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The effect of environmental decentralization on polluting industries in India.

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Abstract

This paper examines the unintended effects of the 2006 reform of the Environmental Impact Assessment (EIA) process in India using firm-level data for the period 1998-2012. The reform favored a decentralization process by delegating the responsibility over environmental clearance of certain activities to state-level authorities. The results show that variations in the strength of environmental enforcement across states has resulted in an increase of births for polluting industries affected by the reform in states with lower level of enforcement.

1 Introduction

This paper examines the impact of the 2006 Environmental Impact Assessment (EIA) reform on firm decisions concerning births and locations. The reform delegates the responsibility over environmental clearance of certain activities, previously under the control of the central government, to newly

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established state-level authorities. While environmental standards are decided by the central government, most of the environmental compliance monitoring and enforcement in India was already a responsibility of state-level Pollution Control Boards (SPCB). The 2006 EIA reform has expanded this decentralized model by assigning additional tasks to state-level authorities. Though this could potentially lead to a more transparent and efficient environmental clearance process, it could also have unintended effects on firms' decisions.

Environmental enforcement varies notably across Indian states. Differences arise possibly due to variations in socio-economic and political conditions across states but also due to state-specific technical and financial constraints. This paper examines whether differences in environmental enforcement influence firm births across states through the EIA process stringency. The key findings are derived from the fact that the reform of the EIA has affected only certain polluting activities, while for others the process has remained almost unchanged, and that pre-reform differences in environmental enforcement across states are likely to be indicative of differences in the stringency of the EIA process across states. The empirical approach is based on a firm-level latent-startup model where the number of births is a function of time-varying state and sector level characteristics.

The estimations compare pre- and post-reform births, conditional on the strength of environmental enforcement in each state. Environmental enforcement is measured using a composite index obtained by aggregating various state-level indicators of institutional quality, civic participation and institutional capacity. The identification strategy relies on the presumption that, while firm births in sectors affected by the reform should respond to variations in environmental enforcement after the implementation of the 2006 EIA reform, no effects are expected on non-polluting firms and on polluting industries not affected by the decentralization process. The estimations are based on the population of registered firms born during the period 1998-2012. Although the formal sector contributes to only a small fraction of total Indian output, large firms are the only ones subject to environmental clearance, since smaller informal firms tend to operate outside the control of pollution control authorities.

The results show a significant increase in births of polluting firms in states with lower enforcement levels relative to states with higher enforcement levels. This relocation effect has ambiguous consequences for the Indian economy. The relocation of firms across the territory may negatively impact the Indian economy if it implies that firms choose inferior locations that increase operational costs and decrease efficiency (Becker and Hender-

son, 2000). On the other hand, firm relocation may be socially beneficial since firms might locate in less populated areas where either pollution damages are lower or economic growth benefits are higher and offset the environmental costs. It is, however, not in the scope of this paper to quantify all the welfare effects resulting from polluting firms locating in states with lower enforcement.

The remainder of the paper is organized as follows. Section 2 describes the policy background and the reform of the EIA process introduced in 2006. Section 3 provides a brief overview of the relevant literature. The empirical model is described in section 4 while the data are presented in section 5. The empirical results are discussed in section 6 and section 7 concludes.

2 Environmental policies in India

Environmental protection rights and duties are incorporated into the Indian Constitution which mandates that the State and every citizen shall protect and improve the environment. India has an elaborate set of laws relating to environmental protection that dates back to the Water Act in 1974. The central government, through the Ministry of Environment and Forests (MOEF) and the Central Pollution Control Board (CPCB), is in charge of planning and formulating national policies and standards. Their implementation and enforcement are decentralized and are the responsibility of the State Pollution Control Boards.

Besides in addition to the role undertaken by central and state institutions, Indian citizens benefit from a unique approach to the enforcement of environmental laws by exercising their constitutional right to a healthy environment in the form of Public Interest Litigations (PILs) before the Court of Justice. PILs have resulted in some environmental improvements on one side, (Kathuria, 2007) but have also contributed to increase the amount of work for state authorities because of court-ordered directives (OECD, 2006).

A compulsory Environmental Impact Assessment (EIA) was first introduced in India with the Environmental Protection Act of 1986, but became effective only in 1994 when the MOEF passed a major legislative measure (Panigrahi and Amirapu, 2012). The main purpose of the EIA is to inform decision makers and the public about the environmental implications of a particular project (Panigrahi and Amirapu, 2012). The EIA process has been notably modified with the introduction of the 2006 EIA notification. These changes brought by the new notification are the focus of this study.

The 2006 EIA notification introduces, among others, one major change:

polluting projects/firms are classified into two categories based on the potential impacts on human health and natural resources. Projects classified as category A have to undertake the EIA at the national level, as per the 1994 notification, while category B projects are referred to the State Environmental Impact Assessment Authority (SEIAA) of the state in which the project is located. The classification of projects into these two categories is based on three main criteria. The first criterion defines those projects that are of exclusive competence of either state or national authorities. Any project within the petroleum refining industry, for instance, should undertake the EIA at the central level, while projects in the integrated paint industry are the exclusive responsibility of state authorities. A second criterion distinguishes projects in terms of capacity. Large coke oven plants (above 150,000 tonnes per year), for example, are under the authority of the central government, small ones are referred to the SEIAA in which the project is located. A third criterion categorizes projects on the basis of whether they are located within or outside a notified industrial area. Projects in the leather/skin/hide processing industry, for example, are subject to state level EIA only if located within an industrial estate/area. Table 1 summarizes the five different groups of activities defined in accordance to the three criteria mentioned above. The detailed list of projects and activities, as reported in the official 2006 EIA notification, is provided in table 8 of the Appendix.

Table 1: Classification of sectors according to EIA status

#	Group	Category	Description	Sectors (NIC)
1	No EIA	No EIA	Not subject to EIA	All sectors not reported below
2	Central	A	Exclusively subjected to central-level EIA	111, 112, 232, 233, 269, 2412, 2421
3	Small/Large	A/B	State-level EIA if of small capacity	101, 102, 120, 131, 132, 141, 142, 155, 231, 271, 272, 273, 401, 451, 452, 453, 454, 2694
4	EI	A/B	State-level EIA if located within industrial estates (IE)	182, 1911, 2411, 2413, 2423, 2424
5	State	B	Exclusively subjected to state-level EIA	1542, 2101, 2422, 2430, 2439

SSEIAAs were constituted in each state at different points in time and all projects were treated as category A in absence of a notified state authority. Table 9 of the Appendix reports the date of establishment of each SSEIAA. The 2006 notification initiated a process of decentralization of the EIA procedure which could reduce the burden on the central government and accelerate the approval process. However, the decentralized powers could either be misused if state governments intend to actively pursue industrialisation for their respective state, or be ineffective if state authorities lack technical and financial powers.

The EIA process is subdivided into four stages. The first stage (Screening) affects only category B projects and is aimed at determining whether a project requires an environmental impact assessment report. Projects requiring EIA are categorized as B1 while the others are termed B2 and submit a much shorter application form. Although guidelines for the screening process are provided by the MOEF, there is still lack of clarity on this stage of the process. The second stage (Scoping) involves either the central or state authority in determining the terms of references covering all relevant environmental concerns for the preparation of the EIA. The third stage requires a public consultation through both a public hearing in the proximity of the site and invitations of written responses from the concerned stakeholders. The final stage (Appraisal) involves the scrutiny of the EIA application which can result in either approval or rejection of the project. Each EIA contains the environmental management plan, which becomes part of the business permit and is binding upon the company that is carrying out the activities. Therefore, it sets the point of departure for future supervision and enforcement as it determines what can be enforced.

3 Decentralization, environmental regulation and firm location

The decentralization of environmental regulation is often justified by the intention to form a better understanding of local environmental problems, to promote a more transparent and efficient use of natural resources and to increase local participation due to higher homogeneity of common needs (Cistulli, 2002). There are, however, well recognized constrains on the successfulness of any decentralization process such as weak administrative or technical capacity, lack of financial resources, poor coordination between national and local policies and the risk of local elite capture.

While the theoretical literature has studied extensively the trade-offs in-

volved in the decentralization of the decision making process (Besley and Coate (2003); Oates (2002)) fewer studies have empirically investigated its consequences. Brunnermeier and Levinson (2004) review the empirical literature and find that while earlier cross section studies tend to find no significant effect of environmental regulation on firms' decisions, more recent studies that use panel data estimations find evidence of firms responding to variations in regulation within a country. Many empirical studies focus on variations in regulation across counties and states of the United States (List et al., 2003). Becker and Henderson (2000), for example, study variations in air quality regulation across counties and find that there has been a significant relocation of polluting firms from more to less polluted areas. Sigman (2005) shows that the decentralization of environmental authorities in the United States has led to a 4% increase in water degradation downstream of states that had the authority to issue and enforce permits for point source polluters.

This literature is related to that on the pollution-heaven hypothesis. Several studies have analysed the impact of cross-country differences in environmental regulation on the location of foreign direct investment. The results are mixed. Javorcik and Shang-Jin (2003), for example, analyze investment flows to 25 economies in Eastern Europe and the former Soviet Union and find no evidence that FDI from polluting industries is more likely to go to countries with weaker environmental regulations. On the other hand, Dean et al. (2009) find evidence of pollution heaven behavior in China for investment in highly polluting industries from ethnically Chinese countries, while no effect was found for investment from other sources.

Fewer studies have focused on firm's location decisions in developing countries. Duvivier and Xiong (2013), for example, studies trans-boundary pollution in China where environmental policy is decentralized. Similarly to India, while the central government sets the standards, local governments are in charge of monitoring and sanctioning. The authors analyze the location choice of polluting firms in one of the most polluted province in China and find that polluting firms tend to locate in counties that share a border with another province. Similarly, Lipscomb and Mobarak (2007) analyze rivers water quality across jurisdictions in Brazil and find a significant strategic polluting behavior around borders.

The first study to analyse firms' location decisions in response to environmental regulation in India was conducted by Mani et al. (1997). The study finds that the number of new plants is not affected by the stringency of environmental regulation at the state level. A positive correlation between a measure of enforcement and the number of new plants, however,

suggests that the variable might be capturing the quality of state government rather than environmental enforcement. Moreover, the data date back to 1994 when there was very little enforcement of environmental regulation across all states since prosecution could only occur through the judicial system (Lipscomb, 2008). There is, however, evidence of Indian firms adjusting their behavior in response to changes in environmental regulation over time. Lipscomb (2008), for example, analyses the response of multi-product firms to changes in enforcement at state level[1]. The author finds that firms react to increase stringency by increasing the share of product portfolio allocated to clean products. High productivity firms invest in new and cleaner products and gain from an increase in enforcement. Kathuria (2007) finds that an increase in informal regulation, measured by local news coverage of pollution-related events and the number of public interest litigations filed, has reduced industrial pollution in the state of Gujarat. On the other hand, however, formal regulation, measured by the number of staff allocated to a region, was found not to affect polluting behavior.

Finally, this paper relates to the broader literature on firms' location choices. This is a vast literature that covers various aspects such as agglomeration economies (Brülhart et al., 2012), variations in corporate taxes (Barrios et al., 2012) and infrastructure (Holl, 2004). In India, Lall and Chakravorty (2005) estimate a cost function at the plant level where economic and geographic factors are included to explain firms agglomeration. The authors find that only local economy diversity matters as a cost-reducing factor for medium and large industries. The empirical model presented below builds upon this well established literature and takes advantage of the institutional setting of the 2006 EIA reform to analyze the impact of differences in environmental enforcement on firms' location decisions.

4 Empirical model

This section adapts the so called *latent-startup* model (Becker and Henderson, 2000) to represent the possible responses of Indian polluting firms to the policy changes introduced with the 2006 EIA notification. While environmental clearance is required also for the expansion or modernization of existing polluting firms, this paper considers only the effects on the birth of new polluting firms. The model assumes that potential entrepreneurs are spatially immobile and decide whether to set up a firm in a particular

[1]Enforcement is measured by the percentage of polluting firms which as been closed by state and year.

sector and location. The alternative model, the *footloose-startup* model, instead, considers the decision about which location to select once investors have already decided to set-up a company. Empirically, the two models are equivalent (Brülhart et al., 2012). At each point in time, an entrepreneur acts as maximizing its net expected present value and compares the sunk cost of entry with the expected profits in a particular sector and location. The expected profits, π_{fijt}, of firm f in sector i state j at time t depends on the characteristics of the sector and location of the firm at the time of establishment, x_{ijt}, and on the expected relative compliance costs, c_j, which refers to expected future monitoring, reporting and punishment costs which varies according to the location. Sunk costs are, for simplicity, only represented by the cost of complying with the EIA application, s_{ijt}. Assuming a linear approximation of profits, the expected net present value can be written as follows:

$$npv_{fijt} = \pi_{fijt} - S_{jit} + \epsilon_{fijt} = \boldsymbol{\alpha}_0' \mathbf{x}_{ijt} + \alpha_1 c_j + \beta_1 s_{jt} + \epsilon_{fijt}, \qquad (1)$$

where ϵ_{fijt} is a random disturbance. Expected compliance costs depend on the relative level of enforcement at state level, $c_j = f(E_j)$, and are assumed to be constant, in relative terms, over time, i.e. enforcement is allowed to increase or decrease over time but the ranking across countries in terms of environmental stringency is expected to be unaffected. Set-up costs are instead expected to change over time, but only for category B firms. The introduction of the 2006 EIA notification has decentralized the process of environmental clearance for category B firms introducing a new source of variation across states. The model assumes that before 2006, set-up costs were identical across states because the EIA was conducted at the central level for all firms. After 2006, environmental clearance costs depend on E_j only for firms in category B.

Set-up costs after the implementation of the reform can, therefore, be re-written as a function of the enforcement capacity in each state:

$$npv_{fijt} = \boldsymbol{\alpha}' \mathbf{x}_{ijt} + \beta_0 f(E_j) + \beta_1 \left(D_T \times E_j\right)) + \epsilon_{fijt}, \qquad (2)$$

where D_T is a dummy variable indicating the years following the implementation of the EIA notification at time T. After T, set-up costs can be higher or lower than pre-reform costs. States with low levels of enforcement are expected to impose lower environmental clearance costs. For some firms, start-up costs could drop to zero if the screening process conducted by the SEIAA indicates that the project is exempted from the EIA process.

The expected effect of this decentralization process for category B firms is twofold. Some states might impose more stringent conditions than those

imposed previously by the central government resulting in a reduction of births in high enforcing states (deterrence). On the other hand, some states might conduct a laxer EIA in order to promote industrialization, or due to technical and financial constraints, facilitating the birth of new polluting firms (attraction). Both forces lead to relative higher birth rates in lower-enforcing states compared to higher-enforcing states.

Following Becker and Henderson (2000), the model can be represented as a reduced form equation where the total number of firms born in each sector, state and year, n_{ijt}, is a function of the above mentioned variables and a set of state ($\mathbf{g}_j$), sector ($\mathbf{d}_i$), and time ($\mathbf{w}_t$) fixed effects:

$$\begin{aligned} n_{ijt} = \exp(\boldsymbol{\alpha}'\mathbf{x}_{ijt} + \beta_1((D_T \times E_j) \\ +\gamma'\mathbf{d}_i + \delta'\mathbf{g}_j + \rho'\mathbf{w}_t). \end{aligned} \tag{3}$$

The above equation can be estimated separately for each group of sectors reported in table 1. We expect the coefficient β_1 to be negative only for firms affected by the decentralization process (Category B: group 5) while being insignificant for non-polluting firms (i.e. not included in the reform, group 1) and those undertaking the EIA at central level (Category A: group 2). For groups 3 and 4 the effect is ambiguous as they contain a mixture of category A and B firms.

In practice, the model is estimated by pooling the five groups of sectors and interacting all variables by group dummies. In doing so the results are equivalent to those obtained by estimating the model separately but have the advantage of allowing for a statistical comparison of the coefficients across groups. Moreover, the pooled model can be related to a heterogeneous treatment effect model where the treated sectors are those included in group 3, 4 and 5 and the control group includes non-polluting sectors and sectors subject to central-level EIA (group 1 and 2). The treatment effect is allowed to be heterogeneous depending on the level of enforcement in each state prior to the implementation of the 2006 reform.

Because the model includes state, year and sector fixed effects it is not possible to identify the effects of pure location, time and sector-specific variables. All specifications will control for the average share of firms in each year and location to control for state-level growth patterns. Additional controls will be discussed in the next sections. Although the EIA notification was introduced in September 2006, the decentralization process could not actually take place unless a SEIAA was created. Because most of the SEIAAs were established between 2007 and 2008 (table 9 in the appendix), the variable D_T will take values one for 2008 and subsequent years. This

approach, de facto, compares the average number of new firms born before and after the implementation of the EIA notification, conditioned on the level of enforcement in each state.

The model is estimated using a Poisson pseudo-maximum-likelihood estimator with robust standard errors (Wooldridge, 1991), which allows for the discreteness of the dependent variable and the large number of zeros. The estimator produces consistent estimates under relatively weaker assumptions than a standard Poisson model, i.e. only the conditional mean need to be correctly specified[2]. The model is also estimated using a standard linear model (OLS) after log-transforming the dependent variable. While the log-transformation does not alter the multiplicative relationship between the explanatory variables and allows for double clustering, it has the disadvantage of dropping all cells with zero births. In this specification, the dependent variable is the ratio of new firms in each sector and location over the total number of new firms in the sector as it better deals with differences in growth rates across sectors. The number of births is, however, also used in an alternative specification.

4.1 Identification issues

At the aggregate level, enforcement capacity is both the cause and the consequence of firms' location choices. A larger amount of polluting firms may increase awareness about pollution and lead to increasing pressure to control pollution. On the other hand, however, more polluting firms may put pressure on the capacity of state-level authorities to deal with non-compliance and reduce the ability of the authorities to monitor and punish polluters. By considering only the number of new firms created each year in each state and sector this problem is substantially reduced. Moreover, the measures of enforcement considered in the regressions are time-invariant and therefore do not lead to a spurious statistically correlation between changes in enforcement over time and changes in the number of new firms. Although all specifications control for the presence of state, location and year-level

[2]Another possible solution is to assume that the dependent variable follows a negative binomial distribution, a test is available to assess whether this model is preferable to a standard Poisson model (Duvivier and Xiong, 2013). Over-dispersion may also arise from an excess of zeros (zero inflation) which means that the dependent variable reports more zeros that what is assumed by the Poisson model. An excess of zeros might be explained by the fact that some states are not suitable locations for particular types of firms. Table 10 in the appendix reports the estimates using a zero-inflated negative binomial model where the stock of firms in the previous period is used to differentiate between suitable and unsuitable locations.

unobservables, unobserved heterogeneity could still be a concern. Nevertheless, the regressor of central interest in the estimations reported below is a three-way interaction term, between state-level enforcement, a dummy variable indicating the post-implementation period and a group dummy that is less subject to endogeneity problems. Moreover, the results are tested for robustness to the inclusion of additional control variables that should capture other sources of unobserved variation over time, such as changes in average real wages and in the number of special economic zones.

In cross-section studies it is often argued that failing to control for corruption creates a problem of omitted variable bias (Dean et al., 2009). High corruption often implies lower environmental stringency but may also act as a deterrent for new investments. This is not a concern in this study. Corruption is included as a measure of environmental stringency since it is the best available measure of the quality of state-level institutions and there are no reasons to expect that its deterrence effect should vary before and after the implementation of the EIA notification.

5 Background and Data

This section describes the data used to measure differences in environmental enforcement across states and the firm-level data used to analyze the relationship between the decentralization of the EIA process and firm births.

5.1 State-level environmental enforcement measures

Although environmental standards for industrial pollution are determined by the central government, evidence suggests that there are large differences across states in terms of enforcement and compliance (OECD (2006); World Bank (2006)). Variations arise from socio-economic differences across states but also from differences in commitment and technical and financial capacity of state-level environmental authorities. We adopt five measures of environmental enforcement aimed at capturing state-level differences in institutional capacity, civic participation and institutional quality. These measures are reported in table 2.

The choice of these indicators was constrained by data availability. Institutional capacity is measured by the number of monitoring stations per million people. The data, taken from the IndiaStat database, refer to the year 2007 and reveal a significant variation across states, ranging from 0.02 per million people in Bihar to 2.12 per million people in Himachal Pradesh.

Table 2: Measures of environmental enforcement by state

State	NGOs	Judgements	Corruption	Articles[a]	Stations[a]	Index
Andhra Pradesh	29	4	4	213	21	2.27
Assam	7	0	15	9	12	-1.54
Bihar	2	3	20	13	2	-1.25
Chandigarh	2	2		4	5	
Chhattisgarh	3	0	6	4	9	-1.38
Delhi	22	2	11	166	11	2.27
Goa	0	0		13	3	
Gujarat	7	4	3	146	20	0.81
Haryana	3	1	13	21	5	-1.31
Himachal Pradesh	4	2	2	3	11	-0.14
Jammu & Kashmir	6	0	19	3	3	-1.85
Jharkhand	2	0	14	5	6	-1.89
Karnataka	17	3	17	247	14	0.73
Kerala	7	0	1	155	16	0.05
Madhya Pradesh	12	4	18	43	26	0.03
Maharashtra	26	4	5	165	42	1.83
Meghalaya	1	0		0	2	
Odisha	17	3	9	8	12	0.42
Puducherry	1	0		2	3	
Punjab	1	1	7	25	15	-1.05
Rajasthan	12	0	16	6	18	-1.31
Tamil Nadu	29	2	12	443	16	1.89
Uttar Pradesh	24	4	10	111	35	1.22
Uttarakhand	4	1		2	2	
West Bengal	15	2	8	120	21	0.20

[a] The indicator is divided by population before constructing the index

When formal regulation is weak, informal regulation through civic participation can play an important role. This is particularly true in India where a democratic system allows the formation of groups and NGOs, the press is relatively free and people are empowered with the use of public interest litigations to demand interventions of the judiciary system. These features are particularly relevant for this study since citizens are given an active role in the EIA procedure through a public hearing stage. Three measures of civic participation are adopted: the number of environmentally oriented NGOs, the number of newspaper articles mentioning environmental-related news and the number of judgments passed by the supreme and high courts related to environmental disputes. NGOs play an important role in shaping the socio-political discourse in India and there are several examples of how these organizations have successfully promoted environmental disclosure and

raised awareness of governments and the general public (UNESCAP, 2000)[3]. The number of environmentally-oriented NGOs was also used in Javorcik and Shang-Jin (2003) to measure variation in strength of environmental enforcement across countries. Another measure of public concern over environmental issues is represented by the number of newspaper articles covering topics related to industrial pollution. The number of newspaper articles in each state and year was obtained by conducting a search across all English-language Indian newspapers contained in the database Factiva for the period 1998-2006. Each search included a set of common keywords, such as closure, court, order, fine etc., and the name of the State Pollution Control Board, e.g. Bihar State Pollution Control Board. The variable used to construct the enforcement index was obtained by calculating the cumulative number of articles referring to each State Pollution Control Board for the entire pre-reform period. Finally, it was noted that Indian citizens can benefit from a unique approach to enforce environmental law by exercising a constitutional right before the Supreme Court and the High Courts in the form of Public Interest Litigations (PIL). Unfortunately, it was not possible to obtain the number of PILs filed in each state, but the number of judgments of the Supreme and High courts offers a reasonable proxy. The list of judgments related to environmental issues was obtained from the Judgments information system of the Supreme and High courts of India. Judgments were manually assigned to each state based on the location of the firms or the pollution control boards involved in the court case.

To measure institutional quality we used the corruption index at state-level provided in a study by the Centre for Media Studies issued by Transparency International India for the year 2005 (CMS, 2005). While this index is our preferred measure of corruption, it is not available for the Union territories of Chandigarh, Goa, Meghalaya, Puducherry and Uttarakhand that are, therefore excluded from part of the analysis[4].

All enforcement measures are time-invariant and, when possible, refer to the pre-reform period. They are aggregated into one unique measure of state-level enforcement through principal component analysis. The use of principal component analysis techniques is appealing because these multiple

[3]The list of Indian NGOs was obtained from an online database: http://ngosindia.com/ accessed in June 2013.

[4]We also tested an alternative measure of institutional quality constructed as the number of cases of persons arrested under the prevention of corruption act and related sections that have obtained charges. The information was obtain from the India Bureau of Crime and was available for all states. We also tested the robustness of the results to the exclusion of corruption from the enforcement index.

Table 3: Environmental enforcement index: principal component analysis

Component	Eigenvalue	Proportion of Variance	Cumulative
Comp1	1.876	0.375	0.375
Comp2	1.492	0.298	0.674
Comp3	0.883	0.177	0.850
Comp4	0.479	0.096	0.946
Comp5	0.270	0.054	1.000
Variable	First component		
NGOs	0.638		
Judgments	0.519		
Corruption Index	-0.299		
Total articles/Population	0.481		
Stations/Population	0.060		

variables are correlated and aim at capturing the same concept, i.e. the level of environmental enforcement. Table 3 shows that, as expected, all measures but the corruption index are positively related to the latent environmental enforcement measure. The first principal component explains about 37% of the total variance in the data. The eigenvalue of the first principal component is close to two, thus we retain only the first component which will be referred to as enforcement index. The index ranges between -1.9 and 2.2 and takes higher values in states where environmental enforcement is stronger.

5.2 Firm-level data

The firm-level data used to compute the number of births in each sector and year are collected in the Orbis database by Bureau Van Dijk and are originally provided by the Centre for Monitoring Indian Economy (CMIE). The database covers the universe of registered companies, i.e. all companies, public or private, that are registered under the Companies Act, 1956 at the Registrar of Companies (RoCs). It records about 140,000 companies created between 1998 and the end of 2012. Although registered companies account for only 20% of all firms in India, which tend to be very small and operate under informality, these companies are the most likely to be subjected to pollution controls as only large and medium-sized facilities have the required environmental clearance permits. Most small-scale industries operate without any consent (OECD, 2006).

The analysis considers only companies belonging to the manufacturing and energy sectors. While the database provides very little information on companies characteristics, such as assets, employment etc., it was possible

to obtain important information using the corporate identification number (CIN) that the Ministry of Corporation assigns to each registered company and that combines information on the year of establishment, state, 5 digit industry code (National Industrial Classification, NIC), ownership type and a registrar code. In 1998 the Indian Statistical office adopted a substantially different sector classification which also affected the sector definition contained in the CIN code. To avoid problems of misclassification of some firms, the analysis only considers firms established after 1998. This does not constitute a major drawback since prior to 1997 there was very little enforcement of environmental regulation across all states (Lipscomb, 2008).

A birth is defined as the registration of a new company in the Registrar of Companies of the Ministry of Corporation. Companies are assigned to the five groups reported in table 1 based on the sector they operate in. Unfortunately, it is not always possible to assign a particular activity or project listed in the 2006 EIA notification to a specific sector. Projects/activities descriptions are sometimes too broad or too narrow to perfectly match a sector as defined in standard industrial classifications. It was, however, possible to recover some useful information from a previous draft of the EIA notification, which was circulated before the official approval of the reform that provides a concordance table between sectors classification and activities using the National Industrial Classification (NIC). NIC is the main classification used by the Indian Statistical Office and form part of the CIN number. The concordance table was later removed from the official EIA notification. The list provided in the draft notification was supplemented by manually matching activities that did not report a corresponding sector code. The detailed sector-activity concordance used in the analysis is reported in table 8 in the Appendix while a summary is provided in table 1. Sectors are considered at different digits based on the highest level of aggregation that allowed a one-to-one matching between activities and sectors. Some sectors, however, were dropped because of ambiguous matching with listed activities and are reported in table 11 of the appendix. The exclusion of these sectors, however, does not significantly affect the results.

The information contained in the Orbis database does not allow for the identification of production capacity or of whether a company is located within an industrial estate. Therefore, it was not possible to distinguish whether a company belonging to group 3 and 4 (defined as Capacity and IE) had undertaken the EIA at the central or state level. One attempt, however, will be made in the next sections to distinguish large from small companies. The number of births in each group and year is reported in table 4. The same information is reported by state and year in table 12 in the

Table 4: Number of new firms by category and year of incorporation

Year Year	1 Without EIA	2 Central-level	3 Capacity	4 IE	5 State-level	Total
1998	2346	160	1045	399	116	4066
1999	2438	208	1273	483	141	4543
2000	1780	154	1038	422	99	3493
2001	1497	115	1128	343	106	3189
2002	1747	154	1400	458	101	3860
2003	2284	207	2200	590	128	5409
2004	3133	225	3660	706	193	7917
2005	4097	335	5799	952	231	11414
2006	3966	351	6556	877	255	12005
2007	4944	337	7084	1020	250	13635
2008	4802	397	7984	833	230	14246
2009	5058	350	4653	699	194	10954
2010	6792	437	7297	980	311	15817
2011	7405	477	7045	1226	328	16481
2012	6534	404	5232	1007	209	13386
Total	58823	4311	63394	10995	2892	140415

Appendix. We excluded the states and union territories of Andaman and Nicoba, Lakshadweep, Manipur, Mizoram, Nagaland, Tripura, Daman and Diu, Dadra and Nagar Haveli and Arunachal Pradesh because of insufficient firm level data and the lack of information on most enforcement measures. These states, however, represent only about 1% of the Indian population.

6 Firm births and environmental enforcement

This section begins presenting the results of estimating equation 4 using a linear model. The results are reported in table 5. Columns 2 to 6 show the effects of each of the five individual enforcement measures used in the construction of the environmental enforcement index used in column 1 and 7. All specifications include state, year and sector fixed effects capturing state, time and sector level shocks and trends[5].

The results show that the decentralization of the EIA process has affected firm births in those sectors subject to state-level environmental clearance. This conclusion is reinforced when considering the possibility that states

[5]Standard errors are clustered at sector level. Sectorial clustering appears to be the most relevant source of correlation since the dependent variable is the share of new firms in the sector. The last column, however, reports standard errors clustered at both state and sector level.

applying a more stringent environmental clearance process may attempt to mitigate its negative effects by offering fiscal incentives to new plants. Considering the results reported in column 7, while no effect is found for non-polluting firms and for new firms subject to central-level EIA (No EIA and Central), the strength of environmental enforcement is shown to have a larger negative effect after the implementation of the 2006 EIA reform for firms in sectors of exclusive competence of the SEEIA authority (State) and for those firms subject to state-level EIA if located within an industrial estate (EI). The effects are not statistically different among these latter two categories.

The results are consistent across all different individual measures of enforcement, although, in few instances, some coefficients are not significant. The coefficient related to the third group of sectors (Capacity), those subject to state-level EIA only if of small capacity, is also negative but much smaller and not statistically significant. It is likely that many of the companies included in this category are of large capacity, this issue, however, will be further explored below. In order to interpret the magnitude of the effects we can consider that the average gap between states in terms of the environmental index score is 0.25. Therefore, an increase in enforcement that would, on average, allow a state to catch up with the next higher ranked state would lead to a decrease in the share of new polluting firms between 4% and 6% every year. This is a relevant effect considering that the overall average annual change in births is about 9-10%.

Table 5: Base results: log-linear model

Dependent variable: log of new firms over total new firms in the sector							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Index	NGOs	Judgments	Corruption	News	Monitoring	Index[a]
Baseline: No EIA	0.051**	0.009***	0.058***	0.002	0.008	0.007***	0.051
	(0.023)	(0.003)	(0.016)	(0.005)	(0.010)	(0.002)	(0.043)
After x Aj x Central	0.030	0.001	0.027	-0.014***	-0.004	0.004	0.030
	(0.044)	(0.008)	(0.039)	(0.005)	(0.028)	(0.005)	(0.055)
After x Aj x Capacity	-0.019	-0.002	-0.020	-0.008	0.003	0.001	-0.019
	(0.067)	(0.008)	(0.041)	(0.011)	(0.015)	(0.007)	(0.062)
After x Aj x IE	-0.159***	-0.015***	-0.104**	0.030*	-0.035**	-0.011***	-0.159***
	(0.054)	(0.005)	(0.041)	(0.015)	(0.016)	(0.004)	(0.054)
After x Aj x State	-0.193***	-0.029***	-0.166***	0.010	-0.013	-0.020***	-0.193***
	(0.063)	(0.006)	(0.028)	(0.007)	(0.022)	(0.003)	(0.055)
State	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11561	12590	12590	11561	12590	12590	11561

Standard errors clustered at sector level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

[a] Double clustering at sector and state level. All regressions control for the average share of new firms in the state (not reported).

In table 6 we test the robustness of the above results considering alternative specifications. The first column, considers the log of new firms as dependent variable and produces similar findings: the strength of environmental enforcement has a larger negative effect after the reform for those sectors affected by the decentralization process. The remaining columns include additional control variables. The results reported in column 2 are obtained after controlling for the average wage in each state and year. The data are provided by the Ministry of Statistics and Programme Implementation (Government of India, 2012) and are calculated from the Annual Survey of Industries that collects information on medium and large firms in India. Wages are deflated using state-level price indexes (source: IndiaStat). The inclusion of this variable does not significantly affect the results. On the other hand, changes in average wages do not appear to significantly affect the birth of new firms (coefficients not reported). While wages are usually found to be an important determinant of firms' location decisions, their poor performance in these specifications is likely to be due to the limited variation in real wages over time, as suggested also in Becker and Henderson (2000).

Table 6: Log-linear model: additional control variables

	(1)	(2)	(3)	(4)	(5)
	Log of new	Log of share	Log of share	Log of share	Log of share
Baseline: No EIA	0.065	0.055	0.055	0.038	-0.014
	(0.040)	(0.045)	(0.045)	(0.047)	(0.043)
After x Aj x Central	0.009	0.017	0.016	-0.001	-0.005
	(0.046)	(0.056)	(0.056)	(0.072)	(0.070)
After x Aj x Capacity	-0.011	-0.021	-0.030	-0.019	-0.035
	(0.063)	(0.067)	(0.068)	(0.073)	(0.073)
After x Aj x IE	-0.099*	-0.150**	-0.150**	-0.150***	-0.142***
	(0.056)	(0.069)	(0.066)	(0.051)	(0.052)
After x Aj x State	-0.148*	-0.200***	-0.201***	-0.179***	-0.164***
	(0.084)	(0.055)	(0.054)	(0.059)	(0.061)
Average wage	Yes	Yes	Yes	No	No
Minimum wage	No	Yes	Yes	No	No
SEZ	No	No	Yes	No	No
State	Yes	Yes	Yes	Yes	No
Year	Yes	Yes	Yes	Yes	No
Sector	Yes	Yes	Yes	Yes	No
State time-trend	No	No	No	No	Yes
Observations	11561	11561	11561	11561	11561

Standard errors clustered at sector and state level in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ All regressions control for the average share of new firms in the state (not reported).

Column 3 controls for changes in minimum wages in polluting sectors (source: IndiaStat), while column 4 includes an additional variable indicating the presence of sector-specific special economic zones (source: Ministry of Commerce and Industry, Department of Commerce). It is important to control for the creation of new special economic zones (SEZ) as they provide notable advantages, such as tax exemptions, to new firms. India is one the first country to recognize the importance of SEZs and the first zone was created in 1965. The Indian government passed the SEZ act in 2005 in order to increase investors' confidence. The bill was implemented in 2006 and brought about a simplification of the bureaucratic procedures. While most of the SEZs involve only the information technology sectors (55%) it is still important to consider those that affected polluting sectors (about 20% including also general multi-product SEZs) as they could induce possible confounding effects if omitted. The inclusion or exclusion of both variables has no significant effect on our main results.

The results obtained so far have helped to deal with the concern that variations in environmental enforcement across states could proxy for differences in other state level unobservable characteristics. It is, however, possible that some differences in the policy environment remain unmeasured. The results reported in column 5 include state-specific time trends and identify the effect of a change in the EIA process deviating from the pre-existing state-specific trends. The effect of the 2006 EIA reform is still apparent and mostly unchanged.

Table 7 reports the results obtained using the Poisson model. Also these results support our central hypothesis: firm births in sector affected by the decentralization process are more negatively affected by the strength of environmental enforcement after the implementation of the reform, while no changes are observed for non-affected sectors. The results are robust to the inclusion of the additional control variables considered previously in table 6 and reported in column 2, 3, 4 and 5.

The coefficient related to those firms subject to state-level EIA if of small capacity (Capacity) is now negative and statistically significant in one specification (column 4). It is possible to further disaggregate this group of firms by considering the classification of companies provided in the Orbis database. This classification allows to distinguish firms into small, medium and large and is based on annual turnover, total assets or total number of employees. Although this classification is not intended to measure capacity it can provide a reasonable approximation. The results reported in table 13 of the Appendix show that the effect is indeed much larger for small firms, i.e. those more likely to be subject to state-level EIA. In column 2 of table

Table 7: Poisson Pseudo-maximum likelihood model: base specification and additional control variables

	(1)	(2)	(3)	(4)	(5)
Baseline: No EIA	0.002	0.003	0.003	0.001	0.004
	(0.038)	(0.038)	(0.038)	(0.038)	(0.040)
After x Aj x Central	-0.007	-0.027	-0.029	-0.032	-0.038
	(0.056)	(0.058)	(0.058)	(0.059)	(0.057)
After x Aj x Capacity	-0.102	-0.113	-0.113	-0.153**	-0.078
	(0.079)	(0.073)	(0.073)	(0.073)	(0.058)
After x Aj x IE	-0.119***	-0.113**	-0.114**	-0.126**	-0.089*
	(0.041)	(0.049)	(0.050)	(0.055)	(0.050)
After x Aj x State	-0.114*	-0.103*	-0.108*	-0.110*	-0.099*
	(0.059)	(0.061)	(0.057)	(0.058)	(0.060)
Average wage	No	Yes	Yes	Yes	Yes
Minimum wage	No	No	Yes	Yes	Yes
SEZ	No	No	No	Yes	Yes
State time-trend	No	No	No	No	Yes
Observations	24900	24900	24900	24900	24900

Robust (clustered by sector) standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions control for the average share of new firms in the state (not reported).

13 the results are obtained using the Poisson estimator and show that the negative effect previously attributed to the category "Capacity" is entirely capture by small firms. This confirms once again that the observed negative effects are attributable to the decentralization process that has affected only some polluting firms (Category B) established after 2007.

As noted earlier, no changes are observed for firms belonging to non-polluting sectors. While this finding supports the underlying hypothesis, this control group includes a large number of sectors and, although on average the effect is close to zero, it could conceal significant individual sector responses. To provide further evidence in support to our hypothesis, the effect is estimated separately for each of the 18 non-polluting sectors at two-digit level. The extended model was estimated using both the linear and Poisson estimators. A negative and significant coefficient was found only for the tobacco (-0.214) and the office, accounting and computing machinery (-0.371) sectors. It is reasonable to expect these two sectors to not be indirectly affected by the reform as their appear to be quite disconnected from category A sectors. The negative effects could, instead, be associated to pre-existing trajectories in birth rates that will be analyzed in the next section.

Among the 18 sectors mentioned above we consider also the automobile industry. This sector was initially included in the draft EIA reform, officially circulated in September 2005, but later removed from the final version of the notification. Because all projects in the automobile sector were assigned to state-level authorities, the fact that we do not find any effect of the intervention suggests that there were no anticipatory effects of 2006 EIA reform.

6.1 Time-varying effects

The results reported above are obtained by comparing the average number of births before the implementation of the reform with the average number of births after the reform, conditional on the level of enforcement in each state. While a significant difference would indicate that on average the pattern of births has changed across the two periods, the change could also be attributed to pre- or post-reform events that can significantly affect the average number of new firms. In this section we explore the effects that differences in the strength of environmental enforcement at state level have in each point in time. This is done by interacting the enforcement index with year dummies.

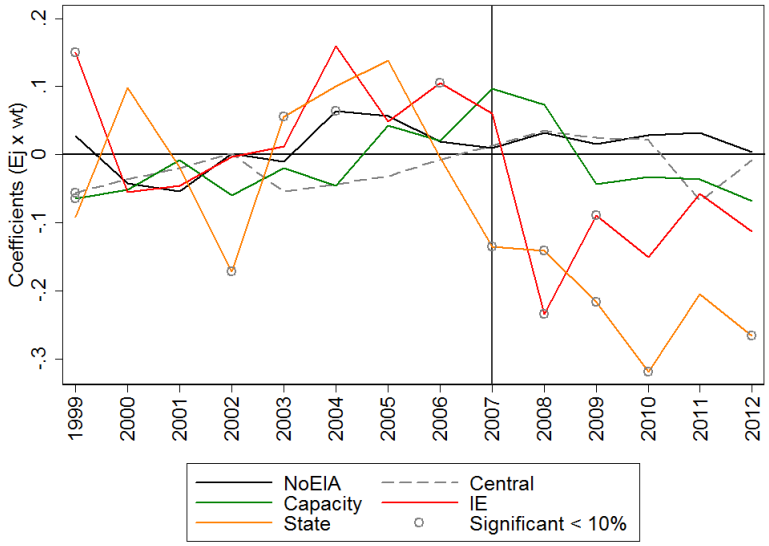

Figure 1: Impact of enforcement index over time

The results are summarized in figure 1 and are obtained using a linear

specification with a log-dependent variable applied separately to each group of sectors. The graph reports the coefficients of the interaction terms for each of the 5 groups of sectors. Statistical significance at a level lower than 10% is indicated by a grey circle. Considering those sector of exclusive competence of state-level authorities (State), the results show that environmental enforcement to have a significant negative effect from the end of 2007, while for the period prior to the reform the effect is often close to zero or not statistically significant. The drop after the implementation of the reform is large and the coefficients remain negative and significant for the entire post-reform period. Similarly, the coefficients related to those companies subject to state-level EIA if located within an industrial estate (IE) show a significant drop between 2006 and 2008. The coefficients remain negative thereafter although not always significant. No significant differences are observed for the group labeled "Capacity", probably for the reasons already mentioned above, and for non-polluting firms.

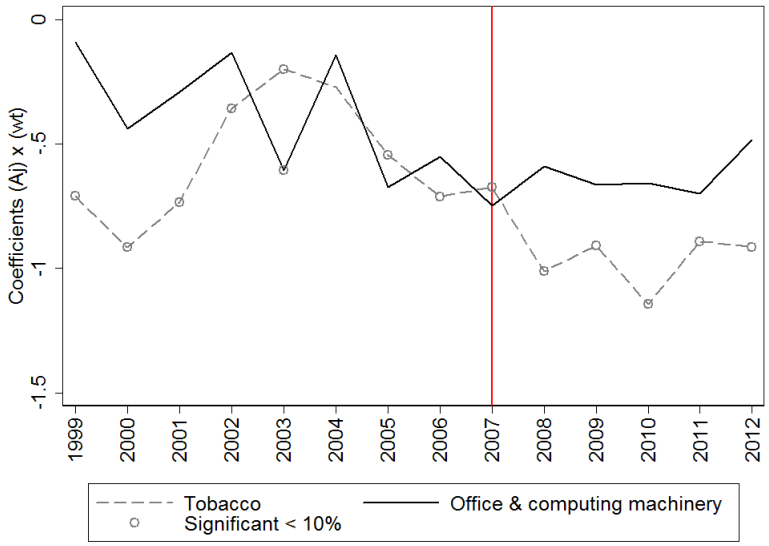

Figure 2: Impact of enforcement index over time

Figure 2 reports the results of a similar analysis conducted for the sectors tobacco and office, accounting and computing machinery that were found to exhibit a significant drop in average births after the implementation of the EIA reform. The graph reveals a negative trend in births beginning in 2003, two years before the implementation of the reforms for the tobacco sector. In

the case of the machinery sector, in particular, the coefficients remain almost stable before and after the implementation of the reform. This indicates that the effects previously observed for these two sectors cannot be attributed to the EIA reform and confirms our hypothesis that, while the decentralization of the EIA process has affected firm births in polluting sectors subject to state-level EIA, no unintended effects are observed on non-polluting sectors.

7 Conclusions

The decentralization of environmental regulation and enforcement has the potential to lead to a more efficient and transparent system of pollution control and management. On the other hand it carries the risk of inducing a race-to-the bottom competition among local authorities and to suffer from the consequences of heterogeneous financial and technical constraints across the territory.

This paper has investigated whether the decentralization of the EIA process in India initiated in 2006 has produced unintended effects on the location decisions of polluting firms. The results have shown that the reform has produced a significant change in the number of firm births in polluting sectors leading to relatively higher birth rates in states with lower enforcement levels. The results are robust to different specifications and are not driven by other pre- or post- reform shocks.

These findings show that firms are responsive to variations in environmental enforcement within India but are not intended to prove that states actually use environmental stringency as a competitive instrument since institutional, technical and financial constraints also play an important role in determining the effectiveness of environmental enforcement. Moreover, the results neither suggest that a centralized approach (as the one in place before the reform) would be optimal since no attempts were made to compare the two enforcement models. The net social welfare effects of the 2006 reform were not quantified and room is left for further research on the environmental and socio-economic consequences of the environmental decentralization process in India.

Appendix

Table 8: Activities listed in the EIA notification, their categorization and the corresponding NIC classification

Project or Activity	Nic 3 digit	A	B	Type
Mining, extraction of natural resources and power generation				
Mining of minerals	101 102 120 131 132 141 142	[$] 50 ha. of mining lease area; Asbestos mining irrespective of mining area	<50 ha; 5 ha of mining lease area.	Capacity
Offshore and onshore oil and gas exploration, developmentt & production	111 112	All projects		Central
River Valley projects	401 452 452	(i) > 50 MW hydroelectric power generation; (ii) > 10,000 ha. of culturable command area	(i) < 50 MW > 25 MW hydroelectric power generation; (ii) < 10,000 ha. of culturable command area	Capacity
Thermal Power Plants	401 401 -	500 MW (coal/lignite/naphta & gas based); 50 MW (Pet coke diesel and all other fuels)	< 500 MW (coal/lignite/naptha & gas based); <50 MW; >=5MW (Pet coke ,diesel and all other fuels)	Capacity
Nuclear power projects and processing of nuclear fuel	401 452 233	All projects		Central
Primary Processing				
Coal washeries	101 102	[$] 1 million ton/annum throughput of coal	<1million ton/annum throughput of coal	Capacity
Mineral beneficiation	-	[$] 0.1million ton/annum mineral throughput	< 0.1million ton/annum mineral throughput	Capacity
Materials Production				
Metallurgical industries (ferrous & non ferrous)	271 272	a)Primary metallurgical industry: All projects; b) Sponge iron manufacturing: ≥ 200TPD; c)Secondary metallurgical processing industry: All toxic and heavy [$] 20,000 tonnes /annummetal producing units	Sponge iron manufacturing : <200TPD; Secondary metallurgical processing industry : i.)All toxic andheavymetal producing units: <20,000 tonnes /annum; ii.)All other non-toxic secondary metallurgical processing industries >5000 tonnes/annum	Capacity
Cement plants	269 269 269	1.0 million tonnes/annum production capacity	<1.0 million tonnes/annum production capacity. All Stand alone grinding units	Capacity
Materials Processing				
Petroleum refining industry	232	All projects		Central
Coke oven plants	231	>=2,50,000 tonnes/annum	<2,50,000 &>=25,000 tonnes/annum	Capacity
Asbestos milling and asbestos based products	269 269 269 142 269	All projects		Central
Chlor-alkali industry	2411	>300 TPD production capacityor a unit located out side the notified Industrial estate/ estate	<300 TPD production capacity and located within a notified Industrial estate/ estate	Capacity
Soda ash Industry	-	All projects		Central
Leather/skin/hide processing industry	1911 182	New projects outside the Industrial estate or expansion of existing units out side the Industrial estate	All new or expansion of projects located within a notified Industrial estate/ estate	Industrial estate
Manufacturing/Fabrication				
Chemical fertilizers	2412	All projects		Central
Pesticides industry	2421	All units producing technical grade pesticides		Central

Table 8 – continued from previous page

Project or Activity	Nic 3 digit	A	B	Type
Petrochemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	-	All projects		Central
Manmade fibres manufacturing	2430	Rayon	Others	State
Petrochemical based processing (processes other than cracking & reformat not covered under complexes)	-	Located out side the notified Industrial estate/ estate	Located in a notified Industrial estate/ estate	Industrial estate
Synthetic organic chemicals industry (dyes & dye; intermediates; bulk drugs and intermediates; synthetic rubbers; basic organic chemicals, other synthetic	2411 2413 2423	Located out side the notified Industrial estate/ estate	Located in a notified Industrial estate/ estate	Industrial estate
Distilleries	155	(i)All Molasses based distilleries; (ii) All Cane juice/ non-molasses based distilleries ³30 KLD	All Cane juice/non-molasses based distilleries <30 KLD	Capacity
Integrated paint industry	2422	All projects		State
Pulb & paper industry excluding manufacturing of paper waste from paper and manufacture of paper from ready pulp with out bleaching	210		≥ 5000 tcd cane crushing capacity	State
Sugar Industry	1542		All projects	State
Service Sectors				
Induction/arc furnace/cupola furnaces 3TPH	-			State
Oil & gas transportation pipe line (crude and refinery petrochemical products), passing through national parks / sanctuaries/ coral reefs / ecologically sensitive areas including LNG Terminal	-	All projects		Central
Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 &3 of MSIHC Rules 1989 amended 2000)	-		All projects	State
Physical Infrastructure including Environmental Services				
Air ports	-	All projects		Central
All ship breaking yards including ship breaking units	351	All projects		Central
Industrial estates/ parks/ complexes/ areas, export processing Zones (EPZs), Special Economic Zones (SESz), Biotech Parks, Leather Complexes having projects or activities which require EC as per Schedule	-			-
Common hazardous waste treatment, storage and disposal facilities (TSDFs)	-	All integrated facilities having incineration &landfill or incineration alone	All facilities having land fill only	-
Ports, Harbors	-	≥ 5 million TPA of cargo handling capacity (excluding fishing harbours)	< 5 million TPA of cargo handling capacity and/or	-
Highways	-	i) New National High ways; and; ii) Expansion of National High ways >30 KM, additional right of way >20m involving land acquisition and passing through more than one State.	i) New State High ways; and ii) Expansion of National / State Highways greater than 30 km involving additional right of way greater than 20m involving land acquisition.	-
Aerial ropeways	-		All projects	State
Common Effluent Treatment Plants	-		All projects	State
Common Biomedical Waste Management Facility (CBMWF)	-		All projects	State
Construction projects (Residential and Non Residential)	452 452 451 453 454		≥20000 sq.mtrs and <1,50,000 sq.mtrs. of built-up area#	Capacity
Now Towns, townships and settlement colonies	-		Covering an area ≥ 50 ha and or built up area ≥1,50,000 sq .mtrs	Capacity

Table 9: Date of constitution of State EIA Authority

State	Date of constitution of SEIAA
Andhra Pradesh	4th July 2007
Arunachal Pradesh	27th March 2008
Bihar	7th February 2011
Chandigarh	21st August 2009
Chhattisgarh	9th January 2008
Dadra and Nagar Haveli	11th October 2007
Daman & Diu	11th October 2007
Delhi	30th July 2008
Goa	15th April 2010
Gujarat	12th June 2007
Haryana	21st April 2008
Himachal Pradesh	11th October 2007
Jammu and Kashmir	8th January 2008
Jharkhand	20th December 2012
Karnataka	11th June 2007
Kerala	3rd November 2011
Madhya Pradesh	8th January 2008
Maharashtra	21st April 2008
Meghalaya	23rd July 2007
Nagaland	15th April 2010
Orissa	17th November 2008
Puducherry	13th December 2007
Punjab	19th November 2007
Rajasthan	30th July 2008
Sikkim	8th July 2008
Tamil Nadu	3rd March 2008
Uttar Pradesh	12th July 2007
Uttarakhand	22nd September 2008
West Bengal	13th April 2007

Table 10: Results obtained employing a negative binomial model

	(1)	(2)	(3)	(4)
Baseline: No EIA	0.046*	0.047*	0.047*	0.029
	(0.028)	(0.028)	(0.028)	(0.029)
After x Aj x Central	0.017	0.016	0.018	0.008
	(0.057)	(0.058)	(0.059)	(0.073)
After x Aj x Large	0.002	0.000	-0.007	0.006
	(0.059)	(0.058)	(0.060)	(0.064)
After x Aj x District	-0.131*	-0.130*	-0.131*	-0.111
	(0.075)	(0.075)	(0.073)	(0.087)
After x Aj x State	-0.095*	-0.096*	-0.101**	-0.091
	(0.054)	(0.054)	(0.051)	(0.059)
inflate				
Constant	1.387***	1.377***	1.379***	1.382***
	(0.137)	(0.135)	(0.135)	(0.135)
lnalpha				
Constant	-0.621***	-0.626***	-0.627***	-0.629***
	(0.082)	(0.082)	(0.082)	(0.082)
Observations	21075	21075	21075	21075

Sector-clustered standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Sectors excluded from the analysis because of ambiguities in their classification

NIC code	Description
103	Extraction and agglomeration of peat [incl. digging of peat]
181	Manufacture of wearing apparel, except fur apparel
192	Manufacture of footwear.
261	Manufacture of glass and glass products
281	Manufacture of structural metal products, tanks, reservoirs and steam generators
289	Manufacture of other fabricated metal products; metal working service activities
2410	Manufacture of basic chemicals
2420	Manufacture of other chemical products
2424	Manufacture of soap and detergents
2429	Manufacture of other chemical product n.e.c.
2102	Manufacture of corrugated paper
2109	Manufacture of other articles of paper

Table 12: Number of new firms by category and state

State	Without EIA	Large	Central-level	EI	State-level	Total
Andhra Pradesh	3281	326	4909	1406	259	10181
Assam	301	52	488	27	18	886
Bihar	454	30	1733	124	17	2358
Chandigarh	326	16	325	180	22	869
Chhattisgarh	265	56	1041	49	13	1424
Delhi	11984	512	12018	1823	605	26942
Goa	207	14	258	28	12	519
Gujarat	6200	803	4110	1346	215	12674
Haryana	1349	61	743	200	59	2412
Himachal Pradesh	134	10	514	83	14	755
Jammu & Kashmir	123	12	177	24	5	341
Jharkhand	242	29	1053	39	7	1370
Karnataka	3474	169	3291	407	161	7502
Kerala	1179	96	1639	274	55	3243
Madhya Pradesh	1075	164	2065	387	73	3764
Maharashtra	12822	875	11306	2061	651	27715
Meghalaya	48	13	170	7	4	242
Odisha	531	78	2165	91	27	2892
Puducherry	89	6	86	33	9	223
Punjab	1202	78	858	197	61	2396
Rajasthan	1919	186	4711	435	75	7326
Tamil Nadu	5185	266	3898	652	269	10270
Uttar Pradesh	2121	135	1776	668	92	4792
Uttarakhand	217	19	163	50	13	462
West Bengal	4095	305	3897	404	156	8857
Total	58823	4311	63394	10995	2892	140415

Table 13: Small versus large companies in the "Capacity" group

	(1) OLS	(2) Poisson
Baseline: No EIA	0.038	0.001
	(0.047)	(0.038)
After x Aj x Central	-0.001	-0.032
	(0.072)	(0.059)
After x Aj x Large	0.003	-0.001
	(0.050)	(0.049)
After x Aj x Small	-0.058	-0.261*
	(0.095)	(0.136)
After x Aj x IE	-0.150***	-0.126**
	(0.051)	(0.055)
After x Aj x State	-0.179***	-0.110*
	(0.059)	(0.058)
Observations	12596	30000
Average wage	Yes	Yes
Minimum wage	Yes	Yes
SEZ	Yes	Yes
State	Yes	Yes
Year	Yes	Yes
Sector	Yes	Yes

Clustered standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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