Minimum wages and enforcement in India: Inverted U-shaped employment effects

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ABSTRACT

The minimum wage literature on both developed and developing countries ignores the imperfect nature of enforcement. In an attempt to fill this gap, this paper estimates an interactive effect of minimum wage and enforcement on wages and employment, among low wage construction workers in India, using flexible parametric and semi-parametric spline regressions. Results indicate that wage elasticities are positive for all ranges of minimum wages and increase with enforcement intensity. Employment elasticities are positive in the lowest 25% of the minimum wage distribution and negative beyond that range indicating an inverted U-shaped relationship, consistent with a monopsonistic labor market model. Further, employment elasticity decreases with the intensity of enforcement. These results imply that, for an appropriately set and enforced minimum wage, both wages and employment increase, improving overall welfare.

Key words

Minimum wage, enforcement, employment, labor markets, monospony, construction, India

1. INTRODUCTION

The effects of minimum wages on employment and wages are widely debated in the labor economics literature. The efficacy of such regulations in achieving their intended welfare consequences is less straightforward and depends on characteristics such as, income and health of institutions of the country or state in question (Blanchard, 2004). Enforcement intensity is one such institution that is important, but often neglected in the evaluation in empirical labor market studies. This paper argues that the extensive literature on the evaluation of the minimum wage policy does not acknowledge the poor standards of enforcement, despite the growing evidence on the latter. The imperfect nature of enforcement and the effects of spatial and time varying enforcement intensities on wages, employment, firm size, productivity, and informality have been studied in a number of papers on developing countries. However, studies that estimate the joint impact of minimum wages and enforcement are starkly missing. This paper attempts to fill this gap in the literature by estimating an interactive effect of minimum wages and enforcement among low wage construction workers in India using six repeated cross-section datasets from the employment-unemployment survey conducted by the National Sample Survey Organization of India.

As Hamermesh (2002) notes, developing countries act as a good workroom for policy evaluation, because they provide quasi-experimental research designs. India provides such a platform with minimum wages and enforcement varying exogenously across states and time. Both parametric reduced-form and semi-parametric regression (using splines) results are reported. These findings would not only lend themselves to the understanding the role of

minimum wage, but the direction of estimated effects indicate the nature of the underlying labor markets. Theories predict a uniform negative effect of minimum wages on employment in competitive labor markets, and an inverted U-shape relationship in monosponistic and oligospnistic models (Stigler, 1946). Further, varying levels of enforcement could potentially interact with varying minimum wages to produce interesting outcomes. For instance, Basu, Chau and Kanbur (2010) develop an incentive compatible equilibrium model and define several thresholds, to show that the response of employment to a minimum wage rise can be positive, negative or subdued depending on the level of minimum wage and enforcement.

Typically, minimum wages are instituted to empower workers in the lower end of the wage distribution. A well enforced minimum wage could increase productivity (through the efficiency wage argument) and the purchasing power of workers (Levin-Waldman, 1997). According to the efficiency wages argument, wages higher than the marginal revenue product of labor potentially raises productivity either from improved nutrition or human development of workers, assuming higher income translates to better nutritional outcomes. In addition, employers may provide on the job training to increase the productivity of workers, given that the higher minimum wage will now force them to pay higher wages. A minimum wage could also increase the purchasing power of workers, which in turn benefits the economy by stimulating aggregate demand. The argument against the minimum wage policy is centered on its effects on employment.

Critics of the policy argue that in a perfectly competitive labor market, where workers are paid their marginal revenue product, a minimum wage policy causes employment to fall. This is

however not true if the labor market is monosponistic or oligosponisitic, where introducing a perfectly enforced minimum wage increases employment for a range of minimum wages (Stigler, 1946). Stigler's model predicts an inverted U-shape relationship between employment and minimum wages, rather than a uniform negative effect, as predicted by the competitive model. In other words, with perfect enforcement and monosponistic labor markets, employment increases with an increase in minimum wages until a threshold; beyond this threshold, employment decreases with higher minimum wages. For subsequent minimum wage models based on monopsony, see Bhaskar, Manning and To (2002), Basu, Chau and Kanbur (2010), and Ashenfelter, Farber and Ransom (2010).

There is a large empirical literature on the evaluation of the minimum wage policy but the enforcement is visibly absent there, despite many studies that model the role of enforcement in a firm's decision to comply. Ashenfelter and Smith (1979) report that a firm's compliance with minimum wage law in the United States was 65% in 1973 and 55% in 1975. Their expected profit maximizing model, using a fixed penalty for violation, predicts that a firm's incentive to comply is lower, lower the market wage is below the minimum wage and larger the absolute value of elasticity of demand for labor. Grenier (1982) employs a similar model but assumed that penalty is proportional to the depth of violation and find that the incentive to comply is lower, closer the minimum wage to the market wage and smaller the elasticity of demand for labor, a finding exactly opposite to Ashenfelter and Smith (1979). Chang and Ehrlich (1985) put forward that the penalty structure is not important for the decision to comply. They find that no matter the penalty structure, a firm's incentive to comply is lower, lower the market wage below the minimum wage. Yaniv (2001) allows for the fact that employers might find it worthwhile to pay

subminimum wages to just a fraction of their employed workers, and not all. This "portfolio choice" model predicts that in presence of minimum wages, employment falls below the competitive level and law gives rise to a full compliance employment effect even if there is only partial compliance. Basu, Chau and Kanbur (2010) develop an incentive compatible equilibrium model and predict that the response of employment to minimum wage rise can be positive, negative or subdued, depending on the level of minimum wage and enforcement.

Despite these theories, the empirical literature on the evaluation of minimum wages is silent on the interactive effect of minimum wages and enforcement. This paper attempts to bridge this gap between the theory and the empirical literature. Moreover, studies in the minimum wage literature are typically based on parametric regression methods that restrict the functional form of the relationship between minimum wages and outcomes. However, this paper, in addition to the standard parametric methods, motivated by the non-linear theoretical predictions, assumes away any functional form on the minimum wage variable and estimates a set of semi-parametric regressions using splines.

The construction industry is chosen because it is the second largest employer in India, after agriculture, employing 32 million workers. It is a dynamic industry that contributed to 8% of the country's Gross Domestic Product in 2011-12 and grew at 14.58% on average between 2000-01 and 2011-12. Despite the growth and employment generation in the construction industry, the majority of workers are unskilled, have little job security, and receive wage

payments below the minimum wage[1]. In 2009-10, 52% of the construction workers nationwide

received wages below the minimum; state specific noncompliance varied from as low as 4% to

as high as 90%. Low wage unskilled workers are usually not employed directly by construction

companies, but through contractors and middlemen who exert considerable monospony power in

hiring[2]. These are low wage workers for whom minimum wages are relevant and binding, and an

evaluation of minimum wage policy essential. For these workers, the direction of relationship

between minimum wages and employment is a direct test of labor market monospony and the

effectiveness of minimum wage as a welfare enhancing tool.

Results indicate that wage elasticity estimates are piecewise nonlinear, but positive for all

ranges of minimum wages. Employment elasticity estimates are positive at the lowest 20% or

25% of the minimum wages, and negative beyond that range, indicating an inverted U-shaped

relationship between employment and minimum wages. Wages and employment elasticity

estimates are robust to the additional of the enforcement intensity variable. Wage elasticity

increase with enforcement intensity. Employment elasticity estimates at the lowest 25% of the

minimum wage distribution decrease with enforcement intensity. These results imply that a

minimum wage has the potential to increase the wage levels, and more effectively so with better

enforcement. Moreover, when set at an appropriate level, a legally set minimum wage increases

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[1] Semi-skilled and unskilled workers are defined based on the occupational classification as reported by the workers in the National Sample Survey. In this paper, occupational categories, 712, 714 and 931, under India's National Occupational Classification, 2004 are classified as unskilled and semi-skilled.
[2] Self-Employed Women's Association (2005) reports from a worker survey in Ahmedabad, that more than 87% of workers receive work through contractors. They further state that the "prevalent practice is that the owner employs contractors who undertake the task of supplying both labour and materials, and also of supervising the building. In larger works, the main contractor hires specialised "labour contractors" who are generally themselves skilled construction workers, often masons, but whose task is to supply, supervise and pay the labour at a construction site."contractors" who are generally themselves skilled construction workers, often masons, but whose task is to supply, supervise and pay the labour at a construction site."

the level of employment at the intensive margin. Further, these findings empirically corroborate the monosponistic nature of markets in India, and establish the effectiveness of an appropriately set minimum wages as a welfare enhancing tool.

The rest of the paper is organized as follows. Section 2 presents an overview of the literature without attempting to be exhaustive. Section 3 provides institutional details that help clarifying the identifying assumptions. Section 4 describes the data, section 5 presents the methodology. Section 6presents the results. Section 6 concludes the paper and discusses the implications.

2. EXISITNG EVIDENCE ON THE IMPACT OF MINIMUM WAGES AND ENFORCEMENT

The "new minimum wage" literature that began in the early 1990s could be categorized along two important dimensions. The first division is based on methodology, the two primary types being the case studies approach and the traditional panel approach. While the former focuses on a particular event of a change in minimum wage, the latter approach exploits the state and time variation of minimum wages in the study period. One could also divide the literature into studies based on developed countries on the one hand and studies on developing countries on the other. Wage effects are found to be strongly positive in most studies, and are less a matter of debate than employment effects, for which the results are mixed. For obvious reasons, employment effects are the focus of this review. In the developed country literature, employment effects are usually found to be positive or none in the case studies, but are negative

in the traditional panel studies. Studies on developing countries mainly employ the panel data approach and most of them find negative effects on employment.

(a) Studies based on developed countries

Traditional national-level studies use all the cross-state variation in minimum wages over time. A standard model looks like this:

$$Y_{it} = \alpha MW_{it} + R_{it}\beta + \varepsilon_{it}$$

In the above equation, Y_{it} is the outcome in state 'i' at time 't', and is typically wages or employment; MW_{it} is the minimum wage; R_{it} is the vector of control variables which usually includes state and time fixed effects (Neumark and Wascher, 2007).

Neumark & Wascher (1992) were the first to use such a panel approach. They used panel data on state minimum wages and other economic conditions in the period 1973 to 1989, and report that a 10% increase in minimum wages causes a 1-2% decline in employment for teenagers and 1.5-2% decline for young adults. Neumark & Wascher (2007) employ the panel approach and study the interactive effects of minimum wages and EITC on employment. They find a negative effect on teen employment but mixed results for other groups. Dickens, Machin and Manning (1999) estimate a traditional panel specification and use council-level panel data between 1975 and 1992 in eighteen industries covered by wage councils in Britain. They empirically show that minimum wages significantly compress the distribution of earnings and does not have a negative impact on employment.

Case studies typically compare adjoining local areas with different minimum wages around the time of a policy change. Card and Krueger (1994) conclude that New Jersey's 1992 minimum wage increase did not result in the fall in fast food employment and may even have resulted in an increase in New Jersey's employment relative to Pennsylvania. Neumark and Wascher (2000) estimate the effect of the same New Jersey minimum wage increase, employing the same methodology as Card and Krueger (1994), but use payroll data from Unemployment Insurance (ES202) records, instead of the survey data from telephone interviews as by Card and Krueger (1994 and find negative effects on employment. Card and Krueger (2000) correct for reporting time bias and point out inconsistencies in Neumark and Wascher (2000)'s compilation of the payroll data and estimate the effects of the same New Jersey minimum wage increase and find no significant effects on employment.

Dube et al. (2007) evaluate the effects of San Francisco's adoption of an indexed minimum wage, set at $8.50 in 2004 (from an earlier $6.75). They conclude that the increase in minimum wage policy, augmented wages, compressed the wage inequality, and resulted in no significant employment loss in affected restaurants. Dube et al (2010) use county level data from the Quarterly Census of Employment and Wages (QCEW) between 1990 and 2006 in the United States and exploit minimum wage differentials across states in the border counties. They construct a unique dataset - the Contiguous border county pairs dataset - to estimate the within county-pair minimum wage effects. In doing so, they claim to address spatial heterogeneity in employment growth that plague traditional panel studies. They find positive and significant effect on wages but positive and insignificant effects on employment. Dube et al. (2011), motivated by job search theory, estimate reduced form equations using the same data set and

methodology. They find positive effects on wages and employment, but negative effects on hires, separations and turnover rates.

(b) Developing country studies

Studies on developing countries mainly employ the panel data approach and most of them find negative effects on employment. Bell (1997) uses yearly data on wages and employment, estimates a time series model separately for Mexico and Columbia, and finds a positive effect on wages (0.17 for Mexico and 0.44 for Columbia) but finds negative effects on employment in both countries (-0.18 for Mexico and -0.33 for Columbia). She also estimates a standard panel data regression using firm data employing firm fixed effects; the estimated elasticity of employment ranges from -0.03 to 0.03 for unskilled workers and -0.01 to 0.05 for skilled workers in Mexico (all estimates are insignificant). For Columbia, the estimated employment effects are negative in all specifications, ranging between -0.15 to -0.33 for unskilled workers and -0.03 and -0.24 for skilled workers. Feliciano (1998) uses firm level panel data on the years 1970, 1980, and 1990, and employs a traditional standard specification. She finds no minimum wage effects on employment for men, but significant disemployment effects for women with elasticities ranging from -0.41 to -0.76. Maloney and Nuñez (2004) use a rotating household panel data set with matched individual data and find negative employment effects (elasticity of -0.15) in Colombia.

A few studies combine individual level outcomes with aggregate policy variables, and estimate a model similar to the traditional panel model. Montenegro and Pagés (2004) use repeated cross-section data on Santiago from 1960 to 1998, and employ a model, controlling for

individual demographic characteristics, and an interaction of demographic terms and minimum wage indices. They find disemployment effects for young and unskilled workers, but find positive employment effects for women. Gindling and Terrel (2004) exploit the variation created by the consolidation in the number of minimum wages (for each occupation and skills categories) in Costa Rica to study their effects on employment. They use pooled time series and cross section data between 1988 and 2000 and show significant positive wage effects in the covered sector (with an elasticity of 0.10) but no effect on wages of workers in the uncovered sector. A 10% increase in minimum wages lowers employment in the covered sector by 1.09% and decreases the average number of hours worked of those who remain in the covered sector by about 0.6%.

Jones (1997) uses both time series data and firm level panel data to estimate the employment elasticity in Ghana between 1970 and 1991. The time series methods use national data and estimate an elasticitiy of -0.12 using the public sector minimum wage and -0.17 using the private sector minimum wage. In the second part of analysis, she uses two waves of firm level panel data of 200 manufacturing firms; the first wave of data corresponds to the period just before the introduction of the minimum wage in August 1991 and the second wave data correspond to the period immediately after that. Controlling for firm characteristics, region dummies, and capital intensity, employment elasticities with respect to real minimum wages (deflated by unskilled wage) are found to be -6%. When a GAP measure of minimum wage (=0 if wages of workers in firm i exceeded the minimum in wave 1; if not it takes the value of $(MW-W_i)/W_i$)) is used using the same set of controls, she finds positive employment effects; employment increases by 0.25 per firm after the minimum wage change. It is useful to note here

that the firm level effects measured by Jones are similar to the case study approach seen in the US studies, since a single case (although across the country) is considered. Lemos (2004) uses monthly Brazilian household survey data from 1982 to 2000 to estimate a panel model at the regional level. A 10% increase in the nominal minimum wage is associated with an increase in total employment (mean hours of the entire population) by 0.09% (0.1%) in the formal (informal) sector; this can be decomposed into 0.12% (0.24%) increase in the number of hours worked for those working and 0.04% (0.15%) decrease in the number of jobs. After two years of adjustments though, total employment increases by 0.06% (0.04%); hours increase by 0.10 % (0.21%) and jobs decrease by 0.04% (0.17%) in the formal sector (informal).

(c) Documentation of imperfect enforcement and its effects on firm and labor market outcomes

These above studies on minimum wages overlook the imperfect nature of enforcement. In developing countries, and to an extent in developed countries, there is high non-compliance with labor laws, and the *de facto* level of regulation is lower than the *de jure* level of regulation (Ronconi, 2005). Ashenfelter and Smith (1979) found that compliance with the minimum wage law during the early 1970s in the United States was just 64%. Ronconi (2010) found that compliance with employment regulations in Argentina between 1995 and 2002 was merely 48.26%. Other studies find imperfect compliance in Brazil (Lemos, 2004, 2006), Costa Rica (Gindling and Terrell, 1995), Honduras (Gindling and Terrell, 2006), Indonesia (Harrison and Scorse, 2004), Mexico (Bell, 1994), Peru (Baanante, 2005), Trinidad and Tobago (Strobl and Walsh, 2001), and a selection of Latin American countries (Maloney and Nunez, 2004). The introductory section of this paper established the presence of a rich theoretical literature on the

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interactive effects of enforcement on labor market outcomes. Below is a review of the literature (focusing on Latin American countries) on the effects on imperfect and varying enforcement intensities on a number of intra country outcomes such as informal/formal employment, firm size, and productivity.

Almeida and Carneiro (2005) use Brazil's firm level data and administrative data on enforcement of regulations at the city level to show firms employ a smaller amount of informal employment in areas where law enforcement is stricter. Almeida and Cameiro (2007) study the effect of enforcement of labor regulations on unemployment and inequality using city level data from Brazil. They find that stricter enforcement leads to higher unemployment, less income inequality, a higher proportion of formal employment and a lower formal wage premium. Almeida and Carneiro (2009) use firm level data to investigate how enforcement of labor regulations affects firm characteristics in Brazil. They account for endogeneity in enforcement, using the distance between firms and neighboring labor enforcement offices, as an instrument. They show that stricter enforcement of labor regulation constrains firm size and leads to higher unemployment. Ulyssea (2010) use numerical methods and find that increasing enforcement of labor regulations effectively reduces the size of the informal sector, but it also significantly increases unemployment and leads to substantial welfare losses.

More recently, Ronconi (2010) found that higher enforcement decreased non-compliance under all regulations such as minimum wages, hours worked, paid vacation time and health insurance in Argentina. Almeida and Carneiro (2011) use the municipal level variations in labor inspections in Brazil to find that as a result of an increase in labor inspections, formal

employment rises, informal employment declines, unemployment rises, wages in the top of the formal wage distribution declines, and informal sector wages rises. Almeida and Susanli (2011) use firm level data from 63 countries and exploit the within country variation in the enforcement of firing regulations. They find that firms facing stricter enforcement and higher firing costs are smaller on average.

To summarize, there are two parallel strands of that beg to be bridged. On the one hand, there is a large and growing literature on minimum wage that does not account for imperfect enforcement. On the other hand, there is ample evidence on imperfect enforcement of labor regulations and their effects on informal employment and firm characteristics. It is essential to study the interactive effects of both minimum wage and enforcement, as pointed out in theories.

3. INSTITUTIONS

(a) The minimum wage legislation in India

The Minimum Wages Act 1948 of India legally grants a minimum wages for workers in many industries. The act periodically fixes minimum wages for workers employed in employments listed under the "employment schedule" of the concerned government. The concerned government is either the state government or the central government depending on the industry and sector of work. In India's federal constitutional setup, the labor ministry's programs are in the concurrent list– this means that both the center and state governments pass, implement, and share responsibilities within the same law. Government owned enterprises and firms in the mining and railway sector belongs to the central sphere; rest of the firms fall under the state

sphere. Lists of scheduled employments for which the minimum wages are defined along with their associated minimum wages are maintained by the appropriate government. Employments other than those listed are not covered under the law. New sectors or occupations that cross a minimum threshold level of employment (at least be 1000 workers engaged in that activity in that state) should be added to the list of scheduled employments and assigned a minimum wage. This law is applicable to both informal and formal sectors, as long as the industry they fall into is on the list.[3] India's system of minimum wages is complicated; there exists a large number of minimum wages for different employments in each state. Besler and Rani (2011) find that the central government sets 48 minimum wages for different categories including mining, agriculture and oil extraction, or any corporation under its ownership. State governments altogether set minimum wages for 1,123 job categories making a grand total of about 1,171 different minimum wage rates in India.

The statute requires that minimum wages typically be updated once in at most five years. The text of the law is vague about whether the revision of the 'cost of living' component is mandatory, and this brings in arbitrariness in setting of minimum wage.[4] Further, many scholars observe that in practice minimum wages are infrequently revised by states (Bhagat 1997;

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[3] It is important to note here that in India the definition of formal and informal sector is not defined on the basis of coverage of labor laws, unlike in many countries. Many labor laws in fact are designed specifically for informal sector workers like the contract labor Act 1970 and the Interstate Migrant Labor Act 1979.

[4] To quote verbatim from the law, "Any minimum rate of wages fixed or revised by the appropriate Government in respect of scheduled employments under section 3 may consist of (a) a basic rate of wages and a special allowance at a rate to be adjusted, at such intervals and in such manner as the appropriate Government may direct, to accord as nearly as practicable with the variation in the cost of living index number applicable to such workers (hereinafter referred to as the "cost of living allowance");or (b) a basic rate of wages with or without the cost of living allowance, and the cash value of the concessions in respect of supplies of essential commodities at concession rates, or; (c) an all-inclusive rate allowing for the basic rate, the cost of living allowance and the cash value of the concessions, if any." (Labor Bureau, 2010)

Jhabvala 1998) and that some states have linked cost of living to minimum wages, while others have not. In 2007, 2008 and 2010, 20 states[5] did not report "Dearness Allowance" (DA) as a separate component of their minimum wages. The report on the working of The Minimum Wages Act, 1948 for the year 2010 reports that only 5 States, 3 U.T. and the CLC (Central) have linked wages to periodic revision of D.A. The same report published in 2009 mentions that only 2 States, 1 U.T. and the CLC (Central) have linked wages to periodic revision of DA. Similarly in 2008, only 6 States, 1 U.T. and the CLC (Central) have linked wages to periodic revision of DA. In 2007, only 6 states and the CLC (Central) have linked wages to periodic revision of DA (Labor Bureau, 2010). The arbitrariness arising out of these inconsistencies across time and states provides a useful identification strategy.

Since 90% of the construction industry's work occurs as casual work in the private sector, minimum wages defined by states for construction activities in the private sector are considered. Minimum wages are defined on per day basis. Figure 1 presents the changes in nominal minimum wages over time in different states. Minimum wages in the construction industry changed a number of times in the period of study, between 1999-00 and 2009-10 (more than three times for many states), but there was no change at all for a few states.

(b) The enforcement machinery in India

The profusion of minimum wages, especially across sectors and states, makes enforcement cumbersome, even in theory. Enforcement is weak due to poor human resource capacity and low availability of funds in the state labor departments. Labor laws are designed

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[5] Assam, Arunachal Pradesh, Bihar, Goa, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Manipur, Meghalaya, Nagaland, Orissa, Puducherry, Punjab, Rajasthan, Sikkim, Tripura, West Bengal, Chandigarh, Delhi

such that every officer, inspector, or a commissioner working under the state or central sphere are responsible for enforcing multiple laws. There are 45 central government labor regulations (on which states can make further amendments) and in addition, hundreds of state laws (see Debroy (2005) and Anant et al. (2006))[6]. Consequently, there is a gap between the number of available officers and their demand in enforcing these innumerable acts which, if not anything, definitely reduces the effectiveness of and the pressure on the existing staff. Legally, the enforcement of The Minimum wages Act 1948 is shared between the central and state governments. There is usually a chief labor commissioner and deputy chief labor commissioner, and many regional labor commissioners, assistant labor commissioners, and labor inspectors in every state labor department. There are separate divisions such as those concerning factories, boilers, and shops and establishments, and officers (both commissioners and inspectors) within each division share responsibilities in implementing a number of laws[7]. Some states have separate divisions for administrative convenience[8] and enacting special laws.

Enforcement intensity, measured in terms of human capacity - number of officers per ten thousand workers - has been reducing unambiguously under the minimum wage law (and all the labor laws in India), for the reasons described above. Mean number of officers under the minimum wage law per ten thousand workers across states, which was already low at 6.51 in

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[6] In the concurrent labor department system and the multiplicity of its systems, enforcement of a central law is carried out either by the state government or central government depending on the law and whether the firm is under the central or state sphere.

[7] Interactions with the Chennai labor commissioners during my field work revealed that commissioners and inspectors take responsibilities for multiple laws.

[8] Bihar has a separate directorate of agriculture to ensure proper enforcement of minimum wages Act in the agricultural sector (http://labour.bih.nic.in/Labour.htm). Gujarat has separate labor commission for rural and urban areas (http://labourandemployment.gov.in/)) (Pais, 2007). Maharashtra has a separate Development commissioner for implementing laws related to the unorganized sector (http://www.mahashramm.gov.in/dcl/index_dcl.html).

1999-00, declined to 4.17 in 2009-10 (Figure 2)[9]. The mean for all years taken together is 4.52, indicating that nationwide, there are only 4.5 inspectors for every ten thousand workers. This resource squeeze is associated with an overall decline in the number and the quality of inspections. For evidence on this, see Shyam Sundar (2007) for Maharashtra, Sharma and Kalpana (2007) for Uttar Pradesh and Reddy (2007) for Andhra Pradesh. This phenomenon is possibly associated with declining budget allocation to the enforcement wing in state labor departments. A qualitative study by (Madheswaran, Rajasekhar, & Gayathri Devi, 2005) reveals that labor officers and inspectors have a good knowledge of firms and their activities in their jurisdiction, but find it difficult to conduct inspections due to lack of transport facilities, shortage of time and paucity of funds. Further and importantly, labor inspections are not rigorous, but mostly an occasion for money to pass hands. Many a times, there are collusive agreements between employers and inspectors with the latter turning a blind eye to the non-compliance of laws (Basu, Chau, & Kanbur, 2010).

Until about the beginning of the last decade, inspections of firms were out carried out both in response to complaints and as random checks, universally across all industries. Inspectors were expected to initiate prosecutions against erring employers and establishments. However since the beginning of the last decade, many states started making institutional changes to curtail the power of their labor inspection systems; certain types of firms were exempted from inspections (such as firms in nonhazardous industries, small scale industries and special economic zones etc.), and are also allowed to self-certify compliance. Some states have made inspections less random and compliant based, in certain industries. A possible hypothesis for this

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[9] Although this paper does not focus on the manufacturing sector, a simple statistics on inspectors under the Factories Act also reveals a similar picture. The ratio of number of working inspectors to sanctioned inspectors under the Factories Act declined from 90% in 2001 to 65% in 2009.

behavior is that there are inter-state strategic interactions to attract business investment (Shyam Sundar, 2010). Remarkably corroborating this theory is the manner in which the above changes in the enforcement system are being implemented. Legal notifications are issued as a part of "new industrial policies", offering concessions to potential investors by the state commerce and industry departments, rather than through state labor departments. States offer concessions on labor enforcement and other areas such as taxes, duties and environmental standards[10]. In effect, this paper argues that enforcement intensities are driven mainly by the state's quest for investment, and are exogenous to wages and employment levels.

4. DATA DESCRIPTION

The primary data source for this study are six rounds of the National Sample Surveys (NSS) administered in 1999-2000, 2003-04, 2004-05, 2005-06, 2007-08, and 2009-10. These are cross section surveys conducted at the household level, inquiring on characteristics of the household, the demographic particulars of individuals, their employment status and characteristics. Among other things, every wage earning member of the household is asked to report up to four "activities" they did in the last seven days, which can include looking for work (unemployed), not looking for work (not in the labor force), or working (employed), and if employed, the industry and occupation of the industry they were employed in. Household

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[10]Kanta (2011), Schneider (2004) and Venkatesan (2000) also note that a number of large tax and other fiscal incentives are offered by states within India to attract investment. Vadlamannati (2011), employsspatial econometrics techniques and uses business investment data from 32 states in India between 1991 and 2009 to show that there are game theoretic interactions between states and that the inflow of investment proposals in one state positively affects the investment proposal inflows into other states. They also provide an explanation to state competition. During the early reform period (early 1990s), states with advantages such as, large markets, better infrastructure, skilled labor force, and a large investor base started to benefit, in comparison to less well-endowed states. This in turn puts more pressure on less developed states, and all states for that matter, to increase their competitiveness in order to gain investment.

members also report the number of half days[11] they spend and the total earnings they received on each of these four activities in the last week[12]. Daily wage of workers for an activity is obtained by dividing total earnings on that activity by total days spent on that activity. The final data set consists of unskilled construction workers (classified based on the National Industrial Classification and National Classification of Occupation as defined in foot note 1), and who are educated below middle school, or illiterates. There are 22, 045 observations for all years and states altogether[13].

Minimum wage and enforcement intensity corresponding to the labor force survey years are obtained from the reports on the working of the minimum wage law published by the Labor Bureau, Ministry of Labor & Employment of the Government of India. These reports provide state specific information on minimum wages set in different industries and on the enforcement machinery of the minimum wage legislation for all years[14]. Minimum wages for construction workers defined for each state and year were mapped to workers, accordingly. Enforcement intensity is defined for every state-year pair and not available at the industry level. This data were also mapped into the worker dataset.

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[11]Employment is recorded as number of half days, rather than number of hours. If the person works for 1 hour or more but less than 4 hour on an activity, he/ she is considered 'working' for half-day on that activity. A person is considered 'working' (employed) for the entire day (or two half days) if he/ she had worked for 4 hours or more during the day.

[12]Household members also report labor force information during the reference period of 365 days preceding the date of the survey, but they do not report earnings from this recall and consequently not used for the purpose of this paper.

[13] Number of observations in different regression specification varied based on the missing values in minimum wage and enforcement variables in different states in different years.

[14] The former data are available in table 3 and the latter are available in annexure II of the report.

The descriptive statistics in Table 1 indicate that the vast majority of those employed in the construction industry are men, although the proportion of females has been increasing slowly. Due to breakthroughs in technology, the construction industry is increasingly using sophisticated, skill intensive methods that are more suited to men than women. The average age of the workers in the construction sector increased marginally from 32 to 35 between 1999-00 and 2009-10. Other backward caste represents the majority social group among construction workers, closely followed by scheduled caste in all the sample years. There are more construction workers in rural, compared to urban areas. This is an interesting conundrum, because it is expected that there is more construction activity happening in the urban areas, than rural areas. But these statistics can be reconciled from the fact that the NSS surveys are based on the place of residence (households), and not the place of work. For migrants, who dominate the construction industry, the place of residence is typically in rural areas, while their work site is in urban areas. The NSS captures such short term migratory flows, in the place of residence, the rural areas, which explains the conundrum. On an average across all years, 51% of the construction workers are not literates.

Wages, both real and nominal, have risen in the study period. Table 1 indicates that average nominal daily wages increased from Rs. 58.5 in 1999-00 to Rs. 123.41 in 2009-10. Not only have average real wages risen, but the distribution of real wages has shifted. An overlaid cumulative distribution plot of log real wages in different years indicates that wages in the later years stochastically dominate the wages in the earlier years (Figure 3). The rise in real wages parallels the rise in log real minimum wages; while the former increased from 3.9 to 4.21 between 1999-2000 and 2009-10, the latter rose from 4.01 to 4.21 in the same period (Figure 4).

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The scatter plot of log real daily wages and log real minimum wages (varying at the state-year pair) in Figure 5 show a positive correlation between the two. The non-parametric lowess smoother estimator, overlaid on the scatter plot, estimates a positively correlated, albeit nonlinear relationship between log real wages and log minimum wages.

Employment is measured in half days in the seven days preceding the date of the survey. Table 1 indicates that the mean half days of employment rose from 12.09 in 1999-00 to 12.67 in 2009-10. A histogram of this variable, presented in Figure 6, indicates that work typically is done for even half days (full days) rather than odd half days. This is expected because construction work is usually performed for very long hours, typically 12 hours. There is right censoring at 14 half days, because the recall period is 7 days preceding the survey. The relationship between employment and log minimum wages is unclear from the scatter plot in Figure 7. But a lowess smoother non-parametric estimation in the same graph indicates an inverted U-shaped relationship. This graph provides the first crucial hint towards a monosponistic labor market model, which is encouraging given the narratives about the construction industry and contractors' market power.

5. ECONOMETRIC MODEL AND MAIN FINDINGS

(a) Empirical specification

Higher order flexible parametric regressions and semi-parametric spline regressions are considered, because of the flexibility envisaged by theoretical studies, and the nonlinear lowess smoothing curves obtained in Figures 5 and 7. For monosponistic labor markets, theory predicts

an inverted U-shaped relationship between minimum wage and employment. A particular motivation comes from Basu, Chau and Kanbur (2010), who consider four wage thresholds and predict a piecewise relationship between minimum wages interacted with enforcement intensities, and employment and wages. The thresholds include the monospony wage level, competitive wage level, the endogenously determined wage level based on enforcement intensity, equilibrium marginal revenue product in the increasing order. These four thresholds define five ranges of minimum wages. The theoretical model predicts that the interactive effect of minimum wage and enforcement depends on the level of the minimum wages, particularly based on what range (defined based on the above thresholds), the minimum wages falls into. A minimum wage increase can have a positive, negative or no effect based on the intensity of enforcement, and the level of minimum wage. This piecewise relationship motivated by these theoretical thresholds, call for a flexible functional form.

A flexible model can be generically specified as follows.

$$\mathbf{Y_{ist} = f\,(MW_{st}\,,\ MWst * E_{st}) + \beta_5 *PWGDP + \beta_6 *X_{ist} + D_s + D_t + Dg * t + \varepsilon_{ist}}$$

$$\mathbf{---\,(1)}$$

Y_{ist} represents the individual level outcome for worker `i' working in state 's' at time 't' and could be either (1) log daily wage of a worker, conditional on working in the construction industry, or (2) half days employed in the construction industry in the preceding week, conditional on working in the construction industry. f() is a generic function of minimum wage, MW_{st} (the real minimum wage in state s in time t in 1999-2000 prices) and enforcement intensity at state 's' at time 't', E_{st}, measured by the number of inspectors per ten thousand

workers. Owing to high measurement error in the enforcement variable, the intensity it simply categorized as a dummy variable in the regressions, taking a low or high value based on whether intensity is below or above the median value, respectively. The median value of enforcement intensity is 4.52. The base category in the regressions is low enforcement.

The function f () are additive functions of minimum wages, enforcement, and their interaction. Minimum wages appear either as additive higher order terms (up to the fourth power of minimum wage are considered), or splines representing different ranges of minimum wage. Splines or the higher order terms are interacted with the enforcement dummy and these interaction terms enter additively.

A linear spline is a piecewise linear function or a series of linear line segments spliced together to form a continuous function. Splines are created for desired intervals of the original variable. For instance, a variable X can be transformed in to 'n' linear splines based on n-1 pre-specified knots, or simply as n-1 equally spaced knots or percentiles of data. Splines are constructed such that when used in regression estimations, the coefficients of each of the spline represent the slope measure for that interval[15]. Basic specifications employ (a) 4 splines, created using 3 knot positions at 25th percentile, 50th percentile and 75th percentile positions of the log real minimum wage variable. These positions correspond to 3.987, 4.186 and 4.364 in the data.; (b) 5 splines, created using 4 knot positions at 20th percentile, 40th percentile, 60th percentile, and 80th percentile positions of the log real minimum wage variable. These positions correspond to 3.94, 4.12, 4.27, and 4.43 in the data. Figure 8 and 9 presents the kernel density estimate of log

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[15] Splines could also be constructed so that, when used in regression estimations, the coefficients represent the change in the slope from the preceding interval.

real minimum wages with the knot positions using four and five splines respectively, marked as red reference lines.

PWGDP$_{st}$ is log per worker construction GDP in state 's' at time 't' and controls for local labor market conditions. X$_{ist}$ represents individual demographic characteristics such as, age, square of age, sex, social group, sector, and education. Base category for gender is females. Social groups are coded as binary variables, and the base category is scheduled tribes. Education is also a dummy variable and base category is illiterates. The model also controls for state fixed effects (D$_s$), time fixed effects (D$_t$) and state group specific time-trend (D$_g$ * t) to control for common trends in the outcome variable. Five state groups are defined based on geography – northern states, southern states, central states, north east states, and union territories. The standard errors are clustered at the state level.

(b) Main findings

(i) Wage and employment effects without enforcement

The results of Ordinary Least Square regression of log real minimum wages on log real daily wages (columns 1 and 2) and Tobit regression of log half days employment on log minimum wages (column 3, 4, and 5) are presented in Table 2. Besides minimum wage variables, all regressions include individual characteristics such as, age, age squared, sex, social group, sector, education and state-time varying labor market characteristics such as, log per worker construction sector GDP. Also included, are time fixed effects, state fixed effects and group-specific time trends.

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Results in column 1 indicate that minimum wages have a positive and significant effect on log daily wages. With a quadratic term in column 2, the coefficient on the linear term is positive but higher compared to column 1, and the coefficient on the quadratic term is negative. All effects are significant. Elasticity of minimum wages, at its mean value in both column 1 and 2, are 0.27 and 0.29 respectively. Elasticities at different points in the distribution (10%, 25%, 50%, 75% and 90%) are estimated. Elasticity is positive for all values of the minimum wages in the data, but declines from tenth percentile in moving towards the ninetieth percentile, indicating that maximum benefits from raising minimum wages are obtained at lower levels of minimum wages.

Regression results on the employment variable, censored at the highest value (log (14)), are reported in columns 3, 4, 5, and 6. Column 1 indicates a negative relationship between employment and minimum wages, albeit an insignificant one. A brief glance at coefficients in columns 4, 5, and 6 reveal that results are not robust to functional form specification. This is partly, the motivation for estimating more flexible spline regressions. Column 4 in Table 2 indicates a positive linear term and a negative quadratic term, but both coefficients are insignificant. Column 5 results estimates a positive and significant linear term, negative and significant quadratic term, and positive and significant cubic term. In column 6, the signs reverse: a negative linear term, positive squared term, negative cubic term, and positive fourth order term. The elasticity of employment is negative at the mean level of minimum wages in all specifications, but only significantly so, in models with cubic (-0.11) and fourth order terms (-0.11). A striking point is that, elasticity at the tenth percentile is positive (but not significant), in models in columns 5 and 6, decreases, and becomes more and more negative beyond the quartile value of minimum wage.

Spline regression estimates using four splines and five splines separately, are reported in Table 3. The coefficients of splines can be directly interpreted as elasticities in the corresponding ranges of minimum wage. OLS regression results of wages on four splines and five splines, reported in columns 1 and 2 respectively indicate positive coefficients for all splines (except spline 4 in Column 2 but the coefficient is not significant). The overall function is piecewise non linear; the elasticity estimates are higher for spline 1 compared to spline 2, and higher for spline 3 compared to spline 4. Coefficient for spline 1 is greater than spline 3 in column 1, but lower in column 2. Predicted values of log real wages from spline estimates in column 1 and column 2 are presented in panel 1 in Figure 10 and panel 2 in Figure 11, respectively. The graph mirrors the regression results, indicating an increasing and non-linear relationship between wages and minimum wages.

Effects of minimum wages on employment using OLS and Tobit models are presented for the employment spline regressions, for four splines and five splines separately. The coefficient of spline 1, representing the first quartile of minimum wage, is positive and significant, with elasticity estimates of 10% and 16%[16] from the OLS and Tobit regressions respectively. The coefficients from all other splines are negative, but with significant results only for spline 3. Similarly for the regression with five splines, the elasticity estimates from spline 1 are 13% from OLS and 22% with Tobit regressions respectively, and are significant at 1% level of significance. Spline results for OLS and Tobit can be seen graphically in panels 2 and 3 of

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[16] In a Tobit model, the coefficients of variables are changes in the mean of the latent dependent variable.

Figures 10 and 11, respectively. These fitted values indicate an inverted U-shape relationship between employment and minimum wages.

(ii) Wage and employment effects with enforcement

Introducing enforcement in the regressions does not change the nature of relationship between wage and minimum wage and employment and minimum wages, as obtained in both parametric and spline regressions without enforcement in Tables 2 and 3. The results with enforcement are presented in Table 4 and Table 5. Enforcement dummy takes the value low and high, based on whether inspectors for every ten thousand workers are below or above its median level. In Table 4, Columns 1 presents the results of the OLS regression with a linear minimum wage term, enforcement dummy and an interaction of both. The coefficient on minimum wage terms and its interaction with the enforcement dummy are positive, but the latter is not significant. Coefficient on the first order enforcement dummy itself is negative and insignificant. In column 2, the first order minimum wage term is found to be positive, and the quadratic term is negative, and both coefficients are insignificant. High level of enforcement itself has a negative effect on wages, but the interaction effect of high enforcement and the linear minimum wage term is positive, with the quadratic term is negative. The second panel of Table 4 shows elasticity estimates for low and high enforcement separately. Positive and significant elasticities are obtained in both columns 1 and 2 through the distribution of minimum wages (10%, 25%, 50%, mean, 75%), except the 90% level for column 2.

Employment regressions with parametric minimum wage terms are presented in columns 3, 4, 5, and 6. Column 3 indicates a negative relationship between employment and

minimum wages, albeit an insignificant one. But in columns 4, 5, and 6, the coefficient of the linear minimum wage term is positive, the quadratic term is negative, the cubic term is positive, and the fourth order term is negative. These results are significant, though, only for the regression with the cubic term in column 5. Enforcement dummy in column 3 is negative, but the interaction term is positive, albeit insignificant. In columns 4, 5, and 6, enforcement term is positive, the first order interaction term is negative and the second order interaction term is positive. The elasticity estimates are presented in panel 2, for low and high enforcement separately. Elasticity is negative throughout the minimum wage distribution, for both low and high enforcement, but are significant only in Column 5[17].

Spline regression estimates for enforcement are presented in Table 5. Column 1 and 2 presents results of log wage on minimum wage splines using four and five splines respectively. Minimum wage effects on wages, after adding enforcement, are positive across all splines, except spline 4 in both column 1 and 2, although the coefficients are not significant. The coefficient of the enforcement dummy is negative, although it is not significant. The interaction of splines and the enforcement dummy produces interesting results – it is positive for splines 1 and 2 in both specifications in column 1 and 2, negative for splines 3 and 4 in both column 1 and column 2, and positive for spline 5 in column 2.Predicted values of log real wages from spline estimates in column 1 and column 2 are presented in panel 1 in Figure 12 and 13.

Spline regressions of the employment variable are presented in columns 3, 4, 5, and 6. In columns 3 and 4, the coefficients of spline 1 are positive and significant, with elasticity

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[17] In Column 6, marginal effects could not be estimated in stata due to higher collinear covariance variance matrices obtained in the regression with the fourth order term.

estimates of 11% and 32% from the OLS and Tobit regressions, respectively. The coefficients of all other splines are negative and insignificant. The dummy on enforcement is positive but insignificant and the interaction terms are not significant. The elasticity estimates are presented separately for low and high enforcement in the second panel. For spline 1, the elasticity of employment at low enforcement is positive and significant (this is simply the coefficient of spline 1), and for high enforcement is positive, smaller in magnitude than low enforcement, but insignificant. In regression with five splines, the elasticity estimates from spline 1 are 14% and 42% with OLS and Tobit regressions respectively, and are significant. Interestingly, at higher splines, the coefficients alternate signs, although not significant throughout. The enforcement dummy is positive (and significant in the Tobit regression). Here again the interaction of enforcement and splines alternate in sign, but most of them are not significant. The elasticity results are interesting because the estimated elasticity is positive and significant in both low and high enforcement in spline 1 (13% and 10% respectively) in column 5, with the magnitude slightly lower for high enforcement. The results in column 6 are similar; the elasticity estimates for low enforcement in spline 1 is 41%, and reduces to 10% for high enforcement. The results are consistent across different number of splines and across OLS and Tobit regressions. Spline results for OLS and Tobit can be seen graphically in panels 2 and 3 of Figures 12 and 13, respectively. These fitted values indicate an inverted U-shape relationship between employment and minimum wages.

(c) Discussion of the results

Minimum wages on wages are positive, significant, and nonlinear. The wage elasticity at the mean value of minimum wage is 27% (column 2 in Table 2). Positive elasticity and nonlinearity are also obtained in the spline regressions. Elasticity of wages in the lowest 25% of minimum wages (spline 1) is 49%, for a model with four splines, and the elasticity for the lowest 20% of minimum wages (spline 2) is 52% for a model with five splines (Table 3). When the enforcement dummy is introduced, the minimum wage elasticity remains robust with similar magnitudes. Elasticity of wages (from the quadratic parametric equations in column 2 in Table 5) at the mean value of minimum wages, are 22% for low enforcement, and are higher (26%) for high enforcement. This is intuitive because with stricter enforcement, it is expected that the wages raises further with an increase in minimum wages. Spline regression results, from models using four and five splines (Table 5), estimates an elasticity of 30%, for the lowest 25% and 20% minimum wages respectively. When there is high enforcement, the elasticity is higher at 55%. These results are similar to the parametric results, in that both models predict that higher enforcement increases the elasticity of wage.

In the employment regressions, elasticity estimates are positive at the lower ranges of minimum wages and negative at the higher range of minimum wages. This is an indication of an inverted U-shaped relationship between employment and minimum wages at the intensive margin. These results are again consistent over both parametric and spline regressions, but the results are more pronounced and statistically significant for spline regressions. Table 1 indicates that the elasticity is positive (6% and 9%),though not statistically significant, at the tenth

percentile of minimum wage, in the flexible functional form specifications of columns 5 and 6. The elasticity however is negative and significant at higher levels of minimum wage. In spline regressions, elasticity estimates at the lowest 25% or 20% of the minimum wages are 10%, 16% 13% and 22%, in different specifications, and also significant unlike in the parametric specification. When enforcement is introduced in the parametric model, the elasticity estimates are not robust to the model without enforcement. Further, the elasticity estimates at the tenth percentile, for both low and high enforcement are negative. Spline regression estimates though, are robust to introduction of the enforcement dummy variable. The elasticity estimates at the lowest 25% obtained from the model with four splines are statistically significant at 11% and 32% for OLS and Tobit regressions respectively; for models using five splines, elasticity estimates obtained at the lowest 20%, are 14% and 42% for OLS and Tobit regressions respectively. At high enforcement, elasticity estimates are 7%, 4%, 10%, and 10.9%, respectively for the above four specifications.

6. CONCLUSION AND POLICY IMPLICATIONS

In this paper, employment and wage elasticity estimates are reported for low wage construction workers in India, using flexible parametric and semi-parametric spline regressions. Wage elasticity estimates are piecewise nonlinear, but positive for all ranges of minimum wage. Employment elasticity estimates are positive at the lowest 25% of the minimum wages, and negative beyond that range, indicating an inverted U-shaped relationship between employment and minimum wages. Results on wages and employment elasticity are robust to the addition of the enforcement dummy variable. Wage elasticity estimates increase with the level of

enforcement. However, employment elasticity estimates at the lowest 20% and 25% of the minimum wage distribution decrease with the level of enforcement. These contrastive effects of enforcement on wage and employment elasticities need to be reconciled, by examining the theory more closely.

Some key weaknesses of the current state of this study are identified. These are hoped to be fixed in subsequent revisions to this paper. First, the results on employment elasticity are reported only for the intensive margin, and not for the extensive margin due to data limitations. It is expected that for an industry like construction, there is considerable movement in the extensive margin since work is casual in nature, and job contracts are flexible and short-lived. Consequently, as a next step, the estimations of elasticity at the extensive margin are considered. Second, in subsequent revisions of this paper, estimations based on other semi-parametric estimation methods like quadratic and cubic splines would be considered. Third, my field interactions with construction workers, and certain key policy players in Delhi revealed that minimum wages are more effective in public sector construction works and in huge construction sites that have a lot of workers compared to private construction work and smaller sites with fewer workers. Therefore, I plan to revise my regression models using these two additional variables. Lastly, the results need to be tied to the theory, more effectively.

These results in this paper indicate that a minimum wage policy plays an important role in improving welfare of construction workers. It has the potential to increase the wage levels, and more effectively so, with stricter enforcement. Moreover, when set at an appropriate level, a legally set minimum wage increases the level of employment at the intensive margin. This effect

on employment is muted at higher levels of enforcement, but nevertheless positive. For the

minimum wage literature itself, the implications are twofold. This is the first paper to estimate

the interaction effect of enforcement and minimum wages on wages and employment. Further,

while most papers in this literature employ a non flexible parametric regression models, this is

the first paper to successfully test theories on the effects of minimum wages using flexible semi-

parametric methods.

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Figure 1: Changes in minimum wages of the construction industry over time in different states
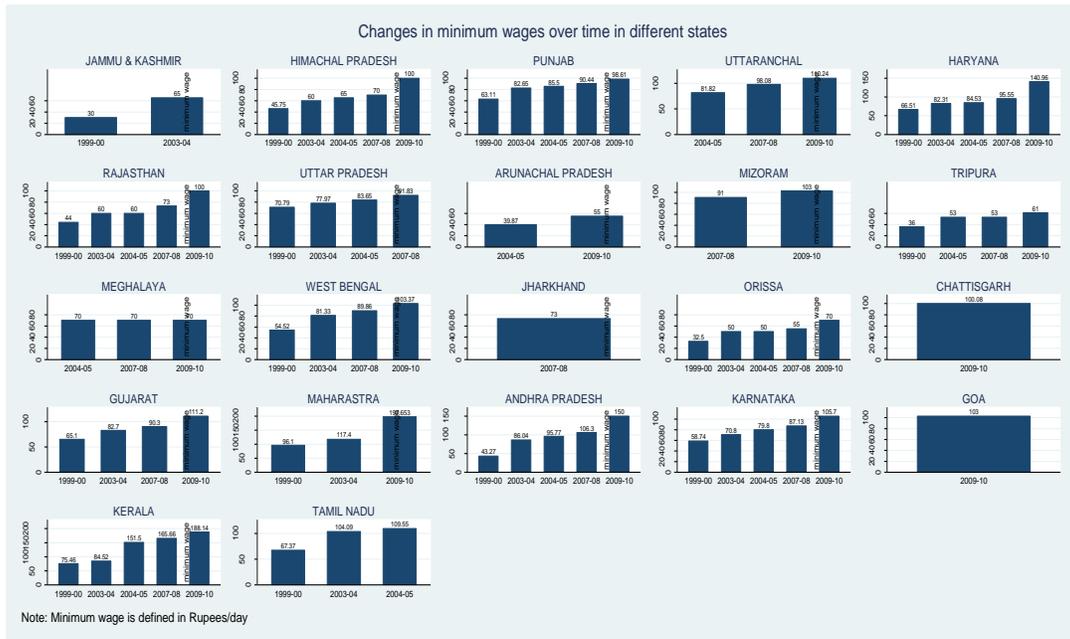
**Source: Ministry of labor and employment (2001, 2005, 2006, 2007, 2009, 2010)**

Figure 2: Number of inspectors per ten thousand workers
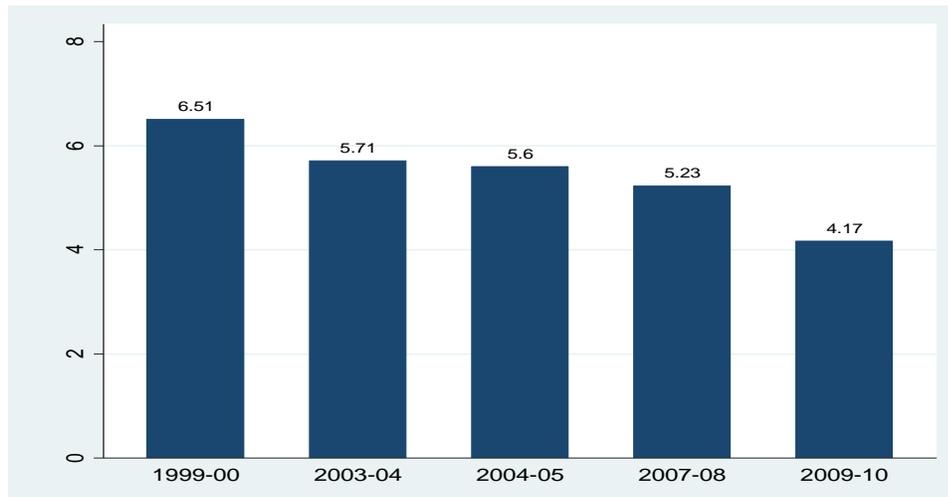
Source: Ministry of labor and employment, 2010

Figure 3: cumulative distribution of log real daily wages across years
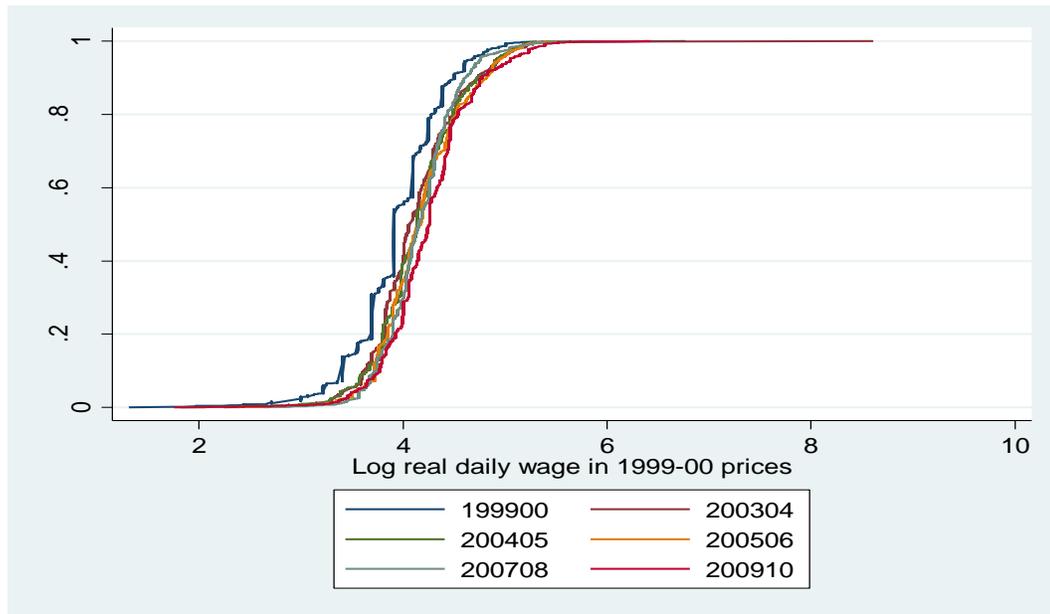
Figure 4: Mean of log real minimum wage (blue) and log real daily wage (red)
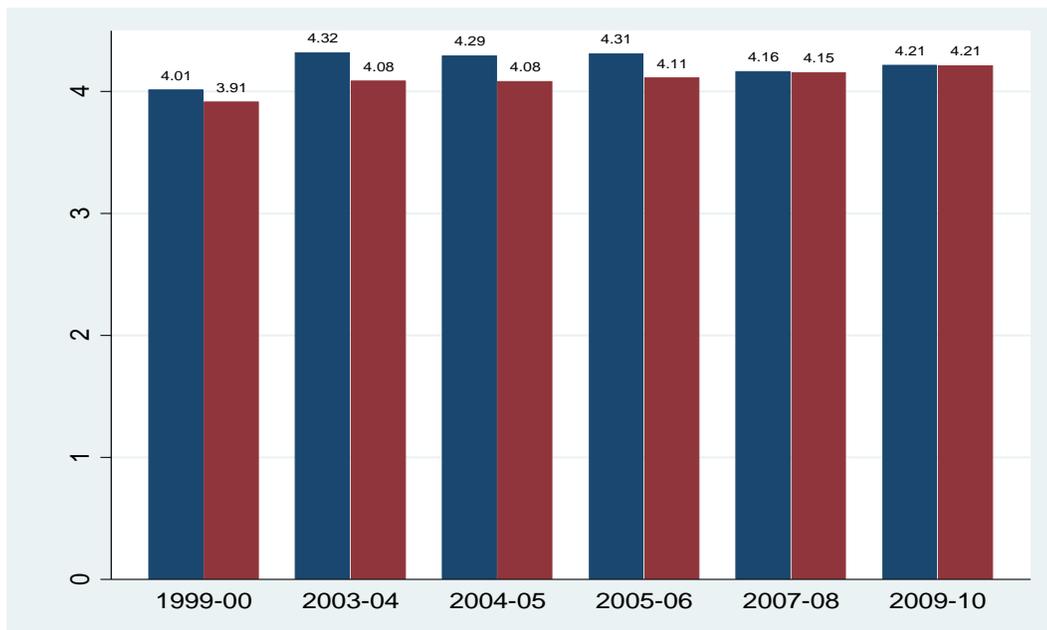
Figure 5: A simple scatter plot of log daily wage on log minimum wage across all years shows a positive, albeit nonlinear relationship. A lowess smoother fit is superimposed.
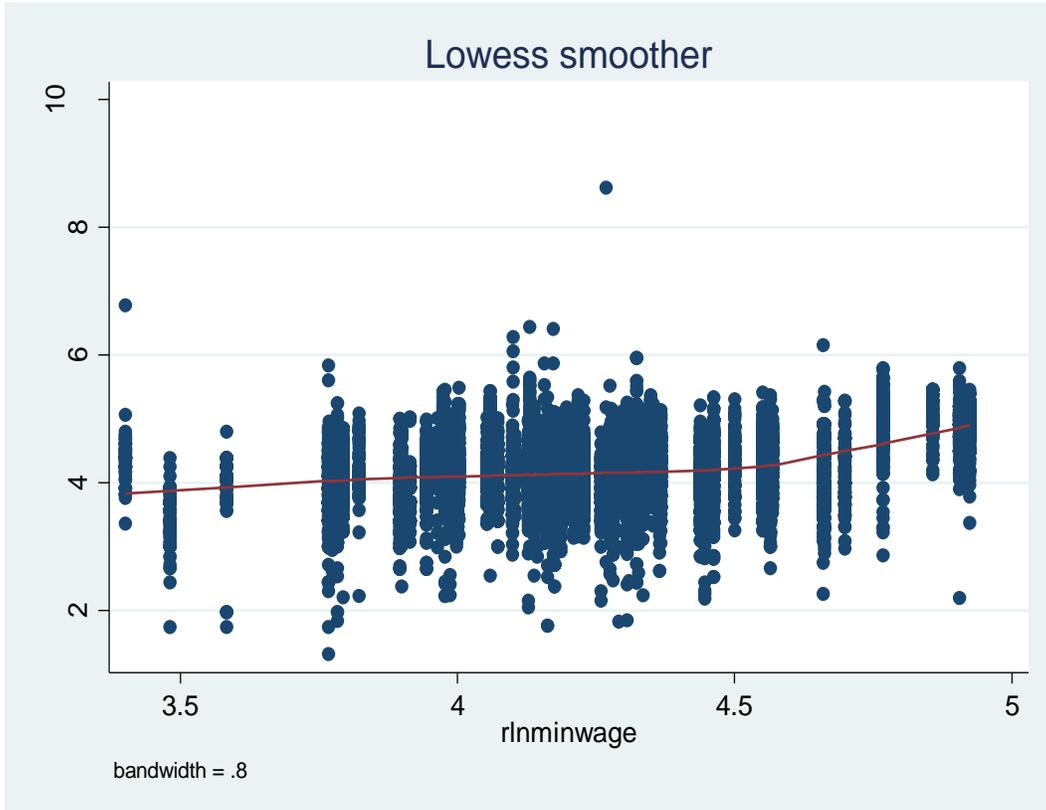
Figure 6: Histogram of half days of employment in the construction sector
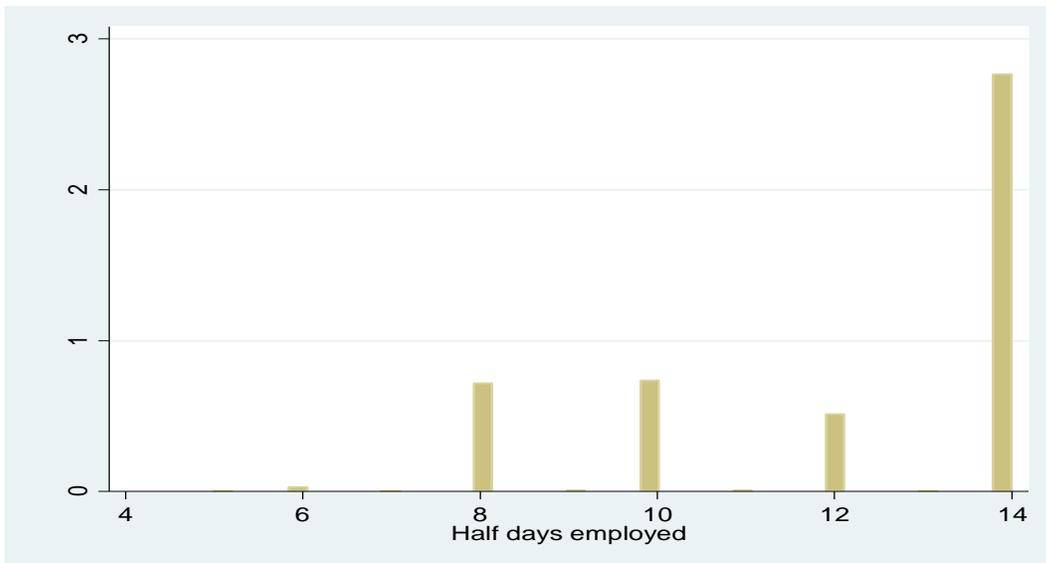
Figure 7: A simple scatter plot of log daily wage on log minimum wage for all workers shows a positive, albeit nonlinear relationship. A lowess smoother fit is superimposed.


Lowess smoother

bandwidth = .8
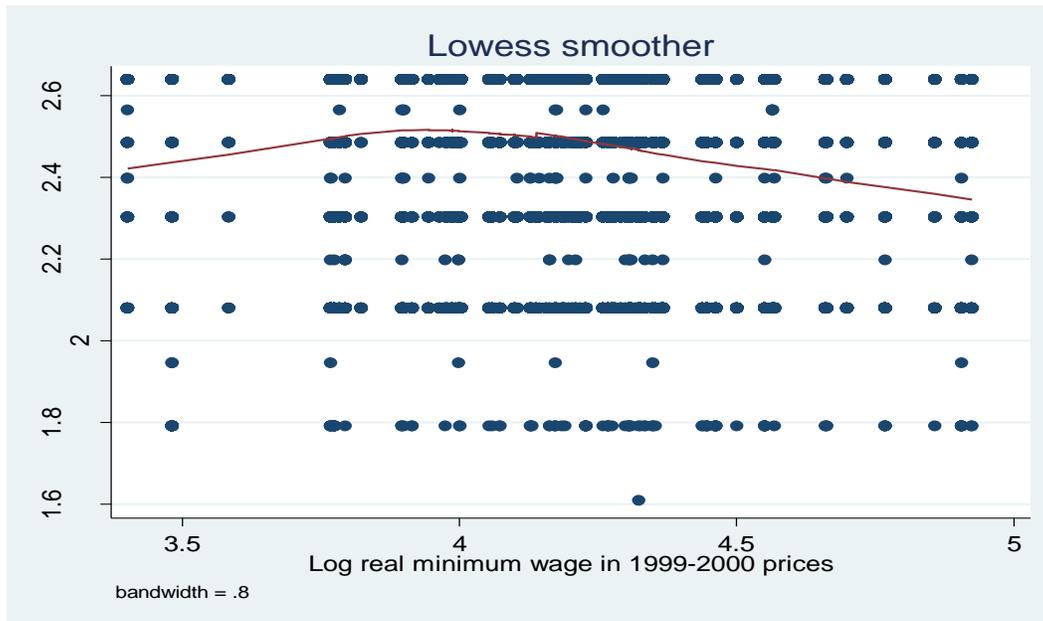
Figure 8: Kernel density estimate of log real minimum wages with knot positions – 4 splines

Kernel density estimate

kernel = epanechnikov, bandwidth = 0.0345
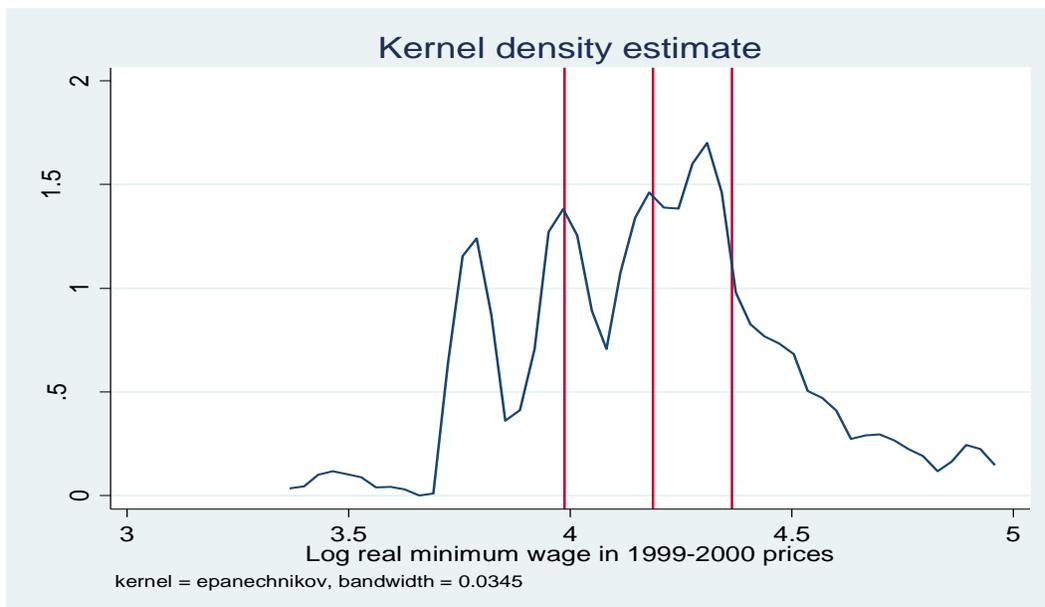
Figure 9: Kernel density estimate of log real minimum wages with knot positions – 4 splines

Kernel density estimate

kernel = epanechnikov, bandwidth = 0.0345
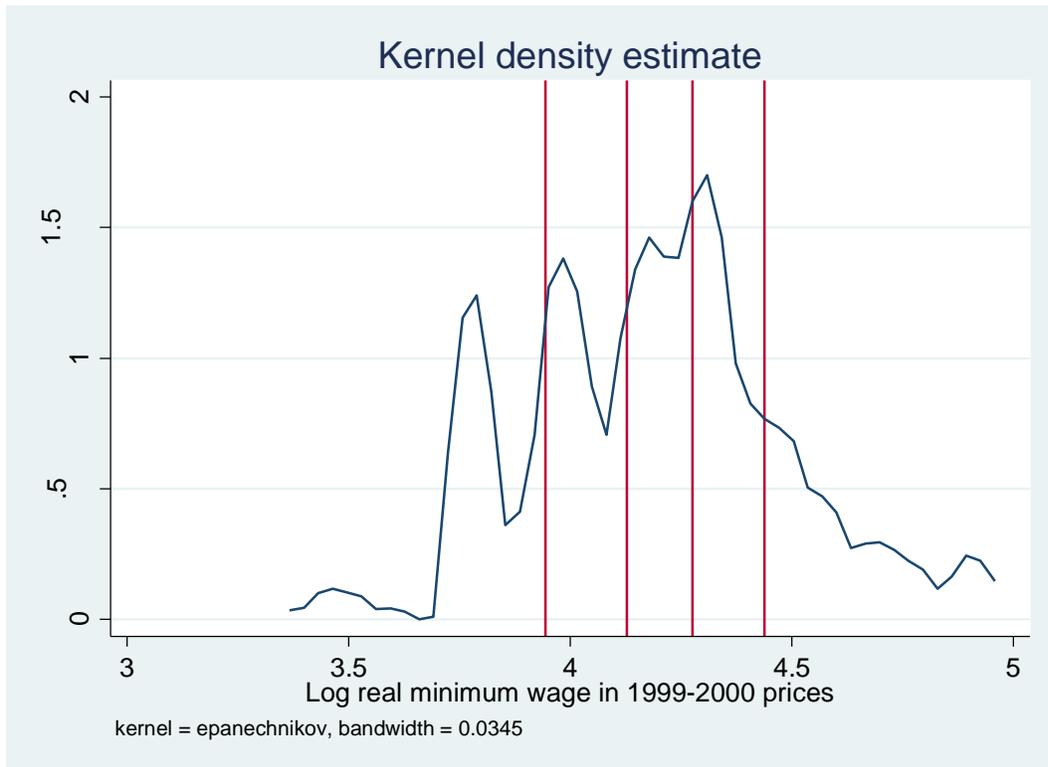
Figure 10: Fitted values of wages and employment from spline regressions (4 splines)
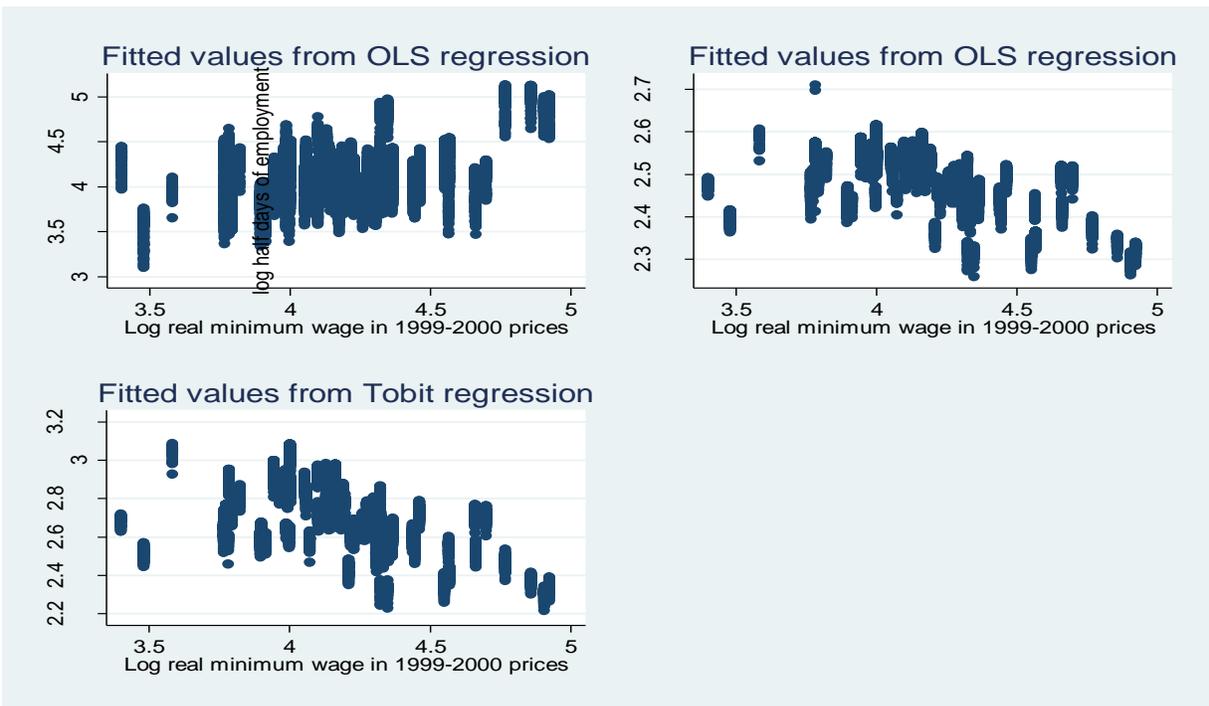
Figure 11: Fitted values of wages and employment from spline regressions (5 splines)
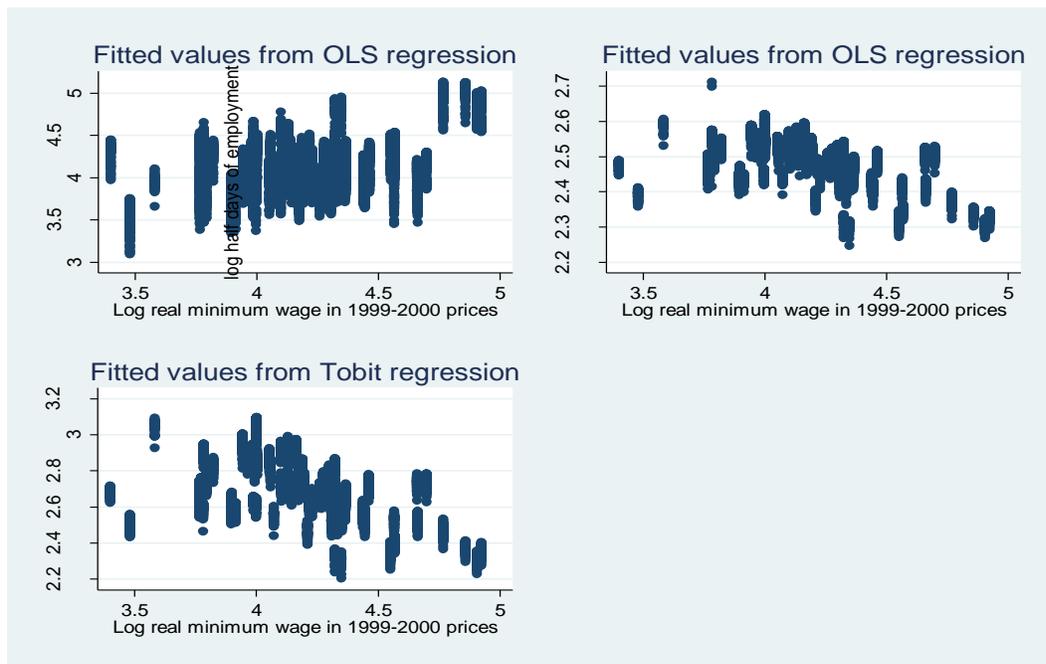
Figure 12: Fitted values of wages and employment from spline regressions with enforcement (4 splines)
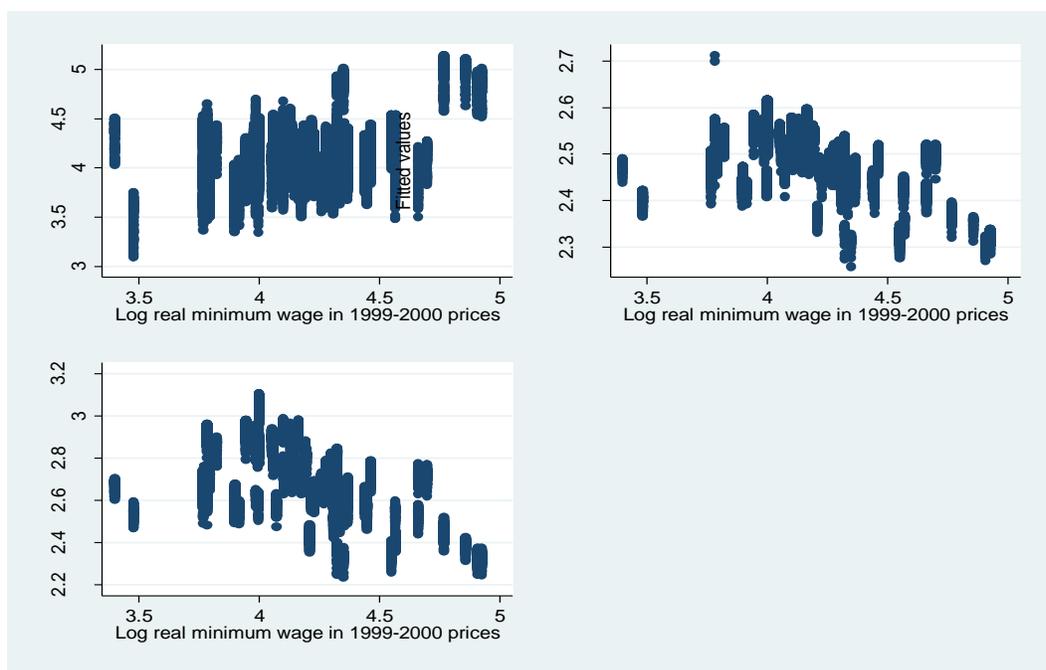
Figure 13: Fitted values of wages and employment from spline regressions with enforcement (5 splines)
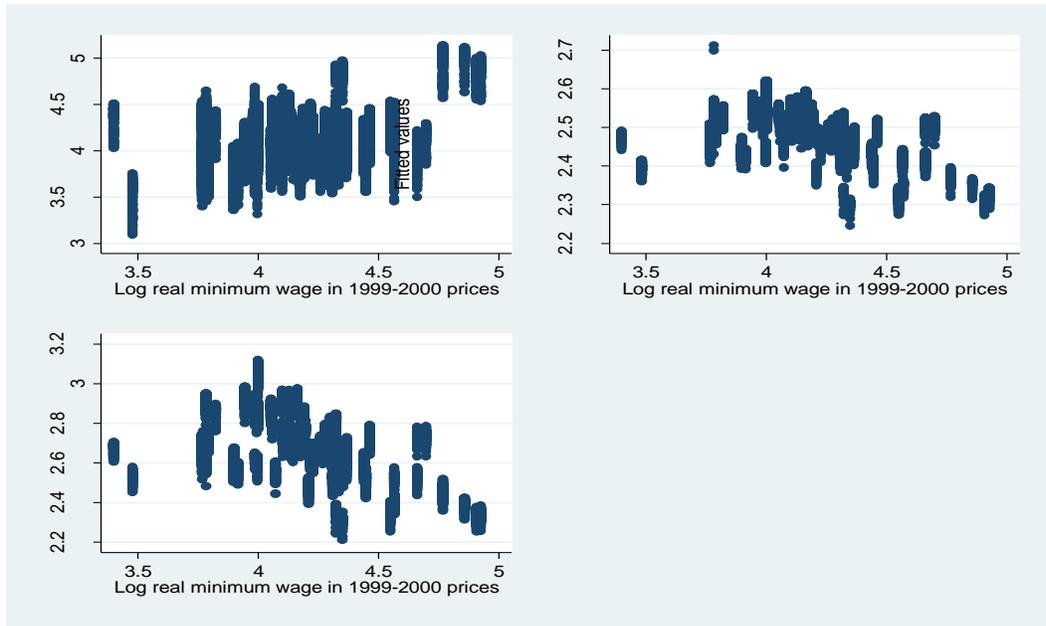
Table 1: Descriptive statistics

|	1999-00	2003-04	2004-05	2005-06	2007-08	2009-10
Sex						
Male (sex=1)	85.15	84.25	86.99	88.31	84.93	81.84
Female (sex=0)	14.85	15.75	13.01	11.69	15.07	18.16
Average age	31.49	32.25	32.32	31.64	33.65	34.37
Social group						
scheduled tribe	14.33	18.67	10.81	11.47	18.41	15.60
scheduled caste	30.48	34.58	38.61	44.93	31.11	30.31
other backward classes	35.16	33.08	39.45	34.77	35.18	38.40
Others	20.03	13.67	11.13	8.82	15.29	15.68
Sector						
Rural	66.06	72.00	76.54	77.60	78.27	76.49
Urban	33.94	28.00	23.46	22.40	21.73	23.51
Education						
Not literate	51.94	66.55	49.07	44.28	56.42	40.08
Literate: below primary	14.76	24.11	11.96	11.97	0.46	15.45
Primary	17.30	7.21	19.64	22.46	17.17	21.41
Middle	16.00	2.13	19.33	21.29	25.95	23.07
Half days employment	12.09	11.78	11.89	12.03	12.20	12.67
Average nominal daily wage	58.51	73.02	72.71	76.17	88.43	123.41
Average nominal minimum wage	60.02	82.38	84.43	88.24	88.70	117.94

Table 2: Parametric estimations of log real wage and log employment on log minimum wage

	OLS - log real wages		TOBIT - Log half days of employment			
	(1)	(2)	(3)	(4)	(5)	(6)
log real minimum wage	0.29*** (0.08)	2.009** (0.70)	-.06 (0.05)	0.47 (1.11)	23.7*** (5.82)	-44.45 (72.32)
Quadratic term of log real minimum wage		-0.20** (0.08)		-0.06 (.13)	-5.62*** (1.38)	19.13 (26.51)
Cubic term of log real minimum wage					0.44*** (0.10)	-3.53 (4.28)
Fourth order term of log real minimum wage						0.238 (0.25)
Elasticity						
Elasticity at mean log real MW (4.18)	0.29*** (0.08)	.27*** (.068)	-.06 (0.05)	-0.07 (0.06)	-0.11*** (0.031)	-0.11*** (0.03)
Elasticity at tenth percentile of log real MW (3.78)		0.44*** (0.11)		-.01 (0.11)	0.06 (0.07)	0.09 (0.11)
Elasticity at quartile MW (3.98)		0.35*** (0.08)		-.04 (0.07)	-0.13*** (0.05)	-.10 (0.08)
Elasticity at median MW (4.1868)		0.27*** (.068)		-0.07 (0.06)	-0.22*** (0.05)	-.24*** (0.05)
Elasticity at seventy fifth percentile of MW (4.364)		0.20*** (0.06)		-0.09 (0.08)	-0.21*** (0.04)	-.27*** (0.07)
Elasticity at ninetieth percentile of MW (4.56)		0.11 (0.07)		-0.12 (0.12)	-0.10*** (0.04)	-0.16* (0.08)

Note: Robust standard errors clustered at the state level in parentheses; All regressions control for covariates such as, age, age squared, sex, education, social group, state and time fixed effects and state group specific time trend. The Tobit regression is censored at the top at log(14). *** - p value is less than -0.01; ** - p value is between 0.05 and 0.01; ** - p value is between 0.1 and 0.05.

Table 3: Spline regressions of log minimum wage

	Log real wages		Log half days employment			
	OLS	**OLS**	**OLS**	**TOBIT**	**OLS**	**TOBIT**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Spline 1	0.49***	0.52***	0.10**	0.16**	0.13***	0.22***
	(0.10)	(0.12)	(0.04)	(0.08)	(0.04)	(0.08)
Spline 2	0.14	0.06	-0.07	-0.13	-0.07	-0.17
	(0.18)	(0.24)	(0.07)	(0.17)	(0.06)	(0.16)
Spline 3	0.44**	0.81**	-0.18*	-0.40*	0.03	0.12
	(0.17)	(0.31)	(0.10)	(0.21)	(0.09)	(0.23)
Spline 4	0.07	-0.23	-0.02	-0.04	-0.42***	-0.91***
	(0.06)	(0.39)	(0.04)	(0.07)	(0.08)	(0.16)
Spline 5		0.19**			0.09**	0.18***
		(0.07)			(0.04)	(0.07)
Constant	1.90***	1.82***	2.11***	2.14***	2.02***	1.94***
	(0.33)	(0.42)	(0.15)	(0.31)	(0.14)	(0.30)
Observations	20,092	20,092	20,093	20,093	20,093	20,093
R-squared	0.42		0.10		0.10	

Note: Robust standard errors clustered at the state level in parentheses; All regressions control for covariates such as, age, age squared, sex, education, social group, state and time fixed effects and state group specific time trend). The tobit regression is censored at the top at log(14). *** - p value is less than -0.01; ** - p value is between 0.05 and 0.01; ** - p value is between 0.1 and 0.05.coefficients of splines represent marginal effect of log minimum wages on outcomes in that interval where the spline is defined.

Table 4: Parametric estimations of log wage and log employment on log minimum wage, enforcement dummy and their interaction

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	OLS of log real wages		**Tobit of half days employment**			
Log real minimum wage	0.27***	1.05	-0.11	0.65	28.77***	58.01
	(0.08)	(0.98)	(0.08)	(1.25)	(8.46)	(112.81)
Quadratic term of log real minimum wage		-0.10		-0.09	-6.82***	-17.36
		(0.11)		(0.15)	(1.98)	(40.48)
Cubic term of log real minimum wage					0.53***	2.21
					(0.15)	(6.42)
Fourth order term of log real minimum wage						-0.10
						(0.38)
Number of inspectors per ten thousand workers (base category – low enforcement)						
High	-0.08	-2.76	-0.26	0.58	9.03	10.23
	(0.28)	(3.11)	(0.31)	(2.57)	(14.34)	(17.70)
High # Log real minimum wage	0.01	1.27	0.06	-0.32	-6.44	-7.32
	(0.07)	(1.42)	(0.07)	(1.16)	(10.40)	(12.91)
High # Quadratic term of log real minimum wage		-0.15		0.04	1.50	1.72
		(0.16)		(0.13)	(2.49)	(3.10)
High # Cubic term of log real minimum wage					-0.12	-0.13
					(0.20)	(0.25)
High # Fourth order term of log real minimum wage						0.00
						(0.00)
Constant	2.77***	1.28	3.06***	1.52	-37.28***	-67.53
	(0.31)	(2.07)	(0.32)	(2.54)	(11.90)	(117.20)
Observations	19,889	19,889	19,890	19,890	19,890	19,890
R-squared	0.41	0.41				
ELASTICITIES (for low and high enforcement separately)						
Marginal effects of minimum wage at mean	.27***	.22***	-0.10	-.10	-.16***	NE
	(.08)	(0.06)	(0.07)	(0.08)	(0.04)	

MW (low)						
Marginal effects of minimum wage at mean MW high	.28*** (.09)	.26*** (0.09)	-0.04 (0.07)	-.05 (0.07)	-.09** (0.03)	NE
Marginal effects of minimum wage at 10% MW – low	.27*** (.08)	0.30** (0.12)	-0.10 (0.07)	-0.02 (0.14)	0.06 (0.07)	NE
Marginal effects of minimum wage at 10% MW – high	.28*** (.09)	0.46*** (0.14)	-0.04 (0.07)	-0.02 (0.14)	0.05 (0.06)	NE
Marginal effects of minimum wage at 25% MW- low	.27*** (.08)	0.26*** (.08)	-0.10 (0.07)	-0.06 (0.1)	-0.18*** (0.05)	NE
Marginal effects of minimum wage at 25% MW- high	.28*** (.09)	0.36*** (.11)	-0.04 (0.07)	-0.03 (0.09)	-0.13* (0.06)	NE
Marginal effects of minimum wage at median MW –low	.27*** (.08)	0.22*** (.06)	-0.10 (0.07)	-0.1 (0.08)	-0.3*** (0.08)	NE
Marginal effects of minimum wage at median MW –high	.28*** (.09)	0.26*** (.09)	-0.04 (0.07)	-0.05 (0.07)	-0.2*** (0.07)	NE
Marginal effects of minimum wage at 75% MW – low	.27*** (.08)	0.19*** (.06)	-0.10 (0.07)	-0.13 (0.09)	-0.29*** (0.09)	NE
Marginal effects of minimum wage at 75% MW – high	.28*** (.09)	0.17*** (.08)	-0.04 (0.07)	-0.07 (0.09)	-0.19*** (0.06)	NE
Marginal effects of minimum wage at 90% MW– low	.27*** (.08)	0.15 (.09)	-0.10 (0.07)	-0.16 (0.14)	-0.16** (0.07)	NE
Marginal effects of minimum wage at 90% MW– high	.28*** (.09)	0.07 (.09)	-0.04 (0.07)	-0.09 (0.13)	-0.08* (0.04)	NE

Note: Robust standard errors clustered at the state level in parentheses; All regressions control for covariates such as, age, age squared, sex, education, social group, state and time fixed effects and state group specific time trend). The tobit regression is censored at the top at log(14). *** - p value is less than -0.01; ** - p value is between 0.05 and 0.01; ** - p value is between 0.1 and 0.05.

Table 5: Spline regressions of log minimum wage and enforcement

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Wages		Employment			
	OLS	OLS	OLS	TOBIT	OLS	TOBIT
Spline 1	0.30***	0.30**	0.11**	0.32**	0.14**	0.42***
	(0.09)	(0.12)	(0.05)	(0.13)	(0.05)	(0.13)
Spline 2	-0.36	-0.34	-0.10	-0.51	-0.13	-0.62**
	(0.30)	(0.29)	(0.13)	(0.35)	(0.09)	(0.30)
Spline 3	0.90***	0.86**	-0.19	-0.29	0.06	0.18
	(0.18)	(0.30)	(0.12)	(0.25)	(0.17)	(0.43)
Spline 4	-0.17	-0.08	-0.00	-0.08	-0.40**	-0.83**
	(0.13)	(0.36)	(0.03)	(0.07)	(0.17)	(0.37)
Spline 5		0.04			0.08*	0.09
		(0.08)			(0.04)	(0.09)
Number of inspectors per ten thousand workers (base category – low enforcement)						
High	-1.08	-1.13	0.14	1.03	0.11	1.12*
	(0.68)	(0.67)	(0.24)	(0.65)	(0.23)	(0.65)
High # spline 1	0.25	0.26	-0.04	-0.28	-0.03	-0.31*
	(0.18)	(0.18)	(0.06)	(0.17)	(0.06)	(0.17)
High # spline 2	0.88**	0.95**	0.07	0.52	0.09	0.52
	(0.33)	(0.40)	(0.19)	(0.43)	(0.12)	(0.33)
High # spline 3	-1.11***	-0.21	-0.00	-0.19	-0.02	-0.06
	(0.31)	(0.43)	(0.16)	(0.33)	(0.17)	(0.47)
High # spline 4	0.17***	-1.32***	0.00	0.09***	-0.09	-0.20
	(0.05)	(0.37)	(0.01)	(0.03)	(0.20)	(0.46)
High # spline 5		0.32***			0.03*	0.15***
		(0.04)			(0.02)	(0.03)
Constant		2.72***			1.99***	1.22***
		(0.44)			(0.16)	(0.43)
Observations	19,889	19,889	19,890	19,890	19,890	19,890
R-squared	0.42	0.42	0.10		0.10	
MARGINAL EFFECTS						

Marginal effects of minimum wage (spline 1 - rlnmw1) – low enforcement	.30*** (0.09)	0.30** (0.12)	0.11** (0.04)	.32** (0.13)	0.13** (0.04)	0.41*** (0.13)
Marginal effects of minimum wage (spline 1 – rlnmw1) – high enforcement	0.55*** (0.12)	.55*** (0.13)	0.07 (0.05)	0.04 (0.14)	0.10** (0.05)	0.109 (0.12)
Marginal effects of minimum wage (spline 2 – rlnmw2) – low enforcement	-0.35 (0.3)	-.33 (0.287)	-0.09 (0.12)	-0.5 (0.34)	-0.12 (0.08)	-.61** (0.30)
Marginal effects of minimum wage (spline 2 – rlnmw2) – high enforcement	0.51** (0.2)	.61** (0.28)	-0.02 (0.09)	0.01 (0.19)	-0.03 (0.06)	-.10 (0.18)
Marginal effects of minimum wage (spline 3 - rlnmw3) – low enforcement	0.9*** (0.17)	0.85** (0.29)	-0.18 (0.12)	-0.29 (0.24)	.05 (0.16)	.18 (0.42)
Marginal effects of minimum wage (spline 3 – rlnmw3) – high enforcement	-0.2 (0.24)	.64* (0.30)	-0.19** (0.08)	-0.48 (0.2)	0.03 (0.08)	0.11 (0.24)
Marginal effects of minimum wage (spline 4 – rlnmw4) – low enforcement	-0.16 (0.12)	-.07 (0.35)	-.002 (0.03)	-0.07 (0.07)	-.40** (0.17)	-0.83** (0.36)
Marginal effects of minimum wage (spline 4 – rlnmw4) – high enforcement	0.0009 (0.12)	-1.39*** (0.384)	0.00001 (0.03)	0.01 (0.07)	-0.49*** (0.08)	-1.02*** (0.21)
Marginal effects of minimum wage (spline 5 – rlnmw5) – low enforcement		.04 (0.07)			0.07* (0.04)	0.09 (0.09)
Marginal effects of minimum wage (spline 5 – rlnmw5) – high enforcement		0.36 (0.07)			0.11 (0.03)	0.24*** (0.07)

Note: Robust standard errors clustered at the state level in parentheses; All regressions control for covariates such as, age, age squared, sex, education, social group, state and time fixed effects and state group specific time trend). The tobit regression is censored at the top at log(14). *** - p value is less than -0.01; ** - p value is between 0.05 and 0.01; ** - p value is between 0.1 and 0.05. Coefficients of splines represent marginal effect of log minimum wages on outcomes in that interval where the spline is defined.