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Weekly Earnings in Export-Intensive U.S. Services Industries

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Executive Summary

In this paper, we analyze the weekly earnings of workers in the U.S. services sector. We estimate the premium in labor earnings in U.S. services industries that are export-intensive. The calculations combine worker-level data on weekly earnings, educational attainment, occupational categories, and other demographic characteristics from the Current Population Survey with industry-level data on U.S. exports of services from the Bureau of Economic Analysis. We estimate that workers in export-intensive services industries earn 15 to 20 percent more than comparable workers in other industries.

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1. Introduction

There are a growing number of econometric studies that estimate an export wage premium in U.S. manufacturing industries, including Bernard and Jenson (1999) and Bernard, Jensen, Redding, and Schott (2007). These studies define the export wage premium as the percentage difference in the average wages of workers in plants that export manufactured goods and the average wages of workers in plants that do not export. Bernard, Jensen, Redding, and Schott (2007) report an export wage premium in 2002 of 6 to 17 percent, depending on whether the authors calculate the premium from within-industry variation or also include between-industry variation. While the authors are able to link specific plants to exporting, their calculation does not control for the level of education and experience of the individual workers within each plant. In addition, these estimates are limited to the manufacturing sector.

It is common for economic studies of international trade and U.S. labor markets to focus on the manufacturing sector rather than the much larger services sector.[1] One reason is that data on international trade in services are less detailed and probably less reliable. A second reason is that services are commonly portrayed as non-traded. For example, economics textbooks often draw a stark contrast between non-traded haircuts and trade in manufactured goods like steel. In fact, for many services, international trade does not require face-to-face interaction. Many U.S. services industries have measurable exports, and their volumes are large and growing. In total, U.S. exports of private services accounted for $410.8 billion in 2006, $478.1 billion in 2007, and $527.8 billion in 2008.

In this paper, we focus on the U.S. services sector, and specifically on the weekly earnings of workers in services industries. We analyze worker-level data on weekly earnings, educational attainment, occupational categories, and other demographic characteristics from the Current Population Survey (CPS) in 2006, 2007, and 2008 and industry-level data on U.S. services exports from the Bureau of Economic Analysis (BEA). We find that workers in export-intensive services industries earn, on average, 15 to 20 percent more than comparable workers in other U.S. services industries.

[1] Jensen (2009) estimates that the services sector accounts for approximately 85 percent of U.S. employment.

Our estimates update and corroborate the estimated earnings premium for tradable services industries in Jensen and Kletzer (2006, 2008). Jensen and Kletzer also analyze individual-level data and control for worker characteristics like educational attainment.[2] However, instead of directly measuring U.S. services trade, they infer whether services industries are tradable based on the geographic concentration of each industry's employment within the United States. Despite the differences in methodology, the set of industries that Jensen and Kletzer classify as tradable is essentially the same as the set that we classify as export-intensive. Many of these are in the export-intensive major business services sectors highlighted in Jensen (2009). Despite the difference in the time period that Jensen and Kletzer examine, the export earnings premium that they estimate is similar to our estimates for more recent years. They find that workers in tradable services industries earned approximately 15 percent more, even after controlling for differences in the educational attainment of the individual worker. In addition, they find that earnings are almost 20 percent higher in tradable industries within the professional services sector.

2. We combine data on individual worker characteristics with data on international trade in services

We analyze the weekly earnings of approximately 430,000 U.S. workers who responded to the CPS in 2006, 2007, or 2008. These data are provided in the NBER's Merged Outgoing Rotation Group extracts. The sample is limited to individuals employed in U.S. services industries.[3] The measure of each worker's compensation is his or her usual weekly earnings, converted to constant 2008 dollars. Our statistical analysis takes into account individual characteristics that are likely to affect a worker's earnings, including educational attainment, age, occupational category, race, sex, and state of residence.

The data on U.S. private services exports are published by the Bureau of Economic Analysis (BEA) in *U.S. International Services: Cross-Border Trade 1986-2008, and Services*

[2] They analyze data from the Public Use Micro-Sample of the 2000 Census.

[3] We define the services sector as Census Industrial Classification codes 0770, 0570-0690, and 4069-9291 in the CPS data.

Supplied Through Affiliates, 1986-2007. The data are based on responses to BEA surveys. Responding companies reported the dollar value of their sales of selected services and intangible assets to foreign entities. BEA started publishing significantly more disaggregated services trade data in 2006, and therefore we restrict our econometric analysis of earnings in 2006, 2007, and 2008. There are 26 distinct types of private services reported for these three years (Table 1).

We construct a concordance between the industry categories of the BEA services exports and the NAICS codes used in the 2007 Economic Census and the Current Employment Survey (CES) and to the Census Industry Classification (CIC) codes assigned to individuals in the CPS data. In most cases, the concordance is straightforward. For example, the Advertising Services category in the BEA data corresponds to NAICS 5818. In other cases, the concordance is more ambiguous. For example, there is not a specific match for BEA's Other Services category. The BEA categories that we could clearly match account for $469.2 billion in private U.S. services exports in 2008, which is 89.2 percent of total private U.S. services exports in that year. The remaining categories cannot be assigned to a specific CIC code and therefore are not matched to the CPS data. The largest examples of unmatched export categories are a miscellaneous Other Services category (4.7 percent of the total), Installation and Maintanence (2.1 percent of the total) and Operational Leasing (1.7 percent of the total).

For each of the CIC industries that we matched to the BEA services export data, we calculated two measures of export intensity, the dollar value of exports per worker and the ratio of the value of exports to the total revenues for the corresponding NAICS industry (Table 2). We classify industries as Export-Intensive Services Industries (EISIs) if the dollar value of the industry's exports per employee was greater than $5,000 in 2007 *or if* the ratio of the value of exports to the total revenues of the industry was greater than one percent. The classification of industries as EISIs is the same under either of these two criteria.

Table 1: U.S. Private Services Exports in Millions of Dollars

Industry	2006	2007	2008
Accounting auditing and bookkeeping	$717	$883	$1,399
Advertising	$3,773	$4,041	$4,019
Architecture and engineering (1)	$8,605	$9,186	$9,964
Computer services	$10,079	$11,638	$12,599
Construction	$739	$1,021	$1,679
Education	$14,647	$15,956	$17,796
Film and television tape rentals	$12,823	$14,422	$13,598
Financial services	$47,647	$61,393	$60,190
Installation, maintenance, and repair	$7,673	$8,946	$9,661
Insurance services	$9,445	$10,184	$10,756
Legal services	$5,256	$6,409	$7,269
Management and consulting services	$21,421	$25,331	$26,942
Medical services	$2,166	$2,306	$2,467
Mining	$721	$2,170	$3,080
Operational leasing	$6,183	$7,363	$7,942
Other business professional and tech	$920	$1,160	$1,352
Other services	$7,737	$8,241	$8,500
Research and development and testing	$12,810	$14,293	$17,139
Royalties – Industrial	$32,415	$36,791	$40,130
Royalties – Other	$38,311	$47,033	$51,469
Sports and performing arts	$431	$635	$755
Telecommunications	$7,105	$8,043	$9,163
Trade-related services	$3,611	$5,216	$6,112
Training Services	$1,284	$1,240	$1,414
Transportation	$68,261	$77,186	$90,568
Travel (2)	$85,789	$97,050	$110,090
Total Private Services	$410,805	$478,136	$527,786

Source: BEA. *U.S. International Services: Cross-Border Trade 1986-2008, and Services Supplied Through Affiliates, 1986-2007*.

Notes: (1) this category includes architectural, engineering and other technical services as well as industrial engineering; (2) this category includes passenger fares and other transportation services.

Table 2: Export-Intensive Services Industries

Industry	2007 NAICS Codes	Services Exports per Employee	Exports as a Share of Revenues	Classified as EISI? (1)
Accounting auditing and bookkeeping	5412	$943	0.8%	No
Advertising	5418	$8,572	4.5%	Yes
Architecture and engineering	5413	$6,414	3.6%	Yes
Computer services	5182	$43,458	17.0%	Yes
Construction	23	$134	0.2%	No
Education	6113	$10,762	32.5%	Yes
Financial services	5211-5239	$16,431	3.0%	Yes
Insurance services	5241-5242	$4,415	0.6%	No
Legal services	5411	$5,453	2.5%	Yes
Management and consulting services	5416	$26,589	19.2%	Yes
Medical services	6211-6239	$178	0.1%	No
Mining	21	$3,269	0.1%	No
Research and development and testing (2)	5417	$23,735	14.7%	Yes
Sports and performing arts	7111-7115	$1,568	0.8%	No
Telecommunications	5171-5179	$7,804	1.6%	Yes
Transportation	4811-4889	$23,425	17.2%	Yes
Travel	5615, 7211	$47,583	44.8%	Yes

* Note: (1) We classified services industries as EISI if the dollar value of service exports per employee was greater than $5,000 in 2007 and exports accounted for more than one percent of total revenues. The same set of industries meet both of these alternative criteria. (2) In this table, we did not include royalties in the exports for research and development and testing, to be conservative. If we had, research and development and testing would still be classified as an EISI.

3. There are significant differences in earnings and demographics among the services industries

Having separated the industries into two groups, we examine whether there are significant different in average earnings of the groups. Usual weekly earnings are approximately 33% higher for workers in the EISIs than for their counterparts in the other services industries (Table 3). To determine whether this difference is statistically significant, we compare the difference in the group means to the standard errors of the group means. A formal t-test indicates that the group means are statistically different at the one percent significance level.

Likewise, there are significant differences in the group means of the educational attainment, occupation, and demographic measures, and these differences across the two groups of industries account for some of the differences in earnings. For example, the share of workers with a college degree is 12.8 percentage points higher for the EISIs, and the share of workers with a graduate degree is 7 percentage points higher, indicating that workers in the EISIs are, on average, more highly educated than workers in the other services industries. The share of workers who are at least 35 years old is 5.8 percentage points higher for the EISIs, and the average age is approximately 1.75 years older for the EISIs, which suggests that workers in these industries are probably more experienced on average. In addition, the share of workers in white collar occupations is more than 12 percentage points higher for EISIs.

If we condition on these differences in individual characteristics, then the differences in usual weekly earnings are smaller than the 33% difference that we observed in the unconditional means. For example, among college graduates, the average of usual weekly earnings in EISI industries is only 28% higher than the average of usual weekly earnings in the other services industries. Similarly, if we only look at workers who are at least 35 years old, then the average of usual weekly earnings in EISIs (for workers at all levels of educational attainment) is only 19% higher than the average of usual weekly earnings in the other services industries. In the next section, we use a multivariate regression model to quantify the export premium in weekly earnings by simultaneously conditioning on a combination of the education, occupation, and demographic measures.

Table 3: Descriptive Statistics for the Two Groups of Services Industries

	Export-Intensive Service Industries	All Other Service Industries	Test of the Difference in the Group Means
Average weekly earnings in 2008 dollars	$947.57 (2.2746)	$714.76 (0.9499)	t = 120.000 p = 0.000
Share with a college graduate	0.4146 (0.0017)	0.2871 (0.0008)	t = 72.3634 p = 0.000
Share with a graduate degree	0.1645 (0.0013)	0.0935 (0.0005)	t = 60.1905 p = 0.000
Share with Age ≥ 35	0.6736 (0.0016)	0.6155 (0.0008)	t = 31.4622 p = 0.000
Age	41.6985 (0.0445)	39.9512 (0.0239)	t = 33.0602 p = 0.000
Share with a white collar occupation	0.7381 (0.0015)	0.6120 (0.0008)	t = 68.9457 p = 0.000
Number of observations	85,363	344,165	

Note: Standard errors are reported in parentheses.

4. Regression analysis provides more precise estimates

We estimate an econometric model of earnings based on the following equation:

$$ln(W_{ijt}) = \alpha_t + \beta\ EISI_j + \gamma\ Z_{it} + \varepsilon_{ijt}$$

The variable W_{ijt} is the usual weekly earnings for individual i, employed in industry j in month t. $EISI_j$ is an indicator variable that is equal to one if industry j is export-intensive, following the definition above, and is equal to zero otherwise. Z_{it} represents a set of earnings-relevant individual characteristics, including educational attainment, age, occupational category, race, sex, state, and year. ε_{ijt} is an error term.

The coefficients on the individual characteristics (the γ coefficients) measure the contribution to the worker's usual weekly earnings from these characteristics. The coefficient on $EISI_j$ (the β coefficient) measures the premium in export-intensive services industries relative to the other services industries.[4] We estimate a common β coefficient across the EISIs. If the premium varies across the EISIs, then this pooled estimate is the average premium for the group of industries. We estimate the parameters of the model using Ordinary Least Squares.[5] Our estimates are based on variation in earnings both within industries and between industries.[6]

We report the parameter estimates for three alternative specifications that include different sets of individual characteristics Z_{it} (Table 4). Workers who have a college education, are 35 or older, work in white collar occupations, are male, and are white had higher weekly earnings on average. The coefficient on each of these individual characteristics is statistically significant at the one percent level, and the positive signs are consistent with the extensive

[4] Technically, it is the mean difference in usual weekly earnings conditional on the set of worker characteristics Z_{it}. The regression estimate is equivalent to the following three-step process: First, estimate the contribution to the weekly earnings from the worker's individual characteristics like education and age. This is the average percentage addition to earnings that is associated with each characteristic. Second, subtract these percentage additions from the measure of weekly earnings to calculate the conditional means for each group of industries. Third, calculate the difference in the conditional means.

[5] We weight the individual observations using the CPS sampling weights, and we correct for potential clustering in the error terms.

[6] The studies by Bernard and Jensen that focus on manufacturing industries find that the export premium in earnings is smaller when it is estimated using only within-industry variation in earnings. However, it is not possible for us to include industry fixed effects in our regression specification, because our measure of export intensity is an industry-level effect. It would be possible to include additional industry-level explanatory variables in the regression specification, and this would change the estimate of β because it would change the definition of the coefficient. We are estimating the average wage difference in services industries that are export-intensive conditional on the workers' observable individual characteristics. The alternative specification would also condition on the new industry-level variables. This would be an important estimation issue if we were trying to establish the cause of the export earnings premium, but we are not. Our export earnings premium, β, is intended to simply measure the difference in the conditional means of the two groups of industries.

economics literature on the determinants of wages. Conditional on these individual characteristics, the weekly earnings for workers in EISIs are 15.84 to 20.40 percent higher, depending on the model specification. Because we utilize a large sample of workers in the CPS, this export earnings premium is fairly precisely estimated for each of the model specifications.

We designate Model 3 as the benchmark specification. It includes the largest number of individual characteristics, and they are all statistically significant. Next, we examine the sensitivity of the benchmark estimate of β to variations in the sample period and in how the individual characteristics are measured.

When we estimate separate models for each year, we find that the export earnings premium varies across the years, but it remains in a small range (14.82 to 16.55) around the benchmark estimate (Table 5). The estimated coefficients on the individual characteristics are fairly consistent across the three years.

Next, we estimate the model using alternative measures of age and education. We find that the earnings premium in the EISIs again remains close to the point estimate of 15.84 percent in the benchmark model (Table 6). First, we replace age with a proxy for experience.[7] Second, we replace the indicator that a worker is a college graduate with separate indicators for whether the college graduate has only an undergraduate degree or has a graduate degree as well.

We find that adding an indicator of the union status of the individual worker also does not have a substantial effect on the estimated earnings premium in the EISIs (Table 7). The indicator variable for union status is equal to one if the worker is a member of a union or is covered by a union agreement. Otherwise, it is equal to zero. Union status is likely to be a determinant of earnings, and it may be correlated with the export intensity of the worker's industry.

We also find that the estimated earnings premium is larger when we adopt a stricter definition of EISIs. In this sensitivity analysis, we only include industries with services exports greater than $15,000 per employee, compared to $5,000 per employee in the benchmark model. Using this more restrictive definition of EISIs, we calculate that the weekly earnings for workers in export-intense services industries are 19.64 to 24.14 percent higher (Table 8).

[7] The proxy for experience is age minus years of education minus six.

Table 4: Baseline Econometric Models

The dependent variable is the log of usual weekly earnings.

Regressors	Model 1	Model 2	Model 3
Export Intensive Services Industry	0.2040 (0.0019)	0.1610 (0.0054)	0.1584 (0.0053)
Age ≥ 35	0.3827 (0.0182)	0.3898 (0.0115)	0.3891 (0.0112)
College Graduate	0.5574 (0.0091)	0.5234 (0.0246)	0.5183 (0.0254)
White Collar Occupation	0.1766 (0.0141)	0.2926 (0.0077)	0.2920 (0.0079)
Male		0.4025 (0.0176)	0.3981 (0.0170)
White		0.0383 (0.0174)	0.0562 (0.0202)
Constant Included	Yes	Yes	Yes
Year Fixed Effects Included	No	No	Yes
State Fixed Effects Included	No	No	Yes
R^2 Statistic	0.2101	0.2626	0.2678
Number of Observations	429,528	429,528	429,528

Note: Robust standard errors are reported in parentheses.

Table 5: Sensitivity Analysis for the Econometric Analysis – Separate Estimates for Each Year

The dependent variable is the log of usual weekly earnings.

Regressors	Benchmark Model	2006 Only	2007 Only	2008 Only
Export Intensive Services Industry	0.1584 (0.0053)	0.1655 (0.0046)	0.1482 (0.0044)	0.1617 (0.0067)
Age ≥ 35	0.3891 (0.0112)	0.3966 (0.0073)	0.3830 (0.0151)	0.3879 (0.0112)
College Graduate Only	0.5183 (0.0254)	0.5135 (0.0221)	0.5183 (0.0261)	0.5228 (0.0279)
White Collar Occupation	0.2920 (0.0079)	0.2934 (0.0080)	0.2953 (0.0058)	0.2878 (0.0097)
Male	0.3981 (0.0170)	0.4011 (0.0112)	0.4059 (0.0133)	0.3876 (0.0260)
White	0.0562 (0.0202)	0.0596 (0.0145)	0.0533 (0.0254)	0.0561 (0.0210)
Constant Included	Yes	Yes	Yes	Yes
Year Fixed Effects Included	Yes	No	No	No
State Fixed Effects Included	Yes	Yes	Yes	Yes
R^2 Statistic	0.2678	0.2738	0.2656	0.2655
Number of Obs.	429,528	144,524	143,384	141,620

Table 6: Sensitivity Analysis for the Econometric Analysis – Alternative Demographics

The dependent variable is the log of usual weekly earnings.

Regressors	Benchmark Model	Alternative 1	Alternative 2
Export Intensive Services Industry	0.1584 (0.0053)	0.1619 (0.0056)	0.1552 (0.0065)
Age ≥ 35	0.3891 (0.0112)		0.3828 (0.0106)
Experience		0.0117 (0.0004)	
College Graduate	0.5183 (0.0254)	0.5728 (0.0241)	
Undergraduate Degree Only			0.4654 (0.0226)
Post Graduate Degree			0.6307 (0.0419)
White Collar Occupation	0.2920 (0.0079)	0.2958 (0.0099)	0.2870 (0.0085)
Male	0.3981 (0.0170)	0.3974 (0.0163)	0.3959 (0.0181)
White	0.0562 (0.0202)	0.523 (0.0199)	0.0564 (0.0201)
Constant Included	Yes	Yes	Yes
Year Fixed Effects Included	Yes	Yes	Yes
State Fixed Effects Included	Yes	Yes	Yes
R^2 Statistic	0.2678	0.2533	0.2704
Number of Obs.	429,528	429,528	429,528

Table 7: Sensitivity Analysis for the Econometric Analysis – Adding Union Status

The dependent variable is the log of usual weekly earnings.

Regressors	Model 4	Model 5	Model 6
Export Intensive Services Industry	0.1995 (0.0003)	0.1566 (0.0044)	0.1544 (0.0042)
Age ≥ 35	0.3678 (0.0171)	0.3747 (0.0109)	0.3746 (0.0106)
College Graduate	0.5419 (0.0031)	0.5078 (0.0115)	0.5042 (0.0128)
White Collar Occupation	0.1868 (0.0082)	0.3029 (0.0031)	0.3018 (0.0033)
Union	0.2335 (0.0284)	0.2350 (0.0378)	0.2302 (0.0375)
Male		0.4026 (0.0204)	0.3982 (0.0198)
White		0.0414 (0.0196)	0.0588 (0.0224)
Constant Included	Yes	Yes	Yes
Year Fixed Effects Included	No	No	Yes
State Fixed Effects Included	No	No	Yes
R^2 Statistic	0.2181	0.2707	0.2754
Number of Observations	429,528	429,528	429,528

Table 8: Sensitivity Analysis – Stricter Definition of Export-Intensive Services Industries

The dependent variable is the log of usual weekly earnings.

The stricter EISI definition includes the industries in Table 2 with exporters per employee above $15,000.

Regressors	**Model 7**	**Model 8**	**Model 9**
Export Intensive Services Industry	0.2414 (0.0009)	0.2000 (0.0030)	0.1964 (0.0031)
Age ≥ 35	0.3814 (0.0118)	0.3884 (0.0169)	0.3878 (0.0166)
College Graduate	0.5716 (0.0020)	0.5344 (0.0113)	0.5290 (0.0122)
White Collar Occupation	0.1873 (0.0003)	0.3015 (0.0053)	0.3007 (0.0054)
Male		0.4043 (0.0119)	0.3999 (0.0113)
White		0.0398 (0.0132)	0.0576 (0.0139)
Constant Included	Yes	Yes	Yes
Year Fixed Effects Included	No	No	Yes
State Fixed Effects Included	No	No	Yes
R^2 Statistic	0.2099	0.2631	0.2682
Number of Observations	429,528	429,528	429,528

5. The export earnings premium can have important policy implications

At first glance, the earnings premium suggests that the expansion of U.S. services exports will not only increase jobs but will increase relatively high-paying jobs. However, this depends on whether the export earnings premium is *replicable*, meaning that additional hires in the industry will also earn the premium that was earned by the workers in our 2006-2008 sample. Whether the export earnings premium is replicable depends on its cause.

Economic theory provides some guidance on this issue. Export-intensive industries generally offer opportunities for greater productivity and greater compensation, though this is not necessarily a consequence of exporting. For example, an industry may be more productive due to superior technology that was not developed in response to export opportunities, but by virtue of its high productivity, the industry is also successful in export markets.[8] There is an extensive economics literature that tries to identify factors that lead to export success, including Bernard and Jensen (1999). Helpman, Itskhoki, and Redding (2010) is an important contribution to this literature. The authors demonstrate in the context of a general equilibrium model of international trade that exporters tend to employ workers with higher average ability than non-exporters, and the higher productivity of the employment match is reflected in higher labor compensation.[9]

If the export earnings premium is due to superior technology that does not exhibit decreasing returns to scale, then we would expect the earnings premium to persist as U.S. services exports expand and the export-intensive industries hire additional workers. On the other hand, the export earnings premium may not be replicable.[10]

Our econometric analysis does not try to establish the cause of the export earnings premium and whether it is replicable; however, as we noted above, the export earnings premium in the U.S. services sector appears to be stable in magnitude over the last decade – in the analysis

[8] In this case, higher wages are positively correlated with exporting but they are not a consequence of exporting.

[9] In their model, export opportunities also raise the compensation of workers with a given level of productivity.

[10] In theory, the premium could reflect unobservable worker skills that are not possessed by new hires.

of 2000 earnings by Jensen and Kletzer and in our analysis of earnings in 2006, 2007, and 2008 – *despite* the substantial expansion of U.S. services exports over this period. The stability of the export earnings premium suggests that it will not diminish with future expansion of U.S. services exports.

6. Conclusions

Our econometric analysis indicates that relatively higher weekly earnings in export-intensive services industries can be explained in part by higher levels of educational attainment of the workers and other individual characteristics. However, even after conditioning on the observable differences in individual characteristics, there is a significant difference in earnings between services industries that are export-intensive and services industries that are not. Workers in export-intensive services industries earn 15 to 20 percent more than comparable workers in other U.S. services industries.

The estimates in this paper are limited by the availability of data on U.S. services exports. The data are not reported on an adequately disaggregated industry basis, unlike data on trade in manufactured goods, and therefore it is difficult to match the services exports to the detail industry data available for the U.S. economy. If the coverage and quality of services trade data can be significantly improved, then the analysis of their relation to earnings can be further refined.

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