The Effects of Multiple Minimum Wages Throughout the Labor Market: The Case of Costa Rica*

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Revised
October 25, 2005

Abstract

This paper investigates the effects of legal minimum wages on employment and hours worked 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. Using 1988-2000 micro data, we 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%. We do not find a significant impact on hours worked in the uncovered sector. Finally, we show that despite the wide range of minimum wages, the largest impact on the employment of covered sector workers is in the lower half of the skill distribution.

JEL Classification: J23, J31, J38
Keywords: minimum wages, employment, wages, Costa Rica

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* Acknowledgements: We would like to thank Orley Ashenfelter, Rebecca Blank, Francisco Ferreira, Daniel Hamermesh, Brad Humphreys, John Kennan, Martin Ravallion, Sarah Lemos, Pablo Sauma, Juan Diego Trejos, and Juan Rafael Vargas and two anonymous referees for helpful suggestions on earlier drafts of this paper. Special thanks to Charlie Brown, Janos Kollo and John DiNardo for several valuable discussions. Staff members at the Central Bank and Ministry of Labor and Social Security were very helpful in providing us with data and important information on minimum wages. We are especially grateful to José Pablo Carvajal, Orlando Garcia and Yabera Alvarado of the Ministry of Labor. We benefited from comments of seminar participants at the Economic Development Seminar at University of Michigan; Institute for Social and Economic Research, University of Costa Rica, the IZA/WDI Conference on Labor Market Dynamics in Emerging Market Economies at INCAE, Costa Rica; Conference on Social and Economic Impacts of Liberalization and Globalization at the University of Toronto; the Latin American Meetings of the Econometric Society in Sao Paulo, and the University of Maryland Baltimore County. Justine Wagner provided highly valued research assistance. Katherine Terrell would like to acknowledge the generous support from the NSF (grant SES-0111783).

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 data from other countries 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 520 occupation/skill categories during 1988-2000). More important is that during the period under study

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

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 employment, our results are not likely to suffer from the potential endogeneity bias found in many studies.

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 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) 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

[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)

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-third 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 three other empirical studies in English that examine the impact on the uncovered sector in a developing country: Fajnzylber (2001), Lemos (2004) and Maloney and Núñez (2004).

The potential 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.[3] 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.[4]

[3] According to many studies, the proportion of workers in the informal sector has increased throughout Latin America in the late 1990s (see Ferranti, et al., 2003). The question is whether legal minimum wages played a role in the "informalization" of employment in Latin America in the 1990s.

[4] There are of course other models with different predictions of the impact of minimum wages on relative wages and employment in the covered and uncovered sectors. For example, Saint-Paul (1994) and McIntyre's (2004) models both predict that increases in the minimum wage will increase wages in the uncovered sectors, and in one model increases employment are predicted in the uncovered sector while in the other the predicted change in employment is ambiguous.

In this paper we analyze the effects of minimum wages on 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 industry/occupational/skill categories of workers in each year. We estimate the employment and hours worked effects 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 higher minimum wages lower the probability of employment in the covered sector relative to the uncovered sector and unemployment. 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 hours and employment of covered sector workers in the lower half of the distribution. We find no effect on hours worked n the uncovered sector.

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 and hours worked. Combining this with our knowledge of the Costa Rican labor market, we form 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.[5] 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.[6] 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. 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 wages in Indonesia and Hungary, respectively, and find negative significant employment effects. In Indonesia a 10% increase in minimum wages lowers urban employment by 2%. Maloney and Núñez (2004) estimate that a 10% increase in the minimum wage reduces total employment by roughly 1.5% in Colombia. Bell (1997) 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 no employment effect in Mexico's

[5] 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).

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

manufacturing sector but 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.) Given that minimum wages are between 50-70% of the average wage in Costa Rica and they have not fallen over time (see Table 2), 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. Zavodny (2000) 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 results imply that employers demand 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 of high for low 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 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. (2000) have consistent results: they conclude that low-wage workers are

more adversely affected by minimum wage increases than higher-wage workers.[7] For effects on non-U.S. workers, we turn to the studies by Abowd et al. (1999) of French workers, Maloney and Núñez (2004) 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" vs. 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 1.0%. Maloney and Núñez (2004) and Fajnzylber (2001) find similar results to those of Neumark et al. (2000) in 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.

What do we know about the effect of minimum wages on employment in the uncovered sector? Maloney and Núñez (2004) estimate employment equations for male full-time self-employed in Colombia and find that increases in the minimum wage have a significant positive effect on their employment and the impact is felt for those earning 0.7 to 1.5 of the minimum wage. Lemos (2004) finds that a 10% increase in the nominal wage in Brazil is associated with a very small, but statistically significant, 0.04% increase in employment of the informal sector. Hence, there is some evidence of a positive effect on employment in the uncovered sector, defined as self-employed in one case and informal in another,

In sum, the empirical literature using both U.S. and developing country data indicates that the covered sector employment effects from minimum wage increases tend to be small among low-wage workers and in some cases not significantly different from

[7] Although the wages of low-wage workers increase, their hours and employment decline leading to a decline in earned income. On the other hand, high wage workers experience an increase in earned income due to an increase in their hours of work, but no change in their wage.

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 and employment of workers near the minimum more than wages of workers above the minimum. The two studies of the impact on the uncovered sector in developing countries found positive effects on the employment of self-employed and informal workers, consistent with the competitive two-sector model.

3. Minimum Wage Setting in Costa Rica and Endogeneity Bias

Legal minimum wages 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] Only private sector employees are covered by this legislation; public sector employees (including those in state-owned enterprises) and the self-employed are not subject to minimum wages. Although public sector workers have their wages set by separate government decrees, interviews with officials at the Ministry of Labor indicate that changes in the legal minimum wages are often used as a guide in the setting of public sector wages. Hence, we consider only the self-employed and unpaid family workers as the uncovered sector.[9]

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. Clearly, adjusting the average minimum wage by the rate of inflation reflects changing demand conditions in the economy, which will also affect employment levels. Thus, the average changes in minimum wages, and employment are determined

[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] In response to a suggestion by a referee, we have included in Appendix 1 a separate analysis of the effects of changes in the minimum wage on employment and hours worked in the public sector (including state-owned enterprises).

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 reduces this 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 520 categories (set by occupation, skill and industry) in 1987 to 19 categories (set by education and skill only) in 1997. In addition to the simplification of minimum wages for low-skilled workers, in the early 1990s new minimum wages were added (and some dropped) for workers with a university education. In the process of reducing the number of minimum wage categories, the adjustments made to minimum wages within and between each category followed the goal of reducing the number of wage cagetories rather than of adjusting to labor market conditions, and hence are exogenous over this period. In order to convince the reader that this consolidation process affected all wages in every year and drove adjustments in the minimum wage that were not affected by changes in demand and supply in the labor market, we give below a detailed explanation of how minimum wages were set and how this process was implemented. We also summarize the changes in each decree in Table 1.

In 1987 individuals who were working as employees in the private sector were assigned to one of 520 minimum wage categories. The vast majority of the employees were assigned to one of 506 minimum wages, defined by detailed industry and occupational classifications.[10] Thirteen of the remaining 14 minimum wage categories were defined by "profession" (and did not have an industry dimension e.g., librarians, nurses, accountants, and laboratory technicians). Finally, employees with a five-year

[10] For example, in the manufacturing sector there were 44 occupational categories. 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.

university degree (*licenciado)* were subject to a separate minimum wage, which was typically the highest one. However, employees with a four-year university education or a technical high school degree who were working as a professional in an occupation that was not specifically included among the fourteen mentioned in the law were classified among the 506 minimum wages defined by occupation and industry.

Beginning in 1988, following the recommendations of an IMF report, the Ministry of Labor began a gradual process of reducing the 506 minimum wage categories for the non-professionals by eliminating the variation in wages given by the industrial dimension. Specifically, the Ministry identified a broadly-defined occupational 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. By 1990, for example, the manufacturing, mining, electricity and construction industries were consolidated into one and there were a total of approximately 65 minimum wages for those without higher education. By 1995 there were only five industrial categories than 54 minimum wages. Beginning in June 1997 the industrial dimension was completely eliminated and there were only ten minimum wages for non-professionals: four by skill categories (unskilled, semi-skilled, skilled, and specialized workers) and six for special categories (e.g., live-in domestics, stevedores, day workers).

While the number of minimum wage categories for less educated employees was falling, the categories for those with higher education were being consolidated and expanded. In 1993 new minimum wages were 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 category was added for workers with a four-year university degree. However, the 14 minimum wage categories for specific professions were largely eliminated. These changes resulted in a total of six minimum wage categories for workers with a technical high school education or higher.

The addition of the new minimum wage categories for *diplomados*, *técnicos* and university graduates increased the level of the minimum wage for these workers since prior to 1993 many of them would have had a minimum wage that applied to less educated workers.

Effectively, this process of eliminating the industry and occupation dimension increased the amount of exogenous year-to-year variation in minimum wages for workers because these changes were driven by institutional factors, (with the goal of simplifying the minimum wage structure to one based on skill) and were not a reflection of labor market conditions. Table 1 summarizes the timing and types of changes in the 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 within each minimum wage category is exogenous to demand and supply conditions in the labor market, and therefore exogenous to actual employment changes. This implies that our results will suffer less from endogeneity/simultaneity bias that exist in many studies which compare frequent changes in a single minimum wage to changes in actual wages and employment.

4. Data

The analysis uses annual data on: a) workers, from the annual *Household Surveys for Multiple Purposes* (HSMPs) carried out by the Costa Rican Institute of Statistics and Census and b) legal minimum wages, from decrees published by the Ministry of Labor. 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, employment status and firm size). We create a cross-section/time-series data set for all individuals who work in the private sector, i.e., employees, the self-employed plus unpaid family workers and those unemployed who have worked before.[11] In this paper we use 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.[12]

Consistent with the complexity of minimum wage categories, the period of reference for the minimum wage differs between categories. Minimum wages may be set as hourly, daily, or monthly wages; the majority is set as daily wages. We impose uniformity on minimum wages by converting each one into an hourly wage by following the Costa Rican labor code and assuming full-time workers are on the job for eight hours a day, six days a week. We selected the hourly wage as the unit of analysis in part to be able to compare the wages of full-time and part-time workers to minimum wages. According to our interviews with Ministry of Labor officials, minimum wages are

[11] Unfortunately, it is not possible to match individual observations in the Costa Rican household surveys across years to create panel data.

[12] We use the three-digit occupational classification available in the household survey, which is not equivalent to the I.L.O. standard classification.

applicable to both full-time and part-time workers. The applicable minimum wage for part-time workers is a fraction of the daily (or monthly, etc.) minimum wage equal to the fraction of full-time work.

The structure of legal minimum wages in Costa Rica is depicted in Figure 1 with histograms of the minimum wage distribution. The figure presents the distribution of real minimum wages in 1999 Costa Rica *colons* among private sector workers who report positive earnings in 1988 (at the beginning of the simplification) and in 1998 (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 graph, 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 minimum wages that surround two smaller spikes at the minimum wages for operators of machinery and specialized workers (supervisors) in most industries. 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 (1999 prices) set for *licenciados* (five-year university graduates) who represent approximately 2% of all workers.

The second graph in Figure 1 presents the distribution of (the log of) real minimum wages among workers who report positive earnings for 1998. A comparison of the graphs for 1988 with the graphs for 1998 illustrates the changes in the structure of legal minimum wages. As in 1988, the spike at the far left of the 1998 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 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 1998 the minimum wage for unskilled workers applies to more than 45% of workers. 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%). The new minimum wage categories for workers with higher education resulted in several new spikes at higher wage levels, including a spike at the minimum wage for four-year university graduates (4% of workers).

Table 2 presents summary statistics on real hourly minimum wage and wages in 1999 Costa Rican *colones* and the covered sector share of total employment in each year from 1988 to 2000. The first column shows that real minimum wages fall slightly from 1987 to 1994 and then increase from 1994 to 2000 by 23%. The next two columns present the mean real hourly wage for workers in the covered and uncovered sectors, (self-employed only). 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. The final two columns of Table 2 present two measures of the proportion of workers in the covered sector, both 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 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.[13] In an earlier paper (Gindling and Terrell, 1995), we show that on average over 1976-1991 more than one-quarter of full-time paid employees earned less than the lowest minimum wage applicable in each year.[14]

Nevertheless, according to the International Labor Organization, 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

[13] See for e.g., Ashenfelter and Smith (1979) and Watanabe (1976) for classic articles on compliance in the US and developing countries, respectively. (However, one might expect enforcement to have improved in developing countries since the time of Watanabe's study.)

[14] 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. We believe that this number may be an overestimate if in fact workers are allowed to received less than the minimum wage if they are given other benefits (such as food and housing). It is also possible that the salary is underestimated in situations where one is paid by piece rate or on commission. However, we surmise that there are a substantial number of workers who are "out of the minimum wage system" and never receive minimum wages, although we do not have panel data to prove this.

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 (15.2%) and transportation and communication (5.9%), which is still primarily a state-owned sector. The penalty for non-compliance is a relatively small fine; however employers must also pay up to two years of owed back pay to the worker.

A straightforward method for checking for compliance is to look for spikes in the wage distribution at or around the minimum wage. Studies of the U.S. 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) find a significant spike at the minimum wage in Puerto Rico and Faynzilber (2001) and Lemos (2004) find them for Brazil. 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 Núñez (2004) 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.[15] Curiously, they 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.

Given the number of minimum wages in Costa Rica, we simplify the graphical analysis by plotting the kernel density estimate of the log wage minus log minimum wage for each worker for the covered and uncovered sector workers separately in Figure 2.[16] A

[15] In many of these Latin American countries (e.g., Argentina, Honduras and Mexico) multiple legal minimum wages are set depending on the industry, occupation, skill level and/or region of the worker. Maloney and Núñez (2004) check for spikes only at the lowest minimum wage in each country.

[16] We look for spikes in the distribution of wages that would correspond to these numerous minimum wages for two years of the data. We present in Appendix 2, Figure A2 the distribution of wages overlaid on

zero indicates that the worker is earning the legal minimum wage. We find that a much higher percentage of salaried workers (10.4%) than self-employed workers (5.3%) earn within 5% of the minimum wage for their industry/occupation/skill level. 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. Moreover there appears to be more bunching to the right of the minimum wage among the covered sector workers than among the uncovered, and a larger reduction in the proportion of workers earning just below the minimum wage in the covered sector. The measure of skewness among the covered sector (salaried) is -0.118 whereas it is -0.138 in the uncovered sector (self-employed) and kurtosis is 6.49 and 6.10 respectively.

Based on the changes in the minimum wage system described in Section 3 and Table 1, there are other patterns we would expect to find in minimum wages over this period which, if complied with, should show in the wage data as well. First, in 1993-97 we should expect to see an increase in the gap between the minimum wage of workers with higher education and the minimum wage of workers without higher education because the minimum wage for workers with technical degrees, two-year and four-year university degrees are added. We see in Figure 3 that this is indeed the case – the ratio of the average minimum wage of the more educated (defined as those with a technical high school or university degree) to the average minimum wage of the less educated rose from 1.5 during the 1987-92 period, to 1.8 in 1993-94 and to 1.9 in 1995-97. In Gindling and Terrell (2004) we show that wages followed this pattern as well: A regression of the ratios of the average wage of more educated workers to the average wage of less educated workers in each industry and year on the corresponding ratios of average

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the kernel density estimates of the minimum wages. Some (but not all) spikes can be seen for covered sector workers and there is no evidence of spikes for the uncovered sector workers.

minimum wages over the 1987-1997 period yields a simple correlation of 0.632, which is significant at the 1% confidence interval.[17]

Second, in the 1993-1997 we should expect a reduction in the inequality of minimum wages both among workers without higher education (as the number of minimum wages for this group is reduced over the 1988-2000 period and the lowest minimum wages were raised more than the highest minimum wages) and among workers with higher education period (since the minimum wage of workers with technical degrees, two-year and four-year university degrees increased relative to the wages of workers with a *licenciado* degree). In Gindling and Terrell (2004) we present evidence that there was a reduction in inequality in the minimum wages for each of these groups; moreover this also born out in the wage data. Regressions using industry panel data (with industry and time fixed effects) find positive and significant correlations between the standard deviation of the log of the minimum wage and the standard deviation of the log of wages among educated workers (0.817) and among the less educated workers (0.432).

Hence, there is reason to believe that there is compliance with the minimum wage laws for a large group of the covered population as we see changes in the minimum wage structure reflected in the actual wage structure. We also show more of the covered sector workers (compared to uncovered sector workers) are found to be working at the minimum wage.

6. Effects of Changes in Minimum Wages on Employment

6.1 Estimation Strategy

We estimate the extent to which changes in the minimum wage affect the number of workers employed and the number of hours worked using individual-level pooled

[17] Since we used industry level data, we could not estimate the regression with data beyond 1997, when the industry dimension no longer existed in the data.

cross-section/time-series data (1988-2000) holding constant other factors that might affect wages. Specifically, we estimate an equation of the form:

$$EMP_{it} = \alpha_o + \alpha_1 lnMW_{it} + X'_{it}\beta + \sum_{j=1}^{J} \lambda_j OCC_{itj} + \sum_{t=1}^{T} \gamma_t YR_t + \mu_{it}. \quad (1)$$

where EMP_{it}, equals 1 if the individual i is employed in the covered sector at time t (1988…2000) while $EMP_{it} = 0$ for the self-employed, unpaid family workers, and those unemployed workers who have worked in the past.[18] The explanatory variables include the log of the real minimum wage (in 1999 Costa Rican *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 employment in the covered sector of changes in the 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). We also include dummy variables for industry/occupation/skill categories, OCC_{itj}, in order to control for minimum-wage-category-specific fixed effects and for the endogenous correlation of employment and minimum wages across minimum wage categories.[19] 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 timing of minimum wage changes,[20] or design changes in the household surveys) we include a dummy variable for each year, YR_t. We estimate equation (1) with a probit and test for a negative

[18] We also estimated a specification where $EMP_{it} = 0$ if the worker is self-employed or an unpaid family worker, which is perhaps a better test of the narrower two-sector competitive model. However, we are interested in whether 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. 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 determine which minimum wage applies to them.

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

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

employment effect of legal minimum wages in the covered sector by testing whether $\alpha_1 < 0$.[21]

Similarly, we use equation (1) 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} and estimating with OLS. 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, 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).

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 on deviations of the minimum wage within industry/occupation/skill categories over time from the average yearly minimum wage change, which can reasonably be thought of as exogenous. As an additional test of the exogeneity of the minimum wage variable, we use minimum wages lagged one year as an instrumental variable. The

[21] 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.

standard tests indicate there is no evidence that the minimum wage variable is endogenous in either the employment or hours worked equations.[22]

6.2 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.[23] The marginal effect calculated from the probit coefficient on the minimum wage variable in this equation is -0.068 and statistically significantly different from zero.[24] 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. Evaluating this at the mean probability of employment (0.625), we calculate that a 10% increase in the minimum wage reduces employment in the covered sector by 1.09%.[25]

Our employment results are roughly consistent with the descriptive statistics presented in Table 2. 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

[22] In all reduced form (first stage) equations, lagged minimum wages were positively correlated with actual minimum wages at the 1% significance level. Using a standard test for the endogeneity of the minimum wage variable in the hours equations (Wooldridge, 2003, p. 506), we find the coefficients on the residual from the reduced form equation in the (second stage) hours worked equations were not significantly different from zero at the 1% significance level. (The t-statistic was 0.65 for the covered sector equation and 1.32 for the uncovered sector equation.) For the employment probit, the Hausman endogeneity test results (chi-square of 6.36) indicate no evidence of endogeneity at a 1% level of significance. We are hence reasonably confident that our results do not suffer from the endogeneity/simultaneity bias.

[23] For the full set of coefficients for the employment and hours equations see Table A2 in the appendix.

[24] 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 is -0.037). We tested for alternative definition of the employment variable: EMP_{it} = 0 if the worker is self-employed or an unpaid family worker (the unemployed are not considered) and find the coefficient on the minimum wage variable is -0.067 (significant at 10%) and not statistically different from the current specification.

[25] 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 2.

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.

Our employment elasticity is in the ballpark of those in the literature. It is larger than the estimate reported for Indonesia by Rama (2001) and similar to the estimates for Colombia (Bell, 1999 and Maloney and Núñez, 2004) and Puerto Rico (Castillo-Freeman and Freeman, 1992). It is at the upper end of the range of estimated employment elasticities for teenagers reported in the recent literature examining minimum wage effects in the United States, 0.5% to 1% (Brown, 1999.).[26]

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.[27]

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[26] 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: $\dot{\eta} = \delta\ln E^*/\delta\ln w^*$, where $\delta\ln w^*$ = the percentage 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, all workers), equivalent to our α_1 in equation (2). Following Brown (1999, p. 2114-5) we adjust our the employment elasticity workers as follows:

$$\eta = \beta[\delta\ln MW/\delta\ln w^*)/ E^*] = \beta\,[(0.0.233/0.115)/0.202] = 10.03\beta$$

where β is the employment elasticity derived from the probit estimation of equation (2) for the covered sector, $\delta\ln MW = 0.233$ is the average annual percentage in the minimum wages for all workers; $\delta\ln w^* = 0.115$ is average percentage 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. Hence the elasticity would be 10.0 times greater, which is larger than the 9.2 adjustment that Brown (1999) gets using Neumark, Schweitzer and Washer's (1997) estimates. We note that the adjustment would make the elasticity of demand around the point of the minimum wage roughly unity (1.09%).

[27] In response to a concern by an anonymous referee, we have tested the robustness of our results for the inclusion of part-time workers. We re-estimated the employment and hours worked equations using only data from full-time workers (those working 40 hours a week or more). The results from these full-time

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 for covered sector workers are negative for both hours (-0.062) and employment (-0.109).

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

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.[28]

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

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regressions are similar to those reported in Table 3: the coefficient on the minimum wage variable in the employment probit is negative (-0.054) and significant at the 1% level; the coefficient on the minimum wage variable in the covered sector hours worked equation is negative (-0.023) and significant at the 1% level, while the coefficient on the minimum wage variable in the uncovered sector hours worked equation is not significantly different from zero. Whereas the coefficients on minimum wage variable in the two employment probits are not significantly different for full-time employees (-0.054) and all employees (-0.064), the coefficient in the hours worked equation is significantly smaller for full-time employees than for all employees.

[28] 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.

data with a set of 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:

$$lnW_{it}^{u} = \alpha_o + \sum_{t=1}^{T} \beta_t^{u} YR_t + \sum_{t=1}^{T} \gamma_j^{u} S_{ijt}^{u} + \sum_{t=1}^{T} YR_t \left(\sum_{h=1}^{H} S_{iht}^{u} \cdot \rho_{ht}^{u} \right) + \varepsilon_{it}^{u} . \qquad (2)$$

In the second step, the estimated coefficients from equation (2) are used to calculate predicted wages for all workers (in both the covered and uncovered sectors) in the pooled (1988-2000) data set.[29] Deciles are then created from the distribution of predicted wages for all workers in each year. We then use data on covered sector workers to estimate Equation (1) on each of these deciles in order to estimate the impact of minimum wages on the number of hours worked per week and the probability of employment in each decile.

Table 4 presents the characteristics of the workers by 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.[30] We also note that in each skill decile there are approximately 19-22% of the workers earning the minimum wage.

The coefficients on the minimum wage for each skill decile are presented in Table 5. The results indicate that in Costa Rica legal minimum wages have an effect on employment and hours worked at the bottom half of the distribution of skills. Either the

[29] 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.

[30] 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.

hours or the worker effect are negative and significant in the 2nd through 5th deciles and the effect is largest in the 2nd decile.

8. Conclusions

Costa Rica, which has for decades set numerous minimum wages that affect workers throughout 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 estimate the employment effects of minimum wages throughout the labor market – in the covered and uncovered sector and across the skill distribution of the covered sector – with micro data on approximately 10,000 workers per year over the 1988-2000 period. The process by which hundreds of minimum wage categories were simplified over this period allows us to be in a uniquely advantageous position to estimate the effects of exogenous changes in the minimum wage on employment and hours worked.

We find that legal minimum wages have negative employment effects in the covered sector. Our estimates imply that on average a 10% increase in minimum wages decreases the total level of employment in the covered sector by 1.09% and reduces by 0.62% the average number of hours worked by those who remain employed in the covered sector. When we examine the impact of minimum wages on the employment and hours worked at different points in the distribution of skills, we find the largest impact on covered workers is in the bottom half (2nd through 5th deciles) of the distribution. Our evidence suggests those leaving covered sector employment flow to a broadly defined uncovered sector. However, we find there is no significant effect on average hours worked in the uncovered sector.

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. Our estimate of the employment effects is higher

than those reported by Rama (2002) for Indonesia but similar to those reported by Bell (1997) and Maloney and Núñez (2004) for Colombia. It is consistent with the traditional estimate that a 10% increase in minimum wages reduces teenage employment in the United States by 0.5-3%. Finally, it is also consistent with the results for teenagers in Europe where minimum wages are relatively high (Neumark and Wascher, 1999). Despite the apparently similar magnitude, our estimates for Costa Rica represent a wider employment effect because, while these estimates from the U.S. and Europe apply only to a relatively small sub-set of low wage teenage workers, our estimates apply to workers across the distribution. Nevertheless, it appears that the evidence is accumulating for small employment effects and perhaps it is time to move on to other implications of minimum wage policy (Dolado et al., 2000).

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Appendix 1:
Minimum Wages and the Public Sector

Public sector wages (both in the central government and in state-owned-enterprises, SOEs) are not set by the minimum wage decrees but by separate government decrees. In this sense, public sector workers are not in the sector covered by legal minimum wages. At the same time, by law the wages in the public sector are not allowed to fall below the private sector minimum wage for a particular occupation, profession or education level. Moreover, our interviews with Ministry of Labor officials indicate that changes in the private sector legal minimum wage are often used as a guide in the bargaining process with unions and the final setting of wages in the public sector.[31] Therefore, with respect to the legal minimum wage decrees, the public sector is an ambiguous sector. It is a covered sector in the sense that public sector wages are not allowed to fall below the private sector legal minimum wage and in the sense that private sector legal minimum wages may act as a guide to setting public sector wages. On the other hand, it is an uncovered sector in the sense that the legally mandated wage for a specific occupation or skill level in the public sector may differ substantially from the specific private sector legal minimum wage for that occupation or skill level. Nonetheless, it is of interest to examine whether changes in legal minimum wages have an impact on public sector employment. To examine this issue, we estimate the effect of changes in private sector legal minimum wages on employment and hours worked separately for the public sector.

First, we construct Figure A1, similar to Figure 2, which presents the distribution of the log wage minus the log minimum wage for each worker in the public sector. As expected, it shows that the vast majority (83%) of public sector workers earn more than the minimum wage for their particular occupation or skill level. Although there is a small

[31] 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.

spike at zero (indicating the proportion of public sector workers earning the legal minimum wage), it is much smaller than the similar spike in the distribution of private covered sector workers; and, unlike in the private covered sector, it is not the mode value in the distribution. The proportion of workers earning within five percent of the minimum wage that applies to them (4.6%) is very similar to that in the uncovered sector (5.3%) and about half of that in the private covered sector (10.4%).

Although Figure A1 does not provide direct evidence of an impact of minimum wages on the public sector, we have been informed that they may have an impact because they may act as a guide in setting wages there. We hence test for the effect of adjustments in the minimum wage on employment and hours work in the public sector and present the results in Table A2. In the employment equation, the worker may be found in one of three sectors: a) the private covered sector (salaried employees): b) the uncovered sector (self-employed, unpaid family workers) plus the unemployed who held a job before or c) the public sector (employees of SOEs and the central government). We estimate the assignment of workers into these three categories with a multinomial logit, where the reference category is the uncovered sector. We present both the coefficients from the logit estimation and the odds ratios calculated from these coefficients. As in the employment probit reported in Table 3, we find that higher minimum wages result in a significant decrease in the probability of private covered sector employment. Interestingly, an increase in private sector legal minimum wages also results in a significant decrease in the probability of public sector employment, which is not significantly different from the coefficient for the private sector. These results indicate that the public sector reacts to an increase in the legal minimum wage in much the same way as the covered private sector, by reducing employment. However, unlike in the private covered sector, the effect of changes in the legal minimum wage on average hours worked in the public sector is insignificant.

Insert Figure A1 here

Insert Table A1 here

Appendix 2:

Insert Figure A2 here

Insert Table A2 here

Table 1: Summary of Changes in Legal Minimum Wages, Costa Rica 1987 - 1999

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 by**
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:		
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%		

contd.

Table 1: Summary of Changes in Legal Minimum Wages, Costa Rica 1987 - 1999 Continued

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%		
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%		

Source: Ministry of Labor and Social Security, *Decrees of Minimum Wages;* interviews with Jose Pablo Carvajal (Director, National Salary Council), May 16 and July 14, 2003

Table 2: Descriptive Statistics, 1988-2000[1]

	Mean Real Hourly Min Wage[2]	Mean Real Hourly Wage[2]		Proportion of Covered as Share of:	
		Covered Sector[3]	Uncovered Sector[4]	All Workers[5]	(All workers + unemployed)
1988	248	343	463	0.644	0.613
1989	254	342	500	0.647	0.625
1990	249	347	463	0.638	0.611
1991	254	333	464	0.639	0.606
1992	263	344	423	0.664	0.639
1993	259	377	587	0.665	0.639
1994	249	396	630	0.667	0.642
1995	258	390	573	0.664	0.632
1996	282	384	552	0.662	0.625
1997	300	387	573	0.648	0.614
1998	309	413	586	0.660	0.626
1999	320	427	640	0.665	0.627
2000	306	435	609	0.659	0.628

[1] Using sample weights.

[2] Denominated in 1999 colones

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

[4] In this paper the uncovered sector includes the self-employed plus unpaid famly workers.
However, in calculating mean real hourly wages, the uncovered sector is defined as self-employed workers only.

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

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

	Covered Sector[2]	Uncovered Sector[2]
Employment (Probit)		
B	-0.068***	-
SE[3]	(0.038)	-
R-Squared	0.408	
N	157,952	
Hours (OLS)		
B	-0.062**	-0.066
SE[3]	(0.029)	(0.048)
R-Squared	0.167	0.256
N	95,628	53,962

* = significant at 1%
**= significant at 5%
*** = 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 A2 for the full set of coefficients

[2]The covered sector is defined as salaried employees in the private sector. In the hours worked equation, the uncovered sector is defined as self-employed workers plus unpaid family workers. In the probits, 1=covered sector workers and 0=self-employed+unpaid family workers+unemployed who have worked before. 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.

[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 minimum wage variable) in the regressions.

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	% within 10% of MW
1	0	2.79	20.6	0.86	5.35	5.38	19
2	0	4.51	18.6	0.90	5.51	5.49	21
3	0	5.21	19.0	0.87	5.60	5.55	21
4	0	5.43	20.9	0.72	5.67	5.57	20
5	0	6.08	20.2	0.67	5.73	5.62	22
6	0	6.51	21.7	0.67	5.79	5.64	21
7	0	7.36	21.7	0.62	5.85	5.71	21
8	0	9.34	16.5	0.74	5.98	5.85	22
9	7	10.85	15.6	0.67	6.13	6.02	19
10	77	14.01	15.4	0.72	6.51	6.52	17

Note: The means are calculated using sample weights.

Table 5: Estimates of the Effects of Minimum Wages on the Covered Sector by Skill Decile[1]

	Hours Worked		Probit	
Skill Decile	**B**	**SE**	**B**	**SE**
1	-0.180	*0.139*	0.108	*0.103*
2	-0.307**	*0.129*	-0.060	*0.089*
3	-0.036	*0.100*	-0.217**	*0.086*
4	-0.010	*0.087*	-0.172**	*0.084*
5	-0.163***	*0.090*	0.013	*0.085*
6	-0.107	*0.079*	-0.126	*0.138*
7	-0.070	*0.076*	-0.141	*0.094*
8	-0.046	*0.067*	-0.102	*0.073*
9	-0.016	*0.046*	0.062	*0.058*
10	-0.046	*0.036*	-0.024	*0.041*

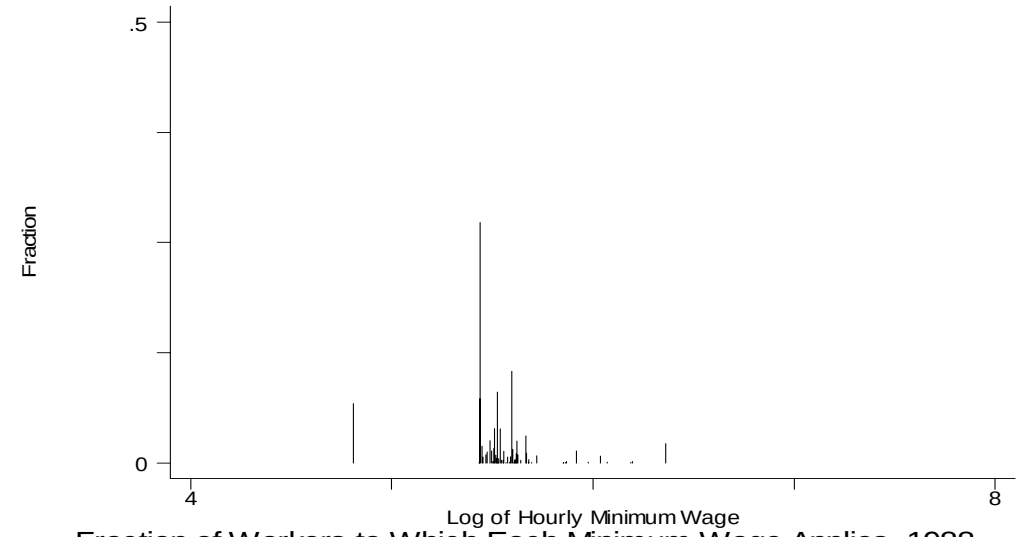
* = significant at 1%

**= significant at 5%

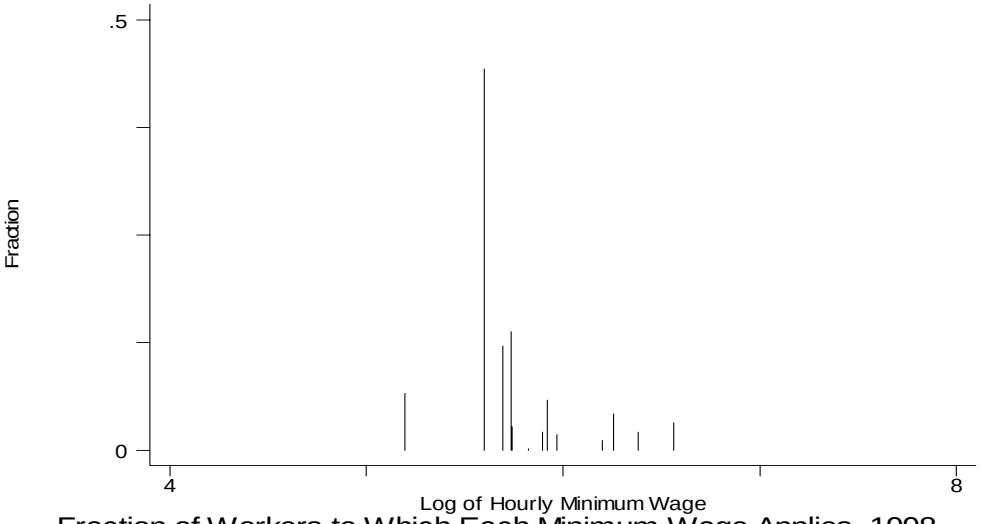
*** = significant at 10%

[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. The standard errors are robust to heteroskedsticity and first-order autocorrelation, and have been corrected for clustering around each minimum wage category.

Figure 1: Distribution of Legal Minimum Wages Among Workers, 1988 and 1998

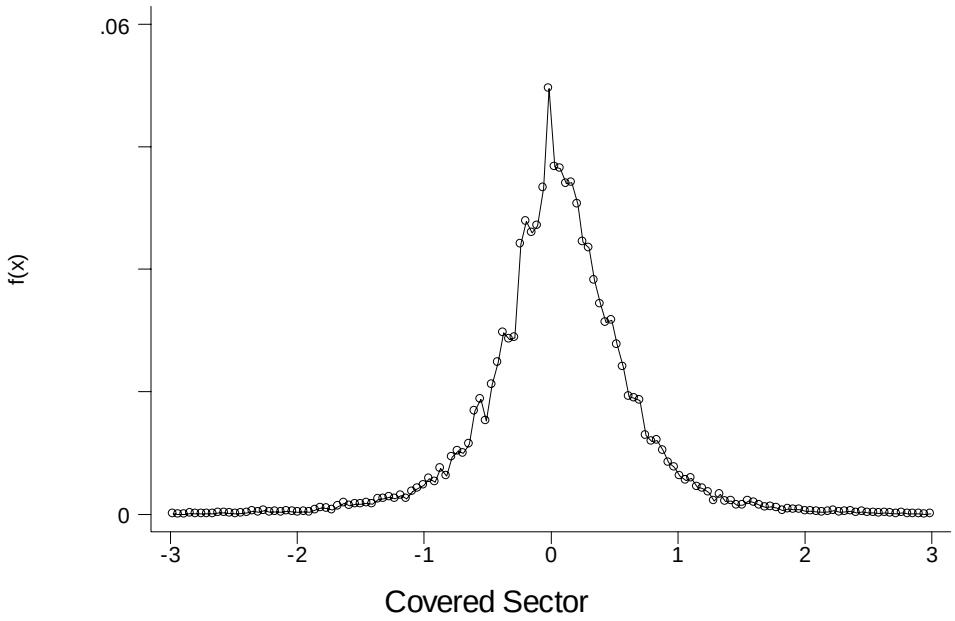


Fraction of Workers to Which Each Minimum Wage Applies, 1988



Fraction of Workers to Which Each Minimum Wage Applies, 1998

Figure 2: Kernel Desnity Fucntion of Ln(Wage) – Ln(Minimum Wage) for the Pooled 1988-2000 Data



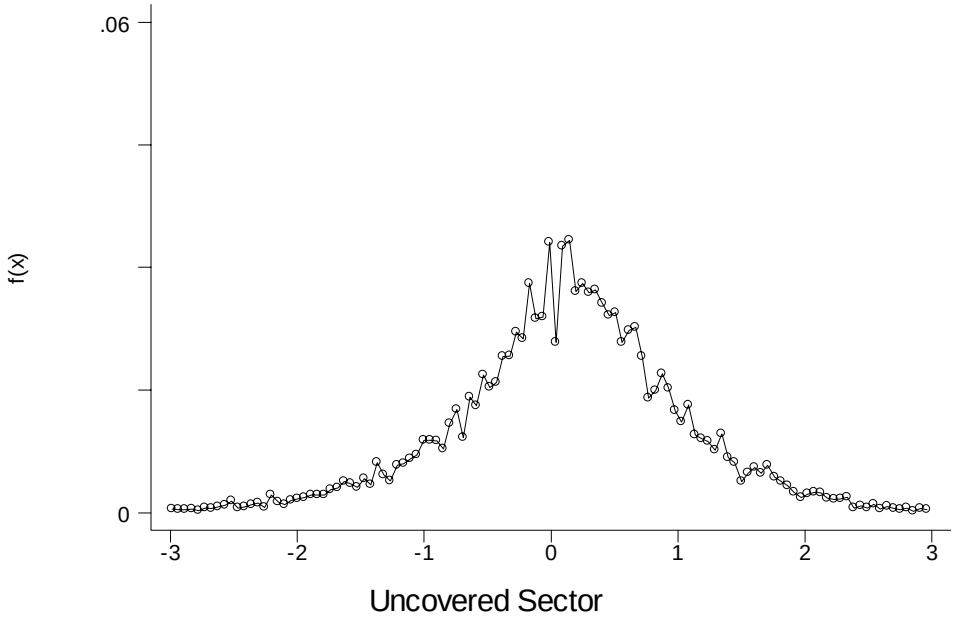


Figure 3: Average MW of Higher Educated Workers to Less Educated Workers

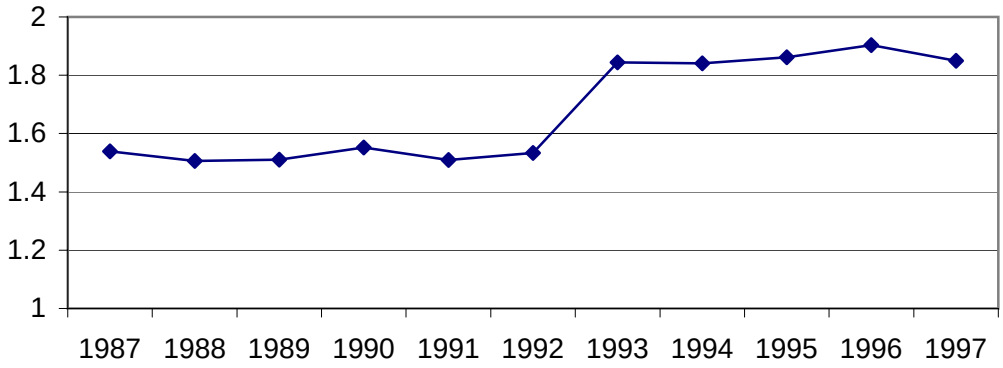


Figure A1: Kernel Density Function of Ln(Wage) – Ln(Minimum Wage) for the Pooled 1988-2000 Data for the Public Sector

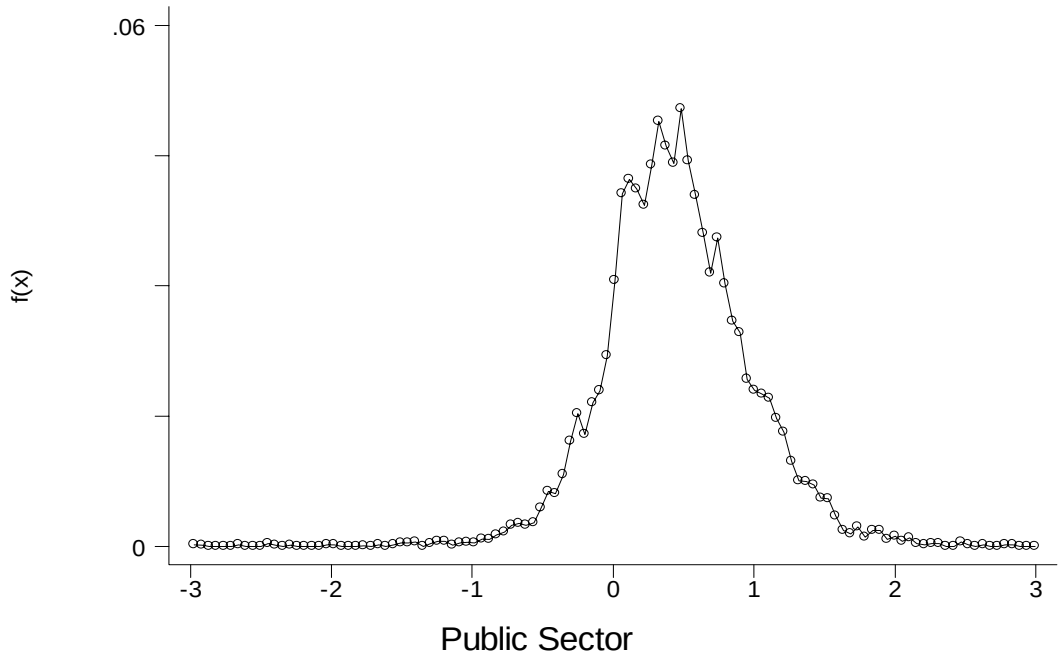


Table A1: Estimates of the Effects of Minimum Wages on Employment[1]

	Covered Sector (private)[2]	Public Sector[2]
Employment (Logit)[3]		
B	-0.444*	-0.491*
SE[4]	(0.106)	(0.158)
Odds Ratio	0.641	0.612
R-Squared	0.481	
N	177,797	
Hours (OLS)		
B	-0.062**	0.034
SE[4]	(0.029)	(0.021)
R-Squared	0.167	0.200
N	95,628	18,833

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

[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.

[2]The covered sector is defined as private sector paid employees; the public sector includes public administration and state-owned enterprises.

[3]For the Logits, we both report the coefficients and the odds ratios (where the reference sector includes the self-employed, unpaid family workers and unemployed) and the pseudo R-squared.

[4]Reported significance levels are based on estimates of the standard errors that are robust to heteroskedasticity and serial correlation.

Figure A2: Comparing the Distribution of Legal Minimum Wages to the Distribution of Hourly Wages in the Covered and Uncovered Sectors, 1988 and 1997

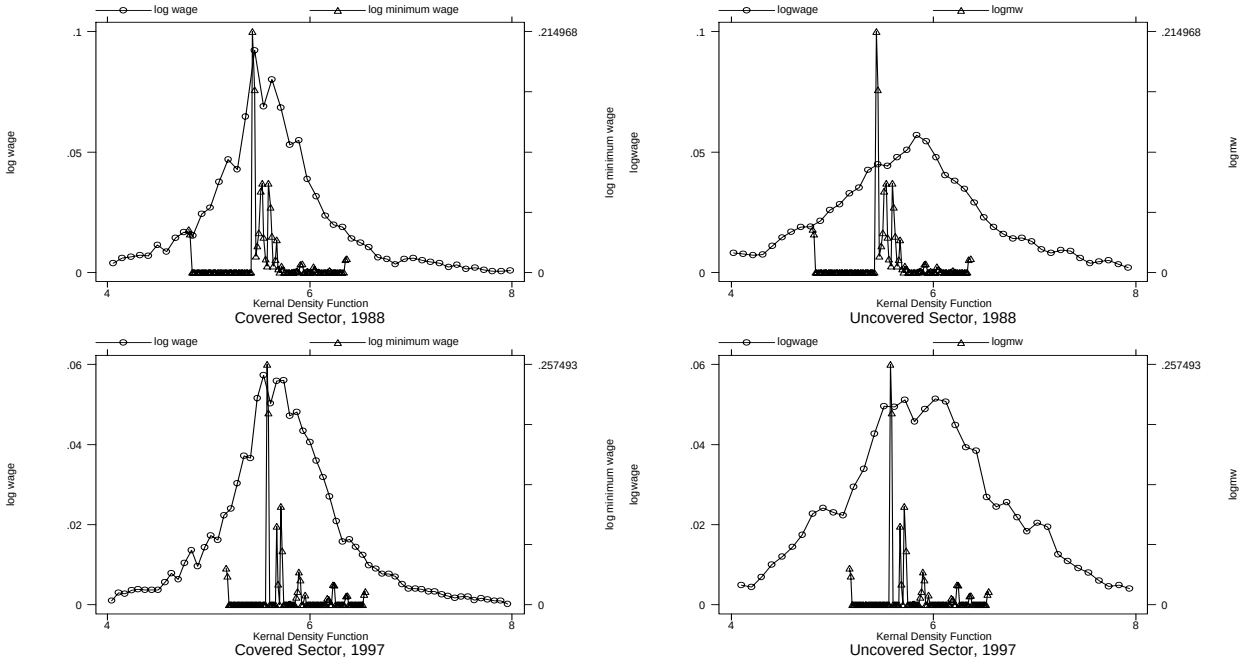


Table A2: Full Regressions

	Covered	Uncovered	Employment
	ln(hours)	ln(hours)	Probits
Ln Min. Wage	-0.062 [b]	-0.066	-0.068 [c]
	(0.029)	(0.048)	(0.038)
YR 88	0.028 [c]	0.033	0.000
	(0.017)	(0.026)	(0.018)
YR 89	-	-	-
	-	-	-
YR 90	0.010	0.021	-0.027
	(0.011)	(0.020)	(0.020)
YR 91	-0.028 [b]	-0.070 [a]	-0.033 [b]
	(0.012)	(0.020)	(0.017)
YR 92	0.005	-0.009	-0.015
	(0.010)	(0.020)	(0.017)
YR 93	0.000	-0.019	-0.029 [b]
	(0.011)	(0.019)	(0.015)
YR 94	-0.003	0.000	-0.041 [a]
	(0.012)	(0.020)	(0.015)
YR 95	-0.039 [a]	-0.057 [a]	-0.110 [a]
	(0.010)	(0.020)	(0.019)
YR 96	-0.012	-0.022	-0.053 [a]
	(0.011)	(0.022)	(0.016)
YR 97	0.007	-0.059 [a]	-0.067 [a]
	(0.011)	(0.020)	(0.019)
YR 98	-0.028 [b]	-0.053 [b]	-0.075 [a]
	(0.014)	(0.021)	(0.017)
YR 99	0.025 [c]	-0.040 [c]	-0.076 [a]
	(0.014)	(0.022)	(0.022)
Schooling	-0.001	0.030 [a]	0.029 [a]
	(0.003)	(0.006)	(0.004)
Experience	0.012 [a]	0.020 [a]	0.025 [a]
	(0.003)	(0.008)	(0.004)
Experience^2	0.000 [b]	0.000	-0.001 [a]
	(0.000)	(0.000)	(0.000)
Experience^3	1.24e-06	2.60e-06	5.78e-06 [a]
	(1.30e-06)	(2.37e-06)	(1.09e-06)
Gender	-0.102 [a]	0.512 [a]	-0.046
	(0.027)	(0.065)	(0.033)
School • Exp.	0.001 [a]	0.001 [b]	-0.003 [a]
	(0.000)	(0.000)	(0.000)
School • Exp^2	0.000 [a]	0.000 [a]	0.000 [a]
	(0.000)	(0.000)	(0.000)
School • Exp^3	7.42e-07 [a]	7.80e-07 [a]	-9.26e-08
	(1.34e-07)	(1.70e-07)	(1.08e-07)
Exp • Gender	0.011 [a]	0.023 [a]	0.010 [a]
	(0.003)	(0.007)	(0.003)
Exp^2 • Gender	0.000 [b]	-0.001 [a]	0.000 [a]
	(0.000)	(0.000)	(0.000)
Exp^3 • Gender	6.77e-07	6.96e-06 [a]	1.45e-06 [c]
	(1.16e-06)	(2.17e-06)	(8.72e-07)
School • Gender	0.006 [a]	-0.020 [a]	-0.001
	(0.002)	(0.004)	(0.002)
Sector Val. Add.	1.19e-07 [a]	6.92e-09	5.33e-07 [a]
	(194e-08)	(7.06e-08)	(4.08e-08)
Constant	4.045 [a]	3.169 [a]	
	(0.192)	(0.289)	
Ind/Occ/Skill Dummies	YES	YES	YES
No of Obs.	95628	53962	157952
R^2	0.167	0.256	0.408

* = significant at 1%; ** = significant at 5%; *** = significant at 10%.