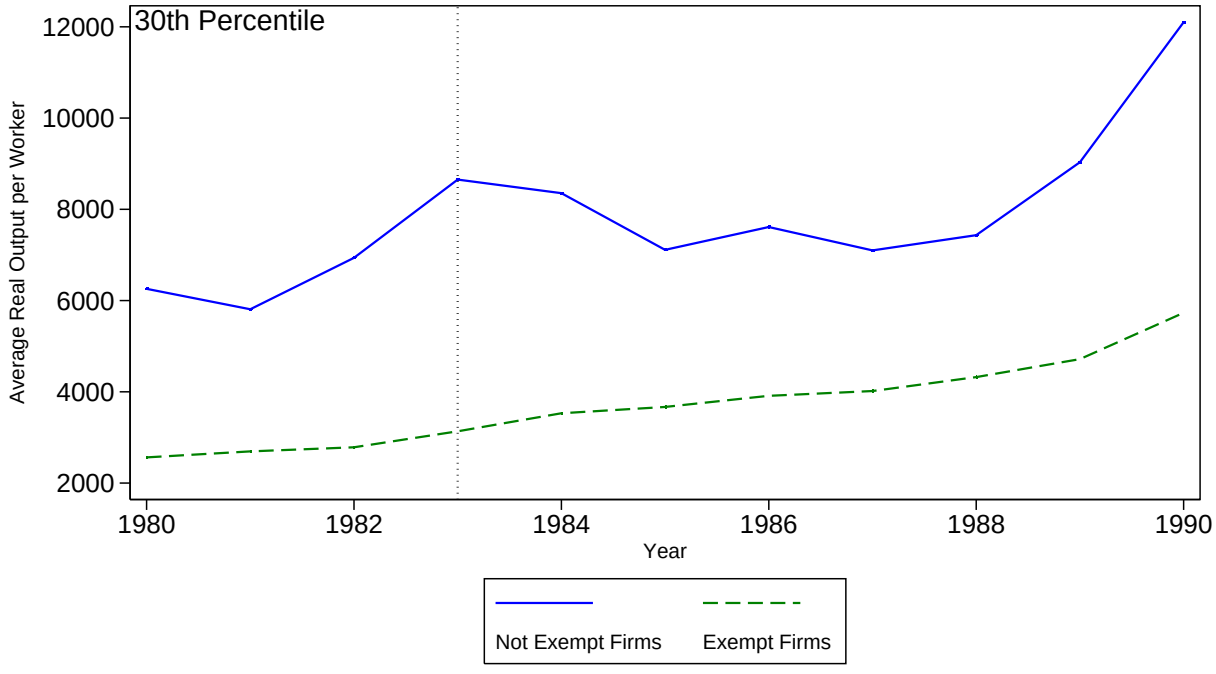


Vertical dotted line shows year in which definition of exemption was changed

Figure 3: Trends in Productivity-20th Percentile

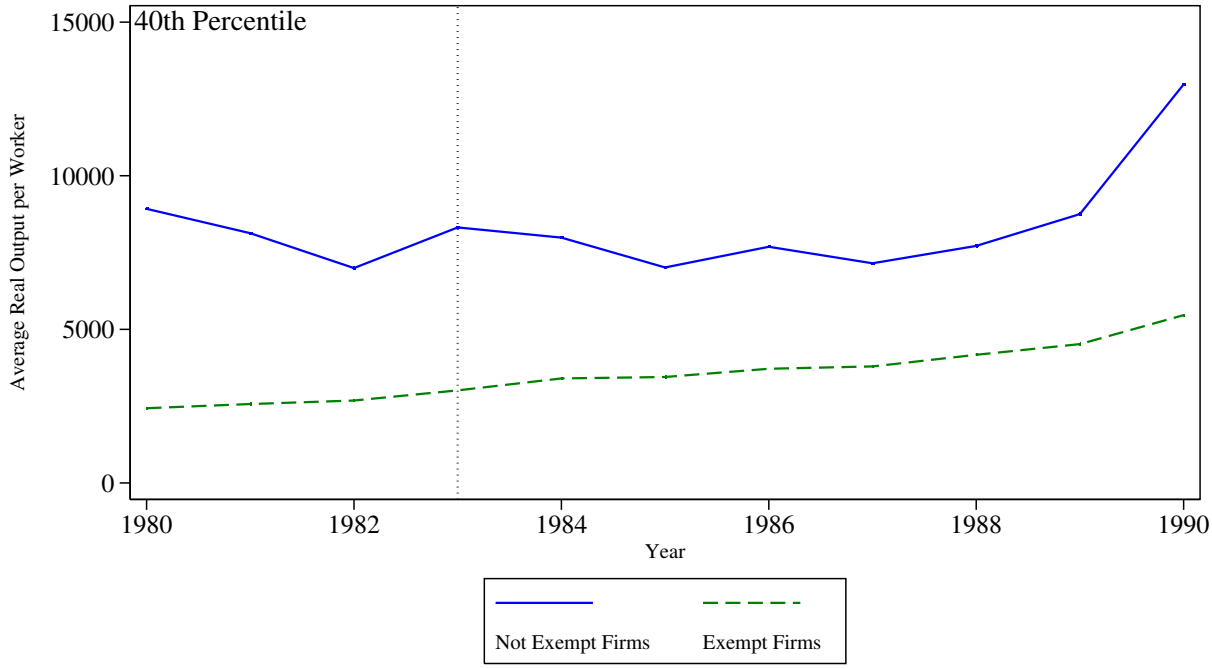
Vertical dotted line shows year in which definition of exemption was changed

Figure 4: Trends in Productivity-30th Percentile



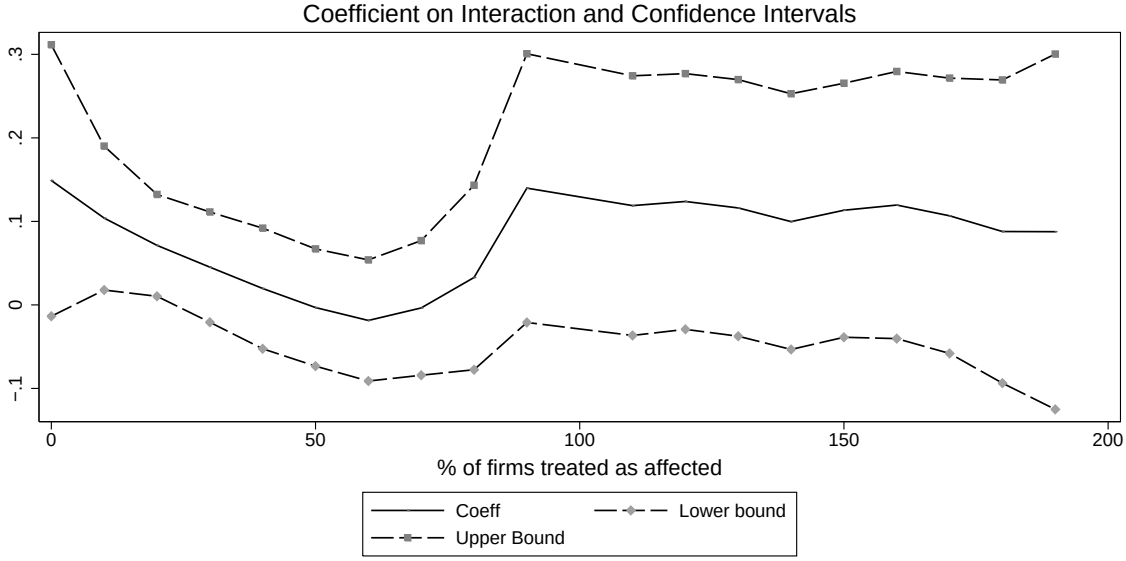
Vertical dotted line shows year in which definition of exemption was changed

Figure 5: Trends in Productivity-40th Percentile



Vertical dotted line shows year in which definition of exemption was changed

Figure 6: Coefficient on Interaction and Confidence Intervals



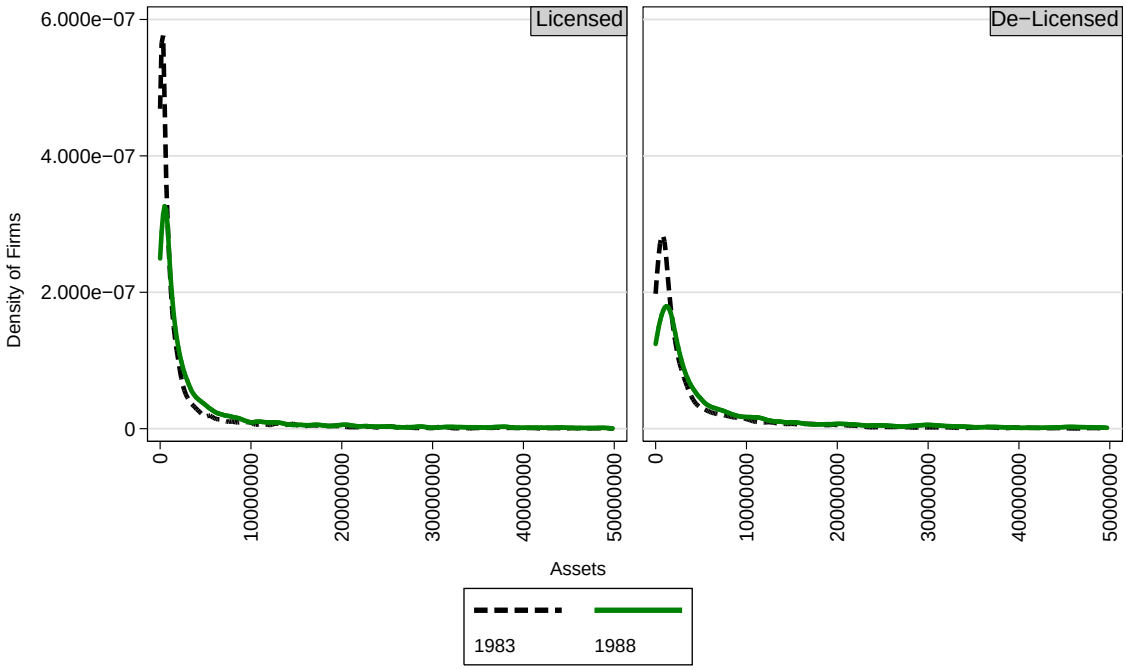


Figure 7: Distribution of Assets of Exempt firms: Assets<=Rs.50 million.

Figure 8: Distribution of Productivity in the Pseudo-panel. The solid line represents the distribution of unique firms-those that were assigned a firm id number. The dashed line represents all firms.

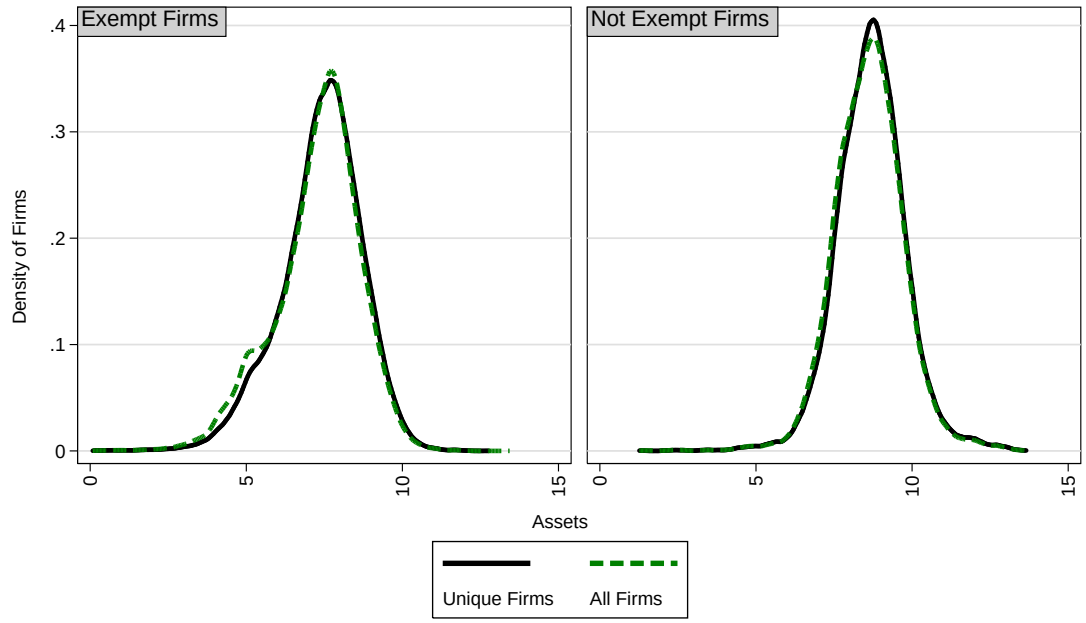
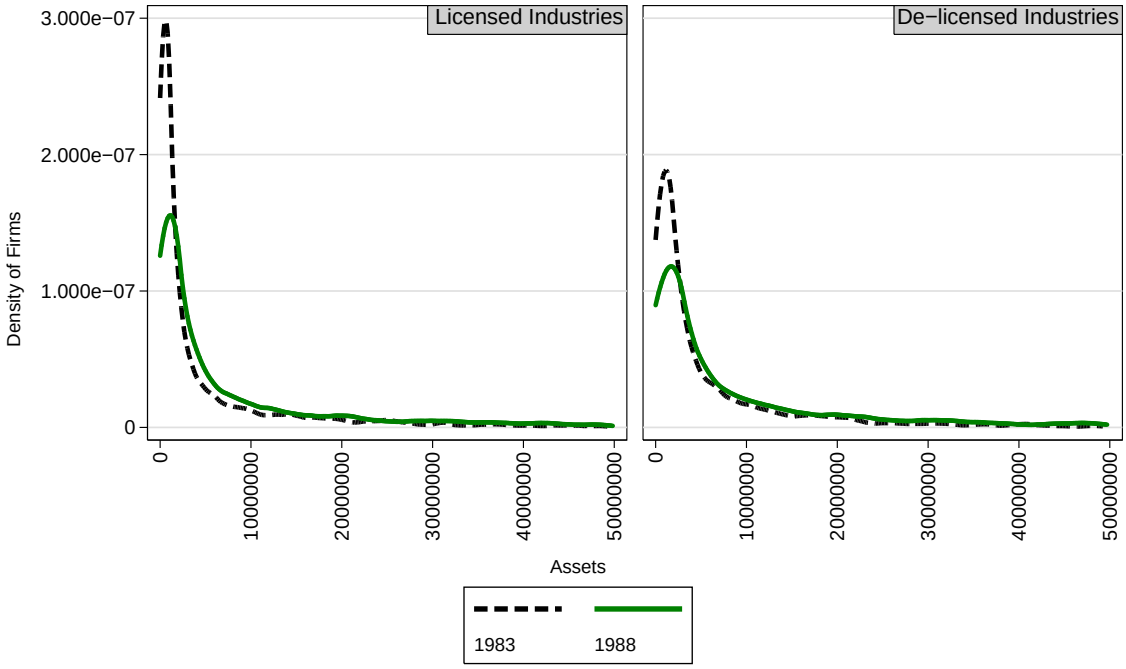


Figure 9: Distribution of Assets of Exempt Firms in the Pseudo-panel.



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