The Effects of Multiple Minimum Wages Throughout the Labor Market*

T. H. Gindling
University of Maryland Baltimore County
Gindling@umbc.edu

Katherine Terrell
University of Michigan
CEPR,IZA,WDI
Terrell@umich.edu

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Abstract

This paper investigates the effects of legal minimum wages on wages, employment, hours worked and monthly earnings among workers covered by minimum wage legislation as well as those for whom it does not apply (the uncovered sector) in Costa Rica. This country's large uncovered sector and complex minimum wage policy, which has for decades set numerous wages throughout the wage distribution, provide a stimulating counterpoint to the U.S. framework for the analysis of the impact of minimum wages. We find that legal minimum wages have a significant positive effect on the wages of workers in the covered sector (with an elasticity of 0.10) but no effect on wages of workers in the uncovered sector. We also find that 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%. Finally, we show that despite the wide range of minimum wages, the largest impact on the wages and employment of covered sector workers is in the lower half of the distribution.

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1. Introduction

Although there has been extensive analysis of the impact of minimum wages on the labor market in the U.S., there is relatively little research on the effect of minimum wages using data from other countries. A search of articles on minimum wages that were published in the leading U.S. and European journals from 1985-2000 shows that only 22 were published using non-U.S. data, compared to over 120 using U.S. data.[1] The fact that so little research exists with non-U.S. data is striking given that minimum wage legislation exists in almost all countries in the world and given the active debate about whether increases in minimum wages have the negative employment effect predicted by the traditional competitive models of the labor market (see for e.g., Card and Krueger, 1994, 1995; Dickens, Machin and Manning, 1999.) As Hamermesh (2002) recently noted, labor economists can learn a great deal about the impact of policies on the labor market from studying countries other than the U.S. since there is generally more variation in these markets, policies and hence, variables of interest. Earlier he wrote: "A major difficulty in evaluating the employment effects of the minimum wage in the United States is the relative lack of exogenous variation in the crucial variable, W_m [the minimum wage]. Since the statutory minimum wage is national in scope, and is altered only infrequently, most of the variation in W_m/W, and modifications of it, arises from variation in the possibly endogenous W [the average wage]. We might thus learn more about the impact of minimum wages by studying economies where there is more independent variation in W_m." (Hamermesh, 1993, p. 190)

We argue Costa Rica is such an economy. In Costa Rica there is more variation in legal minimum wages than in the U.S. since they are typically changed twice a year and they are set for numerous categories of workers (between 19 and 500 occupation/skill categories during 1988-2000). More important is that during the period under study significant changes were made in the structure of minimum wages which resulted in variation over time and within occupations that were exogenous to changes in the labor market. Because we use these frequent exogenous variations to estimate the impact of minimum wages on wages and employment, our results do not suffer from potential endogeneity bias found in many studies.

[1] These numbers are based on the results of searching over three popular search engines: JSTORR, Science Direct and InfoTrac Basic.

There are several additional reasons that make Costa Rica an excellent laboratory for the study of minimum wages and allow us to make a valuable contribution to the largely U.S. based literature. First, minimum wages in Costa Rica have been set at a much higher level (about 70% of the average wage in this period) compared to the U.S., and as such are likely to affect many more workers.[2]

Second, the complex structure of minimum wages in Costa Rica is not uncommon in Latin America (e.g., Argentina and Mexico) and yet ours is the first study that uses the full complexity of legal minimum wages. Hence, our methodology and results are relevant for many other Latin American countries. Moreover, to the extent that studies of the impact of minimum wages in these countries ignore the complexity and instead assume one legal minimum wage applies to all workers, the results of these studies may be biased.

Third, this complex structure also makes an examination of the minimum wage effects throughout the distribution more interesting. Recently, several studies have focused on the effect of changes in legal minimum wages throughout the distribution in the U.S. (Neumark, Schweitzer and Wascher, 2000), Brazil (Faynzilber, 2001; Lemos, 2002) and Britain (Machin and Manning, 1996). However, these studies look at spillover effects from the one low minimum wage whereas we examine how the entire structure of minimum wages directly affects workers at different points of the distribution of skills and wages

A fourth feature of Costa Rica that is also common to many Latin American labor markets is its relatively large uncovered sector, for which the consequences of raising the minimum wage could be negative if the predictions of the two-sector minimum wage model are born out. Approximately one-fifth of the labor market in Costa Rica is not covered by minimum wage legislation as compared to less than one-tenth in the U.S. today. Perhaps because this sector is small in the U.S., it has not attracted the attention of researchers in this country (with the notable exception of Tauchen's (1981) study of the uncovered agricultural sector). However, the impact on the uncovered sector has not been analyzed in other developing countries either. Aside from this paper's predecessors (El-Hamidi and Terrell, 2001; Gindling and Terrell, 1995), we are aware of only two other empirical studies in English that examine the impact on the uncovered sector in a developing country: Fajnzylber (2001) and Maloney and Nunez (2002).

[2] "To find a clear employment effect, one needs to examine a minimum wage that bites rather than nibbles at the edges of the job market." (Castillo-Freeman and Freeman, 1992)

The expected effect of crowding and the subsequently lowered wage in the uncovered sector should be of some concern in general, but especially in developing countries. Given the lack of safety nets in these countries, we would expect that those who lose their jobs because of increases in the minimum wage may not be able to afford to transition to unemployment or leave the labor force, but rather will need to find work in the uncovered sector. If, as predicted by the traditional competitive two-sector model, minimum wage legislation does lead to lower employment and higher wages of (the remaining) workers in the covered sector and higher employment at lower wages in the uncovered sector, the welfare implications of this policy are important and beg analysis.[3]

In this paper we analyze the effects of minimum wages on wages, hours and employment of workers covered by minimum wage laws (covered sector) as well as those not covered by the legislation (uncovered sector). We use cross-section/time-series data from annual household surveys conducted from 1988 to 2000. Using detailed information in the minimum wage laws and definitions of the occupational categories in the surveys, we assign a specific minimum wage to over 350 different occupational/skill categories of workers in each year. We estimate the wage, employment and hours worked effects separately for the covered and uncovered sectors. In addition, we estimate the effects across the distribution of wages and skills using Card's (1996) framework.

We find that legal minimum wages have a significant positive effect on the average wage of workers in the covered sector but no significant effect on the average wage of workers in the uncovered sector. We also find that higher minimum wages lower the probability of employment in the covered sector. Further, we find that higher minimum wages reduce the number of hours worked by those who remain employed in the covered sector. Finally, we also find that minimum wage changes have the largest impacts on the wages, hours and employment of covered sector workers in the lower half of the distribution.

Our estimates of the employment effects of minimum wages are consistent with the lower end of the traditional estimate for the U.S. that a 10% increase in minimum wages reduces teenage employment by 0.5-3%. However, despite the apparently similar magnitude, our estimates represent a larger employment effect in Costa Rica because, while the estimates from

[3] For example, have legal minimum wages played a role in the "informalization" of employment in Latin America in the 1990s? According to many studies, the proportion of workers in the informal sector has increased throughout

the U.S. generally apply only to a relatively small sub-set of low wage teenage workers, our estimates apply to all covered sector workers across the distribution.

2. What do we know? What should we expect?

In this section, we briefly highlight what we know from the existing empirical literature on the effect of minimum wages on covered and uncovered sector employment, hours and wages. Combining this with our knowledge of the Costa Rican labor market, we form some hypotheses as to what we might expect to find.

Regarding employment effects, the commonly accepted estimate from the early time series studies on U.S. data from the 1960s and 1970s was that a 10% increase in the minimum wage reduced teenage employment by 1 to 3% (Brown, Gilroy and Kohn, 1982). Studies which have used more recent data from the United States have generally found smaller, and at times insignificant, employment effects (see Brown, 1999 or Card and Krueger, 1995). Several explanations have been offered for the insignificant employment effects of minimum wages.[4] One argument for the smaller effects when using data from the more recent period (1980s and 1990s) vs. the earlier period is that the real minimum wage in the U.S. has declined to such a low level that it cannot be expected to have a discernable effect.[5] The minimum wage has fallen from around 0.51 of the average manufacturing wage in the 1950s and 1960s to about 0.38 in the 1990s (Ehrenberg and Smith, 1996, p. 118).

Hence, we would expect that a minimum wage that exceeds the equilibrium wage for a substantial fraction of the workforce, i.e., cuts deeper into the wage distribution, will have a larger negative employment impact. Several papers have tested this hypothesis and found it to be true. For example, Castillo-Freeman and Freeman (1992) found the tremendous increases in the minimum wage in Puerto Rico during the 1970s to levels of 70-75% of the average manufacturing wage did in fact "have a bite", although this result has been disputed by Krueger (1994). Rama (2001) and Kollo (2003) examine the consequences of doubling the minimum

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Latin America in the late 1990s (see Ferranti, et al., 2003).

[4] Alternative explanations for these findings range from "offsets" or reductions in other labor costs such as fringe benefits, training, quality of work conditions to compensate for the higher wage to non-compliance, to questions about methodology and finally, to questions about the validity of the traditional competitive model as an accurate depiction of the labor market and suggestions that the monopsony model is a more accurate framework (see Brown, 1999 and Card and Krueger, 1995).

[5] The counter argument is that the studies used the Katz ratio, which has not fallen over time (see Card and Krueger, 1995).

wages in Indonesia and Hungary, respectively, and find negative significant employment effects. Bell (1999) compared the employment impact of the minimum wage in Mexico, where the wage was low and falling throughout the 1980s (from 41% to 31% of the blue collar wage), to its impact in Colombia, where the level of the minimum wage grew and was relatively high throughout the 1980s (from 46% to 52% of the unskilled wage). Using firm level data, she finds that minimum wage increases have a negative impact on manufacturing employment in Colombia but have no employment effect in Mexico's manufacturing sector. Given that minimum wages are between 50-70% of the average wage in Costa Rica and they have not fallen over time (see Table 1), we might expect to find significant negative employment effects.

Another potential dimension by which employment might be affected by a minimum wage increase is hours worked. While there is an extensive literature on the employment effects of minimum wages, few have examined the effects of minimum wages on hours worked. The results from the available studies, which use U.S. data, are mixed.[6] Zavodny (1999) finds that teenagers who remain employed following a minimum wage increase tend to experience an increase in hours worked, which roughly offsets the overall negative employment effect. Similarly, Linneman (1982) finds that average hours worked increase when minimum wage increases for individuals earning near the minimum wage. These make sense in that they imply that employers are demanding more work from existing workers after reducing employment in response to minimum wages. However, more recently, Neumark et al. (2000) find that average hours worked decreases for those workers near the minimum wage but increases for those workers with wages substantially above the minimum wage, implying a substitution effect from low to high wage workers.

The complex structure of legal minimum wages in Costa Rica suggests that we should look for the effects of minimum wages throughout the distribution. Several studies have done this; however, unlike our study, these estimates are based on a single minimum wage and are interested in learning the extent of "ripple" or "spillover" effects. Brown (1999, p. 2149) concludes that the limited evidence from U.S. data "suggests that the increases in minimum wages lead to increases in wages for those above the minimum as well, although these spillovers do not extend very far up the wage distribution." Neumark et al. (2001) have consistent results:

[6] Other than ours, we know of no studies that examine the effect of minimum wages on hours worked in any other developing country.

the wages of workers who initially earning near the minimum wage (including those earning below the minimum) increase but there is no wage affect for workers whose wages are more than three times the minimum wage in 1979 to 1997.[7]

For effects on non-U.S. workers, we turn to the studies by Abowd et al. (1999) of French workers, Maloney and Nunez (2002) of Colombian workers and Fajnzylber (2001) of Brazilian workers. All three use panel data on workers to estimate the impact of the minimum wage on those who are "caught by the minimum wage" as opposed to those who are much higher in the wage distribution, allowing the impact to vary across the wage distribution. Abowd et al. (1999) find employment elasticities for men and women "currently employed at the minimum wage" of 0.0103 and 0.010, respectively. Both Maloney and Nunez (2002) and Fajnzylber (2001) find similar results to those of Neumark et al. (2000). They find that increases in the minimum wage affect wages of low-wage workers more than higher wage workers. However, unlike Abowd et al. (1999), they find the effect is positive and significant throughout the wage distribution. Maloney and Nunez (2002) also find that an increase in the minimum wage has a statistically significant negative impact on the probability of remaining employed and this impact decreases with a rising position in the wage distribution.

What do we know about the effect of minimum wages on the uncovered sector? The two empirical studies of this sector that we are aware of also examine the effect throughout the wage distribution, using the Neumark et al. (2000) methodology. The Maloney et al. (2002) study also estimates wage and probability of employment equations described above (for male full-time salaried workers in Colombia) using data on male full-time self-employed. They find that increases in the minimum wage have a significant positive effect on wages and employment of the self-employed men and the impact is felt for those earning 0.7 to 1.5 of the minimum wage. Fajnzylber (2001) also examines the wage effects for uncovered (informal) salaried workers and self-employed workers in Brazil, using monthly panel data. He finds a positive but falling wage effect throughout the distribution (rather than only at the bottom of the distribution) for both the

[7] Putting together the employment and wage effect, they conclude that low-wage workers are more adversely affected by minimum wage increases than higher-wage workers. Although wages of low-wage workers increase, their hours and employment decline leading to a decline in earned income. On the other hand, higher wage workers have an increase in earned income due to increase in their hours of work, although with no change in their wage.

uncovered salaried workers and the self-employed. Moreover, the sizes of the coefficients for these two uncovered sectors are very similar at each level.

In sum, the empirical literature using both U.S. and developing country data indicates that the employment effects from minimum wage increases tend to be small among low-wage workers and in some cases not significantly different from zero. The hours effect is ambiguous. Studies that estimate the impact of one minimum wage throughout the distribution of wages have found that increases in the minimum affect wages of low-wage workers more than higher wage workers. Two studies of the impact on the uncovered sector found positive effects on the wages of self-employed that are at the low end of the distribution and one study found a negative employment effect for self-employed men earning less than the minimum wage.

3. Minimum Wage Setting in Costa Rica and Endogeneity Bias

Legal minimum wages for private sector employees in Costa Rica are set twice a year by negotiation within the tripartite National Salaries Council, composed of representatives of workers, employers and the government.[8] Public sector employees and the self-employed workers are not subject to minimum wages. One of the criteria for adjusting the average level of minimum wages in Costa Rica is the amount of inflation in the previous period, a practice followed in many countries. [9] Clearly, adjusting the average minimum wage by the rate of inflation reflects changing demand conditions in the economy, which will also affect actual wages and employment levels. Thus, the average changes in minimum wages, wages and employment are determined endogenously. This is a major problem plaguing the empirical minimum wage literature in general. However, we argue that a special feature of Costa Rica's minimum wage policy over this period assures us that we do not have a simultaneity problem in our estimations. During the period under study, the government of Costa Rica implemented a policy of gradually reducing the number of minimum wages from over 500 categories (set by occupation, skill and industry) in 1987 to 19 categories (set by skill only) in 1997. The process

[8] Of these three groups, the representatives of the government have the most influence, and the relative bargaining power of the representatives of the government has increased since initiation of the first Structural Adjustment Plan in the mid-1980s. (Interview with José Pablo Carvajal, Director, National Salaries Council, on May 16, 2002.)

[9] Our description of the process of minimum wage setting in Costa Rica is based on interviews with José Pablo Carvajal (Director, National Salaries Council) May 16, 2002 and July 14, 2003, Yabera Alvarado (Planning Directorate, Ministry of Labor) July 15, 2003 and Pablo Sauma, (former member of the National Salaries Council) May 16, 2002 and July 9, 2003. Ms. Alvarado is writing a detailed history of the minimum wage simplification project, which she hopes to publish in 2004.

of simplification made changes in the relative minimum wage within occupational categories exogenous over this period. In order to convince the reader that this consolidation process was not affected by changes in demand and supply in the labor market, we give a detailed explanation of how minimum wages were set and how this process was implemented.

In 1988, at the beginning of the period under study, all individuals were assigned to a minimum wage category that was defined by a detailed industry and occupational classification.[10] Employees were first classified into a detailed industry category and within this category they were classified according to one of approximately four occupation/skill groups.[11] Professionals were assigned a separate set of minimum wages by type of occupation irrespective of industry of job (e.g., librarians, nurses, accountants, laboratory technicians and drafters in architecture and engineering). Finally, another minimum wage was set for all workers with a five-year university degree (*licenciado)*, the most common terminal university degree in Costa Rica and not surprisingly, the highest minimum wage in most years.

Beginning in 1988, the Ministry of Labor began a gradual process of reducing the number of non-professional minimum wage categories by eliminating the variation in wages given by the industrial dimension. Specifically, the Ministry identified a broadly-defined occupational (skill) category that was to be harmonized across industries and proceeded gradually to increase the lower(est) minimum wage by a greater amount than the higher(est) minimum wage within each occupational category. Over a period of several years, one minimum wage emerged for each broadly-defined skill/occupation, irrespective of industry. By 1997 the industrial dimension of the minimum wage was eliminated completely.[12]

Effectively, this process of eliminating the industry dimension increased the amount of exogenous year-to-year variation in minimum wages for workers because the minimum wages for different occupations/skill categories in each year were increased by different amounts. A

[10] The industrial categories do not correspond to the SIC but the aggregated one-digit categories are similar: agriculture, mining, manufacturing, construction, electricity, commerce, transportation, communications, services. The occupational categories were specific to the industry and also did not correspond to the I.L.O. classification.

[11] For example, workers in match factories (under the broad industry category of manufacturing) were further classified into three occupational categories: specialized workers (primarily supervisors), operators of machinery (skilled workers), and peons and other production workers (unskilled workers).

[12] We calculated the standard deviation of the log of minimum wages for non-professional workers (i.e., without higher education) using a fixed weight distribution of occupations (in the year 2000). The standard deviation falls from 0.22 in 1988 to 0.16 in 1997. This clearly shows that the minimum wages for these workers became less dispersed.

second source of exogenous variation in minimum wage setting arose from the fact that the number of minimum wages for workers with higher education and professionals became more numerous over this period. In 1993 a new minimum wage was set for individuals with two to three years of university education (*diplomados*) and for graduates of five-year technical high schools (*técnicos*). In 1997, another new minimum wage was added for workers with a four-year university degree. By 1997 there were 19 minimum wages: one each for unskilled workers, semi-skilled workers, skilled workers, specialized workers (supervisors) and domestic servants, and numerous minimum wages for professionals.

Appendix Table A.1 summarizes the changes in the level of minimum wages from 1988 to 2000. It shows that there is a range of rate changes every six months, reflecting the harmonization process. Nevertheless, as noted earlier the average minimum wage increase is based largely on the rate of inflation (measured by the consumer price index) in the preceding six months. Although, the average changes in minimum wages, wages and employment are determined endogenously, the minimum wage changes for each occupation/skill category were increased at different rates around this average and these rates do not depend on demand conditions for that specific occupation. Rather, deviations from the average occurred because of the government policy of reducing variation among minimum wages. Therefore, we argue that after controlling for the average change in the minimum wage by year (which we do in the regressions with a set of year-specific dummy variables), any remaining variation in legal minimum wages is exogenous to demand and supply conditions in the labor market, and therefore exogenous to actual wage and employment changes. This implies that our results will not suffer from endogeneity/simultaneity bias that exist in many studies which compare changes in a single minimum wage to changes in actual wages and employment.

4. Data

The analysis uses annual data on: a) legal minimum wages, from decrees published by the Ministry of Labor; b) workers, from the annual *Household Surveys for Multiple Purposes* carried out by the Costa Rican Institute of Statistics and Census; and c) industries, from the Costa Rican Central Bank. The household surveys have been conducted in July of every year since 1976 on approximately 1% of the population; we use data on approximately 10,000 workers each year. Information is available on the individual's demographic characteristics (education, age) and job characteristics (including monthly earnings, hours worked, industry,

occupation, sector and firm size). We create a cross-section/time-series data set for all individuals who work in the private sector, i.e., employees (covered sector) and the self-employed (uncovered sector).[13] In this paper we use only data from 1988-2000 because it is only since 1988 that the occupation categories in the household surveys are sufficiently detailed to be able to adequately match with the detailed occupation /skill/industry categories in the minimum wage decrees.[14]

The structure of legal minimum wages in Costa Rica is depicted in Figure 1 with histograms and kernel estimates of the minimum wage distribution.[15] The figure presents the distribution of real minimum wages (in 1999 colons) among private sector workers who report positive earnings in 1988 (at the beginning of the simplification) and in 1997 (at the end of the simplification process). Spikes in the distribution of minimum wages represent legal minimum wages that apply to larger proportions of workers. For example, starting from the left (the lowest minimum wage) in the 1988 graphs, the first spike is at the minimum wage for domestic servants, who represent approximately 7% of all workers and to whom applies a legal minimum wage of 123 colones (in 1999 prices) or $0.43 (in 1999 U.S. dollars) per hour. There are no minimum wages over a large range of possible wages between the minimum wage for domestic servants and the next minimum wage, which is for unskilled workers (*peones* and other production workers) in most industries. This second spike represents over 20% of all workers. Next there is a cluster of many minimum wages that surround two smaller spikes at the minimum wages for operators of machinery and specialized workers (supervisors) in most industries.

[13]Public sector workers are excluded from the analysis since their wages are governed by a different set of decrees. Unfortunately, it is not possible to match individual observations in the Costa Rican household surveys across years to create panel data.

[14]We use the 3-digit occupational classification available in the household survey, which is not equivalent to the I.L.O. standard classification. For illustration, we present in appendix Table A.2 the two-digit occupational classification found in the Costa Rican survey.

[15]Kernel density estimates differ from the histograms in that the former allow the bandwidth to overlap and allow for different weighting schemes on the x's. In particular, given a kernel K(z), the estimated density function for x is:

$$\hat{f}_k = \frac{1}{nh}\sum_{i=1}^{n} K\left[\frac{x - X_i}{h}\right]$$

where n is the number of observations in the sample and *h* is the bandwidth. The points at which the density is estimated are indicated by x and the data by X_j. In all of our estimates, we evaluate the density at 100 points. In all of our estimates, the bandwidth chosen is 0.02 and the Epanechnikov kernel is used. In general bandwidths are adjusted to be wider where there are few observations, as this allows for sharper fluctuations in the estimated density than seen in a normal by using less smoothing in ranges in which there are many observations.

Finally, at the very right of the distribution of minimum wages (after numerous very small spikes) is a spike at the minimum wage of 578 colones or $2.00 per hour (in 1999 prices) set for *licenciados* (five-year university graduates) who represent approximately 2% of all workers.

The second set of graphs in Figure 1 presents the distribution of (the log of) real minimum wages among workers who report positive earnings for 1997. A comparison of the graphs for 1988 with the graphs for 1997 illustrates the changes in the structure of legal minimum wages. As in 1988, the spike at the far left of the 1997 distribution of wages is at the minimum wage for domestic servants (which again represents approximately 7% of workers) and the second spike occurs at the minimum wage for unskilled workers. However, we can see that the simplification and consolidation process between 1988 and 1997 compressed the distribution of minimum wages around the unskilled wage: while in 1988 the spike at the unskilled minimum wage represented 20% of workers, in 1997 the minimum wage for unskilled workers applies to 45% of workers.[16] Moreover, there are three new spikes in the next range of minimum wages, which in 1988 were not significant: at the minimum wages for semi-skilled workers (12% of workers), skilled workers (14%) and specialized workers (6%). At the same time that the minimum wages for unskilled workers were being compressed, new minimum wage categories for workers with higher education were added, resulting in several new spikes at higher wage levels, including a spike at the minimum wage for four-year university graduates (4% of workers) and at the minimum wage for *licenciados* (2%).

Table 1 presents summary statistics on wages and employment, as well as the size of the sample in each year. The first two columns contain the mean real hourly minimum wage in 1999 Costa Rican *colones* and U.S. dollars, respectively. The next two columns present the mean real hourly wage for workers in the covered and uncovered sectors, respectively. There is a positive correlation between changes in the mean real legal minimum wage and changes in mean real hourly wage in the covered sector (the correlation coefficient is 0.79). There is also a positive correlation between real minimum wages and mean real wages in the uncovered sector, which is however, not as close (the correlation coefficient is 0.59). As we have argued, the correlation between average wages and average minimum wages does not necessarily represent causation because changes in both average minimum wages and average actual wages are related to

changes in inflation and the broader economy. Mean real minimum wages fall slightly from 1987 to 1994 and then increase from 1994 to 2000 by 23%.

The final three columns of Table 1 present three measures of the proportion of workers in the covered sector, all of which increase during the first eight years, when legal minimum wages fall. We also note that the proportions decrease in the 1994-2000 period, when minimum wages rise. These patterns are broadly consistent with the hypothesis that higher minimum wages push workers out of the covered sector and into the uncovered sector and unemployment.

5. Compliance Issues

In order to find an impact of legal minimum wages on wages and employment, minimum wages must be binding in the covered sector (all employees in the private sector). There is ample evidence in the literature that in many developing countries enforcement of legal minimum wages is weak and compliance in Costa Rica is also far from perfect.[17] In an earlier paper (Gindling and Terrell, 1995), we show that on average over 1976-1991 one-third of full-time paid employees earned less than the lowest minimum wage applicable in each year.[18]

Nevertheless, enforcement of minimum wage laws is generally considered to be stronger in Costa Rica than in many other developing countries. Enforcement is carried out by inspectors of the Ministry of Labor and through the complaints made by workers to the National Directorate of Work Inspection. In two recent reports written in this Directorate (Fernandez, et al., 2001; Robles, 2002), we learn that approximately 11% of the businesses in 2000 and 2001 were inspected (some randomly and some as a result of a complaint) for violations of the labor law (in general). In 2000 and 2001, infractions of the minimum wage law was fourth in importance among the fourteen infractions listed. The report indicates that there is some variation in the compliance rates across industries: In 2001 the incidence of reported violations was highest in restaurants (33.1% of all reported violations), food industry (34.8%), wood industry (35.5), educational services and cooperative associations (36.7%) and lowest in the banking sector

[16] We calculated this percentage by directly tabulating the number of workers at each minimum wage. Because the kernel density function smoothes the distribution, the spike at the unskilled minimum wage in Figure 1 is not shown to reach 0.45.

[17] See for e.g., Watanabe, 1976 for a classic article on this topic.

[18] In Gindling and Terrell (1995) we use the lowest minimum wage in each broad industry category. We also show that workers earning less than the minimum are disproportionately female, very young (less than 19 years old), very old (more than 60 years old), have less education, live in rural areas, and work in agriculture or personal services.

(15.2%) and transportation and communication (5.9%), which is still primarily a state-owned sector.

A straightforward method for checking for compliance is to look for spikes in the wage distribution at or around the minimum wage.[19] Studies of the United States have generally found such a spike (e.g., DiNardo et al. 1996 and Neumark et al. 2000) but the evidence of spikes is mixed for developing countries. Castillo-Freeman and Freeman (1992) and Faynzilber (2002) and Lemos (2002) find a significant spike at the minimum wage in Puerto Rico and Brazil, respectively. Whereas Bell (1997) finds evidence of a spike at the minimum wage in Colombia, she does not find any evidence of a spike in Mexico. Maloney and Nunez (2002) find spikes at the minimum wage for workers in the formal sector in Brazil, Chile, Colombia, Brazil, and Honduras but not in Argentina, Mexico or Uruguay.[20] Curiously, Maloney and Nunez (2002) also find spikes at the minimum wage in the distribution of wages for workers in the informal sector in all eight countries. They argue that even though it is assumed that legal minimum wages are not enforced in the informal sector, these spikes in the informal sector represent a "lighthouse effect" of legal minimum wages on informal sector wages.

If legal minimum wages are binding in Costa Rica, spikes in the distribution of minimum wages should be reflected with similarly located spikes in the distribution of wages for covered sector workers. To examine whether this is true, in Figure 2 we overlay kernel density estimates of the log of actual hourly wages for covered sector workers (paid private sector employees with non-zero reported wages) on the kernel density estimates of the distribution of the log of legal minimum wages (same as in Figure 1).[21] We do this for the two sectors (covered and uncovered) and two years: 1988 and 1997.[22] These four graphs make several striking points. First, legal

[19] Since there is never perfect compliance with the minimum wage, a truncation of the wage distribution at the minimum is not expected.

[20] In many of these Latin American countries (Argentina, Brazil and Mexico) multiple legal minimum wages are set depending on the industry, occupation, skill level and/or region of the worker. Maloney and Nunez (2002) check for spikes only at the lowest minimum wage in each country.

[21] In Figure 2, we do not show the (rather long) tails of the wage distributions. Specifically, we do not show the distribution of log wages for log wages below 4 or above 8. We do this to focus on the part of the distribution affected by legal minimum wages.

[22] To facilitate the comparison between the covered and uncovered sectors, we use the same x and y scales to draw the kernel density functions for each sector. Graphs of the distribution of the log of wages and the log of minimum wages for the covered and uncovered sectors for every year for which we have data are presented in appendix Figure A1. In some years the spikes in the distribution of minimum wages and actual wages are not as closely correlated as they are in 1988 and 1997, although in other years the correlations are even closer.

minimum wages are not perfectly enforced in Costa Rica as there are a significant number of workers in the covered sector who earn below the minimum wage. (To the extent that there are errors in reporting wages, this may increase the proportion of workers who seem to be getting less than the minimum wage.) However, legal minimum wages do affect the wages of many workers in the covered sector. In both years, there are two notable spikes: one at the minimum wage for unskilled workers and one at or near the minimum wages for semi-skilled and skilled workers. A third notable spike can be observed in 1997 at the minimum wage for specialized workers. In both years there are also smaller spikes in the distribution of wages near the legal minimum wage for *licenciados* and near the legal minimum wage for domestic servants. In sum, while legal minimum wages affect the largest number of workers in the middle of the distribution, there appear to be affects throughout the entire distribution of wages: The minimum wage for domestic servants (7% of workers) falls in the 2nd decile of the distribution of wages, the minimum wages for unskilled, semi-skilled, skilled and specialized workers fall in the 4th-6th deciles, while the minimum wage for workers with higher education falls in the 10th decile. Finally, unlike in the covered sector, there are no noticeable spikes around the minimum wages for wages of workers in the uncovered sector. [23]

A second way to examine whether workers are getting the minimum wage for their occupation is to calculate the log wage minus log minimum wage for each worker and to plot this for the covered and uncovered sector workers separately. We do this in Figure 3 and we find that indeed a much higher percentage of salaried workers than self-employed workers earn the minimum wage for their occupation. The mode value for log wage minus log minimum wage for salaried employees is zero whereas it is significantly higher than zero for the self-employed.[24]

[23] Our result for the uncovered sector is counter to the findings of Maloney and Nunez (2002), who report a positive impact of legal minimum wages on wages in the informal sector. However they use a different reference group for the uncovered sector. They argue that minimum wages are not effectively enforced among small firms in many developing countries and define the informal/uncovered sector as the self-employed plus paid employees in small firms. This might imply that we should include paid employees in small firms in our definition of the uncovered sector. However, our evidence indicates that minimum wages are binding for small firms in Costa Rica. When we replicated the kernel densities of Figure 2 using data only for paid employees in firms with 5 or less employees, the distribution has notable spikes similar to the kernel densities for all paid workers. Further, when we replicated the regression estimates of the effect of minimum wage changes on actual wages (equation 1) using data for paid employees in small firms, the coefficient on the minimum was significantly positive at the 1% level. Therefore, we continue to use the legal definition for the uncovered sector: self-employed and unpaid family workers.

[24] We thank Charlie Brown for suggesting this measure.

6. Measuring the Effects of Changes in Minimum Wages on Wages

6.1 Estimation Strategy

While the results in Figures 2 and 3 are consistent with the hypothesis that minimum wages are binding for a large group of covered sector workers and not binding for uncovered workers in Costa Rica, these results are only suggestive. The spikes common to the distribution of legal minimum wages and actual wages may not represent the effects of minimum wages on actual wages, but may represent some other phenomenon. For example, rounding in the setting of minimum wages and the reporting of actual wages could result in similar spikes in both distributions. As an alternative test of the degree of minimum wage compliance, we estimate the extent to which changes in the minimum wage affect wages using individual-level pooled cross-section/time-series data (1988-2000) holding constant other factors that might affect wages. Specifically, we estimate separately for the private sector uncovered and the covered sector workers an equation of the form:

$$lnW_{it} = \alpha_o + a_1 lnMW_{it} + X'_{it}\beta + \delta Z_{it} + \sum_{j=1}^{J} \lambda_j OCC_{itj} + \sum_{t=1}^{T} \gamma_t YR_t + \mu_{it,} \qquad (1)$$

where the dependent variable, lnW_{it}, is the log of the real hourly wage (in 1999 colones) of individual i at time t (1988…2000). The explanatory variables include the log of the real minimum wage (in 1999 colones) that applies to that worker's industry/occupation/skill category in each year, $ln\ MW_{it}$. The coefficient α_1 is an estimate of the impact on average actual wages of changes in the legal minimum wage. Other explanatory variables include the vector X_{it}, of individual specific human capital variables (years of education, a quadratic in experience, gender, and full interactions among these variables), and Z_{it}, the value-added in the industry of the individual's job in year t.[25] We also include dummy variables for industry/occupation/skill categories, OCC_{itj} (j = approximately 350), in order to control for occupation-specific fixed effects and for the endogenous correlation of wages and minimum wages across occupation categories.[26] Finally, to control for endogenous changes in yearly average minimum wages (as well as other year-specific factors such as aggregate supply and aggregate demand changes, the

[25] We use the ISIC at the one digit level.

[26] These industry/occupation/skill categories correspond, as best as we can make them, to the categories in the 1988 minimum wage legislation.

timing of minimum wage changes,[27] or design changes in the household surveys) we include a dummy variable for each year, YR_t.

After including these two sets of dummy variables (for industry/occupation/skill and years), our resulting estimates of the impact of legal minimum wages on wages are based only on deviations of each minimum wage from the average minimum wage change within industry/occupation/skill categories over time. We argued in Section 3 that these changes can reasonably be thought of as exogenous.[28]

6.2 Findings[29]

The results, reported in Table 2, indicate that minimum wages have a significantly positive impact on wages in the covered sector (α_1 is 0.103) but do not have a significant impact on wages in the uncovered sector. This result indicates that a 10% increase in minimum wages leads to a 1.03% increase in real wages of covered sector workers, on average. What does our estimated wage elasticity for covered sector workers imply about compliance? The estimated elasticity for all workers in the covered sector, α_1, is equal to the weighted average of the elasticities of the wage with respect to the MW of the directly affected by minimum wages plus the elasticity of the MW with respect to the wage of those not directly affected (where the weights are the proportion of workers directly affected and not directly affected). We calculate a rough estimate of the proportion of workers that we expect to be affected directly by changes in legal minimum wages if minimum wages were fully enforced. We do this by assuming that, in the absence of minimum wage changes, the wages paid to workers in one year would be the same as the wages paid in the next year. Given this assumption, a rough way to measure the proportion of workers that we expect to be affected by changes in legal minimum wages is to calculate the proportion of covered sector workers whose actual wage in year t is between the actual minimum wage for year t and the minimum wage applicable to that worker in the year t +1 (i.e., $MW_t < w < MW_{t+1}$). Using this rough guide, we find on average 20.2% of all covered sector

[27] Minimum wages were set typically in January and July of each year, but sometimes they were set a little earlier or later. See Appendix Table A.1 for the exact timing minimum wage setting over this period.

[28] To further examine whether our estimates can reasonably be thought of as exogenous, we re-estimate equation (1) using minimum wages lagged one year as an instrumental variable. To test for the presence of an endogeneity bias, we estimate an equation that includes both the minimum wage and the instrument as regressors. The coefficient on the instrument is not significantly different from zero, indicating the OLS estimator is consistent.

[29] The standard errors reported in tables 2 and 3 are robust to heteroskedasticity and serial correlation and are corrected for clustering caused by including both micro-level data and a more aggregate variable (the minimum wage variable) in the regressions.

workers are likely to be directly affected by changes in legal minimum wages in the 1988-2000 period. If we further assume that the wages of all workers who earn between the old and new minimum wage are increased to the new minimum wage, then the average wage of these workers would increase by 53% over this period. Finally, if we assume full compliance with minimum wage laws for those workers earning between the old and new minimum wages (and no ripple effects), then a rough estimate of the weighted average of the elasticities of the wage with respect to the MW of those directly affected by minimum wages plus the elasticity of the MW with respect to the wage of those not directly affected would be: (0.202)(0.53) + (0.798)(0) = 0.107. Hence, under perfect enforcement of minimum wage legislation for workers earning near the minimum wage, we would expect a 1% increase in legal minimum wages to increase average wages in the covered sector by approximately 0.107%. Our coefficient estimate is quite close at 0.103, indicating nearly full compliance for wages of workers at or above (and near) the MW at time *t*.

With respect to the uncovered sector, we find no evidence of the positive "lighthouse effect" found by Fajnzylber (2001) and Maloney and Nunez (2002), nor do we find evidence of the negative effect that is predicted by the traditional competitive two-sector model of minimum wages. Why do we not find a negative effect of minimum wages on wages in the uncovered sector? Brown (1999) recognizes that the impact of higher minimum wages on uncovered sector wages may not be negative due to substitution effects. On the other hand, we also recognize that our estimate of the wage effect in the uncovered sector assumes that workers who lose there jobs in the covered sector as a result of a minimum wage increase go into a job in the same industry/occupation in the uncovered sector. To the extent that they do not, we may be underestimating the negative effect of higher minimum wages on wages in the uncovered sector. Further, if most workers who lose their jobs in the covered sector do not find work as self-employed workers but rather become unemployed or work as un-paid family workers, then we would not expect to find a significant negative effect of minimum wages on the wages of uncovered sector workers.[30]

[30] In footnote 33 we present some evidence that this is the case in our robustness tests of the employment effects.

7. Effects of Changes in Minimum Wages on Employment

7.1 Estimation Strategy

Having found that increases in the minimum wage impact wages in the covered sector, we next examine whether employers respond to this by adjusting employment, either by the number of workers employed in the covered sector or the average number of hours worked by covered sector workers. To estimate the effect on the number of workers employed, we use the same estimation strategy as we do for wages, but substitute a binomial variable (whether or not the worker is employed in the covered sector) for the log of wages on the left-hand-side of equation (1):

$$lnEMP_{it} = a_o + a_1 lnMW_{it} + X'_{it}\beta + \delta Z_{It} + \sum_{j=1}^{J} \lambda_j OCC_{itj} + \sum_{t=1}^{T} \gamma_t YR_t + \mu_{it} . \quad (2)$$

where EMP_{it}, equals 1 if the worker is employed in the covered sector while $EMP_{it} = 0$ for the self-employed, unpaid family workers, and those unemployed workers who have worked in the past.[31] We estimate equation (2) with a probit and test for a negative employment effect of legal minimum wages in the covered sector by testing whether $\alpha_1 < 0$.[32]

Similarly, we use equation (2) to examine the effect of minimum wages on the number of hours worked per week in the covered and uncovered sectors, by substituting this variable for EMP_{it}. The direction of the impact of minimum wages on hours worked is ambiguous both in theory and in the empirical literature. If there are fixed costs of employment that are the same no matter how many hours an employee works, then higher hourly minimum wages could result in cost-minimizing employers reducing the number of part-time employees while increasing the hours worked of those who remain employed. On the other hand, employers may view hours worked as another dimension of employment. If this is the case, faced with higher hourly wages,

[31] Workers who lose their jobs in the covered sector because of an increase in the minimum wage could find work in the uncovered sector, become unemployed, or leave the labor force. Therefore, a more complete specification of the excluded sector in the employment equations would include those not in the labor force and unemployed workers who have never worked before. However, it is not possible to assign an occupation to these two groups, and hence it is impossible to determine which minimum wage applies to them. Therefore, we cannot include them in the data used to estimate this equation.

[32] This assumes that workers who lose their jobs in the covered sector then either become unemployed or find jobs in the uncovered sector in the same industry/occupation they left. If some workers who lose their jobs in the covered sector find employment in a different industry/occupation, then our estimates of the employment effect of minimum wages will be affected.

employers in the covered sector may reduce both the number of workers employed and the number of hours worked by those who remain employed. It will be more likely that employers respond to higher legal minimum wages by reducing the average number of hours worked rather than employment if there are costs to firing workers. This is the case in Costa Rica, where legally mandated severance pay is a significant cost (one month's salary for each year the worker has been with the firm).

7.2 Findings

The results for the probit estimates of the effect of legal minimum wages on the probability of being employed in the covered sector are reported in Table 3. The coefficient on the minimum wage variable in this equation is -0.068 and statistically significantly different from zero. Given the coefficient is estimated from a probit, it indicates that a 10% increase in the real minimum wage reduces the probability of being employed in the covered sector by 0.0068.[33] Evaluating this at the mean probability of employment (0.625), we find that a 10% increase in the minimum wage reduces the probability of employment by 1.09%, which can be interpreted as an elasticity of employment (multiplied by 10). [34]

Our employment results are roughly consistent with the descriptive statistics presented in Table 1. For example, from 1994 to 2000 the average real minimum wage increased 23%. Our estimates of the employment effect suggest that a 23% increase in the minimum wage should have decreased the proportion of the labor force employed in the covered sector by 0.016. The actual decline in the proportion of covered sector workers in the labor force from 1994 to 2000 was 0.014 (see Table 1).

Our employment elasticity is in the ballpark of those in the literature. It is larger than the estimate reported by Rama (2001) for Indonesia (less than 0.5%) and similar to the estimates for

[33] We also estimated this equation using OLS; the results are the same as the probit in terms of sign and significance but the magnitude is smaller. The coefficient for this regression was -0.037. We tested for alternative definitions of the employment variable: (a), EMP_{it} =0 if the worker is self-employed or and unpaid family worker (the unemployed are not considered) and (b) EMP_{it} =0 if the worker is self-employed (unpaid family worker and the unemployed are not considered). The coefficient on the minimum wage variable in specification (a) is -0.067 and significant at 10%, while the coefficient on the minimum wage variable in specification (b) is -0.047 but not statistically significant.

[34] In order to convince ourselves that this is indeed an employment elasticity, we carried out the following calculation: The coefficient on the minimum wage variable in the employment equation, α_1, is approximately equal to $\Delta E_c/LF)/(\Delta MW/MW)$, where E_c is the number of workers employed in the covered sector, LF is the number of workers plus the unemployed, and MW is the level of the real minimum wage. Thus, an approximate measure of the percent change in covered sector employment brought about by a 10% change in the minimum wage is $(\Delta E_c/E_c)/(\Delta MW/MW) = \alpha_1*(LF/E_c)*10 = (0.068)(1.6)(10) =1.09$, where LF/E_c is calculated as the inverse of the average E_c/ LF from the final column of Table 1.

Colombia and Puerto Rico. Bell (1997) reports that her estimates imply that a 10% increase in the minimum wage in Colombia reduces low-skilled, low-wage employment by 2%-12% (depending on the lag structure and exact specifications of the equations.) Maloney and Nunez (2002) estimate that a 10% increase in the minimum wage reduces total employment by roughly 1.5% in Colombia. Our estimates are at the upper end of the range of estimated employment elasticities relative to legal minimum wages for teenagers reported in the recent literature examining minimum wage effects in the United States. Traditionally, it has generally been reported that a 10% rise in minimum wages reduces the employment of teenagers by 1% to 3% (Brown, Gilroy and Kohen, 1983.) Time-series studies using more recent data in the United States tend to report effects on teenage employment of 0.5% to 1%, which are at the lower end of the "traditional" range and similar in magnitude to our estimates (Brown, 1999.) However, despite the apparently similar magnitude, our estimates represent a bigger employment effect of legal minimum wages in Costa Rica than in the United States because, while the estimates from the United States generally apply only to a relatively small sub-set of low wage teenage workers, our estimates of the employment effect of minimum wages apply to all workers across the distribution.[35]

The estimated elasticity of average hours worked with respect to minimum wages, also reported in Table 3, indicates that a 10% increase in minimum wages will lower the average number of hours worked by 0.62% in the covered sector and does not have a significant effect on hours worked in the uncovered sector. Hence, our results indicate that in Costa Rica employers respond to higher minimum wages by cutting back on number of hours worked, as well as the number of workers and it appears that the employment effect is larger than the hours effect.

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[35] In addition, as Brown (1999) points out, the estimated coefficients in almost all studies (including ours) are not demand elasticities of the usual sort. Traditional estimates tell you what the effect of minimum wages are on overall employment, but not the elasticity for the workers directly affected by the minimum wage. If we define E* as the employment of those directly affected and w* as the average wage of those directly affected, then a natural measure of the elasticity of demand for these workers would be: $\eta = \delta \ln E^* / \delta \ln w^*$, where $\delta \ln w^*$ = the change in wages of affected workers, assuming all were increased to the new minimum wage. What most traditional studies estimate is $\beta = \delta \ln E / \delta \ln MW$, where $\delta \ln E$ is the proportionate change of employment of the sample (e.g., teenagers, low wage workers or all workers), which will be smaller than $\delta \ln E^*$. On the other hand $\delta \ln w^*$ will be smaller than $\delta \ln MW$ since some workers are close to the new minimum wage. Following Brown (1999, p. 2114) we estimate the employment elasticity for directly affected workers as follows:

$$\eta = \beta [(\delta \ln MW / \delta \ln w^*) / E^*] = (0.109)[0.53/0.202] = 0.286$$

where β is the employment elasticity derived from the probit estimation of equation (1) for the covered sector, $\delta \ln MW / \delta \ln w^* = 0.530$ (the change in wages for E* if their wages were raised to MW_{t+1}). and E* = 0.202 (the share of workers whose wage is $MW_{t+1} < w_t < MW_t$ over 1988-2000), as described in Section 6.2 above.

Since we find that minimum wages raise the wages of covered sector workers and yet lower the number of hours worked, we ask whether the overall effect of wages and hours translates into a positive or negative change in the monthly earnings that the remaining individuals in the covered sector receive. Our results, presented in Table 3, are that the increase in wages is offset by the number of hours worked such that the impact on monthly earnings is not significantly different from zero in the covered sector.

In summary, our evidence indicates that legal minimum wages have significant effects on the covered sector labor market but do not have significant effects on the uncovered sector. Specifically we find the elasticities are positive on wages (0.103), negative on hours (-0.062) and negative on employment (-0.109) in the covered sector. The positive effect of minimum wages on wages and the negative effect on hours cancel each other out such that there is no effect of minimum wages on monthly earnings for those who remain employed in the covered sector.

8. Effects of Changes in Minimum Wages throughout the Distribution of Skills

8.1 Estimation Strategy

As we have seen, legal minimum wages in Costa Rica are set for workers throughout the distribution, hence we naturally want to examine whether the effects of minimum wages on wages, hours and employment vary throughout the distribution. To do so we use the framework developed by Card (1996) to analyze union-nonunion wage differentials. Like Card, we want to measure "treatment" effects at different points of the distribution and since the wage distribution of covered (union) workers is partially determined by the treatment, we must define the deciles using the wage distribution of a control group, i.e., the uncovered (or nonunion) sector. Although there are some caveats with using the earnings of the self-employed (the uncovered sector) as the counterfactual, it can easily be argued that their earnings are determined by market forces and as such are the correct distribution to use.[36]

Following Card's (1996) method, we use a two-step procedure to divide the wage data into "skill" deciles, defined by the distribution of wages predicted from a wage equation estimated with data on uncovered workers. Specifically, in the first step we estimate an hourly wage equation for the uncovered workers using the pooled 1988-2000 data with a set of

[36] The caveats refer to the fact that earnings of self-employed typically include a return to some "entrepreneurial" ability that is not found among employees.

explanatory variables (S) that includes: a quadratic in years of education, a cubic in experience, and a dummy variable for gender, along with terms that fully interact these variables. In addition, we include year dummy variables and interact each of the S variables with year dummies to allow the coefficients to change over the period, as follows:

$$lnW^{u}_{it} = \alpha_o + \sum_{t=1}^{T} \beta^{u}_{t} YR_t + \sum_{t=1}^{T} \gamma^{u}_{j} S^{u}_{ijt} + \sum_{t=1}^{T} YR_t (\sum_{h=1}^{H} S^{u}_{iht} \cdot \rho^{u}_{ht}) + \varepsilon^{u}_{it}. \quad (3)$$

In the second step, the estimated coefficients from equation (3) are used to calculate predicted wages for all workers in the pooled (1988-2000) data set.[37] Deciles are then created from the distribution of predicted wages for all workers in each year. We then proceed to estimate Equations (1) and (2) on each of these deciles to estimate the impact of minimum wages on wages, the number of hours worked per week, monthly earnings, and the probability of employment in each decile.

Table 4 presents the characteristics of the workers in each skill decile. As can be seen, each decile is increasing in the number of years of education and wages. The mean log wages of the actual distribution is quite similar to the wage of the predicted distribution on the upper and lower deciles, but it is lower in the mid range.[38]

8.2. Findings for the Effect of Minimum Wages throughout the Skill Distribution [39]

As we can see from Table 5, in Costa Rica legal minimum wages have an effect on wages, employment and hours worked at various points of the distribution of skills. The estimated elasticities of wages with respect to minimum wages for each skill decile reported in the first column of Table 5 show that legal minimum wages appear to have a positive impact on

[37] We do this for all workers, not just the covered sector, since we want to look at the effect of minimum wages on the entire wage distribution.

[38] However, it is important to recognize that these "skill deciles" do not correspond exactly to the actual wage deciles. In practice, workers in each actual wage decile are found in all of the skill deciles. For example, 78% of the workers who fall in the 4th decile in the actual wage distribution are found in another decile in the skill distribution.

[39] Neumark, Schweitzer and Wascher (2000) write that "previous research has indicated that a significant portion of the total minimum wage effect on employment occurs with a lag of one year" (p.12.) Neumark, et al. (2000) and Maloney and Nunez (2002) include lagged values for minimum wages in their wage, employment and hours equations. We also experimented with the inclusion of lagged values of the minimum wages in the wage, employment and hours equations reported in tables 2, 3 and 5. We found the lagged values to be consistently insignificant at the 10% level in all equations for all skill deciles. We conclude that minimum wages do not affect the Costa Rican labor market with a lag. This is not surprising. In a country where minimum wages are regularly changed twice a year one might expect that the labor market has evolved to adjust rapidly to minimum wage changes.

the wages of workers in every skill decile, however these impacts are only significant for the 2nd to the 5th deciles and in the 10th decile. Moreover, the elasticities are march larger for the lower deciles than for the higher deciles. These findings are roughly consistent with the distribution of minimum wages described by Figure 2, which shows that minimum wage for most workers falls in the 2nd to 6th deciles of the wage distribution, with an additional spike at the minimum wage for university-educated workers in the 10th decile (and very few minimum wages in the 7th through 9th deciles).

The employment effects -- measured in terms of hours and workers -- tend to be negative and larger in the bottom half of the distribution. Either the hours effect or the worker effect are negative and significant in the 2nd through 5th deciles, which is consistent with the decile wage effects described in the last paragraph. Specifically, the effect of minimum wages on the number of workers is negative and significant for workers in the 3rd and 4th skill deciles, while the effect on hours is significant the 2nd and 5th deciles. Neither employment effect is significant in the 6th through 10th or the 1st deciles.

9. Conclusions

Costa Rica, which has for decades set numerous minimum wages that affect workers from the 2nd to the 10th deciles in the wage distribution and where there is a large sector of workers not covered by minimum wages, provides a stimulating counterpoint to the U.S. framework for the analysis of the impact of minimum wages. We have estimated the effects of minimum wages throughout the labor market – in the covered and uncovered sector and across the skill distribution of the covered sector -- in Costa Rica. We have used micro data on approximately 10,000 workers per year over the 1988-2000 period and a methodology that makes use of the multiple minimum wages and the changes in these wages, which we are confident are exogenous.

We find that legal minimum wages have a significant positive effect on the wages of workers in the covered sector, but have no effect on the wages of workers in the uncovered sector. Our estimates imply that a 10% increase in the real legal minimum wage increase average wages in the covered sector by approximately 1%.

We also find that legal minimum wages have significant negative employment effects. Increases in minimum wages lead to decreases in the probability of being employed in the covered sector. Roughly, our estimates imply that a 10% increase in minimum wages decreases

the total level of employment in the covered sector by 1.09%. We also find that minimum wages have a negative effect on another dimension of employment in the covered sector, hours worked. Our results suggest that a 10% increase in the real minimum wage leads to a 0.62% decline in the average number of hours worked by those who remain employed in the covered sector.

Finally, we examined the impact of minimum wages on the wages, employment and hours worked of workers at different points in the distribution of skills. We find that minimum wages in Costa Rica have the largest impact on workers in the bottom half (2^{nd} through 5^{th} deciles) of the distribution.

The results presented in this paper provide evidence of a negative employment effect of minimum wages in a country where minimum wages are set at relatively high levels and throughout the distribution. Specifically, our estimates imply that a 10% increase in minimum wages decreases the total level of employment in the covered sector by 1.09%. This estimate of the employment effects of minimum wages is higher than those reported by Rama (2002) for Indonesia but similar to those reported by Bell (1997) and Maloney and Nunez (2002) for Colombia. Our estimate of the employment effects of minimum wages is also consistent with the traditional estimate that a 10% increase in minimum wages reduces teenage employment in the United States by 0.5-3%. However, despite the apparently similar magnitude, our estimates for Costa Rica represent a bigger employment effect because, while the estimates from the United States generally apply only to a relatively small sub-set of low wage teenage workers, our estimates apply to all workers across the distribution.

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Table 1: Descriptive Statistics, 1988-2000

	Mean Real Hourly Minimum Wage[1]		Mean Real Hourly Wage[1]--Covered Sector[3] (1999 CR colones)	Mean Real Hourly Wage[1]--Uncovered Sector[4] (1999 CR colones)	Proportion of Workers in the Covered Sector[1]		
	1999 CR colones	1999 US dollars[2]			Paid Employees/ (Self-employed + Paid employees)	Paid Employees/ All Workers[5]	Paid Employees/ (All workers[5] + unemployed)
1988	248	0.86	343	463	0.685	0.644	0.613
1989	254	0.89	342	500	0.684	0.647	0.625
1990	249	0.87	347	463	0.680	0.638	0.611
1991	254	0.89	333	464	0.674	0.639	0.606
1992	263	0.92	344	423	0.694	0.664	0.639
1993	259	0.90	377	587	0.694	0.665	0.639
1994	249	0.87	396	630	0.695	0.667	0.642
1995	258	0.90	390	573	0.694	0.664	0.632
1996	282	0.98	384	552	0.688	0.662	0.625
1997	300	1.05	387	573	0.673	0.648	0.614
1998	309	1.08	413	586	0.687	0.660	0.626
1999	320	1.11	427	640	0.689	0.665	0.627
2000	306	1.07	435	609	0.679	0.659	0.628

[1] Using sample weights.

[2] Using official exchange rates for July

[3] The covered sector is defined as all paid employees.

[4] The uncovered sector is defined as self-employed workers

[5] All workers include paid employees, self-employed and unpaid family workers.

Table 2:
Estimates of the Effects of Minimum Wages on Hourly Wages[1]

Sector	Covered Sector[2]	Uncovered Sector[2]
B	.103[b]	0.105
SE[3]	(0.042)	(0.079)
R-Squared	0.384	0.224
N	87,150	37,734

a = significant at 1%

b = significant at 5%

c = significant at 10%

[1]The data used in all regressions are weighted using the sample weights. Explanatory variables in the regressions also include: Years of education, potential experience, experience squared, experience cubed and gender along with full interactions among these individual-level variables, dummy variables for each year and each occupation/skill category in the minimum wage legislation, and value-added by industry. See table A-3 for the full set of coefficients

[2]The covered sector is defined as paid employees. The uncovered sector is defined as self-employed workers.

[3]Reported significance levels are based on estimates of the standard errors that are robust to heteroskedasticity and serial correlation and are corrected for clustering caused by including both micro-level data and a more aggregated variable (the minmum wage variable) in the regressions.

Table 3: Estimates of the Effects of Minimum Wages on Employment[1]

Sector	Covered Sector[2]	Uncovered Sector[2]
Employment (Probit)[4]		
B	-0.068[c]	-
SE[3]	(0.038)	-
R-Squared	0.408	
N	157,952	
Hours (OLS)		
B	-0.062[b]	-0.080
SE[3]	(0.029)	(0.051)
R-Squared	0.167	0.247
N	95,628	45,980
Monthly Earnings (OLS)		
B	0.040	-0.022
SE[3]	(0.036)	(0.077)
R-Squared	0.470	0.347
N	87,150	37,734

a = significant at 1%
b = significant at 5%
c = significant at 10%

[1]The data used in all regressions are weighted using the sample weights. Explanatory variables in the regressions also include: Years of education, potential experience, experience squared, experience cubed and gender along with full interactions among these individual-level variables, dummy variables for each year and each occupation/skill category in the minimum wage legislation, and value-added by industry. See table A-3 for the full set of coefficients

[2]The covered sector is defined as paid employees. For the hours and earnings equations the uncovered sector is defined as self-employed workers.

[3]Reported significance levels are based on estimates of the standard errors that are robust to heteroskedasticity and serial correlation and are corrected for clustering caused by including both micro-level data and a more aggregated variable (the minmum wage variable) in the regressions.

[4] In the probits, 1=covered sector workers and 0=self-employed+un-paid family workers+unemployed. Rather than directly report the coefficients from the Probit equations, in this table we report the marginal effects evaluated at the means of the independent variables. For the Probits we report the pseudo R-squared.

Table 4: Characteristics of Covered Sector Workers in Each Skill Decile

skill decile	Percent w/ Higher Educn	Mean Yrs. of Education	Mean Yrs. Experience	Proportion Male	Mean Log Predicted Wage	Mean Log Wage
1	0	2.79	20.6	0.86	5.35	5.38
2	0	4.51	18.6	0.90	5.51	5.49
3	0	5.21	19.0	0.87	5.60	5.55
4	0	5.43	20.9	0.72	5.67	5.57
5	0	6.08	20.2	0.67	5.73	5.62
6	0	6.51	21.7	0.67	5.79	5.64
7	0	7.36	21.7	0.62	5.85	5.71
8	0	9.34	16.5	0.74	5.98	5.85
9	7	10.85	15.6	0.67	6.13	6.02
10	77	14.01	15.4	0.72	6.51	6.52

Note: The means are calculated using sample weights.

Table 5: Estimates of the Effects of Minimum Wages on the Covered Sector by Skill Decile

	Hourly Wage		Hours Worked		Monthly Earnings		Probit	
Skill Decile	**B**	**SE**	**B**	**SE**	**B**	**SE**	**B**	**SE**
1	0.047	*0.141*	-0.180	*0.139*	-0.130	*0.153*	0.108	*0.103*
2	0.340b	*0.137*	-0.307b	*0.129*	0.031	*0.126*	-0.060	*0.089*
3	0.301a	*0.114*	-0.036	*0.100*	0.232b	*0.118*	-0.217b	*0.086*
4	0.272b	*0.108*	-0.010	*0.087*	0.225b	*0.113*	-0.172b	*0.084*
5	0.197b	*0.099*	-0.163c	*0.090*	0.014	*0.098*	0.013	*0.085*
6	0.107	*0.103*	-0.107	*0.079*	-0.041	*0.105*	-0.126	*0.138*
7	0.136	*0.102*	-0.070	*0.076*	0.069	*0.102*	-0.141	*0.094*
8	0.052	*0.080*	-0.046	*0.067*	0.012	*0.085*	-0.102	*0.073*
9	0.061	*0.064*	-0.016	*0.046*	0.062	*0.064*	0.062	*0.058*
10	0.131b	*0.062*	-0.046	*0.036*	0.068	*0.058*	-0.024	*0.041*

a = significant at 1%
b = significant at 5%
c = significant at 10%

Figure 1: The Distribution of Legal Minimum Wages Among Workers, 1988 and 1997

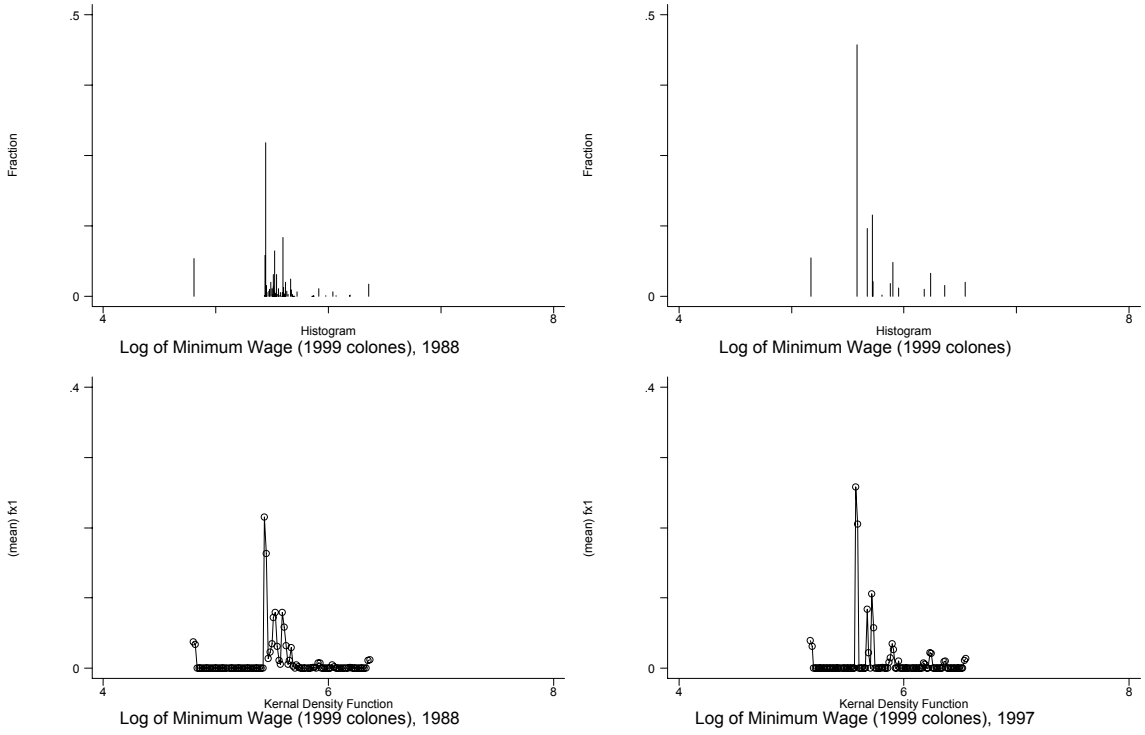


Figure 2: Comparing the Distribution of Legal Minimum Wages to the Distribution of Hourly Wages in the Covered and Uncovered Sectors, 1988 and 1997

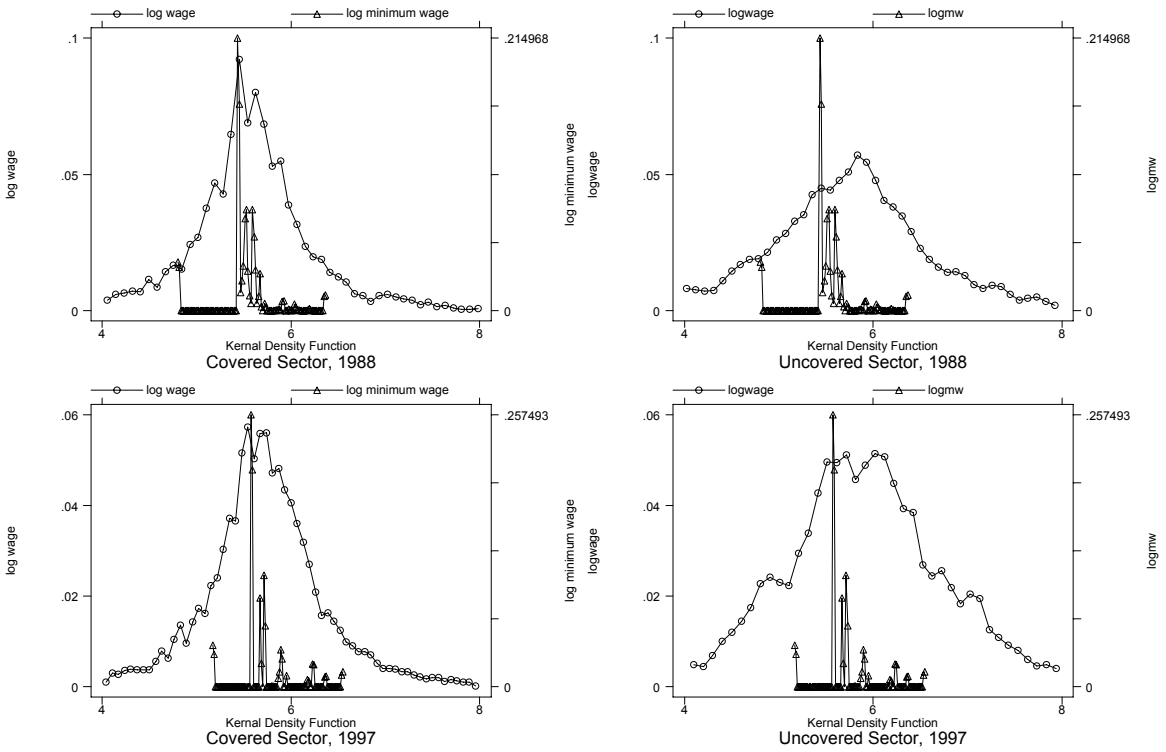
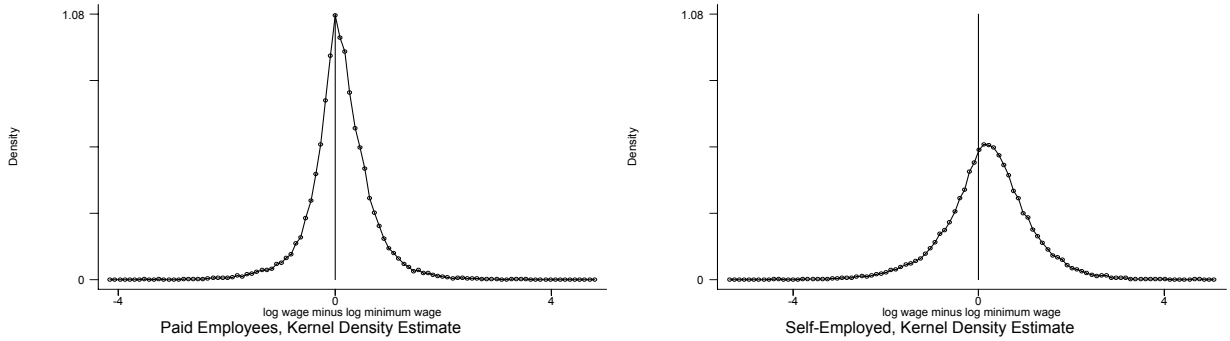


Figure 3: Log of Wage Minus Log of Minimum Wage for the Pooled 1988-2000 Data Set



Appendix Tables and Figures

Table A1: Summary of Changes in Legal Minimum Wages, Costa Rica 1986 - 2000

	M.W. From	To	Raise	
1987	Over 500 different minimum wage categories within 10 major industry categories (agriculture, mining, manufacturing, construction, electricity, commerce, transportation, communications, services, and professionals.) The professional category includes a minimum wage for anyone with a "licenciado," a 5-year university degree (more common that a 4-year bachelors degree.) The other professional minimum wages are for specific professions (and not for anyone with a 2-year or 4-year degree).			
	M.W. From	**To**	**Raise**	
January 1 - August 29	¢0.00	¢267.00	9.00%	
	¢267.05	¢307.80	7.50%	
	¢307.85	¢344.50	5.50%	
	More than ¢344.5		3.50%	
August 30 - December 31	¢312.80	¢0.00	4.00%	
	¢312.85	¢322.90	3.00%	
	More than ¢322.95		2.50%	
1988	Beginning in 1988 the Ministry of Labor began a gradual process of reducing the number of minimum wage categories. To do this, the Ministry identified two or more categories that were to be combined and increased the minimum wage in the category with the lowest minimum wage by a greater amount than the minimum wage in the higher wage category. In this way, over a period of several years, the minimum wage for these categories would become the same. Therefore, for each category in each year minimum wages are increased by different amounts.			
January 1 - August 15	As part of the process of gradually consolidating minimum wage categories, for each category minimum wages were increased by different absolute amounts: the range is 3.5-15.0%. The average increase was 11.0%			
August 16 - December 31	Increases of 8.85% for the lowest salaries down to 2.3% for the highest salaries, with exception for domestic servants (9.16%). Average increase 5.64%.			
1989				
January 1 - September 16	Increases from 4.76% to 16.81%. Average increase was 12.16%.			
September 17 - December 31	Increases from 3.41% to 8.88%. Average increase was 6.41%			
1990	The major industry categories of manufacturing, mining, electricity and construction were combined. The number of minimum wage categories is reduced to 60-70. Consolidation of categories continues.			
January 1 - July 31	Increases from 3.14% to 25.29%. Average increase was 9.91%.			
August 1 - December 31	Increases from 9.79% to 16.35%. Average increase was 13.47%			
1991				
January 1 - June 23	Increases from 2.11% to 15.67%. Average increase was 9.86%.			
June 23 - December 31	Increases from 5.03% to 17.3%. Average increase was 10.51%			
1992				
January 1 - July 1	Increases from 4% to 26.69%. Average increase was 11.38%.			
July 2 - December 31	Increases from 12.02% to 13.89%. Average increase was 13.73%. Exceptions: Domestic Servants, 18.72%, Private Accountants, 37.38% and Journalists, 39.58%.			
1993	Several categories are added for those with higher education. In addition to the already existing minimum wage for "licenciados," legal minimum wages are now set for those with 2-3 years of university education ("diplomados" or "tecnicos") and for graduates of 5-year technical high schools.			
January 1 - July 26	Increases from 4.88% to 14.58%. Average increase was 5.07%.			
July 27 - December 31	Increases from 4.65% to 6.37%. Average increase was 5.02%			
1994				
January 1 - July 30	Increases of		8.00%	Agriculture
			9.00%	Other Activities
July 31 - December 31	Increases of		9.00%	Unskilled ag. labor in Palm Oil
			10.00%	Bus Drivers
			42.86%	"Coyol" harvesters
			8.00%	All other activities

1995			
January 1 - August 9	Increases of	5.71%	"Coyol" harvesters
		10.00%	all other activities
August 10 - December 31	Increases from 5.70% to 12.83%. Average increase was 9.69%		
1996			
January 1 - July 4	Increases from 38.08% to 17.78%. Average increase was 8.35%.		
July 5 - December 31	Increases from 8.54% to 7.95%. Average increase was 8.05%		
1997	The major industry categories were combined into one that specifically includes agriculture, mining, manufacturing, construction, commerce, tourism, services, transport, and warehousing. Within this combined category four minimum wages are set, for unskilled workers, semi-skilled workers, skilled workers and specialized workers (supervisors.) Two other major categories remained: professionals and "specials." "Specials" included a minimum wage for domestic servants. Within the professionals category a minimum wage was added for workers with a 4-year university degree. These changes resulted in only 19 different minimum wages being set in 1997.		
January 1 - July 4	Increases from 38.08% to 17.78%. Average increase was 8.35%.		
July 5 - December 31	Increases from 8.54% to 7.95%. Average increase was 8.05%		
1998			
January 1 - June 30	Increases from 7.00% to 7.14%. Average increase was 7.02%.		
July 1 - December 31	Increases from 6.52% to 6.67%. Average increase was 6.52%		
1999			
January 1 - June 30	Increases from 6.49% to 6.58%. Average increase was 6.43%.		
July 1 - December 31	Increases from 4.57% to 4.59%. Average increase was 4.58%		
2000			
January 1 - June 30	Increases from 5.16% to 5.36%. Average increase was 5.20%%.		
July 1 - December 31	Increases from 5.16% to 5.19%. Average increase was 5.17%.		

Sources: Ministry of Labor and Social Security, National Salary Council, Department of Salaries, and interviews with Jose Pablo Carvajal (Director, National Salary Council), July 14, 2003 and Orlando Garcia (Planning Directorate, Ministry of Labor), July 15, 2003.

Table A2: Occupation Codes used by the Costa Rica's National Statistic and Census Institute for the Multi-purpose Housing Surveys, from 1987 to 2000.

Groups	Description
0	**Professionals and technicians**
00	Professionals and technicians in: architecture, urbanism, technical drawing, engineering and industrial engineering technology.
01	Professionals and technicians in: chemistry, physic, astronomy, geology, bacteriology and industrial laboratories.
02	Professionals and technicians in: agronomy and veterinary medicine, biology, natural sciences, and agricultural technology.
03	Professionals and technicians in: medicine, surgery, dentistry, pharmacy, medic technology, and paramedic and health activities.
04	Professionals and technicians in: arts, literature, sports, recreation, communication, advertising, organization and social welfare.
05	Professionals and technicians in: religious and cult activities.
06	Professionals and technicians in: teaching and research.
07	Professionals and technicians in: mathematics and statistics, economics, business, accounting and social sciences.
08	Professionals and technicians in: law and jurisprudence.
09	Professionals and technicians in: maritime, fluvial and air transport and communications.
1	**Directors and general managers**
10	Directors and senior managers in the public administration (executive, legislative and judicial powers).
11	Directors and managers in government institutions with total or partial administrative independency and private enterprises: in agricultural and industrial production and trade.
12	Directors and general managers in government institutions with total or partial administrative independency and private enterprises in the service industries.
2	**Office clerks in the government and private enterprises**
20	Office clerks and financial accountant employees in the government (central, regional, local levels) and private enterprises.
21	Accounting and budget employees.
22	Employees in secretarial activities and transcription and reproduction of texts.
23	Operators of computers and accounting equipments.
24	Employees in supervision, delivery and control of transport and communication services.
25	Employees in mail and message distribution
26	Employees in the operation of radiotelephony, radiotelegraphy, and telecommunication equipment.
27	Administrative employees in other services.
3	**Traders, retailers, wholesalers and salespersons**
30	Retailers and wholesalers.
31	Retail salespersons and salesmen on the streets.
32	Sale representatives – wholesale and manufacturing.
33	Other salespersons and sale agents, traders and commission agents
4	**Crop and animal farmers, and agricultural workers.**
40	Agricultural Overseers
41	Crop and animal farmers (owners)
42	Agricultural workers

43	Fishers
44	Hunters and other workers in hunting.
45	Forestry workers
5	**Occupations related to driving, operating and controlling of transportation vehicles.**
50	Drivers of terrestrial transport vehicles.
51	Railway conductor and stokers.
52	Conductors and crew of ships and others.
53	Operators of equipment of transit signals and controls.
6	**Occupations in craft and manufacturing production of textiles and clothing. Also, occupations in carpentry, bricklaying, painting, plumbing, mechanic, and electricity.**
60	Textile workers.
61	Clothing production workers (except footwear, leather articles and related goods).
62	Shoemakers, saddlers and related footwear workers
63	Carpenters, cabinetmakers and related wood workers.
64	Bricklayers, ceiling installers and other construction workers.
65	Painters of construction, vehicles, machinery, etc. (except painters and decorators of glass and ceramic).
66	Plumbers or other installers of pipes and metallic structures and welders in general.
67	Electricians. Operators and repairers of electric and electronic installations and equipment.
68	Mechanics and repairers of machinery in different sectors: agriculture, manufacture, construction and transport.
69	Watchmakers, opticians, mechanics of precision; jewelers, silversmiths and related workers of jewels and objects made of precious metals.
7	**Occupations in craft and manufacturing production in graphic, chemical, mining, metal smelting, food product and beverage, ceramic, leather, tobacco and other product industries.**
70	Crafts persons and operators of graphic machines.
71	Miners, mining stonecutters, and operators of mining extraction machinery
72	Smelters, rolling mill operators and workers related to metal treatments.
73	Ceramists, potters and glass object producers.
74	Workers and operators of machinery in chemical, wood, paperboard and corrugated paper industries.
75	Workers and operators of machinery in food product and beverage industries.
76	Workers in tobacco transformation and cigarette production.
77	Workers in tanneries and workers related to transformation of skins and leathers.
78	Other crafts persons and machine operators.
8	**Occupations in packing, loading, and storage**
80	Workers in packing, loading and storage
9	**Personal services and related services.**
90	Workers in vigilance, protection and security.
91	Cooks, maids, cleaners and occupations in food and beverage service.
92	Workers in laundry and ironing.
93	Doormen and building cleaners and managers.
94	Estheticians
95	Other workers in personal services.
98	People working in unidentified occupations.

Table A3: Regressions

	Covered			Uncovered			
	Ln(wage)	ln(hours)	ln(salary)	Ln(wage)	ln(hours)	ln(salary)	Employment Probits
Ln Min. Wage	0.103 [a]	-0.062 [b]	0.040	0.105	-0.080 [c]	-0.022	-0.068 [c]
	(0.042)	(0.029)	(0.036)	(0.079)	(0.051)	(0.077)	(0.038)
YR 88		0.028 [c]			0.034		0.000
		(0.017)			(0.026)		(0.018)
YR 89	0.025	-	-0.006	0.079 [c]	-	0.041	-
	(0.019)	-	(0.016)	(0.042)	-	(0.044)	-
YR 90	0.028	0.010	0.008	-0.046	0.034 [c]	-0.038	-0.027
	(0.020)	(0.011)	(0.015)	(0.038)	(0.019)	(0.044)	(0.020)
YR 91	0.000	-0.028 [b]	-0.060 [a]	-0.051	-0.064 [a]	-0.162 [a]	-0.033 [b]
	(0.020)	(0.012)	(0.016)	(0.036)	(0.017)	(0.036)	(0.017)
YR 92	0.002	0.005	-0.022 [c]	-0.075 [a]	-0.003	-0.111 [a]	-0.015
	(0.017)	(0.010)	(0.014)	(0.027)	(0.017)	(0.025)	(0.017)
YR 93	0.098 [a]	0.000	0.072 [a]	0.114 [a]	-0.010	0.065 [a]	-0.029 [b]
	(0.017)	(0.011)	(0.015)	(0.028)	(0.017)	(0.023)	(0.015)
YR 94	0.122 [a]	-0.003	0.094 [a]	0.129 [a]	0.020	0.122 [a]	-0.041 [a]
	(0.016)	(0.012)	(0.018)	(0.041)	(0.018)	(0.040)	(0.015)
YR 95	0.098 [a]	-0.039 [a]	0.031 [b]	0.112 [a]	-0.048 [b]	0.026	-0.110 [a]
	(0.017)	(0.010)	(0.015)	(0.032)	(0.021)	(0.031)	(0.019)
YR 96	0.066 [a]	-0.012	0.025 [c]	0.036	-0.003	-0.005	-0.053 [a]
	(0.019)	(0.011)	(0.017)	(0.038)	(0.020)	(0.036)	(0.016)
YR 97	0.055 [a]	0.007	0.020	0.076 [b]	-0.035 [c]	0.001	-0.067 [a]
	(0.017)	(0.011)	(0.017)	(0.033)	(0.020)	(0.032)	(0.019)
YR 98	0.114 [a]	-0.028 [b]	0.060 [a]	0.103 [a]	-0.036 [c]	0.041	-0.075 [a]
	(0.017)	(0.014)	(0.016)	(0.036)	(0.021)	(0.034)	(0.017)
YR 99	0.131 [a]	0.025 [c]	0.079 [a]	0.078 [b]	-0.026	0.020	-0.076 [a]
	(0.017)	(0.014)	(0.017)	(0.035)	(0.023)	(0.038)	(0.022)
Schooling	0.050 [a]	-0.001	0.048 [a]	0.058 [a]	0.031 [a]	0.090 [a]	0.029 [a]
	(0.003)	(0.003)	(0.004)	(0.010)	(0.008)	(0.010)	(0.004)
Experience	0.030 [a]	0.012 [a]	0.040 [a]	0.019 [c]	0.045 [a]	0.065 [a]	0.025 [a]
	(0.004)	(0.003)	(0.005)	(0.010)	(0.010)	(0.011)	(0.004)
Experience^2	0.000 [a]	0.000 [b]	-0.001 [a]	0.000	-0.001 [a]	-0.001 [a]	-0.001 [a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience^3	1.79e-07	1.24e-06	7.49e-07	2.01e-07	4.05e-06	4.27e-06	5.78e-06 [a]
	(1.71e-06)	(1.30e-06)	(1.88e-06)	(3.12e-06)	(2.87e-06)	(6.06e-06)	(1.09e-06)
Gender	0.051 [c]	-0.102 [a]	-0.079 [b]	-0.188 [b]	0.476 [a]	0.252 [b]	-0.046
	(0.028)	(0.027)	(0.036)	(0.085)	(0.100)	(0.110)	(0.033)
School • Exp.	0.000	0.001 [a]	0.001 [a]	-0.001	0.000	-0.001	-0.003 [a]
	(0.000)	(0.000)	(0.000)	(0.001)	(0.007)	(0.001)	(0.000)
School • Exp^2	0.000 [a]	0.000 [a]	0.000 [a]	4.31e-06	0.000 [c]	0.000	0.000 [a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
School • Exp^3	8.26e-07 [a]	7.42e-07 [a]	1.72e-06 [a]	9.15e-08	4.37e-07 [b]	6.01e-07 [b]	-9.26e-08
	(1.62e-07)	(1.34e-07)	(2.03e-07)	(2.89e-07)	(1.85e-07)	(2.68e-07)	(1.08e-07)
Exp • Gender	0.009 [a]	0.011 [a]	0.023 [a]	0.010	-0.007	0.007	0.010 [a]
	(0.003)	(0.003)	(0.003)	(0.009)	(0.009)	(0.010)	(0.003)
Exp^2 • Gender	0.000 [a]	0.000 [b]	-0.001 [a]	0.000	0.000	0.000	0.000 [a]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exp^3 • Gender	2.96e-06 [b]	6.77e-07	4.41e-06 [a]	1.13e-06	-1.05e-06	7.54e-07	1.45e-06 [c]
	(1.45e-06)	(1.16e-06)	(1.59e-06)	(2.81e-06)	(2.64e-06)	(3.10e-06)	(8.72e-07)
School • Gender	-0.004 [b]	0.006 [a]	0.003	0.004	-0.008	-0.004	-0.001
	(0.002)	(0.002)	(0.003)	(0.004)	(0.006)	(0.006)	(0.002)
Sector Val. Add.	2.69e-08	1.19e-07 [c]	1.39e-07 [a]	-6.42e-08	6.92e-09	-9.42e-08	5.33e-07 [a]
	(2.27e-08)	(194e-08)	(2.51e-08)	(8.10e-08)	(7.06e-08)	(1.06e-07)	(4.08e-08)
Constant	4.828 [a]	4.045 [a]	10.069 [a]	5.050 [a]	10.391 [a]	10.069 [a]	
	(0.295)	(0.192)	(0.485)	(0.487)	(0.248)	(0.485)	
Ind/Occupation Dummies	YES	YES	YES	YES	YES	YES	YES
No of Obs.	87150	95628	87150	37734	45980	37734	157952
R^2	0.384	0.167	0.470	0.224	0.247	0.348	0.408

a = significant at 1%; b = significant at 5%.

Figure A1: Comparing the Distribution of Legal Minimum Wages to the Distribution of Hourly Wages in the Covered Sector, 1988-2000

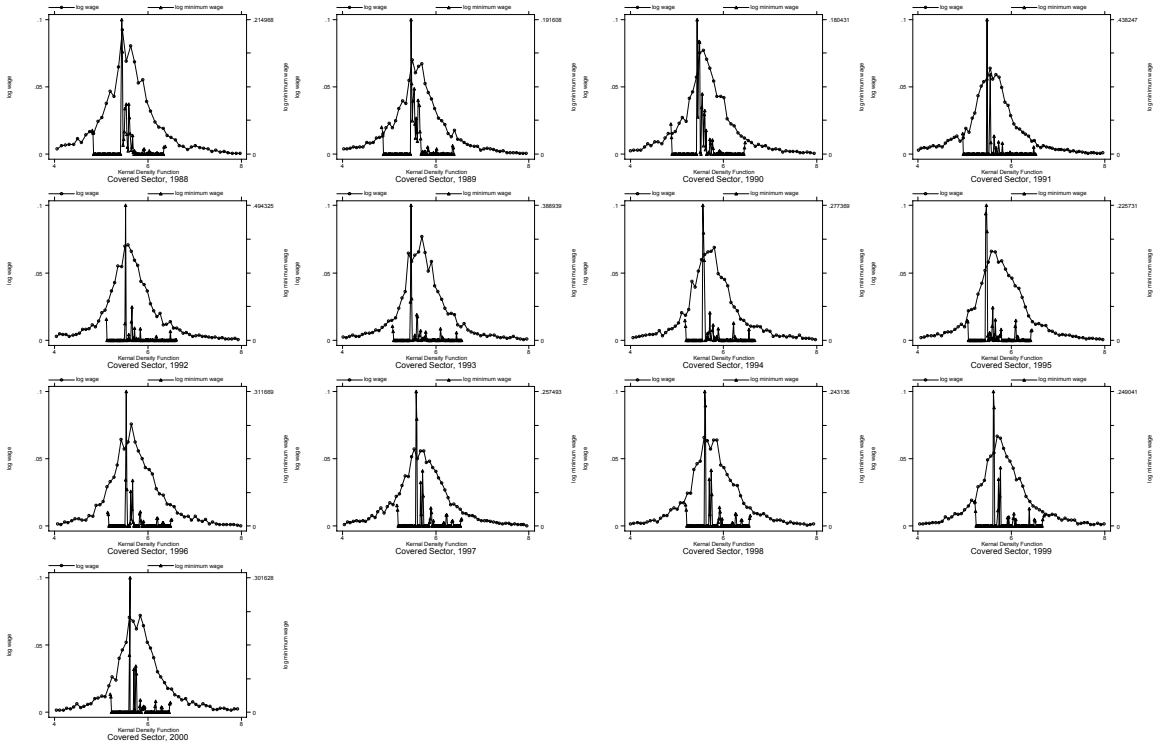


Figure A2: Comparing the Distribution of Legal Minimum Wages to the Distribution of Hourly Wages in the Uncovered Sector, 1988-2000