Labor Market Connections, Minimum Wages, and Youth Employment*

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February 15, 2008

Abstract

We construct a labor search model where individuals can be either connected or unconnected. Connected workers get a higher rate of job offers when unemployed and are separated from their jobs at a lower rate than unconnected workers. Unconnected workers can become connected through employment. This model can account for age patterns in employment data. By introducing minimum wages, the model explains empirical findings on the effects of minimum wage laws. Finally, the model shows that minimum wages account for a large part of the differences in youth employment between Europe and the United States.

*Preliminary, comments welcome. I would like to thank Robert Shimer, Nancy Stokey, and participants of the Capital Theory Working Group at the University of Chicago for helpful comments. First version: December 2006. All mistakes are my own.

1 Introduction

A large literature seeks to explain why people in Europe work less that people in the United States. Most of these papers attempt to explain the aggregate time series data and focus on the effects of labor market policies on a representative worker who faces a single decision of how much time to spend working. This framework overlooks several sources of heterogeneity in work decisions both across individuals and for a given individual at different ages. Heterogeneity across age is particularly important in explaining differences in labor supply across countries as much of the decline in European employment relative to the United States is concentrated in the 15-24 and 55-64 year old age groups. To explain these differences, models need to allow for government policies to have disparate impacts on individual labor decisions by age.

One difference between younger and older workers is their connection to the labor market. Granovetter (1974) examines the method in which workers find jobs. He finds that that most workers find jobs through personal contacts. Moreover, the jobs found through connections are more suited for the individual worker and pay higher wages. Because these jobs are better across many measures, workers who found their jobs through connections are also less likely to search for new jobs. Granovetter (1974) finds that connections made through work are the most valuable in finding future employment. Additionally, Meyer and Wise (1982) show that individuals who work in high school have significantly higher probabilities of employment and higher wages immediately after high school than those who did not work. They also find that low wage jobs taken in or right after high school are not predictive of future low wages. These studies suggest that connections made while working are important in helping workers find new jobs. Younger workers without work experience differ from older workers because they have not developed these connections.

This paper constructs a search model where individuals can either be connected to the labor market or unconnected. Connected workers get job offers at a higher rate when unemployed and separate from their jobs at a lower rate when employed. Unconnected workers become connected while employed. Even though both types of workers draw matches from the same productivity distribution, connected workers have a much higher reservation rate which leads to large differences in wages between groups. Workers enter the labor force as unemployed unconnected workers and become connected over time. The model is able to match the age pattern of employment for young workers in the economy where young workers have increasing probabilities of becoming employed as they age.

While all workers face the same distribution of job offers, in the model connections are a type of human capital that increases an individual's ability to find and keep jobs. While the model does not provide a theory of what factors improve a worker's job prospects[1], there are many possibilities in the literature that are consistent with the model. Neal (1999) argues that young workers first match with a career before searching for a job within a profession. This entails workers trying many jobs in order to find what they are good at. Once a worker finds a suitable profession, it is reasonable to think that she would find new jobs within that profession more easily and be less likely to quit or be fired. Bramoull and Saint-Paul

[1]This paper does not attempt to explain why separation rates decline with age. It exploits this fact in the data and interacts it with minimum wages to explore the effects of minimum wages on employment.

(2004) argue that social networks with other employed workers could influence unemployment durations. Having a network of people who are employed gives a worker contacts to find jobs more easily and makes it less likely to be fired. Finally, simple accreditation from having previous work experience could explain differing transition rates. Having a record as a responsible employee who shows up to work could increase job finding probabilities compared to someone with no work experience.

Adding minimum wages to the model implies that unconnected workers have a more difficult time finding their first job. This, in turn, makes it more difficult for them to become connected and find better jobs. This leads to persistence in negative outcomes from adverse labor market policies. These negative effects of the minimum wage decline with age as more workers are able to become connected and improve their job prospects. The model provides theoretical support for findings in the empirical literature about the effects of minimum wages on employment outcomes. It explains why the effects of minimum wages are only found among young workers. Moreover, the impact of minimum wages on employment are non-linear, implying that low levels of minimum wages should have little effect where high minimum wages lead to much lower employment rates. This reconciles the literature that finds small effects of minimum wage laws in the United States where minimum wages are low while other studies find large effects when looking across countries.

Finally, the model is applied to examine how much of the differences in employment between Europe and the US can be explained by differences in minimum wages. Data reveal that the difference in employment to population ratios between Europe and the US are concentrated in the 15-24 and 55-64 year old age groups. Explanations of the employment differences must be able to account for this age pattern. Employment rates among older workers (55-64) can be rationalized with differences in retirement polices, but the differences for the young remain unexplained. Second, there is large variation among countries in minimum wage regulations. As a percentage of the median wage, the United States has a lower minimum wage level than many European countries with high youth employment rates. This paper seeks to understand the extent to which differences in minimum wage levels across countries account for lower levels of youth employment. We find that minimum wages at levels found in European countries can explain a significant portion of the relative decline in youth employment while not generating a concomitant decrease in employment for prime aged workers. This explanation compliments other factors that have been used to explore changes in European employment including taxes and technological change. While previous work focuses on explaining why total employment declined in Europe, this paper explains why that decline is concentrated among young workers.

Prescott (2002) and Ljungqvist and Sargent (1998) present two leading explanations for the differences in employment between the United States and Europe. Prescott (2002) concludes that differences in hours worked between the United States and Europe are accounted for by differences in labor tax rates across countries. While this representative agent model predicts a decline in total hours worked from higher taxes, it does not take a stand on which margin of work hours adjust. The model does not have implications as to whether differences in hours are at the extensive or intensive margin or how these differences vary with age. Using linear taxes in a life-cycle model Rogerson and Wallenius (2006) extend Prescott's (2002) work to show that an increase in taxes causes a decrease in both hours of work over the life-cycle and a decline in employment early and late in life. It is unclear if the life-cycle model quantitatively accounts for differences in employment across countries. Additionally, if taxes are progressive it may reduce the decline in the extensive margin in favor of larger decreases on the intensive margin.

Ljungqvist and Sargent (1998) show that the combination of lost human capital when unemployed and generous unemployment compensation causes the longer unemployment durations found in Europe. They argue that increases in job turnover rates since the 1970s caused European economies with large unemployment benefits to experience increases in unemployment. This channel is consistent with a decline in employment for older workers who have a large stock of accumulated human capital, but does not account for the decline in youth employment.

The model is presented in section 2. Section 3 adds minimum wages to the model and examines their effect on employment outcomes. Section 4 applies the model to examine the extent to which minimum wages can account for differences in employment between Europe and the United States and section 5 concludes.

2 Model

This model is a generalized version of the matching models of Mortensen and Pissarides (1994) and Pissarides (1985). The key innovation is that workers can be of two types:

connected or unconnected. Connected workers receive a higher rate of job offers and separate from their jobs at a lower rate. Unconnected workers can become connected at rate p when employed.

2.1 Agents

There is a unit mass of workers who exit the labor market at rate δ. A new cohort of size δ enter the labor force at each date to replace the workers who have left. Hence, there is constant number of workers alive at any given time. New workers enter the labor market unconnected and unemployed. Workers have preferences:

$$\int_0^\infty e^{-(\rho+\delta)t} c_t$$

where c_t is consumption. Agents supply labor to the market inelastically when they are employed.

Additionally, there is a continuum of infinitely lived agents that will be called firms with preferences:

$$\int_0^\infty e^{-\rho t}(c_t - k_i v_t)$$

$v_t \in \mathbb{N}_0$ denotes the number of vacancies posted by the entrepreneur and k_i is the flow cost of having an open vacancy of type i.

2.2 Production

Production occurs when a worker is paired with a firm. Connected and unconnected workers have separate constant returns to scale matching functions: $m_c(v_c, u_c)$ and $m_n(v_n, u_n)$. A worker of type $i \in \{c, n\}$ meets a vacant job at rate $\lambda_i = m_i/u_i$. Symmetrically, an open vacancy of type i meets a worker at rate $q_i = m_i/v_i$. The standard boundary conditions are assumed: $\lim_{v/u\to\infty} p = 1$, $\lim_{v/u\to\infty} q = 0$, $\lim_{v/u\to 0} p = 0$, and $\lim_{v/u\to 0} q = 1$.

When a worker and vacancy of either type meet, the pair draw a match specific productivity y from distribution $F(y)$. The productivity draw is perfectly observed by both workers and firms. Given the productivity y both parties agree on whether to form a match. As is standard in the matching literature, the solution to this problem consists of a reservation productivity level for each type of worker. These reservation productivities are denoted by y_n^* and y_c^* for unconnected and connected workers. If a match is formed, wages are determined by Nash bargaining with weight θ given to the workers. This will result in wage function $w_n(y)$ and $w_c(y)$ that depend on the type of worker in the match. In this model, workers and firms will both agree on reservation productivity levels y_n^* and y_c^* for unconnected and connected workers such that any productivity levels above the reservation values will result in matches.

2.3 Equilibrium

To define an equilibrium of this model we will first write down the workers value functions for each of their four possible states. In this model, when we describe a worker as unemployed, this does not correspond to the standard definition of unemployment in the data. Here it simply means that an agent does not currently have a job. All agents in the economy are in the labor market. The value functions for unemployed unconnected, unemployed connected, employed unconnected and employed connected workers are as follows:

$$(r+\delta)U_n = \lambda_n \int \max\{E_n(y) - U_n, 0\}\, dF(y) \tag{1}$$

$$(r+\delta)U_c = \lambda_c \int \max\{E_c(y) - U_c, 0\}\, dF(y) \tag{2}$$

$$(r+\delta)E_n(y) = w_n(y) + p\left[\max\{E_c(y), U_c\} - E_n(y)\right] + s_n\left[U_n - E_n(y)\right] \tag{3}$$

$$(r+\delta)E_c(y) = w_c(y) + s_c\left[U_c - E_c(y)\right] \tag{4}$$

Unemployed unconnected workers are matched with firms at rate λ_n. When matched they get a draw from the productivity distribution $F(y)$ and either become employed with productivity y or remain unemployed. Similarly, unemployed connected workers make the decision but are matched with firms at rate $\lambda_c > \lambda_n$. Employed unconnected workers are paid a wage $w_n(y)$ based on their productivity y. Additionally, they separate from their job and become unemployed unconnected at rate s_n and become connected at rate p. When an employed unconnected worker becomes connected she can choose either to become employed connected with productivity y or she can "quit" and become unemployed connected to search for a better job. Finally, an employed connected workers gets paid $w_c(y)$ and becomes unemployed connected at rate $s_c < s_n$. Note that being connected is an absorbing state:

once unconnected workers become connected; they remain so until they leave the labor force.

Next, firms can choose to open vacancies for either connected or unconnected workers. Their value functions for unconnected and connected vacancies and unconnected and connected filled jobs are as follows:

$$rV_n = -k_n + q_n \int \max\{J_n(y) - V_n, 0\} dF(Y) \tag{5}$$

$$rV_c = -k_c + q_c \int \max\{J_c(y) - V_c, 0\} dF(Y) \tag{6}$$

$$(r+\delta)J_n(y) = y - w_n(y) + s_n[V_n - J_n(y)] + p[\mathbb{I}_{Stay}(J_c(y) - J_n(y)) + (1-\mathbb{I}_{Stay})(V_n - J_n(y))] \tag{7}$$

$$(r+\delta)J_c(y) = y - w_c(y) + s_c[V_c - J_c(y)] \tag{8}$$

If a firm posts an unconnected vacancy, it pays a flow cost k_n for having the open vacancy and meets a worker with probability q_n. When the match occurs the firm decides to establish a job or remain as a vacancy depending on the realization of the productivity draw. Connected vacancies are identical except that they pay flow cost k_c. The flow costs of vacancies may differ in the two markets either due to the type of work requiring more capital to be ready for an individual to start work or higher costs in seeking a more specific type of employee. The firm with an unconnected worker gets the output from the match y less the wage paid to the worker $w_n(y)$. The match breaks up at rate s_n, where the firm gets the vacancy flow value. At rate p the worker becomes connected. If the worker keeps her job the match becomes connected, otherwise the firm and worker separate. Finally, a firm with a connected worker gets the output y and pays the worker $w_c(y)$. The firm and worker separate at rate s_c leaving the firm with a vacancy. Note that filled jobs are discounted at rate $r + \delta$ because when the worker dies the match ends.

To complete the notation for the model let the masses of unemployed unconnected workers, unemployed connected workers, unconnected matches, connected matches, unconnected vacancies, and connected vacancies be denoted by u_n, u_c, e_n, e_c, v_n, and v_c respectively. We can now define a steady state competitive equilibrium of the model:

Definition 1 *A steady state equilibrium consists of the value functions for the worker, U_n, U_c, $E_n(y)$, and $E_c(y)$, the value functions of the firm, V_n, V_c, $J_n(y)$, $J_c(y)$, the aggregate state variables, u_n, u_c, e_n, e_c, v_n, and v_c, the wages, $w_c(y)$ and $w_n(y)$, and the reservation productivity levels for each type of worker, y_c^* and y_n^* such that:*

1. *Value function are satisfied: Given $w_n(y)$, $w_c(y)$, u_n, u_c, v_n, and v_c, U_n, U_c, $E_n(y)$, $E_c(y)$, V, $J_n(y)$, and $J_c(y)$ satisfy equations (1)–(8).*

2. *Match Formation: Given $w_n(y)$, $w_c(y)$, u_n, u_c, v_n, and v_c, the reservation wages y_n^* and y_c^* are optimal decision rules.*

3. *Free Entry: Given $w_n(y)$ and $w_c(y)$, u_n, u_c, v_n, and v_c, must be such that $V_n = V_c = 0$.*

4. *Bargaining: $w_n(y)$ and $w_c(y)$ satisfy the Nash Bargaining equations:*

$$E_n(y) - U_n = \theta[J_n(y) + E_n(y) - V - U_n] \tag{9}$$

$$E_c(y) - U_c = \theta[J_c(y) + E_n(y) - V - U_n] \tag{10}$$

5. Steady State: The following eight equations hold:

$$u_n + u_c + e_n + e_c = 1$$

$$(1-\gamma)pe_n + s_c e_c = \lambda_c(1 - F(y_c^*))u_c + \delta u_c$$

$$\lambda_c(1 - F(y_c^*))u_c + p\gamma e_n = (s_c + \delta)e_c$$

$$\lambda_n(1 - F(y_n^*))u_n = (s_n + p + \delta)e_n$$

$$q_c(1 - F(y_c^*)) + p\delta e_n = (s_c + \delta)e_c$$

$$q_n(1 - F(y_n^*)) = (s_n + p + \delta)e_n$$

$$k_c = q_c \int J_c(y)dF(y)$$

$$k_n = q_n \int J_n(y)dF(y)$$

Where γ is the percentage of unconnected workers who remain employed when they become connected. This is given by $\gamma = \frac{1-F(y_c^*)}{1-F(y_n^*)}$.

2.4 Characterizing the Solution

The solution to the model involves solving for the reservation wage for each type of worker. By continuity of the value functions $E_n(y)$ and $E_c(y)$, the reservation wages are defined by the indifference point between unemployment and being employed at the reservation productivity level. That is, $U_n = E_n(y_n^*)$ and $U_c = E_c(y_c^*)$.

Since being connected is an absorbing state, equations (2), (4), (8), and (10) along with the free entry condition can be used to solve for $w_c(y)$, U_c, $E_c(y)$, $J_c(y)$ and y_c^*. The reservation property implies that:

$$(r+\delta)U_c = w_c(y_c^*)$$

Imposing free entry, the value function for entrepreneurs matched with a connected worker becomes:

$$J_c(y) = \frac{y - w_c(y)}{r + s_c}$$

$E_c(y)$ and $w_c(y)$ are given by the following two equations:

$$E_c(y) = \frac{w_c(y) + s_c \frac{y_c^*}{r+\delta}}{r + \delta + s_c}$$

$$w_c(y) = \theta y + (1-\theta) y_c^*$$

Note that the wage equation implies $w_c(y_c^*) = y_c^*$. Using this fact, the reservation productivity solves the following equation:

$$y_c^* = \frac{\lambda_c \theta}{r + \delta + s_c} \int_{y_c^*}^{\infty} (y - y_c^*) dF(y)$$

Now, the solution for connected workers can be used to solve for the reservation productivity level of unconnected workers. The reservation property implies:

$$w_n(y_n^*) = (r + \delta + p)U_n - p \max\{E_c(y_n^*), U_c\}$$

y_n^* is solved for by using the difference between being employed and unemployed when unconnected:

$$E_n(y) - U_n = \int_{y_n^*}^{y} E_n'(y')dy'$$

Differentiating equation (3) gives an equation for $E_n'(y)$. Since employed workers quit their jobs when they become connected unless their productivity is above y_c^*, the differentiation must be done in two parts. When $y \geq y_c^*$:

$$E_n'(y) = \frac{w_n'(y) + p\frac{w_c'(y)}{r+\delta+s_c}}{r + \delta + p + s_n}$$

When $y < y_c^*$:

$$E_n'(y) = \frac{w_n'(y)}{r + \delta + p + s_n}$$

Imposing free entry, the value function for entrepreneurs matched with a unconnected worker becomes:

$$J_n(y) = \frac{y - w_n(y) + p\mathbb{I}_{y \geq y_c^*} J_c(y)}{r + s_n + p}$$

Then the wage equation is given by:

$$w_n(y) = \theta y + (1-\theta)y_n^*$$

Note that this equation implies that $w_n(y_n^*) = y_n^*$.

Since $w_c'(y) = w_n'(y) = \theta$, we now have a closed form expression for $E_n'(y)$. Note that for each segment $E_n'(y)$ is a constant. Hence, assuming that $y_n^* < y_c^*$, we use equation (1) to solve for y_n^*:

$$\frac{r+\delta}{r+\delta+p}[y_n^* + \frac{p}{r+\delta}y_c^*] = \lambda_n \int_{y_n^*}^{\infty} E_n(y) - U_n dF(y)$$

$$= \frac{\lambda_n \theta}{r+\theta\delta+s_n+p}\left[\int_{y_n^*}^{y_c^*}(y-y_n^*)dF(y) + \int_{y_c^*}^{\infty}(y_c^*-y_n^*) + \left(1+\frac{p}{r+\delta+s_c}\right)(y-y_c^*)dF(y)\right]$$

It remains to show that $y_c^* \geq y_n^*$ to verify that the above equation gives the correct solution for y_n^*. The proof is given in the following proposition:

Proposition 1 *If $\lambda_c > \lambda_n$ and $s_c < s_n$, the reservation productivity level of an unconnected worker is less than a connected worker. That is: $y_n^* < y_c^*$.*

Proof.

Proceed by contradiction. Suppose that $y_n^* \geq y_c^*$, then we have:

$$\frac{r+\delta}{r+\delta+p}[y_n^* + \frac{p}{r+\delta}y_c^*] = \frac{\lambda_n \theta}{r+\theta\delta+s_n+p}\frac{r+\delta+s_c+p}{r+\delta+s_c}\int_{y_n^*}^{\infty}(y-y_n^*)dF(y)$$

Recalling the equation that solves y_c^*, we get:

$$\begin{aligned}
y_n^* &\leq \frac{r+\delta}{r+\delta+p}y_n^* + \frac{p}{r+\delta+p}y_c^* \\
&= \frac{\lambda_n\theta}{r+\theta\delta+s_n+p}\frac{r+\delta+s_c+p}{r+\delta+s_c}\int_{y_n^*}^{\infty}(y-y_n^*)dF(y) \\
&< \frac{\lambda_c\theta}{r+\delta+s_c}\int_{y_c^*}^{\infty}(y-y_c^*)dF(y) \\
&= y_c^*
\end{aligned}$$

A contradiction. ■

3 Minimum Wages

This section introduces minimum wages to the model, calibrates the parameters, and demonstrates the effect minimum wages have on employment and connection rates in the economy. We consider a policy by the government to exogenously set a minimum wage, $\bar{w}$. For a match to form, the wage paid must be equal to or exceed this minimum level. Note that since the wage functions differ for connected and unconnected workers, the wage floor will imply different productivity cutoffs for each type of worker.

3.1 Model with Minimum Wages

Adding minimum wages to the model requires changes to the equilibrium concept. In the original model, workers and firms agreed on when to form a match. With a wage floor, a worker may want to work at the minimum wage, $\bar{w}$, while the firm is unwilling to form a match at this wage. To get around this problem, the firm now unilaterally chooses whether to form a match when a firm and worker meet. Hence, the worker is no longer making a maximization decision about which matches to form. Firms solve the same problem as before.

A second difference in the model with minimum wages is that the firm and worker no longer split the surplus from the match at all times. When the minimum wage is binding, we impose that $w_i(y) \geq \bar{w}$ and $E_i(y) - U_i \geq \theta[J_i(y) + E_i(y) - V - U_i]$ for $i \in \{c, n\}$. The second equation holds with equality if $w_i(y) > \bar{w}$. Under this setup, workers get share θ of the surplus when $w_i(y) > \bar{w}$, but a higher share when the minimum wage binds. This implies that the wage distribution has a positive mass at the minimum wage.

With these modifications to equilibrium the model with minimum wages can be described. Since firms unilaterally make the choice of when to accept a match, the cutoff will be when $y \geq \bar{w}$ as long as the minimum wage is above the original reservation level. Otherwise, firms and workers would agree. The values of the minimum wage considered in this paper are only binding for unconnected workers. In this case, the value function for unconnected workers becomes:

$$(r + \delta)U_n = \lambda_n \int_{\bar{y}_n}^{\infty} E_n(y) - U_n dF(y) \tag{11}$$

Next, we can describe the value function for unconnected vacancies. Define $\bar{y}_n$ as the productivity level where the original wage function for unconnected workers crosses the minimum wage; that is $w_n(\bar{y}_n) = \bar{w}$. $\bar{y}_n$ is needed to define the value function for unconnected vacancies as it denotes the productivity level where the wage begins to rise above the reservation wage. With this we can rewrite equation (5) as:

$$k_n = \frac{q_n}{r+\delta+s_n+p}\left[\int_{\bar{w}}^{\bar{y}_n} y-\bar{w}dF(y) + \int_{\bar{y}_n}^{y_c^*} y-w_n(y)dF(y) + \int_{y_c^*}^{\infty} y-w_n(y)+pJ_c(y)dF(y)\right] \tag{12}$$

When productivity is between $\bar{w}$ and $\bar{y}_n$ the firm pays the minimum wage, for values above $\bar{y}_n$ it pays the wage given by Nash Bargaining. These changes mean that a minimum wage has both a direct effect on which jobs will be available for the worker and an equilibrium effect on the profitability of vacancies in the economy. The immediate equilibrium effect will be to make these vacancies less profitable thus decreasing the number of vacancies. However, in steady state this will lead to an increase in the number of unemployed unconnected individuals thus making unconnected vacancies more profitable. The job offer rate to unconnected unemployed workers will go down. With these changes the model can be solved for employment dynamics given a specified level of the minimum wage.

3.2 Calibration

The model is calibrated with no minimum wage to match key features of employment and job separation in the United States. A period in the model corresponds to one month. The discount rate is $r = 0.003$, which is equivalent to a 4% annual interest rate. δ determines the rate at which individuals exit the labor force. Assuming that workers stay an average of 40 years, we set $\delta = \frac{1}{480}$. For calibrating the rest of the model, we assume that agents enter the labor market unconnected and unemployed at age 18.

The productivity distribution is assumed to be log normal ($\log w \sim N(\mu, \sigma^2)$). As a normalization, the median of the productivity distribution is set to one. This implies $\mu = 0$. The value of σ determines the dispersion of productivity and hence wages in the model. For levels of the minimum wage that we consider, higher values of dispersion imply that the minimum wage has a greater effect. The difficultly in setting this parameter is that in the United States wage dispersion has increased over time as shown by Katz and Murphy (1992), Davis (1992), Card and Lemieux (1996), and others. Davis (1992) documents that in the United States the average within-group standard deviation of log wages roses from around 0.43 in the 1960s to about 0.53 in the 1970s. These are within group estimates that should understate the overall dispersion of wages in the economy. However, they are good starting places for this model as we don't account for educational or other observed differences that might increase wage variation between groups. As wage dispersion has continued to rise in the United States, we choose $\sigma = 0.55$ as a conservative estimate that corresponds to a standard deviation of log wages of 0.4. We also consider values of $\sigma = 0.5$, $\sigma = 0.6$, and $\sigma = 0.65$. These correspond to standard deviations of log wages of 0.36, 0.44, and 0.5 respectively.

The separation rates for connected and unconnected workers are calibrated to match those in the US data for individuals at age 18 and 50 respectively. Figure 1 shows separation rates in the US by age[2]. It shows that separation rates decline dramatically with age. For

[2] This data was constructed by Robert Shimer using CPS monthly microdata from 1976 to 2005. The procedure used follows Shimer (2005) to create a time-series of separation rates for each age. The reported values are the average of this time series. For additional details, please see Shimer (2005) and his webpage http://home.uchicago.edu/∼shimer/data/flows/.

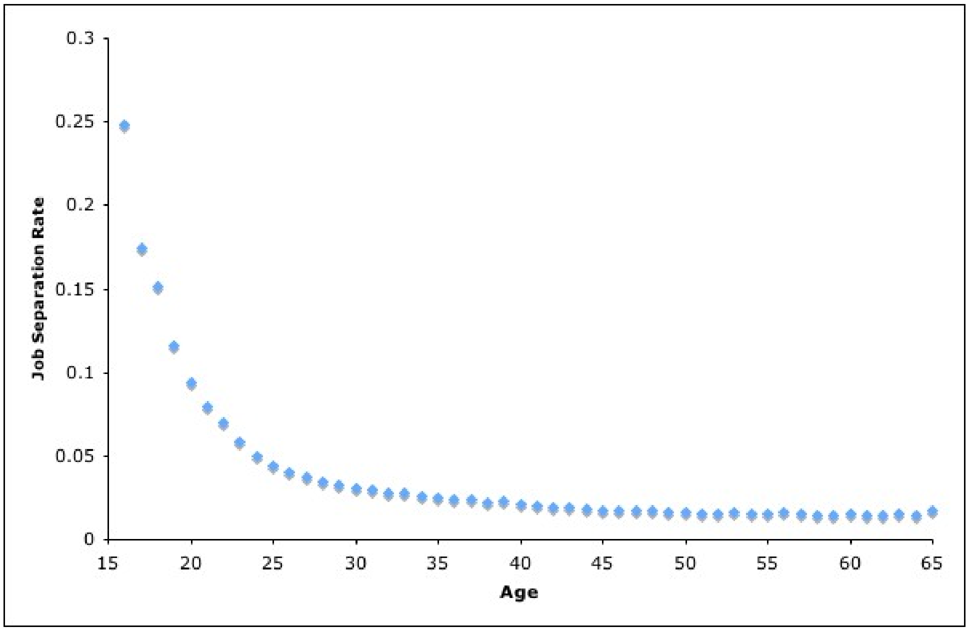

Figure 1: Job Separation Rates in the United States by Age

unconnected workers, the separation rate is set to $s_n = 0.15$ which corresponds to an 18 year old in the US (the age that a worker finishes high school). For connected workers the separation rate is set to $s_c = 0.015$ which is the level observed for individuals at age 50 in the US economy.

The rate at which unconnected employed workers become connected, p, is set so that the decline in separation rates match the US economy. The data indicate that at age 26, the average separation rate is 0.04. This implies that the share of connected workers 8 years after entering the model should be 0.75. Using this target, the rate at which employed workers become connected is set to $p = \frac{1}{36}$. An employed worker, on average, becomes connected after working for three years. The value of p does not have a big impact on the effects of the model. In general, higher values of p imply that workers become connected at a faster rate and hence the employment effects of higher minimum wages have less persistence than for lower values of p. Little difference exists in the magnitudes of employment effects implied by different values of p. The profile of separation rates from simulations of the model under this parameterization are shown in Figure 2. Note that the profile is similar to that found in the US with a sharp decline in the initial years after entering the labor force and a flat profile later in life.

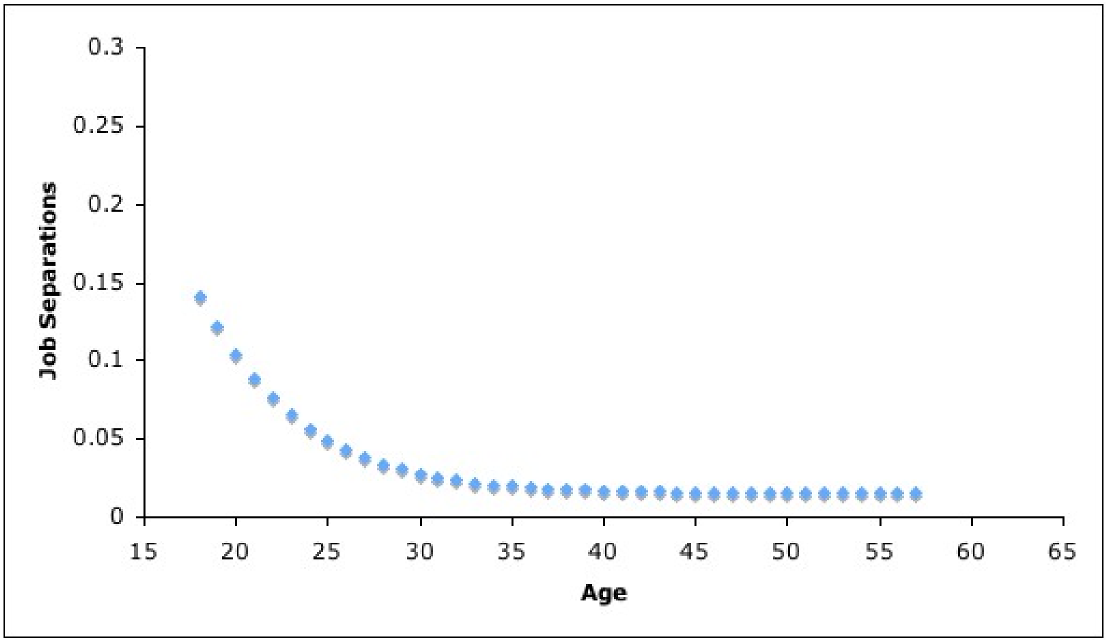

Figure 2: Job Separation Rates by Age from the Simulated Model

We assume that each of the matching functions take the standard Cobb-Douglas form, $m_i(u_i, v_i) = A_i u_i^\eta + v_i^\eta$ for $i \in \{c, n\}$. Note that the scale parameter A_i is allowed to differ between connected and unconnected workers while η is the same in both value functions. We set $\eta = 0.5$. This value is within the range of estimates found in Petrongolo and Pissarides (2001) and is comparable with the calibration found in Pries and Rogerson (2005).

Computing values of A_i for the model requires target values of λ_i and q_i for each type of worker. Target values for the job offer rates λ_n and λ_c are picked to match the employment to population ratios in the US for 18 and 50 year old workers. In this model a worker is either employed or not, hence the probability of being employed for connected and unconnected workers, $\bar{e}_n$ and $\bar{e}_c$, are fully determined by job finding rates (f_n and f_c) and the separation rates. We get:

$$\bar{e}_i = \frac{f_i}{f_i + s_i} \tag{13}$$

for $i \in n, c$. The employment to population ratio for male workers aged 15-24 in the United States was about 0.6 in the 1990s. This and the separation rate of 0.15 imply that the job finding rate for unconnected workers should be set to $f_n = 0.225$. The job offer rate, λ_n, is set so that combined with the reservation wage for unconnected workers the job finding rate is 0.225. To solve for λ_n we need to compute from the model the workers reservation wage to know the probability that a job is accepted. Given the other parameters in the model we find that to hit the target finding rate of 0.225 the workers reservation wage is zero. This implies that $\lambda_n = \frac{f_n}{1-F(y_n^*)} = 0.225$ as well. For workers aged 45-54 in the US the employment to population ratio is about 0.85 in the 1990s. Using the same procedure we get that $f_c = 0.085$ and $\lambda_c = 0.3$. These values are sensitive to the choice of σ, so for other choices of σ new values of λ_c must be chosen.

Next, we need to choose values of q_n and q_c. While there is no evidence to inform the choices of these parameters, their values do not alter the results of the study. Together with λ_n and λ_c they will pin down equilibrium values of A_n, A_c, and the number of connected and unconnected vacancies, v_n and v_c. Since we are not targeting the number of vacancies in the model these numbers will adjust to have identical employment effects in the model. Hence, we set $q_n = 0.1$ and $q_c = 0.5$. With these parameters, the model can be solved for consistent values of A_n and A_c.

Parameter	Value
μ	0
σ	0.35
r	0.003
s_n	0.15
s_c	0.015
p	1/36
η	0.5
λ_n	0.225
λ_c	0.3
q_n	0.1
q_c	0.5
k_n	0.777
k_c	2.02

Table 1: Calibrated Values of the Model Parameters

The remaining parameters for the firms in the model are the flow costs of each type of vacancy, k_c and k_n. In the calibration we have targeted values of λ_n, λ_c, q_n, and q_c. The values of k_c and k_n are chosen so that the equilibrium is consistent with these choices. We set $k_c = 2.02$ and $k_n = 0.777$.

State	Quantity
u_n	0.05
u_c	0.14
e_n	0.07
e_c	0.74

Table 2: Steady state results for number of people in each state in the economy

A summary of the calibrations used for the parameter values is presented in Table 1. As an examination of the effects of these parameter choices we can report the number of individuals in each state $\{u_n, u_c, e_n, e_c\}$ and show the average rate of employment in the model by age that is computed by simulating the model. Table 2 presents the model result for steady state employment. In the model, we see that 81% of people are employed, which is similar to the aggregate employment to population ratio of the US which peaks at 81% in 2000 followed by a slight decline to 77% in 2004. Figure 3 shows the average employment to population ratio by age from the simulated model. Since workers enter the labor force unemployed and unconnected at age 18, employment is initially low. Rates of employment rise steadily into the 30s when it begins to level off above 80% as it asymptotes to the targeted value for connected workers of 85%.

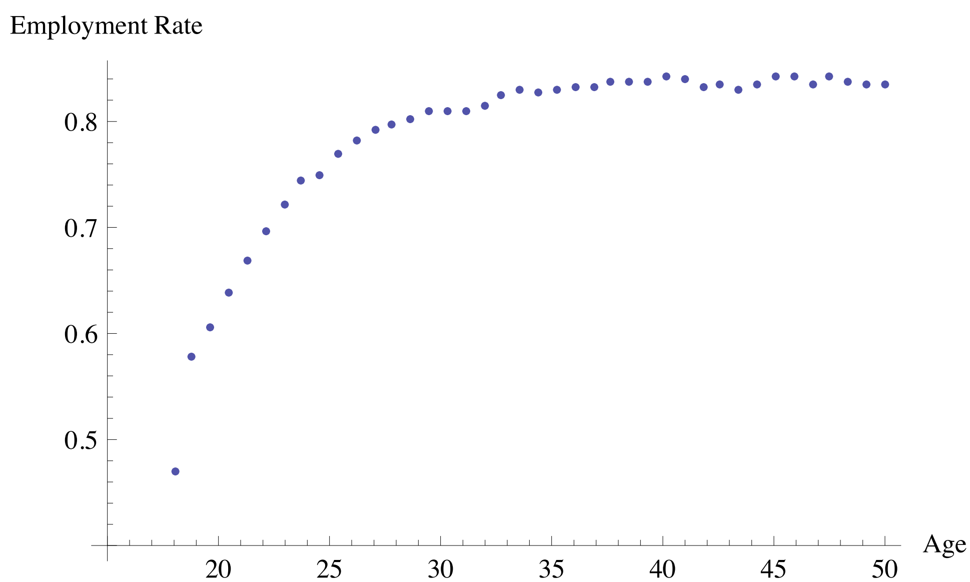

Figure 3: Average Employment Rates by Age from Simulated Model

3.3 Effects of a Minimum Wage

The calibrated model with minimum wage is consistent with many effects of the minimum wage found in the empirical literature. The empirical literature on minimum wages and employment dynamics has looked at many possible effects including direct employment effects, effects on the wage distribution and future earnings of individuals who face high minimum wages, and effects on schooling decisions. The model is consistent with empirical findings that minimum wages disproportionately effects young workers. This section shows that the model provides a theoretical explanation for a variety of empirical findings in the literature.

3.3.1 Employment Effects

Figure 4 shows the employment effects of minimum wages simulated from the model. It shows the average employment rate by age for four different values of the minimum wage. Minimum wages are calibrated as apercentage of the median wage in the calibrated economy without a minimum wage. Figure 4 shows that the effects of minimum wages are non-linear. As minimum wages rise, the effects become more dramatic. The solid line depicts the average employment rate in the model with no minimum wages. The figure shows that the model with minimum wages at 20% of the median wage has almost identical effects to the model without a minimum. As the level of the minimum wage rises to 40% and 60%, the effects become noticeable and large. Moreover, Figure 4 shows that the effects of a minimum wage are initially large and die out over time as the population becomes connected. Higher levels of the minimum wage show greater persistence in employment effects as it takes workers longer to find their initial jobs and become connected on average.

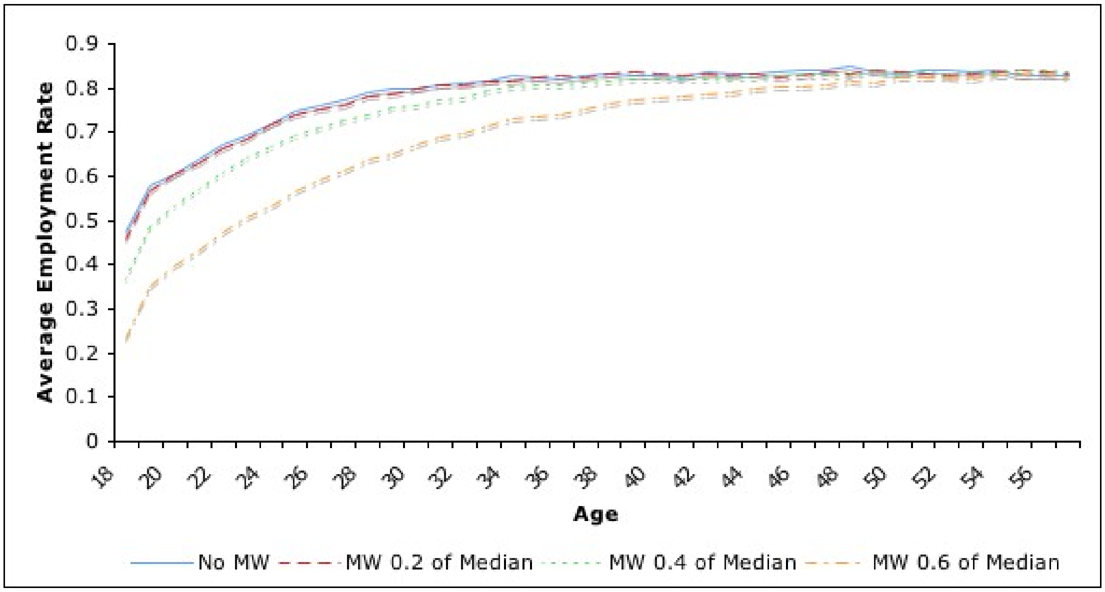

Figure 4: Average employment by age in model by minimum wage level.

Additionally, Figure 5 shows how the results of the model vary for different values of σ. It shows that higher values of σ correspond to lower levels of employment for a given minimum wage. So, the effects of a minimum wage will be more significant in countries or time periods where there is variation in productivity across workers (or a higher variance of the wage distribution). For the main empirical exercises in the paper, we use $\sigma = .55$ which corresponds to a low estimate of the standard deviation of log wages in the US economy. If it is believed that σ is higher, the effects of a minimum wage would be even greater in the model.

Results from the model are consistent with the empirical literature that examines the employment effects of minimum wage regulations. Card and Krueger (1994) stimulated interest in research on minimum wage by arguing that the minimum wage increase in Pennsylvania

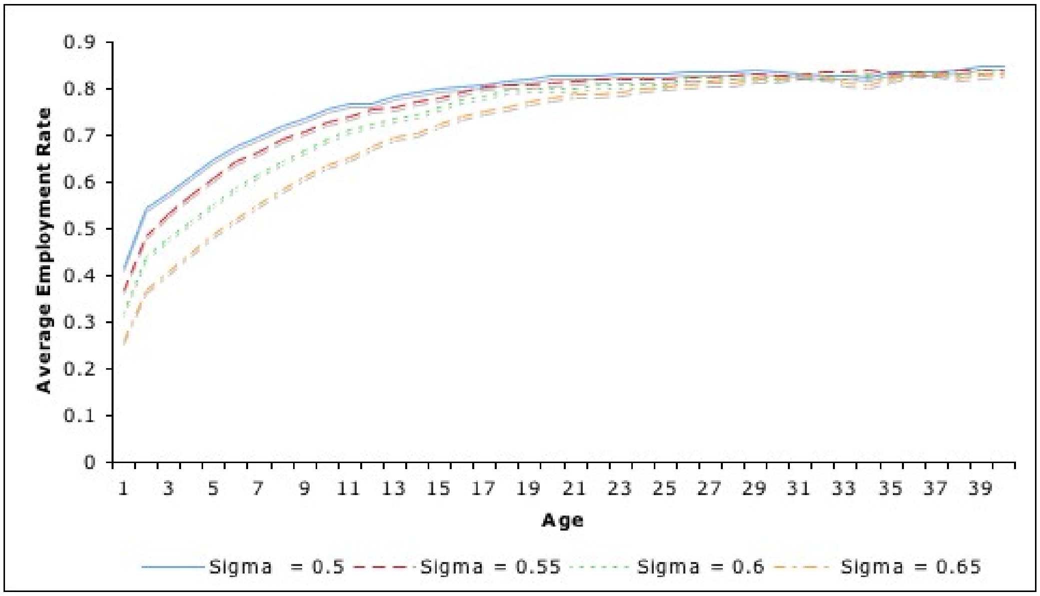

Figure 5: Average employment by age in model by σ with the minimum wage at 0.4 of the median.

had no adverse impact on employment. Since then, a large body of empirical research has sought to evaluate the effects of the minimum wage on employment outcomes. For a recent survey of the literature see Neumark and Wascher (2007). While there is no consensus on the overall effect of minimum wages, the survey reveals that most studies conclude that minimum wages have slightly negative employment effects, though often the effects are not statistically significant. While not a comprehensive review, this section uses the model to help reconcile the major results from this literature.

First, the model helps explain the failure of some papers to find significant effects of minimum wage on employment such as Card and Krueger's (1994) failure to find any negative effects of the minimum wage on employment in the United States. Since minimum wages are relatively low in the United States and minimum wages have a non-linear effect on employment, it is unsurprising that small changes in the minimum wage might have insignificant effects on employment.

Even without a general consensus on the effect of minimum wages on overall employment, there is a large literature that finds that minimum wages adversely effect employment of youths. Despite not finding general evidence that minimum wages hurt employment Dolado et al. (1996) find that minimum wages effect young workers. Using longitudinal data Abowd et al. (1997) find that young men employed at the minimum wage in both France and the United States have large decreases in their probability of employment after an increase in the minimum wage. Differences in total size of employment effects could be a function of the portion of the population paid at the minimum wage which is higher in France. Looking over 17 OECD countries Neumark and Wascher (2004) find that in general minimum wages cause decreased employment among youths. The declines are less severe in countries that have special provisions whereby youths are hired at wages below the minimum. Wessels (2005) finds that minimum wages significantly decrease teenage labor force participation.

Empirical studies have also focused on France where minimum wages are especially high. Bazen and Skourias (1997) find a negative effect of minimum wages on youth employment in France despite finding no significant effects for other groups. Fougere et al. (2000) study the effects of various youth employment policies in France. They find that subsidies that reduce the labor costs of hiring young workers have strong positive effects on increasing employment. The model is broadly consistent with these empirical findings. It reveals a mechanism where youth employment outcomes are hurt by increases in the minimum wage while other segments of the population suffer no adverse employment effect.

3.3.2 Long-Run Effects

Neumark and Nizalova (2004) document that exposure to high minimum wages at young ages has long-run effects for employment outcomes. They show that exposure to high minimum wages implies that workers both work and earn less even into their late 20's. Moreover, Keane and Wolpin (1997) show that human capital accumulation while on the job is important to understanding worker's labor market decisions and outcomes. Missing skill accumulation early in life has long run implications for wage growth if the agent is unable to make up for the lack of skill accumulation while waiting for employment.

Figure 6: Average Percent of People Connected by Year from Entering Labor Market for Model with no Minimum Wage and Model with $\sigma = 0.55$ and Minimum Wage at 0.6 of the Median.

The model can account for differences in wage outcomes as connected workers have a higher reservation productivity and earn much higher wages than unconnected workers. Workers who are exposed to high minimum wages early in life will have a much lower probability of becoming employed and connected to earn higher wages later. Figure 6 presents the percentage of people who are connected by year from entering the labor market for the model with no minimum wage and the model with $\sigma = .55$ and the minimum wage at .6 of the median wage. It shows that under a higher minimum wage a worker is less likely to be connected at any date from entering the labor force. This lower rate of connections will show up as persistence of low wages later in life for those who fail to gain experience and become connected.

3.3.3 Education Effects

Neumark and Wascher (2003) evaluate the effect of minimum wage on school enrollments. Surprisingly, they find that an increase in the minimum wage decreases school enrollment. In their estimation, the minimum wage increases the number of individuals who are neither in work or in school while decreasing the number in school and the number who work. This empirical finding provides evidence against models that predict positive welfare effects from an increase in the minimum wage by encouraging individuals to stay in school to accumulate human capital longer before seeking employment. This effect of attaining more education to increase productivity to levels above the minimum wage before finding a job is not supported by the data. While the model in this paper has no direct implications for individuals education decisions, it is not inconsistent with these findings.

4 European Employment

A large literature examines the difference in labor market outcomes between the United States and Europe. Prescott (2004) documented that labor input, defined by employment to population ratio multiplied by the average annual hours worked per person in employment, has declined dramatically in Europe relative to the US since the 1970s. Rogerson (2005) decomposes this decline showing that both hours worked and the employment to population ratio decline since the mid 1950s. These papers attribute the weaker labor market outcomes to taxes and a weakness in the market services sector in Europe respectively.

This section examines the extent to which minimum wages can explain the cross sectional pattern in employment found in European countries, the United States, and Canada in 2002-2003. A cursory examination of the data shows that minimum wages have been declining in real terms in the United States while they have been increasing in many European countries since the 1970s, which is consistent with the time series pattern of employment. However, limited time series data on employment by age and minimum wages prevent a close empirical examination of the entire time series of employment for a large number of countries.

4.1 Employment Differences

Using male labor force statistics, we decompose the employment to population ratio for each country into five different age groups revealing that the bulk of the decline is found in the youngest (15-24) and oldest (55-64) age groups. Male labor force data are used to abstract away from differences across countries in female labor force participation. Female

Country	15-24	25-34	35-44	45-54	55-64	Total
Belgium	30.9	86.1	87.6	81.9	36.9	67.6
Canada	57.6	84.8	86.7	84.4	59.9	76.1
France	28.8	84.4	89.6	86.9	44.5	68.6
Luxembourg	31.6	92.5	95.0	90.0	38.4	74.4
Netherlands	67.1	91.0	91.7	88.9	56.1	80.8
Portugal	44.8	87.4	91.6	87.0	61.4	74.8
Spain	42.8	83.5	89.0	85.4	58.9	74.2
United Kingdom	62.0	87.9	88.8	85.1	63.5	78.7
US	56.2	86.6	87.7	84.3	66.0	77.5

Table 3: Average employment to population ratio from 2002-2003 for each age group.

participation has increased dramatically since the 1950s, but the timing of this change has varied across countries.[3] An examination of average outcomes in Belgium, Canada, France, Luxembourg, the Netherlands, Portugal, Spain, the United Kingdom, and the United States is included. Germany and Italy are excluded as they do not have nationally legislated minimum wages.[4]

The labor data used in this paper are obtained from the OECD Corporate Data Environment Labor Market Statistics Database. Using the Labor Force Statistics (LFS) by Sex and Age, series of male employment to population ratios are constructed by age group. In order to see age patterns of employment, the data are broken down into five different age groups: 15-24, 25-34, 35-44, 45-54, and 55-64.

Decomposing the employment to population ratio into five bands reveals that the differ-

[3] Using employment data for both men and women does not change any of the general patterns found in the data. The largest difference is that total employment rises slightly for men and women while it is relatively flat for just men reflecting the increase in work by women over the past half-century.

[4] The age patterns of employment for Germany and Italy are similar to those in other European countries, especially France. In Germany and Italy, minimum wages are set by bargaining between unions and firms in each industry. Due to this heterogeneity, relevant data on the levels of the minimum wages does not exist. Negotiated wages, however, appear to be relatively high in both of these countries.

ence in employment outcomes is concentrated in the 15-24 and 55-64 age groups. Table 3 shows average male employment to population ratios by age group of nine countries for 2002-2003. Netherlands, the United Kingdom, and the US have the highest total employment to population ratios of the group. Intermediate values are found in Canada, Luxembourg, Portugal, and Spain with the lowest total values found in Belgium and France. The table shows that all countries have remarkably consistent employment to population ratios for male workers aged 25-54. All countries have employment to population ratios above 80% for these workers with most entries around 85% and a maximum of 95% for workers aged 35-44 in Luxembourg. Also of note from the figure is that the largest differences among age groups is found in the youngest (aged 15-24) and oldest (aged 55-64) workers. The age pattern documented is consistent with that shown in Rogerson (2006) for Belgium, France, Germany, and Italy in 2000. This pattern implies that the relative decline in European employment is due primarily to more young and old workers being out of employment.

Figure 7 and Figure 8 plot the values in Table 3. The data are broken into two groups based on the employment level of young workers. The United States is included in both figures for comparison. Figure 7 depicts the countries with low levels of youth employment. This figure shows that when the employment to population ratio is broken down by age, the youngest (15-24) and oldest (55-64) age groups are far below the US levels in many European countries while the prime age groups (25-34, 35-44, and 45-54) are similar across all countries. Across countries there is a consistent inverted U shape that shows that employment is lower for the young and old with little divergence for prime age groups. Plots for Spain and

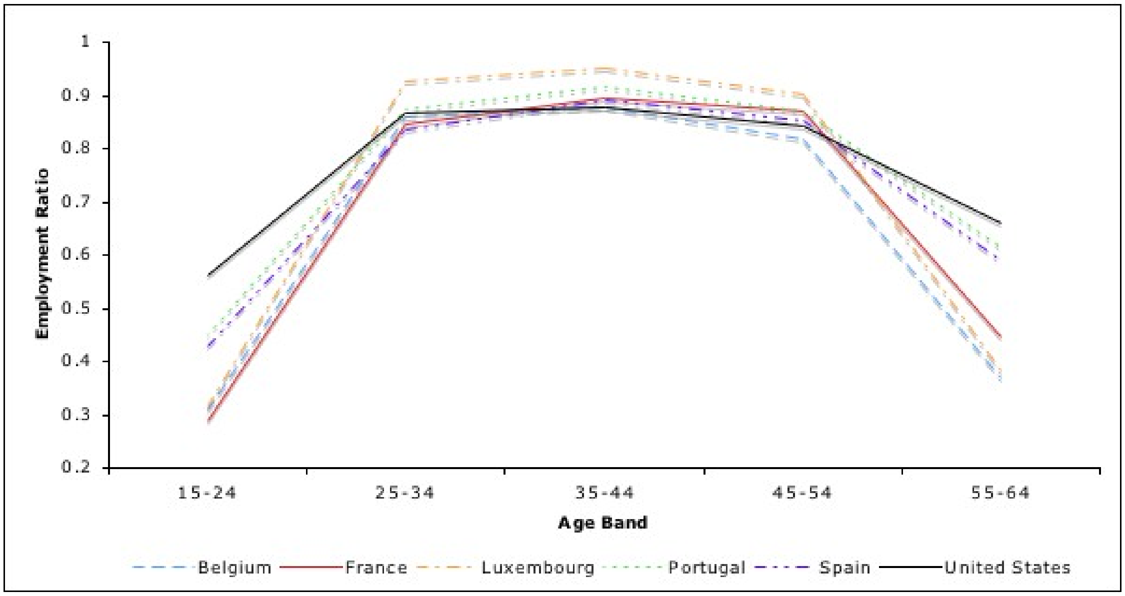

Figure 7: Average employment to population ratio by age for 2002-2003 (Countries with low youth employment levels.).

Portugal show less curvature than Belgium, France, and Luxembourg. This flatter profile indicates that youth employment is not as important in the total decline in employment for Spain and Portugal. Figure 8 shows countries with high level of employment. This figure reveals that the age pattern of employment is remarkably similar between Canada, the Netherlands, the United Kingdom, and the United States.

This evidence reveals that to explain the relative decline in European employment, one must understand why the young and old work less than in the United States. While a large literature has tried to understand the total decline in hours worked, few have examined differences by age. This paper will focus on explaining the differences in employment for the young across countries. A sizable literature on differences in unemployment insurance and social security benefits may be able to explain the differences among older workers.

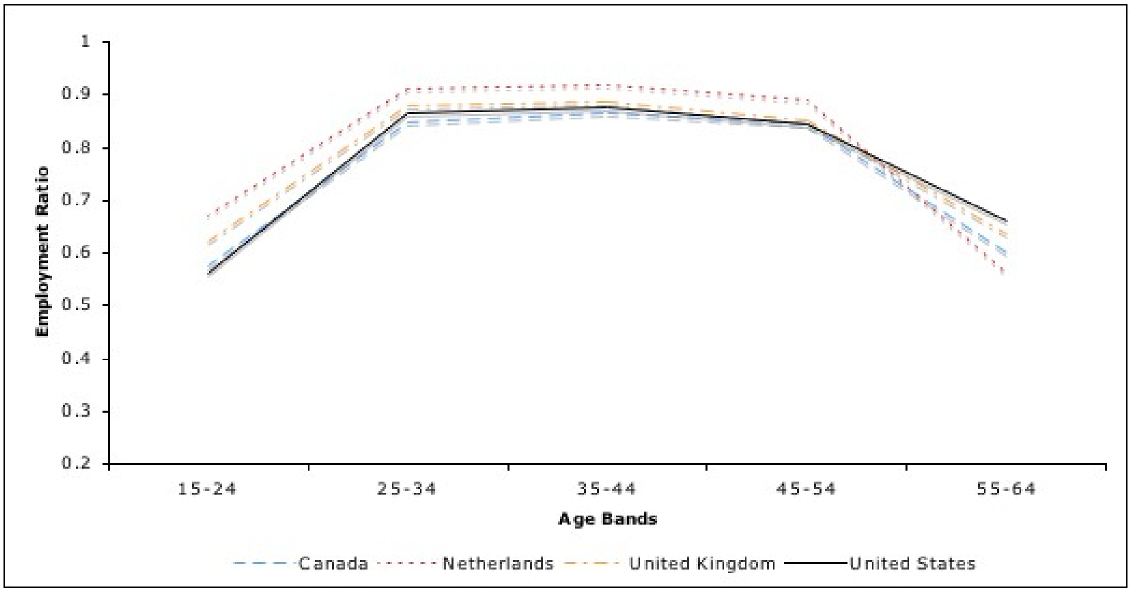

Figure 8: Average employment to population ratio by age for 2002-2003 (Countries with high youth employment levels.).

4.2 Minimum Wages

Minimum wages vary dramatically both across countries and over time. However, there is no standard measure for comparing minimum wage levels. This paper looks at many measures of the minimum wage to observe how they vary in magnitude. Purchasing power parity standardized (PPPS) minimum wages are presented to compare the overall levels of the minimum wage. As an alternative measure, the level of the minimum wage relative to the median wage is used to compare how binding the minimum wage is across countries. The effects of the minimum wage are more sensitive to how binding the wage is rather than its overall level[5]. Finally, the percentage of full-time employees who are paid the minimum

[5]Another important factor for determining the degree that the minimum wage binds is the level of payroll taxes in the economy. High payroll taxes interact with the minimum wage driving down an employees take-home pay and driving up the cost to a firm of hiring a worker. Pries and Rogerson (2005) show that the high European level of payroll taxes interacts with minimum wages to have greater employment effects. While

Country	EUR	PPPS	Ratio of Min to Median	% Earning Minimum
Belgium	1186	1187	0.53	NA
Canada	NA	NA	0.4	NA
France	1173	1170	0.62	14.0
Luxembourg	1403	1237	0.52	15.1
Netherlands	1265	1202	0.465	2.3
Portugal	498	663	0.455	4.0
Spain	537	625	0.365	0.8
United Kingdom	1083	1084	0.425	1.9
US	727	797	0.335	1.5

Table 4: Monthly minimum wage levels in January 2004 in Euros and PPPS, average ratio of the minimum wage to the median wage in 2002-2003, and percent of full-time employees earning the minimum wage in 2002.

wage provides evidence of how binding the minimum wage is across countries.

Data on minimum wages come from two sources. First, the OECD Minimum Wage Database has data on the level of the minimum wage with respect to the median wage. Second, in a EuroStat Statistics in Focus handout, Paternoster (2004) presents the level of monthly minimum wages in Euros and PPP adjusted minimum wage levels in January 2004 for all countries in the EU and the US and the percentage of the population that is paid the minimum wage in 2002 in all countries under consideration except Belgium and Canada.

Table 4 presents the evidence on different measures of the minimum wage. The first two columns show the average monthly minimum wages in January 2004 in Euros and in PPPS units. The patterns are similar, though there is slightly less variation across countries when examining the PPPS minimum wages. The levels of minimum wages in Belgium, France, the Netherlands, Luxembourg and The United Kingdom are higher than in the US while

including payroll taxes would imply a greater effect of minimum wages in Europe, they are left out of this study so that the effects of a minimum wage can be determined in the absence of other policy differences.

minimum wages are lower in Spain and Portugal.

The third column shows the ratio of the minimum wage to the median wage, averaged from 2002-2003. This statistic is useful in comparing how binding minimum wages are across countries, where a higher minimum wage relative to the median indicates that the minimum wage has a greater effect on the wage distribution assuming constant wage dispersion across countries. The US, Spain, and Canada have low minimum wages relative to the median with the Netherlands, Portugal and the United Kingdom at intermediate levels and Belgium, France, and Luxembourg with the high minimum wage levels.

Finally, the last column reports data on the percent of full-time employees who earn the minimum wage in each country for 2002. Here, the the Netherlands, Spain, the United Kingdom, and the US have very few workers who earn the minimum wage, in Portugal 4% earn the minimum, but in France and Luxembourg high percentages of workers (14% and 15.1% respectively) earn the minimum wage. This gives further evidence that the minimum wage seems to be binding in France and Luxembourg while being less so in the Netherlands, Portugal, Spain, the United Kingdom, and the US.

To calibrate the model for minimum wage levels in different countries, we will use the ratio of the minimum wage to the median. However, some countries have alternative minimum wages for younger workers, which reduce the actual wages paid to many workers. A survey by Funk and Lesch (2006) details the minimum wage regulations across Europe. They find that there are alternative lower rates for young workers in the Belgium, the Netherlands, and the United Kingdom. To adjust for this we lower the minimum to median ratio used in the calculations for these three countries. We assume that minimum wages affect individuals aged 15-24 in each economy so we average the actual ratio of the minimum to median wage in each of these three countries over those ages. The estimated ratios of the minimum wage to the median is 0.466 in Belgium, 0.289 in the Netherlands, and 0.35 in the United Kingdom.

4.3 Quantitative Results

This section quantitatively assesses the impact of minimum wages on employment outcomes by analyzing how employment patterns differ by changing the level of the minimum wage from that found in the United States to those observed in Europe. We seek to answer the question of how employment dynamics in the United States would change if the US adopted minimum wage levels the other countries. The model is then used to calculate how much of the employment differences are accounted for by observed differences in minimum wages holding other policies constant.

For a given ratio of the minimum wage to the median wage in each country, the model is used to compute job finding rates for unconnected and connected workers and the probability that a worker quits when she becomes connected. These three numbers along with the calibrated separation rates for connected and unconnected workers are used to simulate the model in continuous time. From the continuous time simulation, the worker's employment status and level of connections are recorded at the end of each model period. This corresponds to monthly employment data. Employment outcomes for each worker are recorded for 40 years of data. Results abstract from the decline in employment later in life that the model does not attempt to capture. For each specification the model is run 10,000 times so that the average employment and connection rates can be computed for each month from the time that a worker enters the labor force. These data are then aggregated into yearly data or by age to be comparable with OECD statistics.

To match the data, averages for 10 year age bands are computed from the simulated data. Since workers are are assumed to enter the model at age 18, the 15-24 age band is computed as the average employment rate for a worker's first seven years of work. This is done as most people are in school through at least age 18. The model is attempting to capture employment patterns when individuals enter the labor market. Starting the model at age 18 is likely a low estimate for when a worker enters the labor force since a significant portion of people are still completing schooling after the age of 18. This low estimate implies that the effects of minimum wages from the model are conservative estimates since the employment effects are greatest in worker's first years after starting work. This means that the initial age band is computed using seven years instead of say the first five if a worker entered at age 20. If the averages for 15-24 year old workers were taken over only the first five years of employment the effects of the minimum wage over this time period would appear greater. Another reason the results are conservative is that differences in payroll taxes across countries are not accounted for which should imply greater effects of the minimum wage in Europe.

Table 5 reports the employment to population ratios for each age band and in total from the model with minimum wages set to the level of each country. The qualitative features of the model are similar to those found in the data. The United States along with the

Country	15-24	25-34	35-44	45-54	Total
Belgium	51.1	72.9	80.8	83.1	77.3
Canada	55.1	75.3	81.9	83.3	78.5
France	40.4	70.9	79.6	82.5	72.7
Luxembourg	47.8	70.9	79.6	82.5	76.0
Netherlands	60.0	77.7	82.8	83.8	79.9
Portugal	52.3	77.5	81.0	83.1	77.5
Spain	57.3	76.8	82.3	83.2	79.1
United Kingdom	58.2	76.9	82.4	83.6	79.3
US	58.8	77.3	82.7	83.4	79.4

Table 5: Average employment to population ratio from 2002-2003 for each age group simulated from the model.

Netherlands, Spain, and the United Kingdom have high total employment to population ratios followed by Belgium, Canada, and Portugal. Luxembourg and France have levels that are significantly lower than the US. The model does not do a good job of accounting for the total employment difference in Luxembourg as it cannot account for its high employment to population ratio among prime aged workers. In the model all countries converge to the same rate of employment as the United States.

The model is similar to the data in that there is not much variation in outcomes of prime aged workers. However, the differences in minimum wages manifest themselves in large differences in the employment to population ratios of the young workers. Here we see the same pattern as the total employment with the Netherlands, Spain, the United Kingdom, and the US is high, followed by Belgium, Canada, and Portugal, and Luxembourg with France having the lowest youth employment.

The results from Table 5 are graphed in figures 9 and 10. Again the results are broken up into two groups. Figure 9 plots the United States along with Belgium, France, Luxembourg,

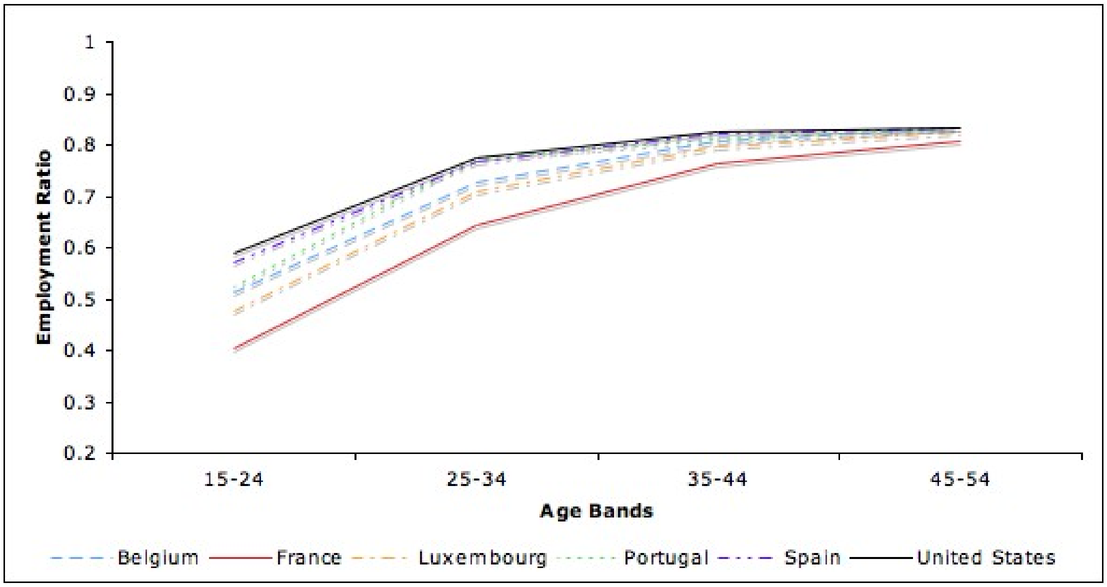

Figure 9: Simulated average employment to population ratio by age for 2002-2003.

Portugal, and Spain. The figure reveals that the age deviations are somewhat consistent with the data, but that the model shows more persistence in employment differences that continue into the 25-34 age band. Figure 10 plots the results for Canada, the Netherlands, and the United Kingdom. These countries have nearly indistinguishable age employment patterns. This shows that minimum wages will not be able to account for the small employment differences between these countries.

Next, we ask to what extent differences in minimum wages can explain differences in employment between each country and the US. To do this the difference in between relative employment with the US from the model is divided by the difference in relative employment from the data for each country. This is done for both the total employment to population ratios and for the 15-24 year old age band. Table 6 shows the quantitative extent to which the model is capable of accounting for the decline in European employment. The explanatory

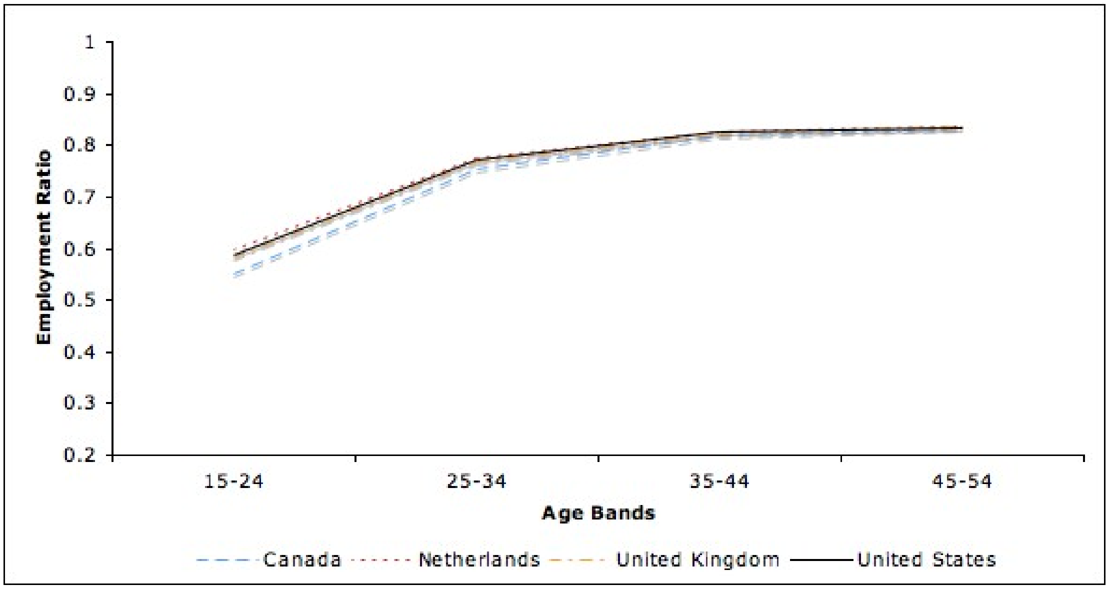

Figure 10: Simulated average employment to population ratio by age for 2002-2003.

power of the model varies widely among countries with the model accounting for between 14% and 21% of the variation in Belgium and the Netherlands to over 60% in Canada, France, Portugal, and Spain. The model over explains the variation in employment in Luxembourg. This is because prime aged workers in Luxembourg are employed at a much higher rate than in the United States, which the simulation does not account for. In the UK, the model predicts that the UK would have lower employment where the data show that it has a higher employment ratio than the US. Here, the minimum wage levels are nearly identical, so we would expect other factors to dominate employment differences.

Table 7 does the same comparison for the 15-24 year age band. This table should be evaluated separately for the groups with low and high youth employment. For the group with low youth employment relative to the US, we find that the model accounts for an important part of the variation in employment differences. It accounts for 29%, 64%, 42%,

Country	Model	Data	Percent
Belgium	97.4	87.2	20.7
Canada	98.9	98.2	62.7
France	91.6	88.5	73.5
Luxembourg	95.7	96	107.1
Netherlands	100.6	104.3	14.8
Portugal	97.6	96.5	68.7
Spain	99.6	95.7	88.7
UK	99.9	101.5	-8.1
US	100	100	NA

Table 6: Comparison of total employment to population ratios generated by the model and found in the data.

Country	Model	Data	Percent
Belgium	86.9	54.9	29.0
Canada	93.8	102.5	-245.4
France	68.8	51.2	64.0
Luxembourg	81.3	56.3	42.7
Netherlands	102.0	119.3	10.3
Portugal	88.9	79.7	54.5
Spain	97.4	76.1	11.0
UK	99.0	110.3	-10.0
US	100	100	NA

Table 7: Comparison of Employment to Population Ratios for 15-24 Year Olds Generated by the Model and Found in the Data.

54%, and 11% of the difference in Belgium, France, Luxembourg, Portugal, and Spain. In Spain, where the least is explained, minimum wages are relatively low, indicating that other factors are more important. In the group with relatively high youth employment, the model does a poor job of accounting for the differences. This is the case both because minimum wages are relatively low in Canada, the Netherlands, and the UK, so they shouldn't have much effect since their impact increases as the wages rise and because the initial differences between the US are small. Other factors should be found to explain differences in these countries.

What should be emphasized form these results is that minimum wages can play a significant role in explaining differences in youth employment between the United States and European countries that have high minimum wage regulations. The results in this paper are conservative estimates of the effect of minimum wages as low values of productivity variation are used and other policy differences such as payroll taxes that may exacerbate the effects of minimum wages are ignored. The model accounts for a significant part of the employment differences in youth employment given that it not include many factors that could influence youth employment rates including differences in schooling, tax rates, and employment regulations that make it more difficult to fire workers. Additionally, the model assumes that all countries have the same exogenous separation rates for both types of workers. A theory of what determines these separation rates could improve the predictions of the model.

This explanation does not rule out other explanations for lower levels of European employment. However, the data indicate that any explanation of employment differences between the US and Europe must account for the age pattern of employment. Minimum wages are a promising candidate to explain differences in youth employment. It should also be noted that this paper examines only differences in employment to population ratios where Prescott (2004) documents that average annual hours of work per person in employment is also much lower in Europe. Evidence on hours worked is not available by age which makes it difficult to evaluate the total effects of the model. Complimentary explanations for lower levels of

European employment include tax policies and structural change offered by Prescott (2004) and Rogerson (2005). Ljungqvist and Sargent's (1998) explanation that lost human capital when unemployed along with high levels of unemployment insurance cause longer unemployment durations in Europe is a plausible candidate to explain the lower rates of employment among older workers who have acquired large stocks of human capital, but will be unable to account for differences in youth employment.

5 Conclusion

Much of the macro labor literature has focused on representative agent models that abstract from differences in labor market decisions over an individuals life cycle. This paper extends standard search models to feature a workers connection to the labor market. Workers gain connections by working, which gives them a higher rate of job offers and a lower rate of separations form their jobs. This model allows differences in employment outcomes to be considered by age, since older workers are more likely to be connected to the labor force.

Examining the model with minimum wages provides a theoretical foundation for empirical findings on the effects of minimum wages and an ability to evaluate the effects of minimum wages on youth employment outcomes across countries. The model is consistent with many of the empirical findings on the effects of minimum wages. In the model, minimum wages decrease youth employment while having a small effect on prime aged employment outcomes. Also, the model predicts minimum wages to have highly non-linear effects on employment, which helps explain why empirical studies have found very small effects of minimum wages in the US but greater effects in other countries.

The relative decline in European youth employment is a significant feature in the discrepancy of labor market outcomes between Europe and the United States. Understanding why Europeans work less than Americans must include an explanation of the large differences in the age patterns of work across countries. The model matches the decline of European employment relative to the United States in that there is little difference in employment outcomes for prime aged workers.

The findings in this paper should be viewed as complimentary to other explanations for the decline in European employment. Rogerson (2006) outlines a research agenda to quantitatively assess the impacts of various institutions on employment across countries. This paper documents that minimum wages have a significant effect on youth employment outcomes. Other policies that have been studied such as differences in taxes and technology certainly play a role in accounting for overall differences in work across countries. An important area for further research would be a comparison of average hours of work across age groups. Since both hours worked and employment to population ratios decline in Europe relative to the US, it would be informative if hours worked decline across all workers or just among some groups. A decline among all workers seems consistent with taxes playing a major role. Also, future work to understand how institutions interact would be informative. Most current research has focused on mono-causal explanations to see how well each institution accounts for differences. To completely understand differences in employment it is important to understand how institutions interact.

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