Journal of Economic and Social Measurement 38 (2013) 229–242
DOI 10.3233/JEM-130378
IOS Press

An improved measure of inter-industry pay differentials[1]

Maury Gittleman* and Brooks Pierce
U.S. Bureau of Labor Statistics, Washington, DC, USA

The measurement of inter-industry pay differentials and the resulting use of this information to assess the empirical relevance of different labor market theories have been hampered by the fact that measures of total compensation – as opposed to just wages and salaries – are not available in the datasets traditionally used. We improve upon past measures of inter-industry pay differentials by being the first, to our knowledge, to incorporate microdata on nonwage compensation. Such compensation can easily exceed 40 to 50 percent of wages and thus its inclusion may either diminish or amplify measured industry pay differences. Using the Employer Costs for Employee Compensation (ECEC) data produced by the U.S. Bureau of Labor Statistics, we find that the inclusion of benefits increases industry dispersion by 16 percent when no controls are included and by an even greater 30 percent when controls are included.

Keywords: Inter-industry wage structure, compensation

1. Introduction

Are equivalent workers doing similar work paid more in some industries than in others? This question has been an important one in labor economics for many decades. Slichter [17] was among the first to address it, noting the differing wage rates for unskilled laborers in manufacturing industries. In the 1980s, spurred in part by the increasing availability of microdata that enabled controls for individual characteristics, there was a revival of interest in this area [2,3,11,12]. Though the expanding availability of employer-employee matched databases has helped shift focus away from industry and towards individual employers [1], work in this area continues [4,6,7].

It is well known that large inter-industry wage differentials remain even after attempts have been made to control for a wide array of individual characteristics.

*Corresponding author: Maury Gittleman, Bureau of Labor Statistics, 2 Massachusetts Ave., NE, Room 4130, Washington, DC 20212, USA. Tel.: +1 202 691 6318; Fax: +1 202 691 6310; E-mail: gittleman_m@bls.gov.

[1]The views expressed here are those of the authors and do not necessarily reflect the views or policies of the Bureau of Labor Statistics or any other agency of the U.S. Department of Labor. Researchers may gain access to the data used here by applying to BLS's onsite researcher program (for details, see http://www.bls.gov/bls/blsresda.htm).

Groshen [8] offers a taxonomy for models seeking to explain this finding. Such differentials may arise because: 1) employers sort workers by ability; 2) compensating differentials lead to a variation of wages across industries; 3) there are random variations in pay, perhaps generated or perpetuated by costly information; 4) firms may pay efficiency wages to increase effort, reduce turnover and improve worker morale; and 5) there may be rent sharing. Distinguishing among these competing theories is important because they have different implications for policies in a number of different areas, including foreign trade, unemployment insurance and industrial policy. In addition, variation in wages by industry and, more generally, by employer are important for understanding the distribution of pay, given their impact on the overall distribution and their implications for understanding and addressing differences in pay by demographic group.

The measurement of inter-industry pay differentials and the resulting use of this information both to assess the empirical relevance of different labor market theories and to understand patterns in the distribution of pay have been hampered by the fact that measures of total compensation – as opposed to just wages and salaries – are not available in the datasets traditionally used by labor economists, such as the Current Population Survey (CPS) in the U.S. To our knowledge, we are the first to use compensation microdata in a study of inter-industry pay differentials. Compensation is clearly preferable to wages, given that it measures the actual willingness to pay on the demand side by companies and is what, in competitive labor market models, is being equated to the value of marginal product. Almost without exception, studies prior to this one have used wages and salaries to measure pay, thus omitting an important and growing portion of compensation, noncash benefits. Because nonwage compensation can sometimes exceed 40 to 50 percent of wages, its inclusion has the potential to alter the industry differences noted.

It is possible, for instance, that inter-industry differences are overstated by wages and that including benefits would diminish such differences. For example, health insurance and legally required employer costs like unemployment insurance can have fixed cost attributes that reduce measured percentage differentials across groups of workers. Or, tradeoffs between wage and nonwage forms of compensation could manifest along industry lines. On the other hand, there are a number of reasons to think that the exclusion of noncash compensation has led to an understatement of inter-industry differences. For a variety of reasons, higher benefits tend to go with higher wages. First, some benefits – for example, health insurance and defined contribution pensions – are tax-advantaged in the U.S., making them relatively cheaper for workers with higher marginal tax rates. Second, demands for benefits tend to be very income-elastic [20]. Third, higher-wage individuals tend to have other characteristics such as being older or being married that correlate with greater demand for benefits.

To determine the direction of this effect, this study makes use of a dataset that contains both wage and nonwage compensation, the Employer Costs for Employee

Compensation (ECEC) data produced by the U.S. Bureau of Labor Statistics (USBLS). We find that the inclusion of benefits increases industry dispersion, as measured by the standard deviation of inter-industry differentials, by 16 percent when no controls are included and by an even greater 30 percent when controls are included.

2. Data

The ECEC data used here form part of the National Compensation Survey (NCS) program of the USBLS. The NCS program houses a unique array of data. It is an establishment survey designed to yield comprehensive measures of compensation levels and trends, and of the incidence and characteristics of employer-provided benefits plans. The main strength of the survey is that it provides information on employer-provided benefit plans and costs, in conjunction with other data elements, at the level of the job. Our application, which requires good measures for industry and compensation, along with productivity controls at the job level, plays to this strength.

The NCS surveys workers in private industry establishments, and in State and local government, in the 50 States and the District of Columbia. Major exclusions from the survey are workers in Federal and quasi-Federal agencies, military personnel, agricultural workers, workers in private households, the self-employed, volunteers, unpaid workers, individuals receiving long-term disability compensation, individuals working overseas, individuals who set their own pay (for example, proprietors, owners, major stockholders, and partners in unincorporated firms) and family members being paid token wages [18].

ECEC data are collected from probability samples selected in three stages: (1) a probability sample of geographic areas, (2) a probability sample of establishments within sampled areas, and (3) a probability sample of jobs within sampled establishments. In the first stage, certainty areas are determined and non-certainty areas are selected with probability proportionate to size. In the second stage, establishments within each area are chosen, also with probability proportionate to size.[1,2] Finally, in the third stage, within each establishment, a number of jobs are sampled, with the selection probabilities being proportionate to employment in the job. The number of jobs selected generally ranges from 4 to 8 depending on establishment size.

The typical method of selecting a single job is as follows: Employers will provide a list of all employees, which is refined to correctly reflect the NCS scope, and then an

[1]The sampling frame, or universe, of establishments from which the NCS samples are drawn is derived from state unemployment insurance reports. The frame allows the NCS to start out with robust information on establishment characteristics such as employment, industry and location.

[2]The NCS uses a panel structure to rotate establishments into the survey. To keep the sample current and reduce respondent burden, about one-fifth of the private industry sample is reselected each year, and newly selected private industry panels stay in the survey for five years. For details on the NCS panel structure and the resulting implications for weights construction, see [18].

algorithm selects an individual at random. The job the individual has is then defined using the employer's most narrow occupational classification. The Standard Occupational Classification (SOC) code will be determined, along with whether the job is covered by a collective bargaining agreement, is full-time or part-time, and whether its pay is tied, at least in part, to commissions, piece rates, production bonuses, or other incentives based on production or sales. Job duties, discussed further below, and the job's usual work schedule are also determined. Data are then collected for all workers in a job with these same characteristics as the sampled job. The number of workers in a job ranges from one, when a unique position has been chosen, to as high as in the thousands.

One major use to which NCS data are put is to enable the U.S. President's Pay Agent – which consists of the Secretary of Labor and the Directors of the Office of Management and Budget and the Office of Personnel Management – to compare rates of pay under the General Schedule (GS) to non-Federal rates of pay. As a step in doing so, the NCS collects information on job duties. We use these data elements (or "factors") describing job duties, each of which is an ordinal variable with a number of possible levels, as proxies for skill in our analysis below. As a practical matter, much of the explanatory power of these data keys off of the *Knowledge* factor, which is meant to capture skills related to schooling, training, and experience. *Guidelines* captures the extent to which policies and rules direct the job tasks. *Complexity* describes the intricacy of tasks. *Scope and Effect* describes the importance of the job to the organization as a whole. *Supervision Received* captures how directed the job is. The *Personal Contacts* and *Purpose of Contacts* variables capture the amount and importance of interpersonal communications that are not in the supervisory chain. The variables collected in this process have been shown to be of great use in controlling for skill differences across jobs [7].[3]

Earnings data are collected and converted into average hourly wage rates using work schedule information common to all workers in the sampled job. In the ECEC, earnings are defined to include incentive pay but exclude premium pay for overtime, holiday, and weekend work; shift differentials; bonuses not directly tied to production; payments by third parties such as tips; and payment in kind such as room and board. The ECEC also measures the following types of benefits: paid leave – vacations, holidays, sick leave, and personal leave; supplemental pay – premium pay for work in addition to the regular work schedule (such as overtime, weekend, and holiday work) and for shift differentials, and nonproduction bonuses (such as yearend, referral, and attendance bonuses); insurance benefits – life, health, short-term disability, and long-term disability insurance; retirement and savings benefits – defined benefit and defined contribution plans; and legally required benefits – Social

[3]During the period of our data, the job duty fields were simplified by combining some factors. *Knowledge* was maintained, the two contacts variables were collapsed into one (*Contacts*) and the remaining four factors were aggregated into a single factor called *Job controls and complexity.* For additional details on these job duty elements, see [17].

Security, Medicare, Federal and State unemployment insurance, and workers' compensation. Each component of the ECEC data is collected and converted to a cost per hour worked, and then averaged over the incumbents within a job. These averages are then summed over all the nonwage components to form a measure of nonwage compensation and then added to the hourly wage rate to obtain a measure of total compensation.

As is detailed in [16], there are caveats to be kept in mind when considering these data. First, as the name implies, the data refer to employer costs, which will differ from employee valuations due to a number of considerations including taxes, the fact that the same benefits are being provided to a large group, and to any divergence between an employer's price for a benefit and what an employee would have to pay as an individual [5]. Second, there is a certain amount of measurement error involved in getting job-specific data for some of the components of the ECEC because respondents are sometimes able to report data only for a broader group than the job incumbents, such as the average for all white-collar workers or for all workers.

Nonetheless, we believe the ECEC to be the best compensation microdata that are available in the U.S. They come from a representative sample, comprehensively cover the benefit spectrum and are derived from employer and administrative records. As the industry reports come from the employer and not from descriptions of an employee or his/her proxy, they are apt to be more accurate than those from a household survey. In addition, occupation, which we use as a regression control, is likely to be less error ridden as well [13,14]. While we do not have demographic information, we have high-quality job content information, which, along with other information about the job and the establishment, enable a comparison of jobs across industries.[4]

In contrast to the case of the microdata traditionally used in inter-industry wage analysis, the unit of analysis is a job rather than an individual. When weighted, however, the data represent the average worker and not the average job. Though ECEC data have not been used previously for an analysis of inter-industry pay differences, they have been used in more general studies of compensation inequality [15,16]. In addition, as noted, the ECEC is part of the NCS program of the U.S. Bureau of Labor Statistics, and wage data from the NCS have been used together with data from the CPS in a study of inter-industry wage differentials [7].

3. Prior literature

While the literature on inter-industry *wage* differentials is vast, articles on inter-industry *compensation* differentials are scarce. Two studies have tried to circumvent the lack of availability of nonwage compensation data by linking CPS hourly wage

[4] As shown in [7], R-squareds in wage regressions including the factors underlying work level reach about 0.8, much higher than the comparable wage regressions using the CPS.

Table 1
Employer costs per hour worked and as a percentage of compensation

Compensation component	Average cost per hour worked ($/hr)	Percent of compensation
Wages and salaries	20.81	69.3
Total benefits	9.23	30.7
Health insurance	2.47	8.2
Retirement and savings	1.32	4.4
Paid leave	2.14	7.1
Other benefits	3.30	11.0

Notes. Estimates are based on employer costs from the 2009 ECEC sample, and are hours-weighted statistics. Other benefits include overtime pay and shift differentials, nonproduction bonuses, life insurance, short- and long-term disability benefits, and all legally required benefits.

data with data on total compensation from the U.S. National Income and Product Accounts (NIPA). Krueger and Summers [12] multiplied hourly wages in the May 1984 CPS by the ratio of compensation to wages in NIPA for the corresponding industry. They found that including nonwage compensation tends to increase rather than reduce cross-industry differentials. In a similar exercise with the same NIPA data, Katz and Summers [10] also find that consideration of fringe benefits expands inter-industry differences. While these results are suggestive, the assumption that benefits as a share of compensation do not vary within industry need not hold. For example, Pierce [16] has shown that the share of compensation devoted to benefits tends to increase as compensation rises. Given this and other reasons for within-industry variation in compensation, it seems that compensation microdata would allow for more accurate inter-industry differential estimation. Another motivation for the present study is that the aforementioned results used data from more than 25 years ago, when benefits composed a smaller share of total compensation.

4. Results

Before turning to our main results, we present some descriptive statistics on wages and four groups of benefits: health insurance, retirement and savings, paid leave and a catch-all category for the remainder.[5] As shown in Table 1, wages in the 2009 ECEC averaged $20.81 per hour, or 69.3 percent of total compensation, for the economy as a whole. Benefits averaged $9.23 per hour, or 30.7 percent of total compensation, with the most important categories being health (8.2 percent), leave (7.1 percent) and retirement (4.4 percent).

[5]This final category includes overtime pay and shift differentials, nonproduction bonuses, life insurance, short- and long-term disability benefits, and all legally required benefits. Legally required benefits consist of employer costs for unemployment insurance, workers compensation, and social security and Medicare.

Table 2
Average wages and benefits by industry, 2009 ECEC

Industry	Compensation component ($/hr)				
	Wages and salaries	Health insurance	Retirement and savings	Paid leave	Other benefits
Mining	27.91	3.63	2.99	2.78	6.20
Construction	21.61	2.27	1.68	1.18	4.66
Nonmetallic mineral product manufacturing	18.00	2.72	0.88	1.48	3.94
Primary metals and fabricated metal products	18.71	2.99	0.89	1.78	3.78
Machinery manufacturing	21.57	3.21	1.00	2.46	3.94
Computer and electronic product manufacturing	30.53	3.40	2.15	4.11	5.12
Electrical equipment, appliance manufacturing	19.12	2.94	1.18	2.19	3.68
Transportation equipment manufacturing	26.47	4.26	1.67	3.78	5.78
Wood products	15.22	1.68	0.32	0.92	2.98
Furniture and fixtures manufacturing	16.20	2.22	0.31	1.31	2.81
Miscellaneous and not specified manufacturing	17.95	2.60	0.64	1.84	3.15
Food manufacturing	15.08	2.74	0.92	1.45	3.16
Beverage and tobacco products	22.69	3.92	2.89	3.04	4.99
Textile, apparel, and leather manufacturing	15.29	2.02	0.42	1.35	2.81
Paper and printing	20.43	2.71	1.02	2.15	3.81
Petroleum and coal products manufacturing	34.50	4.12	5.12	4.78	7.17
Chemical manufacturing	27.90	3.45	2.62	3.67	4.87
Plastics and rubber products	16.18	2.53	0.52	1.59	3.22
Wholesale trade	20.91	2.47	0.96	2.01	3.51
Retail trade	13.62	1.25	0.38	0.91	2.03
Transportation and warehousing	20.13	3.01	1.57	2.14	3.77
Utilities	31.26	4.65	3.92	4.71	5.45
Publishing industries (except internet)	26.80	2.75	1.46	3.36	3.95
Motion picture and sound recording industries	27.83	1.99	0.76	3.84	3.17
Broadcasting	26.56	2.54	1.43	3.13	3.96
Telecommunications	28.50	4.37	1.72	4.09	5.02
Internet service providers and data processing services	35.68	3.33	1.76	5.11	4.52
Other information services	20.83	3.18	1.45	2.67	2.58
Finance	27.00	2.90	1.73	3.45	5.59
Insurance	26.04	3.12	1.87	3.22	4.03
Real estate	20.24	2.25	0.61	2.14	3.14
Rental and leasing services	18.52	1.98	1.03	1.63	3.00
Professional and technical services	32.52	2.55	1.38	3.52	5.30
Management of companies and enterprises	31.17	3.18	2.20	4.07	4.68

Table 2, continued

Industry	Compensation component ($/hr)				
	Wages and salaries	Health insurance	Retirement and savings	Paid leave	Other benefits
Administrative and support services	15.10	1.00	0.33	0.87	2.36
Waste management and remediation services	24.44	3.14	2.58	2.54	4.55
Educational services	29.17	4.41	3.11	2.81	2.76
Hospitals	24.03	3.27	1.43	3.19	3.77
Health care services, except hospitals	23.09	2.10	1.09	2.39	3.05
Social assistance	14.75	1.70	0.49	1.56	2.19
Arts, entertainment, and recreation	14.08	1.38	0.33	1.14	2.10
Accommodation	11.54	1.55	0.24	0.92	1.85
Food services and drinking places	8.64	0.37	0.05	0.20	1.26
Repair and maintenance	18.38	1.26	0.41	1.25	2.92
Personal and laundry services	12.63	0.94	0.21	0.76	1.76
Membership associations and organizations	23.92	2.66	1.58	2.92	3.72
Public administration	23.39	4.45	3.63	3.81	3.14

Notes. Source is the 2009 ECEC data.

Table 3
Across-industry correlations of wages and benefits

	Wages and salaries	Health insurance	Retirement and savings	Paid leave	Other benefits
Wages and salaries	1				
Health insurance	0.791	1			
Retirement and savings	0.750	0.912	1		
Paid leave	0.897	0.839	0.761	1	
Other benefits	0.787	0.557	0.474	0.721	1

Notes. Source is the 2009 ECEC data. Statistics shown are weighted correlations of the columns in table 2, with weights being the total employment weight in the industry cell.

Table 2 provides further detail on wages and benefits, showing similar information as in Table 1, except that it is arrayed by industry. A glance at this table suggests that benefit costs are non-negligible components of compensation, with substantial variation across industry. Those industries with high wages also tend to have high benefits, but the rank across all the columns is not identical. That impression is confirmed by the matrix of correlation coefficients, shown in Table 3. The cross-industry correlation of wages with the four benefit categories ranges from 0.750 for retirement and to 0.897 for paid leave. Retirement and health insurance costs are more highly correlated than are either alone with wages. While these correlations are high, it is clear that the ratio of compensation to wages varies by industry, so that including nonwage compensation affects inter-industry differentials.

To see by how much, we now turn to inter-industry analysis. We employ a series of regressions of the form

$$Y = X\beta + Z\alpha + \varepsilon \tag{1}$$

Table 4
Industry wage and compensation premia, 2009 ECEC

Industry	Wages		Compensation	
	Without controls	With controls	Without controls	With controls
Mining	0.329	0.305	0.433	0.404
Construction	0.124	0.115	0.120	0.103
Nonmetallic mineral product manufacturing	−0.043	0.056	0.013	0.089
Primary metals and fabricated metal products	0.002	0.052	0.062	0.088
Machinery manufacturing	0.115	0.063	0.172	0.093
Computer and electronic product manufacturing	0.401	0.078	0.459	0.114
Electrical equipment, appliance manufacturing	0.023	0.108	0.103	0.146
Transportation equipment manufacturing	0.326	0.145	0.441	0.193
Wood products	−0.239	−0.025	−0.249	−0.038
Furniture and fixtures manufacturing	−0.155	0.047	−0.158	0.038
Miscellaneous and not specified manufacturing	−0.055	0.028	−0.015	0.054
Food manufacturing	−0.222	−0.008	−0.140	0.023
Beverage and tobacco products	0.180	0.170	0.305	0.226
Textile, apparel, and leather manufacturing	−0.240	−0.006	−0.238	−0.006
Paper and printing	0.061	0.115	0.095	0.125
Petroleum and coal products manufacturing	0.576	0.344	0.723	0.430
Chemical manufacturing	0.318	0.207	0.398	0.257
Plastics and rubber products	−0.149	0.042	−0.100	0.067
Wholesale trade	0.058	0.082	0.066	0.102
Retail trade	−0.354	−0.124	−0.419	−0.144
Transportation and warehousing	0.020	0.089	0.077	0.111
Utilities	0.510	0.262	0.641	0.343
Publishing industries (except internet)	0.256	0.035	0.258	0.042
Motion picture and sound recording industries	0.082	0.125	0.007	0.088
Broadcasting	0.217	0.029	0.231	0.050
Telecommunications	0.443	0.145	0.528	0.185
Internet service providers and data processing services	0.583	0.077	0.594	0.090
Other information services	0.041	−0.146	0.063	−0.098
Finance	0.212	0.058	0.270	0.135
Insurance	0.276	0.107	0.324	0.156
Real estate	0.025	0.038	0.009	0.050
Rental and leasing services	−0.076	0.007	−0.095	0.013
Professional and technical services	0.469	0.122	0.439	0.117
Management of companies and enterprises	0.458	0.139	0.480	0.144
Administrative and support services	−0.268	−0.064	−0.369	−0.151
Waste management and remediation services	0.226	0.093	0.293	0.133
Educational services	0.369	0.010	0.405	0.015
Hospitals	0.202	−0.028	0.263	−0.003
Health care services, except hospitals	0.074	0.025	0.051	0.025
Social assistance	−0.268	−0.119	−0.290	−0.128
Arts, entertainment, and recreation	−0.340	−0.067	−0.410	−0.115
Accommodation	−0.509	−0.151	−0.518	−0.183
Food services and drinking places	−0.811	−0.224	−0.958	−0.310
Repair and maintenance	−0.055	−0.041	−0.144	−0.103
Personal and laundry services	−0.399	−0.082	−0.500	−0.138
Membership associations and organizations	0.125	0.027	0.109	0.044

Table 4, continued

Industry	Wages		Compensation	
	Without controls	With controls	Without controls	With controls
Public administration	0.209	−0.026	0.352	0.043
R-squared	0.332	0.760	0.383	0.778
Standard deviation of premia (standard error)	0.341 (0.006)	0.107 (0.005)	0.394 (0.006)	0.139 (0.005)

Notes. The final row gives the weighted standard deviation of industry wage premia, where weights are proportionate to total hours worked in the industry. The standard deviations are corrected for sampling error in the premia estimates; their standard errors are shown in parentheses [9]. Controls are the job content variables, ln(establishment employment), and indicators for full-time status, union status, incentive pay, two-digit occupation, Census division, and presence in a metropolitan area.

where Y is either the log hourly wage or the log hourly compensation, Z is a set of indicator variables representing 47 industries, and X is a set of other covariates. There are two regressions for each dependent variable. First, X is only a constant, allowing for the measurement of raw differentials. Second, to assess adjusted differentials, we include a series of variables measuring job duties or content, the log of establishment employment, along with indicators for full-time status, union status, incentive pay, two-digit occupation, Census division, and presence in a metropolitan area.

As shown near the bottom of Table 4, industry affiliation alone explains a substantial amount of the variation in wages (33 percent) and compensation (38 percent). When other controls are added, the R-squared reaches nearly 0.8, much higher than in comparable regressions using household data. The primary explanation for this is that the job content variables explain much more pay variation than their counterparts in the CPS, education and experience. Additionally, as noted, the NCS probably more accurately measure wages, occupation and industry.

Table 4 also displays the industry wage premia in detail. There are two sets of premia for wages and for compensation, one with no controls and one with controls. In all cases, industry premia are log differentials measured relative to the sample average, so weighted averages of the premia equal zero by construction. In addition to the detailed industry premia, the table displays as summary measures the weighted standard deviations of the industry premia, in the final row. Because sampling variation in the coefficient estimates artificially inflates the standard deviation measure, we make an adjustment as in [9].

In the first column, the raw industry wage differentials range from a high of 0.583 log points for Internet service providers and data processing services to a low of −0.811 log points for Food services and drinking places, with a standard deviation of 0.341. When controls are added, industry differentials shrink greatly – all raw industry differentials above 0.10 in absolute value shrink toward zero – with the standard deviation declining by 69 percent. Despite the narrowing of the differentials, industries that were high-paying before controls are added tend to be high-paying

Table 5
Industry wage premia, 2009 CPS

	Wages	
Industry	Without controls	With controls
Mining	0.275	0.365
Construction	0.040	0.109
Nonmetallic mineral product manufacturing	0.002	0.114
Primary metals and fabricated metal products	0.019	0.114
Machinery manufacturing	0.160	0.177
Computer and electronic product manufacturing	0.418	0.173
Electrical equipment, appliance manufacturing	0.188	0.132
Transportation equipment manufacturing	0.294	0.199
Wood products	−0.180	0.004
Furniture and fixtures manufacturing	−0.126	0.042
Miscellaneous and not specified manufacturing	0.093	0.066
Food manufacturing	−0.194	−0.011
Beverage and tobacco products	0.155	0.149
Textile, apparel, and leather manufacturing	−0.254	−0.107
Paper and printing	0.014	0.102
Petroleum and coal products manufacturing	0.470	0.430
Chemical manufacturing	0.344	0.243
Plastics and rubber products	−0.071	0.074
Wholesale trade	0.061	0.106
Retail trade	−0.281	−0.132
Transportation and warehousing	0.000	0.106
Utilities	0.336	0.256
Publishing industries (except internet)	0.171	0.034
Motion picture and sound recording industries	0.153	0.073
Broadcasting	0.161	0.077
Telecommunications	0.319	0.170
Internet service providers and data processing services	0.178	0.034
Other information services	−0.010	−0.085
Finance	0.252	0.124
Insurance	0.234	0.123
Real estate	−0.005	−0.031
Rental and leasing services	−0.148	−0.027
Professional and technical services	0.410	0.156
Management of companies and enterprises	0.362	0.174
Administrative and support services	−0.249	−0.080
Waste management and remediation services	−0.051	0.112
Educational services	0.088	−0.107
Hospitals	0.215	0.031
Health care services, except hospitals	−0.060	−0.050
Social assistance	−0.303	−0.243
Arts, entertainment, and recreation	−0.214	−0.058
Accommodation	−0.358	−0.188
Food services and drinking places	−0.557	−0.214
Repair and maintenance	−0.207	−0.067
Personal and laundry services	−0.435	−0.146
Membership associations and organizations	−0.043	−0.151
Public administration	0.157	0.032

Table 5, continued

	Wages	
	Without controls	With controls
R-squared	0.195	0.514
Standard deviation of premia	0.251	0.132
(Standard error)	(0.001)	(0.002)

Notes. The final row gives the weighted standard deviation of industry wage premia, where weights are proportionate to total hours worked in the industry. The standard deviations are corrected for sampling error in the premia estimates; their standard errors are shown in parentheses [9]. Controls are for five education groups, a quartic in experience, full-time status, union status, two-digit occupation, Census division, and presence in a metropolitan area.

afterwards, as the hours-weighted employment correlation between the two sets of wage differentials is 0.84.

Before turning to the main focus of the paper, inter-industry compensation differentials, it is useful to compare the inter-industry wage differentials from the ECEC to those from the more familiar Current Population Survey (CPS), shown in Table 5. Both sets of wage differentials, with and without controls, are highly correlated with their counterpart in the other dataset. Without controls, the standard deviation is higher for the ECEC, 0.341 to 0.251 in the CPS, owing in part to more accurate industry reporting in establishment surveys. With controls, however, the order is reversed, as the explanatory power of the skill variables in the ECEC leads to a greater narrowing of the standard deviation in that dataset than in the CPS.

We now turn to the measurement of compensation differentials and ask if it is misleading to have wage differentials stand in for compensation differentials. Looking at raw differentials first, we compare column 3 of Table 4 to column 1 in the same table. Some of the differences are quite large. For instance, the raw differential for petroleum and coal products manufacturing widens from 0.576 to 0.723 points when one switches from wages to compensation, while that for Food services and drinking places moves from -0.811 to -0.958 points. Most of the other changes are, however, smaller in absolute value. Even so, for the compensation differentials, we see evidence of increased dispersion, as the standard deviation has risen to 0.394, up 16 percent from that for the raw wage differentials. In other words, rather than offsetting the differentials, the inclusion of compensation has expanded them, with the two sets being very highly correlated (0.99).

How do the compensation differentials look after controlling for skill and other variables? As with the wage differentials, they contract, though not by quite as much (by 65 percent, as measured by the standard deviation). When these adjusted compensation differentials are compared to the wage differentials, however, a different picture emerges. The standard deviation of 0.139 is 30 percent higher than that for wage differentials, confirming that wage differentials do understate the extent of inter-industry differences. While neither Krueger and Summers [12] nor Katz and Summers [10] presented a measure of change for raw dispersion, their increases in dispersion after controls were on the order of 26 and 28 percent, respectively.

Thus, the incorporation of benefit costs clearly expands rather than offsets measured inter-industry differentials. This pattern emerges for a variety of possible reasons, including: tax-advantaged benefits are relatively cheaper for workers with higher marginal tax rates; demand for benefits are very income-elastic; and higher-wage individuals tend to have other characteristics (such as being older or married) that correlate with greater demand for benefits. These explanations do not require that inter-industry differentials reflect ability differences, only that firm and worker choices regarding wage-benefits packages act to magnify inter-industry pay differences. For example, rent capture by workers could generate greater benefit demand (via income or tax-price effects), or, unionized bargaining environments may stress noncash compensation.

5. Concluding remarks

The vast literature measuring inter-industry differentials has almost without exception focused on wage premia and excluded nonwage compensation, an important and growing portion of total compensation. The inclusion of fringe benefits has the potential to either offset measured differentials or expand them. We find that the inclusion of compensation increases industry dispersion, as measured by the standard deviation, by 16 percent when no controls are included and by 30 percent when controls are included. An interesting avenue for future research would be to see if this finding holds at other points in time and for other countries.

References

[1] J.M. Abowd and F. Kramarz, The analysis of labor markets using matched employer-employee data, in: *Handbook of Labor Economics*, O. Ashenfelter and D. Card, eds, Elsevier, New York, 1999, pp. 2630–2710.
[2] W.T. Dickens and L.F. Katz, Inter-industry wage differences and industry characteristics, in: *Unemployment and the Structure of Labor Markets*, K. Lang and J. Leonard, eds, Basil Blackwell, New York, 1987, pp. 48–89.
[3] W.T. Dickens and L.F. Katz, Inter-industry wage differences and theories of wage determination, National Bureau of Economic Research Working Paper No. 2271, 1987.
[4] P. Du Caju, G. Kátay, A. Lamo, D. Nicolitsas and S. Poelhekke, Inter-industry wage differentials in EU countries: What do cross-country time varying data add to the picture? *Journal of the European Economic Association* **8** (2010), 478–486.
[5] M. Famulari and M.E. Manser, Employer-provided benefits: Employer costs versus employee value, *Monthly Labor Review* **112** (December 1989), 24–32.
[6] R. Gibbons, L.F. Katz, T. Lemieux and D. Parent, Comparative advantage, Learning and sectoral wage determination, *Journal of Labor Economics* **23** (2005), 681–724.
[7] M. Gittleman and B. Pierce, Inter-industry wage differentials, job content and unobserved ability, *Industrial and Labor Relations Review* **64** (2011), 356–374.
[8] E.L. Groshen, Five reasons why wages vary among employers, *Industrial Relations* **30** (1991), 350–381.
[9] J.P. Haisken-DeNew and C.M. Schmidt, Interindustry and interregion differentials: Mechanics and interpretation, *Review of Economics and Statistics* **79** (1997), 516–521.

[10] L.F. Katz and L.H. Summers, Industry rents: Evidence and implications, *Brookings Papers on Economic Activity: Microeconomics* (1989), 209–290.
[11] A.B. Krueger and L.H. Summers, Reflections on the inter-industry wage structure, in: *Unemployment and the Structure of Labor Markets*, K. Lang and J. Leonard, eds, Basil Blackwell, New York, 1987, pp. 17–47.
[12] A.B. Krueger and L.H. Summers, Efficiency wages and the inter-industry wage structure, *Econometrica* **56** (1988), 259–294.
[13] N. Mathiowetz, Errors in reports of occupation, *Public Opinion Quarterly* **56** (1992), 352–355.
[14] W. Mellow and H. Sider, Accuracy of response in labor market surveys: Evidence and implications, *Journal of Labor Economics* **1** (1983), 331–44.
[15] B. Pierce, Compensation inequality, *Quarterly Journal of Economics* **116** (2001), 1493–1525.
[16] B. Pierce, Recent Trends in Compensation Inequality, in: *Labor in the New Economy*, K.G. Abraham, J.R. Spletzer and M.J. Harper, eds, University of Chicago Press, Chicago, 2010, pp. 63–98.
[17] S.H. Slichter, Notes on the structure of wages, *Review of Economics and Statistics* **32** (1950), 80–91.
[18] U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Methods, Chapter 8, National Compensation Measures [accessed on December 3, 2012.] Available at: http://www.bls.gov/opub/hom/pdf/homch8.pdf.
[19] U.S. Department of Labor, Bureau of Labor Statistics, National Compensation Survey: Guide for Evaluating Your Firm's Jobs and Pay [accessed on December 3, 2012.] Available at: http://www.bls.gov/ncs/ocs/sp/ncbr0004.pdf.
[20] S.A. Woodbury, Substitution between wage and nonwage benefits, *American Economic Review* **73** (1983), 166–182.