

# The Effects of Risk Aversion on Job Matching: Can Differences in Risk Aversion Explain the Wage Gap?

by

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## **Abstract**

Previous research has shown that more risk averse workers are at a disadvantage when bargaining over wages. However, it has yet to be determined whether this differential treatment can be sustained in markets where equally productive workers differ in their attitudes toward risk. This paper investigates the question by examining a simple matching model in which the standard assumptions of risk neutrality and homogeneity are relaxed. It is shown that more risk averse workers have lower reservation wages, and conditional on productivity they receive lower wages. Thus, they are faced with a wage distribution which is stochastically dominated by that of less risk averse workers. As a result more risk averse workers are less likely to enter the labor force, and their unemployment rate and duration are smaller. Evidence from the psychology literature and recent empirical evidence in economics indicate that women are more risk averse than men. The results presented in this paper therefore suggest that gender differences in risk aversion may provide an alternative explanation for the observed differences in male and female labor market experiences. Contrary to most discrimination models, this model is consistent with both utility and profit maximization in the long run.

**The Effects of Risk Aversion on Job Matching:  
Can Differences in Risk Aversion Explain the Wage Gap?**

*By Lise Vesterlund<sup>1</sup>*

## 1. Introduction

Previous research has established that when bargaining over deterministic outcomes more risk averse workers are at a disadvantage. Hence the prediction of partial equilibrium labor market models is that more risk averse workers receive lower wages than equally productive but less risk averse workers. However, it is questionable whether this prediction holds in a general equilibrium framework. Specifically, one may wonder whether it is possible to sustain an equilibrium where firms hire the more expensive and less risk averse workers.

This paper is the first general equilibrium analysis of the effect of heterogeneity in risk aversion on the wage distribution and on equilibrium participation and employment in the labor market. The approach used is that of matching models. The attractive feature of these models is that while in competitive labor market models it is assumed that job offers arise instantaneously at a wage determined by the market, job matching models assume that offers arrive in each period with some probability according to a known stochastic process. As a result equilibrium in a job matching model may be characterized by unemployment and wages below marginal product. To keep the model mathematically tractable it is generally assumed that workers are identical and risk neutral. Thus, equally productive workers receive equal pay, and the wage distribution is simply a truncated transformation of the productivity distribution.

In this paper both the risk neutrality and the homogeneity assumptions are relaxed, and the stationary equilibrium that results when individuals differ in their attitudes toward risk is

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examined.<sup>2</sup> It is demonstrated that when there is not instantaneous matching, differences in risk aversion can result in fundamental differences in labor market experiences. In particular, more risk averse workers accept lower quality matches, and conditional on productivity they receive lower wages, thus the wage distribution of more risk averse workers is stochastically dominated by that of less risk averse workers. In addition, more risk averse workers are less likely to participate in the labor market, and conditional on labor force participation they are more likely to be employed.

The next section develops the model and defines the stationary equilibria, and the section that follows examines the predictions from the model. A fundamental assumption of the model is that the degree of risk aversion is identifiable. The model therefore applies to groups of individuals who are known to differ in their degree of risk aversion. For example, the experimental psychology literature and recent empirical evidence in economics suggest that women are more risk averse than men.<sup>3</sup> This application of the model is examined and it is shown that the observed male and female job market differences are broadly consistent with the predictions of the model. Gender differences in risk aversion may therefore be seen as an alternative explanation for wage discrimination. It is of particular interest that this explanation is consistent with both utility and profit maximization in the long run.<sup>4</sup> Using recent estimates of male and female relative risk aversion coefficients, a numerical solution of the model is examined, and it is shown that this difference in risk aversion may result in a substantial wage gap.

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<sup>2</sup> Two exceptions are Costain (1995) and Valdivia (1995). They incorporate risk aversion into a simple matching model in which steady state wage offers are identical and therefore workers accept any job offer. As a result, the wage distribution is degenerate and there is no actual search process.

<sup>3</sup> The experimental evidence is plentiful. See for examples Levin, Snyder and Chapman (1988); Hudgens and Fatkin (1985); Zinkhan and Karande (1991); Arch (1993); Fagley and Miller (1990); Kogan and Wallach (1964); Slovic (1964); Maccoby and Jacklin (1974). For empirical evidence see Jianakoplos and Bernasek (1996).

<sup>4</sup> Because we do not observe that male dominated industries are being driven out of business, Victor Fuchs (1988) argues that the wage gap cannot be attributed to discrimination.

## 2. Model

The model developed in this paper is inspired by the Diamond-Mortensen-Pissarides model, but it differs in several respects. Rather than analyzing a single type of individual, in this model there are two types of individuals, which are identical in all respects except for their degree of risk aversion. Specifically, type  $A$  is globally more risk averse than type  $B$ . Both are assumed to have a common discount factor,  $\beta < 1$ , and to have concave, additively separable and monotonically increasing utility functions,  $U_j(w_j)$ , where  $w_j$  denotes the wage received by  $j$  for  $j=A, B$ . Since type  $A$  is more risk averse than type  $B$ ,  $A$ 's utility function can be written as a concave transformation of  $B$ 's utility function. That is,  $U_A(w) = K[U_B(w)]$  for all  $w$ , where  $K$  is a strictly concave and monotonically increasing function. Assume for simplicity that individuals are infinitely lived and that the population grows at a constant rate  $n$ . Let  $N_t$  denote the population at time  $t$ .

Firms are risk neutral and infinitely lived, and in each period  $t$  there is a pool of  $V_t$  job vacancies. The creation of vacancies is endogenous. If the expected return from a vacancy is positive, a new job is created. Denote the steady state rate at which new vacancies are created by  $\lambda$ . Finally, assume that firms and workers know all the parameters of the model.

### 2.1. *The different states of the economy*

The purpose of this model is twofold. First, I wish to determine how differences in risk aversion affect the steady state wage distribution for workers who have the same productivity potential. Second, I wish to examine how risk preferences affect the decision to search for jobs. For the latter purpose it is assumed that individuals in the beginning of their first period can choose one of two alternatives: enter the job market and search for a job, or accept an outside option which yields a fixed annual return in all future periods. Refer to the outside option as home production. Since an individual must be unemployed to look for a job, the choice between entering the job market and home production is permanent; that is, it will never be reversed.

An individual who enters the job market begins searching for jobs from a pool of identical firms. It is assumed that a search process stochastically brings together unemployed workers and firms with vacancies. Thus, neither the firm nor the worker can screen for good matches. If a match is rejected both the worker and the firm return to searching. In each period following the acceptance of a match, there is a constant probability  $\delta$  that the contract will end. If the contract ends both the firm and the worker return to searching.

Let us first examine the dynamics that bring firms and individuals from one state of the world to another.

### *2.1.1. The individual's decision process*

At any given time an individual is in one of three mutually exclusive states: home production, unemployment or employment. Denote the number of people in home production  $L_{Ht}$ , the number of people unemployed  $L_{Ut}$ , and the number of people working  $L_{Wt}$ . In steady state, the per capita equivalents will be constant over time and will be denoted by  $l_H$ ,  $l_U$  and  $l_W$ .

Let us examine the decision process which leads people to be in one of the three states. Individuals are faced with a two stage decision problem. First, they must decide whether to enter the labor force or work at home. Second, once in the labor force they will randomly receive job matches, and depending on the quality of the match they must decide whether to accept the match or return to searching.

### *Home production vs. labor force participation*

The decision to enter the labor force is made in the beginning of the first period.<sup>5</sup> An individual enters the labor force if the expected return from doing so exceeds that of home production. Assume that the return from home production is a personal trait which is randomly assigned from the strictly monotonic cumulative distribution  $G(\cdot)$ . Denote this per period home production return by  $h_k$ , where  $h_k \in [0, L]$  and  $k=1, \dots, N_t$ . Thus, there are no systematic differences in the return from home production for the two types.<sup>6</sup>

Upon entering the labor force an individual is faced with an uncertain stream of returns from potential job matches. Denote the per period certainty equivalent of this expected stream of income by  $r_j$ . Alternatively  $r_j$  may be referred to as the reservation wage. The decision to participate in the labor force is therefore very simple: enter the labor force if  $h_k \leq r_j$  and choose home production otherwise. Hence, the probability of entering the labor force is  $G(r_j)$ .

### *Unemployed vs. employed*

Once in the labor force the individual begins searching for jobs. Only unemployed workers search for jobs, that is, there is no on-the-job search. In each period  $mN_t$  matches are made between an unemployed worker and a vacancy. Let the function  $m = m(l_u, v)$  determine the per capita number of matches, where  $l_u$  denotes the per capita number of unemployed workers and  $v$  denotes the per capita number of job vacancies.  $m$  is assumed to be strictly less than  $l_u$  and  $v$ , increasing in both arguments and homogeneous of degree 1.

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<sup>5</sup> This is a simplifying assumption. Alternatively individuals could have a stochastic home production realization. This specification does not change the qualitative predictions of the model.

<sup>6</sup> This outside option could potentially capture other aspects of the labor market. For instance, it could be thought of as a job opportunity that requires no search either because it is easily available to all individuals or because some individuals have connections that essentially guarantee employment without any actual job search.

A worker can find at most one match in each period. Thus, independent of type, unemployed workers find a match with probability

$$(1) \quad \alpha = m/l_U.$$

Upon being matched with a prospective partner, the worker and the firm draw a production parameter  $x$  at random from the continuous and strictly monotonic cumulative distribution  $F(\cdot)$ . Let  $x \in [0,1]$  be the quantity produced in each period that the contract is in effect. Assume that  $x$  is the numeraire good and that the quality of a match is entirely described by the production parameter.

Due to the matching process firms are able to pay workers a wage lower than their marginal product. Wages are set endogenously through a Nash bargaining process between the firm and the worker. Denote the per period return to the worker by  $w_j(x)$ . A contract that generates a return which exceeds the certainty equivalent of the expected return from continued search will be accepted. Thus a worker will only accept a match if  $w_j(x) \geq r_j$ , where  $r_j$  denotes the per period certainty equivalent from searching. If a match is accepted the worker will receive  $w_j(x)$  in all future periods that the contract is in effect. After the acceptance of a match there is a probability  $\delta$  that the contract ends in the next period, at which point both the firm and the worker return to searching.<sup>7</sup> Likewise, if a match is rejected the worker returns to searching and will be rematched at a later point. Once rematched a new production capacity  $x$  will be assigned. It is assumed that this future sequence of  $x$  is i.i.d. Coupled with the assumption that the distribution of  $x$  is known, the worker learns nothing over time. Hence, the worker's information set can be ignored.

### 2.1.2. *The firm's decision process*

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<sup>7</sup> Alternatively one could assume that contracts have infinite life. This does not alter the results, but it does result in equilibria with very low unemployment rates.

A job is either filled or vacant. A vacancy finds at most one match in any period, thus the probability of getting matched with a worker is

$$(2) \quad \gamma = m / v.$$

Denote the per capita number of unemployed type  $A$  workers by  $l_{UA}$  and the per capita number of unemployed type  $B$  workers by  $l_{UB}$ . Conditional on matching, the probability that a firm matches with a type  $A$  worker is

$$(3) \quad \phi = l_{UA} / (l_{UB} + l_{UA}).$$

Once a match with a per period production of  $x$  has been found, the firm must decide whether it wishes to accept the match or return to searching. Let the expected per period return from searching be denoted by  $\pi$ . Given the worker's wage  $w_j(x)$ , a match will be accepted if it generates a return  $x - w_j(x) \geq \pi$ .

Combining the worker's and the firm's individual rationality constraints it is seen that an agreement will be reached only if  $x$  exceeds the sum of the two parties' expected returns from continued search,  $x \geq r_j + \pi$ .

## 2.2. *The expected return from searching*

Given the matching technology and the wage determination process, let us examine how the worker's and firm's expected returns from searching are determined.

### 2.2.1. *The worker's reservation wage*

To keep the model analytically tractable it is assumed that agents are restricted from borrowing



and lending. This implies that in any given period the worker consumes all of the income acquired in that period. Once a match is accepted the worker earns  $w_j(x)$  in all future periods that the contract is in effect. Denote the expected present discounted utility of a match with production  $x$  and an associated wage offer of  $w_j(x)$  by  $W_j(x)$ . In the first period of a match the worker earns  $w_j(x)$ . In the following period there is a probability  $(1-\delta)$  that the contract is still in effect, yielding a present discounted utility of  $W_j(x)$ . However there is a probability  $\delta$  that the contract ends and the worker returns to searching. Denote the expected present discounted utility from searching by  $R_j$ . Then  $W_j(x)$  is determined as follows

$$W_j(x) = U_j(w_j(x)) + \beta[(1-\delta)W_j(x) + \delta R_j],$$

which can be rearranged as

$$(4) \quad W_j(x) = \frac{U_j(w_j(x)) + \beta \delta R_j}{1 - \beta(1-\delta)} \quad j = A, B.$$

Given the previous definition of the reservation wage, it is apparent that  $r_j$  is related to the expected present discounted utility from searching,  $R_j$ , as  $R_j = U_j(r_j) / (1-\beta)$ .

Now let us see how the reservation wage is determined. While searching, a worker gets paid an unemployment benefit,  $b$ , net of search cost. Assume for simplicity that the unemployment benefit consists of home production and utility from leisure. In each search period there is a probability  $(1-\alpha)$  that the worker does not get a match and hence returns to searching.

Conditional on following the optimal strategy in all future periods, this will generate an expected present discounted utility of  $R_j$ . The worker's probability of getting a match is  $\alpha$ . Upon getting a match the worker has to decide, conditional on the quality of the match, whether it is better to accept the match or reject the match and return to searching. If the discounted utility of a match,  $W_j(x)$ , is higher than the discounted utility of continued search,  $R_j$ , the worker stops searching and accepts the current match.

The value of searching for one more period is

$$R_j = U_j(b) + \beta[\alpha \int_0^1 \max[R_j, W_j(x)] dF(x) + (1 - \alpha)R_j].$$

All matches that have a per period return that exceeds  $r_j + \pi$  are accepted and generate  $W_j(x)$ . All other matches are rejected, in which case the worker returns to searching, generating a present discounted utility of  $R_j$ . Hence,  $R_j$  can be written as

$$R_j = U_j(b) + \beta[\alpha \int_0^{r_j + \pi} R_j dF(x) + \alpha \int_{r_j + \pi}^1 W_j(x) dF(x) + (1 - \alpha)R_j],$$

and by rearranging and recalling the definition of  $R_j$  this can be written as

$$(5) \quad U_j(r_j) = U_j(b) + \alpha\beta \int_{r_j + \pi}^1 [W_j(x) - R_j] dF(x) \quad j = A, B.$$

Substituting (4) into (5) yields the equation which implicitly determines type  $j$ 's optimal reservation wage,  $r_j$ ,

$$(6) \quad U_j(r_j) = U_j(b) + \frac{\alpha\beta}{1 - \beta(1 - \delta)} \int_{r_j + \pi}^1 [U_j(w_j(x)) - U_j(r_j)] dF(x) \quad j = A, B.$$

### 2.2.2. The firm's reservation profit

Let us first determine the firm's expected present discounted profit  $P_j(x)$  from a match of quality  $x$ . Assume for simplicity that firms also discount the future at rate  $\beta$ . The firm will earn a profit of  $x - w_j(x)$  in the first period of a match. In the following period there is a probability  $(1 - \delta)$  that the firm is still matched with the worker yielding an expected present discounted profit of  $P_j(x)$ . However, there is a probability  $\delta$  that the contract ends at which point the firm returns to searching. Let  $\Pi$  denote the firm's expected present discounted value of searching. Recalling that  $\pi$  is the per period return from searching, it is seen that  $\Pi = \pi / (1 - \beta)$ . Consequently the

expected discounted profit,  $P_j(x)$ , of a match with worker  $j=A, B$  is

$$P_j(x) = x - w_j(x) + \beta [(1 - \delta)P_j(x) + \delta \Pi],$$

which can be rewritten as

$$(7) \quad P_j(x) = \frac{x - w_j(x) + \delta \Pi \beta}{1 - \beta(1 - \delta)} \quad j = A, B.$$

Now let us examine how the firm's reservation profit is determined. Analogous to the worker's decision, a firm only accepts matches that generate a higher return than the expected return from continued search. While searching, a firm loses net revenue of  $d$  per period. In each period there is probability  $(1 - \gamma)$  that the firm does not find a match for the vacant position, in which case the firm will search for yet another period and receive an expected present discounted profit of  $\Pi$ . However there is probability  $\gamma$  that the firm does find a match for the vacant position. Once the firm is matched with a potential worker, it must decide based on the quality of the match and the type of worker whether it wishes to return to searching or accept the current match. If a match is accepted it generates a discounted profit of  $P_j(x)$ . Given that there is no screening and that the proportion of  $A$  workers is  $\phi$ , the firm's expected present discounted value of future search is

$$\Pi = -d + \beta [ (1 - \gamma) \Pi + \gamma ( \phi \int_0^1 \max[\Pi, P_A(x)] dF(x) + (1 - \phi) \int_0^1 \max[\Pi, P_B(x)] dF(x) ) ].$$

Matches are negotiated only if they generate a return that exceeds the sum of the expected returns from searching for the two parties. Thus,

$$\pi = -d + \gamma \beta [ \phi \int_{r_A + \pi}^1 [P_A(x) - \Pi] dF(x) + (1 - \phi) \int_{r_B + \pi}^1 [P_B(x) - \Pi] dF(x) ].$$

Combining this equation with (7) yields the equation which determines the firm's optimal reservation profit,

$$(8) \quad \pi = -d + \frac{\gamma\beta}{1-\beta(1-\delta)} [\phi]_{r_A+\pi}^1 [x-w_A(x) - \pi] dF(x) + (1-\phi) ]_{r_B+\pi}^1 [x-w_B(x) - \pi] dF(x).$$

### 2.3. Bargaining

Once a firm and a worker are matched they face a bargaining problem in the sense that they must determine how to split  $x$  between them. As is common in the matching literature, the analysis is limited to the Nash bargaining solution. Similar results hold with other bargaining models such as an alternating offer bargaining model.<sup>8</sup>

Nash (1953) showed that the unique bargaining solution which possesses the property of Pareto optimality, symmetry, independence of irrelevant alternatives, individual rationality and independence of equivalent utility representations is

$$w_j(x) = \text{Argmax} [W_j(x) - R_j][P_j(x) - \Pi].$$

The individual rationality assumption implies that a solution will be found only if  $x$  exceeds the sum of the returns to firms and workers from continued search. Thus, bargaining takes place only if  $x\beta r_j + \pi$ . Equivalently the problem can be stated as

$$w_j(x) = \text{Argmax} [U_j(w_j(x)) - U_j(r_j)][x - w_j(x) - \pi].$$

The solution  $w_j(x)$  therefore satisfies the following first order condition,

$$(9) \quad \frac{\partial U_j(w_j(x))}{\partial w_j(x)} [x - w_j(x) - \pi] = U_j(w_j(x)) - U_j(r_j).$$

Thus  $w_j(\cdot)$  is a function of  $r_j$ ,  $\pi$  and  $x$ . By differentiating the first order condition with respect to  $r_j$ , the effect of the reservation wage on the equilibrium wage can be determined:

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<sup>8</sup> Ståhl (1972) and Rubinstein (1982).

$$(10) \quad \frac{\partial w_j(x)}{\partial r_j} = \frac{\frac{\partial U_j(r_j)}{\partial r_j}}{2 \frac{\partial U_j(w_j(x))}{\partial w_j(x)} - \frac{\partial^2 U_j(w_j(x))}{\partial^2 w_j(x)} (x - w_j(x) - \pi)}.$$

Due to the concavity of the utility function, the denominator is positive, hence the wage rate is increasing in the reservation wage. Likewise it can be shown that  $w_j(x)$  is increasing in  $x$ , and decreasing in  $\pi$ .

### 3. Steady State

Suppose for simplicity that there are equal numbers of the two types of individuals.<sup>9</sup> The conditions for constant population growth in all sectors of the economy are as follows.

(a) *Constant growth of the home production population:* For each  $j=A,B$  a proportion  $1-G(r_j)$  of the incoming population of  $0.5 n N_{t-1}$  selects into home production in each period. Hence, the growth rate in home production is

$$\frac{L_{Hj,t} - L_{Hj,t-1}}{L_{Hj,t-1}} = \frac{.5 n N_{t-1} (1 - G(r_j))}{L_{Hj,t-1}} = n,$$

which implies

$$(11) \quad l_{Hj} = \frac{1 - G(r_j)}{2}.$$

(b) *Constant growth of the unemployed population:* In each period a proportion  $G(r_j)$  of the entering population selects into the labor force. A proportion  $\alpha(1 - F(r_j + \pi))$  of last period's

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<sup>9</sup> The result holds for any arbitrary fixed proportion of types.

unemployment pool enters employment, and a proportion  $\delta$  of last period's workforce becomes unemployed. In other words, the growth rate of unemployment is

$$\frac{L_{Uj,t} - L_{Uj,t-1}}{L_{Uj,t-1}} = \frac{.5 n N_{t-1} G(r_j) - \alpha(1 - F(r_j + \pi))L_{Uj,t-1} + \delta L_{Wj,t-1}}{L_{Uj,t-1}} = n.$$

(c) *Constant growth of the employed population:* Upon leaving unemployment  $\alpha(1 - F(r_j + \pi))L_{Uj,t-1}$  workers enter the work force. Due to the termination of contracts a constant fraction  $\delta$  of the work force becomes unemployed in each period. That is, the growth rate in the labor force of type  $j$  workers is

$$\frac{L_{Wj,t} - L_{Wj,t-1}}{L_{Wj,t-1}} = \frac{\alpha(1 - F(r_j + \pi))L_{Uj,t-1} - \delta L_{Wj,t-1}}{L_{Wj,t-1}} = n.$$

Using the condition for constant population growth in the employed and unemployed population, it is found that per capita unemployment and per capita employment can be written as

$$(12) \quad l_{Uj} = \frac{(n + \delta) G(r_j)}{2[n + \delta + \alpha(1 - F(r_j + \pi))]},$$

$$(13) \quad l_{Wj} = \frac{G(r_j) \alpha(1 - F(r_j + \pi))}{2[n + \delta + \alpha(1 - F(r_j + \pi))]}.$$

(d) *Constant growth in the number of vacancies:* In each period  $\lambda$  new vacancies are developed, and  $\delta(L_{WA,t-1} + L_{WB,t-1})$  previously filled positions become vacant. Given the matches in the previous period a proportion  $\gamma[\phi(1 - F(r_A + \pi)) + (1 - \phi)(1 - F(r_B + \pi))]$  of last period's vacancies will be filled with acceptable matches in this period. Hence, the growth rate in the number of vacancies is

$$\frac{V_t - V_{t-1}}{V_{t-1}} = \frac{\lambda V_{t-1} - \gamma V_{t-1} [\phi(1 - F(r_A + \pi)) + (1 - \phi)(1 - F(r_B + \pi))] + \delta(L_{W_A, t-1} + L_{W_B, t-1})}{V_{t-1}} = n,$$

which implies

$$(14) \quad \lambda = n + \gamma [\phi(1 - F(r_A + \pi)) + (1 - \phi)(1 - F(r_B + \pi))] - \frac{\delta[l_{W_A} + l_{W_B}]}{v}.$$

Finally, assuming that there are no fixed costs to opening a vacancy generates a zero expected profit condition which closes the model,

$$(15) \quad \pi = 0.$$

Given the matching function  $m(l_U, v)$ , the utility functions  $U_j(\cdot)$ , the job productivity distribution  $F(\cdot)$ , the home production distribution  $G(\cdot)$  and the parameters  $(n, b, d, \beta, \delta, L)$  the steady state of this economy is characterized by the wage functions  $w_j(x)$  and the vector  $(\alpha, \gamma, \phi, r_j, \pi, v, l_{Hj}, l_{Uj}, l_{Wj}, \lambda, m)$  which simultaneously satisfy equations (1)-(3), (6), (8)-(9), (11)-(15).

#### 4. Evaluation of the model

The following section examines how risk aversion affects the steady state of the economy. Due to the complexity of the model there does not exist a closed form solution. Nevertheless, it is still possible to make several interesting predictions. First, the effect of risk aversion on the reservation wage is examined. Second, the wage distributions of the two types of workers are compared. Then the conditions under which the wage gap increases with productivity are explored. Finally, the expected unemployment duration, rate of unemployment and labor force participation of the more risk averse individual, type  $A$ , are compared to that of the less risk averse individual, type  $B$ .

#### 4.1. Risk aversion and the reservation wage.

This section determines how an individual's attitude toward risk affects the optimal reservation wage. For this purpose, Pratt's Theorem (Pratt, 1964) will prove to be very useful. Define the risk premium,  $p_{j,y}$ , to be the maximum amount of wealth that an individual gives up in order to avoid facing the random income,  $y$ , such that  $E(y) \equiv I$  and  $U_j(I - p_{j,y}) \equiv EU_j(y)$ . Pratt's Theorem implies that the following three statements are equivalent:

- (i)  $U_A(I) = K[U_B(I)]$  for some increasing strictly concave  $K$ .
- (ii)  $p_{A,y} > p_{B,y}$  for all random  $y$ .
- (iii)  $-U_A''(I) / U_A'(I) > -U_B''(I) / U_B'(I)$  for all  $I$ .

Since a more risk averse worker attaches a smaller value to the uncertain income stream from searching than does a less risk averse worker, one would expect that if two workers are faced with the same distribution of wages, then the more risk averse worker stops searching earlier than the less risk averse worker. That is, the more risk averse worker has a lower reservation wage. This result has been shown by both Nachman (1975) and Hall, et al. (1979).

*Proposition 1: If faced with the same wage distribution, a more risk averse worker will have a lower reservation wage than a less risk averse worker: If  $w_A(x) = w_B(x)$  for all  $x$ , and  $U_A(w) = K[U_B(w)]$  for all  $w$ , where  $K$  is a strictly concave function, then  $r_A < r_B$ .*

*Proof:* Let  $B$ 's optimal search strategy be as follows: reject all offers  $w < r_B$  and accept otherwise. Let  $y_B$  denote the random return that is generated when following this strategy. Likewise let  $A$ 's optimal strategy be: reject all offers  $w < r_A$  and accept otherwise. Let  $y_A$  denote the random return generated by this strategy. Now, determine whether  $r_B$  is an acceptable wage to a type  $A$  worker.

$$U_A(r_B) = K U_B(r_B) = K E U_B(y_B).$$



Since  $y_B$  is the income generated when following  $B$ 's optimal strategy, it must be the case that worker  $B$  is no better off when using  $A$ 's strategy and getting income  $y_A$ , thus

$$K U_B (y_B) \beta K U_B (y_A) \equiv K U_B (E(y_A) - p_{By}),$$

where  $p_{By}$  is the risk premium  $B$  would pay to avoid facing the random income  $y_A$ . With  $A$  being more risk averse than  $B$ ,  $A$ 's risk premium is larger than that of  $B$ ,

$$K U_B (E(y_A) - p_{By}) > K U_B (E(y_A) - p_{Ay}) \equiv U_A (r_A).$$

Hence,  $U_A (r_B) > U_A (r_A)$ .

Thus, any wage that is acceptable to an unemployed type  $B$  worker is also acceptable to an unemployed type  $A$  worker. Given this result let us examine the effect of risk aversion on the Nash bargaining solution.

*Proposition 2: A more risk averse individual will receive a lower wage for all levels of production  $x$ : If  $U_A(w) = K [U_B(w)]$  for all  $w$ , where  $K$  is a strictly concave function, then  $w_A(x) < w_B(x)$  for all  $x$ .*

*Proof:*

We know that  $w_B(x)$  satisfies the following condition,

$$(17) \quad \frac{\partial U_B(w_B(x))}{\partial w_B(x)} [x - w_B(x) - \pi] - U_B(w_B(x)) + U_B(r_B) = 0.$$

Now, evaluate type  $A$ 's first order condition from the Nash bargaining solution at  $w_B(x)$ .

$$\frac{\partial U_A(w_B(x))}{\partial w_B(x)} [x - w_B(x) - \pi] - U_A(w_B(x)) + U_A(r_A) .$$

Use the definition  $U_A(w) \equiv K(U_B(w))$  to get

$$(18) \quad K' \frac{\partial U_B(w_B(x))}{\partial w_B(x)} [x - w_B(x) - \pi] - K(U_B(w_B(x))) + K(U_B(r_A)).$$

Substitute the solution for  $w_B(x)$  from (17) into (18) to get

$$(19) \quad K' [U_B(w_B(x)) - U_B(r_B)] - K(U_B(w_B(x))) + K(U_B(r_A)).$$

Both  $K(\cdot)$  and  $U(\cdot)$  are monotonic, and from the previous result we know that  $r_A < r_B$ , hence the following expression (20) is larger than (19),

$$(20) \quad K' [U_B(w_B(x)) - U_B(r_B)] - K(U_B(w_B(x))) + K(U_B(r_B)) < 0.$$

Since  $w_B(x) < r_B$  and  $K(\cdot)$  is a strictly concave function, (20) is less than zero.<sup>10</sup> Thus, type A's first order condition is less than zero when evaluated at  $w_B(x)$ . From the second order condition, we know that the first order condition is decreasing in  $w$ , thus  $w_A(x) < w_B(x)$  for all  $x$ .

Hence, a more risk averse worker receives a lower wage for all matches. The lower wage that a type A worker earns for each  $x$  shifts A's entire wage distribution to the left and causes the reservation wage to decrease further. This only strengthens the result found above.

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<sup>10</sup> Let  $x_1 < x_2$  and let  $f(x)$  be a strictly concave function, then  $f(x_1) < f(x_2) - f'(x_2) [x_2 - x_1]$ .

#### 4.2. Risk aversion and the wage distribution.

The previous section shows that although it is assumed that the two types are equally qualified and search from the same pool of jobs, a difference in risk aversion will cause a wage gap to arise between the two workers. There are two reasons for this. The first is that the type A worker has less bargaining power, and therefore receives a lower wage for any match  $x$ . The second reason is that the type A worker has a lower reservation wage and therefore accepts less productive matches than those accepted by the type B worker. The purpose of this section is to compare the resulting wage distribution of the more risk averse workers to that of the less risk averse workers.

*Proposition 3: The wage distribution of less risk averse workers dominates in the first-order stochastic sense the wage distribution of more risk averse workers. If  $U_A(w) = K[U_B(w)]$  for all  $w$ , where  $K$  is a strictly concave function, then  $F_A(w) \beta F_B(w)$ , for all  $w \in [0, 1]$  with  $F_A(w) > F_B(w)$  with positive probability.*

*Proof:*

Let  $F_j(w)$  denote the continuous cumulative wage distribution for  $j=A, B$ , where  $w \in [0, 1]$ .

Define  $x_j$  such that  $w_j(x_j) = w$ .  $F_j(w) = 0$  for  $w \in [0, r_j)$  and  $F_j(w) = 1$  for  $w \in (w_j(1), 1]$ .

Finally, for  $w \in [r_j, w_j(1)]$

$$F_j(w) = \int_{r_j}^w f_j(w) dw = \frac{1}{1 - F(r_j)} \int_{r_j}^{x_j \text{ s.t. } w_j(x_j)=w} f(x) dx = \frac{F(x_j) - F(r_j)}{1 - F(r_j)}$$

For  $w \in [r_B, w_A(1)]$  it is seen that since  $x_A > x_B$  and  $r_B > r_A$

$$F_B(w) = \frac{F(x_B) - F(r_B)}{1 - F(r_B)} < \frac{F(x_B) - F(r_A)}{1 - F(r_A)} < \frac{F(x_A) - F(r_A)}{1 - F(r_A)} = F_A(w)$$

It follows that

$$\begin{aligned}
0 = F_B(w) \leq F_A(w) & \quad \text{if} \quad 0 \leq w < r_B \\
F_B(w) < F_A(w) & \quad \text{if} \quad r_B \leq w < w_A(1) \\
F_B(w) \leq F_A(w) = 1 & \quad \text{if} \quad w_A(1) \leq w < 1
\end{aligned}$$

Hence,  $F_B(w) \leq F_A(w) \forall w \in [0, 1]$ , and  $F_B(w) < F_A(w)$  with positive probability.

Given first order stochastic dominance, the wage distribution of less risk averse workers is strictly preferred to that of more risk averse workers. In addition to having a smaller mean and lower median wage, one might expect that the wage distribution of more risk averse workers also has a smaller variance. However, that is not necessarily the case. The results above imply that the effect of risk aversion on the variance of the wage distribution is ambiguous. There are several effects at work. First, if the two types of workers are sampling from the same wage distribution the more risk averse workers will have a lower reservation wage, and as a result their wage distribution will have a larger variance than that of less risk averse workers. Second, if the two types have the same reservation wage,  $r$ , the type  $B$  workers will have a larger range of wages than the type  $A$  workers. That is, the more risk averse workers will have wages in the  $[r, w_A(1)]$  range, and the less risk averse workers will have wages in the  $[r, w_B(1)]$  range, where  $w_A(1) < w_B(1)$ . Finally, the result also depends on whether the wage gap increases or decreases with the productivity level. All else equal, an increasing wage gap increases the variance of the less risk averse workers' wage distribution relative to that of the more risk averse workers. The following section will examine how the wage gap changes with the productivity level.

#### 4.3. Risk aversion and the wage function.

Thus far it has been shown that conditional on  $x$  more risk averse workers receive a lower wage than less risk averse workers. By examining the Nash bargaining solution one can gain insight into the way in which the wage gap changes with the productivity level. The wage gap is increasing if a marginal increase in productivity increases the wage more for the less risk averse worker than it does for the more risk averse worker, conditional on  $x$ . While it is possible to

show that the more risk averse worker faces a flatter wage function conditional on wage, I am not able to show that the same result generally holds when conditioning on the productivity level.

*Proposition 4: At a given wage, the wage function  $w_j(x)$  for a type B worker is steeper than for a type A worker: If  $U_A(w) = K[U_B(w)]$  for all  $w$ , where  $K$  is a strictly concave function, then  $\partial w_A(\cdot)/\partial x < \partial w_B(\cdot)/\partial x$  for all  $w_A(\cdot) = w_B(\cdot)$ .*

*Proof:* Totally differentiate the Nash Bargaining solution:

$$\frac{\partial w}{\partial x} = \frac{1}{2 + (x - w(x))\rho(w(x))}$$

where  $\rho(w(x))$  is the Arrow-Pratt measure of absolute risk aversion. With  $K(\cdot)$  being concave,  $\rho(w(x))$  is larger for the more risk averse worker, hence at a given wage rate, the wage function for a type B worker is steeper than for a type A worker.

Since the more risk averse worker receives a lower wage for all levels of productivity it will always be the case that  $x - w(x)$  is larger for the more risk averse worker. Therefore when preferences exhibit constant or decreasing absolute risk aversion the wage gap is increasing with the productivity level.

*Corollary 4.1: When preferences exhibit decreasing or constant absolute risk aversion the wage gap increases with the productivity level.*

*Proof:* Since a type A individual is more risk averse than a type B individual,  $\rho_A(w) > \rho_B(w)$  and  $w_A(x) < w_B(x)$ . Thus, when preferences exhibit constant absolute risk aversion,  $\rho_A(w_A(x)) = \rho_A > \rho_B = \rho_B(w_B(x))$ , for all  $x$ . Likewise when preferences exhibit decreasing absolute risk aversion, then  $\rho_A(w_A(x)) > \rho_A(w_B(x)) > \rho_B(w_B(x))$ , for all  $x$ . Hence, for both types of preferences it is the case that the slope of the wage function is larger for the less risk averse worker for all values of  $x$ .

In sum, we have found that the wage distribution of more risk averse workers is stochastically dominated by that of less risk averse workers. Thus, both the mean and median wage is lower for the more risk averse workers. However, depending upon the value of the exogenous parameters, the variance of the wage distribution may be either larger or smaller for the more risk averse worker. In addition the more risk averse worker faces a flatter wage function.

#### 4.4. Risk aversion and unemployment

Given the unambiguous effect of risk aversion on the reservation wage, it is straightforward to determine the effect of risk aversion on the equilibrium unemployment rate.

*Proposition 5: If  $r_A < r_B$ , the steady state unemployment rate is smaller for type A workers than for type B workers.*

*Proof*

The unemployment rate is

$$\frac{l_{Uj}}{l_{Uj} + l_{Wj}} = \frac{n + \delta}{n + \delta + \alpha(1 - F(r_j))},$$

which for constant  $\alpha$  is increasing in  $r_j$ .

If more risk averse workers have a lower steady state unemployment rate, then this group of workers must exit unemployment faster than less risk averse workers.

*Proposition 6: If  $r_A < r_B$ , the steady state unemployment duration is smaller for type A workers than for type B workers.*

*Proof*

The per period probability of getting a contract is  $\alpha(1 - F(r_j))$ , which is decreasing in  $r_j$ .

These findings are expected; if more risk averse workers accept lower wages and correspondingly worse matches, a smaller proportion of them will be unemployed, and when unemployed they will have a shorter unemployment duration.

#### *4.5. Risk aversion and labor force participation*

The more risk averse individuals attach less value to an uncertain outcome. Thus, they are more likely to choose the certain home production return over the risky return of entering the labor market.

*Proposition 7: If  $r_A < r_B$ , the probability of a more risk averse individual joining the labor force is less than that of a less risk averse individual.*

*Proof:*

Since  $G(\cdot)$  is monotonic and the threshold level of home production is  $h_j = r_j$ ,

$$G(r_A) < G(r_B).$$

## 5. Application: Male and Female workers

A fundamental assumption of the model is that the degree of risk aversion is identifiable. Thus, the model applies to groups of individuals that are known to differ in their attitudes toward risk. Evidence from the experimental psychology literature suggests that two such groups may be men and women. In a summary of work done on gender differences in risk taking behavior, Arch (1993, p.4) states “...males and females differ in their responses to the physical and social risks present in certain types of situations, with males more likely to perceive such situations as challenging and therefore to be willing to participate, while females tend to see such situations as threatening and pull back from taking the risks.”

Recent empirical evidence in economics also supports the proposition that women are more risk averse than men. Using survey responses Jianakoplos and Bernasek (1996) analyze holdings of risky assets in household portfolios to estimate the ratio of male and female relative risk aversion coefficients. They find that single women have a relative risk aversion coefficient that is significantly higher than that of single men.<sup>11</sup>

These findings in combination with the predictions of the model imply that male and female job experiences should differ in several respects. The predictions are as follows: the more risk averse women are less likely to participate in the labor market and when they do participate they are less likely to be unemployed, thus their unemployment duration is shorter. Women have lower reservation wages and will therefore on average be less productive than equally qualified men. Conditional on productivity, the more risk averse women receive lower wages than men,

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<sup>11</sup> They define risk free assets to include dollar balances in checking, savings, money market accounts, certificates of deposit, U.S. savings bonds, IRA balances invested in certificates of deposit or bank accounts, and the cash value of life insurance less policy loans outstanding. Risky assets are the sum of balances in IRAs not invested in bank deposits, stock holdings less margin loans outstanding, bonds, trust assets, the net value of real estate owned other than residential housing, the net value of businesses owned, and the net value of other miscellaneous assets. Using this definition of risky assets they find that the relative risk aversion coefficient of single males is 32 percent lower than that of single females. When the equity value of houses and cars is included in the definition of risky assets they find a 28 percent difference, and when including the asset value of houses and cars they find a 9 percent difference.



and their wage distribution is stochastically dominated by that of men. Thus, both the median and mean female wages are lower.

Although a careful empirical study is required to test these predictions it is interesting to note that findings of previous research are consistent with the predictions. First, whereas the full time median weekly income was \$418 for women in 1996, that of men was \$557, which implies a wage gap of 25 percent. While a large portion of this wage gap can be explained by factors that are thought to be correlated with productivity, a substantial portion of the wage gap remains unexplained. Most research finds an unexplained wage gap of no less than 10 percent.<sup>12</sup> Second, examining first time jobs of youths, Bowlus (1996) finds that after controlling for race, education and experience, women are willing to accept lower paying jobs than those accepted by men. In fact she finds that the female wage distribution is stochastically dominated by that of men. Third, estimating production functions Voos (1986), Leonard (1984) and Hellerstein et al (1996) show that conditional on productivity females are paid less than males. Fourth, the aggregate employment figures for the U.S. are broadly consistent with the predictions of the model. The labor force participation rate of men was 76.8 percent while that of women was only 59.9 percent. Although the unemployment rate of men and women were both 5.4 percent in 1996, the female unemployment duration was shorter than for men. Women are more likely to be unemployed less than 5 weeks, and less likely to be unemployed more than fifteen weeks. In 1996 the average unemployment duration of women was 15.6 weeks while that of men was 17.7 weeks. Nevertheless, this difference in duration is primarily caused by the fact that unemployed women exit the labor force at a higher rate than do unemployed men. To determine the extent to which gender differences in risk aversion provides an alternative explanation for different male and female job experiences, a careful empirical analysis is required. However, it is interesting to note that evidence from previous research are consistent with the predictions of the model.

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<sup>12</sup> Polachek and Kim (1994), Becker and Lindsay (1995), Light and Ureta (1995), Blau and Ferber (1987), Madden (1985), and Cain (1986).

## 6. Numerical Examples

Although the model lacks a closed form solution, section 4 shows that differences in risk aversion imply that the two types of workers have different labor market experiences. To gauge the sensitivity of the wage gap to differences in risk aversion, it is necessary to parameterize the model. Specifying the parameters of the model also allows us to predict the sign of some of the model's interesting and less intuitive comparative statics. For example, one may wonder whether the number of vacancies will be larger or smaller in an economy with more risk averse workers. Similarly, it would be interesting to know whether individuals prefer an economy in which other potential workers have similar preferences or whether they prefer an economy where relatively more or relatively less risk averse individuals are present. Without a closed form solution it is not possible to compare the steady state of an economy with a group of more risk averse agents to one with less risk averse agents.

To gain insight into the comparative statics of the model, I examine four numerical examples. For illustrative purposes I pick the exogenous variables such that a chosen base line matches aggregate male and female employment data. Thus, in this section the more risk averse group is referred to as female and the less risk averse group is referred to as male. In this hypothetical economy it is shown that although male and female workers differ only by their degree of risk aversion, a substantial wage gap is generated.

To parameterize the model I make the following assumptions:

- (1) the period length is one month.
- (2) individuals have constant relative risk aversion,  $U_j(c) = (c^{1-\rho_j} - 1) / (1-\rho_j)$ ,
- (3) the matching function is  $m = C l_U^\epsilon v^{1-\epsilon}$ , where  $\epsilon = 0.4$  and  $C = 0.0876$ .
- (4) the quality of matches,  $x$ , lies in the  $[0, 1]$  interval and is uniformly distributed.
- (5) home production parameters,  $h_k$ , lie in the  $[0, L]$  interval and are uniformly distributed, where  $L = 0.6119$ .
- (6) the unemployment benefit,  $b = 0.05$ .
- (7) the firm's cost of searching,  $d = 0.2$ .
- (8) the per period population growth rate,  $n = 0.0008$ .
- (9) the per period discount factor,  $\beta = 0.99$ .
- (10) the per period probability of a contract ending,  $\delta = 0.008$ .

The exogenous variables are set such that the equilibrium generated for  $\rho_F = 1.12$  and  $\rho_M = 0.88$  matches the aggregate empirical evidence. This particular base line is chosen because the 28 percent difference in relative risk aversion is consistent with the recent empirical evidence found by Jianakoplos and Bernasek (1996). Furthermore, the average coefficient of relative risk aversion of 1 is consistent with most macroeconomic evidence.<sup>13</sup>

The upper limit on the possible values of the home production capacities,  $L$ , was chosen such that the base line labor force participation of men matches the empirical evidence. With  $L = 0.6119$ , the male labor force participation rate is 76.8 percent which corresponds to the 1996 male participation rate.

Results of Blanchard and Diamond (1989) support a constant returns to scale specification of the matching function  $M = C l_U^\epsilon v^{1-\epsilon}$ , and provide an estimate of the matching elasticity with respect

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<sup>13</sup> Mehra and Prescott (1985) summarize the empirical evidence and find that most studies show a relative risk aversion coefficient between 1 and 2.

to unemployment of  $\epsilon = 0.4$ . By choosing  $C = 0.0876$  the base line female unemployment rate matches the empirical evidence of 5.4 percent. I assume that average male and female job duration is seven years, which corresponds to a probability of dissolution  $\delta = 0.008$ .<sup>14</sup> The annual population growth is set to one percent and the annual discount factor is set equal to 0.9.

To evaluate the plausibility of the base line, Table 1 compares the resulting endogenous variables to the aggregate employment figures from 1996. While the female unemployment rate is anchored at 5.4 percent, the male unemployment rate of 5.9 percent is higher than the actual 5.4 percent. Actual labor force participation decisions of women are obviously affected by factors that are not included in this model.<sup>15</sup> Therefore, it is not surprising to find that the base line labor force participation rate for women is large compared with actual female labor force participation.

**TABLE 1**  
Comparison of Baseline and Aggregate Data

	Female		Male	
	Base Line	1996	Base Line	1996
Unemployment	5.4	5.4	5.9	5.4
Labor force participation	68.2	59.9	76.8	76.8
P(duration $\leq$ 3 months) <sup>16</sup>	40.4	43.9	37.3	39.9
P(duration $>$ 1 year)	12.6	9.9	15.5	13.1

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<sup>14</sup> Valdivia(1995) uses results from Marston (1976) and sets the quarterly transition probability at .015; Elaine Sorensen (1989), using 1984 data from the PSID, finds that average job tenure for women is 6.348 , and 9.824 for men. However, using 1983 data from the CPS she finds that average job tenure for women is 5.782 while that of men is 7.909.

<sup>15</sup> Child bearing and child rearing.

<sup>16</sup> The unemployment duration for 1996 is calculated by using the mean unemployment duration and assuming constant exit rates.

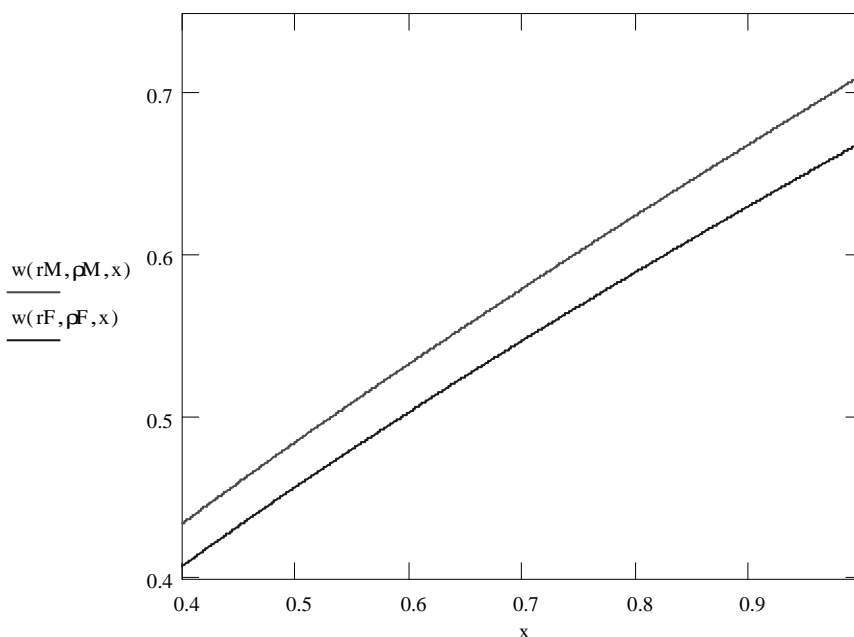
In any given period one out of four unemployed workers gets matched with a vacancy, but given the reservation wages, the probability of finding an acceptable match is much lower. In each period 14 percent of unemployed males and 16 percent of unemployed females find employment. The empirical counterpart is the mean unemployment duration which is 15.6 weeks for women and 17.7 weeks for men. Assuming that the probability of exiting unemployment is constant over time, this corresponds to a monthly exit rate of 18 percent for women and 16 percent for men. As seen in Table 1 the numerical solution slightly overpredicts the unemployment duration.

The results for the overall base line are summarized in the shaded column of Table 2. It is seen that the female reservation wage is 11.3 percent lower than the male reservation wage, causing a substantial 7.6 percent average male-female wage gap. The lower reservation wage and the higher degree of risk aversion shifts the entire female wage distribution to the left. In response to this shift the reservation wage decreases, causing yet another shift in the wage distribution. Due to this feedback effect it is not possible to determine whether the wage gap occurs primarily as a result of the effect of risk aversion on searching or the effect of risk aversion on bargaining. Holding the reservation wage constant a relatively small wage gap is found between males and females and one is led to believe that differences in the male and female reservation wage account for more than ninety percent of the average wage gap.<sup>17</sup> However, when holding the wage distribution constant a small difference in male-female reservation wages is found, thus it appears as if the effect of risk aversion on bargaining is driving the result.<sup>18</sup> It is therefore not possible to disentangle the effects.

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<sup>17</sup> If women had the same reservation wage as men, their average wage would be 0.592. If men had the female reservation wage, their average wage would be 0.552.

<sup>18</sup> If women were faced with the male wage distribution the resulting reservation wage would generate an average female wage of 0.587. If men were faced with the female wage distribution the resulting reservation wage would imply an average wage of 0.555. Thus, it appears as if differences in bargaining power account for more than 80 percent of the wage gap.



**FIGURE 1**  
Male and female wage functions in the base line

The male and female wage functions are illustrated in Figure 1. Given the assumed preference structure, workers' absolute risk aversion is decreasing. As predicted in corollary 4.1., that implies that the male wage function is steeper than the female wage function for all productivity levels,  $x$ . Thus the male-female wage gap increases with  $x$ .

Although the wage gap is increasing, the difference between the male and female reservation wage is so large that the variance of the female wage distribution is larger than for male workers. As shown in section 4.2. this result is sensitive to the values of the exogenous variables. When analyzing other steady states it was found that in some instances the more risk averse worker faces a wage distribution which has a smaller variance than that of the less risk averse worker.

While the wage distribution of men is strictly preferred to that of women, the female unemployment rate is lower than that of men. It is therefore possible that the female workers prefer the female scenario to the male scenario. That is, if given the choice, it may be that women would choose the female wage distribution and unemployment rate to that of male workers. However, calculating the present discounted utility of searching reveals that the female

workers would be better off if faced with the male scenario.<sup>19</sup>

The unshaded columns of Table 2 shed light on the comparative statics of changes in male and female risk aversion. When moving from left to right in Table 2, the overall risk aversion in the economy increases. In the first column men and women have the same “low” degree of risk aversion. In the next two columns women become more risk averse. Holding the female risk aversion constant at a “high” level, the last column illustrates how the equilibrium changes when men become more risk averse.

Let us examine how an equilibrium with less risk averse women compares to one with more risk averse women. Denote the economy depicted in column 2 as Economy I, and denote the economy depicted in column 3 as Economy II. The female relative risk aversion coefficient is 5 percent larger in Economy II than in Economy I.

As expected the more risk averse females in Economy II have a lower reservation wage, and a lower average wage than females in Economy I. Due to the larger gap in risk aversion the average male-female wage gap in Economy II is 7.6 percent, compared to 5.9 percent in Economy I. Although the proportion of unemployed females is smaller, they accept a larger share of the available matches and conditional on productivity will receive a lower wage, hence the firms’ expected profit per contract is higher in Economy II. As a result of the zero expected profit condition, the firm’s probability of getting a match is smaller and the steady state vacancy rate is slightly higher in Economy II. Combined with the smaller per capita number of unemployed workers, this implies that the workers’ probability of getting a match is higher in the more risk averse economy. Thus, the male reservation wage is higher in Economy II. Despite the increase in the reservation wage the increased probability of getting a match with a vacancy results in a decrease in the male unemployment rate from 6.0 percent to 5.9 percent. This comparison shows that less risk averse workers benefit when other workers in the market are

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<sup>19</sup> Present discounted utility of searching for female workers is -105.83 if faced with the female wage distribution and unemployment rate, while it is -99.81 if faced with the male scenario.

more risk averse.

In contrast, the more risk averse workers benefit from a more homogeneous population. Comparing the average wage in the base line to that in an economy where all workers have the female preference structure (column 4), it is seen that the average female wage would be higher if all agents had the same preferences. Also despite the higher labor force participation in this homogeneous scenario, fewer female workers are unemployed. This is due to the fact that the matching probability is 10 percent higher in the homogeneous economy.



**TABLE 2**  
Numerical Solution

	Low	Med, Low	High, Low	High
Relative risk aversion coef. $\rho_F(r)$	.877	1.067	1.123	1.123
Relative risk aversion coef. $\rho_M(r)$	.877	.877	.877	1.123
Reservation wage $r_F$	.457	.427	.417	.432
Reservation wage $r_M$	.457	.467	.470	.432
Average $w_F$	.584	.557	.549	.561
Average $w_M$	.584	.592	.594	.561
Standard deviation of $w_F$	.071	.073	.073	.072
Standard deviation of $w_M$	.071	.070	.070	.072
F labor force participation	74.7	69.7	68.2	70.6
M labor force participation	74.7	76.3	76.8	70.6
F's unemployment rate	6.2	5.6	5.4	5.1
M's unemployment rate	6.2	6.0	5.9	5.1
Workers prob. of a match, $\alpha$	.251	.267	.272	.298
Female prob. of job	.137	.153	.159	.169
Male prob. of job	.137	.142	.144	.169
Prob. of match w/ F, $\phi$	.5	.460	.448	.5
Expected profit per match	.079	.082	.083	.088
Number of vacancies, $v$	.269	.271	.272	.275
Firms prob. of a match, $\gamma$	.043	.042	.041	.039
Number of matches, $m$	.012	.011	.011	.011

While the assumed risk aversion gap is based on the empirical finding of Jianakoplos and Bernasek, it is of interest to know how sensitive the wage gap is to this difference. Assuming that the average relative risk aversion coefficient is 1, Figure 2 illustrates how the female-male wage gap monotonically increases with the percentage difference between the female and male relative risk aversion coefficient.

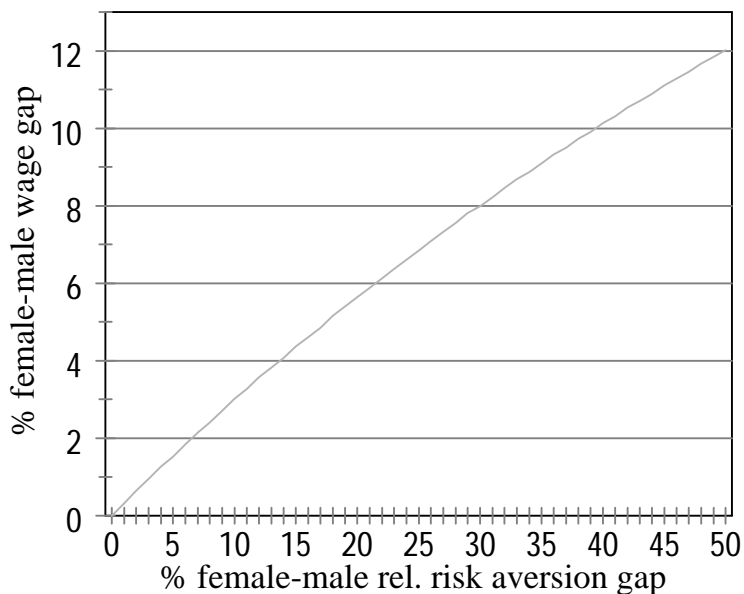


FIGURE 2  
RISK AVERSION VS. WAGE GAP

In sum, these numerical results demonstrate that the wage gap is quite sensitive to differences in risk aversion, and that workers as well as firms prefer an environment where other workers are more risk averse.

## 7. Conclusion

This paper has examined the effect of risk aversion on the wage distribution and on equilibrium participation and employment in a simple matching model. The solution to the model demonstrates that when there is not instantaneous matching, differences in risk aversion can result in fundamental differences in labor market experiences. In particular, two workers who are equally qualified and search from the same pool of jobs will not receive the same wage if they differ in their attitudes toward risk. The more risk averse workers accept lower quality matches, and conditional on productivity they receive lower wages. Therefore their wage distribution is stochastically dominated by that of less risk averse workers. Numerical solutions to the model suggest that this wage gap may be quite large. The model also predicts that less risk averse

workers are more likely to participate in the labor market and, conditional on participation, they have higher unemployment rates and expect longer unemployment spells.

This model may be applied to understand the job market experiences of groups in the population that are known to differ in their attitudes toward risk. For example, the experimental psychology literature and recent empirical studies in economics provide evidence that women are significantly more risk averse than men. If this finding is correct, the model analyzed in this paper predicts that when comparing workers in equally productive jobs, women receive lower pay than men, and when comparing average productivity across gender, women are less productive than men.

Such predictions are consistent with empirical evidence. When median weekly earnings of full-time female workers are compared to those of full-time male workers, one finds that the female/male earnings ratio has been in the .60-.80 range for the past 30 years. Many attempts have been made to explain this large and persistent wage gap, and although it has been found that a portion of the gap can be explained by productivity differences, between 30 and 50 percent of the wage gap cannot be explained by observable factors.

This unexplained portion of the wage gap has often been interpreted as being inconsistent with the fundamental assumption of profit maximizing behavior. However, the random quality of job matches generated in the matching model serves to explain why firms might continue to hire less risk averse workers despite the difference in wages. Thus, this paper has shown that if women are more risk averse than men, then the observed wage gap is consistent with both profit and utility maximizing behavior.

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