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LABOUR MARKET INSTITUTIONS AND EMPLOYMENT IN FRANCE

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SUMMARY

The purpose of this paper is to use individual data to study how the minimum wage and the welfare system combine to affect employment in France. Using the 1997 Labour Force Survey, we decompose non-employment of married women into three components: voluntary, classical (due to the minimum wage) and 'other' (a residual category). We find that the minimum wage explains close to 15% of non-employment for these women and that the disincentive effects of some welfare policy measures may be large. Our approach also allows us to evaluate various labour and welfare policy experiments in their effects on participation and employment.

1. INTRODUCTION

> If the misery of our poor be due not to the laws of nature, but to our institutions, great is our sin.
> Charles Darwin, *The Voyage of the Beagle*.

The unemployment rate in France has been hovering around or above 10% for the last fifteen years, and it is particularly high among low-skilled workers. Many potential culprits have been identified: the minimum wage, a rigid labour market, the power of insiders, recessionary conditions (especially in the 1990s), a generous welfare state, more recently globalization... The French labour market has two salient features that place it somewhat apart from the UK or the US markets. First, the cost of the minimum wage is much larger relative to the average wage. This may lead potential employers of low-skilled workers to turn to more capital- or skill-intensive technologies. Second, largely in response to the high unemployment levels of the past two decades, France has developed a rather generous welfare state to support people who are out of employment.

The purpose of this paper is to study how these specificities of the labour market influence the employment of married women in France. We propose a way to disentangle the respective roles of the welfare system and of the minimum wage. Understanding the respective roles of these two aspects of the labour market clearly is crucial for policymaking. It is also a modelling challenge, since there does not seem to exist ready-made techniques to apply to this question.

Our study is based on individual data. We posit a structural model. Every individual is supposed to be characterized with a potential wage and a reservation wage, which depends on her precise family situation and on the detailed working of the welfare system. To hold a job, an individual must clear three conditions:

(1) She must be willing to work (her potential wage must be enough to compensate her for the disutility of work, the cost of child care, and the possible loss of some welfare benefits).
(2) She must be productive enough that employers offer her at least the minimum wage.
(3) She must not be caught in a recession or in frictional unemployment.

Failure to clear one of these conditions results in non-employment. The first is usually associated with 'voluntary non-employment'. Failure to meet the second indicates a state of 'classical non-employment', the idea being that wages or costs are too high to make it worth-while to hire this person and increase production (this terminology was introduced by Malinvaud, 1977); the last condition corresponds to a catch-all category, 'other non-employment', which in particular accounts for the business cycle component of unemployment.

Condition 1 underlies the very large empirical literature on labour supply (see the recent survey by Blundell and MaCurdy, 2000). Our paper contributes to this literature in two ways. First, our structural participation equation takes into account most of the actual features of the French tax-benefit system. Indeed, a large part of the actual work underlying the paper consists of a careful simulation of the family and housing benefits, the social contributions and income tax, based on the information contained in our dataset. Our rather exhaustive modelling of the tax-benefit system lets us hope that we describe the work incentives facing households much more faithfully than many earlier studies, which model only a small part of it such as the income tax. As a by-product, this allows us to estimate the effect of a large number of policy parameters on participation and employment. Second, earlier studies do not take the minimum wage into account; thus they effectively label individuals who are excluded from employment by the minimum wage as voluntarily unemployed. Our procedure therefore should lead to more reliable estimates of labour supply parameters in countries such as France that have a high minimum wage.

Regarding condition 2, we adopt here the method used by Meyer and Wise (1983a,b) to identify the effect of the minimum wage. This consists of estimating the wage distribution of workers, conditional on their characteristics, taking into account the left censoring induced by the minimum wage. The Meyer and Wise approach has been subject to much criticism. A serious objection, which we address, is that Meyer and Wise used a participation equation that is a very restrictive reduced form. This neglects the fact that some low-productivity individuals may find the additional income obtained when working so low that they decide not to look for a job. As above, our simultaneous treatment of the minimum wage and participation should correct this source of bias.[1] Another objection, which we cannot deal with, is that the identification of productivity below the minimum wage threshold relies on the choice of the functional form. Note also that, following the competitive paradigm, the wage distribution is assumed to be merely truncated at the minimum wage: in a single cross-section, with a uniform minimum wage across France, we cannot identify from the data the impact of the minimum wage on the wage distribution.

Our approach has two main shortcomings. First, it is static: we do not have the necessary data to simulate the complex calendar of the French taxes and benefits. Moreover, our study is based on a single cross-section, so that we do not use changes in the welfare system to identify the labour supply. Second, we use a very simple structural model with competitive features. In

[1] van Soest (1989) also made a step in that direction.

the past ten years, the study of unemployment has relied heavily on search models (see e.g. the book by Pissarides, 2000 and the empirical studies by van den Berg and Ridder, 1998 and Bontemps, Robin, and van den Berg, 1999). The main aim of such models is to capture the dynamic, transitional, aspects of unemployment, largely as a temporary situation in between jobs, whose duration may vary with the macroeconomic state of the economy. About half the female population of working age, in our sample, is not working. We estimate that the bulk of female non-employment in France comes from women who either do not find it worth-while to enter the labour market given the social benefits that they receive (voluntary unemployment), or are not skilled enough to earn a wage above the minimum wage (classical unemployment). While these features could be made part of a search model, we believe that the important roles of the minimum wage and the welfare system must be accounted for first. In our opinion, going to a structural search model is premature at this stage of our research programme. There are in fact a number of technical difficulties in implementing a search model in an environment such as ours: we have a large number of dimensions of observed heterogeneity both in the composition of the household and in the skills of workers, and search should be modelled across these categories, with possible substitutions among them.[2]

Since labour market institutions play a central role in our paper, we describe them in section 2. Section 3 then presents the data set we use and explains how we selected observations on married women aged 25–49. In Section 4, we set up our model and describe how we assign non-employment to the three categories defined above. Section 5 presents our estimation results. Section 6 breaks down non-employment into its three components and Section 7 gives two examples of using our model for policy evaluation. Finally, Section 8 contains some concluding remarks.

2. THE FRENCH LABOUR MARKET INSTITUTIONS

Many features differentiate the French from, say, the US labour market. We focus here on the two most obvious differences, the minimum wage and the tax-benefit system.

2.1. The Minimum Wage

France has had a minimum wage since 1950. It applies to most wage-earners, irrespective of age and occupation; only some special labour contracts such as those of apprentices are not subject to the minimum wage. In 1997, the *net* minimum wage was 5000 francs per month, or about $5 an hour at 1997 exchange rates. Thus the net minimum wage was set at about the same level in France and in the USA. However, social contributions are much higher in France: they amounted to 2900 francs per month for a minimum wage earner (or 58% of the net wage), so that the actual cost of the minimum wage to the employer was 7900 francs. Another way to compare France and the USA without becoming involved with exchange rates is to compute the ratio r of the cost of the minimum wage to the cost of the median wage. This was 0.39 in the USA in 1997 and 0.52 in France, one-third higher.

[2] Also, there are various specifications of search models with a minimum wage, some of which lead to a spike of the wage distribution at the minimum wage, which we do not observe in our data.

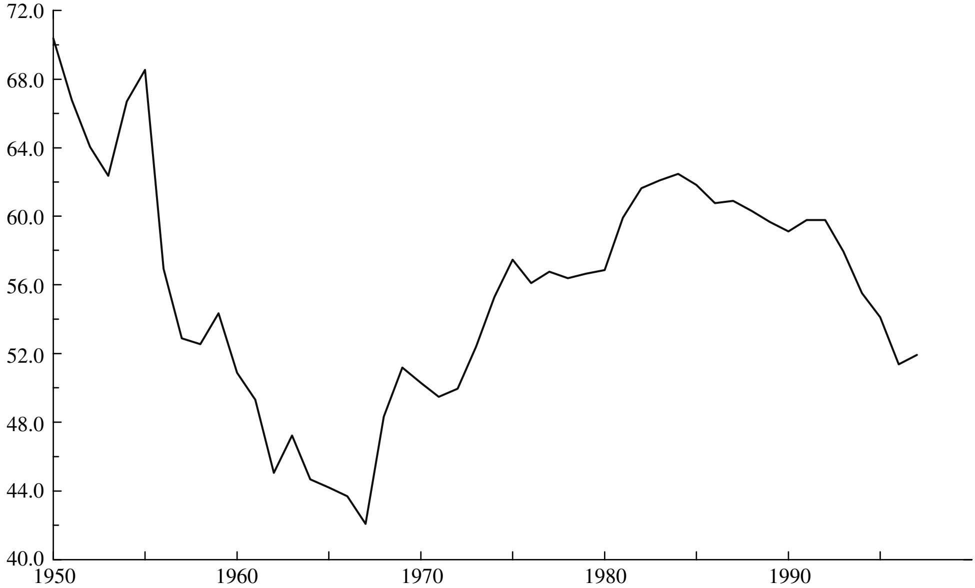

Figure 1. Ratio of full-time labour costs: minimum wage over median wage

Figure 1 plots the changes in the ratio r over time for full-time employees.[3] The ratio was at a very high level, above 70%, in 1950 when the minimum wage was instituted. Two laws, in 1952 and 1957, indexed it more and more closely on inflation. Nevertheless, the minimum wage did not keep up with the high labour productivity gains which prevailed in France in the thirty *Glorieuses* years that followed the Second World War. The ratio therefore was on a declining trend until 1967, where it reached a minimum at 43%. The indexation regime was significantly modified in 1968, taking into account the evolutions both of inflation and of the average working wage and allowing for discretionary increases. After the May 1968 strikes and especially the first oil shock, the French government relied on Keynesian policy measures: it increased the minimum wage to sustain consumption and also made the welfare system more generous, which led to an increase in social contributions. Since productivity was slowing down at the same time, this made the minimum wage much more costly. The ratio therefore increased markedly until the mid-1980s, up to over 63%. In recent years, increases in the minimum wage have been smaller and social contributions have been reduced on low wages, which has pushed down the indicator.

2.2. The Tax-benefit System

The simplest way to describe the French tax-benefit system is perhaps to ‘follow the money’ after it has been paid by the employer and until it becomes disposable income for the employee. Along the way, social contributions are paid; the employee pays income tax; she may receive family benefits; she may be eligible for the guaranteed minimum income; she may receive housing subsidies; and

[3] The data comes from the *Rapport Economique, Social et Financier, Projet de Loi de Finances pour 2001*, Annexe statistique, Tableau V.5. For the years 1953, 1954, 1958 and 1959, when the median wage is not available, we used the rate of growth of the average labour cost per head from the national accounts to interpolate the missing data.

she may have to pay the housing tax. For future reference, we denote by R the function that associates the net resources of the household to the cost of labour of the individual.

Social contributions

As explained above, social contributions[4] are rather high in France and typically account for about 40% of the cost of labour. Their schedule is piecewise linear. Since 1993, measures have been taken to lower the social wedge for low-paid workers. In 1997, their employers' social contributions are lowered by 12.8% of the original labour cost at the minimum wage level. This reduction decreases linearly with the wage and cancels at 1.33 times the minimum wage.

Social contributions finance benefits for health, family, unemployment and pensions. For the last two items, it may be argued that contributions in fact are later repaid (in expectation) as deferred income, and that individuals take this into account when deciding whether to participate. We eventually decided against including this feature in the model, as it is not clear whether this is really relevant in practice and it would substantially complicate things. Since medical coverage is almost universal and family benefits are given without reference to contributions, health and family contributions are not linked to benefits in the same way.

Income tax

Taxable income is computed in two steps. First, one must add the net wages of both spouses, taking into account the non-tax-deductible part of the CSG and the CRDS[5] and capital income. The schedule then applies two successive deductions, of 10% and 20% (both of which are subject to a high ceiling). This gives the taxable income, which is used in the means-tested formulae for some family benefits and for housing benefits.

The income tax in France relies on 'income splitting'. Call taxable income I; then the income tax is basically given by

$$T = Nf\left(\frac{I}{N}\right)$$

where N is the number of *parts*, a semi-integer that increases with the number of children, and f is a piecewise linear increasing function. This function f is convex (increasing marginal rates), except for low incomes where there is a *décote* mechanism that locally doubles marginal rates.[6] This formula, called the *quotient familial*, gives a higher tax rebate per child for higher-income families. This advantage is subject to a ceiling.

It should be noted that income tax in France is highly concentrated: low-income households (say, where both spouses earn the minimum wage) pay very little, and nothing if they have at least two children. As a consequence, the income tax represents a much lower share of GDP than in most OECD countries.

Family benefits

There are a variety of family benefits in France. Some are means-tested; the relevant income variable then is taxable income. Family benefits are not subjected to income tax. Some of them are only granted to families with at least two children, and increase with the number of children.

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[4] We include in social contributions the CSG (a proportional social tax, part of which is deductible from taxable income) and the CRDS (another, small, proportional social tax).

[5] Family, social and housing benefits are not subject to any tax (except for the CRDS).

[6] Also, the income tax is not due if it is less than 400 francs per year.

Others depend on there being a child under three in the household. We describe only the largest benefits here.

The *allocations familiales* are not means-tested. They are given to all families with at least two children under eighteen and increase with the number of children and their ages. The benefit is about 700 francs per month for 2 children and 800 francs for each additional child. The *complément familial* (CF) is given only to families with at least three children over 3 years of age. It is means-tested (with an income ceiling of about 10,000 francs per month) and worth about 900 francs/month, independently of the number of children. The benefit for young children (APJE) is given to every family with a child below 3, conditional on the same means-testing as for the CF. It is about 1000 francs per month. The APE (parental benefit for raising young children) is much more generous: about 3000 francs per month for every household with at least two children of whom one is younger than 3, provided one of the spouses (typically the woman) stops working.

The minimum income guarantee

The non-employed may be entitled to various types of unemployment benefits. Unfortunately, we do not have enough data to properly model these benefits. Therefore we focus on the most extensive transfer available in the long run. Since 1989, there is a minimum income guarantee in France, called the RMI. This works by defining a guaranteed amount G for each household in which one of the spouses is at least 25. Let TR be the total resources of the household, computed by adding the incomes of its members and the family benefits it receives, net of income tax. If these total resources of the household are lower than G, it gets $(G - TR)$ from the state. Thus the RMI induces a 100% marginal tax rate for its beneficiaries.[7] G is about 3000 francs per month (60% of the net minimum wage) for a childless couple and increases with the number of children.

Housing subsidies

Households who rent a home (or who own it but are still paying interest on it) are eligible for a means-tested benefit called *allocation logement* (AL) for private sector housing and *aide personnalisée au logement* (APL) for public sector housing. These benefits have different schedules that depend on rent or interest paid, taxable income and the number of children in the household. If the household gets the RMI, its wage income is taken to be zero by the authorities when computing housing subsidies; this induces an infinite marginal tax rate when the income of a household crosses the RMI ceiling.

The housing subsidies are a very important component of the welfare system. They benefit a large number of households: half of all tenants receive some housing subsidy. Also, their means-testing induces a non-negligible marginal tax rate, of the order of 20%.

The housing tax

Every household in France is liable to a housing tax, whether it owns or rents a home. It is not completely clear how we should model it, as housing is a consumption and the tax depends on the features of the home. However, we did include it since it interacts with the minimum income guarantee: households who receive the RMI are exempt from paying the housing tax and thus lose about 150 francs per month when they cross the RMI threshold.

[7] This statement must be qualified. In 1997, a RMI beneficiary who found a job and whose new resources were larger than G could still receive the RMI for six months before losing the benefit. We neglect this feature, as we focus on long-term effects.

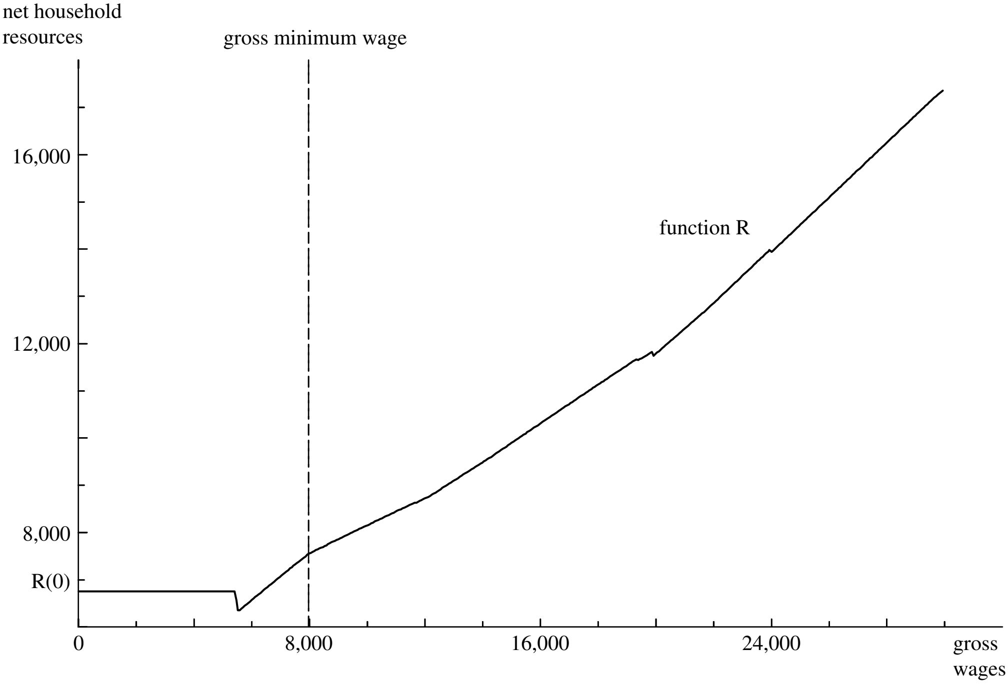

Figure 2. The poverty trap: an actual example

2.3. The Poverty Trap

The 100% marginal tax rate induced by the RMI and the means-testing of many benefits induce very large withdrawal rates for low incomes. This is illustrated in Figure 2, which relates to a woman aged 35 with two children aged 5 and 7. Crucially, we assume that her spouse is not employed. The figure shows the function R, that is, the net monthly resources of the household as a function of the cost of the woman to her employer. The graph of the function R starts with a horizontal plateau that corresponds to the minimum income guarantee, of about 4300 francs in that case ($R(0)$ is higher, at 6750 francs, because of the housing subsidies). When the woman starts earning wages, it takes a while before the household breaks out of this poverty trap, which is made more severe by the drop in housing subsidies and the increase in the housing tax when the household stops qualifying for the minimum income guarantee (which together induce a 400 francs drop). In fact, earning the minimum wage only results in a very small increase of 750 francs per month in the net resources of the household.

3. THE DATA

Every year, the French statistical institute INSEE runs a Labour Force Survey (*Enquête Emploi*). All members of about 70,000 households are asked for their job status, their net monthly wage[8] if

[8] Recall that in France, the 'net wage' is what people see on their pay cheques before they pay income tax.

they earn one, and personal characteristics (age, sex, number and ages of children, highest diploma, age at leaving school, type of residence,...). We used the most recent survey available when we started this project: the March 1997 Labour Force Survey.

As is well known, it is easier to estimate a structural participation equation for women than for men, especially for women who have a partner. Moreover, we wanted to avoid the modelling difficulties caused both by young people deciding to stay at school and by older people retiring or using one of the state-subsidized pre-retirement programmes that operate in France. Therefore we focus in this paper on women aged 25–49 who live with a partner (for simplicity, we will call them 'spouses' and refer to the women as 'married').

The Labour Force Survey only reports wages (and, less thoroughly, unemployment benefits), as opposed to pensions and other non-wage income. We thus had to eliminate households in which one of the spouses is retired, works as an independent or an employer. We also eliminated households in which the woman works as a civil servant, as civil servants have tenure in France. Part-time work creates another difficulty. There are several questions about hours in the Survey, so that we could attempt to model the choice of hours. However, it is well known that French workers rarely choose their hours, much less than comparable workers do in other countries. In fact, surveys consistently show that about half of part-time workers would like to work more. To take this properly into account, we would have to model how many individuals who would like to work full-time end up working part-time. We decided that at this stage this would make the model too complicated. We therefore focus in this paper on women who either declare working full-time (at least 35 hours per week) or not working at all. We also eliminated women who both declare working full-time and report a number of hours per week less than 30 or more than 50.

Even so, a few per cent of the employed women declare wages that are lower than the minimum wage, sometimes very much so. These women represent about 3% of our sample. In similar circumstances, Meyer and Wise chose to use these data points for estimation; they justified this treatment by the fact that, in the USA (but not in France), there are exceptions to the minimum wage legislation that still give information on the wage distribution. Our own analysis of these observations shows that two-thirds of these women have no diploma and work in the 'services to households' sector. This suggests that many of them are cleaning persons or hold similar occupations, where hours are ill-defined, there is a lot of underground activity, and measurement error is probably rampant. We eventually decided to exclude these women from our sample.[9] The resulting sample size of 10,889 represents about 3,500,000 women.

Table I describes our sample.[10] About 42.9% of women in our sample work, as compared to 87.0% of their spouses. Our wage statistics refer to the net wage (including bonuses), corrected to bring it to the legal standard of 39 hours per week. By construction, the net minimum wage in our sample should be the legal minimum wage, which was 5037 francs per month[11] in March 1997. However, given that wages are known to be declared with rounding error, we set the minimum bound in our programmes to 5000 francs. The mean wage of our women is about 60% higher than the minimum wage. For lack of more detailed information about job spells, 'experience' refers to the number of years since leaving school. Unfortunately, we could not find any good proxy for the time spent raising children or unemployed.

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[9] After a first estimation, we also dropped three observations which were clear outliers in the wage equation. They all correspond to employed women with low diplomas but very high wages.

[10] The figures in Table I are unweighted by sample weights, unlike those in Tables V to VII.

[11] The nominal exchange rate fluctuated between 5.5 and 6 francs to the dollar in 1997.

Table I. Descriptive statistics

Variable	Minimum	Mean	Maximum
Employment	0	0.429	1
Employment of spouse	0	0.870	1
Net monthly wage	5000	7,980	89,700
School-leaving age	6	18.0	35
Experience	0	18.7	40
Graduate	0	0.059	1
Undergraduate	0	0.095	1
High school	0	0.126	1
Basic technical training	0	0.288	1
Junior high school	0	0.093	1
No diploma	0	0.338	1
Number of children	0	1.442	9
Children less than 3	0	0.208	3
Children 3 to 6	0	0.257	3
Children 6 to 18	0	0.977	8
Age	25	36.7	49

Diplomas are listed from highest to lowest. The names we give them probably are only a rough English equivalent. Note that a full 33.9% of the sample has no diploma. The next variables describe the composition of the family. A quarter of women have no children, but there is a large variability: a sixth have at least three children.

Figures 3 and 4 plot the distribution of net full-time equivalent monthly wages in our sample, before excluding the observations below the minimum wage and the outliers. The minimum wage

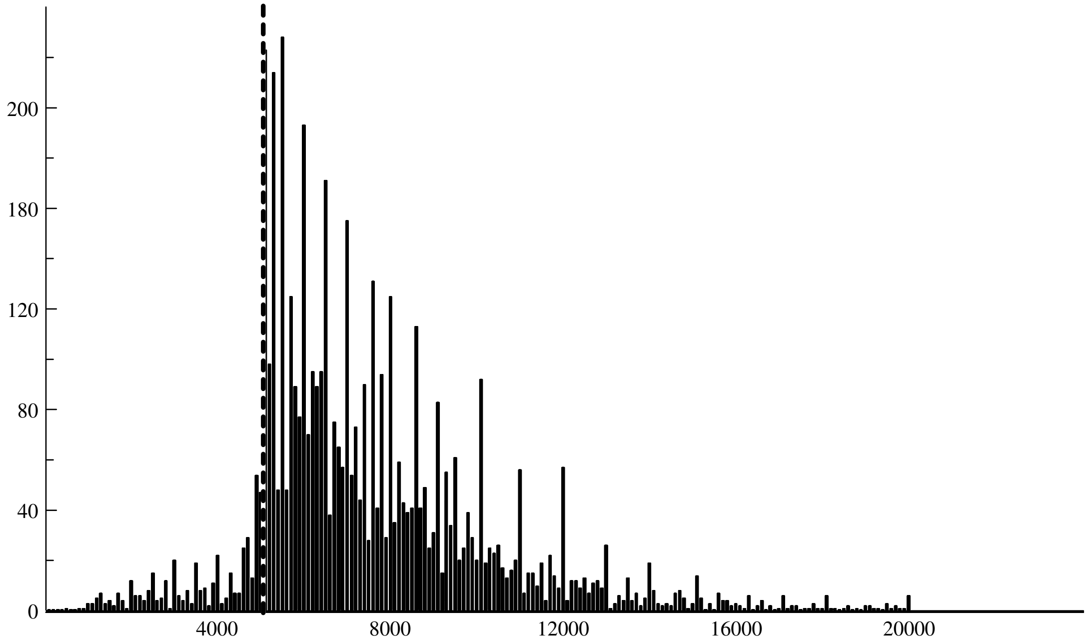

Figure 3. Distribution of wages

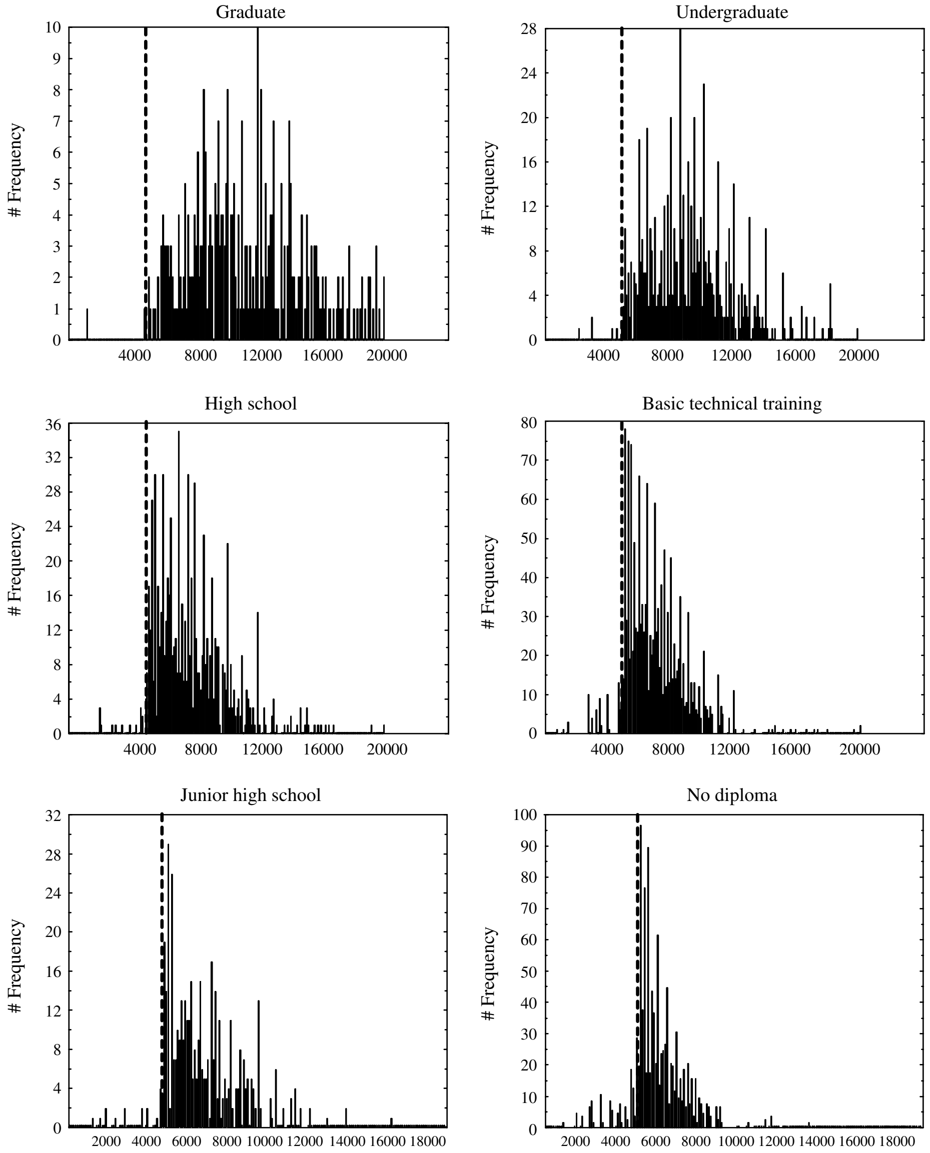

Figure 4. Distribution of wages by diploma

is represented by a dashed vertical line. The histograms, for all employees and by diploma, are computed by steps of 100 francs, up to 20,000 francs. There is clearly a large amount of rounding error. Beyond this, however, there does not seem to be a cluster at the minimum wage, contrary to what Meyer and Wise (1983a, 1983b) claim for their US data. The left censoring effect induced by the minimum wage obviously is stronger for women with low diplomas (or no diploma at all).

4. THE MODEL

Our approach rests on a very simple structural model. This is the classical general equilibrium model of macroeconomics, adjusted for a continuum of skills. Thus assume that there is only one good in the economy and it is produced according to a production function

$$Q = \int_0^\infty \rho L(\rho)\, d\rho$$

where $L(\rho)$ is the number of workers with productivity ρ employed in production.[12] Then given competitive markets, labour demand for a skill ρ that is larger than the cost of the minimum wage is perfectly elastic at a real labour cost $W(\rho) = \rho$. Barring Keynesian or frictional unemployment, employment of skill ρ then is determined by labour supply at this wage level; this in turn relies on the comparison of the net resources, what remains of the wage after taxes and social benefits, with a reservation level. Any worker with productivity smaller than the minimum wage ends up without a job.

The econometric implementation of this model rests on a wage equation and a participation equation. The wage equation represents what employers are prepared to pay for a woman of characteristics X. Since employers only care about the cost of labour, we define W to be the cost of full-time labour to the employer, which is computed by applying the schedule of social contributions to the net wage.[13] The wage equation then is

$$\ln W = X\alpha + \sigma\varepsilon$$

where X includes school-leaving age and experience, their squares, the diploma variables (except for the 'no diploma' variable) and a constant.[14]

Given that women in our sample are either employed full-time or non-employed, the participation equation is based on comparing potential household net resources $R(W)$ when the woman works at a labour cost W and when she does not.[15] We denote

$$\Psi = R(0)Z\beta_r + Z\beta_c$$

the 'reservation net resources' that must be compared with $R(W)$. In this definition, $R(0)$ represents the household's net resources when the woman does not work (including the spouse's net wage and transfers) and Z collects children and age variables. We interact $R(0)$ with explanatory variables to account for income effects and the fact that child care costs depend on household resources.[16]

Thus a woman decides to participate when

$$R(W) + \frac{\eta_p}{\gamma}$$

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[12] Thus all skills are perfectly substitutable, as in most optimal taxation models.

[13] Since weekly hours H vary across employed women, we standardize W to the legal 39-hour week by multiplying the observed wage by $39/H$.

[14] Our equation thus only allows for individual characteristics, as opposed to sectoral characteristics or regional variables.

[15] Note that we adopt a purely static perspective here. Thus we neglect the fact that taking a job today may increase the probability of having one tomorrow. Some of these dynamic effects may appear in the estimated coefficients of the equation.

[16] Unfortunately, we can do little more to model the cost of child care. Some parents hire a nanny, others send their children to day nurseries that are run by local government agencies and whose cost varies significantly across cities or even neighbourhoods.

is larger than

$$\Psi + \rho\varepsilon + \frac{\eta_r}{\gamma}$$

where the variables η, which represent unobserved characteristics, are independent with an extreme value distribution, so that the probability of participation has the familiar logit shape:

$$\frac{\exp \gamma(R(W) - \Psi - \rho\varepsilon)}{1 + \exp \gamma(R(W) - \Psi - \rho\varepsilon)}$$

The term $\rho\varepsilon$ allows for correlation between the unobserved heterogeneity factors that affect productivity and the participation decision. We assume that the disturbances are uncorrelated across individuals and that the distribution of ε is a centred normal with unit variance.

In these equations, R is the function that associates the net resources of the household to the woman's labour cost W; of course, R takes into account the wages of the spouse, if any. For an employed woman, W can be computed from the net wage w which is reported in the survey. For women without a job, W is given by the wage equation (which implicitly sets $H = 39$ for these women), so that $R(W)$ is a complicated function of the unobservable wage disturbance ε.

The Appendix explains how we simulated the function R, taking into account as well as we could the complexities of the French tax-benefit system.

All in all, there are four possibilities. If

$$R(W) + \frac{\eta_p}{\gamma} < \Psi + \rho\varepsilon + \frac{\eta_r}{\gamma}$$

then the woman does not want to work. We call this 'voluntary non-employment' (VNE). If she does want to work, then it may still be that employers are not ready to offer her a wage greater than the legal minimum:

$$X\alpha + \sigma\varepsilon < \ln \mathbf{w}$$

where $\mathbf{w}$ is the cost of the minimum wage (7900 francs per month). In that case, we talk of 'classical non-employment'. Finally, if the woman wants to work and is productive enough, we assume that she ends up being employed with a probability P which we allow to depend on the diploma and on her age. Thus with probability $(1 - P)$, such a woman does not have a job.[17] This may be due to frictional non-employment (she is between two jobs) or cyclical non-employment (e.g. of a Keynesian nature). We then talk of 'other non-employment', as this is a rather heterogeneous category.

After estimation, we therefore end up with a breakdown of non-employment with the following probabilities:

- Voluntary non-employment:

$$P_V = \Pr\left(R(W) + \frac{\eta_p}{\gamma} < \Psi + \rho\varepsilon + \frac{\eta_r}{\gamma}\right)$$

[17] We therefore implicitly assume that the underlying disturbance is independent of ε and the η's. Adding correlation would substantially complicate the model. P is equal to a constant which depends on the diploma, multiplied by a decreasing function of age, $\exp(-\delta \text{ age})$.

• Classical non-employment:

$$P_C = \Pr\left(R(W) + \frac{\eta_p}{\gamma} > \Psi + \rho\varepsilon + \frac{\eta_r}{\gamma}\right.$$
$$\left.\text{and } X\alpha + \sigma\varepsilon < \ln \mathbf{w}\right)$$

• Other non-employment:

$$P_O = (1 - P)\Pr\left(R(W) + \frac{\eta_p}{\gamma} > \Psi + \rho\varepsilon + \frac{\eta_r}{\gamma}\right.$$
$$\left.\text{and } X\alpha + \sigma\varepsilon > \ln \mathbf{w}\right)$$

In the complementary case, the woman is employed. This happens with probability

$$P_E = P\Pr\left(R(W) + \frac{\eta_p}{\gamma} > \Psi + \rho\varepsilon + \frac{\eta_r}{\gamma}\right.$$
$$\left.\text{and } X\alpha + \sigma\varepsilon > \ln \mathbf{w}\right)$$

The estimation is based on a full parametric specification of the model with lognormal errors in the wage equation and a logit model for participation.[18] Even though current semiparametric estimation techniques are not powerful enough to estimate such a model, it is of interest to see whether our approach crucially depends on the choice of functional forms and on distributional assumptions. Identification is a complicated matter in this model. First, consider the model where only the minimum wage constraint may bind. Then the wage distribution is non-parametrically identified above the actual minimum wage, but not below. It is nevertheless semiparametrically identified below the minimum wage (from the observation of employed women with very favourable observable productivity characteristics). Now add other non-employment. This is again non-parametrically identified on women with high productivity (since in the limit, they are only affected by other non-employment). Adding voluntary non-employment makes things more complicated, as is well known from the participation literature and the standard difficulties in identifying supply from demand. We conjecture that given the exclusion restrictions implicit in our modelling of the wage equation and the participation equation[19], the model is semiparametrically identified; but we have not been able to prove it.

5. ESTIMATION RESULTS

Our estimation procedure is maximum likelihood. For a woman who is employed with labour cost W, the likelihood function is[20]

$$l_E = \frac{1}{\sigma}\phi\left(\frac{\ln W - X\alpha}{\sigma}\right)\frac{\exp\gamma\left(R(W) - \Psi - \rho\dfrac{\ln W - X\alpha}{\sigma}\right)}{1 + \exp\gamma\left(R(W) - \Psi - \rho\dfrac{\ln W - X\alpha}{\sigma}\right)}P$$

[18] However, we explore an alternative error specification in the conclusion.
[19] Family composition does not enter the wage equation and diplomas do not figure in the participation equation.
[20] We denote ϕ and Φ the p.d.f. and the c.d.f. of the centred normal with unit variance.

For a non-employed woman, the likelihood function is more difficult to compute; as pointed out in the previous section, it involves the highly non-linear function $R(\exp(X\alpha + \sigma\varepsilon))$. Therefore the probability of employment involves an integral that cannot be computed using standard functions. Denote $\boldsymbol{\varepsilon}$ the value of the wage shock which brings 39-hour labour cost to the level of the cost of the minimum wage:

$$X\alpha + \sigma\boldsymbol{\varepsilon} = \ln \mathbf{w}$$

Then the probability term we need for non-employed women can be written

$$\int_{\boldsymbol{\varepsilon}}^{+\infty} \phi(\varepsilon) \frac{\exp \gamma(R(\exp(X\alpha + \sigma\varepsilon)) - \Psi - \rho\varepsilon)}{1 + \exp \gamma(R(\exp(X\alpha + \sigma\varepsilon)) - \Psi - \rho\varepsilon)}\, d\varepsilon$$

For computing such integrals of the form

$$\int_a^b \phi(\varepsilon) F(\varepsilon)\, d\varepsilon$$

we first select quantiles of the normal distribution restricted to the interval $[a, b]$:

$$\Phi(\varepsilon_i) = \Phi(a) + \frac{i}{m}(\Phi(b) - \Phi(a))$$

for $i = 0, \ldots, m$. Then we compute the average (normal-weighted) point $\overline{\varepsilon}_i$ in each interval $[\varepsilon_i, \varepsilon_{i+1}]$, which yields

$$\overline{\varepsilon_i} = m \frac{\phi(\varepsilon_i) - \phi(\varepsilon_{i+1})}{\Phi(b) - \Phi(a)}$$

and finally we approximate the integral with

$$\int_a^b \phi(\varepsilon) F(\varepsilon)\, d\varepsilon \simeq \frac{\Phi(b) - \Phi(a)}{m} \sum_{i=0}^{m-1} F(\overline{\varepsilon}_i)$$

We found that this strategy, which exploits the shape of the normal density, gives much better results than all-purpose approaches such as Monte Carlo integration: even with $m = 10$, we obtain results that are within one-thousandth of the true value of the integral.[21]

After estimation, it is also easy to compute the probabilities of the three forms of non-employment and of employment; again, this involves the numerical integration method presented above.

Another difficulty is that the tax-benefit system contains many kinks (because of piecewise linear schedules) and even some discontinuities (because of means-tested benefits and minimum payment rules). This would make the likelihood function non-differentiable and even discontinuous. To avoid these problems, we smoothed the schedules. When it was feasible (for the family allowances and the RMI), we did the smoothing by hand, replacing e.g. the Heaviside step function with

[21] We might also have used Gaussian quadrature, which gives good results for such integrals.

Table II. Estimation results: wage equation

Variable	Estimate	Standard error
School-leaving age	0.102	0.011
squared	−0.0016	0.0003
Experience	0.045	0.003
squared	−0.0006	0.0001
Graduate	0.766	0.027
Undergraduate	0.536	0.023
High school	0.320	0.020
Basic technical training	0.187	0.016
Junior high school	0.168	0.020
Constant	7.244	0.119
σ	0.302	0.004

Table III. Estimation results: participation equation

Variable	Estimate	Standard error
	Cross effects β_r	
Constant	1.083	0.051
Children less than 3	−0.141	0.042
Children 3 to 6	0.001	0.035
Children 6 to 18	0.122	0.018
Age −25	−0.002	0.003
	Own effects β_c	
Constant	−3764	1021
Children less than 3	5047	691
Children 3 to 6	3942	580
Children 6 to 18	1017	278
Age −25	232	47
	Probability	
ρ	1496	265
1000γ	0.359	0.026

$\Phi(x/h)$, where h is a small number. For more complicated schedules (social contributions, housing benefits and income tax), we used automatic spline programs.

The maximization converged without much difficulty; starting from reasonable initial values, it took about a day on a Pentium II 300 microcomputer.[22] One measure of the fit of the model is how well it predicts employment status; we find that, on average, P_E is 0.548 for employed women, while it is 0.350 for non-employed women. The pseudo-R^2 of the employment 0-1 variable is about 0.15, which seems satisfactory for this sort of individual-level application. Therefore it seems that our model fits the data reasonably well.

The estimation results are given in Tables II (wage equation), III (participation equation) and IV (‘other non-employment’ P factor).

[22] Most of the CPU time is spent computing integrals.

Table IV. Estimation results: P factor

Variable	Estimate	Standard error
Graduate (age 30)	0.732	0.026
Graduate (age 40)	0.667	0.027
Undergraduate (age 30)	0.871	0.025
Undergraduate (age 40)	0.794	0.026
High school (age 30)	0.920	0.033
High school (age 40)	0.837	0.030
Basic technical training (age 30)	0.954	0.036
Basic technical training (age 40)	0.869	0.031
Junior high school (age 30)	0.937	0.046
Junior high school (age 40)	0.854	0.041
No diploma (age 30)	0.874	0.047
No diploma (age 40)	0.796	0.042

5.1. The Wage Equation

All coefficients in the wage equation are highly significant and go in the expected direction, with a concave profile for the effects of the school-leaving age and of experience. Simple calculations show that, given the correlation between these two variables, the returns to education for zero experience workers hover between 10% and 12% per additional year of schooling when the school-leaving age is between 18 and 24. This estimate seems high but is comparable to what is usually found on French data.[23] We tried to interact diplomas and age, but the cross-effects were very small and insignificant.

5.2. The Participation Equation

It is more difficult to describe the participation equation, given the presence of both cross-effects of $R(0)$ and the other variables and own effects of these variables. Recall that we denote Ψ the 'reservation net resources', i.e. the deterministic part of the right-hand side of the participation equation. Then, on average, in the sample, Ψ is given by

$$\Psi = 1.147R(0) + 2002$$

Household net resources when the woman does *not* work $R(0)$ are, on average, 10,753 francs per month, and never go below 3028 francs (the minimum income guarantee for a childless couple). Thus, on average, a woman will not work if the monthly increase in household resources $(R(W) - R(0))$ is less than about 3600 francs, while 2400 francs would suffice for a woman in one of the poorest households. The children effects go in the expected directions[24] and their

[23] Another way to present the estimates is that for zero experience workers with no diploma, possession of a high-school diploma would raise expected net wages by 66% and a graduate degree would raise them further by 79%.

[24] The only *a priori* surprising feature is the negative sign on the cross-effect of $R(0)$ and 'Children less than 3', which implies, all other things equal, that the presence of a young child reduces the reservation wage by more for richer households. In fact, all other things are not equal, since the tax-benefit system and thus $R(0)$ depend in a very complicated way on the number and ages of children. A young child may make the household eligible for the APE, but this is lower than the minimum income guarantee and thus poorer households do not benefit from it. Simulations indeed show that adding one child younger than 3 hardly changes participation for poorer households, while it reduces it by about 15 points for better-off households. The effect of older children on participation varies much less with income.

magnitudes are very reasonable. On the other hand, the age effect is large: younger women tend to participate much more than older women.

The estimates for γ and ρ allow us to compute the standard error of the participation equation: it is about 5300 francs, so that a large part of the participation behaviour remains unexplained. Note that the coefficient ρ is estimated at 1496 with a standard error of 265; thus the correlation between unobserved heterogeneities on wages and on reservation wages is significantly positive and is non-negligible.

One possible difficulty with our participation equation is that the age effects are additive. Taken at face value, they would suggest that older women request a greater increase in net resources to take a job. As a variant, and also to check the robustness of our policy experiments, we also estimated a model in which the whole participation equation depends on the age class of the woman. The results of estimating and simulating this model differ very little from those reported here.

It is difficult to summarize elasticities of participation, given the complex nature of the tax-benefit system and the variation in individual/household characteristics. One possible experiment is to increase by 1% the net resources $R(W)$ of households when the woman works; this results in a 1.52% increase in the number of women who are willing to work. This seems fairly large, but is of a similar order of magnitude to some earlier estimates on French married women. Another experiment consists of increasing the gross wages of spouses by 1%; this has a much smaller effect on participation (the estimated elasticity is -0.11).

In many cases, an increased wage for the spouse actually increases participation. The usual argument assumes that the woman maximizes utility of consumption and leisure $u(C, L)$ under a budget constraint

$$pC \leq w(T-L) + \overline{w}$$

where $\overline{w}$ is the wage of the spouse. Then an increase in $\overline{w}$ only has an income effect, which reduces labour supply if leisure is a normal good. Taking into account the tax-benefit system transforms the budget constraint into

$$pC \leq R(w(T-L) + \overline{w})$$

When R is increasing, which is the case for most women, barring accidents such as leaving the minimum-guarantee income zone, an increase in $\overline{w}$ again reduces labour supply through the income effect. But this time there is also a substitution effect, as the local perceived net wage is $R'w$ and the derivative R' depends on $\overline{w}$. When R' increases in $\overline{w}$ (which is the case for poorer households), an increase in $\overline{w}$ increases the perceived net wage and therefore labour supply; this substitution effect here appears to be much stronger than the usual income effect. Again, this is entirely an effect of the tax-benefit system: a decent wage for the spouse allows the household to escape the poverty trap, and thus to be subjected to less forbidding withdrawal rates. The usual argument remains valid (but its empirical effects are weak) when the wage of the spouse increases further.

The strong effect of the welfare system on participation decisions can be illustrated by considering a familiar puzzle of French labour data: women whose husband is non-employed have a much lower employment rate than women whose husband is employed.[25] The employment rates are indeed 31.1% and 46.1% in our sample. The puzzle is that past studies which have attempted to regress employment rates on individual characteristics explain only a very small part

[25] We thank Thomas Piketty for suggesting that we explore this issue.

of this difference. The rest is often put down to 'assortative matching' i.e. the fact that low-skilled women tend to marry low-skilled men. Our model, however, predicts employment rates of 30.8% and 45.7% for these two categories, so that it in fact predicts the difference rather well. Our estimates suggest that the welfare system is responsible. The estimated average productivity is only 8% higher for women with an employed husband, which is far from solving the puzzle. The greatest difference in fact lies with voluntary non-employment, which is estimated at 35.7% (resp. a very large 53.6%) for women with an employed (resp. non-employed) husband. It turns out that the average gain from working, which is 5600 francs for women with an employed husband, is only 2500 francs for women whose husband is not employed. The households of the latter indeed receive substantial means-tested benefits when the woman does not work, and they lose them when the woman gets a job. Assortative matching does play a role, but only a limited one: the estimated wage disturbance is only less than 2 percentage points higher for working women with an employed husband.

5.3. Other Non-employment

As we let the P factor depend on diploma and age, we give the estimates for all diplomas and ages 30 and 40. To interpret the estimated P factors, recall that P is the probability of having a job, conditional on being willing to work and productive. Thus Table IV shows that other non-employment is particularly prevalent for highly skilled women. This is not that surprising: other non-employment is a catch-all category in this model for all sorts of non-employment that are not voluntary or classical. Since high-skilled women can get high wages, they are not very affected by voluntary or classical non-employment; our model therefore must classify non-employed high-skilled women as 'other non-employed'.

6. BREAKING DOWN NON-EMPLOYMENT

Table V shows how non-employment breaks down into the three categories. The first three columns report P_V, P_C and P_O. The fourth column is $(1 - P_E)$, the simulated probability of non-employment, which should be compared with the fifth column, actual non-employment in the sample. Finally, the last column gives the percentage of officially unemployed women in the sample, for purpose of comparison.[26] All these figures were computed using the sampling weights provided in the survey.

Table V shows a very consistent and dramatic pattern: when going down diploma levels, both voluntary and classical non-employment increase, while other non-employment generally decreases. As mentioned in Section 5, the latter only means that we explain non-employment much better for the unskilled. Classical non-employment, which is attributed to the minimum wage in our model, is a full 9.8% of the sample (or about 340,000 women), and even 16.5% for the third of women with no diploma (who therefore represent more than half of these 340,000 classical non-employed). While high-skilled women are unaffected by classical non-employment, they are only a small subpopulation. Thus the minimum wage explains more than 15% of non-employment in our sample. Since a large part of non-employment is estimated to be voluntary, another way to put it

[26] Note that this is not the unemployment rate; the unemployment rate is the ratio of the sixth column to its sum with one minus the fifth column.

Table V. Breaking down non-employment

Category	Voluntary	Classical	Other	Simulated	Observed	*U*
All	38.1%	9.8%	8.4%	56.3%	55.9%	16.3%
Graduate	18.3%	0.3%	24.0%	42.6%	42.0%	16.3%
Undergraduate	23.1%	1.9%	12.0%	37.0%	36.6%	13.1%
High school	30.3%	5.9%	7.8%	44.1%	43.8%	14.2%
Basic technical training	37.9%	9.3%	5.7%	52.9%	51.7%	15.7%
Junior high school	40.2%	8.5%	6.9%	55.6%	55.7%	15.9%
No diploma	49.2%	16.5%	7.1%	72.8%	73.1%	18.8%
No child	14.0%	12.4%	12.8%	39.2%	38.8%	15.3%
One child	26.3%	11.9%	9.6%	47.8%	47.6%	18.0%
Two children	50.7%	8.0%	6.2%	64.9%	63.1%	16.0%
At least three children	80.4%	4.4%	2.4%	87.2%	89.2%	15.5%

is that according to our results, the minimum wage explains 55% of involuntary non-employment in this sample.

Of course, even if the model is well specified, there are two sources of errors in these ‘regime probabilities’. The first is due to the nature of the survey itself: it implies a sampling error which is in fact fairly small (about 0.2 point for the probabilities for the whole population, up to 0.8 point for smaller subpopulations). The second error is due to the variance of the estimators. We computed it for the whole population; it is 1.7 points for voluntary non-employment and other non-employment, but only 0.5 points for classical non-employment.

7. SOME POLICY EXPERIMENTS

Once the model is estimated, we can run experiments by modifying some of the (literally dozens of) policy parameters, provided that other non-employment remains at a constant proportion of employment and that the distribution of nominal productivities does not change. There are many policy experiments; we study here the effects of the minimum wage and of the extension of the *Allocation Parentale d’Education*, designed to help mothers of young children who quit their job raise their children. Experiments on, say, the income tax schedule are also easy to program.

In the following, we give the results of experiments weighted by the sampling weights; remember that our sample comprises 3,500,000 women. We ran unconditional simulations (in which the disturbances are sampled from their unconditional distributions) and used the numerical integration procedure detailed in Section 5 to compute the relevant integrals.

7.1. Employment Effects of the Minimum Wage

In their paper, Meyer and Wise (1983b) evaluate the effect of the minimum wage by the size of what we call classical non-employment, or 9.8% of the sample in our estimates. Since there is little prospect of abolishing the minimum wage in France and, in any case, negotiated minima at the industry level would then bind, we prefer to simulate an increase of 10%. Moreover, as we have seen, the identification of the model is on firmer grounds above the minimum wage than below. Our simulation still assumes that raising the minimum wage does not affect the *P* (other non-employment) factors or the distribution of productivities.

Table VI. Increasing the minimum wage by 10%

Category	Effect on probability	Effect on numbers
Voluntary	−0.004	−10,000
Classical	+0.042	+150,000
Other	−0.005	−20,000
Employment	−0.033	−120,000

As social contributions have a lower rate between the minimum wage and 1.33 times the minimum wage, increasing the minimum wage also makes these exemptions more generous and thus reduces voluntary non-employment. Moreover, other non-employment by construction is a fixed proportion of employment in our model:

$$P_O = \frac{1-P}{P} P_E$$

Since P depends only on diploma and age, any policy reform that reduces employment also reduces other non-employment. The simulation results reported in Table VI show that these two effects are small: according to our estimates, increasing the minimum wage by 10% would reduce employment by 120,000 jobs. Note that as we do not model the labour market for men, we hold the employment rate of spouses constant. Thus we neglect the fact that the increase in the minimum wage, by destroying some jobs for men, pulls more households into the poverty trap, which should discourage women's participation and employment. In that sense, we underestimate the job-destroying potential of increasing the minimum wage.

This effect is rather precisely estimated: the standard error of jobs destroyed is only 10,000. It is also easy to compute the elasticity of employment to the gross minimum wage as −0.7, which is way below the estimates of −0.1 to −0.3 (for US teenagers only!) quoted in Brown, Gilroy and Kohen (1982). However, we remind the reader that our sample has much lower skills than the total French population. Also, the cost of minimum wage is much more on the left of the wage distribution in the USA than in France (see Section 2.1 above). According to our estimates and given our identifying assumptions, lowering the cost of the minimum wage to US levels would go a long way towards eliminating classical non-employment. Moreover, at this lower level of the gross minimum wage, the employment elasticity would only be −0.1, which is more in line with American estimates.

7.2. Employment Effects of the APE

The *Allocation Parentale d'Éducation* (APE) was created in 1986 to help parents (almost always mothers) to raise their children. Originally, it gave about 60% of the net minimum wage to mothers of at least three children, one of whom was younger than 3, provided the mother stopped working. In 1994, it was extended to mothers of two children, who are rather more numerous in France. This reform seems to have had a very strong effect on participation: using the methodology of natural experiments, Piketty (1998) estimates that it may have reduced the participation rate of newly eligible women by about 15 points.

Our model allows us to simulate the effect of reversing the 1994 reform of the APE: we just modify the function R so that only mothers of at least three children are eligible to the APE.

Table VII. Reforming the APE

Category	Effect on probability	Effect on numbers
Voluntary	−0.149	−40,000
Classical	+0.030	+8,000
Other	+0.014	+4,000
Employment	+0.105	28,000

Then about 270,000 women stop being eligible for the APE. As seen in Table VII participation increases by 14.9 points for these women. Not all of them can find a job, since some are not productive enough to earn the minimum wage and others are barred by frictional or Keynesian unemployment. Still, our model suggests that the 1994 reform of the APE may have reduced employment by 10.5 points for this subpopulation. We find it rather remarkable that our structural approach yields an estimate of the effect of the 1994 reform on participation that is so close to that of Piketty (1998).[27]

8. CONCLUSION

Our estimates suggest that both the disincentive effects of benefits and the employment effects of the minimum wage are underestimated in the usual policy literature. Our experience of this model is that reasonable variants (such as a probit model for participation, or changes in the explanatory variables) hardly change the overall diagnosis. By focusing on married women, we have of course chosen to study a subpopulation that is relatively low-skilled and more sensitive to incentives. This clearly implies that the large estimate we obtain for the elasticity of employment to the minimum wage cannot be extended to the entire population. However, we have applied the approach of this paper to other subpopulations. The diagnosis for single women is very similar to that for married women. On the other hand, male participation is harder to explain and is much less sensitive to financial incentives. Also, the elasticity of male employment to the cost of the minimum wage is about twice smaller than that of female employment. We also added part-time to the model for married women, which leads to a much more complex model but does not modify the basic qualitative conclusions (Laroque and Salanié, 2000).

Another possible extension is to relax the parametric identification assumptions, e.g. by using a more general distributional assumption than the lognormal in the wage equation. Dickens, Machin, and Manning (1998) argue that the Meyer–Wise approach is very sensitive to the choice of functional form for the wage equation. It is not clear how relevant this criticism is to our study, as Dickens *et al.* do not have a participation equation and use very few explanatory variables in their wage equation. Still, this is worth exploring. While the model is not identified non-parametrically, it could be identified via semiparametric restrictions. However, our model is much more complicated than the models to which semiparametric econometrics has been applied so far. We did try to model the error in the wage equation with a mixture of two normals, replacing the term $\sigma\varepsilon$ with

$$\sigma_1\varepsilon_1$$

[27] Note that these results can also be interpreted as pointing to the large potential effects on participation of subsidizing child care for working women.

Table VIII. Using a mixture of two normals

Coefficient	Estimate	Estimated standard error
p	0.933	0.062
σ_1	0.312	0.005
μ	0.260	0.018
σ_2	0.101	0.019

with probability p and

$$\mu + \sigma_2 \varepsilon_2$$

with probability $(1 - p)$, where ε_1 and ε_2 are drawn from independent centered normal distributions with unit variance. We obtained the estimates[28] in Table VIII.

Recall that our estimated σ in the normal model was 0.302, which is very close to the estimated σ_1. Moreover, p is close to one.[29] The likelihood function increases by 18 points, but that is not surprising with nearly 11,000 observations. We provisionally conclude from this exercise that there is little evidence that deviating from the normality assumption greatly improves the fit of the model.

APPENDIX: MODELLING THE TAX-BENEFIT SYSTEM

We give here some further details on how we model taxes and benefits. The purpose of this Appendix is not to describe all our modelling of the tax-benefit system (which runs into several hundred lines in GAUSS), but rather to explain where and how we had to make approximations.

A.1. Social Contributions

The rates of social contributions differ somewhat for executives and non-executives, but we clearly cannot model this for non-employed women. Therefore we assume that there are no female executives, whereas there are in fact about 3% in the sample.

A.2. Income Tax

We have no information on capital income, so we completely neglect it when computing income tax. This may only be a minor problem, as we are most interested in low-income households. Our only other departure from the actual income tax is that we neglect the (small) tax credits for children of schooling age.

A.3. Family Benefits

We simulate most family benefits.[30] For the *allocations familiales*, there is a supplement for each child aged 10 to 15, and a larger one for each child aged over 15. Given that we do

[28] The estimates for the other coefficients of the model change very little.

[29] We did not attempt a formal test: the hypothesis $p = 1$ is at the frontier of the parameter space and makes μ and σ_2 unidentified, which significantly complicates the asymptotics.

[30] We neglect a few other allocations like the benefit for a handicapped adult, which we do not have enough information to simulate.

not use such detailed information on ages, we give a supplement for each child aged 6 to 18. The APE raised a more difficult problem: to benefit, one must have held a job for at least two in the past five years. But we only know if the woman is out of work, not whether she worked before she had a child. We therefore resolved to give the APE to every non-working woman with the required household composition. This is a serious but unfortunately necessary approximation.

APE, CF and APJE are mutually exclusive. We assume that the household chooses the most generous benefit it is entitled to (in practice the APE, then the APJE, then the CF).

A.4. Housing Subsidies

Housing subsidies depend on rent paid. Since we do not know how much rent each household pays, we imputed an average rent that depends on the number of children. Our modelling also should differentiate between households who pay rent and households who pay interest. As we do not have information on interest paid, we assume that every interest-paying household gets the housing subsidy as if it were a tenant and paid the average rent.

A.5. The Housing Tax

The housing tax depends on an imputed 'rent value' of the home, to which a tax rate is applied. Both of these parameters vary significantly across towns. We model an average rent as above and apply to it the national tax rate.

A.6. Unemployment Benefits

The most obvious omission from our modelling is unemployment benefits. We do have (partial) information on benefits received by the unemployed. On the other hand, we cannot model unemployment benefits for a worker who loses his job, as these depend on the duration of employment, the previous history of wages and of job status, all of which information is unavailable to us. Therefore we set unemployment benefits to zero. As a consequence, we assign the RMI to many households who in fact may live on more generous unemployment benefits. This procedure effectively increases the gap between income when working and when not working compared with reality, as the system we model is less generous than the actual system.

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