Employee Referrals and Efficiency Wages[*]

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Abstract

Many workers believe that personal contacts are crucial for obtaining jobs in high-wage sectors. On the other hand, firms in high-wage sectors report using employee referrals because they help provide screening and monitoring of new employees. This paper develops a matching model that can explain the link between inter-industry wage differentials and use of employee referrals. Referrals lower monitoring costs because high-effort referees can exert peer pressure on co-workers, allowing firms to pay lower efficiency wages. On the other hand, informal search provides fewer job and applicant contacts than formal methods (e.g., newspaper ads). In equilibrium, the matching process generates segmentation in the labor market because of heterogeneity in the size of referral networks. Referrals match 'good' high-paying jobs to well-connected workers, while formal methods match less attractive jobs to less-connected workers. Industry-level data show a positive correlation between industry wage premia and use of employee referrals. Moreover, evidence using the NLSY shows similar positive and significant OLS and fixed-effects estimates of the 'returns' to employee referrals, but insignificant effects once sector of employment is controlled for. This evidence suggests referred workers earn higher wages not because of higher unobserved ability or better matches but rather because they are hired in high-wage sectors.

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I. Introduction

       In their 1962 study of the Chicago Labor Market, Albert Rees and George Schultz (1970) found that employers in high-wage sectors rely extensively on employee networks to fill vacancies. According to the study, high-wage employers prefer hiring through referrals because they provide screening and monitoring of new employees. In contrast, employers in low-wage sectors prefer using formal methods, such as newspaper ads and employment agencies.

       Ethnographic studies of the workplace also document the link between the payment of wage premia and employee networks. For example, a study of Boston's labor market by Wial (1991) found that workers believe that obtaining a 'good' job requires either "luck or the help of a friend or relative who put[s] in a good word with the boss."[1] In contrast, according to the working class youths studied by Wial, low-wage jobs are easily obtained without the need for personal contacts.

       This paper develops an equilibrium matching model that generates a link between inter-industry wage differentials and use of employee referrals, as suggested by these accounts. In the model, workers and employers match through referrals or formal methods. The benefit of using referrals is that they lower monitoring costs, since workers can exert peer pressure on co-workers. The cost is that this provides fewer contacts for workers and firms than formal methods. Since the size of referral networks varies across firms and workers, there is heterogeneity in the efficiency of referral search. This means that while firms and workers with large networks prefer to use referrals, others are better

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[1] Workers in Wial's study considered 'good' jobs to be jobs that offered high pay and considerable job security. Examples of 'good' jobs provided by these employees included jobs in Public Utilities, Transportation, Repair Services, and Construction, all industries which have been documented to pay wage

off using formal methods. Moreover, since referrals lower monitoring costs, firms relying on referrals find it cheaper to elicit effort by paying efficiency wages than firms using formal hiring methods. In equilibrium, the matching process generates segmentation in the labor market: referrals match 'good' high-paying jobs to well-connected workers, while formal methods match less attractive jobs to less-connected workers.

To test the implications of the model, I match Krueger and Summers' (1987) estimates of industry wage premia with estimates from the NLSY on the percent of workers hired through employee referrals by industry, controlling for (CPS) average education and experience by industry, and information on industry characteristics (e.g., unionization rates, sales, assets, concentration ratios) from the National Organizations Survey. The data show positive correlations between industry wage premia and the percent of workers hired through employee referrals.

Since the correlations based on industry-level data could be capturing the correlation between industry premia and percent referred and other omitted factors (e.g., workers' unobserved ability in the sector), I also present evidence using individual-level data from the NLSY. Fixed-effects estimates of the 'returns' to employee referrals are only slightly lower than OLS estimates, suggesting that referred workers are not earning higher wages simply because they have higher unobserved ability. Moreover, fixed-effects estimates are larger for the sub-sample of industry-switchers, indicating that referrals are particularly useful for those changing sectors. On the other hand, the 'returns' to referrals disappear once sector of employment is controlled for, suggesting that referred workers

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premia (see, Krueger and Summers, 1987, 1988). Finally, workers in the study saw 'good' jobs as being scarce, in the sense that there was always an excess supply of entry-level job applicants for these jobs.

earn higher wages not because of higher unobserved ability or better matches but rather because of the sectors they are hired into.

The analysis in this paper links together two important strands of literature in labor economics: research on the inter-industry wage structure and efficiency wages, and research on the incidence of employee referrals. The latter literature has documented that referred workers earn higher wages and have higher productivity and lower quit rates, without controlling for sector of employment.[2] This work generally argues that referred workers earn higher wages and have higher productivity because referrals provide information either to employers about the unobserved quality of workers or to workers about the quality of matches.[3] The model in this paper suggests instead that referrals lower monitoring costs, allowing referred workers to obtain high-paying jobs and making it less likely for them to quit. There is little empirical evidence, however, examining the link between use of referrals and firm and industry characteristics.[4] On the other hand, the literature on the inter-industry wage structure shows persistently higher wages and lower quit rates in some sectors and lower wages and higher quit rates in other sectors after controlling for observed human capital characteristics, working conditions, and individual fixed effects.[5] This paper provides evidence that industry wage premia are correlated with

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[2] The higher wages, higher productivity, lower turnover, and higher tenure of referred workers are documented by Corcoran et al. (1980), Datcher (1983), Staiger (1990), Simon and Warner (1992) and Holzer (1997). These studies, however, do not control for sector of employment.

[3] See Saloner (1985) and Montgomery (1991) for explanations of referral use based on unobserved worker quality and Staiger (1990) and Simon and Warner (1992) for match quality explanations.

[4] Aside from the study of the Chicago labor market by Rees and Schultz (1970), only a study by Holzer (1997) attempts to relate firm characteristics to use of employee referrals.

[5] See, e.g., Krueger and Summers (1987, 1988) who estimate large and significant industry wage premia using a variety of control strategies with CPS and QES data. Similarly, Gibbons and Katz (1992) provide further evidence from the DWS using a sample of approximately exogenous industry-switchers (i.e., workers displaced by plant closings). More recently, Abowd, Kramarz, and Margolis (1999) have used matched employer-employee French data to decompose annual compensation per worker into personal and firm heterogeneity. Consistent with the payment of non-competitive wages, they find that firms that pay higher wages, controlling for person effects, are more productive and more profitable.

use of employee referrals. Moreover, the evidence suggests that the reason why referred workers earn higher wages is not because they have higher unobserved ability or better matches but because they are hired in high-wage sectors.

The paper is organized as follows. Section II models the matching process and derives the endogenous split between referral and formal matches in the economy. Section III presents empirical evidence on the payment of wage premia to referred workers and contrasts the evidence against alternative explanations of the 'returns' to employee referrals. Section IV concludes.

II.   Theoretical Set-up: Matching with Referrals and Formal Search

This section introduces an equilibrium matching model that generates a link between inter-industry wage differentials and use of employee referrals. In the model, workers and firms can search through referrals or formal methods.[6] The benefit of referrals is that they lower monitoring costs because high-effort referees can exert peer pressure on co-workers. The downside of referrals is that they provide fewer contacts for workers and firms. Heterogeneity in the size of referral networks, however, implies that some firms and workers may rely more on referrals while others may rely more on formal methods.

A. Structure

Workers can be either employed or unemployed. The unemployed get unemployment benefits, b, while searching for a job. The arrival rate of offers is $p(\theta)$ when searching formally and $\beta_i p(\theta)$ when searching through referrals, where $p(\theta)$ is the

arrival rate of job offers, $\theta = v / u$ is the ratio of vacancy to unemployment rates, and β_i is the arrival rate of encounters with those in one's social network. Workers differ in the size of their social networks. In particular, the arrival rate of encounters with those in the network is distributed uniformly over the unit interval. I assume the matching function is such that $p'(\theta) > 0$.

Firms can have either filled or vacant jobs. There is free-entry, so that the expected value of a vacancy is zero in equilibrium. Firms face a cost, C, of holding a vacancy, which can be filled using referrals or formal methods. The arrival rate of applicants is $q(\theta)$ when using formal methods and $\gamma_j q(\theta)$ when using referrals, where $q(\theta)$ is the arrival rate of acceptances and γ_j is the arrival rate of encounters with the network members of firm j's employees. The arrival rate of firms' encounters with those in their employees' networks is distributed uniformly over the unit interval. I assume $q'(\theta) < 0$. The separation rate from all jobs is denoted by λ.

Once jobs are filled, firms pay the wage, w_M, that minimizes labor costs per efficiency unit when hiring through method M, where M=R,F. Employment contracts are negotiated in advance and cannot be renegotiated. Firms paying low wages obtain only ϕA units of output from employed shirkers where $1 > \phi \geq 0$, while firms paying high wages elicit worker effort and obtain A units of output per unit of time. Firms that do not find it worthwhile to pay efficiency wages to eliminate shirking bargain with workers to share the economic rents generated from matches.[7] Rents are shared according to Nash bargaining,

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[6] The model assumes a binary choice between informal and formal search to capture the fact that most firms and workers concentrate their search by using either personal contacts or formal methods, while few use other search methods.

[7] Frictions in the labor market, imply that matches generate economic rents equal to the sum of the cost of search and the cost of hiring.

where π is the bargaining power of workers. In contrast, firms wanting to elicit effort from workers pay the efficiency wage which satisfies the no-shirking condition.[8]

Once employed, workers choose whether to exert effort, $e = \hat{e}$, or to exert no effort, $e = 0$. Workers' disutility of work is $\hat{e}^2$. Individual effort levels are observed by firms only with an error, so that there is imperfect monitoring. Shirkers are caught and dismissed with probability κ. In addition, referees can lower firms' monitoring costs through peer effects. The social psychology literature highlights the importance of peer-pressure in both increasing and reducing effort in work groups, suggesting that workers prefer conformist behavior at the workplace.[9] Moreover, since current employees are often thought to "put their reputations on the line" when referring friends, these friends are likely to be specially prone to peer-pressure from referees.[10] A simple formulation of this idea models peer pressure as costing $\rho(e_W - e_R)^2$ in terms of worker utility, where e_W is the effort level of a referee and e_R is the effort level of a referred worker.

B. Solution

Choice of Wages

Firms decide whether to offer high wages that motivate workers to produce a high level of output or to offer low wages. The firms' goal is to pay the wage that maximizes

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[8] Due to the problem of observability of effort, it is assumed that firms pay efficiency wages because they cannot specify an enforceable employment contract, where the wage paid to an individual depends on his actual effort level. As in Malcomson (1981) and MacLeod and Malcomson (1989), the types of contracts described here are incomplete contracts with discretionary dismissals. See Malcomson (1981) for a detailed discussion of the problem of observation and why this generates incomplete contracts.

[9] According to this literature, the workplace is often characterized by informal norms among workers that regulate work effort by setting lower as well as upper limits. See for example, Roethlisberger and Dickson (1939), Dalton (1948), Roy (1952), and Jones (1984) for accounts of this kind of behavior.

[10] While peer effects within work groups may operate even when workers do not refer each other, peer effects are likely to be stronger when workers interact both at work and in a social context.

the lifetime stream of profits of a job filled through method M, J_M. The Bellman equation for a filled job is

$$rJ_M = Q(A) - w_M + \lambda(V_M - J_M),$$

(1)

where $Q(A)$ is revenue which equals A if firms pay efficiency wages and ϕA if firms pay bargained wages, and V_M is the value of a vacancy filled through method M, where the Bellman equations for vacancies being filled through referrals and formal methods are

$$rV_R = - C + E[\ \gamma_j q(\theta)(J_R - V_R)\ |\ R],$$

(2a)

$$rV_F = - C + q(\theta)(J_F - V_F).$$

(2b)

To elicit effort, firms must pay a wage high enough for workers to be indifferent between working and shirking. This means the wage has to satisfy a no-shirking condition, $E_M \geq S_M$, where E_M and S_M are the expected lifetime utilities for an employed worker and an employed shirker hired through method M. Lifetime utilities for those matched through referrals are determined by

$$rE_R = w_R - \hat{e}^2 + \lambda(U_R - E_R),$$

(3a)

$$rS_R = w_R - \rho\hat{e}^2 + (\lambda + \kappa)(U_R - E_R),$$

(4a)

where U_R is the lifetime utility for an unemployed worker searching through referrals,

$$rU_R = - b + E[\ \beta_i p(\theta)(E_R - U_R)\ |\ R\ ].$$

(5a)

Similarly, lifetime utilities for employed and unemployed workers matched through formal methods are

$$rE_F = w_F - \hat{e}^2 + \lambda(\ U_F - E_F\ ),$$

(3b)

$$rS_F = w_F + (\ \lambda + \kappa\ )(\ U_F - E_F\ ),$$

(4b)

where U_F is the lifetime utility for an unemployed worker searching formally,

$$rU_F = -\ b + p(\theta)(\ E_F - U_F\ ),$$

(5b)

Substituting (3a)-(5a) and (3b)-(5b) into the no-shirking condition yields the efficiency wages, $w_R{}^e$ and $w_F{}^e$, paid by firms using referrals and formal methods. Lemma 1 compares these (all proofs are in the Appendix).

<u>Lemma 1</u>: Efficiency wages paid when hiring formally and when hiring through referrals compare as follows:

$$(\ w_F{}^e - w_R{}^e\ ) = [\ (\ \rho + \overline{\beta}^2\ )\ p(\theta)/2 + (\ r + \lambda\ )\ \rho\ ]\ \hat{e}^2\ /\ \kappa > 0,$$

where $\overline{\beta}$ is the highest arrival rate of contacts inducing referral search.

Firms using employee referrals pay lower efficiency wages for two reasons. First, referrals lower monitoring costs, allowing firms to pay lower efficiency wages to motivate workers. High-effort referees are willing to put in a good word for their friends, but since they "put their reputations on the line" they credibly threaten to impose peer-pressure on shirking friends. Second, since referral search is less effective in generating contacts, it is harder for workers using referrals to find alternative job opportunities and thus firms can pay lower wages to motivate workers.

Firms may instead choose to pay the market wage and tolerate shirking. Since there is frictions in the labor market, matches generate economic rents that are split between workers and firms according to the following Nash bargaining condition:

$$(1 - \pi)\ (\ E_M - U_M\ ) = \pi\ (\ J_M - V_M\ ).$$

(6)

Substituting the firms' and workers' surpluses when using referrals into (6) yields the market wage paid if hiring through referrals:

$$w_R^* = \{ \pi[\, r + \lambda + (\, 1 - \overline{\beta^2}\,)p(\theta)/2\,](\, \phi A + C\,) + (1-\pi)[\, \underline{r} + \lambda + (\, 1 - \overline{\gamma^2}\,)q(\theta)/2\,]b\, \} \, / $$
$$\{\, r + \lambda + (1-\pi)(\, 1 - \overline{\gamma^2}\,)q(\theta)/2 + \pi(\, 1 - \overline{\beta^2}\,)p(\theta)/2\, \}.$$

Similarly, substituting the formal surpluses into the Nash-bargaining condition yields the formal market wage:

$$w_F^* = \{\, \pi\, (\, r + \lambda + p(\theta)\,)(\, \phi A + C\,) + (1-\pi)(\, r + \lambda + q(\theta)\,)b\, \}/$$
$$\{\, r + \lambda + (1-\pi)q(\theta) + \pi p(\theta)\, \}.$$

Lemma 2 compares the market wages paid by firms hiring through referrals and formal methods.

Lemma 2: Market wages are lower when hiring formally than when hiring through referrals:

$$(\, w_F^* - w_R^*\,) < 0,$$

if $q(\theta) \gg p(\theta)$.

Firms filling jobs using method M choose between paying efficiency wages, w_M^e, or market wages, w_M^*, depending on which maximize the lifetime stream of profits, J_M. Comparing J_R for firms paying efficiency and market wages, it follows that firms hiring through referrals pay efficiency wages if $A(\, 1 - \phi\,) \geq (\, w_R^e - w_R^*\,)$ and market wages if $A(\, 1 - \phi\,) < (\, w_R^e - w_R^*\,)$. Similarly, firms hiring formally pay efficiency wages if $A(\, 1 - \phi\,) \geq (\, w_F^e - w_F^*\,)$ and market wages if $A(\, 1 - \phi\,) < (\, w_F^e - w_F^*\,)$.

Lemmas 1 and 2 imply the difference between efficiency and market wages is greater when using formal methods than when using referrals, i.e., $(\, w_F^e - w_F^*\,) > (\, w_R^e - w_R^*\,)$. Consequently, there are three possible configurations of wage choices in equilibrium:

<u>Case 1</u>: $A(1 - \phi) \geq (w_F^e - w_F^*) > (w_R^e - w_R^*)$. Firms hiring through referrals and formal methods pay efficiency wages.

<u>Case 2</u>: $(w_F^e - w_F^*) > A(1 - \phi) \geq (w_R^e - w_R^*)$. Firms hiring through referrals pay efficiency wages and firms hiring formally pay market wages.

<u>Case 3</u>: $(w_F^e - w_F^*) > (w_R^e - w_R^*) > A(1 - \phi)$. Firms using referrals and formal methods pay market wages.

For the rest of this section I focus on case 2. In case 1, all workers opt to search formally since efficiency wages are higher when using formal methods than when using referrals, and formal methods are also a more efficient search method. This implies that no firm will ever find it worthwhile to search through referrals. In case 3, all firms opt to hire formally since market wages are lower when using formal methods than when using referrals and formal methods are also a more efficient search method. This implies that no worker will ever find it worthwhile to search through referrals. This means that the use of both referrals and formal search may only arise in case 2.

Firms' Choices of Hiring Methods

In case 2, firms decide between hiring through referrals and paying efficiency wages or hiring formally and paying bargained wages. Since the benefit of using referrals rises with firms' arrival rates of encounters, γ_j, firms connected to larger networks prefer to use referrals while firms with smaller networks prefer to use formal methods. The critical value of the arrival rate of encounters which makes a firm indifferent between the two methods is

$$\bar{\gamma} = \{ (r + \lambda)(\phi A - w_F^* + C) \} / \{ (r + \lambda) (A - w_R^e + C) + q(\theta)(A - (w_R^e - w_F^*)) \}, \tag{7}$$

which gives $\bar{\gamma}$ as a function of the labor market tightness parameter, θ. Consequently, firms with idiosyncratic arrival rates of encounters $\gamma_j \in [\bar{\gamma}, 1]$ find it optimal to use

employee referrals and pay efficiency wages, while firms with arrival rates $\gamma_j \in [\ 0\ ,\ \overline{\gamma}\ ]$ find it optimal to hire formally and pay the market wage. The critical value that triggers the use of referrals falls as the cost of tolerating shirking increases (i.e., ϕ decreases), the cost of holding a vacancy falls (i.e., C falls), workers' productivity increases (i.e., A increases), and the separation rate falls (i.e., λ falls).

Workers' Choices of Search Methods

In practice, workers typically concentrate on a few methods when searching for work.[11] In the model, this dichotomy is captured by assuming workers use either formal methods or social networks.

Unemployed workers observe the wages paid by firms hiring through each method and focus their search accordingly. In particular, worker i chooses the search method that maximizes the value of being unemployed. As for firms, the workers' benefit of using referrals rises with the arrival rates of encounters, β_i. Workers connected to larger networks find it easier to rely on referrals, while workers with smaller networks prefer relying on formal methods. The critical value of the arrival rate of encounters which makes a worker indifferent between the two methods is

$$\overline{\beta} = \{\ \kappa\pi(\ \phi A - b + C\ )\ \}\ /\ \{\ (\ 1 - \rho\ )\hat{e}^2[\ r + \lambda + (1-\pi)q(\theta) + \pi p(\theta)\ ]\ \}.$$

(8)

Consequently, workers with idiosyncratic arrival rates of encounters with network members $\beta_i \in [\ \overline{\beta}\ ,\ 1\ ]$ find it optimal to rely on employee referrals to find jobs, while workers with arrival rates $\beta_i \in [\ 0\ ,\ \overline{\beta}\ ]$ find it optimal to search formally. The critical value that triggers search through referrals falls as the disutility of effort, $\hat{e}$, decreases; the

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[11] See, for example, the evidence presented by Holzer (1988).

cost of peer pressure, ρ, decreases; the probability of being caught shirking, κ, decreases; the separation rate, λ, increases; and unemployment benefits, b, increase.

The split of firms and workers into the two search methods indicates that, in case 2, the matching process generates segmentation in the labor market, where referrals match 'good' high-paying jobs to well-connected workers and formal methods match less attractive jobs to less-connected workers.

Vacancy Creation

To close the model, the vacancy and unemployment rates need to be determined. The vacancy rate is pinned down using the free-entry condition. Since firms' network size is only realized after entry, free-entry implies that the expected value of a vacancy must be zero,

$$\overline{\gamma}\, V_F^* + (1 - \overline{\gamma})\, V_R^e = 0,$$

(9)

where $(1 - \overline{\gamma})$ and $\overline{\gamma}$ are the probabilities of using referrals and formal methods; V_F^* is the value a formal vacancy which offers market wages, and V_R^e is the value of a referral vacancy which offers efficiency wages, and their corresponding Bellman equations are

$$rV_R^e = -C + E[\, \gamma_j\, q(\theta)(A - w_R^e + C) / (r + \lambda + \gamma_j q(\theta)) \mid R\,],$$

$$rV_F^* = -C + [\, q(\theta)(\phi A - w_F^* + C) / (r + \lambda + q(\theta))\,].$$

The free-entry condition above provides a relationship between $\overline{\gamma}$ and the labor market tightness parameter, θ. Equation (7), which determines the split of firms between the two search methods, provides the other relationship between $\overline{\gamma}$ and θ. Figures 1a and 1b graph the search behavior and free-entry conditions in θ - $\overline{\gamma}$ space, and determine the equilibrium values of $\overline{\gamma}$ and θ.

Steady-State Unemployment

The unemployment rate is determined by the steady-state condition. In steady-state, the flow into unemployment for workers hired through both methods has to be equal to the flow out of unemployment for workers searching through both methods. Thus, the steady-state condition is

$$\lambda(1 - u) = \overline{\beta} \, p(\theta)u + (1 - \overline{\beta}) \, E[\, \beta_i \, p(\theta)u \mid R \,].$$

where $(1 - u)$ and u are the shares of employed and unemployed workers, and $(1 - \overline{\beta})$ and $\overline{\beta}$ are the shares of workers using referrals and formal methods, respectively. Solving for the unemployment rate yields,

$$u = 2\lambda \, / \, \{\, 2\lambda + p(\theta)[\, 2 \, \overline{\beta} + (1 - \overline{\beta})(1 - \overline{\beta}^2) \,] \,\},$$

(10)

which falls with $\overline{\beta}$. That is, greater search through referrals increases the unemployment rate because referral networks are less efficient in generating contacts. In addition, externalities in search further increase unemployment since workers' reliance on referrals generates congestion in social networks.

C. Matching, Labor Market Segmentation, and Unemployment Benefits

In case 2, the matching process generates labor market segmentation, with well-connected workers using referrals to jump job queues for good jobs and those with less connections searching formally. This division of firms and workers between referrals and formal search is, however, unlikely to be efficient because of congestion externalities in search. Workers deciding to search through referrals consider their probability of obtaining 'good' jobs without considering the negative effects of their decisions on others. By searching through referrals, workers lower everyone else's probability of getting good

jobs and this congestion implies that 'too many' people search through referrals making unemployment inefficiently high.

Policies that reduce the use of referrals move unemployment closer to its optimal level. For example, a reduction in unemployment benefits reduces workers' reliance on referrals,

$$d\,\overline{\beta}/db = -\kappa\pi\,/\,\{\,(1-\rho)\hat{e}^2[r + \lambda + (1-\pi)q(\theta) + \pi p(\theta)]\,\} + d\,\overline{\beta}/d\theta \times d\theta/db < 0.$$

This is because unemployment benefits implicitly subsidize search, so a reduction in unemployment benefits induce workers to rely on faster search methods. In addition, the reduction in unemployment benefits lowers the efficiency wages paid by firms hiring through referrals, making referral jobs less attractive.

This reduction in use of referrals unambiguously lowers unemployment, because workers rely on faster search methods and there is less congestion in search. This is captured by the first term in the comparative statics of the unemployment rate with respect to b,

$$du/db = du/d\,\overline{\beta} \times d\,\overline{\beta}/db + du/d\theta \times d\theta/db,$$

where, as shown above, $du/d\,\overline{\beta} < 0$ and $d\,\overline{\beta}/db < 0$. The second term, however, can be either positive or negative depending on whether π is high or low. For low π, a reduction in unemployment benefits reduces unemployment not only because workers rely more on formal methods, thus reducing congestion, but also because formal and referral wages fall and firms generate more vacancies.

III.   Evidence on Employee Referrals and Industry Wage Premia

The model in the previous section establishes a theoretical link between employee referrals and wage premia. In particular, the model suggests the reason why referred

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workers earn higher wages is that they are hired by firms paying wage premia to avoid shirking. In this section, I explore this idea empirically.

A. Evidence from Industry Data

To investigate the relation between use of employee referrals and inter-industry wage premia, I merge data on industry wage premia, percent of referrals by sector, and industry characteristics from various sources. I use two measures of industry premia estimated by Krueger and Summers (1987) using the 1984 Current Population Survey (CPS), with and without labor quality controls where the controls include education and its square, six age dummies, eight occupation dummies, gender and race dummies, a central city dummy, a union member dummy, an ever married dummy, veteran status, and interactions of marriage, education, and age with gender. I estimate the percentage of workers referred by current employees in two-digit industries from the 1982 National Longitudinal Survey of Youth (NLSY). The advantage of using data from the 1982 NLSY is that it contains precise information on whether workers hired in a particular industry were referred by *current* employees.[12] I use the 1984 CPS to estimate the average years of education and potential experience in two-digit industries. Finally, I obtain data on industry characteristics for two-digit industries from the National Organizations Survey (NOS), including the percent of unionized workers in the industry, industry concentration, and average establishment size, sales and assets in the industry.[13]

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[12] Since in 1982 the NLSY asked workers whether their jobs were found through personal references from *current* employees, this provides a measure of referrals which closely captures the peer monitoring story presented in the previous section. A shortcoming of the NLSY is that it only includes persons between the ages of 14 and 27. However, the use of these data is unlikely to introduce significant positive biases, since not only do older workers use personal contacts more extensively than younger workers (Granovetter, 1995; Corcoran et al., 1980) but they are also more likely to be hired in high-wage sectors.

[13] The NOS surveyed a representative sample of work establishments in the U.S. in 1991. The probability sample of all types, sizes and ages of establishments used to generate the data set was obtained from

Table 1 shows descriptive statistics for the industry data in the full sample and in the sub-samples of industries relying more and less on employee referrals. The percent of referred workers in two-digit industries goes from 10.9% to 57.8%, with a mean of 38% and a standard deviation of 9.3%. The table shows that industries where the use of employee referrals is above the mean pay higher industry premia, have workers with higher average experience and lower average education, and have a higher percentage of unionized workers, larger establishments, higher concentration, and higher average sales and assets. Table 2 shows correlations of the percent of referred workers and various industry characteristics. The correlation between the percent of referred workers and wage premia are 0.4 and 0.34 for measures with and without labor quality controls. In addition, the percent of referred workers is positively correlated with factors generally associated with high-wage industries. In particular, the correlations between percent of referred workers and average experience and percent union are 0.39 and 0.25. In addition, the correlations between percent referred and average industry concentration, and average establishment size, sales and assets are 0.18, 0.28, 0.2, and 0.07, respectively. In contrast, percent referred is negatively correlated with average education in the industry (an important measure of labor quality), suggesting against an unobserved ability story of referrals if one believes that observed and unobserved labor quality are positively correlated.

The correlation between percent referred and industry premia in Table 2 may be reflecting the higher experience or unionization rates of referred workers rather than any

information provided by respondents to the 1991 General Social Survey (GSS). The 1991 GSS was used to construct the sample because in this year the GSS asked questions on work organizations, including the names, addresses, and phone numbers of respondents' employers. This national database was then

direct relation between referrals and industry premia.[14] Table 3 reports the correlation

between percent referred and industry premia after controlling for other industry

characteristics. The results show positive correlations between both the labor quality

adjusted and unadjusted measures of industry premia and percent referred, after controlling

for average experience, average education, percent unionized, industry concentration, and

average establishment size, sales and assets in the industry. The correlation using the

labor quality adjusted measure controlling for all industry characteristics indicates that

industries where 10% more of the workforce was hired through referrals pay premia which

are 0.1 higher or, equivalently, the difference in the wage premium paid in the insurance

and the machinery production sectors.

B. Evidence from Micro-data

The industry level data provides some evidence suggesting referred workers earn

higher wages because they are hired into high-wage sectors. However, it may be that

referred workers earn higher wages because they have higher unobserved ability. I use

individual-level data from the NLSY to control for individual fixed-effects in wage

regressions with an indicator of whether the person was referred by a current employee.

Table 4 shows descriptive statistics of the 1982 NLSY sample used for the

analysis. The sample is restricted to workers who are not self-employed, in school, or in

the military at the time of the 1982 interview. The first column shows descriptive

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supplemented with aggregate data from various government sources on the characteristics of the industries in
which the establishments operate.

[14] Previous work offers mixed evidence on the association between unionization rates and use of referrals.
For example, Holzer (1997) uses Employment Opportunity Pilot Project (EOPP) data and finds no
association between proportion of workers covered by collective bargaining and firms' hiring methods.
Koch and Hundley (1997) use data from a survey of human resources practices conducted at Columbia
University and find that unionized firms are less likely to use employee referrals, newspapers ads, walk-ins

statistics for this sample. The characteristics of this sample reflect the focus on young workers. Average hourly wages in the sample are $6.16, average experience and tenure are 4 and 1.6 years, average schooling is 11.6 years, and only 27% of those in the sample are married, only 3% found their current job through a union, but more than half are employed in the retail and service sectors.

Columns 2 and 3 of Table 4 contrast the characteristics of individuals who did and did not find their 1982 job through a referral. Referred workers are defined as workers who found their job through a personal contact working with the employer at the time the person found the job. Referred workers earn higher wages, are more likely to be male, less likely to live in an SMSA and are less educated, but have more experience and tenure than non-referred workers. More importantly, referred workers are more likely to be employed in sectors considered as high-wage sectors such as mining, construction, and manufacturing and less likely to be employed in low-wage sectors such as personal and public sector services. In contrast, referred workers are less likely to have found their job through a union contact and probably less likely to be affiliated to a union.[15]

Table 5 presents results from regressions of log hourly wages on a referral dummy, an interaction of the referral dummy with tenure, and a number of controls including male, race and marital status dummies, education, experience and experience squared, tenure and tenure squared, a dummy for whether the current job was found through a union contact, a dummy for whether the person lived in an SMSA, and interactions of marital status with the male dummy and tenure. Columns 1 and 2 report the results of regressions estimated

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and private employment agencies, but just as likely to use government employment agencies as non-unionized firms.

in levels, with and without industry controls. The results show that referred workers earn hourly wages that are 8% higher than those of non-referred workers, controlling for whether the job was found through a union contact to be sure that the referral premium is not simply capturing union rents. However, the results in Column 2 show that the "return" to being referred becomes insignificant once sector dummies are included, suggesting that the referral premium is associated with sector of employment.

As already indicated, it is possible that referred workers are both employed in high-wage sectors and have higher unobserved ability (although, as noted, they have lower schooling). Columns (3)-(6) present fixed-effects regressions which control for time-invariant individual effects. Controls in fixed-effects regressions include male, race, and marital status dummies, experience, tenure, a dummy for whether the current job was found through a union contact, and interactions of marital status with a male dummy and tenure, and differences in schooling and differences in whether the person lived in an SMSA between 1981 and 1982. Column (3) shows a slightly smaller referral premium in the fixed-effects regression compared to the levels regression, suggesting that unobserved ability can account at most for a small part of the referral premium.[16] As before, however, the "returns" to referrals become insignificant after controlling for industry dummies, suggesting that the reason why referred workers earn higher wages is associated with sector of employment. The next two columns limit the analysis to industry-switchers, since if referrals are mainly capturing the premia associated with certain industries then the referral premium should be higher for industry-switchers than for industry-stayers.

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[15] While the NSLY does not have information about union affiliation in 1982, it does ask workers whether they found their current job through a union contact. Since having found a job through a union contact is likely to be related to union affiliation, this variable is used as a proxy for union membership.

Column (5) shows indeed a higher referral premium of 17% for industry-switchers. As before, however, the referral premium disappears once the current sector of employment is controlled for, suggesting that what matters is what sectors referred workers switched into.

C. Other Possible Explanations of the Referral Premium

The evidence presented above suggests that referred workers earn higher wages because they are hired into high-wage sectors. This evidence is consistent with the view that workers use referrals to jump to the front of the queue for high-paying jobs. Moreover, an explanation of referrals as simply a way of getting good jobs is also consistent with the lower quit rates of both referred workers and of workers employed in high-wage sectors found in the data.

Two alternative explanations have been offered, however, for the referral premium based on the view that referrals provide additional information to firms or workers. Referrals may provide information to firms about the unobserved ability of heterogeneous workers, allowing firms to hire the most productive workers (see Saloner (1985) and Montgomery (1991) for models of this type). Alternatively, referrals may provide prospective job applicants with information about match-quality, allowing them to self-select into those jobs in which they are most productive (see Staiger (1990) and Simon and Warner (1992)). While both of these explanations of referrals can explain why referred workers earn higher wages, they cannot explain why the referral premium should be associated with sector of employment (or why industry-level use of referrals should be associated with industry premia). Moreover, evidence from the NLSY shows that the referral premium does not go away once controlling for individual fixed-effects,

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[16] This estimate is necessarily less precise (i.e., p-value of 0.065) because of the smaller sample when

suggesting that the referral premium cannot be explained by a standard worker heterogeneity story (i.e., time-invariant individual effects). A less standard worker heterogeneity story with two sectors (one with an ability-sensitive and one with a less-ability sensitive technology) like the one offered by Montgomery (1991), however, would be able to explain the relation between referrals and wages across sectors. On the other hand, while match-quality explanations can explain why referred workers have lower quit rates, heterogeneous ability explanations cannot explain this empirical regularity.

IV.   Conclusion

This paper develops an equilibrium matching model in which high-wage firms rely on referrals to fill jobs. Referrals lower monitoring costs since high-effort referees can exert peer pressure on co-workers, allowing firms to pay lower efficiency wages. The cost of using referrals is that they provide fewer contacts for workers and firms. Heterogeneity in the size of referral networks implies that while some firms and workers may prefer to use referrals, others are better off using formal methods. In equilibrium, the matching process generates segmentation in the labor market: referrals match 'good' high-paying jobs to well-connected workers, while formal methods match less attractive jobs to less-connected workers. Congestion externalities, however, may imply an inefficient split of firms and workers between the two search methods. This means that while well-connected workers may do well by using referrals to jump queues for good jobs, the unemployment rate would be lower if workers "at the margin" were induced to search formally.

The model suggests referred workers earn higher wages and have lower quit rates because referrals are a way of getting a good job. This paper provides new empirical

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estimating the regression in differences.

evidence showing that industry-level use of referrals to fill job vacancies is correlated with industry wage premia (adjusting for worker skills). Moreover, evidence from the NLSY shows similar OLS and fixed-effects estimates of the referral premium, suggesting that unobserved ability is not accounting for the higher wages earned by referred workers. Finally, the results show that the referral premium disappears when sector dummies are included, suggesting that the referral premium is associated to sector of employment.

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APPENDIX

Proof of Lemma 1

The no-shirking condition (NSC) for a referred worker is

$$E_R = S_R,$$
$$(w_R^e - \hat{e}^2) + \lambda(U_R - E_R) = (w_R^e - \hat{e}^2) + (\lambda + \kappa)(U_R - E_R),$$
$$(E_R - U_R) = (1 - \rho)\hat{e}^2 / \kappa,$$

Adding and subtracting rU_R in equation (3a), and then substituting rU_R from equation (5a) and $(E_R - U_R)$ from above, I obtain w_R^e:

$$w_R^e = \hat{e}^2 + \lambda(E_R - U_R) + rE_R,$$
$$w_R^e = \hat{e}^2 + (r + \lambda)(E_R - U_R) - b + E[\beta_i p(\theta)(E_R - U_R) \mid R],$$
$$w_R^e = \hat{e}^2 - b + (r + \lambda + E[\beta_i p(\theta) \mid R])(1 - \rho)\hat{e}^2 / \kappa,$$
$$w_R^e = \hat{e}^2 - b + (r + \lambda + (1 - \overline{\beta}^2) p(\theta)/2)(1 - \rho)\hat{e}^2 / \kappa,$$

where $\overline{\beta}$ is the arrival rate of encounters which makes workers indifferent between hiring through referrals and formal methods.

Using the NSC for formal hires and solving as described above yields the rents earned by workers hired formally, $(E_F - U_F) = \hat{e}^2 / \kappa$. The lowest wage satisfying the NSC for formal hires is

$$w_F^e = \hat{e}^2 - b + (r + \lambda + p(\theta))\hat{e}^2 / \kappa.$$

Comparing the formal and referral efficiency wages:

$$(w_F^e - w_R^e) = [(\rho + \overline{\beta}^2) p(\theta)/2 + (r + \lambda) \rho] \hat{e}^2 / \kappa > 0.$$

Proof of Lemma 2

Subtracting (2a) from (1) and rearranging yields the surplus for firms hiring through referrals,

$$(J_R - V_R) = (\phi A - w_R + C) / (r + \lambda + (1 - \overline{\gamma}^2) q(\theta)/2),$$

where $\overline{\gamma}$ is the arrival rate of encounters which makes firms indifferent between hiring through referrals and formal channels. Similarly, subtracting (5a) from (3a) and rearranging yields the surplus for workers hired through referrals,

$$(E_R - U_R) = (w_R - b) / (r + \lambda + (1 - \overline{\beta^2}) p(\theta)/2).$$

The market wage paid by firms hiring through referrals is obtained by replacing the firms' and workers' surpluses into equation (6):

$$(1 - \pi)[(w_R^* - b)/(r + \lambda + (1 - \overline{\beta^2})p(\theta)/2)] = \pi[(\phi A - w_R^* + C)/(r + \lambda + (1 - \overline{\gamma^2})q(\theta)/2)].$$

Solving for the referral market wage yields,

$$w_R^* = \{ \pi[r + \lambda + (1 - \overline{\beta^2})p(\theta)/2](\phi A + C) + (1-\pi)[r + \lambda + (1 - \overline{\gamma^2})q(\theta)/2]b \} /$$
$$\{ r + \lambda + (1-\pi)(1 - \overline{\gamma^2})q(\theta)/2 + \pi(1 - \overline{\beta^2})p(\theta)/2 \}.$$

Similarly, subtracting (2b) from (1) and rearranging yields the surplus for firms hiring formally,

$$(J_F - V_F) = (\phi A - w_F + C) / (r + \lambda + q(\theta)).$$

Subtracting (5b) from (3b) and rearranging yields the surplus for workers hired formally,

$$(E_F - U_F) = (w_F - b) / (r + \lambda + p(\theta)).$$

The market wage paid by firms hiring formally is obtained by replacing the firms' and workers' surpluses into equation (6):

$$(1 - \pi)[(w_F^* - b) / (r + \lambda + p(\theta))] = \pi[(\phi A - w_F^* + C) / (r + \lambda + q(\theta))].$$

Solving for the formal market wage yields,

$$w_F^* = \{ \pi (r + \lambda + p(\theta))(\phi A + C) + (1-\pi)(r + \lambda + q(\theta))b \} /$$
$$\{ r + \lambda + (1-\pi)q(\theta) + \pi p(\theta) \}.$$

Comparing the formal and referral market wages yields,

$$(w_F^* - w_R^*) = - (r + \lambda)(q(\theta) - p(\theta)) + [\overline{\gamma^2} q(\theta)(r + \lambda - p(\theta)) - \overline{\beta^2} p(\theta)(r + \lambda - q(\theta))] < 0.$$

So, sufficient conditions for $(w_F^* - w_R^*) < 0$ are:

(i) $(q(\theta) - p(\theta)) > 0$, and

(ii) $[\ \overline{\gamma}^2\, q(\theta)\, (\, r + \lambda - p(\theta)\,) - \overline{\beta}^2\, p(\theta)\, (\, r + \lambda - q(\theta)\,)\,] > 0$,

and both hold if $q(\theta)$ is sufficiently greater than $p(\theta)$.

Critical Values that Trigger Referral Search

In case 2, firm j chooses the search method that maximizes its value of a vacancy by comparing $V_{Rj}{}^{e}$ and $V_F{}^*$, where these are given by the following Bellman equations,

$$rV_{Rj}{}^{e} = -\, C + \gamma_j q(\theta)\, [\, (\, A - w_R{}^{e} + C\,) / (\, r + \lambda + \gamma_j q(\theta)\,)\,],$$

$$rV_F{}^* = -\, C + q(\theta)\, [\, (\, \phi A - w_F{}^* + C\,) / (\, r + \lambda + q(\theta)\,)\,].$$

The critical value that triggers use of referrals, $\overline{\gamma}$, is obtained by equating $V_{Rj}{}^{e}$ and $V_F{}^*$ and is given by equation (7).

Similarly, worker i chooses the search method that maximizes the value of being unemployed by comparing $U_{Ri}{}^{e}$ and $U_F{}^*$, which are given by

$$rU_{Ri}{}^{e} = -\, b + \beta_i\, p(\theta)\, [\, (\, w_R{}^{e} - b\,) / (\, r + x + \beta_i\, p(\theta)\,)\,],$$

$$rU_F{}^* = -\, b + p(\theta)[\, (\, w_F{}^* - b\,) / (\, r + x + p(\theta)\,)\,].$$

The critical value that triggers use of referrals, $\overline{\beta}$, is obtained by equating $U_{Rj}{}^{e}$ and $U_F{}^*$ and is given by equation (8).

Slope of the Free-Entry (FE) Curve

Totally differentiating the free-entry condition (9) with respect to θ, yields the slope of the free-entry curve,

$$
\begin{aligned}
d\,\overline{\gamma}/d\theta = \{ &- (\, 1 - \overline{\gamma}\,)q'(\theta)(\, A - w_R{}^{e} + C\,)\, E[\, \gamma_j / (\, r + x + \gamma_j q(\theta)\,)\,] \\
&+ (\, 1 - \overline{\gamma}\,)q(\theta)\, E[\, \gamma_j / (\, r + x + \gamma_j q(\theta)\,)\,] \times dw_R{}^{e}/d\theta \\
&- [\, \overline{\gamma} q'(\theta)(1 - q(\theta))(\, \phi A - w_F{}^* + C\,) / (\, r + \lambda + q(\theta)\,)\,] \\
&+ [\, \overline{\gamma} q(\theta) / (\, r + \lambda + q(\theta)\,)\,] \times dw_F{}^*/d\theta\ \} / \\
&\{ - q(\theta)[(\, A - w_R{}^{e} + C\,)\, E[\gamma_j / (\, r + x + \gamma_j q(\theta)\,)\,] \\
&- [\, (\, \phi A - w_F{}^* + C\,) / (\, r + \lambda + q(\theta)\,)] - \overline{\gamma} / (\, r + \lambda + q(\theta)\,)\, \} < 0,
\end{aligned}
$$

where the numerator is positive since $q'(\theta) < 0$ and $dw_R^e/d\theta > 0$ and $dw_F^*/d\theta > 0$, and the denominator is negative since profits out of a referral hire are higher than out of a formal hire. Thus, the free-entry condition is unambiguously downwardly sloping.

Slope of the Search Behavior (SB) Curve

Totally differentiating equation (7) with respect to θ, yields the slope of the search behavior curve. Since the denominator of the derivative is the square of the original denominator, then the sign of the slope is the same as the sign of the numerator of the derivative,

$$
\begin{aligned}
d\,\overline{\gamma}/d\theta \propto\ & -\,(\,r + \lambda + q(\theta)\,)(\,A - w_R^e + C\,) \times dw_F^*/d\theta \\
& +\,(\,r + x + q(\theta)\,)(\,\phi A - w_F^* + C\,) \times dw_R^e/d\theta \\
& -\,q'(\theta)(\,A - (\,w_R^e - w_F^*\,)\,)(\,\phi A - w_F^* + C\,) - q(\theta)\phi A \times dw_F^*/d\theta,
\end{aligned}
$$

where $q'(\theta) < 0$ and $dw_R^e/d\theta > 0$ and $dw_F^*/d\theta > 0$, so the first and the last terms are negative and the second and third terms are positive. However, as π decreases, $dw_R^e/d\theta$ increases so that the second term becomes larger and it is more likely for $d\,\overline{\gamma}/d\theta$ to be positive. On the contrary, as π increases, $dw_R^e/d\theta$ decreases so that the second term is smaller and it is more likely for $d\,\overline{\gamma}/d\theta$ to be negative. There are two effects at work here. An increase in labor market tightness, θ, reduces the arrival rate of applicants, $q(\theta)$, and makes firms want to rely more on formal methods. On the other hand, a higher θ increases w_F^* and make firms want to rely more on referrals. If π is low, the first effect dominates and the search behavior curve slopes upward as in Figure 1a. If π is high, the second effect dominates and the search behavior curve slopes downward as in Figure 1b.

Effect of Unemployment Benefits on the Critical Value of Referral Search

Totally differentiating equation (8) with respect to b yields

$$
d\,\overline{\beta}/db = -\,\kappa\pi\,/\,\{\,(1-\rho)\hat{e}^2[\,r + x + (1-\pi)q(\theta) + \pi p(\theta)\,]\,\} + d\,\overline{\beta}/d\theta \times d\theta/db,
$$

The first term is clearly negative. The second term can also be shown to be negative both

for low and high values of π. Note that

$$d\ \overline{\beta}/d\theta = \overline{\beta}\kappa\{ -\pi(\phi A - b + C)[(1-\pi)q'(\theta) + \pi p'(\theta)] \} /$$
$$\{ (1 - \rho)\hat{e}^2[r + \lambda + (1-\pi)q(\theta) + \pi p(\theta)] \}^2.$$

Since $q'(\theta) < 0$ and $p'(\theta) > 0$, $d\ \overline{\beta}/d\theta$ is positive for low values of π and negative for high

values of π. The sign of $d\theta/db$ is obtained by doing comparative statics of Figures 1a and

1b with respect to b. Figure 2a shows that, for low values of π, a reduction in b

unambiguously increases θ, while Figure 2b shows that, for high values of π, a reduction

in b unambiguously reduces θ. This means that $d\theta/db$ is negative for low values of π and

positive for high values of π. Consequently, the second term in $d\ \overline{\beta}/db$ is always negative.

<u>Effect of Unemployment Benefits on the Unemployment Rate</u>

Totally differentiating equation (10) with respect to b yields,

$$du/db = du/d\ \overline{\beta} \times d\ \overline{\beta}/db + du/d\theta \times d\theta/db,$$

where, as shown above, $du/d\ \overline{\beta} < 0$ and $d\ \overline{\beta}/db < 0$, so the first term is positive. The

second term can be either positive or negative depending on whether π is high or low.

Since $du/d\theta < 0$, the second term is also positive for low values of π but negative for high

values of π.
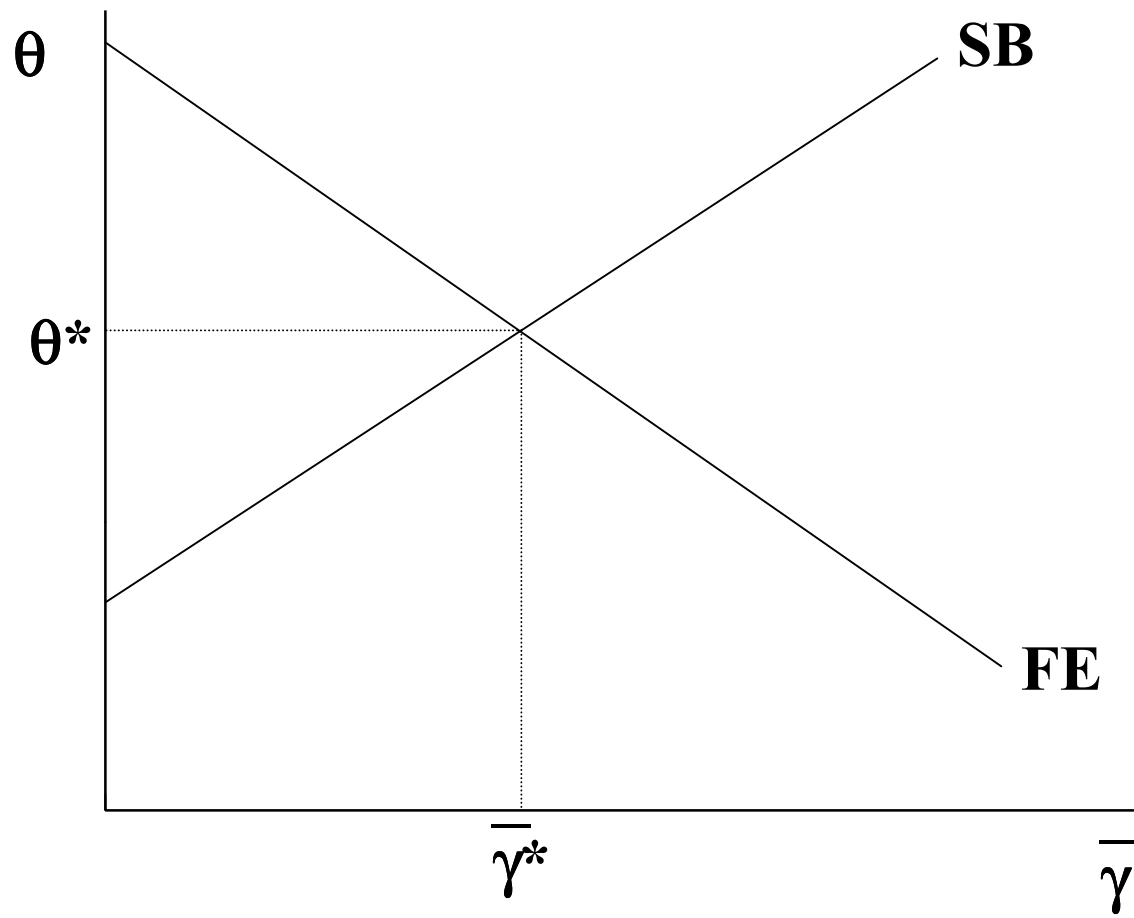
Figure 1.a: Equilibrium with Low π

Figure 1.b: Equilibrium with High π

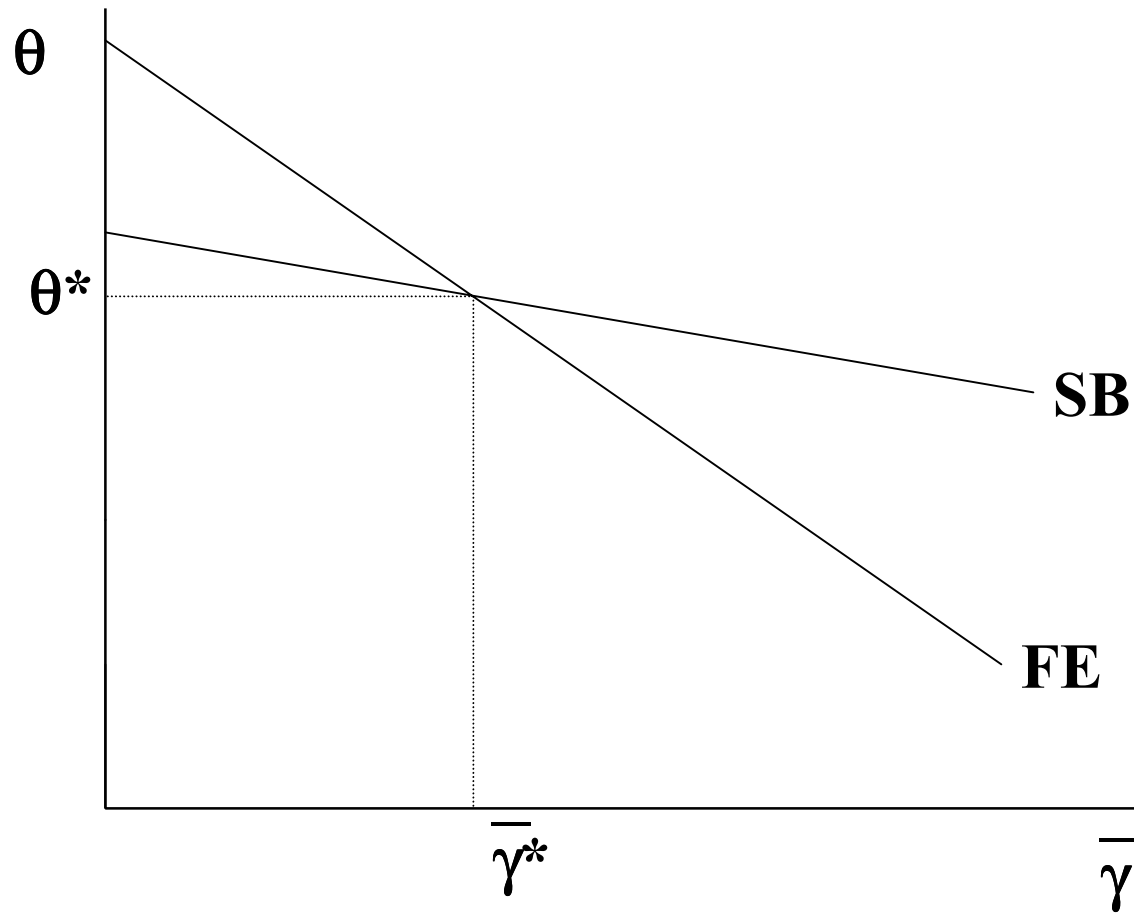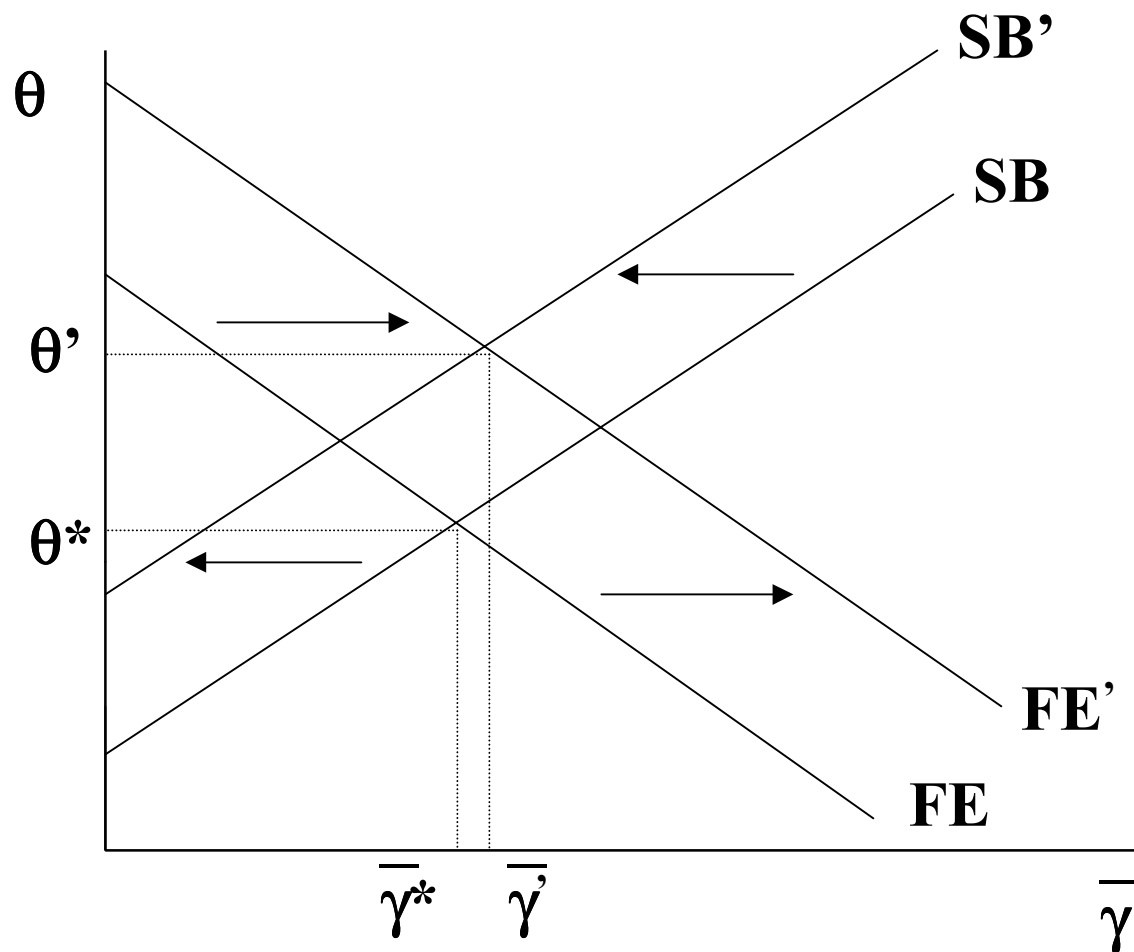# Figure 2.a: Effect of a Reduction in b, Low π

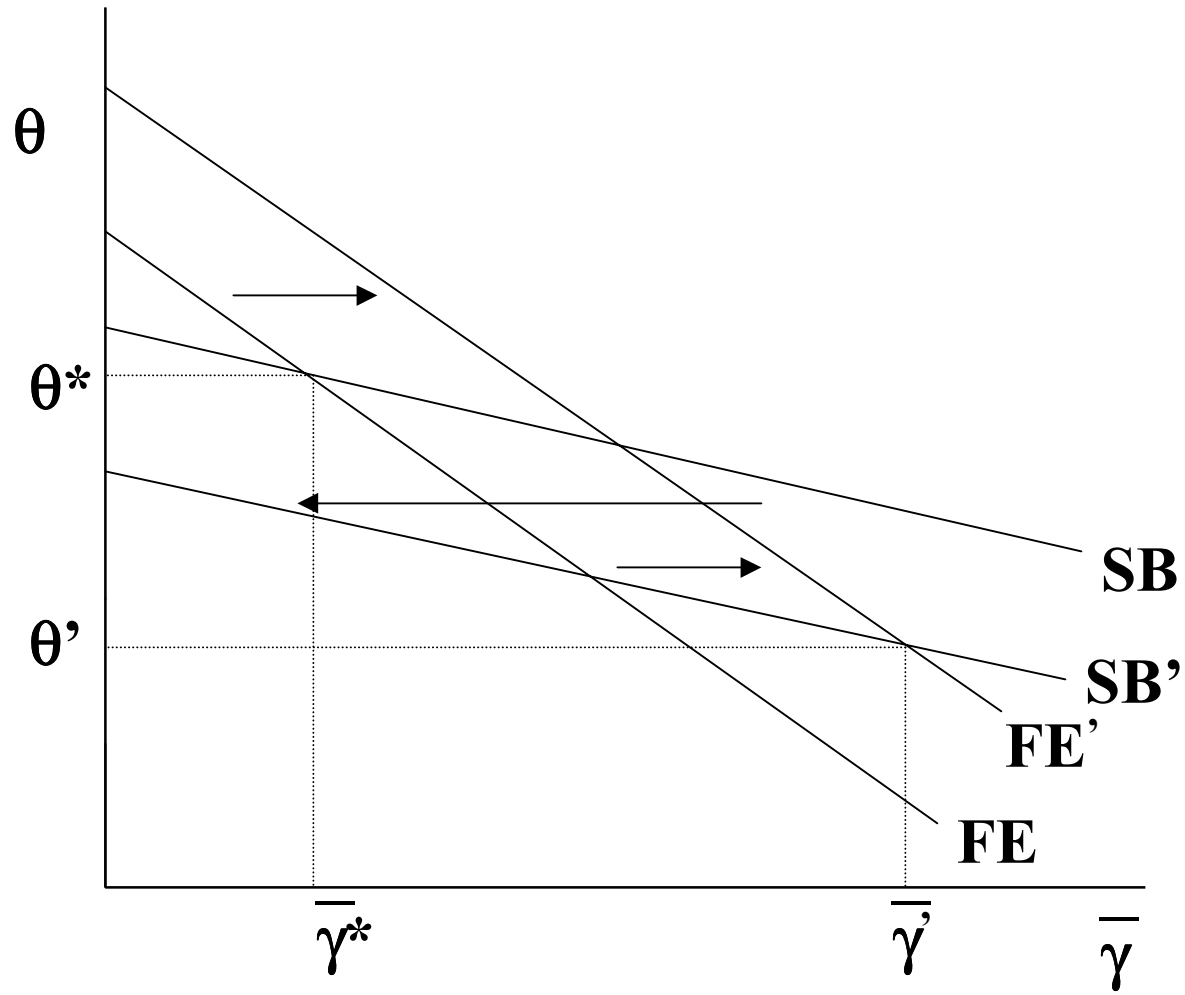# Figure 2.b: Effect of a Reduction in b, High π

Table 1: Descriptive Statistics, Industry Data

Variable	Full Sample	Industries Above Mean of % Referred in all Industries	Industries Below Mean of % Referred in all Industries
Quality Unadjusted Industry Premia	0.028 (0.143)	0.066 (0.102)	-0.014 (0.171)
Quality Adjusted Industry Premia	0.065 (0.266)	0.114 (0.227)	0.01 (0.302)
Average Experience	19.443 (2.182)	20.444 (1.676)	18.324 (2.177)
Average Education	12.18 (1.138)	11.575 (0.76)	12.856 (1.124)
Percent Union	18.842 (10.285)	20.889 (10.522)	16.387 (9.772)
Industry Concentration	0.478 (0.27)	0.523 (0.24)	0.42 (0.303)
Average Establishment Size	43.97 (39.59)	54.02 (45.49)	31.05 (26.66)
Average Sales	8,383.507 (12,217.35)	10,759.39 (14,144)	5,159.088 (8,424.67)
Average Assets	10,378.07 (16,750.75)	12,046.7 (19,529.53)	8,113.505 (12,368.88)
N	36	19	17

Notes: The table shows means for variables at the industry 2-digit SIC level. Standard deviations are in parenthesis. The first column shows the means for the full sample, while the second column shows the means for the industries where the percent of referred workers was above 38% and the third column shows the means for industries where the percent of referred workers was below 38%. The percent referred are calculated as the percent of workers in the NLSY in 1982 who found jobs through friends working with the employer at the time the job was found. The industry wage premia are the returns to industry affiliation estimated by Krueger and Summers (1987) with cross-sectional data from the 1984 CPS at the 2-digit SIC level, with and without the following controls: education, age, sex, race, union, status, a central city dummy, marital status, and several interaction of marital status with sex and age. Average experience and average education for each 2-digit industry where estimated using the 1984 CPS. The rest of the industry characteristics (i.e., % union, industry concentration, average establishment size, average sales, and average assets) come from the National Organizations Survey.

Table 2: Correlation Matrix of Industry Characteristics (2-Digit Industries)

	Percent Referral	Industry Premia	Quality Adjusted Premia	Average Experience	Average Education	Percent Union	Average Establish. Size	Industry Concentr.	Average Sales	Average Assets
Percent Referral	1.000 (36)	0.395 (36)	0.342 (36)	0.388 (36)	-0.37 (36)	0.245 (33)	0.275 (32)	0.178 (34)	0.199 (33)	0.07 (33)
Industry Premia		1.0000 (36)	0.936 (36)	0.343 (36)	0.219 (36)	0.426 (33)	0.337 (32)	0.744 (34)	0.498 (33)	0.562 (33)
Quality Adjusted Premia			1.000 (36)	0.264 (36)	0.409 (36)	0.47 (33)	0.255 (32)	0.68 (33)	0.467 (33)	0.557 (33)
Average Experience				1.000 (36)	-0.37 (36)	0.487 (33)	0.514 (32)	0.315 (34)	0.436 (33)	0.308 (33)
Average Education					1.000 (36)	-0.079 (33)	-0.189 (32)	0.102 (34)	-0.06 (33)	0.097 (33)
Percent Union						1.000 (36)	0.396 (32)	0.397 (33)	0.584 (32)	0.554 (32)
Average Establish. Size							1.000 (36)	0.521 (32)	0.835 (32)	0.676 (32)
Industry Concentr.								1.000 (36)	0.655 (33)	0.726 (33)
Average Sales									1.000 (36)	0.917 (33)
Average Assets										1.000 (36)

Notes: The table presents pairwise correlations of the variables described in Table 1. The number of observations for each pairwise correlation is in parenthesis.

Table 3: Regressions of Industry Wage Premia

Regressor	Unadjusted Industry Wage Premia			Quality Adjusted Industry Wage Premia		
	(1)	(2)	(3)	(4)	(5)	(6)
Percent Referred	0.007	0.006	0.005	0.014	0.012	0.01
	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Average Experience	0.237	0.016	0.01	0.042	0.023	0.017
	(0.01)	(0.012)	(0.01)	(0.016)	(0.018)	(0.015)
Average Education	0.065	0.063	0.038	0.166	0.165	0.13
	(0.19)	(0.02)	(0.021)	(0.031)	(0.03)	(0.031)
Percent Union	–	0.004	0.002	–	0.009	0.007
		(0.002)	(0.002)		(0.003)	(0.003)
Other Industry Characteristics	NO	NO	YES	NO	NO	YES
R²	0.359	0.392	0.593	0.5	0.615	0.694
N	36	33	32	36	33	32

Notes: The table presents coefficients of regressions of unadjusted industry premia in Columns (1)-(3) and of quality adjusted premia in Columns (4)-(6). Standard errors are in parenthesis. The other industry controls included in columns (3) and (6) are: the industry concentration, and the average establishment size, sales and assets in the sector.

Table 4: Descriptive Statistics, NLSY 1982

Variable	Full Sample	Referred	Not Referred
Hourly Wage	6.158	6.17	6.13
	(0.5)	(0.472)	(0.556)
% Male	55.38	57.49	50.75
% White	72.95	72.63	73.67
% Black	21.59	22.02	20.63
% Other Race	5.46	5.35	5.7
% Married	27.14	27.62	26.1
Education	11.571	11.453	11.832
	(1.794)	(1.843)	(1.653)
Experience (Years)	4.017	4.09	3.853
	(2.094)	(2.141)	(1.978)
Tenure (Weeks)	76.577	79.967	69.223
	(67.104)	(68.231)	(64.023)
% Living in SMSA	74.35	73.56	76.08
% Union Found Job	3.02	2.97	3.14
% Mining	1.57	1.83	1.01
% Construction	8.76	8.97	8.29
% Manufacturing	24.47	27.6	17.59
% Transportation	5.46	5.14	6.16
% Retail	25.06	25.83	23.37
% Finance, Insurance and Real State	5.42	4.4	7.66
% Business Services	6.44	6.69	5.9
% Personal Services	5.03	3.65	8.04
% Entertainment	1.22	1.26	1.13
% Professional Services	12.33	11.31	14.57
% Public Sector	4.24	3.31	6.28
% Industry-Switchers from 1981 to 1982	35.08	34.97	35.33
N	2,142	1,410	732

Notes: The table reports means and percentages in 1982. Standard deviations are reported in parenthesis where appropriate. The first column provides descriptive statistics on the full sample, while the second column provides statistics on the sample of referred workers and the third column on the sample of workers who found their jobs through other methods. Referred workers are defined as workers who found their job through a personal contact working with the employer at the time the person found the job.

Table 5: Effects of Referrals on Hourly Wages for Industry-Switchers
and Industry-Stayers, NLSY

| | Levels | | First Differences | | | |
| | Full Sample | | Full Sample | | Industry-Switchers | |
Regressor	(1)	(2)	(3)	(4)	(5)	(6)
Referred	0.083	0.054	0.079	0.043	0.166	0.093
	(0.034)	(0.03)	(0.043)	(0.039)	(0.074)	(0.068)
Referred × Tenure	-0.001	-0.001	-0.001	0.0	-0.001	0.0
	(0.0)	(0.0)	(0.0)	(0.0)	(0.001)	(0.001)
Industry Dummies	NO	YES	NO	YES	NO	YES
R^2	0.226	0.298	0.012	0.08	0.025	0.123
N	2,142	2,142	1,562	1,559	544	544

Notes: The table reports coefficients of wage regressions estimated in levels in Columns (1) and (2) and estimated in first differences in Columns (3)-(6). Robust standard errors are in parenthesis. The first four columns estimate the regressions on the full sample, while the last two columns limit the analysis to the sample of workers who switched industries from 1981 to 1982. The levels regressions include male and marital status dummies, race dummies, education, experience and experience squared, tenure and tenure squared, a dummy for whether the person lived in an SMSA, a dummy for whether the person found job through a union, and interactions of marital status with the male dummy and tenure. The regressions in first differences include male, marital status, and race dummies, interaction of marital status with the male dummy, tenure, a dummy for whether person found job through a union, and differences in schooling and differences in whether the person lived in an SMSA from 1981 to 1982. In addition, Columns (2), (4), and (6) control for industry affiliation.