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Environmental standards and political federalism: Do labor legislations matter?

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ABSTRACT

The relevance of labor laws in affecting the environment has not been adequately addressed in the literature. Employing data on Indian states for 1981–2000, the results appear to suggest that different labor laws exert an uneven impact on the environment, either directly or in association with state political characteristics. Importantly, we also find strong complementarities between dispute resolution mechanism and other relevant labor laws.

1. Introduction

The role of economic and political factors in impacting environmental quality has been widely discussed in the literature (Shafik and Bandyopadhyay, 1992; Grossman and Krueger, 1995; Harbaugh et al., 2002; Pellegrini and Gerlagh, 2006; Carson, 2010). However, an aspect that is not adequately addressed in the literature is the impact of labor laws on environmental standards.

Employing cross-national data, labor legislation has been found to impact several important variables such as employment, labor productivity, investment and output. Indeed, studies suggest that environmental regulations exert an important influence on firm's input choice (Greenstone, 2002),

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although more systematic assessments of the interface between labor laws and environment are beginning to be explored (Walker, 2011).

What are the possible effects of labor legislation on environmental standards? On the one hand, it has been argued that that stricter labor legislation could slow down or inhibit industrial restructuring that focuses on the development of cleaner technologies, thereby leading to higher pollution (Bernauer and Koubi, 2009). Besley and Burgess (2004) for example, find that pro-worker legislations are associated with lower output. If that were the case, then one would expect stringent labor laws to lower pollution levels, consistent with the EKC hypothesis. On the other hand, in as much the stated focus on environmental concerns is in conflict with government objectives of full (or, greater) employment, this could, in fact, increase pollution (Touraine et al., 1987; Dobson, 1995). The Eurobarometer Survey (European Commission, 2012) notes that, notwithstanding their significant impact on pollution, governments have been actively encouraging the growth of SMEs because of their overarching role in fostering economic growth and ensuring greater employment. Therefore, the net effect of labor legislation on environmental standards is not, a priori.

The paper has a three-fold purpose. We first examine the role of different labor laws on environmental standards. Next, we investigate whether political factors have a role to play in influencing the environment. Finally, we explore the possible complementarities between labor laws and political factors and their impact on the environment. While several studies have examined the of political factors on the environment (Lopez and Mitra, 2000; Dinda, 2004; Rehman et al., 2012), the interaction between labor laws and political factors and its impact on the environment has been a hitherto under-researched area of study.

After accounting for various controls, the analysis appears to suggest that labor regulations exert a non-negligible impact on environmental standards. Besides, the evidence indicates that political factors play an important role in influencing the environment, either directly or indirectly via its interaction with labor legislations.

For our analysis, we focus on sub-national data for India, the world's largest democracy and one of the leading emerging economies. The country provides a compelling case to explore this issue for several reasons. First, India's population of over a billion people accounts for a sixth of the global population. A significant proportion of this population is in the working age group. While this raises the possibility of the country reaping the 'demographic dividend' (Bloom, 2011), it also exerts enormous pressure on the country's natural resources with attendant environmental concerns. As Greenstone et al. (2015) remark, a lowering of air pollution in India would, on average, raise life expectancy by 3.2 years. Second, the country has a rich history of labor and environmental regulations. Environmental legislations, which are formulated primarily at the Federal level, have a history of well over 40 years. As compared to this, laws relating to labor dates back to the 1930s, Being on the concurrent list (i.e., under the domain of both Federal and state governments) in the Indian constitution, both sets of government can enact their own legislation on the subject[2]. This, in effect, provides state governments with the flexibility to enact labor legislation either in favor of employers (pro-business) or in favor of workers (pro-worker). The significant time-series and cross-sectional variation in this data can be exploited for purposes of analysis. And finally, the country has witnessed rapid economic growth, averaging around 6% per annum since the mid-1990s. This growth and the resultant changes in consumption patterns are putting significant pressure on its environmental resources. It, therefore, remains a moot issue as to how suitably can be labor laws be re-oriented in sync with the demands of a modern market economy, whilst at the same time, ensuring that the environmental sustainability is not jeopardized.

The inclusion of sub-national data presents several benefits as compared to cross-country data. First, data comparability issues are less of a concern within a country (Carson et al., 1997; Honohan, 2008). Second, as Rodrik (2012) has remarked, the comparison of institutional and political characteristics across countries can be rendered difficult due to the diversity in their historical experiences, cultural norms and institutional contexts. An examination of the experiences of individual countries can provide much more valuable insights (Stern et al., 1996; Welsch, 2003). Third, India is one of the few important emerging

[2] Anant et al. (2006) mention 47 Federal and 200 state labor laws.

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economies for which a comprehensive and reliable state-level database has recently become available, both for labor laws as well as environmental standards. The longitudinal nature of the data makes it amenable to rigorous statistical examination.

The present study augments the existing literature in a few important ways. First, the study highlights the impact of labor legislation on environmental standards, an aspect not adequately addressed in extant empirical studies. On the one hand, several papers have investigated the impact of labor legislation on economic efficiency. A large part of the literature exploits cross-country variation to identify the effects of restrictive labor regulation on aggregate outcomes (Botero et al., 2004). The evidence appears to suggest that stringent labor market regulations are inimical to growth.

More closely related to our work are papers that investigate the impact of environmental standards on economic growth employing sub-national data. There are several studies for the US which examine this issue. By way of example, Meyer (1995) found that US states with stronger environmental regulations experienced higher income growth as compared to those with relatively less stringent environmental standards. List (1999) found evidence that NO_x and SO_2 emissions per capita converged during the 1929–1994 period. Using similar data within a seemingly unrelated regression (SURE) framework, List and Gallet (1999) report state-level differences in the predicted EKC. Aldy (2005) find evidence that US states follow substantially different income–pollution path, using data for 1960–1999. Among other countries, Vincent (1997) focused on 17 Malaysian states and found no support for the EKC for several of the pollutants examined. Employing the percentage of protected area of a country as an environmental measure, Bimonte (2009) reports strong evidence in support of convergence, using data on OECD countries for 1970–2006[3].

Also related to our research are studies that focus on sub-national labor legislation. Holmes (1998) for example, exploits variations in labor laws across US states and demonstrates that manufacturing employment is about one-third higher in states with pro-business laws. Yet others employ disaggregated information on labor laws and show that pro-worker labor legislations are associated with lower elasticity of demand for labor (Ahsan and Pages, 2009).

Our paper also adds to a growing literature that seeks to explore the political determinants of environmental quality. In an early study, Neumayer (2003) observed that given their stated objective of full employment, left-wing parties might be sympathetic towards environmental protection since the poor and the working class are the ones who are most adversely affected by environmental degradation. Carlsson and Lundstrom (2003) found that economic freedom entails better resource allocation and consequently, leads to lower levels of emission. Yet others (de Mesquita et al., 2003) argue that a parliamentarian or presidential system affects pollution. Welsch (2004) puts forward the argument that corrupt governments tend to under-provide public goods (environmental quality), because of possible opportunities for rent seeking. We construct several variables that proxy for the political factors at the state-level and determine their impact on environmental standards.

The rest of the analysis continues as follows. Section 2 outlines the theoretical framework for the subsequent analysis. In Section 3, we provide a brief overview of the developments relating to labor and environmental laws in India. A description of the stylized facts for the Indian states with emphasis on environmental standards and labor legislation is contained in Section 4. Section 5 discusses the regression specification and findings, while the final section concludes.

2. Theoretical framework

The relationship between income and environmental standards has come to be known as Environmental Kuznets Curve (EKC). The EKC suggests that economic growth initially leads to deterioration in the environment and beyond a threshold, environmental quality improves. A number of studies have analyzed the EKC. The results indicate different shapes of the EKC with widely differing thresholds (Grossman and Krueger, 1995; Dinda, 2004; Harbaugh et al., 2002; Leib, 2003; Stern, 2004).

Beginning with the work of Botero et al. (2004) and Besley and Burgess (2004), several papers have analyzed the interlinkage between labor legislation and income. For example, Botero et al. (2004)

[3] This is referred to as 'green' convergence.

conclude that increased regulation of labor is related to lower labor force participation. Besley and Burgess (2004) employ amendments in labor regulations in Indian states and find that pro-worker legislations dampen output and employment in organized manufacturing.

In contrast to the income–pollution and the labor–income linkages, analyses of labor-environment interactions are of recent origin. This line of thinking has focused primarily on endogenizing environmental standards. In researching the amendments to the Clean Air Act in the US that affected polluting plants during 1972–1987, Greenstone (2002) found that those companies lost almost 600,000 jobs compared to what would have happened without the regulation. In contrast, the present paper focuses on the actual level of pollution as the dependent variable. These actual levels of pollution are not only dependent on the stringency of environmental standards, but also on the efficacy with which environmental laws are enforced.

Even if environmental standards tend to become more stringent as income increases, it appears likely that the desire for stricter environmental regulation will translate into concrete policy action only if the relevant interest groups are in sync with these regulations. Following from this logic, it has been argued that public goods (i.e., environmental quality) might be under-provided in the presence of interest groups opposing environmental policies (Olson, 1993). Relatedly, labor laws can also shape environmental policy. Employing cross-national data on 42 countries for 1971–1996, Bernauer and Koubi (2009) uncover evidence that stricter labor legislation is associated with deterioration in environmental quality (i.e., higher pollution). In addition, labor legislations may impact pollution not only via the formation of labor laws, but also through the strictness with which such laws are enforced.

These considerations suggest that pollution might be affected by not only income, but also labor laws. This gives rise to the following formulation, as given by (1)

$$p = f_1\,(y;\ \ l) \tag{1}$$

where p is the pollution, y is the per capita income, l is the labor legislation.

The partial derivative $\partial p/\partial y$ is what is commonly known as the EKC literature. From our previous discussion, it appears likely that the sign of $\partial p/\partial l$ could be positive or negative, reflecting the possible impact of labor legislation on environmental quality.

Over and above the direct effect, there might also be an indirect effect. Stern (2001) has contended that, stringent labor laws, by granting excessive bargaining power to organised labor, might blunt investment incentives and thereby dampen economic growth. This enables us to postulate the following labor–income relationship

$$y = f_2\,(l) \tag{2}$$

Therefore, the overall effect of labor legislations on environmental quality can be decomposed as

$$\frac{\partial p}{\partial l} = \frac{\partial p}{\partial y} * \frac{\partial y}{\partial l} + \frac{\partial p}{\partial l} \tag{3}$$

In other words, there is a direct effect, which focuses on the impact of labor legislations on pollution (environmental quality). In addition, there is also an indirect effect *via* the interlinkage between labor laws and income. An empirical exploration of Eq. (3) is central to the analysis of the paper.

3. Labor and environmental laws in India

3.1. Labor laws

The *Trade Union Act* 1926, the *Industrial Employment* (Standing Orders) Act 1946 and the *Industrial Disputes Act* 1947 are the three most important enactments that have shaped the nature of industrial relations in India. The first Act allows registration of unions in an industrial establishment subject to the proviso that the union has at least seven members from the establishment. Following the economic reforms process initiated in 1991, the Act was revised in 1993 and it presently requires a

minimum membership of 10% of the employees in any firm. The *Industrial Employment Act*, which is applicable, by and large, to establishments employing 100 or more workmen, provides for standing orders to be certified from prescribed authorities, after hearing the employers' and workers' representatives, in respect of several matters relating to conditions of employment. An amendment of the Act in 1984 has made it applicable to establishments employing 50 or more workers.

The *Industrial Disputes Act* (IDA) provides the bedrock of the dispute resolution mechanism: the machinery for dealing with existing or apprehended industrial disputes. Apart from the provision for the formation of work committees in units of a certain size, the Act provides for consultation by a board or a conciliation officer, investigation by a court of inquiry, arbitration on mutual consent of parties and adjudication by labor courts and industrial tribunals.

What has attracted most attention is Chapter 5B of the IDA which governs layoffs and retrenchment of workers. The 1976 amendment stipulated that if a firm employs 300 or more workers, then they cannot be laid off without prior government consent. Later, an amendment in 1982 (effective since 1984) reduced the employment threshold to 100. In practice however, permission to retrench is rarely granted and unapproved separations carry a punitive action of both a substantial fine and a prison sentence for the employer.

One strand of the literature, following from Fallon and Lucas (1993), treats these years as structural breaks which can be exploited for 'before–after' comparisons of employment in manufacturing in order to assess the impact of job security legislations. Using data for the period 1959–1981, they find that employment would have been nearly 20% higher in the organized sector without the provision of job security. An alternate literature exploits the cross-state as well as inter-temporal variations in labor legislation and develops a state-year 'regulatory index' (Besley and Burgess, 2004). The broad conclusion is that pro-worker labor laws are associated with lower output.

3.2. Environmental laws

Several environmental legislations existed in India even before independence, but the impetus for a well-developed framework came only after the UN Conference on the environment. Under its influence, the National Council for Environmental Policy and Planning was set up in 1972. This Council later evolved into a full-fledged Ministry of Environment and Forests (MoEF) in 1985 which is presently the apex administrative body for regulating environmental protection. After the Stockholm Conference in 1976, constitutional sanction was given to environmental concerns. Since the 1970s, an extensive network of environmental legislations has grown in the country. The MoEF and the pollution control boards at the Federal and state levels together constitute the regulatory and administrative core of the sector.

A policy framework has also been developed to complement the legislative provisions. The Policy Statement for Abatement of Pollution as well as a Policy Statement on Environment and Development were published by the MoEF in 1992. The objective of these policy statements was to develop and promote initiatives for the protection and improvement of the environment. The Environmental Action Programme was formulated in 1993 with the aim of improving environmental services and integrating environmental considerations into development programmes.

Several key pieces of legislation presently exist at the Federal level for prevention and control of pollution. Salient among these include: Water (Prevention and Control of Pollution) Act of 1974, subsequently amended in 1988, which lays down the standards for facilities discharging facilities into water bodies; Air (Prevention and Control of Pollution) Act, 1981 which provides the means for the control and abatement of air pollution; the Forest (Conservation) Act, 1980. Over and above these all is the more generic Environment (Protection) Act, 1986 which articulates a policy for environmental protection covering air, water and land. Besides, the Act also provides a framework for ensuring coordination among the relevant authorities at both the Federal and state levels.

As the aforesaid discussion suggests, the extent of the environmental legislation network is quite vast, although the enforcement of the laws remains a challenge. One commonly cited reason is the prevailing command and control nature of the environmental regime (World Bank, 2007). Coupled with this is the prevalence of the all-or-nothing approach of the law: fines are levied on a flat basis and in addition, there are limited incentives for employing pollution-reducing technologies.

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Taking cognizance of these concerns, several initiatives have been undertaken in the recent past. The Government of India announced a Policy Statement for Abatement of Pollution in 1992, which declared that market-based approaches would be considered in controlling pollution. Accordingly, it was stated that economic instruments will be employed to encourage a shift from curative to preventive measures. In 1995, the MoEF constituted a Task Force to evaluate market-based instruments. Following from its recommendations, economic incentives such as depreciation allowances, exemptions from excise or customs duty payment, and arrangement of soft loans for the adoption of clean technologies, are being used to supplement the erstwhile policies to sensitize the polluters about the harmful effects of a deteriorating environment. Beginning 2011, the Government of India has also incorporated a separate chapter on sustainable development and climate change in its annual *Economic Survey* publication to generate wider public awareness on this issue.

4. Data and variables

For the purpose of our analysis, we use state-level data for the period 1981–2000. We selected this time period for two reasons. First, as observed above, it is two decades since some of the important pieces of environmental legislation were promulgated. This period therefore, seems adequate to allow long-run influences to play out. Second, although data on state-level variables is available for a much longer period, information on the dependent variable is available only till 2000. This constrains us from considering a more extended time frame.

The data includes 14 states in India, in line with the standard practice of comparing the economic performance of states that treats smaller or North Eastern states differently (Ahluwalia, 2002; Sachs et al., 2002; Ghosh, 2013)[4]. In the final year of the sample, these states accounted for roughly 90% of India's land area, over 80% of her population and around 90% of the domestic product. With a total of 14 states for 20 years, we have a maximum of 280 state-years.

The dependent variable is the state-level carbon-di-oxide (CO_2) emission for the period 1981–2000. In a recent exercise, Ghoshal and Bhattacharya (2008) have estimated CO_2 emissions for India, based on fuel usage patterns in different states. Unlike country level data, the data has the advantage of being built up using state-level information. The analysis is an adaptation of the methodology applied by Oak Ridge National Laboratory (ORNL), from which country-level data is usually sourced by most studies[5]. On the flip side, the sources of emission which are industrial in nature are not considered. The differences in the source dataset could also engender an aggregation bias. Notwithstanding these shortcomings, our analysis represents the first major attempt to link environmental standards with labor laws at the state-level.

Using this data, we compute two measures of emission: per capita emission (CO_2 emission per 1000 persons) and emission density (CO_2 emissions per square mile)[6]. Studies on EKC typically employ the former variable (see, for example, Leib, 2003; Dinda, 2004). However, it needs to be recognized that the area of each state is a constant number and therefore, using emission density preserves the principal characteristic of total CO_2 emission in each state. Since the same quantity of emission might cause greater health damage in a state with higher population density, the evolution of emission density can actually extrapolate some characteristics of pollution concentration indicator[7]. In the Indian context, with widely divergent state sizes (the largest state is nearly 12-times the size of the smallest, in terms of area) and the uneven distribution of population (the largest state by population was fourth largest by area in 2000), it seems likely that the behavior of these two variables could differ across states.

[4] These states are: Andhra Pradesh (AP), Karnataka (KARN), Kerala (KER) and Tamil Nadu (TN) in the Southern region, Haryana (HARY), Punjab (PUNJ) and Rajasthan (RAJ) in the Northern region, Bihar (BIH), Orissa (ORIS) and West Bengal (WB) in the Eastern region, Gujarat (GUJ) and Maharashtra (MAH) in the Western region and finally, Madhya Pradesh (MP) and Uttar Pradesh (UP) in the Central region.

[5] The correlation between ORNL data and GB data is 0.99, although on average, the GB estimates are 10–15% higher across all years as compared to ONRL estimates.

[6] Per capita emission is measured as 1000 metric tonnes of carbon per 1000 persons, whereas emission intensity is measured as 1000 metric tonnes of carbon per square mile.

[7] $\frac{\text{Emission}}{\text{Area}} = \frac{\text{Emission}}{\text{Population}} * \frac{\text{Population}}{\text{Area}} \equiv \frac{\text{Emission}}{\text{Population}} * \text{Population density.}$

State-level income data is derived from the *Economic and Political Weekly States Database* (Economic and Political Weekly Research Foundation, 2003). Using this data, we construct an annual series on real state income per capita. Besides, we also include several control variables, including proxies for state economic structure, human capital, institutional quality and governance. These data are obtained from various government publications. The Appendix provides the relevant details, including data source and summary statistics.

The main focus of the study is to examine the efficacy of state-level labor legislations. Following Ahsan and Pages (2009), we distinguish between sections of the IDA that address the dispute settlement process between employers and workers and those that affect the employment adjustment capacity of firms. The former is referred to as Dispute Settlement (DS) legislation and the latter as Employment Protection Legislation (EPL). As part of the latter, we focus specifically on Chapter 5B, which prohibits firms with a threshold minimum employment level to retrench workers without prior government permission.

Employing data on labor legislation from Ahsan and Pages (2009), we proceed as follows. First, all amendments in a given year that enhance (resp., weaken) workers job security or prolong (resp., shorten) dispute duration is coded as $+1$ (resp., -1). In case there are no labor legislation amendments in any year, it is coded as zero. These scores are cumulated over time for each state to separately obtain the three indices: DS, EPL and Chapter 5B. In case the sum of the amendments in a given year is greater than zero, the legislation is deemed as pro-worker. Reverse is the case if the sum of the amendments in less than zero. The labor legislation is deemed neutral if the sum of the amendments in any year equals zero. Therefore, we examine not only the labor laws per se, but also the impact of their stringency on pollution levels.

5. Environmental standards in Indian states: Stylized facts

We begin the analysis by examining the divergence in the relevant variables across states (Table 1). For expositional simplicity, we classify the states on three-fold criteria: income, region and geography. Specifically, high-income states are as defined by World Bank (2005) and corroborate the earlier classification by Ahluwalia (2002). Likewise, states have also been classified according to regions, following Reserve Bank of India (2007) and finally, as coastal or hinterland (Government of India, 2008)[8].

The evidence indicates significant differences in environmental standards across states, defined in terms of income (Panel A), geography (Panel C) and to a certain extent, in terms of region as well (Panel B). By way of example, the emission intensity in the high-income states was 0.142, which is over 30% higher as compared to low-income ones. The difference is statistically significant at the 0.01 level. Looking at regions, the divergence is most pronounced in case of Southern as compared to other regions. To see that, note that, per capita emission in the Southern states at 0.159 is the lowest among regions and the differences vis-a-vis other regions is statistically significant.

Turning to the independent variables, the evidence indicates differences across states in terms of per capita incomes across all state characteristics. To exemplify, per capita NSDP was 9.59 in the coastal states, which is around 3% higher as compared to landlocked ones.

The independent variables of interest are the relevant labor legislations. While there are no significant differences in labor laws between high- and low-income states, there are perceptible differences across states, both in terms of region as well as geography. By way of example, the EPL in coastal states was 0.76, much higher than the value of 0.26 for the landlocked states. The difference is statistically significant at the 0.01 level.

Table 2 reports the correlation among the measures of environmental standards, juxtaposed with the labor regulation. Both measures of emissions display a negative association with labor laws (except for Chapter 5B) and in almost all the cases, these are statistically significant. For example, the

[8] High-income states are: AP, GUJ, HAR, KARN, KER, MAH, PUNJ, TN and WB. Likewise, coastal states are AP, GUJ, KARN, KER, MAH, ORIS, TN and WB (see fn. 3).

Table 1
State-specific variables—summary statistics.

Variables	PCE	EMI	PCNSDP	Ind	Literacy	T&D loss	Crime	EPL	DS	Ch. 5B	N.Obs
	Dependent variables		Independent variables								
Panel A: Income											
High income	0.235 (0.110)	0.142 (0.087)	9.721 (0.311)	0.229 (0.063)	0.568 (0.142)	0.206 (0.039)	7.445 (0.436)	0.589 (0.908)	−0.322 (1.416)	0.244 (0.431)	180
Low income	0.240 (0.120)	0.108 (0.069)	9.086 (0.365)	0.239 (0.064)	0.455 (0.123)	0.240 (0.059)	7.512 (0.355)	0.500 (0.503)	−0.400 (0.569)	0.320 (0.469)	100
t−test for difference	−0.37	3.55***	14.69***	−1.18	6.93***	−5.22***	−1.37	1.05	0.65	−1.33	
Panel B: Region											
North	0.227 (0.111)	0.128 (0.097)	9.802 (0.364)	0.239 (0.058)	0.492 (0.119)	0.232 (0.043)	7.267 (0.569)	0.233 (0.427)	−0.367 (0.609)	0.233 (0.427)	60
South	0.159 (0.098)	0.092 (0.051)	9.593 (0.256)	0.226 (0.067)	0.604 (0.176)	0.206 (0.037)	7.619 (0.221)	0.325 (0.471)	−1.450 (1.078)	0.100 (0.302)	80
West	0.329 (0.068)	0.123 (0.036)	9.837 (0.271)	0.226 (0.059)	0.516 (0.102)	0.188 (0.033)	7.791 (0.116)	0.900 (1.008)	0.450 (0.504)	0.450 (0.504)	40
East	0.255 (0.082)	0.193 (0.101)	9.073 (0.453)	0.237 (0.063)	0.474 (0.109)	0.241 (0.073)	7.176 (0.199)	1.033 (1.057)	0.666 (1.115)	0.600 (0.494)	60
Central	0.284 (0.126)	0.119 (0.056)	9.121 (0.157)	0.238 (0.068)	0.520 (0.141)	0.218 (0.029)	7.589 (0.417)	0.450 (0.504)	−0.450 (0.504)	0.00 (0.00)	40
t−test for difference											
North v. South	3.74***	2.63***	3.81***	1.224	−4.49***	3.81***	4.56***	−1.20	7.53***	2.06***	
North v. West	−5.72***	0.36	−0.58	1.039	−1.08	5.94***	−6.93**	−3.96***	−7.29***	−2.24**	
North v. East	−1.54	−3.61***	9.72***	0.163	0.87	−0.76	1.16	−5.44***	−6.29***	−4.35***	
North v. Central	−2.32***	0.61	12.83***	0.030	−1.06	1.94***	−3.26***	−2.24**	0.75	4.24***	
South v. West	−11.06***	−3.88***	−4.79***	0.050	3.46***	2.82***	−5.57	−3.43***	−13.15***	−4.05***	
South v. East	−6.21*** *	−7.14***	7.98***	−1.016	5.39***	−3.35***	12.46**	−4.84***	−11.76***	−6.93***	
South v. Central	−5.46***	−2.56***	12.48***	−0.958	2.81***	1.99**	0.44	−1.309	−6.92***	2.96***	
West v. East	4.96***	−4.92***	10.57***	−0.862	1.97**	−4.94***	−19.49***	−0.672	−1.32	1.47	
West v. Central	2.01**	0.43	14.54***	−0.843	−0.16	−4.46***	−2.96***	2.53***	7.99***	5.65***	
East v. Central	−1.30	4.74***	−0.75	−0.104	−1.72*	2.12**	−5.28***	3.69***	6.79***	9.41***	
Panel C: Geography											
Coastal	0.228 (0.116)	0.126 (0.084)	9.599 (0.292)	0.232 (0.064)	0.561 (0.149)	0.210 (0.055)	7.548 (0.311)	0.775 (0.911)	−0.353 (1.498)	0.388 (0.489)	160
Land-locked	0.248 (0.111)	0.134 (0.080)	9.354 (0.569)	0.235 (0.062)	0.484 (0.128)	0.229 (0.041)	7.364 (0.494)	0.266 (0.444)	−0.333 (0.539)	0.117 (0.322)	120
t-test for difference	−1.43	−0.83	4.32***	−0.38	4.64***	−3.19***	3.57***	6.15***	−0.152	5.58***	

Standard deviation within parentheses.
*** Denote statistical significance at 1%.
** Denote statistical significance at 5%.
* Denote statistical significance at 10%.

Table 2
Correlation matrix of state-specific variables.

	PCE	EMI	DS	EPL	Ch. Vb
PCE					
EMI	0.689 (0.00)				
DS	−0.168 (0.00)	−0.332 (0.00)			
EPL	−0.287 (0.00)	−0.186 (0.00)	0.248 (0.00)		
Ch. 5B	0.105 (0.07)	0.009 (0.87)	0.303 (0.00)	0.793 (0.00)	

p-Values in parentheses.

correlation of DS with PCE is 17% and with EMI is 33%. These raw correlations however, do not take on board the state-specific or other demand-side factors.

6. Empirical strategy and results

6.1. Regression specification

The univariate tests do not control for factors that might systematically impact state-level environmental standards. First, state-level controls are not accounted for. The demand side activity could also be an important consideration.

Akin to Ahsan and Pages (2009), we employ the following specification for state s at time t as given by (4)

$$\ln(P_{s,t}) = \alpha_s + \tau_t + \gamma' X_{s,t} + \omega\,[Labor]_{s,t-1} + \varepsilon_{s,t} \tag{4}$$

in Eq. (4), P is the outcome variable of interest (defined alternately as per capita emission and emission density). It is assumed to be a function of a vector of state state-level controls (**X**), including state per capita income, share of industry as a proxy for state economic structure (Neumayer, 2003), literacy rate as a proxy for educational attainment (Torras and Boyce, 1998), T&D losses as a proxy for institutional quality (Panayotou, 1997; Torras and Boyce, 1998) and cognizable offenses as a proxy for governance standards (Samimi et al., 2012); β and γ are parameters to be estimated, α_s and τ_t are state and year fixed effects and ε denotes the error term[9].

Our primary interest lies in *Labor*, the vector of labor regulation index, lagged one period to account for the time gap between implementation and enactment.

This methodology allows us to identify the effect of labor laws that are enacted at the state level. Additionally, it also enables us to discern the effect of state-level labor reforms from the effect of national-level shocks, which is often not possible just by comparing outcomes before and after such reforms. Across all specifications, we take on board the possible autocorrelation of the error term by estimating robust standard errors that are clustered at the state level (Bertrand et al., 2004).

6.2. The role of labor legislation

The results are set out in Table 3. The evidence clearly suggests that labor legislations exert an uneven impact on environmental standards. To illustrate, EPL or Chapter 5B does not appear to exert any perceptible impact on the environment (Cols. 1 and 2). On the contrary, dispute resolution laws exert a statistically significant impact on the environment. According to the results, on average, state amendments focusing on the dispute resolution standards (DS) are associated with a 13% reduction in

[9] It is also possible that the pollution series could contain a unit root, so that it would be preferable to work with changes, instead of levels. However, the Levin-Lin-Chu (2002) unit root test rejects the null hypothesis of a unit root for the pollution variables, suggesting that the specification is appropriate. Variable Probability. Per capita emission (PCE) 0.004*** Emission intensity (EMI) 0.004*** (***$p < 0.01$).

Table 3
Analysis of environmental standards—role of labor legislation.

	Dependent variable = per capita emission						Dependent variable = emission intensity					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ch.5B	0.049 (0.089)				0.041 (0.058)		0.069 (0.089)				0.054 (0.058)	
EPL		0.002 (0.084)		0.038 (0.052)		0.056 (0.040)		0.015 (0.088)		0.049 (0.057)		0.071 (0.042)
DS			**−0.127*** (0.027)**	**−0.133*** (0.026)**	**−0.099*** (0.034)**	**−0.080** (0.036)**			**−0.124*** (0.039)**	**−0.131*** (0.027)**	**−0.093** (0.035)**	**−0.069** (0.031)**
Ch. 5B * DS					**−0.116** (0.048)**						**−0.129*** (0.047)**	
EPL * DS						**−0.046** (0.021)**						**−0.054** (0.012)**
F-test: EPL = DS				9.45*** (0.00)		5.50** (0.03)				9.96*** (0.00)		5.75*** (0.00)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000
N.Obs; States	279	279	279	279	279	279	279	279	279	279	279	279
R-squared	0.933	0.932	0.943	0.944	0.947	0.946	0.961	0.960	0.966	0.967	0.969	0.969

Standard errors (clustered by state) are in parentheses. The constant term is suppressed.
*** Denote statistical significance at 1%.
** Denote statistical significance at 5%.
* Denote statistical significance at 10%.

per capita emissions (Col. 3). Intuitively, higher dispute resolution cost has a two-sided effect. On the one hand, it increases the bargaining power of workers. On the other, firms are able to hold-on for much longer in the 'war of attrition'. Sensing this, workers might be inclined to facilitate the adoption of environment-friendly technologies. The net effect is an improvement in environment standards.

When DS and EPL are considered jointly, the results confirm previous findings: DS exerts a salutary effect on the environment, whereas there is no discernible impact of EPL (Col. 4). A test of the equality of the coefficients rejects the null hypothesis.

Next, we examine the possible complementarities between amendments to Chapter 5B in IDA and amendments in dispute resolution provisions. These complementarities might emanate owing to the fact that laws that enhance job security tend to reinforce workers' bargaining power, which in turn, raises their ability to initiate and sustain industrial disputes. Conversely, the higher the cost of dispute resolution, the greater the bargaining power which workers can obtain with higher employment protection. The results reported in Col. (5) lend credence to this conjecture. The negative sign on the interaction variable suggests that both types of amendments interact with each other, compounding their effects on the environment. An amendment to Chapter 5B in the direction of increasing job security taken alongwith the dispute resolution laws serves to lower emissions by nearly 12 percentage points.

In sum, the results appear to indicate that regulations that increase the cost of solving industrial disputes are associated with large improvements in environmental standards. Importantly, we also find strong complementarities, especially between Chapter 5B and dispute resolution mechanism. We next examine how state-specific political factors interact with labor laws in impacting the environment.

6.3. Political factors and labor legislation

The importance of political factors in influencing the environment has been well-recognized in the literature. For example, it has been argued that non-democratic regimes are typically ruled by small elites. These elites tend to prioritize private benefits at the expense of socially optimal outcomes (Fredriksson et al., 2004; Welsh, 2004). Therefore, if the costs of stringent environmental policies are borne disproportionately by the elites, their incentive to implement such policies could be significantly lower. In contrast, in democracies, the median voter, who decides on public policy, encounters lower cost from environmental policies. This makes the adoption and implementation of stricter environmental policies more feasible in democratic regimes.

Empirical evidence also underscores the relevance of political factors for environmental standards (Dinda, 2004; Rehman et al., 2012). To exemplify, Lopez and Mitra (2000) argue that corruption and rent-seeking behavior can influence the relationship between income and the environment. Using cross-country data, Bernauer and Koubi (2009) and Lamla (2009) report that presidential systems tend to be more sympathetic towards the environment as compared to parliamentary systems. Taking these considerations on board, we estimate the following specification as given by (5)

$$\ln(P_{s,t}) = \alpha_s + \tau_t + \gamma' X_{s,t} + \phi\,[Pol]_{s,t} + \omega\,[Labor]_{s,t-1} + \lambda[Pol]_{s,t} * [Labor]_{s,t-1} + \varepsilon_{s,t} \quad (5)$$

where *Pol* denotes the political factors; the remaining variables are as defined earlier. The coefficient of interest is λ, which signifies how political and labor laws interact in shaping the environment. Provided that politically fragmented states with pro-worker labor legislations experience a worsening of the environment, one would expect $\lambda > 0$.

In our analysis, we consider three sets of political factors which capture the competitiveness of political participation and the nature of government. First, we include a dummy which equals one if the government is a coalition, else zero. Roubini and Sachs (1988) claim that the heterogeneity in the objective function of the political parties in a coalition might lower the flexibility of the government in re-orienting its expenditures. Following from this line of argument, we examine how coalition governments impact environmental standards. Second, following Elgie and McMenamin (2008), we examine the impact of political fragmentation. Without loss of generality, higher fragmentation can be construed as lower competition. The fragmentation variable is measured in two ways: in terms of number of seats and also the number of votes. Table 4 presents the results.

In Cols. (1)–(3), only the coefficient on DS is negative and statistically significant, confirming our earlier findings. More importantly, neither the coefficient on *Coalition* nor its interaction with any of the labor regulation indices are statistically significant, suggesting that the nature of governments does not appear to exert any noticeable impact on the environment, either in isolation or in conjunction with labor legislation. Intuitively, in coalition governments, the cost of coordination among the members of different political parties is likely to be high. As a result, members might be less inclined to undertake changes that could influence the environment.

Cols. (4)–(6) examines the impact of political fragmentation, where fragmentation is measured in terms of vote share. The effect of the labor laws working through political fragmentation is extremely significant: in Col. (4) for example, an increase in political competition by 10% would lower per capita emissions (i.e., improve environmental standards) by about 4 percentage points on average, which suggests that more politically fragmented states are less considerate about preserving the environment.

As observed earlier, our coefficient of interest is λ, which captures possible complementarities between political fragmentation and labor legislation. These complementarities might arise because unstable and polarized political systems are likely to experience greater resistance to reform of their labor markets. In a similar vein, labor market reform (i.e., public good) is often likely to be held up because the marginal benefits (i.e., chances of re-election) of undertaking such reforms might be outweighed by the marginal costs, especially in unstable political systems. Empirical research provides persuasive evidence in support of this contention (Botero et al., 2004; Besley and Burgess, 2004; Lucifora and Moriconi, 2012).

In Col. (5), the coefficient on the interaction term is negative and statistically significant with a point estimate equal to -0.14. To ascertain its relevance, take Col. (4) and consider a state with vote fragmentation equal to 0.68, belonging to the 25th percentile of the distribution. For such a state, the impact of dispute resolution, operating through the vote fragmentation index, on per capita emissions is -0.35 $[=-0.25+0.68*(-0.14)]$ percentage points. On the other hand, for a state with vote fragmentation equal to 0.78, belonging to the 75th percentile of the distribution, the overall effect is -0.36 $[=-0.25+0.78*(-0.14)]$, nearly 4% lower as compared to the results obtaining for the 25th percentile. What this would suggest is that as we move from less to more politically competitive states, the effects of dispute resolution laws on the environment are significantly negated. As compared to this, the results in Col. (6) indicate that although political factors do not directly influence the environment per se, stricter employment protection laws do serve to improve the environment. In conjunction with political factors however, the net effect of stricter employment protection is an overall decline in environmental standards. Thus, as earlier, moving from a state at the 25th percentile of vote fragmentation to a state at the 75th percentile would in this case engender a rise in per capita emissions by 15% points[10]. In effect therefore, the laws governing layoff and retrenchment of workers tend to be more of a concern in politically fragmented states.

On the other hand, the results in Cols. (7)–(9) suggest that there is no direct impact of seat fragmentation on the environment; the only effect is through dispute resolution laws (see, Col. 8)[11]. What is interesting is to note is that, as earlier, the interaction terms are directionally similar to those obtained earlier, only the magnitudes are smaller. As in the previous case, there is no perceptible impact of employment protection laws working through the political fragmentation index; the impact is more in case of dispute resolution and Chapter 5B. To see this note that, for a state with seat fragmentation equal to 0.575 – the mean value for the sample – the point estimates in Col. (8) indicate that the net effect is a decline in per capita emissions by 0.14 $[=-0.239*0.469]$ percentage points. As in case with vote fragmentation, Chapter 5B is found to exert an adverse impact on the environment: the overall impact for a state with mean level of seat fragmentation is a rise in per capita emissions by 0.27 $(=0.575*0.469)$ percentage points. Without loss of generality, vote fragmentation can be interpreted as indicating 'majority' of the government and is therefore more relevant for policy

[10] To see this, note that at the 25th percentile of vote fragmentation, per capita emissions equal 0.86 $(=1.26*0.68)$. Likewise, the value at the 75th percentile is 0.98 $(=1.26*0.78)$. The difference is 15 percentage points.

[11] Since the coefficient index on Competition (Seat) is not statistically significant, the coefficient estimate of the interaction term captures the marginal effect of political competition for pro-worker states.

Table 4
Analysis of environmental standards—relevance of political factors.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Coalition	−0.075	−0.084	−0.079						
	(0.108)	(0.086)	(0.119)						
Competition (vote)				**−0.397*** **	**−0.246** **	−0.115			
				(0.121)	**(0.115)**	(0.140)			
Competition (seat)							0.101	0.102	0.046
							(0.321)	(0.166)	(0.297)
EPL	0.010			−0.466			−0.126		
	(0.085)			(0.323)			(0.145)		
DS		**−0.125*** **			−0.027			**−0.017* **	
		(0.027)			(0.102)			**(0.009)**	
Ch. 5B			0.052			**−0.869** **			−0.241
			(0.091)			**(0.404)**			(0.146)
Coalition*EPL	0.007								
	(0.042)								
Coalition*DS		0.021							
		(0.017)							
Coalition*Ch.5B			0.023						
			(0.108)						
Competition (vote)*EPL				0.665					
				(0.432)					
Competition (vote)*DS					**−0.138*** **				
					(0.046)				
Competition (vote)* Ch. 5B						**1.259** **			
						(0.574)			
Competition (seat)*EPL							0.225		
							(0.292)		
Competition (seat)*DS								**−0.239** **	
								(0.094)	
Competition (seat)* Ch. 5B									**0.469** **
									(0.219)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000	1981–2000
N.Obs; states	279; 14	279; 14	279; 14	279; 14	279; 14	279; 14	279; 14	279; 14	279; 14
R-squared	0.923	0.934	0.924	0.924	0.933	0.925	0.924	0.933	0.924

The dependent variable is per capita emission. The results with emission intensity as the dependent variable are qualitatively similar and as a result, not reported for purposes of brevity.
Standard errors (clustered by state) are in parentheses. The constant term is suppressed.
*** Denote statistical significance at 1%.
** Denote statistical significance at 5%.
* Denote statistical significance at 10%.

decisions; the seat fragmentation closely proxies the electoral base and is more informative for political decisions. The analysis appears to suggest that it is policy decisions that matters more for environmental standards.

In sum, the results appear to suggest that labor laws exert a non-negligible impact on environmental standards. In particular, dispute settlement laws, either in isolation or in conjunction with other relevant labor legislations, more particularly those related to worker retrenchment, exert a statistically significant impact on the environment. With countries focusing on labor markets in the light of evidence which suggests that tighter regulations lower labor market participation (Botero et al., 2004), the hitherto neglected nexus between labor laws and the environment remains to be further explored.

The evidence also highlights how political factors interact with labor laws in influencing environmental quality. While there are studies which focus on the political determinants of the

environment, the interlinkage between the two is an area which needs to be taken on board, especially in the light of the fact that political competition plays a role in shaping environment standards, when considered in conjunction with labor laws.

7. Concluding remarks

The EKC hypothesis has attracted significant attention in the literature. What has not been adequately addressed is the role that labor laws play in this regard. Employing data on Indian states, the results support the fact that regulations that increase the cost of resolving industrial disputes are associated with large improvements in environmental standards. The magnitudes are economically large, as well. Importantly, we also find strong complementarities between dispute resolution mechanism and other relevant labor laws. In addition, the analysis suggests that political factors play an important role in impacting environmental standards, either directly or indirectly via its interaction with labor legislations. States which are politically more fragmented appears to be much more impacted by labor legislations.

The erstwhile 'command-and-control' instruments (e.g., environmental impact assessment, consent to establish, consent to operate) in India are being increasingly replaced with market-based instruments. To illustrate, the Bureau of Energy Efficiency (BEE) has launched a market-based mechanism called Perform, Achieve and Trade (PAT) program in 2012. This mechanism entails targets in terms of specific energy consumption for industries in energy-intensive sectors. Industries can meet targets through energy efficiency programs or through purchase of energy saving certificates from other industries which have exceeded their targets. However, an aspect that does not appear to have been adequately taken into account is the role of labor legislations and how political economy considerations interact with labor legislations in impacting the environment. Judged from this standpoint, the present analysis provides some evidence as to how labor standards affect the environment at the sub-national level. It, however, needs to be borne in mind that given the limitations involved in the computation of state-level emission data as pointed out earlier, our results could be influenced by such considerations. For all practical purposes however, given the high correlation between the ORNL and the present series (see fn. 3), this impact might not be overwhelming. While several policy measures are being debated and discussed, it needs no gainsaying that any dialogue on environmental standards in India would need to take on board the hitherto neglected issue of labor laws into account.

Appendix. Data source, variables and summary statistics

Notation	Variable	Data source	N. Obs	Mean	SD
PCNSDP	Ln (real per capita NSDP)	EPW States database (Economic and Political Weekly Research Foundation, 2003)	280	9.494	0.449
Industry	Ln (share of industry/NSDP)	EPW States database (Economic and Political Weekly Research Foundation, 2003)	280	−1.495	0.284
Literacy	Ln (literacy rate)	Statistical abstract	280	−0.676	0.272
T&D loss	Ln (transmission and distribution losses of State Electricity Boards)	Planning Commission website	280	−1.544	0.202
Crime	Ln (number of cognizable offenses per million population). Cognizable offense comprise of murder, robbery, dacoity, burglary, theft and others	National Crime Records Bureau (numerator) and Registrar General, Government of India (denominator)	280	7.469	0.409
Employment protection (EPL)	All amendments in each year which strengthen (resp., weaken) workers job security is coded as +1 (resp., −1). Each state in each year that had no labor law	Ahsan and Pages (2009)	280	0.557	0.788

	amendment regarding job security is coded 0. For each state, values are added over time as of each year to create a cumulative indicator of net amendments				
Dispute resolution (DS)	As in case of EPL, except that we focus on reforms related to labor disputes	Ahsan and Pages (2009)	280	−0.350	1.184
Chapter 5B (Ch. 5B)	As in case of DS, except that we focus on reforms related to Chapter Vb	Ahsan and Pages (2009)	280	0.271	0.445
Per capita emission (PCE)	Ln (total CO_2 emission per million population)	Ghoshal and Bhattacharya (2008) for numerator	280	5.325	0.575
Emission intensity (EMI)	Ln (total CO_2 emission per 1000 square kilometers)	The denominator is from Wikipedia	280	4.154	0.754
Competition (seat)	Defined as $(1-\sum_{i=1}^{N} Seat_i^2)$ where *Seat* is the share of seats of political party *i* and *N* is the total number of parties represented	Election Commission of India (ECI) website (www. eci.gov.in)	280	0.575	0.141
Competition (vote)	Defined as $(1-\sum_{i=1}^{N} Votes_i^2)$ where *Votes* is the share of votes of political party *i* and *N* is the total number of parties represented	www.eci.gov.in	280	0.722	0.087
Coalition	Dummy = 1 if a government is a coalition, else zero	www.eci.gov.in	280	0.071	0.258

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