The Impact of Differential Payroll Tax Subsidies on Minimum Wage Employment

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on Minimum Wage Employment

Abstract

In this article, we study the impact of changes of total labor costs on employment of low-wage workers in France in a period, 1990 to 1998, that saw sudden and large changes in these costs. We use longitudinal data from the French Labor Force survey (« enquête emploi ») in order to understand the consequences of real decreases and real increases of the labor cost. We examine the transition probabilities from employment to non-employment and from non-employment to employment. In particular, we compare the transition probabilities of the workers that were directly affected by the changes ("between" workers) with the transition probabilities of workers closest in the wage distribution to those directly affected ("marginal" workers). In all years with an increasing minimum cost, the "between" group (or the treated using the vocabulary of controlled experiments) comprises all workers whose costs in year t lie between the old (year t) and the new (year $t+1$) minimum. In all years with a decreasing minimum, the "between" group comprises all workers whose costs in year $t+1$ lie between the present minimum cost (year $t+1$) and the old (year t) minimum cost. The results can be summarized as follows. Comparing years of increasing minimum cost and decreasing minimum cost, difference-in-difference estimates imply that an increase of 1% of the cost implies roughly an increase of 1.5% in the probability of transiting from employment to non-employment for the treated workers, the resulting elasticity being –1.5. Second, results for the transitions from non-employment to employment are less clear-cut. Tax subsidies have a small and insignificant impact on entry from non-employment as well as on transitions within the wage distribution. Finally, we show that the "marginal" group constitutes a good control group. In addition, there is no obvious evidence of substitution between the "between" and "marginal" groups of workers, but there is some evidence of substitution between workers within the tax subsidy zone, with wages above those of the "marginal", and workers outside the subsidy zone.

Keywords: Minimum Wage, Total Labor Costs, Tax Subsidies
JEL Classifications: J31, J23

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1. Introduction

The importance of minimum wages on labor market outcomes is a matter of considerable debate. Some argue that minimum wage changes have no visible impact on employment (see the discussions surrounding the Card and Krueger', 1994 study; see also Card and Krueger, 1998 and Card and Krueger, 1995 for a recent critical analysis of the literature; see also Dickens, Machin, and Manning, 1998 for an analysis of the UK). While some others find that the falling real minimum wage over the eighties had impacts both on the employment of young as well as adult workers, and on the increase in wage inequality in the U.S. (see Brown, Gilroy, and Kohen, 1982 for the classic survey of the employment effects of minimum wages; Brown, 1999 for a new comprehensive survey; Dolado, Kramarz, Machin, Manning, Margolis, and Teulings, 1996 for a European perspective; Neumark and Washer, 1992 for the US, Abowd, Kramarz, Lemieux, and Margolis, 2000 for young workers or Abowd, Kramarz, and Margolis, 1999 for adult workers both in France and in the US; and DiNardo, Fortin, and Lemieux, 1996, and Lee, 1999 for inequality).

All these studies, indeed almost all existing ones, use wages as a measure of total labor costs. While this is a good measure for the low-wage labor market in the U.S. it is far from being adequate in Continental Europe. Indeed, in France, for a worker paid at the minimum wage, employee-paid contributions increased from 12.22% of the wage in 1980 to 20.02% at the beginning of 1993 whereas employer-paid contributions remained roughly stable (from 39.00% to 39.19%). But, starting in 1993, the employer-paid contributions started to decrease for minimum-wage workers (from 36.49% of the wage in 1993 to 21.77% in 1996), even though the minimum wage increased steadily over this period. Furthermore, the subsidies increased dramatically and, maybe, unexpectedly, between 1995 and 1996.

In this article, we study the impact of changes of total labor costs on employment of low-wage workers in France in a period, 1990 to 1998, that saw steady increases followed by sudden and large decreases in minimum costs. The tax subsidies were expected to counteract the negative impact of high minimum costs in a country with a large unemployment rate, in particular for young and uneducated workers.

We use longitudinal data from the French Labor Force survey (« enquête emploi ») in order to understand the consequences of real decreases and real increases of the labor cost. We examine the transition probabilities from employment to non-employment and from non-employment to employment. To estimate the effects of the changing cost, we compare these transitions between years as well as within a year. In particular, we compare the transition probabilities of the workers that were directly affected by the changes, the "between" workers, with the transition probabilities of workers closest in the wage distribution to those directly affected, the "marginal" workers. In all years with an increasing minimum cost, the "between" group (the treated using the vocabulary of controlled experiments) comprises all workers whose costs in year *t* lie between the old (year *t*) and the new (year *t+1*) minimum. In those years, we examine whether these workers lose employment more frequently than workers paid marginally above the new minimum cost (the control group). In all years with a decreasing minimum, the "between" group comprises all workers whose costs in year *t+1* lie between the present minimum cost (year *t+1*) and the old (year *t*) minimum cost. In those years, we examine whether such workers come more often from non-employment than those paid marginally above the old minimum cost (the "marginal" group). We complement the first (simple difference) estimates with a difference-in-difference analysis in which the gap in employment to non-employment transitions between the treated group and the control group, in years of increasing minimum costs, is compared to the same gap in years of decreasing minimum costs. Similarly, we compare the gap in non-employment to employment transitions between the "between" group and the "marginal" group in years of decreasing minimum costs with the one observed in years of increasing minimum costs. If employment transitions of the "between" group differ structurally from those of the "marginal" group, the difference-in-difference analysis eliminates these unobserved components.

The results can be summarized as follows. Comparing years of increasing minimum cost and decreasing minimum cost, difference-in-difference estimates imply that an increase in cost of 1% implies roughly an increase of 1.5% in the probability of transiting from employment to non-employment for the treated workers, the resulting elasticity being –1.5. There is strong evidence that the effects of cost increases and cost decreases are not symmetric. Unfortunately, the results for the transitions from non-employment to employment are less clear-cut. Even though tax subsidies seem to have an impact on entry from non-employment, this effect is not significantly different from zero. We also show that the "marginal" group of workers constitute a good control group in our difference-in-difference analysis. Finally, tax subsidies appear to have an effect on transitions within the wage distribution.

In the next section, we present the legal framework surrounding the changes in the minimum wage and in the payroll taxes and their impact of the cost of workers paid around the minimum wage. In Section 3, we present the data that we use as well as first descriptive evidence. In Section 4, we specify our statistical models; the resulting estimates being presented and discussed in Section 5. We briefly conclude in Section 6.

2. Legal Framework

The first minimum wage law in France was enacted in 1950, creating a guaranteed hourly wage rate that was partially indexed to the rate of increase in consumer prices. Beginning in 1970, the original minimum wage law was replaced by the current system (called the SMIC, "salaire minimum interprofessionnel de croissance") linking the changes in the minimum wage to both consumer price inflation and growth in the average hourly blue-collar wage rate. In addition to formula-based increases in the SMIC, the government legislated increases many times over the next two decades (the so-called "coup de pouce"). The statutory minimum wage in France regulates the hourly regular cash compensation received by an employee, including the employee's part of any payroll taxes.[1]

Figure 1 shows for our sample period the changes in the French minimum wage (i.e. including the associated employee-paid payroll taxes) and the changes in the associated total labor costs (i.e. including the employer-paid payroll taxes) in March of every year.

[1] Other features of the French labor market are described in Card, Kramarz, and Lemieux (1999). But, the minimum wage is an essential component of the French labor market institutions.

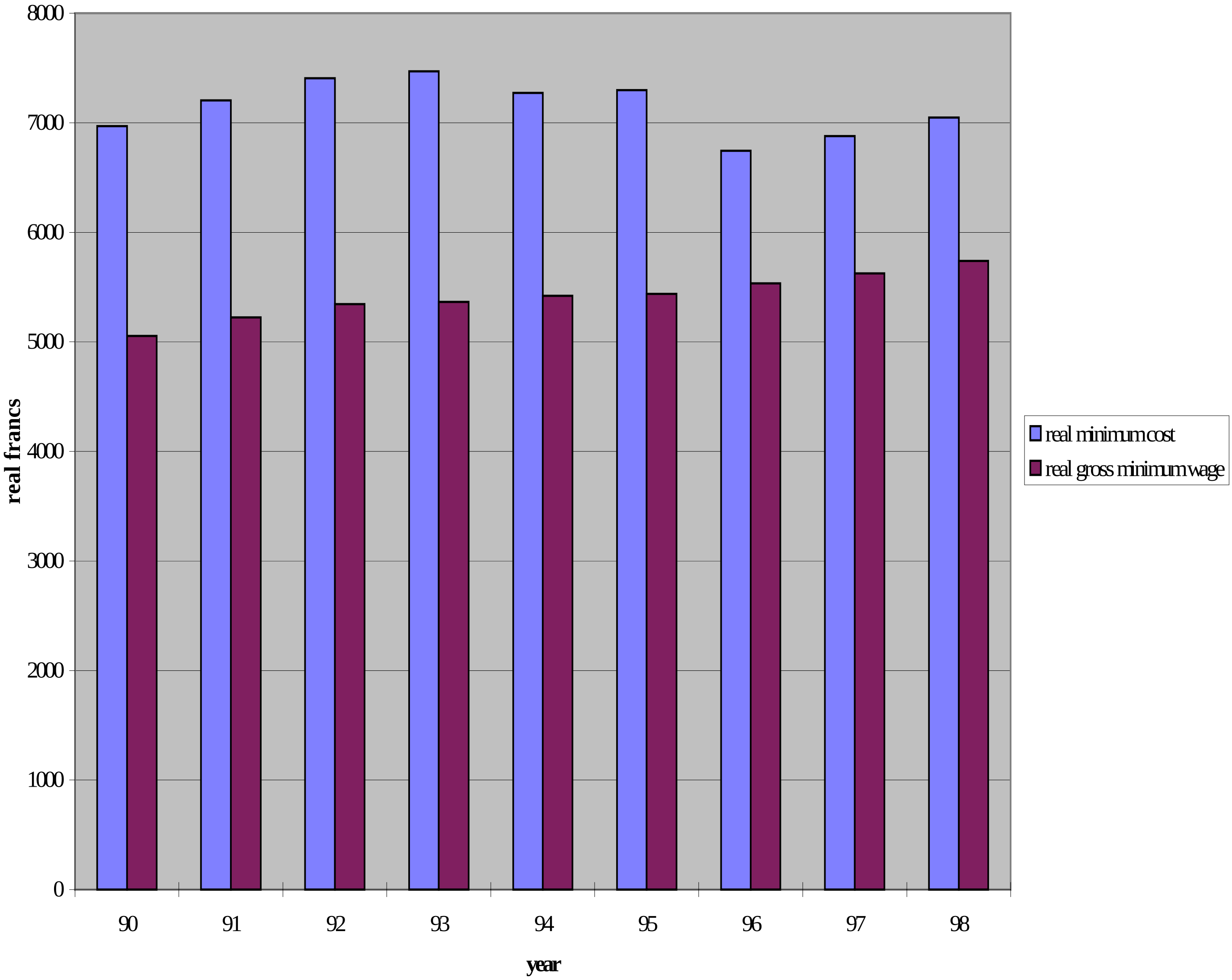

Figure 1: Changes in the Real Minimum Cost and the Real Minimum Wage
Sources: Dares (various years), Insee (various years)

Because of the extensive use of payroll taxes to finance mandatory employee benefits, the French minimum wage imposed a substantially greater cost upon the employer than its statutory value. In addition, the real (statutory) minimum wage increased over the whole period, partly because of increases in the employee-paid payroll taxes, partly because of the voluntary policy of the various French governments. To counteract this increasing burden, tax exemptions were enacted during this period. Figure 2 presents the various policies that were successively implemented over the nineties. The year refers to the situation in March, the month of the French labor force survey, the data that we use in the following. In March 1994, the subsidy is made of two flat rates, the first one, ranging from 1 to 1.1 times the minimum wage, is equal to 5.4%, while the second, ranging from 1.1 to 1.2 times the minimum wage, is equal to 2.7%. In 1995, the ranges became respectively 1-1.2 and 1.2-1.3. In September 1995 (dated 1996 in Figure 2), the subsidy increased dramatically and its shape changed, decreasing from 18% to 5.4% for wages going from 1 times the minimum wage to 1.2 times the minimum wage. In October 1996 (dated 1997 in Figure 2), the two subsidies were merged in one linear reduction that spanned from 1 to 1.33 times the minimum wage. In 1998, the subsidy did not change.

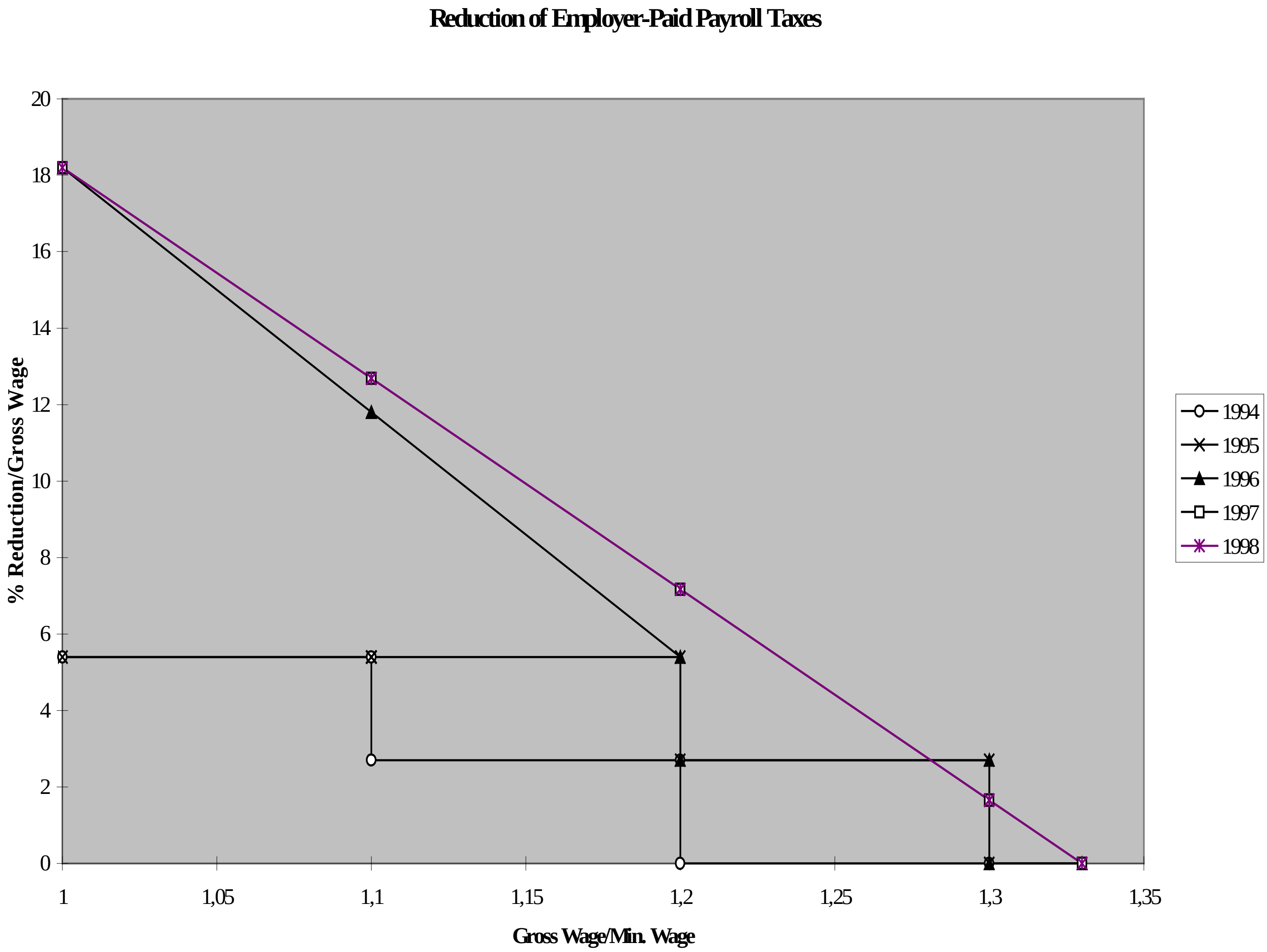

Figure 2: The Tax Subsidies, 1994 to 1998

Hence, between 1993 and 1995, the tax reductions were rather small (at most 6% for a minimum wage worker). But, starting in September 1995, reductions became substantial and the employer-payroll taxes decreased by 18 percentage points at the minimum wage. Employer-paid payroll taxes went from roughly 40% at the beginning of the nineties to 21.77% in 1996. The next figures show the impact of the subsidies on the changes of costs for workers with a wage between the minimum wage and twice the minimum wage for the various years of our sample.

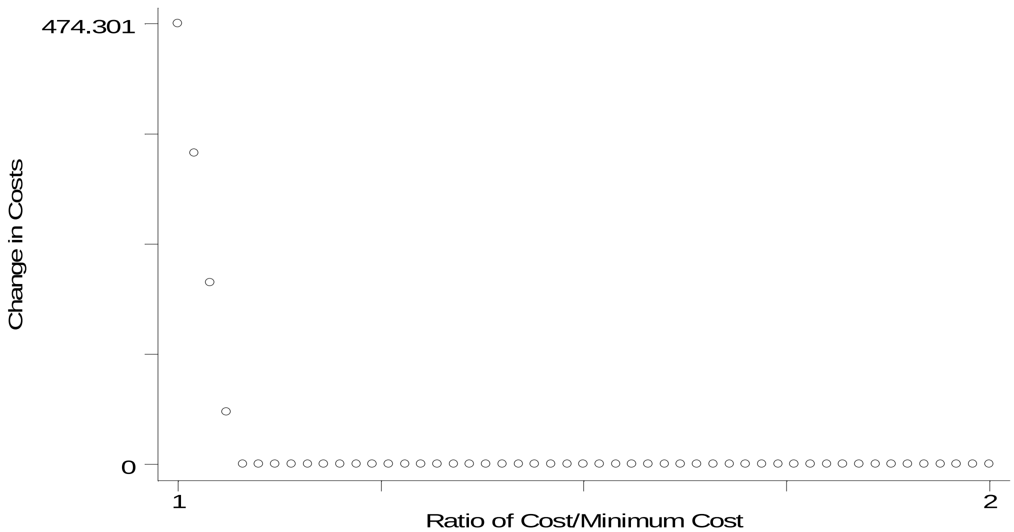

Figure 3a: Changes in Costs, 1990-1991

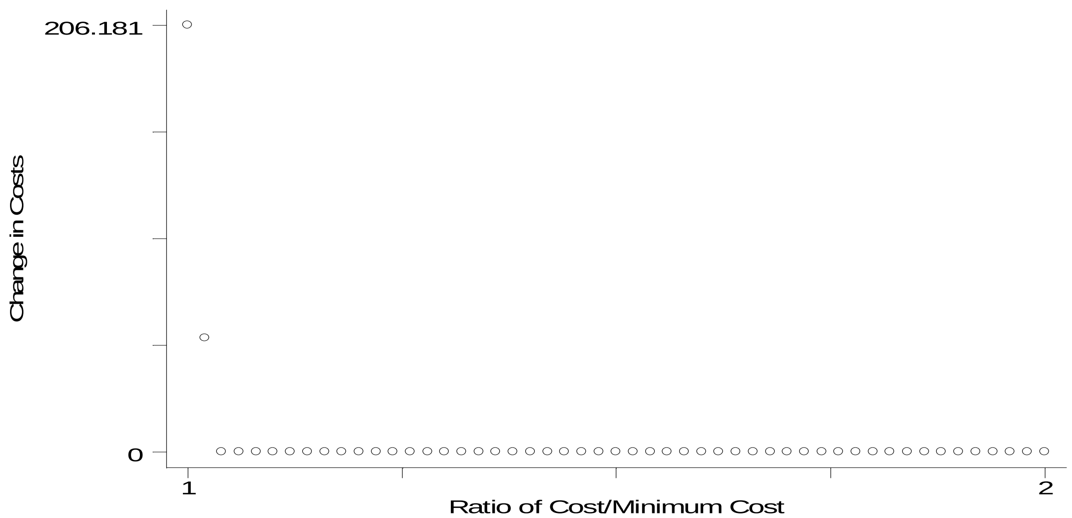

Figure 3b: Changes in Costs, 1991-1992

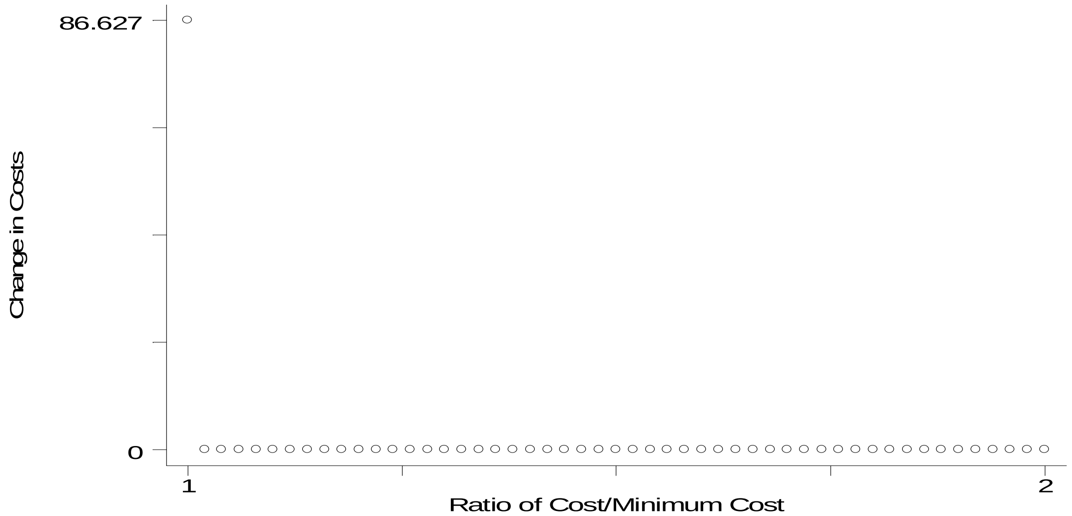

Figure 3c: Changes in Costs, 1992-1993

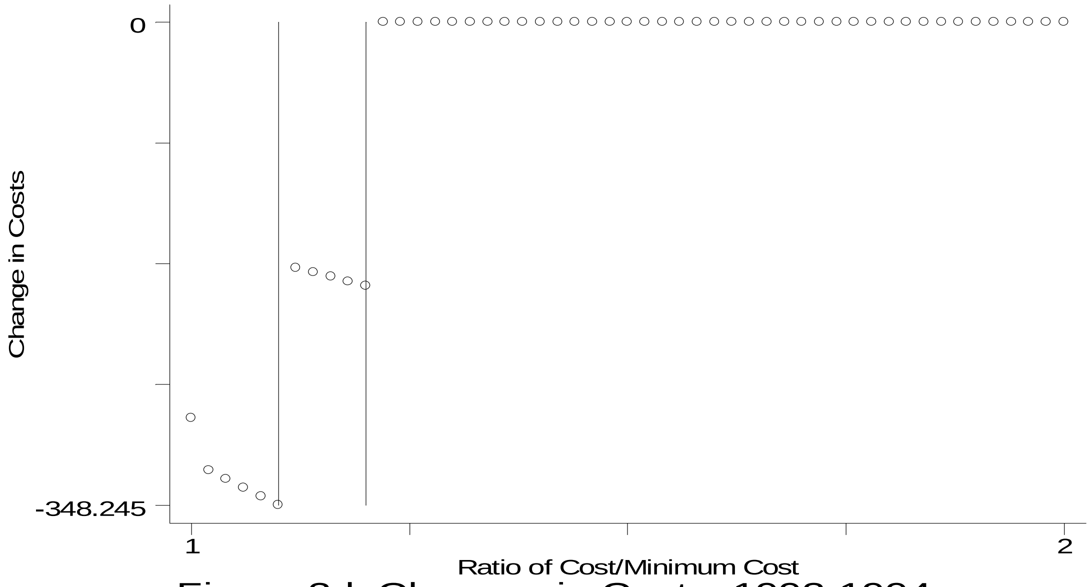

Figure 3d: Changes in Costs, 1993-1994

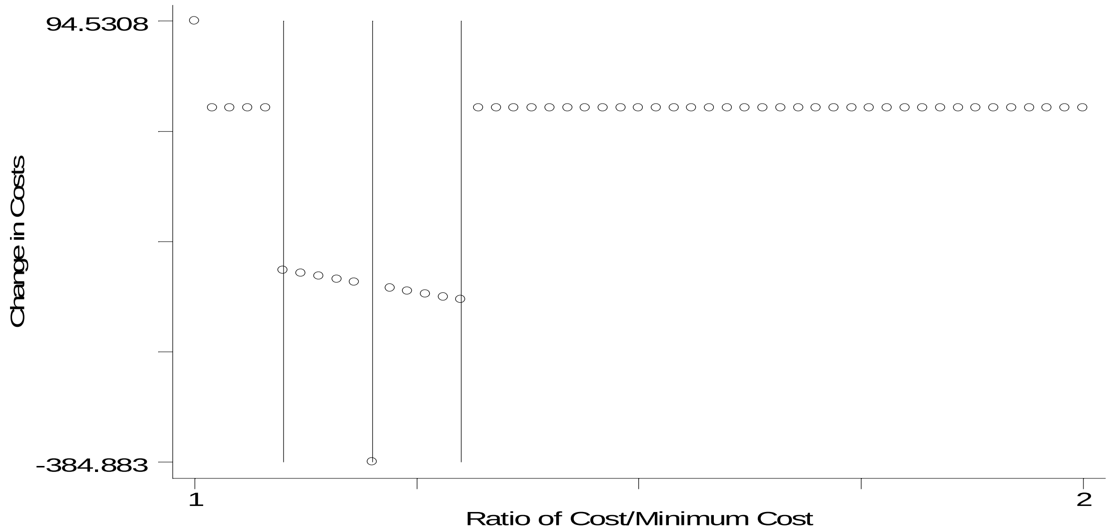

Figure 3e: Changes in Costs, 1994-1995

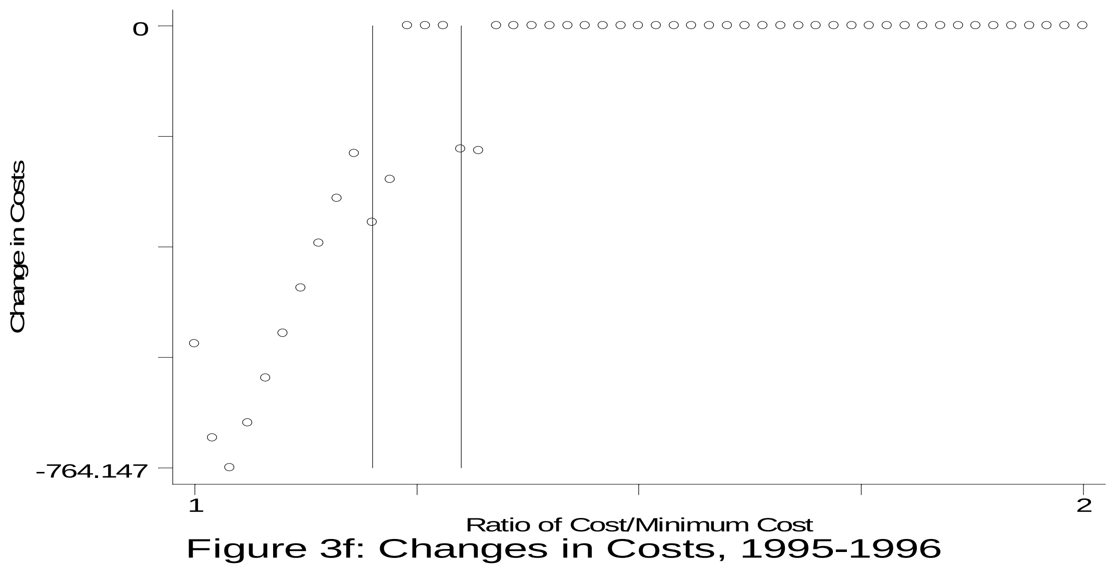

Figure 3f: Changes in Costs, 1995-1996

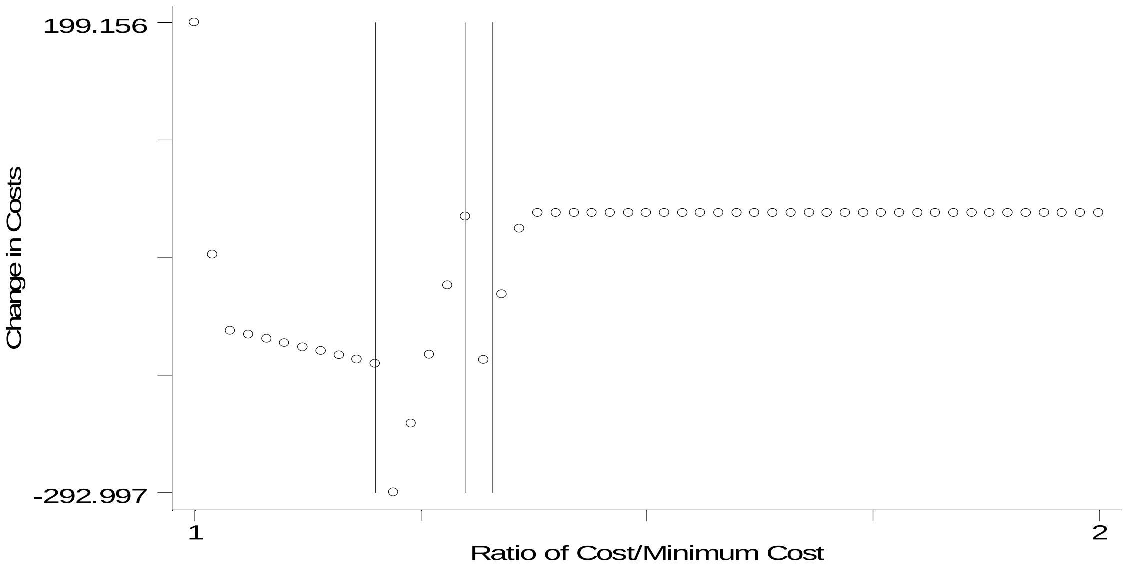

Figure 3g: Changes in Costs, 1996-1997

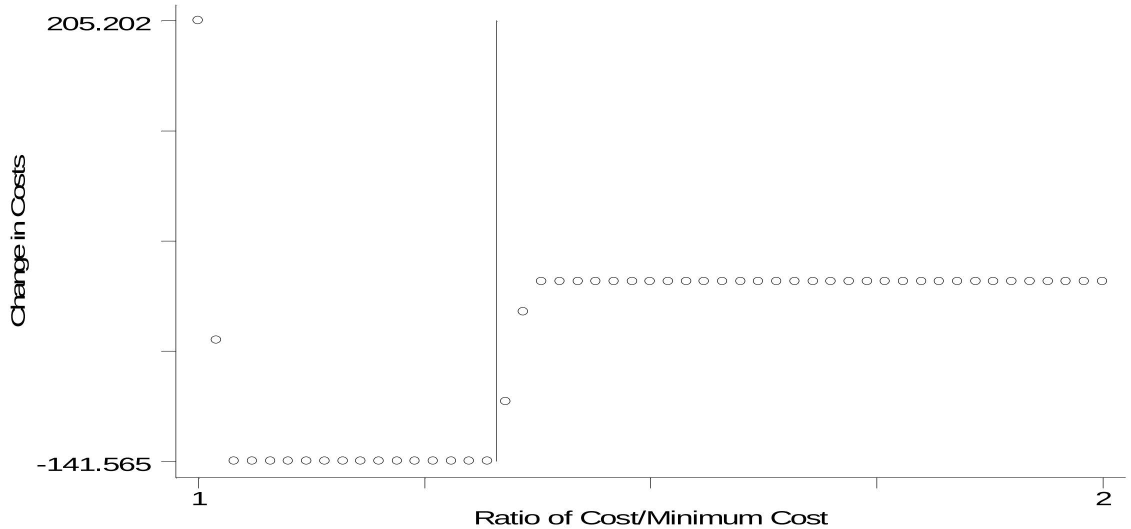

Figure 3h: Changes in Costs, 1997-1998

In Figures 3a to 3h, we have computed the changes in nominal costs between consecutive years induced by changes in the minimum wage and subsidies of each year.[2] To simplify our the descriptive analysis, we do not show changes in costs induced by other changes in the tax system (such as health, or pensions), even though we compute and use the exact changes in the rest of the analysis. More precisely, we assume for this computation that workers paid w at the initial date will be paid exactly w at the next date unless the old wage is between the old and the new minimum wage. If we consider the first three couples of years (Figures 3a to 3c), we see that changes are solely due to increases in the minimum wage. Workers at the minimum have the largest change, whereas workers with a wage above the new nominal minimum wage have an unchanged cost (given the assumptions used for this descriptive analysis). Starting in 1993-1994, the subsidies interact with the changes in the minimum wage. The vertical lines reflect the schedule of the subsidies (at 1.1, 1.2, 1.3, and 1.33 times the minimum wage depending on the year). For instance, changes between 1993 and 1994 are characterized by a small increase in the SMIC, a decrease in payroll taxes for workers with wage between the SMIC and 1.1 times the SMIC, and a smaller decrease between 1.1 and 1.2 times the minimum wage. All workers with a wage in 1993 above 1.2 times the new minimum are unaffected by these changes. The largest decrease occurs between 1995 and 1996 when the employer payroll taxes decrease by 18.2 percentage points, inducing a decrease in costs of more than 700 French Francs (120 US$) for workers close to the minimum. Finally, Figure 3h displays a very particular and interesting feature induced by the interaction of a large increase in the minimum wage and subsidies based on the same minimum wage. The minimum wage strongly increased after Jacques Chirac's election as president (a tradition in France after every presidential election). Hence, workers that were above the minimum wage in 1997, say at 1.1 times the minimum, had a wage at the minimum in 1998. Subsidies for such workers increased, say from 10 percentage points to the maximum of 18.2 percentage points. Consequently, their cost decreased. Therefore, the minimum wage increase induced a decrease in the cost of workers who had, in 1997, a wage between the new minimum wage and 1.33 times the old minimum. We will use the structure of these various changes in our econometric analysis. Notice, however, that the various discontinuities that show up on the figures are, in reality, smoothed by the changes in the rates of other taxes, such as those paying for the health-care system or for pensions.

In addition to these reductions for low-wage workers, contracts in various youth employment programs offer either minimum wage exemptions (apprenticeship, for instance) or payroll tax exemptions. These programs were the focus of Bonnal, Fougère, and Sérandon (1997) and of Magnac (1997). To fully concentrate on the effects of the changes in the labor cost for the usual types of contracts, we will not include young workers (below 25) employed under any special program in our analysis. Indeed, they only represent a very small proportion of the employed population.

[2] As in the previous Figures, the computations reflect the situation as of March of the year.

3. Data and First Evidence

3.1. Data Description

The data were extracted from the French «Enquête Emploi» (Labor Force Survey) for the years 1990 to 1998. The sixty thousand households included in the Labor Force Survey sample are interviewed in March of three consecutive years with one-third of the households replaced each year. Every member of the household is surveyed and followed provided that he or she does not move during this three-year period. We used the INSEE research files for each of the indicated years. These files include the identifiers that allow us to follow individuals from year to year. Using these identifiers we created year-to-year matched files for the years 1990-91 to 1997-98.

The survey measures usual monthly earnings, net of employee payroll taxes but including employee income taxes, and usual weekly hours. The minimum wage is defined on an hourly basis, unfortunately the usual weekly hours measure appears to be somewhat noisy. A lot of respondents say that they work more than 39 hours per week, the legal limit. If one calculates an hourly wage, an unreasonable fraction is paid below the minimum. For instance, some high-paid young engineers declare more than 50 hours a week. Therefore, we used the monthly wage together with the full-time or part-time status to compute the total labor cost. For workers employed part-time, we used the reported weekly hours to compute their full-time equivalent monthly wage. For full-time workers, we use the reported monthly wage.

All young workers employed in publicly-funded programs that either combined classroom education with work («apprentis», «stage de qualification» or «stage d'insertion, contrat emploi - formation») or provide subsidized low-wage employment (such as «SIVP, stage d'initiation à la vie professionnelle») were excluded from the database. All of these programs provide a legal exemption from the SMIC and from certain payroll taxes. These programs are limited to workers 25 years old and under. In addition, all workers who declared a wage below 95% of the minimum wage without reporting employment on a special scheme were not kept in the analysis file (they represent less than 5% of the original file). Most correspond to reporting or coding errors as well as workers on special contracts who did not specify the type of contract. We also eliminated workers employed as civil-servants or in the public sector since they cannot become non-employed, owing to their status.

The employment status in year *t* is equal to one for all individuals who are employed in March of the survey year, and equal to 0 otherwise. The French Labor Force Survey definition of employment is the same as the one used by the International Labor Office: a person is employed if he or she worked for pay for at least one hour during the reference week. The definition is thus consistent with the American BLS definition.

Our control variables consist of education, age, sex, seniority, type of contract, wage, and year. Education was constructed as six categories: none; completed elementary school, junior high school, or basic vocational/technical school; completed advanced vocational/technical school; completed high school (baccalauréat); completed technical college; completed undergraduate or graduate university. Seniority was measured as the response to a direct question in the survey (years with the present employer). The type of contract was constructed as 3 categories: short-term contracts (CDD), temporary work, long-term contracts (CDI). Summary statistics are presented in Table A.1 in the Data Appendix.

The data on minimum wage, price index and taxes were taken from « Les Retrospectives », BMS (Bulletin Mensuel de Statistiques, INSEE) in March of each year. The data on tax subsidies were taken from « Liaisons Sociales » (DARES) and « Séries longues sur les Salaires » (INSEE Résultats, édition 1998).

3.2. Descriptive Analysis

Figure 4a presents a non-parametric estimation of the probabilities of being non-employed at date *t+1* conditional on being employed at date *t* as a function of the ratio of the cost to the minimum cost for two couples of years, 1990-1991 and 1995-1996. These years were selected because the GDP growth rates were similar, but with an increasing minimum cost for the first couple of years and a decreasing minimum cost for the second couple of years.

Figure 4a: Job Losses, 1990-91 and 1995-96, w.r.t the SMIC

In particular, in every year, workers with higher wages are less likely to become non-employed. The vertical lines correspond, from the left to the right to 0.98, 1.03, 1.1, 1.2, and 1.3 times the minimum wage. Our “between” workers (our treated group) are roughly comprised between the first two lines, the “marginal” workers (our control group) are roughly comprised between the second and the third, whereas the last two lines correspond to the steps in the subsidy schedule that prevails in 1996. Considering first the 1990-1991 transitions, the “between” workers, i.e. those directly concerned by the minimum wage increase, have a higher job loss probability than the “marginal” workers, who also have a higher job loss probability than the rest of the distribution. Notice also that “marginal” workers have a roughly constant job loss probability whereas “between” workers’ mirrors the minimum cost increase shown in Figure 3a. The 1995-1996 job loss probability distribution has changed, in particular in the tax subsidy zone, where the subsidy is the largest, i.e. close to the minimum wage, where the job loss probability decreases. Indeed, the changes do not seem much stronger for the “between” than for the “marginal” workers. In fact, comparing the two couples of years in Figure 4a, there is no obvious evidence of substitution between “marginal” and “between” workers. Indeed, from this figure, effect of the changes in minimum cost between the two couples of years may appear to be difficult to isolate. An estimation controlling for all observed factors is needed.

Simultaneously, the decrease in the minimum cost may have favored entry of low-wage workers. Therefore, we contrast entries over the same two couples of years. Figure 4b presents non-parametric estimates of the probability of coming from non-employment (in 1990 and 1995, respectively) for workers employed in the next year (1991 and 1996, respectively) as a function of the ratio of the wage to the minimum wage. Once again, the vertical lines correspond, from the left to the right to 0.98, 1.03, 1.1, 1.2, and 1.3 times the minimum wage.

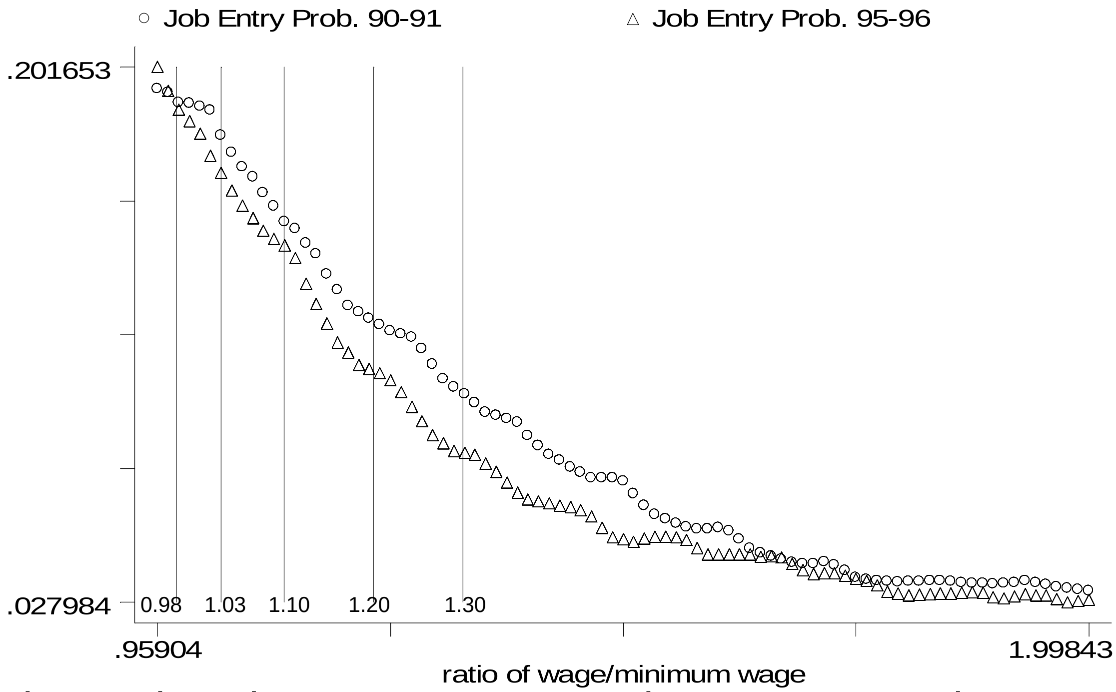

Figure 4b: Job Entry, 1990-91 and 1995-96, w.r.t the SMIC

The results do not show any obvious difference between the two couples of years, even though more entry seems to take place in the bottom of the wage distribution in all years. Indeed, business conditions were not exactly similar in those two couples of years even though they were close. This may explain the slightly larger entry in 1990-1991. Notice that “marginal workers” do not seem to benefit from the decrease in costs more than “between workers”. More detailed statistical analysis is obviously needed here and will be presented in the next sections. Just note that the “marginal” workers, that we use as a control group in our statistical analysis, do not seem to be affected by substitution. But, we will come back to this question later in the analysis. We now turn to our statistical framework in order to analyze the effects of the changes in the minimum costs more systematically.

4. The Statistical Models

Our first interest is the analysis of the impact of minimum wage increases on transitions to non-employment of workers directly affected by the increase. Therefore, we isolate these workers in our statistical framework. From the Figures 3a to 3h presented above, we see that years 1990 to 1992 are excellent examples of years in which the cost for minimum workers increases while that of workers just above the new minimum does not change. The large minimum wage increase that occurs between 1997 and 1998 is also an example where workers at the minimum are directly affected even though tax subsidies were already in place. In fact, workers above the new minimum up to 1.33 times the old minimum benefited from a decrease in costs. But, importantly for us, workers just above the new minimum, say between the new minimum and 1.1 times the new minimum benefit from the same decrease as workers with wage between 1.1 and 1.3 times the new minimum. Hence, in our period analysis, minimum costs increased by much larger factor than for all other categories of workers. The effects of such increases can be contrasted with the effects of decreases in costs that occurred during the same period. In particular, the above Figures show that two couples of years, 1995-1996 and 1993-1994, are undoubtedly years of decreasing cost for minimum wage workers. Furthermore, in those two couples of years, workers situated above in the wage distribution benefited less from the tax subsidies than minimum wage workers.

Therefore, our statistical analyses will contrast outcomes of workers most affected by the changes – increases in the minimum wage or decreases in the minimum costs after implementation of tax subsidies - with those closest to them in the wage distribution but either not affected or less affected by the changes.

A look at the same Figures might lead us to use some of the discontinuities that appear in the changing costs (the statistical methods well-suited to using such discontinuities for program evaluation are presented in Angrist and Lavy, 1999, van der Klaauw, 1996; they are based on ideas of Campbell, 1969). However, there are at least two reasons for not using this type of approach in our particular application. First, the Figures show changes that are not the only cost changes that occur in any given year. In particular, our computations of cost changes include other component of the taxes that are not shown on the graphs but are used in our statistical analysis. As already mentioned, these other components tend to smooth the changes. Furthermore, the data on wages that we use is not precise enough to locate and examine precisely the discontinuities. These wages come from a household survey, and many components of the wage cannot be isolated. For instance, a precise measure of the bonuses is essential to assess the exact situation of a worker vis-à-vis the minimum wage and, therefore, vis-à-vis tax subsidies when the wage is around 1.2 or 1.3 times the minimum. Such information is not available in the French enquête emploi. Administrative data sources would be more suited to such analysis.

4.1. Exit

In this section, we model the ideas discussed above. More precisely, we apply and extend Abowd, Kramarz, Lemieux, and Margolis (2000) and Abowd, Kramarz, and Margolis (1999)' statistical framework (see also Currie and Fallick, 1996) to the study of the impact of changes in total labor costs on employment.

Let $rmic_t$ be the real minimum cost at date t and $rc_{i,t}$ the real cost of worker i at date t. Increasing costs implies $rmic_{t+1} > rmic_t$ Thus, some workers have costs in year t that fall ***between*** the two successive minimum costs:

$B_t = \{i \,/\, rmic_t < rc_{i,t} < rmic_{t+1}\}$ is the population caught by the increasing minimum cost. B_t is the treated group.

As observed in Abowd et al., the low-wage workers also have a higher propensity to exit employment than high-wage workers, even after controlling for all observables. Therefore, they used as a control group workers whose wages were marginally above those directly affected by the increasing minimum wage. We follow the same route and define

$M_t = \{i \,/\, rmic_{t+1} <= rc_{i,t} < 1.1 * rmic_{t+1}\}$, the population whose costs are ***marginally above*** those of the "between" group. M is the control group.

Abowd et al. (id.) use a conditional logit analysis to determine whether the test group (B_t) has a higher probability of transiting to non-employment than the control group (M_t). Hence, following them, we estimate the model :

$$\Pr\left[e_{t+1} = 1 \middle| e_t = 1\right] = \mathrm{F}\begin{pmatrix} x_t\beta + b\,\mathrm{I}\left(rmic_t \le rc_t \le rmic_{t+1}\right) \times \left(rmic_{t+1} - rmic_t\right) \\ + m\,\mathrm{I}\left(rmic_{t+1} < rc_t \le (rmic_{t+1} \times 1.1)\right) \times \left(rmic_{t+1} - rmic_t\right) \end{pmatrix} \quad \textbf{(1)}$$

where F is the standard logistic function. *I(.)* equals to 1 if the individual satisfies the condition, and 0 otherwise, x_t is the vector of all relevant observable individual characteristics: it includes dummy variables for years, education (6 groups), age (8 groups), part-time indicator, short-term contract indicator, potential experience and square, seniority and square, and a cubic in the wage.

This first analysis corresponds to a first difference approach. If the two groups are structurally different, then differences in the above estimates will only reflect heterogeneity between B_t and M_t. Indeed, as a first approach, it is important to contrast years in which the cost is increasing with years in which the cost is decreasing. Existence of differences would provide direct evidence of the impact of minimum wage hikes. However, model (1) is well-defined in years of increasing minimum costs but it has to be modified in years of decreasing minimum costs. To do this, we define the "between" group as workers in the bottom of the wage distribution, i.e. $B_t = \{i$

/ 0.98 $rmic_t$ < $rc_{i,t}$ <1.05* $rmic_t$ }* and "marginal" workers as M_t=*{i / 1.05* $rmic_t$ <= $rc_{i,t}$ <1.15* $rmic_t$ }*. Hence, we estimate the above equation with the appropriate modification of the two groups:

$$\Pr\left[e_{t+1}=1\middle|e_t=1\right]=\mathrm{F}\begin{pmatrix} x_t\beta + b\,\mathrm{I}(0.98\times rmic_t \le rc_t < 1.05\times rmic_t)\times\left|rmic_{t+1}-rmic_t\right| \\ + m\,\mathrm{I}(1.05\times rmic_{t+1} \le rc_t < 1.15\times rmic_t)\times\left|rmic_{t+1}-rmic_t\right| \end{pmatrix} \quad \textbf{(2)}$$

To go further into the direction of a difference-in-difference analysis, one must use all years simultaneously and control for unobserved time-constant unobserved heterogeneity in the two groups by including indicators for B_t and M_t. The resulting estimating equation is:

$$\Pr\left[e_{t+1}=1\middle|e_t=1\right]=\mathrm{F}\begin{pmatrix} x_t\beta + b_0\,\mathrm{I}(B_t) + m_0\,\mathrm{I}(M_t) \\ + b\,\mathrm{I}(B_t)\times(rmic_{t+1}-rmic_t) \\ + m\,\mathrm{I}(M_t)\times(rmic_{t+1}-rmic_t) \end{pmatrix} \quad \textbf{(3)}$$

where we have a constant for each group, B_t and M_t, together with an interaction with changes in the minimum cost. Note that the coefficients *b* and *m* cannot be separately identified from b_0 and m_0 in the above equation unless there is enough variation in the changes of minimum cost. So, we need to include years of decreasing costs in the estimation. As above, we proceed by defining "between" workers in years of decreasing costs as B_t=*{i / 0.98* $rmic_t$ < $rc_{i,t}$ <1.05* $rmic_t$ }* and "marginal" workers as M_t=*{i / 1.05* $rmic_t$ <= $rc_{i,t}$ <1.15* $rmic_t$ }*.

Finally, to account for possible asymmetries in the estimates between years of increasing and years of decreasing costs, we re-estimate the previous equation allowing for different parameters for *b* and *m* in years of increasing minimum cost and in years of decreasing minimum cost. The final equation is:

$$\Pr\left[e_{t+1}=1\middle|e_t=1\right]=\mathrm{F}\begin{pmatrix} x_t\beta + b_0\,\mathrm{I}(B_t) + m_0\,\mathrm{I}(M_t) \\ + b_i\,\mathrm{I}(B_t)\times(rmic_{t+1}-rmic_t)\times\mathrm{I}(rmic_{t+1}-rmic_t>0) \\ + m_i\,\mathrm{I}(M_t)\times(rmic_{t+1}-rmic_t)\times\mathrm{I}(rmic_{t+1}-rmic_t>0) \\ + b_d\,\mathrm{I}(B_t)\times(rmic_t-rmic_{t+1})\times\mathrm{I}(rmic_t-rmic_{t+1}>0) \\ + m_d\,\mathrm{I}(M_t)\times(rmic_t-rmic_{t+1})\times\mathrm{I}(rmic_t-rmic_{t+1}>0) \end{pmatrix} \quad \textbf{(4)}$$

where the index *i* stands for a year of increasing minimum cost and index *d* stands for a year of decreasing minimum cost. Once again, the b_i and m_i and b_d and m_d can only be separately identified from b_0 and m_0 if there is enough variation in the minimum cost. Therefore, we also estimated in model in which $b_0 = m_0$ as soon as the resulting estimates of **(4)** could not reject the null $b_0 = m_0$.

In the last subsection of the results section, we present an economic model that helps us interpret the estimates obtained in this difference-in-difference analysis. The model also allows to discuss the quality of the "marginal" group as a control group in such a framework.

4.2. Entry

Decreasing cost implies $rmic_t > rmic_{t+1}$: thus, some workers have costs in year $t+1$ that are ***between*** the two successive minimum costs, $B_t=\{i \ / \ rmic_{t+1} < rc_{i,t+1} < rmic_t\}$. Hence, it constitutes the population liberated by the decreasing minimum cost. Indeed, if workers are paid their marginal product, this decrease in costs should allow non-employed workers to enter jobs. And, as above, we define $M_t=\{i \ / \ rmic_t < rc_{i,t+1} < rmic_t *1.1\}$, the population with costs ***marginally above*** those of the "between" group.

As Abowd et al. (id.), we use a conditional logit analysis to determine whether the "between" group (*B*) has a higher probability of coming from non-employment than the "control" group (*M*).

Hence, we estimate the following model :

$$\Pr\left[e_t = 1 \middle| e_{t+1} = 1\right] = \mathrm{F}\begin{pmatrix} x_{t+1}\beta + b\,\mathrm{I}\left(rmic_{t+1} \le rc_{t+1} \le rmic_t\right)\times\left(rmic_t - rmic_{t+1}\right) \\ + m\,\mathrm{I}\left(rmic_t < rc_{t+1} \le (rmic_t \times 1.1)\right)\times\left(rmic_t - rmic_{t+1}\right) \end{pmatrix} \qquad \textbf{(5)}$$

where all variables being defined as above.

Notice that the statistical framework is different in its interpretation from the previous one since it adopts a retrospective perspective instead of a prospective one. In the classic evaluation problem, some workers receive a treatment and the statistician examines future outcomes. Here, we face the reverse situation since, in equation (5), we condition on output, i.e. the future location in the wage distribution to examine the past situation. In fact, this is an example of the classic case-control studies in which the statistician examines what past environment may have caused a future outcome, say what are the specific living conditions of persons affected by a particular disease. Prentice and Pyke (1979) show that the logistic framework that we use in our approach is adequate and that the interpretation of the resulting coefficients in a retrospective study is similar to those obtained in a prospective study.

We will also estimate models equivalent to (2) and to the difference-in-difference equations (3) and (4), as explained for increasing costs, with the appropriate modifications:

$$\Pr\left[e_t = 1 \middle| e_{t+1} = 1\right] = \mathrm{F}\begin{pmatrix} x_t\beta + b_0\,\mathrm{I}\left(B_t\right) + m_0\,\mathrm{I}\left(M_t\right) \\ + b\,\mathrm{I}\left(B_t\right)\times\left(rmic_t - rmic_{t+1}\right) \\ + m\,\mathrm{I}\left(M_t\right)\times\left(rmic_t - rmic_{t+1}\right) \end{pmatrix} \qquad \textbf{(6)}$$

and

$$
\Pr\left[e_t = 1 \middle| e_{t+1} = 1\right] = \mathrm{F}\begin{pmatrix} x_t\beta + b_0\, \mathrm{I}(B_t) + m_0\, \mathrm{I}(M_t) \\ + b_i\, \mathrm{I}(B_t)\times(rmic_{t+1} - rmic_t)\times \mathrm{I}(rmic_{t+1} - rmic_t > 0) \\ + m_i\, \mathrm{I}(M_t)\times(rmic_{t+1} - rmic_t)\times \mathrm{I}(rmic_{t+1} - rmic_t > 0) \\ + b_d\, \mathrm{I}(B_t)\times(rmic_t - rmic_{t+1})\times \mathrm{I}(rmic_t - rmic_{t+1} > 0) \\ + m_d\, \mathrm{I}(M_t)\times(rmic_t - rmic_{t+1})\times \mathrm{I}(rmic_t - rmic_{t+1} > 0) \end{pmatrix} \qquad \mathbf{(7)}
$$

Once again, the b_i and m_i and b_d and m_d can only be separately identified from b_0 and m_0 if there is enough variation in the minimum cost. Therefore, we estimated in model in which $b_0 = m_0$ as soon as the resulting estimates of **(7)** could not reject the null $b_0 = m_0$.

5. Results

5.1 Exit

Table 1 presents the estimation results of models (1) – employment to non-employment transitions in years of increasing minimum cost, 1990 to 1992 - and (2) – employment to non-employment transitions in the first year of strongly decreasing minimum cost, 1995. As expected, Table 1 shows that a strong and significant difference between two consecutive groups is observed between the treated group, workers caught up by the increase in the minimum wage, and the control group, those workers with wages just above the new minimum cost in years of increasing minimum costs. The resulting differential elasticity, i.e. between the treated and the control group, is roughly equal to –1.5.
Hence, a one percent increase in the minimum cost induces a 1.5 percent increase in the probability that a minimum wage worker becomes non-employed. The resulting estimates of equation (2) for year 1995, the first year in which the subsidy for a minimum wage worker was equal to 18.2 points, are markedly different. The difference between treated workers and the control group has the opposite sign and is not significantly different from zero.[3] It is important to remember that a decrease in costs affects only employers and not the benefits (health insurance, pensions,...) that accrue to the workers, hence the workers labor supply is unaffected by these changes.

[3] We do not report estimates for men and women separately since they are quite close to those given in Table 1. Furthermore, estimates by age groups show that workers around 30 are those most affected by the increases in the minimum wage.

Table 1: Estimated Effects of Real Minimum Cost Increases and Decreases On Subsequent Employment Probability: 1990-1992 and 1995

Categories	Coefficient	Std Error	P(emp_{t+1}=0)	Share in total employed population at t	Elasticity	Differential Elasticity (with following category)
Years (t): 1990 to 1992 (increasing minimum cost):						
between* |Δ min. cost, t - t+1| (b)	-16.17	2.65	0.16	0.03	-2.59	-1.64
marginal* |Δ min. cost, t - t+1| (m)	-7.86	2.18	0.12	0.07	-0.94	
Year (t): 1995 (decreasing minimum cost):						
between* |Δ min. cost, t - t+1| (b)	-1.95	1.46	0.14	0.04	-0.27	0.05
marginal* |Δ min. cost, t - t+1| (m)	-2.69	1.16	0.12	0.08	-0.32	

Differential Effect	Coefficient	Std Error
b-m (for t from 1990 to 1992)	-8.31	3.11
b-m (for t = 1995)	0.73	1.64

Notes: Number of observations: 60,470 for years 1990 to 1992; 21,695 for year 1995. Exclude workers on special youth employment contracts, civil-servants, workers employed in public firms, and workers with a wage below 0.95*SMIC. Estimation of logistic model (1) for years 1990 to 1992, model (2) for year 1995 by maximum-likelihood. Other variables are the wage (with its square and cube), education (6 categories), seniority (and square), age (8 categories), indicator for short–term contracts, indicator for temporary work, indicator for male, and year dummies.

We conclude from this first analysis that there are strong differences between years of increasing and years of decreasing minimum costs. Workers caught up by the increase of the minimum wage tend to lose their job more often than "marginal" workers. However, there are ways to go from these two simple difference analyses to a difference-in-difference analysis by estimating model (3) in which the effects are assumed to be symmetric. The estimates are presented in Table 2.

Table 2: Estimated Effects of Real Minimum Cost Increases and Decreases On Subsequent Employment Probability: Pooled Estimates

Categories	Coefficient	Std Error	$P(emp_{t+1}=0)$	Share in total employed population at t	Elasticity	Differential Elasticity (with following category)
Years (t): 1990 to 1992, 1997 (increasing min. cost), 1993, and 1995 (decreasing min.cost)						
between* (Δ min. cost, t - t+1) (b)	-2.31	1.13	0.15	0.03	-0.35	-0.38
marginal* (Δ min. cost, t - t+1) (m)	0.32	0.91	0.12	0.07	0.04	

Differential Effect	Coefficient	Std Error
b-m (for t = 1990 to 1993, 1995, 1997)	-2.63	1.37

Notes: Number of observations: 124,689 for years 1990 to 1993, 1995, and 1997. Estimation of model (3). Includes an indicator for the between group and an indicator for the marginal group. All other notes as in Table 1.

The difference-in-difference estimates of the effect of a 1% increase of the minimum cost, -0.38, are smaller than those presented in Table 1, but are still significantly different from zero. Remember that this model assumes that the effects of increases, years 1990 to 1992, and 1997 and of decreases, years 1993, and 1995, in the minimum cost are symmetric.

Table 3 presents the estimates of model (4) in which the symmetry is not assumed.

Table 3: Estimated Effects of Real Minimum Cost Increases and Decreases On Subsequent Employment Probability: Pooled Estimates, Asymmetric Effects

Categories	Coefficient	Std Error	P(emp_{t+1}=0)	Share in total employed population at t	Elasticity	Differential Elasticity (with following category)
Years (t): 1990 to 1992, 1997 (increasing min. cost), 1993, and 1995 (decreasing min.cost)						
Between* |Δ min. cost, t - t+1| (for t with increasing min.cost): b_i	-14.39	3.53	0.16	0.02	-2.30	-1.56
Marginal* |Δ min. cost, t - t+1| (for t with increasing min.cost): m_i	-6.19	3.36	0.12	0.04	-0.74	
Between* |Δ min. cost, t - t+1| (for t with decreasing min.cost): b_d	-2.68	1.71	0.14	0.01	-0.38	-0.03
Marginal* |Δ min. cost, t - t+1| (for t with decreasing min.cost): m_d	-2.85	1.53	0.12	0.03	-0.34	

Differential Effect	Coefficient	Std Error
$b_i - m_i$ (for t = 1990 to 1992, 1997)	-8.20	2.75
$b_d - m_d$ (for t = 1993, 1995)	0.17	1.53
$b_i - m_i - (b_d - m_d)$ (for t = 1990 to 1993, 1995, 1997)	-8.37	3.14

Notes: As in Table 2.

Allowing for distinct coefficients in years of increasing costs and in years of decreasing costs exacerbates the previous results. The estimated elasticity is as large as in Table 1, -1.5, but now it is based on a difference-in-difference analysis. Remember that, in both model (3) and model (4), we have an indicator function for the "between" group and for the "marginal" group. Notice however that, as noted in Section 3, we first estimated model (4). Then, since the null hypothesis that $b_0 = m_0$ could not be rejected, we re-estimated model (4) imposing this restriction. Hence, the resulting estimates control, as much as is possible, for the impact of minimum cost changes on top of the heterogeneity that is specific to each group.

The conclusion of the above analysis is clear: transitions to non-employment in year *t+1* of workers employed in year *t* and paid between the old and the new minimum costs in a year of increasing minimum costs are strongly and adversely affected; a 1% increase in the minimum cost induces a 1.5% increase in the probability of job loss. Notice however that the overall impact on the whole labor market is small since this group represents from 3 to 4% of the workforce.

5.2. Entry

Up to now, we have examined transitions from employment to non-employment. In this subsection, we turn to the symmetric analysis: the impact of tax subsidies on the entry of workers. In particular, we want to see if workers who were previously unemployable – not productive enough given the prevailing minimum cost – become employed after the decrease in the minimum cost.

As a starting point, and similarly to the analysis of increasing costs, we estimate model (5) in years of decreasing costs as well as in years of increasing costs. These first results are presented in Table 4.

Table 4: Estimated Effects of Real Minimum Cost Decreases and Increases On Prior Employment Probability: 1991-1993, 1994, 1996, and 1998

Categories	Coefficient	Std Error	$P(emp_t=0)$	Share in total employed population at t+1	Elasticity	Differential Elasticity (with following category)
Years (t+1): 1991 to 1993 (increasing minimum cost):						
between* |Δ min. cost, t - t+1| (b)	-7.44	2.61	0.19	0.04	-1.41	-0.92
marginal* |Δ min. cost, t – t+1| (m)	-3.26	2.26	0.15	0.08	-0.49	
Year (t+1): 1994 (decreasing minimum cost):						
between* |Δ min. cost, t - t+1| (b)	-10.86	5.33	0.20	0.02	-2.17	-0.94
marginal* |Δ min. cost, t - t+1| (m)	-7.70	3.70	0.16	0.07	-1.23	
Year (t+1): 1996 (decreasing minimum cost):						
between* |Δ min. cost, t - t+1| (b)	-2.72	1.31	0.20	0.06	-0.54	-0.43
marginal* |Δ min. cost, t - t+1| (m)	-0.91	1.52	0.13	0.05	-0.12	
Years (t+1): 1998 (increasing minimum cost):						
between* |Δ min. cost, t - t+1| (b)	2.90	5.56	0.10	0.09	0.29	0.36
marginal* |Δ min. cost, t - t+1| (m)	-0.85	5.50	0.08	0.09	-0.07	

Differential Effect	Coefficient	Std Error
b-m (for t+1 from 1991 to 1993)	-4.18	2.99
b-m (for t+1 = 1994)	-3.16	5.78
b-m (for t+1 = 1996)	-1.81	1.73
b-m (for t+1 = 1998)	3.76	6.43

Notes: Number of observations: 60,428 for years (t+1) 1991 to 1993; 21,465 for 1994; 21,707 for 1996; 16,379 for 1998. All other notes as in Table 1.

Apparently, in years of decreasing minimum costs such as 1994 and 1996, workers that are employed in year *t+1* at a cost between the new and the old minimum cost come significantly more often from non-employment than workers employed at a cost just above the old minimum cost. However, for the years 1991 to 1993 that are years of increasing minimum cost, the same result seems to hold. One may conclude that workers who are at the bottom of the wage distribution enter more often from non-employment than workers located elsewhere in the wage distribution. Results obtained for years of decreasing costs would be due to pure unobserved heterogeneity. However, it is interesting to consider year 1998. Between 1997 and 1998, the minimum wage increased quite strongly after Jacques Chirac's election as French president. As explained previously, this increase mechanically decreased the cost of workers paid above the new minimum because of the tax subsidies. Therefore, the cost of "between" workers vis-à-vis "marginal" workers increased even more than the minimum wage increase. And, this large cost change seems to have had an impact on the entry of workers from non-employment. This is the only year in which workers in the bottom of the wage distribution do not come from non-employment more often than those just above in the same distribution. To examine this issue further, we estimated model (6) and model (7), that are appropriate to examine entry in a difference-in-difference framework. The estimates of these models are presented in Tables 5 and 6. We restricted the pooled analyses to the later years of the period in order to look for some evidence of the benefit of tax subsidies on entry; unreported estimates including all years showing no such benefits.

Table 5: Estimated Effects of Real Minimum Cost Decreases and Increases On Prior Employment Probability: Pooled Estimates

Categories	Coefficient	Std Error	P(emp_t=0)	Share in total employed population at t+1	Elasticity	Differential Elasticity (with following category)
Years (t+1): 1997, 1998 (increasing min. cost), 1994, and 1996 (decreasing min.cost)						
between* (Δ min. cost, t - t+1) (b)	-1.08	1.16	0.16	0.05	-0.17	-0.27
marginal* (Δ min. cost, t - t+1) (m)	0.75	1.31	0.13	0.06	0.10	

Differential Effect	Coefficient	Std Error
b-m (for t+1 = 1994, 1996 to 1998)	-1.83	1.52

Notes: Number of observations: 80,772. All other notes as in Table 2.

In Table 5, effects are assumed to be symmetric between cost increases and cost decreases. In Table 6, we assume as in Table 3 that the effects are not necessarily symmetric.

Table 6: Estimated Effects of Real Minimum Cost Decreases and Increases On Prior Employment Probability: Pooled Estimates, Asymmetric Effects						
Categories	**Coefficient**	**Std Error**	**P(emp_t=0)**	**Share in total employed population at t+1**	**Elasticity**	**Differential Elasticity (with following category)**
Years (t+1): 1997, 1998 (increasing min. cost), 1994, and 1996 (decreasing min.cost)						
between* |Δ min. cost, t - t+1| (for t+1 with increasing min.cost): b_i	-6.03	3.71	0.14	0.03	-0.84	-0.17
marginal* |Δ min. cost, t - t+1| (for t+1 with increasing min.cost): m_i	-6.13	3.82	0.11	0.03	-0.67	
between* |Δ min. cost, t - t+1| (for t+1 with decreasing min.cost): b_d	-3.10	1.19	0.20	0.02	-0.62	-0.43
marginal* |Δ min. cost, t - t+1| (for t+1 with decreasing min.cost): m_d	-1.36	1.34	0.14	0.03	-0.19	

Differential Effect	**Coefficient**	**Std Error**
$b_i - m_i$ (for t+1 = 1997 and 1998)	0.10	4.70
$b_d - m_d$ (for t +1= 1994, 1996)	-1.74	1.61
$b_i - m_i - (b_d - m_d)$ (for t+1 = 1994, 1996 to 1998)	-1.84	4.97

Notes: As in Table 5.

Both Tables show similar results. There is evidence of a small and insignificant effect: low-wage workers seem to come more often from non-employment in years of cost decrease than in years of cost increase. Notice also that in Table 6, the only coefficient that is significantly different from zero is that of "between" workers in years of costs decreases. But, most other standard errors are too large to yield a significant differential effect. And, as mentioned earlier, this, admittedly, small effect seems to exist only in the final years of the panel. In particular, it comes from the couple of years 1997-1998. In a context of tax subsidies, the large minimum wage increase that took place after Chirac's election appears to have deterred firms from hiring low-wage workers from the pool of non-employed. Even if it is not significant, this effect did not exist at the beginning of our sample period, in particular between 1991 and 1993 when the minimum wage also increased. Therefore, the tax subsidies may have changed the behavior of French employers. Note that such subsidies were the first ever to be implemented for low-wage workers in France, without any age restriction. Indeed, many programs for young workers include such subsidies but the tax subsidies that we examine in this article applied to all age categories.

5.3. Are "Marginal" Workers a Good Control Group ?

Let us consider a simple competitive model of labor demand with two skills (the "between" workers and "marginal" workers).[4] Employment at the equilibrium depends on two demand equations:

$$\log L_B = \eta_{BB} \log(1+\tau_B)w_B + \eta_{BM} \log(1+\tau_M)w_M$$

$$\log L_M = \eta_{MB} \log(1+\tau_B)w_B + \eta_{MM} \log(1+\tau_M)w_M$$

where the coefficients on the log cost (wage rate plus employer-paid payroll taxes) represent Hicks-Allen demand elasticities and two supply equations:

$$\log L_B = \varepsilon_B \log w_B \quad \text{and} \quad \log L_M = \varepsilon_M \log w_M$$

where the coefficient on the log wage rate (not the cost) in each supply equation is the Allen elasticity of supply. When the minimum wage rate, w_B, increases the minimum cost increases in proportion. Because the minimum cost is binding, the only movement is along the demand curve for the "between" group. But, there is both a demand and supply response in the market for "marginal" workers. Hence, the equilibrium quantity changes are:

$$\frac{d \log L_B}{d \log(1+\tau_B)w_B} = \left(\eta_{BB} + \eta_{BM}\left(\frac{\eta_{MB}}{\varepsilon_M - \eta_{MM}}\right)\right) + u_B$$

and

$$\frac{d \log L_M}{d \log(1+\tau_B)w_B} = \varepsilon_M \left(\frac{\eta_{MB}}{\varepsilon_M - \eta_{MM}}\right) + u_M$$

where u_B and u_M are unmeasured components for the "between" and the "marginal" groups after a change in the minimum wage rate. The differential effect is:

$$\left[\frac{d \log L_B}{d \log(1+\tau_B)w_B} - \frac{d \log L_M}{d \log(1+\tau_B)w_B}\right] = \left(\eta_{BB} + (\eta_{BM} - \varepsilon_M)\left(\frac{\eta_{MB}}{\varepsilon_M - \eta_{MM}}\right)\right) + u_B - u_M .$$

Of course, with no change in the minimum cost, the equation becomes

[4] We borrow this analysis from Abowd, Kramarz, Margolis, Philippon (2000).

$\left[\dfrac{d\log L_B}{d\log(1+\tau_B)w_B}-\dfrac{d\log L_M}{d\log(1+\tau_B)w_B}\right]=u_B-u_M$ and our difference-in-difference analysis yields an estimate of $\left(\eta_{BB}+(\eta_{BM}-\varepsilon_M)\left(\dfrac{\eta_{MB}}{\varepsilon_M-\eta_{MM}}\right)\right)$. Our "marginal" group of workers is therefore a good control group in our pseudo-experimental analysis if $\varepsilon_M\left(\dfrac{\eta_{MB}}{\varepsilon_M-\eta_{MM}}\right)$which comprises the specific responses of the control group to variations in economic conditions is close to zero, i.e. the demand for "marginal" workers does not vary with changes in the minimum cost.[5] The magnitude of this term depends on the elasticity of supply, ε_M, for the "marginal" group of workers. It also depends on the ratio $\left(\dfrac{\eta_{MB}}{\varepsilon_M-\eta_{MM}}\right)$, which must be positive. If we assume that the own labor demand elasticity of "marginal" workers is negative and large (equal to η_{BB}, for simplicity), the term $\left(\dfrac{\eta_{MB}}{\varepsilon_M-\eta_{MM}}\right)$is small if $\eta_{MB}$is small. This last condition is unlikely. But, recent evidence provided by Laroque and Salanié (1999 and 2000) clearly show that, for workers with potential productivity in the first quartile of the wage distribution, the decision to go from non-participation to participation requires large wage offers, in particular for men (because of multiple benefits that generate the so-called poverty trap). Hence, the supply elasticities for these two groups of workers must be small.

Can we find additional evidence of the small impact of changes in the minimum cost on employment of the "marginal" group ?
In fact, our Tables 1 to 4 give us estimates of $\dfrac{d\log L_M}{d\log(1+\tau_B)w_B}=\varepsilon_M\left(\dfrac{\eta_{MB}}{\varepsilon_M-\eta_{MM}}\right)+u_M$ in years of increasing costs and of u_M in other years. Taking the difference between resulting estimates as can be done from these tables directly shows that $\varepsilon_M\left(\dfrac{\eta_{MB}}{\varepsilon_M-\eta_{MM}}\right)$ is always small and, in fact, never significantly different from zero.

Finally, comparing years before implementation of the tax subsidies and after implementation, computations presented in Appendix B tend to show that most of the action does not consist in substitution between our "marginal" and our "between" workers but mostly in substitution between workers benefiting from the subsidies, i.e. with a wage just below 1.33 times the minimum (between 1.2 and 1.33, approximately), and workers with wage just above. However, evidence of such effects should be investigated more carefully based on a structural approach.
From this evidence, we may conclude that the "marginal" group is a reasonably good control group.

[5] Notice that this analysis extends to changes in both directions as long as the minimum cost remains binding (see Abowd, Kramarz, Margolis, and Philippon, 2000).

6. Conclusion

Using longitudinal data over the 80s, and comparing years of increasing minimum costs with years of decreasing minimum costs, we show the negative effect of minimum cost increases on the employment of minimum wage workers. Our estimates, based on a difference-in-difference, approach suggest that the elasticity of labor demand is roughly equal to –1.5 for this group. A similar analysis of the re-employment impact of tax subsidies gives small and insignificant positive effects on minimum wage workers. In fact, it seems that all workers in the tax subsidy zone benefit from the cost decreases. Unfortunately, identification of such effects is difficult due to the multiple phenomena that happen simultaneously. A direct analysis of the changes in employers' hiring policies in response to the implementation of the subsidies is needed but is beyond the scope of this paper.

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Appendix A: Table A.1

Variable	Full Sample Mean	Full Sample Std. Dev.	Between Workers Mean	Between Workers Std. Dev.	Marginal Workers Mean	Marginal Workers Std. Dev.
wage (french francs)	11,607.6	28,375.6	5,107.9	1,349.4	5,593.2	1,327.0
tenure	10.4	9.2	4.6	6.0	5.8	6.6
age	40.7	9.4	36.6	10.4	37.2	10.2
sex (1=male)	0.62		0.33		0.38	
no education	0.19		0.33		0.33	
CAP, CEP, BEPC	0.54		0.56		0.56	
technical baccalauréat	0.06		0.04		0.04	
baccalauréat (other)	0.04		0.03		0.03	
technical university	0.08		0.02		0.02	
university (other)	0.08		0.02		0.02	
short-term contract	0.04		0.14		0.09	
temporary work	0.01		0.02		0.03	
Number of Observations	169,385		5,815		11,828	

Source: 1990 to 1998 waves of the French labor force survey (Enquête Emploi).

Appendix B: Transitions Within the Wage Distribution

First, we split the wage distribution into bands, and estimate the Markov transition matrix for each pair of years. Then, starting from the same initial distribution (the average one), we can simulate the final distribution using different combinations of matrices. In particular, we want to see if the matrices corresponding to years of decreasing costs lead to a significantly different evolution of the wage (and cost) structure.

More precisely, we define 9 states:

1. Not Employed at date t,
2. Employed and 0<Wage(t)/Minwage(t)<90%,
3. Employed and 90%<Wage(t)/Minwage(t)<110%,
4. Employed and 110%<Wage(t)/Minwage(t)<120%,
5. Employed and 120%<Wage(t)/Minwage(t)<130%,
6. Employed and 130%<Wage(t)/Minwage(t)<150%,
7. Employed and 150%<Wage(t)/Minwage(t)<200%,
8. Employed and 200%<Wage(t)/Minwage(t)<350%,
9. Employed and 350%<Wage(t)/Minwage(t).

We define the initial distribution as the average distribution, using the cells defined above, between 1990 and 1997. For each couple of years, we multiply the initial distribution with the corresponding transition matrix. Figure B.1 shows the relative growth of each cell. Large increases occur in the zone where tax subsidies take place. Even though the GDP growth was much higher in 1994-1995 than in any other year[6], we observe that the 1996-1997 transition is richer in low-paid jobs.

At the same time, the size of the 150-cell (that includes workers whose wages are between 130% and 150% of the minimum wage) decreased. A possible interpretation is that the cost structure is slowly adjusting, leading to substitute workers in the tax cut area for workers above the tax cut area.

Unreported statistics show that the decrease in the 150-cell is due to a lower upward mobility within the wage distribution rather than increased transitions to non-employment.

[6] The French GDP growth over the period was the following: 2.2% in 1990, 0.7% in 1991, 1.3% in 1992, -1.3% in 1993, 2.8% in 1994, 2.1% in 1995, 1.6% in 1996, and 2.3% in 1997.

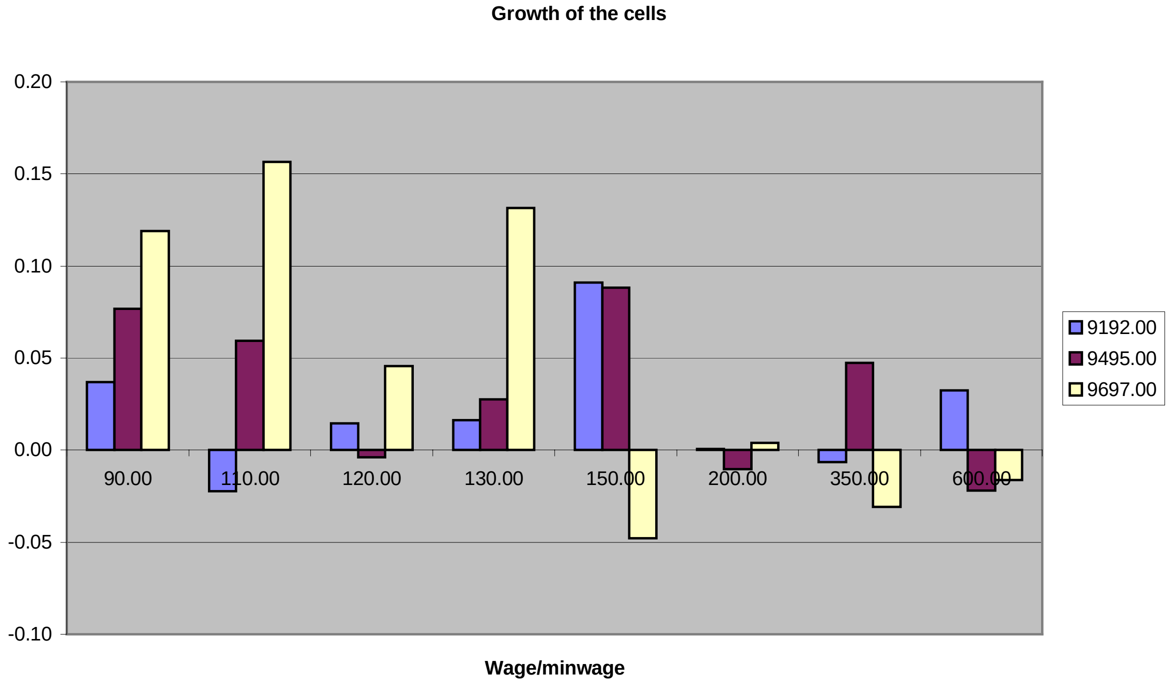

Figure B.1

Notes: The active population is normalized to 100. The «not employed» cell is not reported on this chart.
The figure shows the relative growth of each cell based on the respective transition matrices of the indicated couple of years (9192 stands for 1991-1992, …). The relative growth is defined as follows:100*(final size of the cell – initial size of the cell)/(initial size of the cell). The final size of the cell is the one that is obtained by applying the specified matrix: for 91-92, we use the estimated 1991-1992 transition matrix, similarly for 94-95 and 96-97.