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Wage Dispersion and the Minimum Wage Spike in a Search Economy With Wage-Posting

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Abstract: Wage distributions in economies with mandated minimum wage exhibit both wage dispersion and wage clustering known as the minimum wage spike. The paper builds a search-theoretic model that reconciles the two phenomena simultaneously under the assumptions of wage-posting, urn-ball matching, firm heterogeneity, and wage-dependent search cost. Numerical simulations demonstrate the potency of the model. A non-degenerate minimum wage spike and wage dispersion are obtained. The model also shows that a higher, non-binding minimum wage can be associated with greater employment (and higher wages), previously found in empirical studies.

JEL classification: J30; J64; E24
Keywords: search, wage-posting, minimum wage, minimum wage spike, wage dispersion

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1 Introduction

Empirical wage distributions, generally monotonously continuous, exhibit sizeable clustering at minimum wage in markets that are subject to this regulation. According to the U.S. Department of Labor, in 2012 4.7%, or 3.6 million, of hourly paid workers and 11% of part-time workers earned the federal minimum wage of $7.25 or less. When the minimum wage is raised, the percentage of workers earning it increases. However, the spike is persistent, and does not disappear when the real minimum wage is eroded by inflation.

This paper provides a search-theoretical explanation of the "minimum wage spike puzzle" based on the assumption of costly search: a firm that determines wage offer weighs extra hiring costs associated with a high wage offer (which attracts more applicants) against a least costly alternative – the minimum wage (with fewer job seekers). Firms' productive heterogeneity, also assumed by the model, allows the empirically observed wage dispersion to be replicated alongside the minimum wage spike, which emerges due to attractiveness of the minimum wage offer to a subset of employers.

In addition to generating the spike, the model produces a number of results consistent with empirical data. For example, the model demonstrates that when the minimum increases, the number of minimum wage observations increases, and when the minimum erodes, this number declines. The model also shows that a higher minimum wage raises the overall wage level (Brown 1999), as it increases wage compression, e.g. Machin et al (2003). But more importantly, the model was able to show that hikes in the minimum wage do not necessarily reduce employment or increase unemployment (if the minimum wage is non-binding), as first suggested by Katz and Krueger (1992), and Card and Krueger (1994).

The paper is organized as follows. The next section discusses related literature. The following section builds an inter-temporal search model. The paper concludes with numerical simulations.

2 Stylized Facts

Brown (1999) in his review of the minimum wage research, describes both distributional dispersion and clustering at the minimum wage, which he labels as "the minimum wage spike":

> "...Among those who are employed, the distribution of ln(wage) tends to look bell-shaped with occasional spikes at round-dollar amounts[...] Often there is another spike, at the minimum wage, even when the minimum is not a round-dollar amount."

While existence of wage dispersion has been well-documented (see for ex., Mortensen, 2003), attention to the minimum wage spike is relatively more recent. Card and Krueger (1994), in their study of the fast food industry in New Jersey, were among the first to draw attention to the size of the spike: prior to the 1992 hike in the minimum wage 30% of teenagers earned the minimum, and 85% did following the increase. According to the Bureau of Labor Statistics (Characteristics of Minimum Wage Workers, various years), over the past twelve years the overall percentage of workers earning minimum wage or less in the U.S. fluctuated between 2.2% and 6% for all workers, and between 5.4% and 13.6% for the part-time workers.

Dolado et al. (1996), in their review of the impact of the minimum wage in Europe, also point out that "... in many sectors with a minimum wage, there is a noticeable spike in the wage distribution at the minimum wage", with similar estimates of the spike in the region of 5–10%. According to 2015 Eurostat data on the EU member states with the minimum wage, eight had the minimum wage spike above 9%, and the remaining states had the estimate stand between 2.0% and 4.7% (Eurostat Minimum Wage Statistics, 2015).

The size of the spike is larger in the lower productivity industries (i.e. in sectors where the minimum wage is more binding): for teenagers rather than for all workers, in food and hospitality industries, and in retail trade. Women and minority workers are also more likely to earn minimum wages. The spike is larger in years when the minimum wage is raised rather than after several years of erosion (Brown, 1999; BLS data). The clustering is also greater in wage offer distributions, though such data is generally less available.

3 Related Literature

Observing and explaining wage and price distributions with dispersion and spikes has occupied economists for quite some time. The research activity in this area was plentiful in the 1990's and 2000's, when researchers were attempting to solve the famous Diamond paradox.[1]

Currently, a number of modeling approaches in the search-theoretic literature are able to produce wage dispersion. All of the approaches share a common characteristic of non-sequential search, with roots going back to Stigler (1961), which assumes that workers who search for jobs have simultaneous access to multiple wage offers. Burdett and Mortensen (1998) obtain wage dispersion by introducing on-the-job search, when wage offers arrive not only to the unemployed, but also to the employed workers. A similar approach was adopted by Postel-Vinay and Robin (2000a, 2000b), and some others. In their models wage dispersion is obtained through Bertrand-style competition between worker's current and prospective em-

[1] "The Diamond paradox" is a term used to denote the convergence of price distribution to a single-price monopsony when search cost is introduced (even with seller heterogeneity). Due to Diamond (1971), also see discussion in Woodbury and Davidson (2003).

ployers. Mortensen (2003) was among the first to show that wage dispersion can be obtained in a search setting with multiple wage offers with productively heterogeneous firms. A slightly different modeling approach that succeeded in replicating wage dispersion is found in directed search literature (Shi and co-authors, various papers). In directed search models dispersion is possible due to the fact that workers are able to observe an entire wage offer distribution and apply for jobs in a mixed-strategy manner.

A number of authors combined the above approaches to generate wage dispersion. For example, Delacroix and Shi (2003) combined directed search assumption with on-the-job search; Albrecht and Gautier (2005), Albrecht et al. (2006) combined directed search with the multiple-applications assumption.

Overall, researchers who successfully replicated wage dispersion designed models that adhered to the Stiglerian-style non-sequentiality of the search process, which results in employers' offering differentiated wages and eliminates the possibility of a single-wage equilibrium. The non-sequentiality assumption makes labor markets more 'competitive' by improving available information (as in directed search models) or by increasing the number of available job offers (on-the-job search, multiple applications assumptions).

While it looks like the puzzle of wage dispersion has been successfully solved, theorists are still attempting to explain co-existence of dispersion with distributional spikes, such as the minimum wage spike. For example, Manning (2003), while discussing the search model of Burdett and Mortensen mentioned above, suggested that the minimum wage spike can be replicated if one assumes that the firm-level labor supply is a continuous function of wage, in which case, if the minimum wage binds for the least productive firms (assuming firms' heterogeneity), it produces the spike. However, it can be argued that such a spike will be degenerate in a dynamic framework, since heterogeneous firms that would initially form the spike will have an incentive to deviate by offering a wage that is slightly above the minimum (i.e., the equilibrium is not Nash). The empirical literature on the minimum wage, in turn, tells us that the spike is quite persistent, and does not disappear even when the minimum wage erodes.

Flinn (2006), while not working within the search-theoretic framework, replicates the minimum wage spike within a Nash-bargaining model. In his model, a subset of firms will pay minimum wage, motivated by a choice between positive economic profit earned when paying the minimum wage and a less-attractive option of earning zero profit if no agreement with workers is achieved and vacancies are not filled.

This paper presents a different attempt to replicate wage dispersion alongside the minimum wage spike. As in Manning (2003), the paper adopts a wage-posting framework with heterogeneous firms: the assumption of employers' posting wages and not bargaining with the many minimum wage workers seems more plausible for the low-wage environment. As in Flinn (2006), it assumes that employers may earn positive economic profit by choosing to pay minimum wage.

The mechanism that produces the spike and dispersion lies in tying the search cost faced by a vacant firm to its wage offer: high wage offers attract more applicants, resulting in greater search cost; paying the minimum wage, on the contrary, minimizes the firm's search cost. Given firms' heterogeneity, a stable equilibrium becomes possible, with some firms paying minimum wages while others pay higher, productivity-linked wages. The dispersion is ensured by multiple wage quotes received by a searching worker.

4 Model

The model's labor market is populated by M productively heterogeneous firms, indexed by j, with a fraction v of them vacant. Each firm has exactly one vacancy with a given productivity y_j that does not depend on worker effort. As in Mortensen (2003), in order to ensure distributional continuity (and rule out gaps) and stability, each firm is assumed to represent a productivity type (having same productivity), with firms of the same type offering different wages (thus having different matching probabilities), but earning identical profits. In this case, the upper wage bound for a productivity type serves as a lower bound for the next, higher productivity type. For the rest of the paper we will refer to each firm type as a 'firm' (since continuity of the distribution is not of special interest here).

The supply side of the market is represented by N equally productive workers, indexed by i, with a fraction u of them being unemployed. Each worker supplies one unit of labor to the market inelastically. Each period a fraction s of existing worker-firm matches are exogenously destroyed, firms become vacant, and workers exit into unemployment. An unemployed worker enters the job market and searches for a wage offer that exceeds her reservation wage. When searching, workers sample a wage offer distribution in a way similar to a lottery, in the process of 'urn-ball' matching. Each period an unemployed worker draws two wage quotes[2], compares them, and applies for a job that offers a higher wage. The worker is assumed to have limited information about the number of other applicants each vacancy receives and does not send her application in a mixed-strategy manner. If a worker samples two identical wage quotes, she randomly selects one.

4.1 Search Process

Multiple Wage Quotes

The assumption of workers obtaining two wage quotes is in the spirit of

[2] Double sampling is chosen for simplification, but can be generalized. See Shapiro (2004)

Mortensen's (2003) multiple offer assumption, which constitutes the model's non-sequential search component. Workers' ability to observe and sort among multiple wage offers promotes competition among firms, which is essential for generating wage dispersion. When firms anticipate workers' sorting, they raise wages in an exchange for higher probability of filling a vacancy.

The double-quote assumption is also similar to the multiple-application assumption of Guetier and Moraga (2005) and Albrecht et al. (2006). In their scenarios, workers send out multiple applications to vacant employers in order to receive multiple offers. Workers who receive multiple offers choose a higher offer, generating conditions for wage dispersion. Albrecht et al. (2006) suggested that this search process closely resembles the search process in the Economics Ph.D.'s market: job seekers send out multiple applications to job openings; some job-seekers get multiple offers, and then pick the best offer from those received. In such a market, sending out multiple applications is worthwhile since information about vacancies is centralized and marginal cost of applying is low.

In low-wage markets, where information about job openings is scattered and the cost of applying is high relative to wages paid, modeling workers' search as obtaining multiple (finite number of) quotes, but filling only one application at a time seems more appropriate, though not critically different from having multiple offers. Both search mechanisms share a characteristic known as congestion externality, which is responsible for generating frictional unemployment, due to the fact that a vacancy/worker may receive more than one application/offer, and end up vacant/unemployed at the end of the search cycle.

The Matching Function

The formation of a firm-worker match is a three-stage process, with probability of forming a match determined by the so-called 'urn-ball' matching function (Butters 1977, Burdett and Judd 1983, Albrecht et al. 2004 and 2006, Mortensen 2003). In our case, the urn is the wage offer distribution sampled by unemployed workers, with balls representing individual wage offers.

During the matching process an unemployed worker first samples the distribution of offers by being randomly matched with two vacant firms. Therefore, the number of quotes requested from a firm is binomially distributed, with the firm's expected probability of being sampled equal to $n = \frac{2U}{V} = \frac{2}{\theta}$, with the range $n \in [0, 2U]$; θ is labor market tightness. If V and U are large[3] (which rules out the possibility of a worker requesting two wage quotes from the same employer), distribution of the number of quotes issued by a firm can be approximated by the Poisson distribution with the same mean.

After receiving wage quotes, a worker compares them and applies for

[3] To simplify theoretical analysis we assume that U and V are large. For derivation with finite values of U, V see Albrecht et al. (2004).

a job that offers higher wage. Workers' preference towards higher wages makes a firm's probability of filling its vacancy dependent not only on the labor market conditions, but also on the relative rank of its wage offer in the distribution of offers, with higher ranked wage offers carrying a greater probability of acceptance. Thus, a vacancy that was sampled by one worker will receive an application with probability $F(w_j)$, which is the probability that another wage quote received by the worker is smaller. For a vacancy sampled x times, the probability of receiving at least one application is $(1 - (1 - F(w))^x)$.

Combining the probability of being sampled with the probability of receiving an application, produces the probability of filling a vacancy:

$$p_w(\theta, w) = \sum_{x=0}^{\infty} [1 - (1 - F(w))^x] \frac{\exp(-\frac{2}{\theta})(\frac{2}{\theta})^x}{x!} = 1 - \exp\left(-\frac{2F(w)}{\theta}\right). \quad (1)$$

The expression indicates that a tighter labor market reduces a firm's probability of filling a vacancy, while a higher wage offer increases such chances. The matching process is concluded with hiring, where firms that receive multiple applications randomly select a worker.

The model assumes that all vacancies have positive probability of filling. To ensure this, it is sufficient to have at least one searching worker obtaining a single wage quote (or one 'real' quote and one 'empty' quote). This assumption also implies that without the minimum wage the lower bound of the wage offer distribution would coincide with workers' common reservation wage.

Matching Probabilities for Cluster Firms

Suppose that a wage offer distribution had a cluster of lowest wage offers (i.e., the minimum wage spike). The size of the cluster is $\rho \in (0, 1)$. A single cluster firm will fill its vacancy only if a worker who requested its quote also received a minimum wage quote from another firm. The likelihood of such an event is ρ, and the cluster firm should expect to fill its vacancy with probability $\rho/2$. Generalizing, a cluster firm that had issued x wage quotes could expect at least one worker applying with probability $(1 - \left(1 - \frac{\rho}{2}\right)^x)$.) Therefore, the probability of filling the vacancy by a cluster firm is:

$$p_m(\theta, \rho) = \sum_{x=0}^{\infty} \left[1 - \left(1 - \frac{\rho}{2}\right)^x\right] \frac{\exp(-\frac{2}{\theta})(\frac{2}{\theta})^x}{x!} = 1 - \exp\left(-\frac{\rho}{\theta}\right). \quad (2)$$

Search Cost, Dispersion and the Spike

In an environment with heterogeneous firms the minimum wage would act as a lower bound for the wage distribution, but no spike would exist. For the spike to appear, additional incentives for the firms to pay minimum wage must be present.

If we view wage-setting choices of vacant firms as a variant of the prisoners' dilemma, paying minimum wage could be the desired cooperative solution that is not achieved in finite games. In the labor market setting, the additional incentive that could change the prisoners' dilemma 'payoff matrix' and promote cooperation among firms could be differentiated search costs, with greater cost associated with higher wages and the lowest cost associated with paying the minimum wage.

Filling a vacancy requires a firm to advertise it, screen and interview applicants, and process job applications, resources expended on which we will call the search cost. More specifically, we suggest that the search cost depends positively on the number of applications a firm receives and processes, making it a function of the wage offer (and overall labor market conditions, captured by the labor market tightness):

$$c_j = b\left(\frac{F(w_j)}{\theta}\right)^{\lambda}, \tag{3}$$

where $b > 0$ is the base search cost (can be uniform or different for the firms), $F(w_j)$ is a firm's rank in the wage offer distribution. Note that when $0 < \lambda < 1$, the defined search cost function will exhibit economies of scale to processing multiple job applications.

The search process, in which unemployed workers simultaneously observe two wage offers and sort away from the lowest, results in a shorter queue of job applicants for the minimum-wage positions and a longer queue for better-paying jobs, thus creating a wedge in the search costs between the two types of vacancies, with lower cost incurred by the minimum wage employers. The benefits to paying the minimum wage are further amplified once a position is filled, as profit earned by the firm is also greater. Thus, this greater overall payoff should entice some firms to pay the minimum wage, generating a partially 'cooperative' equilibrium, observed empirically in the form of the minimum wage spike and wage dispersion.

4.2 *Firms*

The wage-setting process outlined here is based on the model of Burdett and Mortensen 1998. Firms maximize lifetime discounted vacancy values:

$$V_j = \frac{1}{1+r}\left[-c_j + p_k J_j + (1-p_j)\max\{V_m, V_w\}\right], \tag{4}$$

where c_j is the search cost; r is the interest rate; p_j is the probability of filling a vacancy; and J_j is the value of a filled position.

A firm j when setting its wage faces a binary choice: it either offers the minimum wage m or a higher, productivity-linked wage w_j, comparing the vacancy values V_m and V_w. A firm's lifetime discounted value of a filled position is:

$$J_j = \frac{1}{1+r}\left[y_j - w_j + s\max\{V_m, V_w\} + (1-s)J_j\right], \tag{5}$$

where w_k takes values $[m, w_j]$; y_j denotes firm's productivity; and s is an exogenous separation rate.

Assuming that the difference in values exists between paying the minimum wage and paying a higher wage, firms with $V_m > V_w$ will pay the minimum wage, and have the following Bellman equations:

$$rV_m = -c_m + p_m(J_m - V_m), \tag{6}$$

$$rJ_m = y_j - m + s(V_m - J_m). \tag{7}$$

Firms for which $V_w > V_m$ will have similar Bellam equations, with terms carrying a different subscript w: p_w, c_w, V_w and J_w, associated with offering a higher wage w.

Solving the sets of Bellman equations, the following equilibrium vacancy value is obtained:

$$V_j = \frac{(y - w_j)p_j - c_j(r+s)}{r(p_j + r + s)}, \tag{8}$$

with $j = [m, w]$.

The model also allows for entry of new firms if excessive returns are currently observed, with firms entering if the life-time value of job creation is positive:

$$V_j^0 = \frac{1}{1+r}[-C_j + V_j], \tag{9}$$

where C is the entry cost (which may also be interpreted as a present value of capital expenses that a firm incurs during its existence).

Wage Offers

A vacant firm sets its wage by balancing the value of its offer and the probability of forming a match. To ensure an atomless distribution, firms' wage offers (or the upper supports for the productivity type) are found by equating two vacancy values, the first wage w_{j-1} that is set just above the wage offered by the adjacent lower productivity firm, and the second, higher wage w_j:

$$V(y_j, w_j, p(\theta, F(w_j))) = V(y_j, w_{j-1}, p(\theta, F(w_{j-1}))). \tag{10}$$

Solving (10), gives an equilibrium wage offer:

$$w_j^* = y_j - \left(\frac{(y_j - w_{j-1})p_{j-1}a + c_j(r+s)(1-a)}{p_j}\right), \tag{11}$$

where $a = \frac{p_j+r+s}{p_{j-1}+r+s} > 1$ (since $p_j > p_{j-1}$).

Firms are also assumed to make the binary choice between paying the minimum wage or offering a higher value, found above:

$$w = \begin{cases} m & \text{if } V_m \geq V_{w_j}; \\ w_j & \text{otherwise.} \end{cases} \tag{12}$$

4.3 *Workers*

Identical workers are assumed to supply one unit of labor to the market inelastically. Worker's Bellman equations for the state of unemployment and employment are given as:

$$rU = z - +q(E - U); \tag{13}$$

$$rE = w + s(U - E), \tag{14}$$

where U is the lifetime discounted value of unemployment; E is the value of employment;z is the value of leisure (unemployment benefits); q is the probability of receiving a job offer. For simplicity, we assume that worker's search cost is zero.

Applying the reservation wage property $U = E$ shows that the reservation wage is $w_r = z$. When z is zero workers accept any extended job offer, making unemployment a consequence of search frictions only.

4.4 *Equilibrium*

A wage-posting equilibrium is defined such that all aggregate quantities are stationary. Standard arguments apply: under given initial conditions there is, at most, one equilibrium in the economy[4]. The equilibrium is characterized by a vector of endogenously determined variables $\{\{w_j\}_{j=1}^{M-V}, \{w_j^o\}_{j=1}^{V}, u, \theta, \rho^o, \rho\}$ and consists of:

- wage and wage offer distributions $\{w_j\}_{j=1}^{M-V}$, $\{w_j^o\}_{j=1}^{V}$;
- the fraction of vacant firms offering the minimum wage ρ^o, and the fraction of occupied firms paying the minimum wage ρ;
- unemployment rate u;
- labor market tightness θ.

In equilibrium:

- vacant firms post wage offers by maximizing vacancy values, taking productivity as given;

[4] See, for example, Alvarez and Shimer (2008) for a general rationale.

- workers apply to the highest offer vacancies and accept job offers, given that the offer exceeds their reservation wage;
- market does not clear due to search frictions (including congestion externality), resulting in equilibrium unemployment.

5 Simulations

To test the model, we conduct a series of numerical simulations. Table 1 contains baseline parameters, and results are presented in Table 2. Though this is not a calibration exercise, we make an effort to use parameters conventionally found in the literature, using monthly values. Thus, the monthly interest rate is set at r = 0.005, which is equivalent to the monthly discount rate of 0.995. The separation rate is set at s=0.04. Hall (2005) estimates monthly separation rates using US data for the past 50 years at slightly above 3%. Low-skilled workers (with a job tenure nearly twice as short as economy's average) separate more frequently. For instance, Pallage and Zimmermann (1997) calculate monthly probability of transition from employment to unemployment for the US workers with less-than-high-school education at 5.14%.

Table 1 - Baseline Parameters

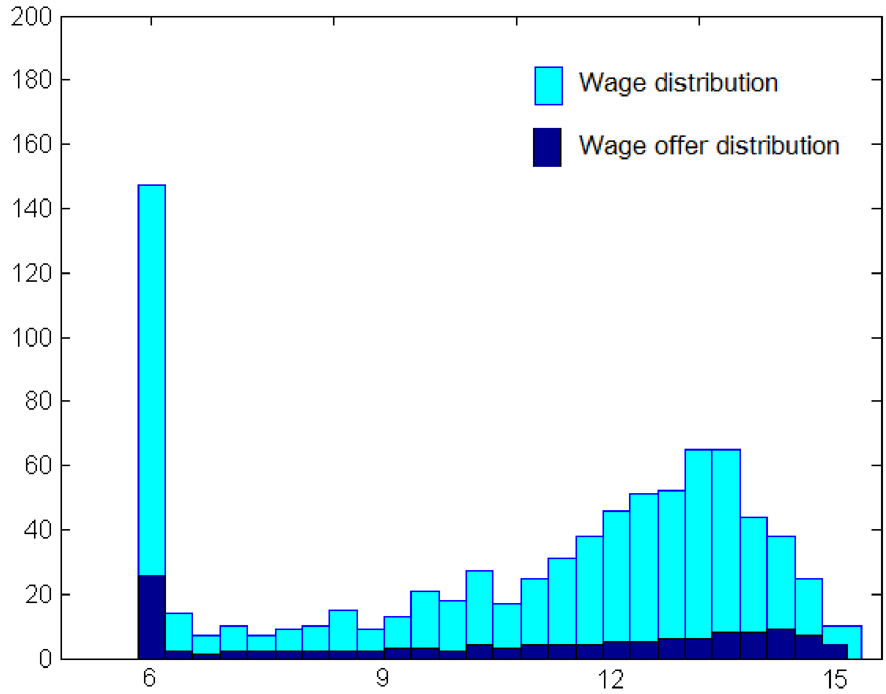
Number of workers, N	3,000
Productivity mean, $\bar{Y}$	30
Productivity variance	20
Separation rate, s	0.04
Interest rate, r	0.005
Base search cost, b	80
Search cost exponent, λ	0.40

There are multiple estimates of search cost in the literature (which depend on model and estimation method used by authors), ranging from two weeks of wage payments (Yashiv 2000) to two quarters of wage payments for hiring a marginal worker (Merz and Yashiv 2007). There is little evidence on search cost available specifically for the low-wage sectors. The search function parameters were arbitrarily chosen to produce an average value of search cost at about one to two months of wage payments. Remaining parameters (number of workers, productivity distribution, minimum wages) are chosen arbitrarily.

There are three sections in the results table corresponding to three productivity levels with means 25, 30 and 35. Table columns refer to different values of the minimum wage at $6, 8, 10, 12 and 14. The presented results are for non-binding minimum wage values, that is, when the minimum wage is above the lower productivity bound, with an exception of one case with productivity Y(25,20) and MW=$14, where the minimum wage binds.

The most important result of the paper was obtaining a wage distribution that has both wage dispersion and the spike at the minimum wage (see Figure 1). The experiments showed that a higher non-binding minimum wage is associated with a greater percentage of firms offering and paying the minimum wage, i.e., a larger spike, which is expected and reflected in the empirical minimum wage literature. We have also experimented with binding minimum wages. The experiments showed that once minimum wage binds, the wage distribution tends to degenerate, converging to a single-wage equilibrium (similar to the Diamond paradox); expectedly, the number of firms also drops (see results for Y(25,20) and MW=$14).

Figure 1 - Wage and Wage Offer Distributions, Y(25,20), MW=6



As the minimum wage gets higher, more employers choose to pay it since the likelihood of filling a minimum wage vacancy increases (less sorting by workers takes place, congestion externality diminishes), combined with the overall lower search cost. The latter is reflected in the declining economy-wide search cost recorded in the results table. As firms' productivity grows or, alternatively, when the real minimum wage erodes, the percentage of firms paying the minimum wage declines, which is consistent with empirical data.

Table 2 - Simulation Results

Y(25,20)	MW=$6	MW=$8	MW=$10	MW=$12	MW=$14
Number of firms	2959	2973	2985	2995	2584
Average search cost	86.07	84.45	83.25	82.73	116.83
Unemployment rate, %	7.69	7.66	7.62	7.59	0.172
Percent of MW offers	10.65	14.53	21.48	34.83	100.00
Percent of MW wages	5.42	8.67	15.01	30.82	96.90
Average wage offer	10.82	10.88	10.92	11.14	14.00
st.d.	4.60	4.69	4.71	4.91	0.00
Average wage	12.60	12.63	12.71	12.93	14.127
st.d.	3.15	3.12	3.13	3.14	0.67
Y(30, 20)					
Number of firms	2953	2959	2966	2979	2985
Average search cost	87.38	87.16	86.62	85.07	84.26
Unemployment rate, %	5.91	5.99	6.05	6.14	6.45
Percent of MW wages	2.52	3.04	4.64	6.98	9.64
Percent of MW offers	5.60	6.78	8.63	11.54	15.98
Average wage offer	14.76	14.84	14.85	14.98	15.11
st.d.	6.47	6.78	6.89	7.06	7.10
Average wage	17.44	17.50	17.54	17.58	17.59
st.d.	4.18	4.41	4.42	4.76	4.90
Y(35, 20)					
Number of firms	2894	2898	2900	2902	2907
Average search cost	93.29	92.61	92.23	91.51	90.21
Unemployment rate, %	8.70	8.50	8.46	8.49	8.13
Percent of MW offers	3.36	3.84	4.61	5.94	8.54
Percent of MW wages	0.21	0.43	0.44	1.02	2.53
Average wage offer	20.56	21.07	21.30	21.35	22.06
st.d.	4.29	3.96	3.85	3.43	5.26
Average wage	21.92	22.28	22.39	22.54	22.06
st.d.	2.35	2.28	2.32	2.31	2.85

An interesting and important result of the model demonstrates that a higher non-binding minimum wage not only is not associated with the absence of employment losses, but may actually lead to job creation. As the minimum wage grows, more firms pay the minimum wage. For an individual firm that pays the minimum, the likelihood of filling its vacancy rises while the search cost decreases. If these savings offset the hike in the minimum wage, the firm earns a greater profit, triggering entry of new firms. Job creation takes place.

Thus, the model and experimental evidence provide further support to the empirical findings of Card and Krueger (1994 and 1995 and subsequent body of literature; see Schmitt 2013 for a recent review), who suggested that hikes in the minimum wage do not need to negatively affect employment.

Lastly, a non-binding minimum wage is shown to increase wages, which is also consistent with empirical data. However, once the minimum wage becomes binding and wage distribution degenerates, the average wage could go down. This happens because as number of firms declines, wage competition diminishes.

6 Conclusion

The empirical wage and wage offer distributions in economies with a minimum wage generally exhibit both the minimum wage spike and wage dispersion. In a wage-posting, non-sequential search environment with heterogeneous firms, one can expect the latter but not the former, as competition pushes firms to pay differentiated wages. Still, the minimum wage spike is a persistent empirical phenomenon, suggesting that a partial cooperation by heterogeneous employers takes place.

This paper reconciled the two phenomena by combining the non-sequential search assumption (multiple wage quotes) with the element that restricts competition, namely, firms' wage-dependent search costs. In the described environment, firms that post minimum wage offers have significantly fewer applicants, thus bearing lower cost of screening and hiring, and firms offering higher 'competitive' wages have higher costs. In other words, deviation from posting the lowest, 'cooperative' minimum wage is penalized by higher search cost. The resulting wedge in the search costs makes it attractive for some firms to offer the minimum wage, while others offer higher wages, resulting in the minimum wage spike along with the wage dispersion. In this partially cooperative equilibrium, firms that pay minimum wages are able to earn greater returns when compared to an equilibrium with pure wage dispersion. Due to the possibility of greater returns in the partially cooperative equilibrium, unemployment can be also reduced.

Higher non-binding minimum wages were also shown to lead to higher wages. Thus, in addition to the main goal of replicating the minimum wage spike and dispersion, the model developed in the paper was able to provide further theoretical support to the absence of negative employment of the minimum wage, previously recorded by a number of economists. Still, the model can produce negative employment effects when the minimum wage binds.

Thus, a policy-maker who formulates minimum wage policies should not only assess how binding the new minimum wage is (to predict its wage and employment effects), but also understand the underlying mechanism of wage determination. Namely, it should be clear whether wage-posting or wage-bargaining takes place, whether the job search process is sequential or simultaneous, and how costly the search is. It should be also understood if there exist any incentives for cooperative behavior by firms that could restrict wage competition (such as differences in search costs). Depending on these characteristics of a particular labor market, the effect of the minimum wage on wages, employment, and welfare in general can be quite different.

References

Albrecht, J., Gautier, P. 2005. Equilibrium Directed Search with Multiple Applications. Working Paper. Department of Economics, Georgetown University.

Albrecht, J., Gautier, P., Vroman, S. 2006. Equilibrium Directed Search with Multiple Applications. Review of Economic Studies 73, 869–891.

Albrecht, J., Tan, S., Gautier, P., Vroman, S. 2004. Matching with multiple applications revisited. Economics Letters 84, 311–314.

Alvarez, F., Shimer, R. 2008. Search and Rest Unemployment,NBER Working Paper 13772.

Bureau of Labor Statistics 2015. Characteristics of Minimum Wage Workers, 2014. Report 1054, BLS. Retrieved from http://www.bls.gov/cps/earnings.htmlminwage.

Brown, C. 1999. Minimum Wages, Employment and the Distribution of Income. In Handbook of Labor Economics. Vol.3B., Ch, 32. Elsevier.

Burdett, K. Judd, K. 1983. Equilibrium Price Dispersion. Econometrica, 51(4), 955–969.

Burdett, K., Mortensen, D. 1998. Wage Differentials, Employer Size and Unemployment. International Economic Review 39, 257–273.

Butters, G. 1977. Equilibirum Distribution of Sales and Advertising Prices. The Review of Economic Studies 44, 465–491.

Card, D., Krueger, A. 1994. Minimum Wage and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania. American Economic Review, 84(4), 772–793.

Card, D. Krueger, A. 1995. Myth and Measurement: the New Economics of the Minimum Wage. Princeton University Press.

Delacroix, A., Shi, S. 2003. Directed Search on the Job and the Wage Ladder. Working Paper. Department of Economics, University of Toronto.

Diamond, P. (1971). A Model of Price Adjustment. Journal of Economic Theory, 156–168.

Dolado, J., Kramarz, F., Machin, S., Manning, A., Margolis, D., Tuelings, C., Saint-Paul, G., Keen, M. 1996. The Economic Impact of Minimum Wages in Europe. Economic Policy 11, 317–372.

Eurostat 2015. Minimum Wage Statistics Eurostat: Statistics explained, Eurostat. Retrieved from http://ec.europa.eu/eurostat/statistics-explained.

Flinn, C. 2006. Minimum Wage Effects on Labor Market Outcomes under Search, Matching and Endogenous Contact. Econometrica 74, 1013–1062.

Gautier, P., Moraga-Gonzalez, J. 2005. Strategic Wage Setting and Coordination Frictions with Multiple Applications. Working Paper.

Hall, R. 2005. Job Loss, Job Finding, and Unemployment in the U.S. Economy Over the Past Fifty Years. NBER Working Paper 11678.

Katz, L., Krueger, A. 1992. The Effect of the Minimum Wage Law on the Fast-Food Industry. Industrial and Labor Relations Review 46, 6–21.

Machin, S., Manning, A., Lupin, R. 2003. Where the Minimum Wage Bites Hard: Introduction of Minimum Wages to a Low Wage Sector. Journal of the European Economic Association 1, 154–180.

Manning, A. 2003. Monopsony in Motion. Princeton University Press.

Merz, M., Yashiv, E. 2007. Labor and the Market Value of the Firm. The American Economic Review 97 1419–1431.

Mortensen, D. 2003. Wage Dispersion. MIT: Zeuthen Lecture Book Series.

Pallage, S., Zimmermann, C. 1997. Moral Hazard and Optimal Unemployment Insurance in an Economy with Heterogeneous Skills. University of Montreal, Working Paper 54.

Postel-Vinay, F. Robin, J.-M. 2000a. Equilibrium Wage Dispersion with Worker and Employer Heterogeneity. Econometrica 70, 2295–2350.

Postel-Vinay, F., Robin, J.-M. 2000b. The Distribution of Earnings in an Equilibrium Search Model with State-Dependent Offers and Counteroffers International Economic Review 43, 989–1016.

Schmitt, J. 2013. Why Does the Minimum Wage Have No Discernible Effect on Employment?. Center for Economic and Policy Research, No.202-293-5380.

Shapiro, J. 2004. Income Taxation in a Frictional Labor Market. Journal of Public Economics 88, 465–479.

Woodbury, S. Davidson, C. 2003. Search Theory and Unemployment. Springer.

Yashiv, E. 2000. The Determinants of Equilibrium Unemployment. The American Economic Review 90, 1297–1322.

