Online Appendix on Does Public Sector Employment Buffer the Minimum Wage Effects?

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A Dropping Invalid Observations in the Data

To estimate the model for the Chilean labor market we use a cross-sectional household survey called Socio-Economic Characterization Survey (CASEN). This survey contains information on labor market status, monthly labor income, hours worked, and individual characteristics such as gender, age, and education. Our sample for estimation is comprised of males between the ages of 25 and 55 years participating in the labor market. For those who are employed, we consider only full-time formal employees in both sectors, private and public, who have an explicit job contract. Unfortunately, we dropped 24.8% of the valid sample observations due to problems with the data, namely individuals with missing information on education, unemployment durations, hours worked or wages.

Dropping such a large portion of the data generates a concern about the selection effect that the deleted observations potentially introduce on the final sample. The distribution of the dropped data is as follows: (1) missing education information: 94 observations (1.4%), (2) missing unemployment duration information: 12 observations (0.2%), (3) missing wages information: 6,033 observations (93.8%), and (4) missing hours worked information: 290 observations (4.5%). Almost all dropped data is related with missing information to compute the hourly wages. Since we need information on wages to compute the likelihood function in the estimation, we cannot include this information. However, to check the effect of eliminating the information on the two most important distributions in the paper, that of schooling groups and that of the labor market states, we compare the distributions using the sample before dropping the missing data with those using the final sample. The results, shown in the table below, reveals that dropping observations with missing data does not fundamentally affect the relevant distributions in the sample. This occurs because, in the final sample, the correction for outliers in hourly wages (dropping observations at the bottom and top percentile) seems to offset the effect of deleting the missing data. The last relevant distributions are the wages distributions by sector, but since these involve the use of the missing data, we cannot check or characterize the workers with missing information. However, given that the wages are positively correlated with education (the correlation coefficient is 0.53 in the final sample), if for example the missing data on hourly wages has a clear over representation of workers with low wages, that would be observed in the distribution of schooling groups. Summing up, even though we cannot be completely sure about not having any selection issues, we are confident that our sample is representative in the relevant dimensions of the paper.

Table A.1: Relevant Labor Market Distributions when Dropping Invalid Observations

	Sample without deleting observations	Estimation sample
Schooling groups		
Prop. of unskilled workers	85.2	86.5
Prop. of skilled workers	14.8	13.5
Unskilled workers		
Prop. of unemployed workers	8.3	8.8
Prop. of private sector employees	82.3	81.6
Prop. of public sector employees	9.4	9.5
Skilled workers		
Prop. of unemployed workers	5.9	6.7
Prop. of private sector employees	68.7	67.1
Prop. of public sector employees	25.4	26.1

B Model Extensions

B.1 Search Effort

Following Mortensen (1986), we introduce endogenous search effort $s(h)$ in the searching state in each sub-market h. The value of unemployment in that sub-market becomes:

$$\begin{aligned}\rho U(h) \;=\; & \max_{0\leq s(h)} \Big\{ z(h) - \frac{s(h)^2}{2} + \alpha^p(h) \int \max[N_p(x,h) - U(h), 0] dG(x|h) \\ & + \alpha^g(h) s(h) \int \max[N_g(x,h) - U(h), 0] dG(x|h) \Big\}\end{aligned} \tag{B.1}$$

where $\frac{s(h)^2}{2}$ is the utility cost of effort and $\alpha^g(h)s(h)$ is the arrival rate of public sector jobs. Note that we normalize the search effort in the private sector to 1. The first order condition with respect to $s(h)$ is:

$$s(h) = \alpha^g(h) \int \max[N_g(x,h) - U(h), 0] dG(x|h) \geq 0. \tag{B.2}$$

In the equilibrium with a non binding minimum wage, the reservation productivities still satisfy equations (8) and (9), while the wage schedules in both sectors remain as equations

(5) and (6). Using these results, equation (B.1) can be written as:

$$\begin{aligned}\rho U(h) &= z(h) - \frac{s(h)^2}{2} + \frac{\alpha^p(h)\beta}{\rho+\delta_p(h)}\int_{\rho U(h)}[x-\rho U(h)]dG(x|h) \\ &+ \frac{\alpha^g(h)s(h)}{\rho+\delta_g(h)}\int_{\frac{\beta\rho(h)-[\lambda(h)+\nu(h)\bar{x}]}{\beta-\nu(h)}}[[\lambda(h)+\nu(h)\bar{x}]+[\beta-\nu(h)]x-\beta\rho U(h)]dG(x|h)\end{aligned}$$

while the optimal search effort in the public sector $s(h)$ in equation (B.2) as:

$$s(h) = \frac{\alpha^g(h)}{\rho+\delta_g(h)}\int_{\frac{\beta\rho(h)-[\lambda(h)+\nu(h)\bar{x}]}{\beta-\nu(h)}}[[\lambda(h)+\nu(h)\bar{x}]+[\beta-\nu(h)]x-\beta\rho U(h)]dG(x|h)$$

In the case of the equilibrium with a binding minimum wage, the minimum required productivity are m and $\underline{x}$ and the workers are paid over the minimum wage only if their productivities are greater than $\widetilde{x}_p(h)$ and $\tilde{x}_g(h)$, respectively. Using these results, equation (B.1) can now be written as

$$\begin{aligned}\rho\tilde{U}(h) &= z(h) - \frac{s(h)^2}{2} + \frac{\alpha^p(h)}{\rho+\delta_p(h)}\int_m^{\widetilde{x}_p(h)}(m-\rho\tilde{U}(h))dG(x|h) \\ &+ \frac{\alpha^p(h)\beta}{\rho+\delta_p(h)}\int_{\widetilde{x}_p(h)}(x-\rho\tilde{U}(h))dG(x|h) + \frac{\alpha^g(h)s(h)}{\rho+\delta_g(h)}\int_{\underline{x}(h)}^{\widetilde{x}_g(h)}(m-\rho\tilde{U}(h))dG(x|h) \\ &+ \frac{\alpha^g(h)s(h)}{\rho+\delta_g(h)}\int_{\widetilde{x}_g(h)}([\lambda(h)+\nu(h)\bar{x}]+[\beta-\nu(h)]x-\beta\rho U(h))dG(x|h),\end{aligned}$$

and the optimal search effort $s(h)$ is

$$\begin{aligned}s(h) &= \frac{\alpha^g(h)}{\rho+\delta_g(h)}\int_{\underline{x}(h)}^{\widetilde{x}_g(h)}(m-\rho\tilde{U}(h))dG(x|h) \\ &+ \frac{\alpha^g(h)}{\rho+\delta_g(h)}\int_{\widetilde{x}_g(h)}([\lambda(h)+\nu(h)\bar{x}]+[\beta-\nu(h)]x-\beta\rho U(h))dG(x|h).\end{aligned}$$

Finally, the steady state conditions given in equations (14) change to

$$\begin{aligned}\delta_p(h)e_p(h) &= \phi(h)q(\theta(h))\widetilde{G}\left(\max\left\{m, x_p^*(h)\right\}|h\right)u(h) \\ \delta_g(h)e_g(h) &= s(h)(1-\phi(h))q(\theta(h))\widetilde{G}\left(\max\left\{\underline{x}(h), x_g^*(h)\right\}|h\right)u(h) \\ u(h)+e_p(h)+e_g(h) &= 1.\end{aligned}$$

The rest of the model and the solution algorithm remains the same. This completes the description of the model with endogenous search effort.

B.2 Payroll Taxes and Public Sector Wage Bill

We assume payroll taxes are paid by the workers in both the private and the public sectors (see for example Pissarides, 2000, chapter 9). Therefore, the flow income in the employment state is the after tax wage rate, $w_s(x,h)(1-\tau)$, where τ is tax rate. In this case, the flow value of employment, equation (2), becomes

$$\rho N_s(x,h) = w_s(x,h)(1-\tau) + \delta_s(h)\left[U(h) - N_s(x,h)\right], \quad s = p, g. \tag{B.3}$$

Private sector wages are determined by Nash bargaining, which leads to a surplus splitting rule of $(1-\beta)\left[N_p(x,h) - U(h)\right] = \beta\left(J_p(x,h) - V_p(h)\right)(1-\tau)$ and generates a before taxes wage schedule of:

$$w_p(x,h) = \begin{cases} m & if\, m \leq x < \widetilde{x}_p(h) \\ \beta x + \left(\frac{1-\beta}{1-\tau}\right)\rho\tilde{U}(h) & otherwise. \end{cases} \tag{B.4}$$

where the productivity threshold is $\widetilde{x}_p(h) = \frac{m(1-\tau)-(1-\beta)\rho\tilde{U}(h)}{\beta(1-\tau)}$. Note that the payroll tax increases the outside option of the worker, which generates a higher before taxes wage. Under the assumption that the public sector pays a premium over the private sector wage, the before taxes public sector wage becomes:

$$w_g(x,h) = \begin{cases} m & if\, \underline{x}(h) \leq x < \widetilde{x}_g(h) \\ [\lambda(h) + \nu(h)\bar{x}] + [\beta - \nu(h)]x + \left(\frac{1-\beta}{1-\tau}\right)\rho\tilde{U}(h) & otherwise. \end{cases} \tag{B.5}$$

where in this case the productivity threshold is $\widetilde{x}_g(h) = \frac{m(1-\tau)-[\lambda(h)+\nu(h)\bar{x}](1-\tau)-(1-\beta)\rho\tilde{U}(h)}{[\beta-\nu(h)](1-\tau)}$. All the definitions of equilibrium conditions and the steady state level of unemployment and employment remain the same, and given these new thresholds in the binding minimum wage case. The non binding minimum wage case is analogous. Finally, we assume that a fraction D of the public sector wage bill is financed by labor income taxes, and that the payroll tax τ is such that the following budget constraint holds:

$$\tau\left[\sum_{h=1}^{H}\int w_p(x,h)dG(x|h)e_p(h)\right] = (D-\tau)\left[\sum_{h=1}^{H}\int w_g(x,h)dG(x|h)e_g(h)\right] \tag{B.6}$$

To solve the model, we use algorithm A.2 to solve for the equilibrium in each sub-market h separately given τ, and then we iterate over τ given the equilibrium in all h sub-markets so equation (B.6) holds.

C Robustness with respect to the Productivity Distributions

In the paper, we assume that the productivity distribution is the same for both, the private and the public sectors. In this section, we check whether we have considerable gains in terms of fit when we do not impose equality across sectors for the productivity distributions parameters, that is the location and the scale, while maintaining all the structure of the model as in the paper. Table C.1 compares the estimation results of both cases, with and without imposing equal productivity distribution.

Table C.1: Estimated Parameters with Equal and Different Productivity Distributions

Parameter	Equal Prod. Dist.		Different Prod. Dist.	
	Unskilled.	Skilled	Unskilled.	Skilled
α_p	0.4986	0.2249	0.5000	0.2257
α_g	0.0186	0.0953	0.0186	0.0956
δ_p	0.0482	0.0230	0.0482	0.0229
δ_g	0.0173	0.0249	0.0177	0.0249
μ_x	1.4310	2.6411	1.4240	2.6453
σ_x	0.6811	0.6971	0.6853	0.7156
$\mu_{x,g}$	-	-	1.4466	2.6440
$\sigma_{x,g}$	-	-	0.6404	0.6794
$\rho\tilde{U}$	0.6517	1.3467	0.6640	1.3473
z	-10.1283	-27.9024	-10.0660	-28.5553
λ	0.8062	0.0000	0.8071	0.0000
ν	-0.1037	0.0290	-0.1345	0.0296
$\underline{x}$	0.2069	1.0661	0.2069	1.0627
ϕ	0.9640	0.7024	0.9641	0.7025
θ	0.3483	0.1617	0.3497	0.1625
c	28.6111	181.9646	28.3650	185.1520
φ	-	0.0140	-	0.0142
Log-Likelihood	-37259.5	-8974.9	-37258.8	-8973.5
LR Test	1.3126	2.7478	-	-

As can be observed, there are no substantial differences in all the estimated parameters and, in particular, in those related with the productivity distributions across sectors. Also, the log likelihood ratio test of the null hypothesis of equality in the location and the scale parameters cannot be rejected at any reasonable significance level for both schooling groups. This means that our wage equation specification is flexible enough to accommodate differences in the wages distributions across sectors.

D Estimation Results Pooling Male and Female Workers in the Sample

Table D.1: Descriptive Statistics using Males and Female Workers

	Unskilled	Skilled
Hourly Wage - Private Sector (US$/hour)		
Mean	3.0827	8.7284
Standard Deviation	1.9777	6.4940
Minimum	1.7978	1.7978
Hourly Wage - Public Sector (US$/hour)		
Mean	3.4372	8.1478
Standard Deviation	2.0816	5.3375
Minimum	1.7978	1.7978
Ratio of Average Wages	0.8969	1.0713
Unemployment Duration (Months)		
Mean	2.2115	2.8360
Proportion of Transitions $u \to e_p$	0.9315	0.7531
Proportion of Transitions $u \to e_g$	0.0685	0.2469
Unemployment Rate	0.1059	0.0697
Employment in the Private Sector	0.7584	0.5893
Employment in the Public Sector	0.1357	0.3410
Proportion of Workers with $w_p = m$	0.2615	0.0042
Proportion of Workers with $w_g = m$	0.1692	0.0006
Proportion of Workers	0.8445	0.1555

NOTE: Data extracted from CASEN 2013. Wage distributions are trimmed 5 percentiles at the bottom and 1 percentile at the top by sector and are reported in US Dollars of December 2009 (Exchange Rate = 559.67 Pesos/US$).

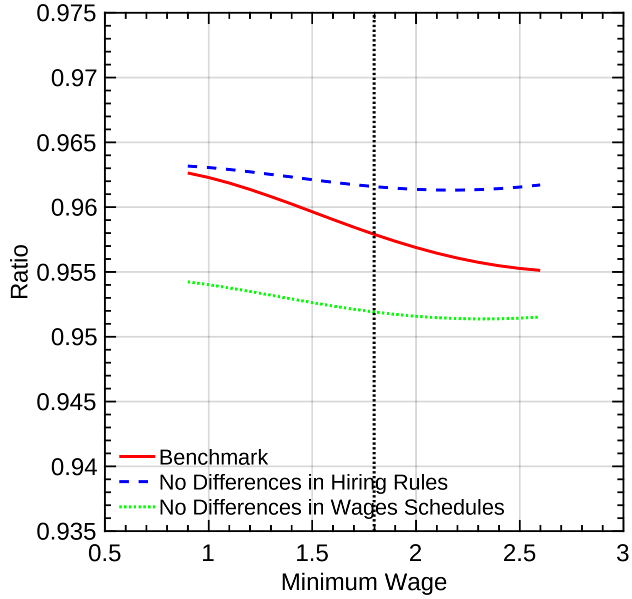
Table D.2: Estimates of the Model Parameters using Males and Female Workers

Parameter	Unskilled		Skilled	
	Coeff.	Standard Error	Coeff.	Standard Error
Estimated Parameters				
α_p	0.5278	0.0164	0.2289	0.1025
α_g	0.0310	0.0009	0.0748	0.0346
δ_p	0.0588	0.0016	0.0278	0.0253
δ_g	0.0242	0.0007	0.0161	0.0156
μ_x	1.2107	0.0213	2.4914	0.0390
σ_x	0.7475	0.0104	0.6862	0.0407
$\rho\tilde{U}$	0.7640	0.0267	1.5294	0.2058
z	-7.8839	0.1860	-21.2644	6.4455
λ	0.8112	0.0459	0.0000	0.0090
ν	-0.0756	0.0126	0.0497	0.0187
$\underline{x}$	0.1360	0.1380	0.4375	1.5715
ϕ	0.9446	0.0009	0.7536	0.0027
θ	0.3941	0.0193	0.1486	0.1271
c	19.5298	0.8458	148.2227	49.7534
φ	-	-	0.0148	0.0080
Predicted Values				
$E[x]$	4.4377	0.0653	15.2844	0.8970
$SD[x]$	3.8396	0.0453	11.8528	1.9197
Fixed Parameters				
β		0.5000		
ρ		0.0670		
γ		0.6250		
m		1.7978		
Log-Likelihood	-64708		-17552	
No. Obs.	26344		4850	

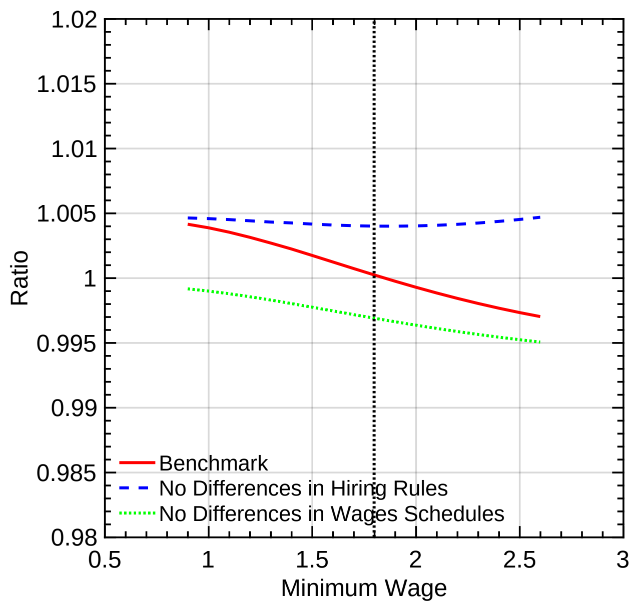
NOTE: Standard errors were calculated using Bootstrap with 1,000 replications.

E Counterfactual Scenarios with e_g Fixed

Figure E.1: Counterfactual scenarios with e_g fixed: Unemployment



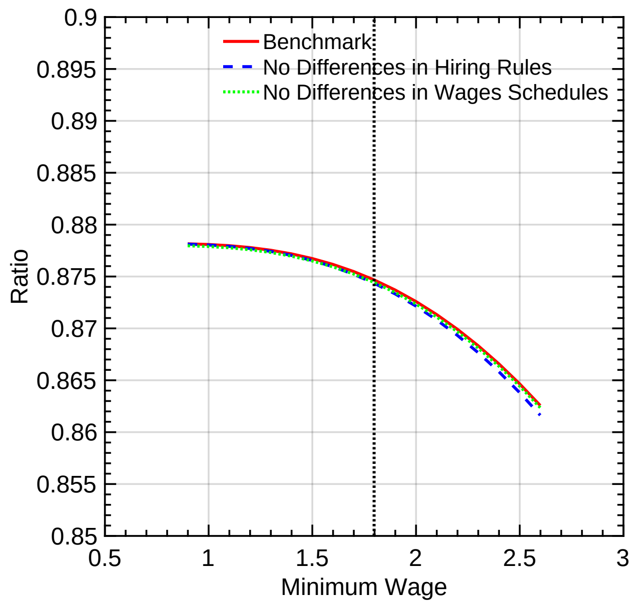
(a) Unemployment rate



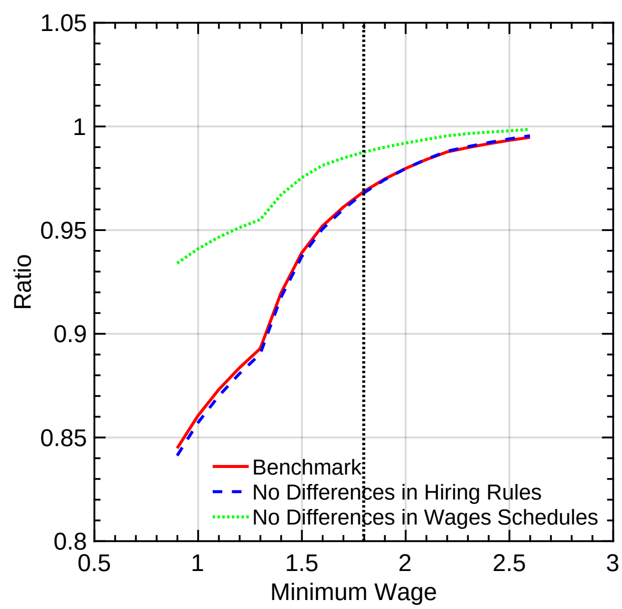
(b) Unemployment duration

Note: The vertical axis corresponds to the ratio between the variable in the described economy and the variable in an economy without the public sector. The vertical line corresponds to the observed value of the minimum wage.

Figure E.2: Counterfactual scenarios with e_g fixed: Employment and minimum wage incidence in the private sector



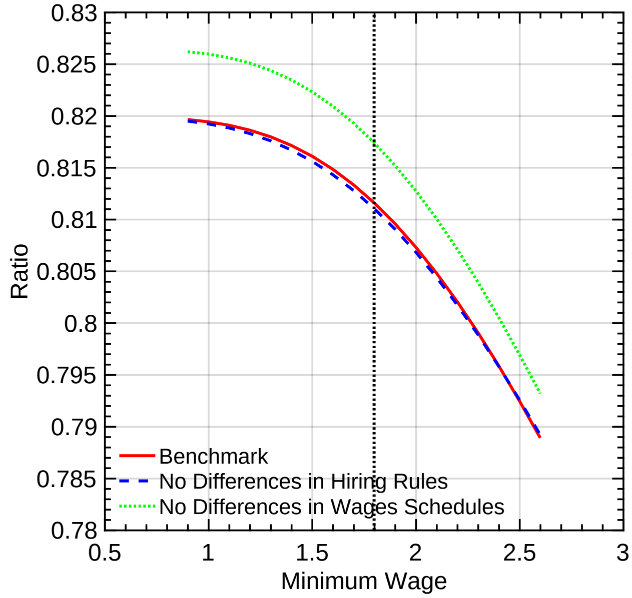
(a) Employment rate



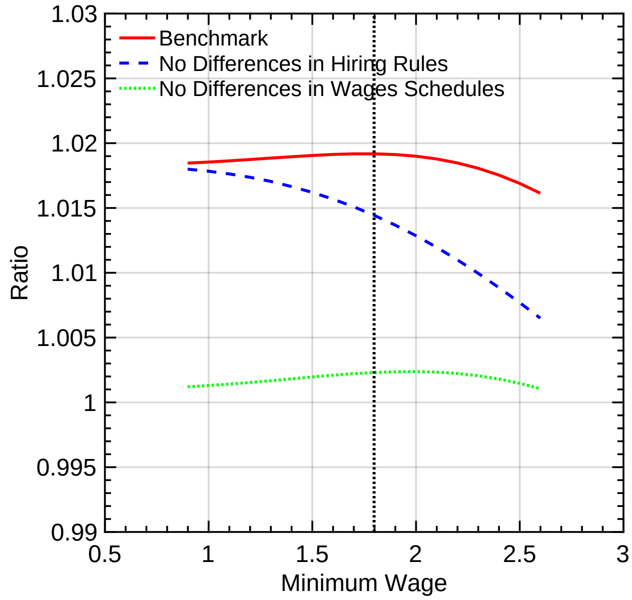
(b) Incidence of the minimum wage

Note: The vertical axis corresponds to the ratio between the variable in the described economy and the variable in an economy without the public sector. The vertical line corresponds to the observed value of the minimum wage.

Figure E.3: Counterfactual scenarios with e_g fixed: Productivity and welfare



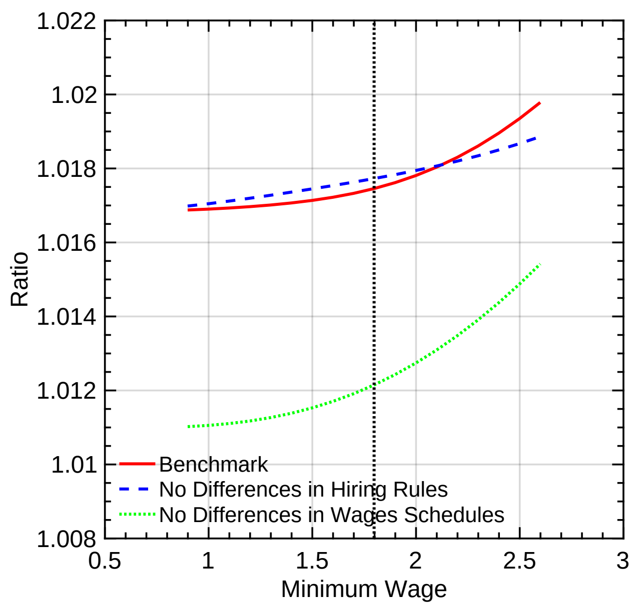
(a) Productivity in the private sector



(b) Welfare measures

Note: The vertical axis corresponds to the ratio between the variable in the described economy and the variable in an economy without the public sector. The vertical line corresponds to the observed value of the minimum wage.

Figure E.4: Counterfactual scenarios with e_g fixed: Schooling Decision



(a) Proportion of unskilled workers

NOTE: The vertical axis corresponds to the ratio between the variable in the described economy and the variable in an economy without the public sector. The vertical line corresponds to the observed value of the minimum wage.

References

Mortensen, Dale T., "Chapter 15 Job search and labor market analysis," in "Handbook of Labor Economics," Vol. 2, Elsevier, 1986, pp. 849 – 919.

Pissarides, Christopher A., *Equilibrium Unemployment Theory*, The MIT Press, 2000.