Volume Title: Labor Statistics Measurement Issues

Volume Author/Editor: John Haltiwanger, Marilyn E. Manser and Robert Topel, editors

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-31458-8

Volume URL: http://www.nber.org/books/halt98-1

Publication Date: January 1998

Chapter Title: Internal and External Labor Markets: An Analysis of Matched Longitudinal Employer-Employee Data

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Chapter URL: http://www.nber.org/chapters/c8365

Chapter pages in book: (p. 357 - 370)

10 Internal and External Labor Markets: An Analysis of Matched Longitudinal Employer-Employee Data

John M. Abowd and Francis Kramarz

10.1 Introduction

For more than three decades, since the publication of Gary Becker's classic treatise on human capital in 1964 and Jacob Mincer's fundamental empirical analysis of earnings in 1974, the study of wage determination has relied heavily on models of labor supply and the analysis of individual wage outcomes. The supply-based models considered the labor market as a whole, the external market, to represent essentially all of the economically important possibilities for the individual. Glenn Cain recognized in 1976 that the labor-supply-based analysis of earnings determination would have difficulty explaining the internal (to the firm) market phenomena that were then called the "segmented" labor markets. In 1986 both Sherwin Rosen and Robert Willis called for increased analysis of matched employer-employee data as a necessary part of the unification of the supply-side and demand-side models of compensation and employment outcomes. The external labor market represents a heterogeneous collection of employment opportunities that might be available as an alternative to any particular person's current job. The internal labor market represents a heterogeneous collection of compensation and human resource management policies that describe the career possibilities for an individual who does not change employers. There is now a general consensus within labor economics

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The authors are grateful for research support in the United States by the National Science Foundation (grants SBR 91-11186 and SBR 93-21053) and in France by the Département de la Recherche in the Centre de Recherche en Economie et Statistique (CREST) at INSEE. The data used in this paper are confidential, but the authors' access is not exclusive. Other researchers interested in using these data should contact CREST, ENSAE, 15 bd Gabriel Péri, 92245 Malakoff Cedex, France.

that symmetric modeling of the employee and employer outcomes and detailed information on both the employer and employee are essential to distinguish internal and external labor market factors. More important, longitudinal data on employers and employees, data in which individuals are observed at multiple employers and a significant percentage of employees are observed within sampled firms, are required to identify the basic individual and firm effects that are at the heart of internal and external labor market models and descriptions.

We begin our analysis by supposing that real compensation costs per employee can be described as the sum of effects due to observable human capital investments by the individual, heterogeneous individual factors revealed to the labor market (but not to the statistician, except by inference), and heterogeneous employer factors. The internal labor market is modeled as factors specific to the employing firm. These include the firm effect in the compensation equation and also the firm's choices regarding the distribution of individual characteristics (including unobservable heterogeneity). The external labor market is the description of the opportunities available to a given individual at a given time. These include the returns to human capital and the returns to search among heterogeneous potential employers. Building on the analysis of Abowd, Kramarz, and Margolis (in press, AKM hereafter) we define a measure of an employee's external wage rate that depends on the worker's labor market characteristics and wage outcomes of other workers with the same characteristics (those observed at different employers). We also define an internal-external wage differential that we show depends only on the firm's compensation policy and the correlation of its human resource management policies with policies of other firms in the labor market. Our measure of the internal-external wage gap can only be identified using longitudinal data on employees and employers. We use estimates from AKM to assess the correlation among the observable human capital, individual heterogeneity, and firm heterogeneity components of compensation. We then use our sample estimates to examine the sources of interindustry wage differentials and firm size-wage differentials for French firms. For France, person and firm effects are positively but weakly correlated. The firm size-wage effect is due almost entirely to variation in the external wage rate (person effects). Ninety percent of the interindustry wage differential is due to variation in the external wage rate.

There are two major barriers to the statistical and economic analysis of models with unobservable personal and firm heterogeneity. First, one must be able to quantify the components of pay related to individual characteristics, individual heterogeneity, employer characteristics, and employer heterogeneity. In an imperfectly designed sample, one may not be able to distinguish among individual and firm effects and may, as a consequence, attribute too much of the empirical variation to one source. This purely statistical phenomenon places heavy demands on the data—demands that can only rarely be satisfied. Second, in the face of the measured heterogeneity of labor market outcomes among individuals and among employers, modeling the economic structure of the worker's "opportunity wage" or the firm's "internal compensation policy" is not straightforward, even if statistical components associated with the individual or the firm are estimable.

Section 10.2 presents a linear model of components of compensation based on a statistical decomposition of real annual compensation costs per employee. The relation between various sources of heterogeneity in wages and interindustry or firm size differentials is explained. Section 10.3 describes our analysis of a matched longitudinal sample of French employers and employees. Section 10.4 presents our results on the employer size-wage differential. Section 10.5 presents our results on the interindustry wage differential. Section 10.6 concludes.

10.2 A Model of Internal and External Wages

We begin with a straightforward model, taken directly from AKM, for the statistical structure of individual compensation:

$$w_{it} = \theta_i + \psi_{J(i,t)} + x_{it}\beta + \varepsilon_{it}, \tag{1}$$

where w_{it} is the natural logarithm of pay per unit of time for individual i in period t; θ_i is the part related to the individual, including observable non-time-varying characteristics; $\psi_{J(i,t)}$ is the part related to the firm;[1] $x_{it}\beta$ is the part related to individual and general time-varying characteristics; ε_{it} is the idiosyncratic part uncorrelated with θ, ψ, and $x\beta$; and the function $J(i,t)$ gives the identity of the employing firm. For a sample of N individuals followed over $t = 1, \ldots, T_i$ years, the general statistical structure of equation (1) is

$$E\begin{bmatrix} \theta_i \\ \psi_{J(i,t)it} \\ x_{it}\beta \\ \varepsilon_{it} \end{bmatrix} = \begin{bmatrix} \mu \\ 0 \\ \bar{x}\beta \\ 0 \end{bmatrix}, \tag{2}$$

$$V\begin{bmatrix} \theta_i \\ \psi_{J(i,t)it} \\ x_{it}\beta \\ \varepsilon_{it} \end{bmatrix} = \begin{bmatrix} \sigma_{\theta\theta} & \sigma_{\theta\psi} & \Sigma_{\theta x}\beta & 0 \\ \sigma_{\psi\theta} & \sigma_{\psi\psi} & \Sigma_{\psi x}\beta & 0 \\ \beta'\Sigma_{x\theta} & \beta'\Sigma_{x\psi} & \beta'\Sigma_{xx}\beta & 0 \\ 0 & 0 & 0 & \sigma_{\varepsilon\varepsilon} \end{bmatrix}, \tag{3}$$

where μ is the overall intercept of w, Σ is the covariance matrix for $[\theta, \psi, x]$, and σ represents elements of Σ. Using data for 1.1 million French workers

1. The firm effect may vary across individuals and over time because of individual-specific seniority effects, which we ignore in this discussion for simplicity.

Table 10.1 **Covariances and Correlations among Components of Real Compensation for a Sample of French Workers**

	Individual Effect	Firm Effect	Individual Characteristics
Individual effect θ	*0.1811*	*0.0027*	*0.0046*
Firm effect ψ	0.1079	*0.0042*	*0.0003*
Individual characteristics $x\beta$	0.0787	0.0325	*0.0192*

Source: Abowd, Kramarz, and Margolis (in press, table VI).

Note: Italic numbers (above the diagonal) are covariances; roman numbers (below the diagonal) are correlations. The correlations with the individual effect have been corrected for sampling variability (not required for the other correlations).

followed from 1976 to 1987, AKM estimated that the covariance matrix in equation (3) had the form shown in table 10.1.[2]

Equations (1), (2), and (3) can be used to construct direct measures of an individual's internal and external wage rates. Define the internal wage rate as the expected wage rate given employment in firm j:

$$(4) \qquad E[w_{it} \mid \theta_i,\ x_{it},\ J(i,t) = j] = \theta_i + \psi_{jit} + x_{it}\beta.$$

Define the external wage rate, w^a, as the expected wage rate given alternative employment in a firm other than j:

$$(5) \qquad E[w^a_{it} \mid \theta_i,\ x_{it},\ J(i,t) = j' \neq j] = \theta_i + E[\psi_{j'} \mid \theta_i,\ x_{it}] + x_{it}\beta.$$

The expectation in equation (5) is taken over all possible employers $j' \neq j$ according to the distribution of employer effects in the population of employees conditional on the individual effect and observable characteristics. We assume that the expectation on the right-hand side of equation (5) is zero. Hence, the expected difference between an individual's internal and external wage rates is given by

$$E[w_{it} - w^a_{it} \mid \theta_i,\ x_{it},\ J(i,t) = j] = \psi_j\ .$$

In data where individual and firm characteristics are both observable for representative longitudinal samples of the relevant populations, a natural estimator of the gap between an individual's internal and external wage rates is given by the least squares estimator of equation (1) from the sample of individuals for the vector of firm effects $\hat{\psi}_j$ for $j = 1, \ldots, J$, where J is the total

2. AKM actually estimate a model in which the individual effect is decomposed into a part due to permanent (non-time-varying) individual characteristics and a part due to nonobservable (to the statistician) individual characteristics. The effect labeled θ in this paper is the full person effect from AKM. Similarly, the firm effect in AKM is decomposed into a part due to initial differences in firm compensation policies and a part due to differential slopes on seniority within the firm. The effect labeled ψ in this paper is the full firm effect from AKM.

number of firms in the sample. Similarly, a natural estimator for the individual-specific component of the wage rate is the least squares estimator of the person effects $\hat{\theta}_i$ for $i = 1, \ldots, N$. This leads to the natural least squares decomposition of equation (1). The statistical problem arises because the full least squares solution to equation (1) is difficult or impossible to compute for samples sufficiently large to permit estimation of a reasonable percentage of the firm effects. AKM propose a solution based on the use of a set of variables z_{it} that do not appear in the model (1) and for which they maintain the assumptions

$$\mathrm{Cov}[\theta_i,\ \psi_{J(i,t)}|Z] = 0 \text{ and } \mathrm{Cov}[x_{it},\ \psi_{J(i,t)}|Z] = 0$$

$$\text{for all } t = 1, \ldots, T_i \text{ and } i = 1, \ldots, N,$$

where Z is the matrix of all observations of the variables z_{it}. Under these maintained assumptions, there are a variety of potential estimators for the effects in equation (1). In this paper we focus on the implications of the estimator in which the person effects are estimated first and the firm effects are estimated second, conditional on z_{it}. The estimation formulas give the following statistical decomposition of equation (1):[3]

$$w_{it} = \hat{\theta}_i + x_{it}\hat{\beta} + z_{it}\hat{\lambda} + \hat{u}_{it}, \tag{6}$$

$$\hat{u}_{it} = \hat{\psi}_{J(i,t)} + \hat{\varepsilon}_{it}, \tag{7}$$

where the circumflex over the indicated effect means that it was estimated by least squares in the given equation, either equation (6) or (7). An individual's estimated internal wage rate is then

$$\hat{w}_{it} = \hat{\theta}_i + \hat{\psi}_{J(i,t)} + x_{it}\hat{\beta}, \tag{8}$$

and an individual's estimated external wage rate is

$$\hat{w}^a_{it} = \hat{\theta}_i + x_{it}\hat{\beta}, \tag{9}$$

An alternative to direct estimation of the internal-external wage difference is to use estimates of the person and firm effects to decompose conventional aggregated components of compensation, such as industry effects or firm size effects, into the part due to person and firm effects. Suppose that one considered the following model as an alternative to equation (1):

$$w_{it} = \kappa_{K(i,t)} + x_{it}\beta + \varepsilon_{it}, \tag{10}$$

where the effect κ measures the effect of some aggregation, say industry or firm size, and the function $K(i,t)$ classifies the individual into the aggregated

3. The estimator discussed here is called "order-dependent: persons first" by AKM. It is one of the two estimators they used for most of their analyses.

category k. AKM show that the least squares estimator of κ can be expressed as a properly weighted average of the average person and firm effects within the category k:[4]

$$\hat{\kappa}_k = \bar{\theta}_k + \bar{\psi}_k, \tag{11}$$

where $\bar{\theta}_k$ and $\bar{\psi}_k$ are the average firm and person effects, respectively, in category k, given the individual characteristics, x.[5] The interpretation of equation (11) is also straightforward: given the individual characteristics, x, the measured average effect of being in category k consists of the amount by which the external wage rate differs from the average $\bar{\theta}_k - \bar{\mu}$ plus the amount by which the internal wage rate differs from the average $\bar{\psi}_k - 0$, in both cases given x.

10.3 Characteristics of the French Longitudinal Matched Employer-Employee Data

Our analysis sample is the same one used by AKM. The reader is invited to consult the data appendix therein for details on the construction of the employee and firm characteristics. We review only the variables used in the present analysis.

The longitudinal sample of employees is a 1/25th sample of all persons for whom employers filed the mandatory "Déclaration annuelle des salaires" (DAS), the French equivalent of the U.S. social security earnings report (see INSEE 1990c; Lollivier n.d.). A person is sampled if he or she was born in October of an even-numbered year. Once sampled, all data from 1976 until 1987 are available (except for the years 1981 and 1983 when the underlying administrative data were not sampled). We converted the reported net salaries of the sampled individuals into annual equivalent real total compensation cost using information on the days worked during the year and on the employer and employee payroll tax rates in effect each year.[6] From the DAS and supplemental sources, AKM were able to measure labor force experience, education, sex, region of employment, and seniority at the employing firm. These variables, as well as data year, were included in the statistical model for estimating the

4. The effect κ in this paper is called κ^{**} in AKM. The average person and firm effects within the category k are estimated conditional on the time-varying observable characteristics x and any observable non-time-varying personal characteristics (e.g., education and sex).

5. For simplicity we have not used the matrix weighting formulas to express the averages in eq. (9). If the variables x_{it} do not enter the equation, these are simple averages; otherwise, the formulas in AKM must be used.

6. The difference between net salary and gross salary in the French reporting system is employee payments for social benefits (health insurance, retirement income, unemployment insurance, workers' compensation, family support, etc.), which are collected through the imposition of a variable rate payroll tax. The difference between gross salary and total compensation costs is employer payments for these same social benefits, which are also collected through the imposition of a (different) variable rate payroll tax. We used the total compensation costs as our measure of the employee's wage rate.

Table 10.2 **Distribution of French Workers by Number of Employers and Years in Sample**

	Number of Employers			
Years in Sample	1	1a	2	3+
1	318,627	247,532		
2	75,299	57,411	51,066	
3+	298,572	254,105	203,710	219,031
Total	692,498	559,048	254,776	219,031

Source: Abowd, Kramarz, and Margolis (in press, table I).

Note: Individuals in column 1a had only one employer but worked for a company employing a mover. N = 1,166,305.

coefficients β in equation (1). The effect of observable characteristics was fully interacted in sex and included unrestricted individual and firm effects.[7] For the present paper, the internal-external wage differentials given in equations (7) and (8) for the DAS individuals were estimated using the AKM estimates of $x_{it}\hat{\beta}$.

Our sample of firms is also the same one used by AKM from the "Echantillon d'entreprises" (INSEE 1990a, 1990b). This sample of 21,642 firms is representative of private French industry. The agricultural and governmental sectors were not sampled. A firm (*entreprise*) is a business unit engaged in a principal economic activity that involves substantially all of the component establishments. For all firms, regardless of their presence in the "Echantillon d'entreprises," an estimate of the size of the firm is available based on the sampling method used for the DAS. The firm size measure, used below, is an estimated of average employment over the calendar year for all the sampled years that the firm appears in the DAS.

Table 10.2 summarizes the pattern of individual responses and employers in our analysis data set. An important consideration in the identification of the person and firm effects in equation (1) is the extent of within-sample mobility between firms. Column 1a of table 10.2 shows that a very large fraction of our single-employer individuals worked for a firm that employed a worker who also worked for another firm in the sample. This feature of large administrative databases is the reason why we are able to estimate person and firm effects for almost 90 percent of the observations.

10.4 Results of the Analysis of Firm Size-Wage Differentials

To study the extent to which the firm size-wage differential is related to our measure of the internal-external wage gap, we constructed an estimate of $\hat{\kappa}_k =$

7. See AKM (table III) for the full set of coefficients in this statistical analysis.

Table 10.3 Analysis of the Importance of Internal and External Factors in the Firm Size-Wage Differential

Firm Size	*N* (1)	Average Firm Size in Cell (2)	Raw Firm Size Effect (3)	Average Person Effect (4)	Average Firm Effect (5)
0–25	1,226,844	11.4	−0.092	−0.068	−0.016
26–50	614,604	34.4	−0.021	−0.011	−0.007
51–100	535,169	70.5	−0.015	−0.009	−0.006
101–200	449,723	142.7	−0.015	−0.012	−0.005
201–300	257,305	245.7	0.010	0.010	−0.004
301–400	164,426	346.6	0.014	0.015	−0.004
401–500	140,786	447.6	0.029	0.028	−0.003
501–600	110,075	548.1	0.023	0.023	−0.005
601–700	95,336	648.7	0.033	0.030	−0.002
701–800	91,048	747.5	0.053	0.050	−0.001
801–900	72,221	850.1	0.051	0.047	−0.002
901–1,000	56,384	947.4	0.038	0.034	−0.001
1,001–1,250	104,416	1,118.4	0.035	0.035	−0.004
1,251–1,500	90,103	1,362.1	0.063	0.058	0.000
1,501–1,750	68,537	1,621.9	0.048	0.041	−0.003
1,751–2,000	60,723	1,882.5	0.056	0.049	0.002
2,001–2,500	117,750	2,224.6	0.042	0.042	−0.005
2,501–3,000	83,316	2,728.7	0.075	0.068	−0.002
3,001–4,000	138,872	3,542.5	0.084	0.079	−0.001
4,001–5,000	102,670	4,427.4	0.054	0.047	−0.002
5,001–7,500	138,154	6,165.6	0.075	0.066	0.002
7,501–10,000	69,059	8,437.2	0.132	0.106	0.008
10,001–15,000	76,514	12,290.3	0.043	0.034	0.000
15,001–20,000	41,252	17,304.1	0.090	0.068	0.006
20,001 or more	399,821	101,444.2	0.111	0.032	0.081

Source: Abowd, Kramarz, and Margolis (in press, estimates related to table VIII).
Note: The maximum standard error for the raw firm size effect and the average person effect is 0.003, while the maximum standard error for the average firm effect is 0.0005.

$\overline{\theta}_k + \overline{\psi}_k$ in equation (11) for 25 firm size cells as shown in table 10.3. As is clear from the table, French firms display the same strong firm size-wage relation that Brown and Medoff (1989) found for American firms.[8] Column (3) shows the estimated differential for firms of that size as compared to zero, the arbitrary reference point, and is the estimated $\hat{\kappa}_k$, controlling for x. Column (4) shows the average, within the firm size cell, of the person effects, again con-

8. The reported results adjust for time-varying personal characteristics x and for measurable non-time-varying personal characteristics (e.g., education) so that person and firm effects reflect only nonobservable heterogeneity. The amount of the firm size-wage effect not related to differences in personal unobservable heterogeneity is much smaller in France than the amount reported by Brown and Medoff (1989, table 2) in their longitudinal analysis.

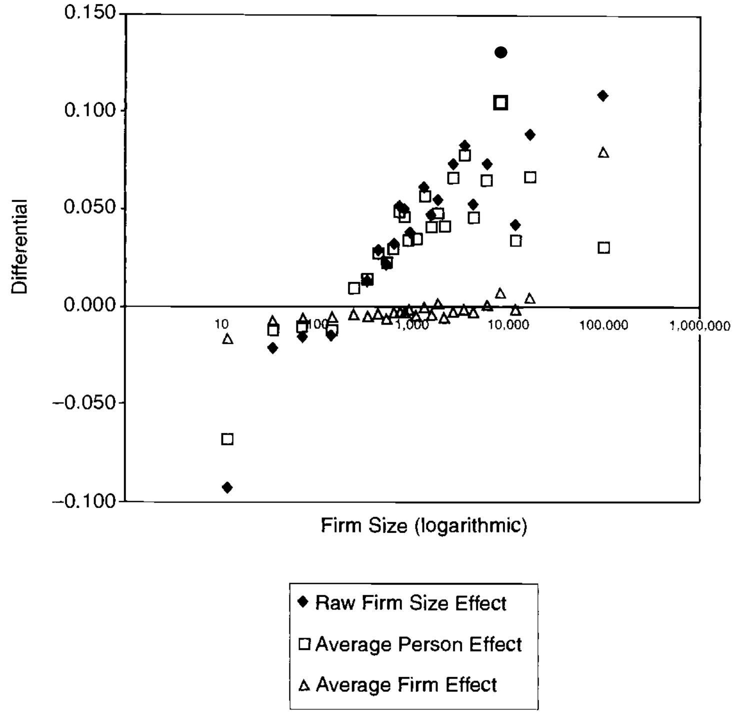

Fig. 10.1 Firm size-wage effects in France

trolling for x, and is the estimated $\overline{\theta}_k$. Finally, column (5) shows the average, within the firm size cell, of the firm effects, again controlling for x, and is the estimated $\overline{\psi}_k$. Figure 10.1 presents the results graphically. Except for the largest firm size, virtually all of the firm size-wage effect in France is explained by the average person effect in the firm size group. In France, the largest firms are almost all stock-based companies in which the government is the sole or majority shareholder. The presence of a firm size effect in the wage rates of the employees of these firms that is not due to a high average person effect could be interpreted as evidence of rent splitting between the government and the employees of these firms. Alternatively, these firms may also be the ones that use technologies most conducive to compensation plans that involve a distinction between the internal and external wage rates.

10.5 Results of the Analysis of Interindustry Wage Differentials

We also used our estimates of the internal-external wage differential to revisit the question of interindustry wage differentials in France. Table 10.4

Table 10.4 Analysis of the Importance of Internal and External Factors in the Interindustry Wage Differential

Industry[a]	N (1)	Raw Industry Effect (2)	Average Person Effect (3)	Average Firm Effect (4)
04 Coal mining	6,020	0.251	0.218	0.023
05 Crude petroleum and natural gas extraction	15,009	0.340	0.316	0.002
06 Electricity production and supply	52,017	0.188	0.084	0.109
08 Water and city heating supply	9,064	0.137	0.109	−0.001
09 Ferrous metal mining	88	0.056	0.048	−0.024
10 Iron and steel foundries	48,708	0.082	0.053	0.008
11 Primary metal manufacturing	18,385	−0.031	−0.051	−0.003
13 Primary nonmetallic manufacturing	23,694	0.107	0.079	0.003
14 Miscellaneous mineral production	2,622	0.036	0.008	0.002
15 Cement, stone, and concrete products	63,544	−0.041	−0.061	−0.007
16 Glass and glass products	27,307	0.113	0.084	0.001
17 Basic chemical manufacture	52,526	0.193	0.166	0.002
18 Allied chemical products, soaps, and cosmetics	46,553	0.110	0.099	−0.001
19 Pharmaceuticals	27,691	0.170	0.151	0.007
20 Founderies and smelting works	30,673	−0.015	−0.040	0.001
21 Metal works	154,626	−0.002	−0.023	−0.007
22 Farm machinery and equipment	17,755	−0.025	−0.048	−0.004
23 Metalworking machinery manufacture	24,740	0.038	0.012	−0.004
24 Industrial machinery manufacture	100,679	0.044	0.020	−0.005
25 Material handling machines and equipment	28,277	0.052	0.022	0.000
26 Ordnance	3,073	0.110	0.075	0.000
27 Office and accounting machines	20,918	0.328	0.283	0.018
28 Electrical machinery equipment	82,859	0.025	−0.005	−0.001
29 Electronic computing equipment	101,851	0.058	0.026	0.001
30 Household appliances	21,367	−0.016	−0.049	−0.002
31 Motor vehicles, trains, and land transport manufacture	180,678	0.027	−0.014	0.024
32 Ship and boat building	20,145	0.101	0.065	0.007
33 Aircraft and parts manufacture	45,188	0.182	0.153	0.008
34 Professional and scientific equipment manufacture	34,121	0.017	−0.010	−0.006
35 Meat products	30,861	−0.003	−0.033	−0.004
36 Dairy products	27,123	0.061	0.023	0.005
37 Canned and preserved products	14,528	−0.004	−0.051	0.002
38 Bakery products	46,156	−0.067	−0.095	−0.012
39 Grain mill and cereal products	25,195	0.044	0.008	0.002
40 Miscellaneous food preparations	29,140	0.082	0.043	0.006
41 Beverage industries	21,277	0.118	0.083	0.007
42 Tobacco products manufacture	3,464	0.246	0.212	0.007
43 Knitting mills, threads, and artificial fibers	4,132	0.052	0.022	0.006

Table 10.4 (continued)

Industry[a]	N (1)	Raw Industry Effect (2)	Average Person Effect (3)	Average Firm Effect (4)
44 Textile products	112,839	−0.082	−0.099	−0.005
45 Leather products except footwear	14,004	−0.105	−0.120	−0.011
46 Footwear	26,097	−0.077	−0.097	−0.007
47 Apparel, clothing, and allied products	91,927	−0.098	−0.115	−0.007
48 Lumber mills	36,965	−0.111	−0.115	−0.009
49 Furniture and fixtures manufacture	42,245	−0.097	−0.098	−0.009
50 Pulp and paper mills and packaging products	49,447	0.065	0.037	−0.003
51 Printing and publishing	81,786	0.126	0.115	−0.004
52 Rubber products	39,252	0.026	−0.008	0.013
53 Plastic products	46,464	0.014	−0.015	−0.004
54 Miscellaneous manufacturing industries	43,463	−0.068	−0.077	−0.006
55 Construction	580,802	−0.119	−0.076	−0.012
56 Waste product management	8,978	−0.123	−0.090	−0.013
57 Wholesale food trade	94,773	−0.009	−0.004	−0.007
58 Wholesale nonfood trade	100,879	0.020	0.029	−0.008
59 Interindustry wholesale trade	139,851	0.061	0.068	−0.007
60 Commercial intermediaries	23,632	0.091	0.105	−0.013
61 Retail food and supermarkets	63,039	−0.037	−0.035	0.000
62 Retail specialty and neighborhood food trade	110,251	−0.103	−0.091	−0.008
63 Retail general merchandise and nonfood trade	30,734	−0.040	−0.033	−0.005
64 Retail specialty nonfood trade	202,973	−0.059	−0.043	−0.014
65 Automobile dealers, auto parts, and repair trade	131,469	−0.059	−0.023	−0.008
66 Miscellaneous repair services	7,733	−0.096	−0.056	−0.013
67 Hotels, motels, bars, and restaurants	171,703	−0.132	−0.103	−0.013
68 Railroad transportation	94,582	0.051	−0.135	0.207
69 Bus, taxicab, and other urban transit	105,248	−0.039	−0.029	−0.009
70 Inland water transportation	1,076	−0.011	−0.017	−0.001
71 Marine transport and coastal shipping	3,469	0.191	0.187	−0.001
72 Air transportation	18,400	0.269	0.256	0.018
73 Allied transportation and warehousing services	12,739	0.069	0.066	−0.003
74 Travel agencies	50,459	0.015	0.015	−0.005
75 Telecommunications and postal services	3,036	0.069	0.070	−0.008
76 Financial holding companies	4,457	0.299	0.301	0.004
77 Advertising and consulting services	275,102	0.038	0.070	−0.016
78 Brokers, credit agencies, and insurance sales	20,119	0.076	0.108	−0.005
79 Commercial real estate development and sales	38,615	−0.045	−0.007	−0.012

(continued)

Table 10.4 (continued)

Industry[a]	N (1)	Raw Industry Effect (2)	Average Person Effect (3)	Average Firm Effect (4)
80 Nonresidential goods rental services	14,453	0.031	0.057	−0.004
81 Real estate renting and leasing	28,879	−0.080	−0.048	−0.013
82 Commercial education services	7,141	−0.141	−0.092	−0.016
83 Commercial research services	3,837	0.165	0.182	−0.005
84 Commercial health services	368,696	0.064	0.089	−0.001
85 Commercial social services	35,987	−0.120	−0.094	−0.007
86 Commercial entertainment and recreation services	27,719	0.111	0.127	0.005
87 Miscellaneous commercial services	85,144	−0.246	−0.207	−0.023
88 Insurance carriers	53,292	0.099	0.124	−0.001
89 Banks and financial institutions	138,909	0.172	0.188	0.003
Weighted adjusted standard deviation		0.098	0.090	0.032

Source: Abowd, Kramarz, and Margolis (in press, table VII).

Notes: Standard errors available on request. Except for ferrous metal, the maximum standard error for the raw industry effect and the average person effect is 0.006 and for the average firm effect is 0.001. The weighted average standard deviation is based on the formula from Krueger and Summers (1988).

[a]Translation of the Nomenclature d'Activités Productives–100 to SIC two-digit.

shows the basic interindustry wage differentials at the two-digit level for the sample of French firms. These basic differentials are adjusted for time-varying individual characteristics, x, and non-time-varying characteristics so that they represent only the unobservable personal and firm-level heterogeneity. Column (2) is our estimate of $\hat{\kappa}_k = \bar{\theta}_k + \bar{\psi}_k$ for the two-digit industrial classification. The overall magnitude of the interindustry wage differentials in France is not as great as in the United States (compare our weighted standard deviation of 0.098 to the Krueger and Summers 1988 estimate of 0.160). Column (3) shows the part of the interindustry wage differential that is the average person effect within the industry, the estimated $\bar{\theta}_k$. The weighted adjusted standard deviation of this average person effect is 0.090, so it is clear that person effects represent the major part of the interindustry wage differential in France. Column (4) is the average firm effect within the industry, the estimated $\bar{\psi}_k$. The weighted adjusted standard deviation of the firm effect is only 0.032; thus firm effects account for only about 10 percent of the total interindustry wage differential in France.[9] Virtually all of the interindustry wage differential in France is due

9. The decomposition is not orthogonal because our method permits the average person and firm effects to be correlated across individuals, firms, and industries. Our estimates are not comparable to Groshen (1991) because she cannot control for individual heterogeneity except through an observable occupation effect.

to the tendency to employ individuals with high external wage rates (high θ_i). Evidently, accounting for the higher external wage rates of employees in high-wage industries is an important part of understanding the economic basis of these differentials.[10]

10.6 Conclusions

We have proposed a new measure of external wage rates that is identified in matched longitudinal individual-firm data. Using this measure, in conjunction with other firm and individual data, we have shown that virtually all of the firm size-wage effect (adjusted for individual characteristics) is due to the tendency of large firms to employ individuals with high external wage rates. Similarly, about 90 percent of the interindustry wage differential, again adjusted for individual characteristics, is due to the tendency of high-wage industries to employ individuals with high external wage rates. We believe that these calculations demonstrate, once again, the importance of matched individual-firm data, particularly longitudinal data, for understanding the structure of the labor market.

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10. It is interesting to note, especially in conjunction with the firm size-wage coefficient for the largest firm size category, that the estimated average person effect for the railroad transportation industry, a national monopoly called the SNCF, is large and negative while the average firm effect in this industry is large and positive. This again supports the rent-sharing interpretation we made above.

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