

Service Offshoring and White-Collar Employment

Online Data Appendix

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July 2009

This web appendix provides additional details on data and variables. The sample includes 144 industries, listed in Table A1, and spans the period 1997-2006.

Occupational Employment

The Occupational Employment Statistics (OES) are based on survey data from a probability sample of approximately 1.2 million non-farm establishments, stratified by area, industry and size. The survey is administered annually (semiannually since 2003) to approximately 400,000 (200,000) establishments. Typically, each establishment is surveyed only once every three years, so that all establishments are interviewed within three years. Yearly estimates of employment and wages are based on survey results for the entire three-year period. Occupational employment at the industry-level is computed as the weighted average of occupational employment across establishments. Construction of industry-level wages is more complicated. For each occupation, the survey asks establishments to report the number of employees that earn wages falling into twelve contiguous intervals. Occupational wages are computed as employment-weighted averages of the mean wage rates for these intervals; wage data for the previous two years are adjusted through a weighting scheme based on the Employment Cost Index of the Bureau of Labor Statistics (BLS).

Before 1999, occupations were classified according to a system that was specific to the OES at that

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time. Afterwards, the OES adopted the Standard Occupational Classification (SOC), which organizes over 800 6-digit minor occupations into twenty-three 2-digit major groups. Only for about half of the minor occupations can a counterpart be found in the earlier coding scheme. From these, I exclude occupations that do not represent productive inputs: "arts, design, entertainment, sports and media occupations", "community and social service occupations", "healthcare support occupations", "military specific occupations", "education, training and library occupations", "protective service occupations", "farming, fishing and forestry occupations", "personal care and service occupations", "healthcare practitioners and technical occupations", "food preparation and serving related occupations". I then merge the remaining minor occupations with their counterparts in 1997-1998, by looking at the descriptions of the main activities available on the BLS web site. Finally, I aggregate some of the minor occupations to keep the dimension of the problem tractable. This yields the final number of 112 minor occupations used in the paper; they are listed in Table A2 with the corresponding thirteen major groups.

The OES report data on wages and employment for both the minor occupations and the major groups. The latter, however, are calculated by considering also some minor occupations for which employment and wages are not reported to avoid disclosure. Hence, I estimate the employment and wage data for the major groups by taking into account only the minor occupations used in the analysis. Finally, for the occupations and industries with zero employment, the OES do not provide a wage estimate. I assume that when firms make decisions as to the number of workers to hire, the expected cost to them for each occupation corresponds to the average wage paid to the occupation in the economy as a whole. Accordingly, I replace missing wage estimates for the occupations and industries with zero employment with the economy-wide average wages of the same occupations reported in the national OES files.

Table A3 reports the share of national employment accounted for by the sample in 2006 for all minor white-collar occupations and for all major groups (column 1), the fraction of zero observations in the sample (column 2), and descriptive statistics on the wage-bill and variable-cost shares used in the FAST model (columns 3-4).

Other Variables

Material offshoring is the share of imported intermediate inputs in total non-energy input purchases. It is computed as in equation (1) in the paper, using the 1997 Import Matrix and economy-wide commodity imports from Feenstra et al. (2002) and the International Trade Commission. Industry openness, import penetration and export intensity are computed with trade data from Feenstra et al. (2002), the International Trade Commission and the Bureau of Economic Analysis (BEA). From BEA also come the data on ICT prices (*Prices and Output for Information and Communication Technologies - GDP and Final Sales of Computers*) and high-tech capital (*Non-Residential Fixed-Assets*); the latter are available at the 2-digit SIC level.

Nominal data on output (shipments), energy (electricity) and non-energy materials come from the Bureau of the Census (*Annual Survey of Manufactures*) and BEA (*Industry Economic Accounts – Supplemental Estimates*); real figures are obtained using industry-specific deflators available from the same sources. Information on capital stock for the service industries comes from BEA; for manufacturing industries, the capital stock is calculated by extending the series in the *NBER Manufacturing Industry Productivity Database* (Bartelsman and Gray, 1996) through a Perpetual Inventory Method using investment data from the *Annual Survey of Manufactures* and depreciation rate equal to 7 percent. Descriptive statistics on these variables are in Table A4.

Proxies for Skills, Tradability and other Occupational Characteristics

Table A5 reports details on the three skill classifications. Tables A6 and A7 report definitions and numerical values of the indices of tradability and other occupational characteristics.

References

- [1] Bartelsman, E.J. and W. Gray, 1996, "The NBER Manufacturing Productivity Database," *NBER Technical Working Paper 205*
- [2] Feenstra, R.C., J. Romalis and P.K. Schott, 2002, "U.S. Imports, Exports, and Tariff Data, 1989-2001," *NBER Working Paper 9387*

Table A1 - Industries Used in the Analysis

Wholesale trade	Rubber and plastics footwear
Retail trade	Gaskets, packing, and sealing devices and rubber
Finance and insurance	Fabricated rubber products, not elsewhere classified
Real estate, rental and leasing	Miscellaneous plastics products
Legal services	Leather tanning and finishing
Computer systems design and related services	Boot and shoe cut stock and findings
Miscellaneous professional, scientific, and technical services	Footwear, except rubber
Management and public relations services	Leather gloves and mittens
Motion picture and sound recording industries	Luggage
Meat products	Handbags and other personal leather goods
Dairy products	Leather goods, not elsewhere classified
Canned, frozen, and preserved fruits, vegetables, and food specialties	Flat glass
Grain mill products	Glass and glassware, pressed or blown
Bakery products	Glass products, made of purchased glass
Sugar and confectionery products	Cement, hydraulic
Fats and oils	Structural clay products
Beverages	Pottery and related products
Miscellaneous food preparations and kindred	Concrete, gypsum, and plaster products
Cigarettes	Cut stone and stone products
Cigars	Abrasive, asbestos, and miscellaneous
Chewing and smoking tobacco and snuff	Steel works, blast furnaces, and rolling and finishing mills
Tobacco stemming and redrying	Iron and steel foundries
Broadwoven fabric mills, cotton	Primary smelting and refining of nonferrous metals
Broadwoven fabric mills, manmade fiber and silk	Secondary smelting and refining of nonferrous metals
Broadwoven fabric mills, wool (including dyeing and finishing)	Rolling, drawing, and extruding of nonferrous metals
Narrow fabric and other smallwares mills cotton, wool, silk, and manmade fiber	Nonferrous foundries (castings)
Knitting mills	Miscellaneous primary metal products
Dyeing and finishing textiles, except wool fabrics	Metal cans and shipping containers
Carpets and rugs	Cutlery, handtools, and general hardware
Yarn and thread mills	Heating equipment, except electric and warm air; and plumbing fixtures
Miscellaneous textile goods	Fabricated structural metal products
Men's and boys' suits, coats, and overcoats	Screw machine products, and bolts, nuts, screws, rivets, and washers
Men's and boys' furnishings, work clothing, and allied garments	Metal forgings and stampings
Women's, misses', and juniors' outerwear	Coating, engraving, and allied services
Women's, misses', children's, and infants' undergarments	Ordnance and accessories, except vehicles and guided missiles
Hats, caps, and millinery	Miscellaneous fabricated metal products
Girls', children's, and infants' outerwear	Engines and turbines
Fur goods	Farm and garden machinery and equipment
Miscellaneous apparel and accessories	Construction, mining, and materials handling
Miscellaneous fabricated textile products	Metalworking machinery and equipment
Sawmills and planing mills, general	Special industry machinery, except metalworking
Millwork, veneer, plywood, and structural wood	General industrial machinery and equipment
Wood containers	Computer and office equipment
Wood buildings and mobile homes	Refrigeration and service industry machinery
Miscellaneous wood products	Miscellaneous industrial and commercial machinery and equipment
Household furniture	Electric transmission and distribution equipment
Office furniture	Electrical industrial apparatus
Public building and related furniture	Household appliances
Partitions, shelving, lockers, and office	Electric lighting and wiring equipment
Miscellaneous furniture and fixtures	Household audio and video equipment, and audio recordings
Pulp mills	Communications equipment
Paper mills	Electronic components and accessories
Paperboard mills	Miscellaneous electrical machinery, equipment, and supplies
Paperboard containers and boxes	Motor vehicles and motor vehicle equipment
Converted paper and paperboard products, except containers and boxes	Aircraft and parts
Books	Ship and boat building and repairing
Commercial printing	Railroad equipment
Manifold business forms	Motorcycles, bicycles, and parts
Blankbooks, looseleaf binders, and bookbinding	Guided missiles and space vehicles and parts
Service industries for the printing trade	Miscellaneous transportation equipment
Industrial inorganic chemicals	Search, detection, navigation, guidance, aeronautical, and nautical systems, instruments, and equipment
Plastics materials and synthetic resins, synthetic rubber, cellulosic and other manmade fibers, except glass	Laboratory apparatus and analytical, optical, measuring, and controlling instruments
Drugs	Surgical, medical, and dental instruments and supplies
Soap, detergents, and cleaning preparations; perfumes, cosmetics, and other toilet preparations	Ophthalmic goods
Paints, varnishes, lacquers, enamels, and allied products	Photographic equipment and supplies
Industrial organic chemicals	Watches, clocks, clockwork operated devices, and parts
Agricultural chemicals	Jewelry, silverware, and plated ware
Miscellaneous chemical products	Musical instruments
Petroleum refining	Dolls, toys, games and sporting and athletic
Asphalt paving and roofing materials	Pens, pencils, and other artists' materials
Miscellaneous products of petroleum and coal	Costume jewelry, costume novelties, buttons, and miscellaneous notions, except precious metal
Tires and inner tubes	Miscellaneous manufacturing industries

Table A2 - Minor Occupations and Major Groups Used in the Analysis

Occupation(SOC code)	Occupation(SOC code)
Management occupations(110000)	Order, receptionist and information clerks(434100)
Chief executives(111000)	Material recording, scheduling, dispatching, and distributing workers(435000)
Advertising, marketing, promotions, public relations and sales managers(112000)	Weighers, measurers, checkers, and samplers, recordkeeping(435111)
Administrative services managers(113011)	Executive secretaries and administrative assistants(436011)
Financial managers(113031)	Other office and administrative support workers(439000)
Human resources managers(113040)	Statistical assistants(439111)
Industrial production managers(113051)	Construction and extraction occupations(470000)
Purchasing managers(113061)	First-line supervisors/managers of construction trades and extraction workers(471011)
Transportation, storage, and distribution managers(113071)	Boilermakers(472011)
Construction managers(119021)	Brickmasons, blockmasons, and stonemasons(472020)
Engineering managers(119041)	Carpenters(472031)
Medical and health services managers(119111)	Cement masons and concrete finishers(472051)
Property, real estate, and community association managers(119141)	Paving, surfacing, and tamping equipment operators(472071)
Business and financial operations occupations(130000)	Electricians(472111)
Buyers and purchasing agents(131020)	Glaziers(472121)
Compliance officers, except agriculture, construction, health and safety, and transportation(131041)	Insulation workers(472130)
Cost estimators(131051)	Painters and paperhangers(472140)
Human resources, training and labor relations specialists(131070)	Plumbers, pipefitters, and steamfitters(472152)
Management analysts(131111)	Sheet metal workers(472211)
Accountants and auditors(132011)	Structural iron and steel workers(472221)
Budget analysts(132031)	Helpers, construction trades(473010)
Computer and mathematical occupations(150000)	Installation, maintenance and repair occupations(490000)
Computer programmers(151021)	First-line supervisors/managers of mechanics, installers, and repairers(491011)
Computer support specialists(151041)	Miscellaneous electrical and electronic equipment mechanics, installers, and repairers(492090)
Computer systems analysts(151051)	Aircraft mechanics and service technicians(493011)
Database administrators(151061)	Automotive body and related repairers(493021)
Architecture and engineering occupations(170000)	Bus and truck mechanics and diesel engine specialists(493031)
Aerospace engineers(172011)	Heavy vehicle and mobile equipment service technicians and mechanics(493040)
Agricultural engineers(172021)	Small engine mechanics(493050)
Civil engineers(172051)	Control and valve installers and repairers, except mechanical door(499012)
Computer hardware engineers(172061)	Heating, air conditioning, and refrigeration mechanics and installers(499021)
Industrial engineers, including health and safety(172110)	Home appliance repairers(499031)
Marine engineers and naval architects(172121)	Industrial machinery installation, repair, and maintenance workers(499040)
Materials engineers(172131)	Musical instrument repairers and tuners(499063)
Mechanical engineers(172141)	Miscellaneous installation, maintenance, and repair workers(499090)
Mining and geological engineers, including mining safety engineers(172151)	Production occupations(510000)
Petroleum engineers(172171)	First-line supervisors/managers of production and operating workers(511011)
Drafters(173010)	Assemblers and fabricators(512000)
Engineering technicians, except drafters(173020)	Food processing workers(513000)
Life, physical, and social science occupations(190000)	Metal workers and plastic workers(514000)
Life scientists(191000)	Tool and die makers, welders, cutters, solderers, and brazers(514100)
Physical scientists(192000)	Printing workers(515000)
Market and survey researchers(193020)	Textile, apparel, and furnishings workers(516000)
Life, physical, and social science technicians(194000)	Woodworkers(517000)
Legal occupations(230000)	Plant and system operators(518000)
Lawyers(230000)	Other production occupations(519000)
Building and grounds cleaning and maintenance occupations(370000)	Production workers, all other(519100)
Janitors and cleaners, except maids and housekeeping cleaners(372011)	Transportation and material moving occupations(530000)
Landscaping and groundskeeping workers(373011)	First-line supervisors/managers of helpers, laborers, and material movers, hand(531021)
Sales and related occupations(410000)	First-line supervisors/managers of transportation and material moving machine and vehicle operators(531031)
Cashiers, except gaming(412011)	Aircraft pilots and flight engineers(532010)
Parts salespersons(412022)	Driver/sales workers and truck drivers(533030)
Retail salespersons(412031)	Rail yard engineers, dinky operators, and hostlers(534013)
Advertising sales agents(413011)	Railroad brake, signal, and switch operators(534021)
Sales representatives, wholesale and manufacturing(414010)	Transportation inspectors(536051)
Demonstrators and product promoters(419011)	Conveyor operators and tenders(537011)
Sales engineers(419031)	Crane and tower operators(537021)
Telemarketers(419041)	Excavating and loading machine and dragline operators(537032)
Office and administrative support occupations(430000)	Hoist and winch operators(537041)
First-line supervisors/managers of office and administrative support workers(431011)	Industrial truck and tractor operators(537051)
Switchboard operators, including answering service(432011)	Laborers and material movers, hand(537060)
Financial clerks(433000)	Tank car, truck, and ship loaders(537121)
Information and record clerks(434000)	

Table A3 - Descriptive Statistics on Occupations

Occupation(SOC Code)	Share of national	% zero	Mean	Std. dev.
	employment	observations		
	(1)	(2)	(3)	(4)
Minor occupations (white-collar only)				
High skilled occupations			Wage bill shares	
Lawyers(230000)	74.7	69.9	0.5	5.8
Petroleum engineers(172171)	15.8	95.3	0.5	3.4
Life scientists(191000)	47.0	74.5	6.8	17.6
Physical scientists(192000)	58.3	29.9	23.4	24.3
Materials engineers(172131)	77.4	43.9	3.7	7.3
Sales engineers(419031)	78.1	44.3	6.2	10.1
Computer hardw engin(172061)	68.0	71.0	2.8	10.3
Accountants and auditors(132011)	65.2	0.6	42.3	16.7
MKT and survey researchers(193020)	68.2	32.3	36.1	40.2
Management analysts(131111)	62.4	53.4	3.9	8.3
Engineering managers(119041)	77.8	12.5	7.7	7.9
Mining and geolog engin(172151)	27.6	97.3	0.1	0.9
Industrial engineers(172110)	82.0	4.8	39.1	26.0
Aerospace engineers(172011)	85.9	88.3	1.3	7.1
Mechanical engineers(172141)	82.5	13.1	22.6	17.4
Marine engineers(172121)	48.7	97.7	0.1	2.0
Civil engineers(172051)	56.2	71.7	1.3	5.4
Agricultural engineers(172021)	50.1	93.9	0.5	2.8
Medium skilled occupations				
Medic and health serv manag(119111)	5.3	92.7	0.1	0.9
Chief executives(111000)	53.9	0.1	47.5	13.9
Budget analysts(132031)	31.3	62.4	1.1	2.3
Purchasing managers(113061)	74.3	10.6	2.6	1.6
Administr serv manag(113011)	37.6	12.9	2.1	1.7
Construction managers(119021)	8.5	81.6	0.2	1.0
Database administrators(151061)	54.0	31.5	6.4	6.5
Computer system analysts(151051)	66.2	15.9	31.2	22.1
Computer support specialists(151041)	53.1	6.8	26.7	15.8
Computer programmers(151021)	69.3	5.8	36.7	21.8
Human resources manag(113040)	54.5	9.5	3.2	2.1
Adv, MKTG, prom, PR and sales manag(112000)	72.6	4.8	11.0	5.5
Compliance officers(131041)	23.8	59.5	1.3	3.1
Hum resources, training and lab rel spec(131070)	39.4	15.3	10.8	8.4
Advert sales agents(413011)	40.8	84.6	0.9	3.9
Financial managers(113031)	70.1	3.7	7.9	3.5
Low skilled occupations				
Cost estimators(131051)	27.0	24.7	8.9	12.0
Life, phys and soc scien technicians(194000)	48.8	22.7	33.7	31.2
Buyers and purch agents(131020)	71.3	3.2	31.9	13.5
Exec secretaries and admin assistants(436011)	38.7	1.9	14.8	7.0
Sales representatives(414010)	88.3	0.1	84.2	18.1
Statistical assistants(439111)	27.7	82.8	0.1	0.4
Drafters(173010)	80.6	32.5	7.4	11.2
Engineering technicians(173020)	59.2	11.2	21.1	15.8
First line superv of off and admin workers(431011)	46.8	2.2	10.2	3.6
Indust prod manag(113051)	90.0	2.9	16.5	6.9
Prop, real est, and comm assoc manag(119141)	80.1	94.4	0.3	3.2
Order, receptionists and record clerks(434100)	39.4	4.3	5.9	3.0
Other off and admin support workers(439000)	39.4	1.4	13.8	6.2
Demonstrat and prod promoters(419011)	75.6	75.2	0.4	1.3
Financial clerks(433000)	47.7	0.7	18.1	5.3
Retail salespers(412031)	95.9	35.6	5.7	9.7
Transp, stor, and distrib, manag(113071)	41.7	33.3	1.3	1.8
Parts salespers(412022)	93.8	85.5	0.2	0.9
Info and record clerks(434000)	46.9	35.6	0.5	1.2
Switchboard operators(432011)	30.8	28.2	0.6	0.7
Telemarketers(419041)	28.8	75.5	1.2	6.5
Mat record, sched, dispatch workers(435000)	73.8	0.1	34.6	10.8
Weighers, measurers, checkers(435111)	56.0	22.1	1.6	2.0
Cashiers(412011)	87.2	74.7	1.7	7.6
Major groups (white- and blue-collar) & non-labor inputs			Variable cost shares	
Management occupations(110000)	55.7	0.7	4.4	4.8
Business and financial operations occupations(130000)	54.9	2.0	1.0	1.9
Computer and mathematical occupations(150000)	61.5	7.9	0.7	3.2
Architecture and engineering occupations(170000)	69.5	6.9	1.2	2.2
Life, physical, and social science occupations(190000)	56.3	16.8	0.3	0.7
Legal occupations(230000)	74.7	69.9	0.5	5.8
Building and grounds cleaning and maintenance occupations(370000)	12.9	3.1	0.1	0.2
Sales and related occupations(410000)	88.2	2.1	1.6	4.1
Office and administrative support occupations(430000)	47.9	0.6	3.1	4.0
Construction and extraction occupations(470000)	7.6	13.9	0.4	0.7
Installation, maintenance and repair occupations(490000)	35.9	5.5	0.5	0.5
Production occupations(510000)	78.7	0.6	9.3	6.1
Transportation and material moving occupations(530000)	45.6	1.1	1.8	1.8
Energy	-	0.0	2.3	3.2
Non-energy material	-	0.0	72.9	17.4

Column 1 reports the fraction of national employment accounted for by the industries included in the sample in 2006. Column 2 reports the fraction of zero observations in the sample. Columns 3-4 report descriptive statistics on the dependent variables of the FAST model: wage bill shares are the shares of the minor occupations in the wage bill of the corresponding major groups; variable cost shares are the shares of the major groups and of the non-labor inputs in total variable costs.

Table A4 - Descriptive Statistics on the Shift-Factors and Quasi-Fixed Inputs

	Obs.	Mean	Std. dev.
Service offshoring	1438	2.5	10.4
Material offshoring	1433	16.6	12.6
Computer and software share of capital stock	1440	4.4	5.0
High-tech share of capital stock	1440	5.9	6.8
Industry-specific ICT prices	1440	0.0	0.1
Openness	1380	-1.2	1.5
Import penetration	1373	-2.0	1.5
Export intensity	1373	-2.4	1.4
Log capital stock	1440	15.5	1.9
Log real output	1440	16.6	1.7

Service offshoring is the share of imported private services in total non-energy input purchases. *Material offshoring* is the share of imported intermediate inputs in total non-energy input purchases. *High-tech capital* includes computer and peripheral equipment, software, communications, photocopy and related equipment, office and accounting equipment. *Industry-specific ICT prices* are obtained by multiplying the economy-wide time series of computer prices with the average capital share of computer and software equipment in each industry between 1987 and 1996. *Openness* is log exports plus imports over total shipments. *Import penetration* is log imports over apparent consumption. *Export intensity* is log exports over total shipments. *Real output* is the real value of shipments.

Table A5 - Skill Classifications

Minor occupation(SOC code)	Schooling	Skill classification based on BLS	Share of college graduate+
High skilled occupations			
Lawyers(230000)	15	High skilled	97.9
Petroleum engineers(172171)	14	High skilled	82.0
Life scientists(191000)	14	High skilled	85.5
Physical scientists(192000)	14	High skilled	93.3
Materials engineers(172131)	13	High skilled	68.1
Sales engineers(419031)	13	High skilled	85.7
Computer hardw engin(172061)	13	High skilled	68.9
Accountants and auditors(132011)	13	High skilled	75.5
MKT and survey researchers(193020)	13	High skilled	78.8
Management analysts(131111)	13	High skilled	76.3
Engineering managers(119041)	13	High skilled	84.3
Mining and geolog engin(172151)	13	High skilled	80.7
Industrial engineers(172110)	13	High skilled	69.6
Aerospace engineers(172011)	13	High skilled	83.9
Mechanical engineers(172141)	13	High skilled	80.2
Marine engineers(172121)	13	High skilled	60.3
Civil engineers(172051)	13	High skilled	87.5
Agricultural engineers(172021)	13	High skilled	80.7
Medium skilled occupations			
Medic and health serv manag(119111)	12	High skilled	59.9
Chief executives(111000)	12	High skilled	57.3
Budget analysts(132031)	12	High skilled	75.0
Purchasing managers(113061)	12	High skilled	57.9
Administr serv manag(113011)	12	Medium-low skilled	41.0
Construction managers(119021)	12	Medium-low skilled	29.6
Database administrators(151061)	12	High skilled	72.4
Computer system analysts(151051)	12	High skilled	65.8
Computer support specialists(151041)	12	Medium-low skilled	41.1
Computer programmers(151021)	12	High skilled	72.2
Human resources manag(113040)	12	Medium-low skilled	60.8
Adv, MKTG, prom, PR and sales manag(112000)	12	High skilled	70.0
Compliance officers(131041)	12	Medium-low skilled	58.4
Hum resources, training and lab rel spec(131070)	12	High skilled	57.5
Advert sales agents(413011)	12	Medium-low skilled	54.8
Financial managers(113031)	12	High skilled	59.2
Low skilled occupations			
Cost estimators(131051)	11	High skilled	32.8
Life, phys and soc scien technicians(194000)	11	Medium-low skilled	39.7
Buyers and purch agents(131020)	11	Medium-low skilled	38.0
Exec secretaries and admin assistants(436011)	11	Medium-low skilled	17.5
Sales representatives(414010)	11	Medium-low skilled	49.6
Statistical assistants(439111)	11	Medium-low skilled	30.7
Drafters(173010)	11	Medium-low skilled	21.6
Engineering technicians(173020)	11	Medium-low skilled	17.8
First line superv of off and admin workers(431011)	11	Medium-low skilled	28.9
Indust prod manag(113051)	11	Medium-low skilled	44.9
Prop, real est, and comm assoc manag(119141)	11	High skilled	36.3
Order, receptionists and record clerks(434100)	10	Medium-low skilled	14.4
Other off and admin support workers(439000)	10	Medium-low skilled	21.6
Demonstrat and prod promoters(419011)	10	Medium-low skilled	36.1
Financial clerks(433000)	10	Medium-low skilled	15.0
Retail salespers(412031)	10	Medium-low skilled	26.1
Transp, stor, and distrib, manag(113071)	10	Medium-low skilled	23.6
Parts salespers(412022)	10	Medium-low skilled	5.4
Info and record clerks(434000)	10	Medium-low skilled	21.3
Switchboard operators(432011)	10	Medium-low skilled	9.6
Telemarketers(419041)	10	Medium-low skilled	15.9
Mat record, sched, dispatch workers(435000)	9	Medium-low skilled	13.6
Weighers, measurers, checkers(435111)	9	Medium-low skilled	12.4
Cashiers(412011)	9	Medium-low skilled	9.9

The first column reports the skill classification based on PUMS. High skilled occupations are those requiring at least a bachelor's degree (*schooling* medium skilled occupations those requiring an associate degree in college (*schooling* =12), low skilled occupations those requiring lower degrees of schooling (*schooling* <12). The second column reports the *skill classification based on BLS*, which defines as high skilled the occupations requiring at least a bachelor's degree, and as medium-low skilled all the others. The third column reports the *share of college graduate+*, i.e., the fraction of workers with at least a bachelor's degree in each occupation.

Table A6 - Indices of Tradability and other Occupational Characteristics: Background Variables

Index	Background variable			Tradability index
	Name	Description	Source	
Routine cognitive 1 Routine cognitive 3	Importance of repeating the same tasks	How important is repeating the same physical activities (e.g., key entry) or mental activities (e.g., checking entries in a ledger) over and over, without stopping, to performing this job?	O*NET 12.0	yes
Routine cognitive 1 Routine cognitive 3	Visual color discrimination	The ability to match or detect differences between colors, including shades of color and brightness	O*NET 12.0	yes
Routine cognitive 2	STS	Adaptability to set limits, tolerances, and standards	DOT 1991	no
Routine cognitive 3	Documenting/recording information	Entering, transcribing, recording, storing, or maintaining information in either written form or by electronic/magnetic recording	O*NET 12.0	yes
Routine cognitive 3	Getting information	Observing, receiving, and otherwise obtaining information from all relevant sources	O*NET 12.0	yes
Routine cognitive 3	Inspecting equipment, structures, materials	Inspecting or diagnosing equipment, structures, or materials to identify the causes of errors or other problems or defects	O*NET 12.0	yes
Face-to-face 1 Face-to-face 2	Face-to-face	Frequency of face-to-face interactions with individuals and groups	O*NET 12.0	yes
Face-to-face 1 Face-to-face 2	Performing for/working with public	Performing for people or dealing directly with the public, including serving persons in restaurants and stores, and receiving clients or guests	O*NET 12.0	yes
Face-to-face 2	Deal with external customers	Deal with external customers (e.g., retail sales) or the public in general (e.g., police work)	O*NET 12.0	yes
Face-to-face 2	Establishing and maintaining relationships	Developing constructive and cooperative working relationships with others	O*NET 12.0	yes
Face-to-face 3	Blinder's offshorability index	The job does not need to be performed at a specific work location in the U.S., and either: 1) the worker does not need to be physically close to her work unit; or 2) the work unit can be moved outside the U.S.	Blinder (2007)	no
Interaction with PCs	Interacting with computers	Controlling computer functions by using programs, setting up functions, writing software, or otherwise communicating with computer systems	O*NET 12.0	yes
Non-routine cognitive	Analyzing data or information	Identifying underlying principles, reasons, or facts by breaking down information or data into separate parts	O*NET 12.0	no
Non-routine cognitive	Developing objectives and strategies	Establishing long range objectives and specifying the strategies and actions to achieve these objectives	O*NET 12.0	no
Non-routine cognitive	Mathematical reasoning	The ability to understand and organize a problem and then to select a mathematical method or formula to solve it	O*NET 12.0	no
Non-routine cognitive	Processing information	Compiling, coding, categorizing, calculating, tabulating, auditing, verifying, or processing information or data	O*NET 12.0	no
Non-routine cognitive	Thinking creatively	Originating, inventing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions	O*NET 12.0	no
Routine manual	Finger dexterity	The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects	O*NET 12.0	no
Routine manual	Manual dexterity	The ability to quickly make coordinated movements of one hand, a hand together with its arm, or two hands to grasp, manipulate, or assemble objects	O*NET 12.0	no

Composite indices of several variables are obtained by Principal Components Analysis using only the first factor. All indices except *routine cognitive 2* have mean 0 and standard deviation 1, and are normalized so that higher values indicate higher levels of the corresponding characteristic. *Routine cognitive 2* is a dummy equal to 1 if the occupation requires to attain precise set limits, tolerances and standards. The last column of the table indicates whether or not each variable enters the *tradability index*.

Table A7 - Indices of Tradability and other Occupational Characteristics: Values

Minor occupation(SOC code)	Tradability index	Routine cognitive 1	Routine cognitive 2	Routine cognitive 3	Interaction with PCs	Face-to-face 1	Face-to-face 2	Face-to-face 3	Non-routine cognitive	Routine manual
Database administrators(151061)	1.57	-0.02	-	-0.31	1.40	0.47	-1.82	-0.94	1.25	1.38
Drafters(173010)	1.48	-0.12	yes	-0.07	1.13	-1.38	-1.08	-1.51	0.23	1.77
Computer support specialists(151041)	1.38	-0.25	-	0.86	1.45	-1.18	-0.60	-1.45	-3.01	0.72
Materials engineers(172131)	1.35	1.26	yes	1.65	0.84	-0.88	-1.14	-0.82	0.86	0.20
Petroleum engineers(172171)	1.31	1.27	yes	1.12	-0.37	-1.20	-1.93	1.30	0.91	-0.33
Statistical assistants(439111)	1.21	-0.19	-	-0.30	1.24	-1.28	-1.03	-1.39	1.78	0.85
Life, phys and soc scien technicians(194000)	1.20	0.24	yes	1.06	0.10	-0.42	-1.19	-0.01	0.18	0.93
Computer programmers(151021)	1.19	-0.32	yes	-0.04	1.59	-1.34	-1.21	-1.69	-0.12	0.05
Mining and geolog engin(172151)	1.18	0.88	yes	1.25	0.48	-1.11	-0.73	1.30	1.01	-0.60
Agricultural engineers(172021)	1.17	1.46	-	1.16	0.61	-0.87	-1.08	1.30	0.44	1.26
Industrial engineers(172110)	1.15	-0.86	yes	-0.03	0.50	-1.44	-1.21	-0.12	0.79	-1.00
Engineering technicians(173020)	1.14	1.48	yes	1.36	0.13	-0.79	-1.06	-0.40	0.01	1.06
Marine engineers(172121)	1.04	0.90	yes	0.82	0.61	-0.87	-1.08	-0.76	0.48	0.15
Computer system analysts(151051)	1.00	0.18	yes	-0.47	1.58	-0.35	-1.19	-1.48	0.84	0.45
Physical scientists(192000)	0.88	1.04	yes	1.20	0.76	-0.53	-0.51	-0.57	1.13	-0.39
Life scientists(191000)	0.86	0.71	no	1.10	0.05	0.00	-0.49	-0.93	0.91	0.23
Mechanical engineers(172141)	0.85	1.61	yes	0.85	0.23	-0.90	-1.27	-0.79	-0.33	0.46
Budget analysts(132031)	0.73	-1.00	-	-1.51	0.55	-1.22	-1.14	-0.49	0.77	-0.73
Computer hardw engin(172061)	0.65	1.22	yes	0.83	1.56	-1.28	-0.84	-0.88	-0.31	0.19
Civil engineers(172051)	0.65	1.92	yes	1.81	0.76	0.64	-0.16	1.30	0.44	0.73
Aerospace engineers(172011)	0.55	-0.19	yes	-0.91	0.90	-0.34	-1.44	0.19	1.19	-2.06
Weighers, measurers, checkers(435111)	0.52	-0.40	yes	-0.67	0.58	0.20	-0.55	0.49	-0.65	1.51
Sales engineers(419031)	0.49	0.95	yes	1.34	1.01	-0.75	0.64	1.30	1.07	0.71
Indust prod manag(113051)	0.42	0.34	yes	0.88	-0.48	-1.09	-0.74	-0.34	-0.24	0.18
Engineering managers(119041)	0.32	0.94	yes	0.84	-0.93	-0.51	-0.61	-0.31	0.25	-0.86
Other off and admin support workers(439000)	0.15	-0.76	yes	-0.74	0.28	0.16	-0.33	-0.95	-0.75	0.85
Management analysts(131111)	0.03	-0.27	yes	0.12	0.02	-0.25	0.79	1.30	1.27	-1.53
Medic and health serv manag(119111)	-0.03	0.07	-	0.57	-0.10	-1.09	0.79	1.30	1.14	-0.21
Purchasing managers(113061)	-0.05	0.79	no	1.42	0.27	0.43	1.10	-0.16	0.35	1.51
MKT and survey researchers(193020)	-0.11	-0.54	-	-0.95	0.49	0.89	-0.15	-1.39	0.71	-0.80
Financial clerks(433000)	-0.15	-2.64	yes	-2.06	0.74	-0.01	-0.13	-0.93	-0.42	-0.84
Hum resources, training and lab rel spec(131070)	-0.25	-0.59	no	-0.39	0.44	0.66	0.61	-0.07	0.41	-0.14
Info and record clerks(434000)	-0.26	-1.06	yes	-1.18	0.51	0.00	0.86	-0.73	-0.53	0.64
Exec secretaries and admin assistants(436011)	-0.26	-2.03	yes	-1.54	0.88	0.33	0.71	1.30	-0.91	-1.47
Compliance officers(131041)	-0.30	-0.64	yes	-0.52	-0.03	0.22	0.38	1.30	0.48	-0.75
Accountants and auditors(132011)	-0.30	-0.64	yes	-0.52	-0.03	0.22	0.38	-0.85	0.48	-0.75
Human resources manag(113040)	-0.34	0.21	-	-0.30	0.17	0.39	0.77	-0.16	0.49	-0.02
Transp, stor, and distrib, manag(113071)	-0.43	0.01	yes	0.36	-0.65	-0.05	0.65	-0.16	0.18	-0.42
Financial managers(113031)	-0.43	0.01	no	0.36	-0.65	-0.05	0.65	-0.94	0.18	-0.42
Mat record, sched, dispatch workers(435000)	-0.45	-0.45	yes	-0.21	-1.32	0.37	-0.17	0.02	-0.93	0.61
Order, receptionists and record clerks(434100)	-0.55	-1.33	yes	-1.63	0.40	0.92	0.19	-0.72	-1.43	0.92
First line superv of off and admin workers(431011)	-0.58	-1.55	yes	-0.49	0.43	0.36	1.35	1.30	0.73	1.06
Telemarketers(419041)	-0.60	-1.55	-	-2.02	-0.10	0.53	-0.51	-1.54	-2.04	-0.87
Construction managers(119021)	-0.60	-0.58	-	0.64	-2.03	-0.10	0.11	1.30	-0.16	-1.40
Administr serv manag(113011)	-0.87	-0.75	no	-0.23	-0.55	0.21	1.11	-0.16	-0.26	0.46
Cost estimators(131051)	-0.94	-0.38	-	0.29	-0.64	0.57	1.21	-0.19	0.29	-0.73
Adv, MKTG, prom, PR and sales manag(112000)	-0.97	0.58	no	0.31	0.49	1.41	1.83	-0.02	0.65	-1.03
Prop, real est, and comm assoc manag(119141)	-1.01	-1.12	yes	0.26	-2.06	-0.03	1.34	1.30	-0.85	-2.20
Lawyers(230000)	-1.02	0.87	no	0.09	-1.38	0.09	0.68	-0.22	0.49	-1.26
Buyers and purch agents(131020)	-1.05	-0.96	no	-1.12	-0.50	1.37	0.43	-0.34	-0.32	-0.61
Chief executives(111000)	-1.15	-0.36	no	-0.83	-1.34	-0.11	0.83	1.30	0.43	-0.67
Demonstrat and prod promoters(419011)	-1.29	2.49	-	1.66	-2.16	3.68	0.50	1.30	-1.25	-0.08
Sales representatives(414010)	-1.45	0.38	-	-0.41	-1.20	-0.26	1.27	1.30	-0.73	-0.80
Parts salespers(412022)	-1.49	0.17	no	-0.51	-0.76	1.98	1.16	1.30	-1.39	1.25
Switchboard operators(432011)	-1.51	-0.96	yes	-1.52	-1.46	1.49	0.60	-0.19	-2.06	0.85
Advert sales agents(413011)	-1.72	0.54	-	-0.41	-0.42	0.43	2.28	0.55	0.02	-1.41
Retail salespers(412031)	-2.05	0.56	no	-0.74	-2.37	1.62	0.91	1.30	-2.06	1.24
Cashiers(412011)	-2.32	-0.61	yes	-1.57	-1.67	2.02	1.25	1.30	-2.06	2.17

See Table A6 for the detailed description of each index.