Tradable Services: Understanding the Scope and Impact of Services Offshoring [with Comments and Discussion]

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Tradable Services: Understanding the Scope and Impact of Services Offshoring

Globalization, particularly globalized production, is evolving and broadening from manufacturing into services. Services activities now account for a larger share of global trade than in the past. Services trade has almost doubled over the past decade: in the period 1992 to 2002, exports increased from $163 billion to $279 billion, and imports increased from $102 billion to $205 billion. These changes, and their implications for American firms and workers, have attracted widespread attention.

Coincident with the broadening of global economic integration from manufacturing to services, the face of job displacement in the United States is changing. While manufacturing workers have historically accounted for more than half of displaced workers, over the period 2001–03, nonmanufacturing workers accounted for 70 percent of displaced workers.[1] The share of job loss accounted for by workers displaced from information, financial services, and professional and business services nearly tripled, from 15 percent during the 1979–82 recession to 43 percent over the 2001–03 period. The industrial and occupational shift

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1. The shift in job loss from manufacturing and production workers toward service and white-collar (nonproduction) workers has been in evidence since the recession of the early 1990s. At that time, concerns about downsizing and reengineering were coincident with a rise in the share of white-collar and service sector job loss. See Podgursky (1992); Farber (1993); Gardner (1993); and Kletzer (1995, 1998).

in job loss has been associated with a rise in the probability of job loss for more-educated workers.[2]

Bringing these two trends together, the changing mix of industries exposed to international trade in services may have deep implications for the structure of U.S. industry and labor markets in the future. Currently, there is little clear understanding of the role of services globalization in domestic employment change and job loss. More fundamentally, there is little clear understanding of the size and extent of services offshoring, how large it is likely to become in the near-term future, or what impact it is having on the U.S. economy.

Fueled by the 2004 presidential race and continued slack in the labor market, the services offshoring debate became headline material. The literature on services offshoring is expanding rapidly. A nonexhaustive list of recent contributors includes: Amiti and Wei (2004); Arora and Gambardella (2004); Bardhan and Kroll (2003): Bhagwati, Panagariya, and Srinivasan (2004); Brainard and Litan (2004); Bronfenbrenner and Luce (2004); Dossani and Kenney (2003, 2004); Kirkegaard (2004); Mann (2003); Samuelson (2004); and Schultze (2004). Despite the attention, relatively little is known about how many jobs may be at risk of relocation or how much job loss is associated with the business decisions to offshore and outsource.

There are a few prominent projections, advanced mostly by consulting firms. The dominant and most widely quoted projection of future job losses due to movement of jobs offshore is Forrester Research's estimate of 3.3 million.[3] Others include: Deloitte Research's estimate that by 2008 the world's largest financial service companies will have relocated up to 2 million jobs to low-cost countries offshore; Gartner Research's prediction that by the end of 2004 10 percent of IT jobs at U.S. IT companies and 5 percent of IT jobs at non-IT companies will have moved offshore; and Goldman Sachs's estimate that 300,000 to 400,000 services jobs have moved offshore in the past three years, and that 15,000 to 30,000 jobs a month, in manufacturing and services combined, will be subject to offshoring in the future.[4]

It is clear that changes in technology are enabling more activities to be traded internationally. What is unclear is how large these trends are likely to become,

2. It is still the case that less-educated workers have the highest rates of job loss overall. Over the 2001–03 period, the rate of job loss for workers with a high school diploma or less was .141; for workers with at least some college experience, the rate of job loss was .096 (estimates from the 2004 Displaced Worker Survey). See Farber (2005) for a more detailed examination of worker characteristics and the risk of job loss.

3. See McCarthy (2002). The Forrester projection was updated in 2004 to 3.4 million.

4. See, in order, Gentle (2003); Gartner Research (2004); and Tilton (2003).

the sectors and occupations affected to date and going forward, and the impact on workers of the resulting dislocations. Without understanding the nature and scope of the changes, it is difficult to formulate effective public policy to address emerging needs.

This paper develops a new empirical approach to identifying, at a detailed level, service activities that are potentially exposed to international trade. We use the geographic concentration of service activities within the United States to identify which service activities are traded domestically. We classify activities that are traded domestically as *potentially* tradable internationally. Using the identified industries and occupations, we develop estimates of the number of workers who are in tradable activities for all sectors of the economy. We compare the demographic characteristics of workers in tradable and nontradable activities and employment growth in traded and nontraded service activities. We also examine the risk of job loss and other employment outcomes for workers in tradable activities.

To preview the results, we find considerable employment shares in tradable service industries and occupations. Based on our estimates, there are more workers in tradable professional and business service industries than in tradable manufacturing industries. We also examine the characteristics of workers in tradable and nontradable activities and find that workers in tradable sectors have higher skills and significantly higher wages. Within specific sectors like professional services, the earnings differentials are even larger, approaching 20 percent.

When we examine employment growth trends across traded and nontraded activities, tradable activities have lower growth rates, due primarily to employment losses in manufacturing. Within services, tradable and nontradable activities have similar growth rates except at the lowest end of the skill distribution. Low-skill tradable industries and occupations have negative average employment growth, whereas employment growth in nontraded, low-skill services is positive (though low).

We also examine worker displacement rates in tradable and nontradable service activities. We see some evidence that displacement rates are higher from tradable service industries than from nontradable. We also find higher displacement rates from tradable white-collar occupations than from nontradable. Consistent with the characteristics of employed workers, we find that workers displaced from tradable service activities are more educated, with higher earnings, than workers displaced from nontradable activities. Job loss from tradable and nontradable service activities is costly to workers in terms of earnings losses (comparing new job earnings to old job earnings). Taken together, the results are consistent with the view that economic activity within the United

States is moving toward a U.S. comparative advantage in services, similar to manufacturing.

In the next section we describe our empirical approach to identifying tradable activities. The following sections describe the tradable and nontradable categories for both manufacturing and services activities; compare worker characteristics in tradable and nontradable services; explore the employment trends in tradable and nontradable services; and consider the most recent evidence on job displacement from tradable activities.

Empirical Approach

Historically, services have been considered nontradable, with a paucity of empirical work examining trade in services relative to empirical work on manufacturing. To examine the potential impact of trade in services on the U.S. economy, we wanted to identify the size and scope of services trade at as detailed a level as possible. As many observers and researchers have noted, gathering detailed data on the extent of services offshoring is quite difficult. While the Bureau of Economic Analysis (BEA) provides data on international trade in services, the data on international trade in services that BEA publishes do not provide particularly detailed industry-level data. Table 1 shows the level of industry detail available from BEA.

Our interest in examining trade in services in more detail than what is available through the BEA services trade data necessitated an alternative empirical approach to identifying tradable service activities. Our approach to identifying service activities that are potentially tradable is novel: we use the geographic concentration of service activities in the United States to identify industries and occupations that appear to be traded domestically. From this domestic information, we infer that service activities that can be traded within the United States are also potentially tradable internationally.

Framework

The economic intuition we rely on to develop our baseline measure of tradable services is that nontraded services will not exhibit geographic concentration in production. We observe that goods that are traded tend to be geographically concentrated (to capitalize on increasing returns to scale, access to inputs such as natural resources, etc.), while goods that are not traded tend to be more ubiquitously distributed. We apply this same intuition to service production.

Helpman and Krugman (1985) present a model that demonstrates this intuition. They model a world with two goods, two countries, and three industries, where the first industry is assumed to be a nontradable constant-returns sector, the second industry is an industry with differentiated varieties that are assumed to be costlessly traded, and the third industry is a tradable constant-returns sector. Helpman and Krugman derive the input vectors V(1), V(2), and V(3) for the integrated world equilibrium. With homothetic and identical tastes, if country j has a share s^j of world income, it must allocate resources s^j V(1) to the nontradable industry; that is, the production of the nontraded good must be allocated between countries in proportion to their shares of world income. Nontraded goods are distributed uniformly according to population and income.

This intuition is revealed more descriptively by Paul Krugman, who notes, "In the late twentieth century the great bulk of our labor force makes services rather than goods. Many of these services are nontradable and simply follow the geographical distribution of the goods-producing population—fast-food outlets, day-care providers, divorce lawyers surely have locational Ginis pretty close to zero. Some services, however, especially in the financial sector, can be traded. Hartford is an insurance city; Chicago the center of futures trading; Los Angeles the entertainment capital; and so on. . . . The most spectacular examples of localization in today's world are, in fact, services rather than manufacturing. . . . Transportation of goods has not gotten much cheaper in the past eighty years. . . . But the ability to transmit *information* has grown spectacularly, with telecommunications, computers, fiber optics, etc."[5] The idea is that when something is traded the production of the activity is concentrated in a particular region to take advantage of some economies in production. As a result, not all regions will support local production of the good, and some regions will devote a disproportionate share of productive activity to a good and then trade it.[6] We use the geographic concentration of service activity within the United States as an indicator that the service is traded within the United States and thus *potentially* tradable internationally.

The "locational Gini" referred to by Krugman is one of several ways to measure geographic concentration.[7] The measures compare a region's share of

5. Krugman (1991, p. 65).

6. The relationship between geographic concentration of production and trade, particularly exports, has a long tradition in both economic geography (where the measure used is the location quotient) and trade analysis (where the measure used is revealed comparative advantage). The measures of economic concentration used in this paper are different from the location quotient and revealed comparative advantage measures, but all the measures have a similar flavor in that they compare the share of production (or exports) in a particular region to an "expected" baseline.

7. Among the different empirical approaches to measuring geographic concentration and agglomeration are Duranton and Overman (2004).

Table 1. Private Services Trade by Type, 2002
Millions of dollars

Trade type	*Exports, 2002*	*Imports, 2002*
Travel	66,547	58,044
Overseas	54,772	44,494
Canada	6,268	6,489
Mexico	5,507	7,061
Passenger fares	17,046	19,969
Other transportation	29,166	38,527
Freight	12,330	25,973
Port services	16,836	12,554
Royalties and license fees	44,142	19,258
Affiliated	32,218	15,132
U.S. parents' transactions	29,066	2,958
U.S. affiliates' transactions	3,152	12,174
Unaffiliated	11,924	4,126
Industrial processes	3,900	1,935
Other	8,024	2,192
Other private services	122,594	69,436
Affiliated services	43,500	32,367
U.S. parents' transactions	25,194	17,529
U.S. affiliates' transactions	18,306	14,838
Unaffiliated services	79,094	37,069
Education	12,759	2,466
Financial services	15,859	3,665
Insurance services	2,839	15,348
Telecommunications	4,137	4,180
Business, professional, and technical services	28,799	10,732
Accounting, auditing, and bookkeeping services	360	716
Advertising	633	1,360

(continued)

employment in or output of an activity with the region's share of overall economic activity. We make use of two common measures of geographic concentration; but before turning to those measures we address one more conceptual issue.

Demand-Induced Agglomeration and Intermediate Services

Measures of geographic concentration are a way to implement the intuition described above. Most measures of concentration use the region's share of employment in an industry relative to the region's share of total employment. The measures of concentration do not differentiate the reasons activity is concentrated. It does not matter whether production is concentrated because of the

Table 1. Private Services Trade by Type, 1992–2002 *(Continued)*
Millions of dollars

Trade type	*Exports, 2002*	*Imports, 2002*
Agricultural, mining, and on-site processing services	366	273
Agricultural and mining services	346	259
Waste treatment and depollution services	20	14
Architectural, engineering, and other technical services	1,916	312
Computer and data processing services	3,004	1,057
Construction, architectural, engineering, and mining services	n.a.	n.a.
Construction	654	226
Data base and other information services	2,426	236
Industrial engineering	749	185
Installation, maintenance, and repair of equipment	4,992	812
Legal services	3,270	768
Management, consulting, and public relations services	1,696	1,188
Medical services	1,901	n.a.
Miscellaneous disbursements	623	1,522
Operational leasing	3,573	190
Research, development, and testing services	1,086	1,040
Sports and performing arts	175	110
Trade-related services	353	95
Training services	501	361
Other business, professional, and technical services	430	283
Other unaffiliated services	14,700	679

Source: Bureau of Economic Analysis.
n.a. = not available.

location of natural resources, increasing returns in production, or spillovers due to the agglomeration of workers; the concentration of production indicates that the good or service is produced in a location different from where it is consumed. So, in general, the reason for the concentration does not matter to us, except in one instance. If a service is nontradable and demand for the service is concentrated (that is, if industries that use the nontraded service are geographically concentrated), the service industry will be geographically concentrated and we would incorrectly infer that the service is tradable.

To incorporate this case into our approach, we extend the intuition from the framework. If a nontradable industry provides intermediate inputs to a downstream industry, we would expect the geographic distribution of the nontraded intermediate industry to follow the distribution of the downstream industry. Instead of being distributed with income, the nontraded good is distributed in proportion to the geographic distribution of demand for that industry.

We construct region-specific measures of demand for each industry using the 1999 input-output use tables produced by the Bureau of Economic Analysis.[8] This measure of industry demand share ($IDS_{i,p}$) represents how much geographic concentration there is in demand for a good or service i in a particular region p. We construct the demand for industry i in Place of Work Metro Area p by:

$$IDS_{i,p} = \Sigma_j (Y_{i,j}/Y_i * InEMP_{j,p}/InEMP_j), \quad (1)$$

where

$Y_{i,j}$ = the output of industry i used by industry j (including government and private households as "industries");
Y_i = total output of industry i;
$InEMP_{j,p}$ = industry j employment in region p;
$InEMP_j$ = total employment in industry j.

We include both direct use and investment in the "use" of industry i output by industry j.

To construct the region-specific measures of demand for each occupation, we use the industry-region-specific demand measures described above and weight those by the share of occupation employment in an industry.

$$ODS_{o,p} = \Sigma_j (IDS_{j,p} * OcEMP_{o,j}/OcEMP_o), \quad (2)$$

where

$IDS_{j,p}$ = industry demand share for industry j in region p;
$OcEMP_{o,j}$ = occupation o employment in industry j; and
$OcEMP_o$ = total employment in occupation o.

These adjustments take account of the concentration of downstream industry concentration and adjust the "denominator" in the geographic concentration measures that follow.

Measuring Geographic Concentration

The first measure of economic concentration, as described in Ellison and Glaeser (1997), is:

$$EC_i = \Sigma_p (s_{i,p} - x_p)^2. \quad (3)$$

8. For more information, see www.bea.doc.gov/bea/dn2/i-o.htm. We aggregate some BEA input-output (IO) industries to a level consistent with the industry classification used by the Census Bureau on the 2000 Decennial PUMS (Public Use Micro Sample).

The measure is an index for comparing a region's share of industry employment ($s_{i,p}$) with the area's share of aggregate activity/employment (x_p). When an area's employment share in an activity is significantly greater than the area's share of aggregate employment, this is interpreted as indicating a concentration, or specialization, in the given activity. The index *EC* provides a national index for each industry, and measures of *EC* indicating geographic concentration are interpreted as indicative of trade in that activity, in the sense that "local" employment exceeds "local" demand in some areas and the difference is traded outside the area. We modify the *EC* measure to look at the difference between the region's share of industry employment and the region's share of industry demand, as noted above:

$$EC_i = \Sigma_p \, (s_{i,p} - IDS_{i,p})^2. \tag{4}$$

The new measure of *EC* is an index for comparing a region's share of an industry's employment (s_i) with the region's share of demand for that industry ($IDS_{i,p}$).

We do not make the Herfindahl adjustment that Ellison and Glaeser (1999) use in their index of agglomeration because we are not interested in agglomeration (the co-location of different firms in the same industry), but are interested in pure geographic concentration (whether the concentration is due to one firm or a number of firms). If economic activity is concentrated because significant scale economies are captured within a firm, we do not want to discount this concentration.

The second measure of geographic concentration we use is the Gini coefficient. The Gini coefficient (G) for the concentration of industry activity is given by:

$$G_i = | \, 1 - \Sigma_p \, (\sigma Y_{i,p-1} + \sigma Y_p) * (\sigma X_{i,p-1} - \sigma X_p) \, | \, , \tag{5}$$

where p's index regions (sorted by the region's share of industry employment), $\sigma Y_{i,p}$ is the cumulative share of industry i employment in region p, $\sigma Y_{i,p-1}$ is the cumulative share of industry i employment in the region ($p - 1$) with the next lowest share of industry employment, σX_p is the cumulative share of total employment in region p, and σX_{p-1} is the cumulative share of total employment in region $p - 1$. We modify the Gini measure to:

$$G_i = | \, 1 - \Sigma_p \, (\sigma Y_{i,p-1} + \sigma Y_{i,p}) * (\sigma IDS_{i,p-1} - \sigma IDS_{i,p}) \, | \, , \tag{6}$$

where $IDS_{i,p}$ is the region's share of demand for industry i.

Implementation

We implement these measures using employment information from the 2000 Decennial Census of Population Public Use Micro Sample (PUMS) files. We use as our geographic entity the Consolidated Metropolitan Statistical Area or the Metropolitan Statistical Area where an individual reports working.[9] We construct the measures of geographic concentration for each industry. Industries that are geographically concentrated are considered tradable.

We recognize that the use of worker-level data to investigate economic concentration is somewhat unusual. We pursue this strategy because we are interested in both industrial concentration and *occupational* concentration. The ability to identify both industries and occupations that are tradable is an important feature of the empirical strategy because many of the service activities that are reportedly being globally sourced are tasks within the service "production" process (for example, a bank's customer service/call center component may be moved offshore, but not the banking relationship); occupations correspond more closely to these types of activities than industries do.

We construct the adjusted G and EC measures for both industries and occupations. The correlation between the EC measure and the G measure is quite high, .713 for industries and .732 for occupations. For the remainder of this paper, we focus on the G results.

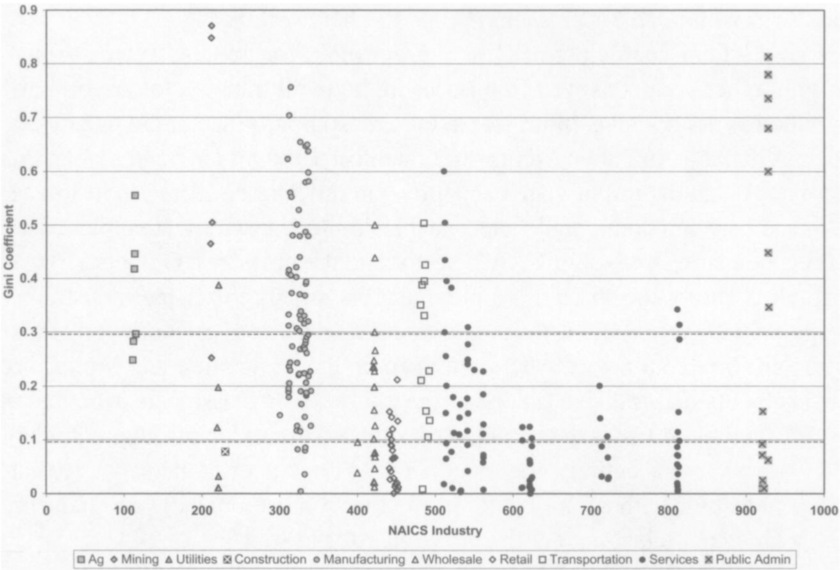
Classifying Industries and Occupations as Tradable or Nontradable

An important task in our empirical approach is to identify the level of geographic concentration that indicates that an industry or occupation is "tradable."[10] We started exploring where to impose the tradable/nontradable threshold with industries because we have a much better sense of which industries are

9. For regions, we use the Place of Work Consolidated Metropolitan Area (POWCMA5) field on the Decennial PUMS. When POWCMA is coded as a nonmetropolitan area or a mixed metro/nonmetro area, we concatenate the Place of Work state code with the POWCMA5 code. For more information on the 5 percent sample PUMS, see www.census.gov/Press-Release/www/2003/PUMS5.html.

10. While choosing the threshold for nontradable and tradable is inherently arbitrary, we ran a number of robustness checks on the results reported in the paper. With the exception of the share of employment in the tradable sector (which decreases as the threshold rises), the results are robust to the choice of threshold.

Figure 1. Geographic Concentration of Industries



tradable, particularly goods-producing industries. We initially placed industries into three roughly equal groups: Gini class 1 (least geographically concentrated) when the industry Gini was less than .1; Gini class 2 when the industry Gini was between .1 and .3; Gini class 3 (most geographically concentrated) when the Gini coefficient was greater than or equal to .3. Approximately 36 percent of industries are in Gini class 1, about 37 percent are in Gini class 2, and 27 percent are in Gini class 3.

Figure 1 plots the Gini coefficients for all industries by two-digit NAICS code. The pattern exhibited in figure 1 is generally consistent with our priors that tradable industries will be geographically concentrated. For example, industries in the goods-producing sectors of Agriculture, Mining, and Manufacturing are typically in the top two Gini classes. Only five of the ninety-two industries in these sectors are in Gini class 1: Cement and Concrete; Machine Shops; Miscellaneous Manufacturing n.e.c.; Structural Metals and Tanks; and Printing and Related Activities. All of these industries seem to be either nontraded because of a high weight-to-value ratio (such as Cement and Concrete), or they are categories that include a range of potentially dissimilar activities (Miscellaneous Manufacturing n.e.c.) that make them appear to be broadly geographically distributed. Most agriculture, mining, and manufacturing products are considered tradable; so as a first-order approximation, classifying the lowest geographic concentration category (Gini class 1) as nontradable seems appropriate for these sectors.[11]

Using a Gini coefficient of .1 as the threshold for tradable seems to make sense in other sectors as well. Industries in the retail trade sector are primarily classified as nontradable. Industries in the Transportation sector are mostly classified as tradable. In Public Administration, most activities are nontradable; Public Finance and the military are exceptions. In the Service sector, industries are balanced between nontradable and tradable. Table 2 provides a complete list of service industries by 2-digit NAICS sector and the industry's Gini class.[12]

Table 3 shows the share of employment classified in tradable industries by major NAICS group. Again, the employment shares across categories and industries conform to our priors. All employment in the Agriculture and Mining sectors is classified as tradable (in one of the top two Gini classes). In Manufacturing, most employment is in the tradable sector.[13] Utilities are mostly nontradable and Construction is entirely nontraded. For the remainder of the paper, we categorize industries with a Gini coefficient below .1 as nontradable and industries with a Gini coefficient greater than or equal to .1 as tradable.

Size and Scope of Tradable Service Industries

We use the categorization of industries as tradable and nontradable to develop estimates of the employment potentially affected by trade in services. Table 4 shows the share of total employment in tradable and nontradable industries by major NAICS group. In contrast to traditional characterizations of services as predominantly nontradable, our categorization suggests that a significant share of

11. Another check on the industry classification is to examine the correlation of geographic concentration of manufacturing industries with the level of trade intensity in those industries. The mean industry trade share [(imports + exports)/domestic production] for Gini class 1 = .40, Gini class 2 = .57, Gini class 3 = .71. If Manufacturing Machinery n.e.c. is removed from Gini class 1 (by virtue of its not being a consistent industry), the mean trade share for that class falls to .35. The pattern revealed is one of a positive correlation between Gini class and mean trade share, with some notable variation within class.

12. Higher education may appear to stand out in table 2 as a nontradable service industry. U.S. colleges and universities, particularly research institutions, have an acknowledged global comparative advantage and attract many foreign students. The sector also includes community colleges that are, by design, geographically dispersed. The types of specialized scientific occupations associated with research institutions (the most likely to "export" educational services) are geographically concentrated and thus considered tradable.

13. Alternatively, if we modify the cutoff and use .2 as the break between tradable and nontradable, 28 percent of manufacturing employment would be in the nontradable sector.

Table 2. Service Industries, Gini Coefficient Class

2-digit NAICS	*Industry description*	*Gini coefficient class*
	Information	
51	Newspaper publishers	1
51	Radio and television broadcasting and cable	1
51	Libraries and archives	1
51	Wired telecommunications carriers	2
51	Data processing services	2
51	Other telecommunication services	2
51	Publishing, except newspapers and software	2
51	Other information services	3
51	Motion pictures and video industries	3
51	Sound recording industries	3
51	Software publishing	3
	Finance and insurance	
52	Savings institutions, including credit unions	1
52	Banking and related activities	1
52	Insurance carriers and related activities	2
52	Nondepository credit and related activities	2
52	Securities, commodities, funds, trusts, and other financial investment	3
	Real estate and rental and leasing	
53	Video tape and disk rental	1
53	Other consumer goods rental	1
53	Commercial, industrial, and other intangible assets rental and leasing	2
53	Real estate	2
53	Automotive equipment rental and leasing	2
	Professional, scientific, and technical services	
54	Veterinary services	1
54	Accounting, tax preparation, bookkeeping and payroll services	1
54	Architectural, engineering, and related services	2
54	Other professional, scientific, and technical services	2
54	Legal services	2
54	Specialized design services	2
54	Computer systems design and related services	2
54	Advertising and related services	2
54	Management, scientific, and technical consulting services	2
54	Scientific research and development services	3
	Management	
55	Management of companies and enterprises	2
	Administrative support	
56	Waste management and remediation services	1
56	Business support services	1
56	Services to buildings and dwellings	1
56	Landscaping services	1
56	Employment services	2

(continued)

Table 2. Service Industries, Gini Coefficient Class *(Continued)*

2-digit NAICS	*Industry description*	*Gini coefficient class*
56	Other administrative and other support services	2
56	Investigation and security services	2
56	Travel arrangement and reservation services	2
	Education	
61	Elementary and secondary schools	1
61	Colleges and universities, including junior colleges	1
61	Other schools, instruction, and educational services	1
61	Business, technical, and trade schools and training	2
	Health care and social services	
62	Hospitals	1
62	Nursing care facilities	1
62	Vocational rehabilitation services	1
62	Offices of physicians	1
62	Outpatient care centers	1
62	Offices of dentists	1
62	Offices of optometrists	1
62	Residential care facilities, without nursing	1
62	Child day care services	1
62	Home health care services	1
62	Other health care services	1
62	Office of chiropractors	1
62	Individual and family services	1
62	Community food and housing, and emergency services	2
62	Offices of other health practitioners	2
	Arts, entertainment, and recreation	
71	Bowling centers	1
71	Other amusement, gambling, and recreation industries	1
71	Museums, art galleries, historical sites, and similar institutions	2
71	Independent artists, performing arts, spectator sports, and related industries	2
	Accommodation	
72	Drinking places, alcoholic beverages	1
72	Restaurants and other food services	1
72	Recreational vehicle parks and camps, and rooming and boarding houses	1
72	Traveler accommodation	2

(continued)

total employment is in tradable service industries. For example, more workers are in tradable industries in the services sector than in the manufacturing sector. The sum of the share of total employment in industries that are tradable in professional services (NAICS 51–56) is 13.7 percent and larger than the share of employment in tradable manufacturing industries (12.4 percent). There are sizable service sec-

Table 2. Service Industries, Gini Coefficient Class *(Continued)*

2-digit NAICS	*Industry description*	*Gini coefficient class*
	Other services	
81	Beauty salons	1
81	Funeral homes, cemeteries, and crematories	1
81	Personal and household goods repair and maintenance	1
81	Automotive repair and maintenance	1
81	Barber shops	1
81	Religious organizations	1
81	Commercial and industrial machinery and equipment repair and maintenance	1
81	Dry cleaning and laundry services	1
81	Car washes	1
81	Electronic and precision equipment repair and maintenance	1
81	Civic, social, advocacy organizations, and grant-making and giving	1
81	Nail salons and other personal care services	2
81	Other personal services	2
81	Business, professional, political, and similar organizations	2
81	Labor unions	3
81	Footwear and leather goods repair	3
	Public administration	
92	Justice, public order, and safety activities	1
92	Administration of human resource programs	1
92	Other general government and support	1
92	Executive offices and legislative bodies	1
92	Military Reserves or National Guard	1
92	Administration of economic programs and space research	1
92	Administration of environmental quality and housing programs	1
92	Public finance activities	2
92	National security and international affairs	3
92	U.S. Armed Forces, branch not specified	3
92	U.S. Coast Guard	3
92	U.S. Air Force	3
92	U.S. Army	3
92	U.S. Navy	3
92	U.S. Marines	3

tors correctly characterized as having low shares of employment in tradable industries (education, health care, personal services, and public administration). However, because the service sector is much larger than the manufacturing sector, the number of workers potentially exposed to international trade in services is actually larger than the number of exposed workers in manufacturing.

Table 3. Share of Sector Employment by Gini Coefficient by NAICS Sector
Percent

NAICS sector	*Description*	*Gini class 1*	*Gini class 2*	*Gini class 3*
11	Agriculture	0	87.95	12.05
21	Mining	0	24.24	75.76
22	Utilities	80.89	15.31	3.80
23	Construction	100.00	0	0
31	Manufacturing	0	40.39	59.61
32	Manufacturing	21.99	44.88	33.13
33	Manufacturing	14.44	65.36	20.21
3M	Manufacturing	0	100.00	0
42	Wholesale trade	45.82	50.62	3.57
44	Retail trade	81.72	18.28	0
45	Retail trade	88.65	11.35	0
4M	Retail trade	100.00	0	0
48	Transportation and warehousing	42.81	22.03	35.17
49	Transportation and warehousing	0	100.00	0
51	Information	33.25	50.37	16.38
52	Finance and insurance	32.05	50.98	16.97
53	Real estate and rental and leasing	9.06	90.94	0
54	Professional, scientific, technical services	13.95	79.87	6.18
55	Management	0	100.00	0
56	Administrative support	59.53	40.47	0
61	Education	98.89	1.11	0
62	Health care/social services	97.80	2.20	0
71	Arts, entertainment, recreation	67.35	32.65	0
72	Accommodation	81.92	18.08	0
81	Other services	79.77	9.86	10.37
92	Public administration	71.68	4.63	23.69
	All Industries	60.82	29.75	9.43

Occupation Results

We are also interested in categorizing occupations as tradable and nontradable. We are interested in identifying tradable occupations because, at least based on anecdotal reports in the press, some intermediate inputs into service production might be tradable even though the service industry is not (think computer programming for the banking industry). We use a similar methodology to classify occupations into tradable and nontradable categories. We construct a demand-weighted Gini coefficient for each occupation as described above and use the same Gini = .1 threshold for the nontradable/tradable categorization. Table 5 shows the share of employment by Major Standard Occu-

Table 4. Share of Total Employment in Tradable and Nontradable Industries by NAICS Sector

Percent

NAICS sector	*Description*	*Nontradable*	*Tradable*
11	Agriculture	0	1.36
21	Mining	0	0.39
22	Utilities	0.76	0.18
23	Construction	6.86	0
31	Manufacturing	0	2.17
32	Manufacturing	0.81	2.86
33	Manufacturing	1.16	6.86
3M	Manufacturing	0	0.53
42	Wholesale trade	1.66	1.96
44	Retail trade	5.90	1.32
45	Retail trade	2.91	0.37
4M	Retail trade	0.62	0
48	Transportation and warehousing	1.32	1.76
49	Transportation and warehousing	0	1.27
51	Information	1.04	2.08
52	Finance and insurance	1.64	3.47
53	Real estate and rental and leasing	0.16	1.63
54	Professional, scientific, technical services	0.82	5.08
55	Management	0	0.06
56	Administrative support	1.99	1.35
61	Education	8.75	0.10
62	Health care/social services	10.90	0.25
71	Arts, entertainment, recreation	1.12	0.54
72	Accommodation	4.52	1.00
81	Other services	3.76	0.95
92	Public administration	4.14	1.63
	All industries	60.82	39.18

pational Classification group by Gini class. The groupings are largely consistent with our priors. The occupational groups with large shares of employment classified as tradable include: Business and Financial Operations (68 percent); Computer and Mathematical Occupations (100 percent); Architecture and Engineering (63 percent), Legal (96 percent), and Life, Physical and Social Sciences (83 percent).[14] The notable nontradable occupational groups include

14. Van Welsum and Reif (this volume) offer a list of U.S. occupations (at the 3-digit level) identified as "potentially affected by offshoring" in table A-2. As explained in the chapter, their method relies on occupations having "offshorability attributes" that rely on the use of information and communication technologies, highly codifiable knowledge, and no face-to-face contact. There is overlap

Table 5. Share of Occupation Employment by Gini Coefficient by Major Occupation Category

Percent

SOC 2-digit code	*Description*	*Gini class 1*	*Gini class 2*	*Gini class 3*
11	Management	34.48	61.15	4.37
13	Business/financial operations	31.73	65.96	2.32
15	Computer/mathematical	0	73.07	26.93
17	Architecture/engineering	36.04	58.31	5.65
19	Life, physical, social sciences	16.32	58.61	25.08
21	Community/social services	100.00	0	0
23	Legal	3.78	96.22	0
25	Education and library	99.54	0.46	0
27	Arts, design, entertainment	17.13	75.02	7.85
29	Health care practitioners/technicians	86.56	13.10	0.34
31	Health care support	96.73	3.27	0
33	Protective service	59.83	40.17	0
35	Food preparation/serving	95.68	4.32	0
37	Building maintenance	98.54	1.46	0
39	Personal care service	82.64	7.22	10.13
41	Sales and related	75.41	21.82	2.77
43	Office/administrative support	93.14	6.66	0.20
45	Farm, fish, forestry	0	81.01	18.99
47	Construction/extraction	61.37	36.18	2.45
49	Installation, maintenance, repair	90.00	8.89	1.11
51	Production	80.30	17.15	2.55
53	Transportation/material moving	89.20	5.86	4.95
55	Military specific	0	0	100.00
	All occupations	71.66	24.86	3.47

Education and Library (99 percent nontradable); Health Care Practitioners (86 percent); Health Care Support (97 percent), Food Preparation (96 percent). On the blue-collar side, 90 percent of employment in Installation, Maintenance, and Repair is classified as nontradable, as is 80 percent of Production and 89 percent of Transportation and Material Moving.[15]

between the two lists of occupations, although our method identifies a larger set of tradable occupations. Van Welsum and Vickery (2005) offer a list of U.S. industries potentially affected by offshoring, in table 6. Our detailed industry list shares similarities with theirs, but our list excludes a number of retail industries (dairy stores, liquor stores, and others) included in their list.

15. The geographic concentration results are at first counterintuitive for production occupations given the manufacturing industry results. Production occupations are typically not industry-specific but instead are functional activities and are thus distributed more broadly.

Table 6. Share of Employment in Tradable and Nontradable Occupations and Industries

Percent

Occupation category (SOC 2-digit code)	*Nontradable occupations*	*Tradable occupations*
Management occupations (11)		
Non-tradable industries	23.97	26.58
Tradable industries	10.51	38.94
Business and financial operations occupations (13)		
Nontradable industries	14.11	27.72
Tradable industries	17.61	40.56
Computer and mathematical occupations (15)		
Nontradable industries	0	24.22
Tradable industries	0	75.78
Architecture and engineering occupations (17)		
Nontradable industries	8.46	13.30
Tradable industries	27.59	50.66
Life, physical, and social science occupations (19)		
Nontradable industries	7.28	36.49
Tradable industries	9.03	47.20
Legal occupations (23)		
Nontradable industries	3.54	18.89
Tradable industries	0.24	77.33
All occupations		
Total nontradable industries	50.03	10.79
Total tradable industries	21.64	17.54

The last two rows of table 6 show for all occupations how many workers are in occupations classified as tradable in industries classified as nontradable. In the aggregate, the share of workers in tradable occupations and nontradable industries is not large, about 10 percent. However, for business and professional occupations, the share of workers in tradable occupations in nontradable industries is much larger. The typical professional occupation has about 25 percent of employment in tradable occupations in nontradable industries. To the extent that firms can vertically "disintegrate" the provision of these intermediate service inputs, workers in these tradable occupations are potentially vulnerable to trade even though their industry is not tradable. This suggests that for service activities the share of workers potentially vulnerable to trade is probably understated. Outside of education and health care occupations, the typical white-collar occupation involves a potentially tradable activity.

Table 7. Mean Earnings and Demographic Characteristics for Selected and All Industries

Percent, unless otherwise noted

Industry (NAICS code)	*Nontradable*	*Tradable*
Manufacturing (3x)		
Employment income (dollars)	36,974	39,901
Male	75.1	67.8
African American	6.1	9.7
Hispanic	9.7	11.7
With advanced degree	2.6	6.0
With bachelor's degree	13.8	20.4
With high school diploma	85.3	82.9
Age	40.0	40.2
Information (51)		
Employment income (dollars)	35,472	49,510
Male	50.9	55.9
African American	10.4	11.5
Hispanic	7.8	7.3
With advanced degree	9.4	10.6
With bachelor's degree	37.4	41.3
With high school diploma	94.2	96.2
Age	38.7	37.6
Finance and insurance (52)		
Employment income (dollars)	38,170	54,460
Male	29.0	42.7
African American	11.5	9.2
Hispanic	7.8	6.4
With advanced degree	7.1	10.2
With bachelor's degree	30.5	43.8
With high school diploma	97.1	97.4
Age	38.1	39.1

(continued)

Worker Characteristics

Beyond mere employment counts, we also examine demographic characteristics such as education, age, gender, and earnings to identify whether there are differences between workers in tradable service activities and those in nontradable industries and occupations. These characteristics are available from the 2000 Decennial Census of Population Public Use Micro Sample (PUMS) 5 percent sample.[16]

Table 7 shows the demographic characteristics of workers in tradable industries and nontradable industries in aggregate. Workers in tradable industries have

16. For more information on the 5 percent sample PUMS see www.census.gov/Press-Release/www/2003/PUMS5.html.

Table 7. Mean Earnings and Demographic Characteristics for Selected and All Industries *(Continued)*

Percent, unless otherwise noted

Industry (NAICS code)	*Nontradable*	*Tradable*
Real estate and rental and leasing (53)		
Employment income (dollars)	23,056	42,915
Male	58.1	51.1
African American	9.1	8.6
Hispanic	10.8	9.7
With advanced degree	1.9	6.7
With bachelor's degree	13.3	29.7
With high school diploma	84.7	90.6
Age	31.1	42.4
Professional, scientific, technical services (54)		
Employment income (dollars)	42,246	57,959
Male	35.3	57.1
African American	5.1	5.5
Hispanic	5.0	5.6
With advanced degree	16.6	25.7
With bachelor's degree	52.5	59.5
With high school diploma	97.1	97.8
Age	39.5	39.3
Management (55)		
Employment income (dollars)	...	61,285
Male	...	45.5
African American	...	5.4
Hispanic	...	4.9
With advanced degree	...	14.3
With bachelor's degree	...	49.7
With high school diploma	...	97.8
Age	...	40.5
Administrative support (56)		
Employment income (dollars)	24,039	28,742
Male	64.1	48.5
African American	11.9	17.6
Hispanic	22.2	12.2
With advanced degree	2.0	5.0
With bachelor's degree	10.7	23.4
With high school diploma	72.3	88.0
	37.2	36.1
All industries		
Employment income	30,966	41,836
Male	49.6	60.1
African American	10.2	9.9
Hispanic	10.4	10.3
With advanced degree	10.2	9.2
With bachelor's degree	26.6	30.2
With high school diploma	87.0	88.7
Age	38.8	39.4

higher incomes, are more likely to be male, and are more likely to have a college degree (though not an advanced degree). The table also breaks out these same characteristics for selected service industries classified as tradable and nontradable. We present the results for the manufacturing sector as a benchmark for demographic characteristics typically associated with trade-affected workers. Workers in tradable service industries are higher paid and more skilled than workers in tradable manufacturing. Within services, the most striking feature of the service industry results is the difference in annual earnings. Across all major service sector groups, the differential in earnings between tradable and nontradable industries is large, with tradable services having appreciably higher wages. Service workers in tradable industries also tend to have attained a higher level of education and are more likely to be male and white.

Table 8 shows the results for all occupations divided into tradable and nontradable groups. Individuals in occupations identified as tradable tend to have higher earnings, are more likely to be male and have more years of schooling. The table also shows the same characteristics for selected occupations. Again, as in the industry results, workers in tradable occupations earn more and are more highly educated than workers in nontradable service occupations.

In tables 9–12, we estimate a number of regressions to examine whether the earnings differentials in tradable industries and occupations are the result of higher educational attainment. Table 9 shows regression results for all industries and NAICS 51–56 industries. Across all industries, controlling for observable demographic characteristics and industry (2-digit NAICS) and regional (POWCMA) fixed effects, workers in tradable industries have 6 percent higher wages. For workers in professional and business service industries, the differential associated with being in a tradable industry is even larger. Again controlling for observable demographic characteristics, in the professional service sector, workers in tradable industries have almost 15 percent higher wages than workers in nontradable industries in the same sector.

Table 10 shows a similar specification for occupations. The first column reports the results for all occupations, and the second column reports the results for "high-end" service occupations.[17] Across all occupations, workers in tradable occupations receive 9 percent higher wages than workers in nontradable occupations. For high-end service occupations, workers in the tradable sector receive almost 13 percent higher wages, even after controlling for demographic characteristics and occupation group (2-digit SOC) and region.

17. High-end service occupations include SOC major groups 11, 13, 15, 17, 19, 23, and 29. See table 8 for the names of the SOC major groups.

Table 8. Mean Earnings and Demographic Characteristics for Occupations

Percent, unless otherwise noted

Industry (NAICS code)	*Nontradable*	*Tradable*
Management (11)		
Employment income (dollars)	51,399	69,029
Male	56.2	67.3
African American	8.3	4.7
Hispanic	6.8	5.0
With advanced degree	19.9	15.7
With bachelor's degree	46.5	49.6
With high school diploma	95.2	95.8
Age	41.8	42.6
Business and financial operations (13)		
Employment income (dollars)	42,813	51,998
Male	41.3	48.0
African American	10.3	8.3
Hispanic	6.9	5.4
With advanced degree	10.5	16.2
With bachelor's degree	44.0	61.6
With high school diploma	97.6	98.6
Age	40.4	40.2
Computer and mathematical occupations (15)		
Employment income (dollars)	...	54,297
Male	...	70.3
African American	...	6.8
Hispanic	...	4.5
With advanced degree	...	17.8
With bachelor's degree	...	59.9
With high school diploma	...	99.1
Age	...	37.3
Architecture and engineering occupations (17)		
Employment income (dollars)	40,505	62,115
Male	82.5	89.0
African American	5.7	3.9
Hispanic	6.4	4.1
With advanced degree	5.3	25.5
With bachelor's degree	26.2	76.2
With high school diploma	96.2	99.9
Age	39.4	40.6
Life, Physical, and Social Science Occupations (19)		
Employment income (dollars)	29,339	50,000
Male	57.4	59.2
Percent African American	7.0	4.6
Percent Hispanic	7.2	4.0
With advanced degree	11.6	54.4
With bachelor's degree	40.0	85.3
With high school diploma	96.4	99.2
Age	36.0	40.3

(continued)

Table 8. Mean Earnings and Demographic Characteristics for Occupations

Percent, unless otherwise noted

Industry (NAICS code)	*Nontradable*	*Tradable*
Legal Occupations (23)		
Employment income (dollars)	71,304	80,265
Male	60.6	51.4
Percent African American	9.1	5.6
Percent Hispanic	4.5	5.1
With advanced degree	58.2	64.1
With bachelor's degree	78.8	76.9
With high school diploma	99.2	99.3
Age	47.7	40.9
Healthcare Practitioners and Technical Occupations (29)		
Employment income (dollars)	39,922	139,375
Male	19.5	70.6
Percent African American	9.8	4.6
Percent Hispanic	4.5	4.8
With advanced degree	17.8	93.4
With bachelor's degree	47.3	97.8
With high school diploma	98.8	99.7
Age	40.5	42.8
Healthcare Support Occupations (31)		
Employment income (dollars)	18,423	18,751
Male	11.9	17.6
African American	24.0	3.7
Hispanic	10.6	5.6
With advanced degree	2.2	9.9
With bachelor's degree	7.9	30.9
With high school diploma	83.8	97.3
Age	37.8	39.0
All Occupations		
Employment income (dollars)	28,789	51,503
Male	48.5	66.7
African American	11.1	7.5
Hispanic	10.9	8.8
With advanced degree	7.4	16.1
With bachelor's degree	21.8	43.9
With high school diploma	86.3	91.0
Age	38.8	39.9

Table 11 examines whether the effects of being in a tradable industry and occupation are independent. Workers in tradable industries *and* tradable occupations are the omitted category. For all industries and occupations, workers in nontradable industries and nontradable occupations have 10 percent lower wages than workers in both tradable industries and occupations. Interestingly, the effect seems to be additive. Workers in either *only* a tradable industry or *only*

Table 9. OLS Regression Results, Tradable Industry Wage Differentials[a]

	All industries	*NAICS 50s*
Dependent variable: log (employment income)		
Tradable industry	0.060 (0.0008)	0.147 (0.0016)
Male	0.214 (0.0006)	0.225 (0.0014)
African American	–0.096 (0.0010)	–0.145 (0.0024)
Hispanic	–0.215 (0.0010)	–0.218 (0.0026)
Hours	0.026 (0.0000)	0.029 (0.0001)
Weeks	0.040 (0.0000)	0.039 (0.0001)
Advanced degree	0.262 (0.0011)	0.224 (0.0023)
Bachelor's degree	0.380 (0.0008)	0.325 (0.0017)
Industry controls (2-digit NAICS)	Yes	Yes
POWCMA[b] controls	Yes	Yes
Summary statistics		
R^2	0.538	0.519
N	5,836,360	1,074,271
Weighted N	122,155,903	23,609,616

a. Standard error in parentheses.
b. Place of Work Consolidated Metropolitan Area.

a tradable occupation receive wages about 5 percent lower than workers in *both* a tradable industry and a tradable occupation. In both professional service industries and "high-end" service occupations, the effect of being in a tradable industry and a tradable occupation is quite large. Workers in tradable industries and occupations in NAICS 50 sector receive wages 17 percent higher than workers in a nontradable industry and nontradable occupation *within the same sector*. For high-end service occupations, the differential is almost as large: workers in tradable industries and occupations make almost 16 percent more than workers in nontradable industries and occupations.

These results demonstrate that tradable industries and occupations pay higher wages, even after controlling for observable characteristics. These effects appear to be independent: being in both a tradable industry and a tradable occupation is associated with a larger (almost double) income differential than being in either a tradable industry or occupation alone.

The comparison of worker characteristics in tradable service activities suggests that tradable services are consistent with U.S. comparative advantage; they

Table 10. OLS Regression Results, Tradable Occupation Wage Differentials[a]

	All occupations	*High-end service occupations*[b]
Dependent variable: log (employment income)		
Tradable occupation	0.091	0.127
	(0.0008)	(0.0014)
Male	0.215	0.245
	(0.0006)	(0.0013)
African American	–0.061	–0.112
	(0.0010)	(0.0023)
Hispanic	–0.187	–0.168
	(0.0010)	(0.0027)
Hours	0.026	0.020
	(0.0000)	(0.0001)
Weeks	0.039	0.038
	(0.0000)	(0.0001)
Advanced degree	0.216	0.227
	(0.0011)	(0.0016)
Bachelor's degree	0.303	0.297
	(0.0008)	(0.0013)
Occupation controls (2-digit SOC)	Yes	Yes
POWCMA[c] controls	Yes	Yes
Summary statistics		
R^2	0.545	0.396
N	5,836,630	1,446,158
Weighted *N*	122,155,903	30,803,183

a. Standard error in parentheses.
b. High-end service occupations are occupations in SOC major groups 11, 13, 15, 17, 19, 23, and 29.
c. Place of Work Consolidated Metropolitan Area.

are high-skill and high-wage activities (relative to both manufacturing and non-tradable service activities).

Changes in Aggregate Employment Growth

Much of the recent attention to services offshoring has emphasized job losses in specific occupational categories. We examine recent employment growth trends using both aggregate industry data from the Census Bureau's County Business Patterns program and aggregate occupation data from the Bureau of Labor Statistics' Occupational Employment Statistics program.[18] We present the

18. The County Business Patterns program is an establishment-based data collection program that uses primarily administrative data and thus has nearly universal coverage of in-scope estab-

Table 11. OLS Regression Results, Tradable Industry and Occupation Wage Differentials[a]

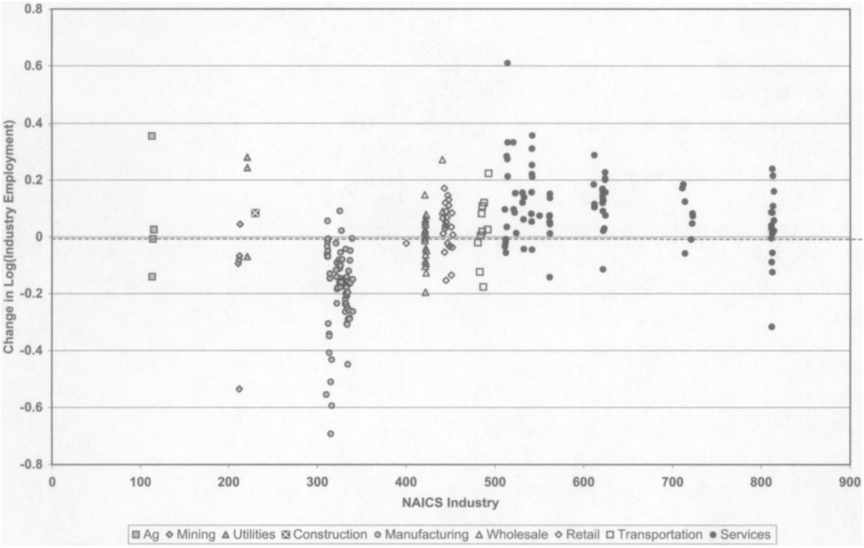
	All industries and occupations	*NAICS 50s*	*High-end service occupations*[b]
Dependent variable: Log (employment income)			
Nontradable industry and nontradable occupation	–0.098 (0.0011)	–0.174 (0.0026)	–0.159 (0.0022)
Nontradable industry and tradable occupation	–0.055 (0.0012)	–0.072 (0.0026)	–0.050 (0.0019)
Tradable industry and nontradable occupation	–0.055 (0.0010)	–0.045 (0.0022)	–0.087 (0.0021)
Tradable industry and tradable occupation		—Omitted category—	
Male	0.205 (0.0007)	0.205 (0.0015)	0.244 (0.0013)
African American	–0.064 (0.0010)	–0.111 (0.0024)	–0.111 (0.0022)
Hispanic	–0.173 (0.0010)	–0.169 (0.0026)	–0.158 (0.0026)
Hours	0.025 (0.0000)	0.027 (0.0001)	0.020 (0.0001)
Weeks	0.039 (0.0000)	0.038 (0.0001)	0.036 (0.0001)
Advanced degree	0.223 (0.0011)	0.197 (0.0024)	0.232 (0.0016)
Bachelor's degree	0.279 (0.0008)	0.245 (0.0017)	0.276 (0.0013)
Industry controls (2-digit NAICS)	Yes	Yes	Yes
Occupation controls (2-digit SOC)	Yes	Yes	Yes
POWCMA[c] controls	Yes	Yes	Yes
Summary statistics			
R^2	0.545	0.540	0.419
N	5,836,630	1,074,271	1,446,158
Weighted *N*	122,155,903	23,609,616	30,803,183

a. Standard error in parentheses.
b. High-end service occupations are occupations in SOC major groups 11, 13, 15, 17, 19, 23, and 29.
c. Place of Work Consolidated Metropolitan Area.

data broken out as tradable/nontradable and by sector. The results in the previous section indicate that tradable activities in general and tradable services in particular require higher skills than other activities. High-skill activities are consistent with U.S. comparative advantage, and we would expect that as trade

lishments. For more information on County Business Patterns see www.census.gov/epcd/cbp/view/cbpview.html. The Occupational Employment Statistics program is also an establishment-based program, but it is collected through a survey instrument. For more information on the Occupational Employment Statistics see www.bls.gov/oes/home.htm.

Figure 2. Industry Employment Growth, 1998–2002



increases, economic activity would shift to activities consistent with U.S. comparative advantage. Thus, we would expect higher-skill industries and occupations to have higher rates of employment growth. We also break out the employment growth rates by industry and occupation skill quartile.[19]

Figure 2 shows the change in industry employment (log) for the period 1998–2002 by NAICS code.[20] Overall, employment in manufacturing industries shrank, and employment in service industries grew. Table 12 presents mean industry employment growth by tradable and nontradable sectors. In the aggregate, the mean tradable industry experienced an employment loss of almost 6 percent, while the mean nontradable industry experienced an employment gain of 5.6 percent. The lower panels of table 12 break out industries by sector, tradable category, and skill quartile. The lower panels of table 12 show that the

19. Industry and occupation skill quartiles are created by placing industries and occupations into skill quartiles based on the share of employees within the industry with a bachelor's degree.

20. We are constrained to use 1998 as our starting point because it is the first year that County Business Patterns was produced on a NAICS basis; 2002 is the most recent year available. Public Administration is not in scope for the County Business Patterns program, so employment change figures are not available for this sector.

Table 12. Industry-Level Employment Change, by Industry Characteristics, 1998–2002

Industry classification	*Tradable v. nontradable*	*Skill quartile*	*Number of industries*	*Mean*	*Standard deviation*
Nontradable			88	0.056	0.114
Tradable			149	–0.059	0.198
Ag, Min, Mfg[a]	Nontradable		5	–0.116	0.099
	Tradable		83	–0.173	0.161
Services	Nontradable		91	0.067	0.107
	Tradable		85	0.076	0.145
Ag, Min, Mfg	Nontradable	Skill Q1	3	–0.067	0.102
		Skill Q2	2	–0.190	0.015
	Tradable	Skill Q1	32	–0.191	0.169
		Skill Q2	24	–0.203	0.148
		Skill Q3	16	–0.114	0.103
		Skill Q4	11	–0.147	0.216
Services	Nontradable	Skill Q1	24	0.016	0.080
		Skill Q2	23	0.084	0.098
		Skill Q3	20	0.015	0.106
		Skill Q4	24	0.156	0.088
	Tradable	Skill Q1	7	–0.006	0.233
		Skill Q2	16	0.112	0.104
		Skill Q3	31	–0.007	0.095
		Skill Q4	31	0.139	0.148

a. Agriculture, Mining, Manufacturing.

employment losses are, on average, concentrated in the goods-producing sector (and in the lower portion of the skills distribution).[21] In the service sector, the average nontradable industry experienced 6.7 percent growth, and the average tradable service industry experienced 7.6 percent growth. In general, industries in the lower-skill quartiles have a lower rate of employment growth. Tradable industries do not seem to have dramatically different employment outcomes than nontradable industries, though at the low end of the skill distribution tradable industries had, on average, employment losses.[22]

21. These results are consistent with Bernard, Jensen, and Schott (forthcoming 2006). Bernard, Jensen, and Schott use detailed, plant-level data to examine the impact of imports from low-wage countries on U.S. manufacturing. The results show that activity in U.S. manufacturing is shifting to industries consistent with U.S. comparative advantage.

22. Using a *t* test to compare the lowest-skill quartile with the highest-skill quartile in the tradable services industry group, we cannot reject the null hypothesis that the means are the same at the 10 percent level.

Table 13. Occupation-Level Employment Change, by Occupation Characteristics, 1999–2003

Occupation classification	*Tradable v. nontradable*	*Skill quartile*	*Number of industries*	*Mean*	*Standard deviation*
Nontradable			197	0.022	0.160
Tradable			228	–0.004	0.247
Ag, Prod, Ext,	Nontradable		38	–0.044	0.143
Con[a]	Tradable		77	–0.141	0.228
Services	Nontradable		180	0.036	0.161
	Tradable		180	0.059	0.230
Ag, Prod, Ext,	Nontradable	Skill Q1	23	–0.070	0.145
Con		Skill Q2	12	–0.026	0.140
		Skill Q3	3	0.056	0.125
	Tradable	Skill Q1	56	–0.148	0.235
		Skill Q2	18	–0.150	0.196
		Skill Q3	3	0.014	0.272
Services	Nontradable	Skill Q1	30	0.005	0.114
		Skill Q2	57	0.037	0.173
		Skill Q3	54	0.021	0.165
		Skill Q4	39	0.078	0.164
	Tradable	Skill Q1	10	–0.065	0.111
		Skill Q2	32	0.086	0.210
		Skill Q3	59	0.032	0.181
		Skill Q4	79	0.083	0.269

a. Agricultural, Production, Extractive, Construction
b. Skill Q is Skill Quartile

Table 13 shows similar employment growth rates for 1999–2003 for occupation categories.[23] Similar to industries, tradable occupations in aggregate have lower employment growth rates than nontradable industries on average. Also similar to industries, this is explained primarily by differences between production-related occupations and service activities. Tradable service occupations have, on average, higher employment growth rates than nontradable service occupations. It is interesting to note that, as in tradable industries, at the low end of the skill distribution tradable service occupations have negative employment growth. In comparison, the highest skill category has positive employment growth.[24]

23. We use 1999 as our starting year because it is the first year the Occupational Employment Survey was published on a Standard Occupational Classification basis. We use 2003 as the end point to have a four-year period consistent with the industry data.

24. Using a t test to compare the lowest-skill quartile with the highest-skill quartile in the tradable services occupation group, we can reject the null hypothesis that the means are the same.

The employment growth results are consistent with the comparative advantage framework. Employment is shifting toward activities that are consistent with U.S. comparative advantage. Industries and occupations that require higher skills are growing relative to low skill industries and occupations. In both tradable service industries and occupations, those in the lowest skill classes experience negative employment growth on average.

Evidence on the Risk of Job Loss and Characteristics of Displaced Workers

The Displaced Worker Surveys (DWS) provide basic information on the scope and cost of involuntary job loss. The DWSs offer large sample sizes, are nationally representative, and allow several key elements to be investigated, including the incidence of job loss; the characteristics of workers affected; likelihood of reemployment; reemployment industry and occupation; and earnings changes.[25] These surveys have been used extensively to study manufacturing job loss (see Kletzer 2001).

The 2000 census provides the most up-to-date industry and occupational classifications of the services and white-collar jobs of primary interest. The need for updated detail on industry and occupation (currently) limits our use of the Displaced Worker Surveys to the most recent administration, in January 2004. Although we lose the ability to observe services and white-collar job loss over time, we gain the industry and occupational detail necessary for studying services offshoring.

Job displacement from services

Job loss rates by industry are reported in table 14, focusing on the 2001–03 period covered by the January 2004 Displaced Worker Survey. Remembering that this time period covered the dot.com bust and the most recent recession, the Information sector (NAICS 51) had a notably high rate of job loss (.232). Overall, the risk of job loss was lower in services than in manufacturing.

As a reference point, table 14 includes job loss rates by industry for the period 1999–2001, from the 2002 Displaced Worker Survey. The industry classifications are different, reflecting the use of 1990 census codes for the 2002 survey. What is clear is that job loss rates increased from 1999–2001 to 2001–03, most

25. See the appendix for more information on the Displaced Worker Surveys.

Table 14. Job Loss Rates, by Industry

Mean

From the 2004 Displaced Worker Survey (2001–03)			
Industry	*Total 2001–03*	*Tradable*	*Nontradable*
Agriculture	0.049	...	...
Mining	0.127	...	...
Construction	0.131	...	...
Manufacturing	0.209	...	...
Wholesale and retail trade	0.113	0.077	0.091
Transport and utilities	0.089		
Information	0.232	0.317	0.075
Financial	0.081	0.08	0.081
Professional and business services	0.144	0.158	0.113
Education and health services	0.040	0.071	0.039
Leisure and hospitality	0.105	0.083	0.113
Other services	0.051	0.03	0.057
Public administration	0.020		
Total	0.103	0.153	0.076
Manufacturing, tradable	0.213		
Manufacturing, nontradable	0.192		
Nonmanufacturing, tradable	0.128		
Nonmanufacturing, nontradable	0.073		
Dropping agriculture, mining, and construction			
Manufacturing, tradable	0.213		
Manufacturing, nontradable	0.192		
Nonmanufacturing, tradable	0.106		
Nonmanufacturing, nontradable	0.054		
Total		0.126	0.058

From the 2002 and 2004 Displaced Worker Surveys		
Industry	*1999–2001*	*2001–03*
Agriculture	0.042	0.065
Mining	0.173	0.127
Construction	0.107	0.131
Manufacturing, durables	0.177	0.236
Manufacturing, nondurables	0.133	0.157
Transportation	0.096	0.103
Communications	0.159	0.305
Utilities and sanitary service	0.054	0.052
Wholesale trade	0.111	0.123
Retail trade	0.099	0.107
Finance,insurance, and real estate	0.079	0.080
Private household	0.044	0.016
Business and repair services	0.181	0.172
Personal services	0.080	0.057
Entertainment and recreation	0.071	0.098
Hospitals	0.026	0.030
Other medical	0.052	0.055
Educational services	0.020	0.030
Social services	0.033	0.060
Other professional services	0.071	0.078
Forestry and fisheries	0.008	0.070
Public administration	0.017	0.020
Total	0.090	0.106

Source: Authors' calculations from the 2002 and 2004 Displaced Worker Surveys, using sampling weights.

notably in Communications (the former name of the sector for some of Information) and Manufacturing.

When we apply our tradable/nontradable distinction to the overall economy, the rate of job loss is notably higher in tradable industries (.153) than in nontradable industries (.076). Within the broad sectors of manufacturing and nonmanufacturing, tradable industries also had higher rates of job loss. The tradable/nontradable distinction is small in manufacturing, with tradable industries having a job loss rate of .213, and nontradable (of which there are few) a rate of .192. Outside of manufacturing, the tradable distinction is large. Tradable nonmanufacturing industries have a rate of job loss of .128, and nontradable industries, .073. This difference is most notable in the Information sector, where the rate of job loss from tradable (3-digit) industries was .317 and the nontradable job loss rate was .075.

Job loss rates by occupation are reported in table 15. The blue-collar occupations faced a higher rate of job loss (about .12) than the white-collar occupations (about .09). Workers in all occupational categories faced a higher rate of job loss in 2001–03 than in 1999–2001. Production workers faced the highest rate of job loss, .206 (the cross-occupation average was .106). Some of the white-collar occupational categories forecast to be at risk of services offshoring had high job loss rates (but lower than Production workers), including Business Operations Specialists (.143), Computer and Math (.177), and Architecture and Engineering (.128).

In the overall economy, tradable occupations had a higher rate of job loss than nontradable occupations, with the greatest difference in white-collar occupations. White-collar workers in tradable occupations faced a job loss rate of .094, and workers in nontradable occupations faced a rate of .065. For blue-collar workers, the tradable job loss rate was .128 and the nontradable rate was .122. There is no clear pattern of exposure to the risk of job loss by tradability within detailed occupations.

Parallel to our discussion of worker characteristics from the 2000 PUMS, table 16 reports demographic and educational characteristics for workers displaced from tradable and nontradable nonmanufacturing industries, with (tradable) manufacturing industries offered as a reference group. As noted by Kletzer (2001), workers displaced from nonmanufacturing industries are slightly younger, less tenured, less likely to be male, and considerably more educated than workers displaced from manufacturing. In tradable nonmanufacturing, 75 percent of displaced workers had at least some college experience. In manufacturing, the share of displaced workers with some college was 46 percent.

Table 15. Job Loss Rates, by Occupation[a]
Mean

From the 2004 Displaced Worker Survey (2001–03)				From the 2002 and 2004 Displaced Worker Surveys		
Industry	*Total 2001–03*	*Tradable*	*Nontradable*	*Industry*	*1999–2001*	*2001–03*
Management business, financial (white collar)	0.089	0.077	0.091	Executive, administrative, managerial	0.086	0.094
Business operations specialists	0.143	0.121	0.171	Professional specialty	0.059	0.066
Financial specialists	0.054	0.057	0.044	Technician and related	0.088	0.110
Professional and related (white collar)	0.070	0.109	0.033	Sales	0.094	0.109
Computer and math	0.177	0.177	n.a.	Administrative support	0.097	0.106
Architecture and engineering	0.128	0.113	0.158	Private household	0.047	
Life, physical, and social science	0.059	0.057	0.066	Protective services	0.045	0.059
Service (white collar)	0.073	0.072	0.056	Food, health, cleaning, personal	0.069	0.075
Sales (white collar)	0.106	0.123	0.079	Precision production, craft, repair	0.111	0.151
Office and administrative support (white collar)	0.109	0.067	0.092	Operators, assemblers, inspectors	0.181	0.219
Farming, forestry, fishery (blue collar)	0.110	...	...	Transportation and material moving equipment	0.103	0.112

Construction and extractive (blue collar)	0.149	...	...
Installation, maintenance, repair (blue collar)	0.112	0.117	0.083
Production (blue collar)	0.206	0.163	0.169
Transportation and material moving (blue collar)	0.117	0.057	0.096
Total	0.102	0.101	0.078
Blue collar, tradable	0.128	...	...
Blue collar, nontradable	0.122	...	...
White collar, tradable	0.094	...	...
White collar, nontradable	0.065	...	...
Full sample			
Blue collar, tradable	0.175	...	...
Blue collar, nontradable	0.150	...	...
White collar, tradable	0.104	...	...
White collar, nontradable	0.078	...	...
Full sample total	...	0.122	0.087

Handlers, cleaners, helpers	0.139	0.151
Farming, forestry, fishery	0.044	0.067
Armed forces		
Total	0.090	0.103

Source: Authors' calculations from the 2002 and 2004 Displaced Worker Surveys.
a. Agriculture, Mining, and Construction omitted.
n.a. Not available.

Table 16 also shows that in tradable nonmanufacturing industries, displaced workers were more educated, more likely to have health insurance, more likely to lose full-time jobs, and more likely to have higher predisplacement earnings than workers displaced from nontradable industries. The educational attainment differences are stark: 42 percent of workers displaced from nontradable nonmanufacturing industries, but 24 percent of workers displaced from tradable nonmanufacturing industries, had a high school diploma or less. The educational differences show up in predisplacement weekly earnings.

Postdisplacement, reemployment rates (also reported in table 16) are higher for displaced nonmanufacturing workers than for manufacturing workers. Reemployment rates are .75 and .77 for nontradable and tradable nonmanufacturing workers, respectively, .64 for manufacturing workers.

The earnings cost of job displacement, well established for manufacturing workers, also affected nonmanufacturing workers. For the 2001–03 period, with the weak job recovery from the recession, we see large earnings losses. Median earnings losses are smaller for nonmanufacturing than for manufacturing, and a larger share of nonmanufacturing workers experience no earnings loss. Consistent with lower predisplacement earnings, workers displaced from nontradable nonmanufacturing industries experienced smaller earnings losses than workers displaced from tradable nonmanufacturing industries.

Table 17 reports worker characteristics and reemployment outcomes for three services sectors: Information; Financial, Insurance and Real Estate; and Professional and Business Services. For the most part, workers in tradable industries in these sectors have higher levels of educational attainment. In Information and Professional and Business Services, predisplacement weekly earnings were higher in tradable industries than in nontradable industries. Consistent with higher earnings, more workers displaced from tradable industries reported that they had health insurance coverage than workers displaced from nontradable industries. Reemployment outcomes (reemployment rates or average earnings losses) are similar within sector, across the tradability of the detailed industries.

Table 18 reports a similar breakdown, by occupation, for sectors: Management, Business and Financial; Professional and Related; Office and Administrative Support. Workers from tradable occupations have higher levels of education, within occupational group, than workers from nontradable occupations. Their predisplacement earnings were higher, as was the availability of health insurance coverage. Men are more highly represented in the tradable occupations. Again, there is no clear pattern of reemployment outcomes by tradability. Earnings losses range from 3 percent to 16 percent, with 40 to 50 percent of reemployed workers reporting no earnings loss.

Table 16. Characteristics of Displaced Workers, by Industrial Sector and Tradability

Worker characteristics	*Manufacturing, tradable*	*Nonmanufacturing, tradable*	*Nonmanufacturing, nontradable*
Age (mean in years)	41.60	39.60	38.10
Standard deviation	11.20	11.10	11.70
Job tenure (mean in years)	7.11	4.40	4.26
Standard deviation	8.43	5.60	5.61
Job tenure > ten years	0.23	0.12	0.14
Educational attainment (share)			
High school dropout	0.14	0.05	0.11
High school graduate	0.40	0.19	0.31
Some college	0.24	0.30	0.33
College +	0.22	0.45	0.25
Male	0.61	0.54	0.45
In predisplacement job			
Share with health insurance	0.75	0.66	0.47
Full-time	0.96	0.90	0.82
If full-time, real weekly earnings (dollars)	342.70	443.18	294.91
Standard deviation (dollars)	300.54	383.08	271.21
Share reemployed	0.64	0.77	0.75
Of reemployed, share full-time	0.80	0.78	0.72
All reemployed			
Change in ln earnings (mean)	–0.32	–0.30	–0.14
Standard deviation	0.89	0.98	1.02
Median change	–0.15	–0.11	–0.03
Share with no loss in earnings	0.42	0.45	0.51
Full-time to full-time			
Change in ln earnings (mean)	–0.21	–0.21	–0.12
Standard deviation	0.76	0.69	0.97
Median change	–0.10	–0.07	–0.03
Share with no loss in earnings	0.42	0.46	0.52

Source: Authors' calculations from the 2004 Displaced Worker Survey, using sampling weights. Agriculture, Mining, and Construction omitted.

Conclusions

This paper develops a new empirical approach to identifying, at a detailed level for the entire economy, industries and occupations that are tradable. Using the methodology, we find substantial employment in tradable service industries and occupations. Workers in these industries and occupations are more highly skilled and have higher earnings than workers in the manufacturing sector and nontradable service activities. The higher earnings are not solely a result of higher skill levels: in regressions controlling for observable characteristics,

Table 17. Characteristics of Selected Service Sector Displaced Workers, by Industry and Tradability

	Information		*Financial, insurance, real estate*		*Professional and business services*	
	Tradable	*Nontradable*	*Tradable*	*Nontradable*	*Tradable*	*Nontradable*
Job tenure (mean in years)	5.80	4.51	5.82	8.28	3.55	3.24
Standard deviation	7.37	7.25	7.00	9.14	3.98	4.68
Job tenure > ten years	0.192	0.16	0.167	0.259	0.066	0.109
Educational attainment (share)						
High school dropout	0.032	0.00	0.04	0.046	0.047	0.173
High school graduate	0.207	0.038	0.179	0.243	0.157	0.446
Some college	0.262	0.45	0.389	0.354	0.261	0.196
College +	0.499	0.512	0.392	0.357	0.535	0.186
Male	0.559	0.668	0.47	0.479	0.527	0.527
In predisplacement job						
Share with health insurance	0.82	0.62	0.62	0.73	0.66	0.36
Full-time	0.93	0.87	0.91	0.94	0.91	0.83
If full-time, real weekly earnings (dollars)	530.82	387.98	409.88	542.51	504.61	273.95
Standard deviation (dollars)	409.45	350.69	380.43	454.14	415.82	251.57
Share reemployed	0.72	0.81	0.61	0.68	0.71	0.62
Of reemployed, share full-time	0.76	0.87	0.80	0.82	0.80	0.73
All reemployed						
Change in ln earnings (mean)	–0.57	–0.72	–0.16	0.013	–0.34	–0.18
Standard deviation	1.07	2.97	1.09	0.499	0.96	0.93
Median change	–0.34	–0.024	–0.08	0.03	–0.08	–0.03
Share with no loss in earnings	0.346	0.469	0.456	0.531	0.457	0.468
Full-time to full-time						
Change in ln earnings (mean)	–0.40	–1.003	–0.15	0.018	–0.185	–0.162
Standard deviation	0.82	3.328	0.51	0.36	0.737	0.999
Median change	–0.25	–0.07	–0.047	–0.007	–0.034	–0.029
Share with no loss in earnings	0.36	0.344	0.457	0.508	0.49	0.489

Source: Authors' calculations from the 2004 Displaced Worker Survey, using sampling weights.

Table 18. Characteristics of Displaced Workers in Selected Service Occupations, by Occupation and Tradability

	Management, business, and financial		*Professional and related*		*Office and administrative support*	
Worker characteristics	*Tradable*	*Nontradable*	*Tradable*	*Nontradable*	*Tradable*	*Nontradable*
Job tenure (mean in years)	6.72	5.03	4.82	4.30	5.31	4.57
Standard deviation	8.04	4.99	6.09	5.25	6.69	5.74
Job tenure > ten years	0.204	0.143	0.111	0.109	0.176	0.136
Educational attainment (share)						
High school dropout	0.008	0.012	0.003	0.026	0.051	0.05
High school graduate	0.132	0.272	0.092	0.115	0.331	0.339
Some college	0.269	0.28	0.198	0.328	0.438	0.406
College +	0.591	0.436	0.708	0.53	0.18	0.204
Male	0.466	0.633	0.717	0.248	0.306	0.241
In pre-displacement job						
Share with health insurance	0.775	0.588	0.794	0.632	0.616	0.577
Full-time	0.965	0.927	0.93	0.791	0.896	0.865
If full-time, real weekly earnings (dollars)	554.78	426.02	523.24	323.60	299.45	261.96
Standard deviation (dollars)	434.23	336.05	369.44	226.58	254.48	198.07
Share reemployed	0.786	0.72	0.80	0.801	0.691	0.755
Of reemployed, share full-time	0.791	0.726	0.805	0.707	0.758	0.763
All reemployed						
Change in ln earnings (mean)	–0.374	–0.364	–0.34	–0.14	–0.227	–0.093
Standard deviation	1.08	1.144	1.155	0.811	0.677	1.063
Median change	–0.127	–0.165	–0.084	–0.037	–0.15	–0.045
Share with no loss in earnings	0.492	0.389	0.455	0.507	0.443	0.512
Full-time to full-time						
Change in 1n earnings (mean)	–0.205	–0.357	–0.318	–0.128	–0.113	0.012
Standard deviation	0.852	1.165	1.176	0.343	0.455	0.704
Median change	–0.045	–0.109	–0.068	–0.029	–0.068	–0.025
Share with no loss in earnings	0.528	0.351	0.462	0.515	0.471	0.542

Source: Authors' calculations from the 2004 Displaced Worker Survey, using sampling weights.

workers in selected tradable service activities earn 16–17 percent higher incomes than similar workers in nontradable activities in the same sector.

Examining employment growth across industries and occupations, there is little evidence that tradable service industries or occupations grow more slowly than nontradable industries or occupations overall, though at the low end of the skill distribution employment growth is negative for tradable services. High-skill service activities have the highest employment growth rates.

There is job insecurity associated with employment in tradable activities, including service activities. We find a higher rate of job loss from tradable industries than from nontradable industries, with the greatest difference outside of manufacturing. In comparison with an overall rate of job loss of .103 for 2001–03, tradable nonmanufacturing industries have a rate of job loss of .128 and nontradable industries .073 (though we note the possibility that these differences are driven by the tech bubble). Also within occupations, workers in tradable jobs faced a higher rate of job loss than workers in nontradable jobs, with the greatest difference within white-collar occupations.

These results have several implications. First, it seems inappropriate to consider all service activities as inherently nontradable. The geographic concentration of some service activities within the United States is as great as in manufacturing and is consistent with the view that a number of service industries and occupations are tradable. The share of employment in tradable services is large enough that a better understanding of the forces shaping trade in services warrants our attention. At a minimum, more resources should be devoted to collecting and publishing considerably more detail on international service flows. Continuing to increase the amount of information collected on the use of intermediate service inputs within the United States would also increase our ability to track and understand developments in this large and growing sector.

Second, the results presented in this paper suggest that tradable services are consistent with U.S. comparative advantage. While professional and business services jobs require higher skills and pay higher wages than manufacturing jobs in general, tradable services jobs in these sectors require even higher skills and are more highly paid than nontradable service activities. We would expect that as technological and organizational change increases the potential for trade in services, economic activity in the United States will shift to activities consistent with U.S. comparative advantage.[26] It is therefore possible that further liberalization in international services trade would directly benefit workers and firms in

26. The United States maintains a positive trade balance in service activities; see table 1.

the United States. The policy community should devote more attention to understanding the impediments to services trade.

Third, although tradable services have relatively high employment growth rates overall, at the low end of the skill distribution tradable service activities have negative employment growth. The potential for reallocation across activities in response to shifting trade patterns in services is real. Policymakers should prepare for additional reallocation among this group of workers.

The process of adjustment to job displacement might be eased by service worker characteristics. For the most part, workers displaced from tradable services are different, in terms of job tenure and educational attainment, from workers displaced from (tradable) manufacturing industries. Generalizing from what we know from studies of manufacturing worker job loss, lower levels of job tenure and higher levels of educational attainment may be advantages in seeking reemployment. Given the current availability of data, it is too early to tell. We need data beyond the time period of the "jobless recovery." We also need more information to discern whether workers in tradable activities face different reemployment outcomes than workers in nontradable activities. The evidence we do have tells us that job loss for services workers is costly. These costs underscore the need to have a less porous safety net (for example, by extending Trade Adjustment Assistance [TAA] to services workers and extending wage insurance beyond TAA). Lower rates of employment growth at the lower end of the skill distribution in tradable service activities may have implications for the retraining strategies and opportunities for displaced low-skill workers in both manufacturing and services.

Appendix: Displaced Worker Survey

The Displaced Worker Survey is administered biennially as a supplement to the Current Population Survey (CPS). The first survey was administered in January 1984 and the most recent in January 2004. In each survey, adults (aged 20 years and older) in the regular monthly CPS were asked if they had lost a job in the preceding three- or five-year period due to "a plant closing, an employer going out of business, a layoff from which he/she was not recalled, or other similar reasons."[27] If the answer was yes, a series of questions followed concerning

27. For the 1984–92 surveys, the recall period was five years. Starting in 1994, the recall period was shortened to three years.

the lost job and the period of joblessness. Other causes of job loss, such as quitting and firing, are not considered displacements.[28] This categorization is consistent with our common understanding of job displacement: it occurs without personal prejudice in that terminations are related to the operating decisions of the employer and are independent of individual job performance. This operational definition is not without ambiguity: the displacements are "job" displacements, in the sense that an individual displaced from a job and rehired into a different job with the same employer is considered displaced.

A key advantage of the DWS is its large-scale representative nature. As part of the CPS, it draws on a random sample of 60,000 households, which is weighted to be representative of the U.S. workforce. As a result, the surveys yield responses from large numbers of displaced workers in a wide set of industries. In exchange for breadth of coverage, the DWSs have two weaknesses relevant to any study of the costs of job loss. The first is the relatively short-term horizon. Individuals are surveyed just once, providing information about one postdisplacement point in time, rather than about their experiences over time. The second weakness is the lack of a readily available comparison group of nondisplaced workers. Without such a comparison group, we cannot investigate what would have happened to these workers if they had not been displaced. The lack of a comparison group leads to some unavoidable errors in measuring outcomes such as postdisplacement reemployment and earnings losses. The rate of job loss reported in the tables is calculated as in Farber (1993, 2003, 2005): it is the ratio of the (weighted) number of reported displacements divided by the (weighted) number of workers who were either employed at the survey date or reported a job loss but were not employed at the survey date. See Kletzer (2001) for more discussion of the issues that arise when using the DWSs to measure the incidence of job loss.

28. Individuals who respond that their job loss was due to the end of a seasonal job or the failure of a self-employed business are also not included.

Comments and Discussion

Jared Bernstein: Jensen and Kletzer have written a refreshingly clear and insightful paper that readers will find to be one of more useful contributions to the often fuzzy literature on offshoring. Much of this work has tried to identify the service or white-collar jobs at risk to offshore competition, but we have been stymied by the difficulty of using trade data on service flows for this purpose. These authors derive a clever method using geographical clustering for doing so, and while they may need to work a bit harder to convince skeptics, many will find their approach convincing, as I do. This innovative classification scheme sets the stage for the paper's other main contribution: a description of the characteristics and earnings of those in tradable services relative to those in nontradable services.

One criticism of the paper is that the title promises more than the authors, or anyone else for that matter, can yet deliver. That is, while they go further than others toward identifying the industries and occupations directly affected by offshoring, to truly capture the "scope and impact" of this growing competitive challenge, researchers need to go beyond the direct effects. The authors do point out that displaced workers in tradable services suffer large wage losses relative to other displaced workers, but (a) it is not clear that this is because they are in tradable services, and (b) surely the impact of offshoring goes beyond this subgroup. This latter point is critical. The implicit supply shock from adding millions of skilled workers to a relatively concentrated set of occupations and industries may have a significant negative impact on the wage structure of white-collar workers, much as the increase of trade in manufacturing goods with low-labor-cost competitors has structurally altered the wage distribution of blue-collar workers. In short, a white-collar worker needn't get displaced to feel the impact of this growing phenomenon.

Using Geographic Clustering to Identify Tradable Services

The credibility of their paper rests on the authors' novel method for identifying tradable services. They point out that BEA data on international trade flows in services are not disaggregated enough by industry to serve this purpose. But the problem goes deeper than this. As my EPI colleague Josh Bivens points out, these data, especially the highly relevant parts relating to information technology, are getting a bit hard to believe, given what so many firms are telling us about their service imports and what some other countries' service export data suggest. Take, for example, data on the value of imports of computer-related services, which includes software writing, from India. Even with recent large upward revisions, the tiny magnitudes of the BEA numbers—for example, $330 million in 2003—are hard to believe. The Indian tech trade group NASSCOM puts this value at $4.7 billion.

This is not to suggest that NASSCOM's data capacity is superior to BEA's. Rather, if you're out to identify service jobs affected by offshoring, most analysts are suspicious of the quality of our data on the import of some key services associated with offshoring.

At any rate, Jensen and Kletzer use the assumption that tradable firms exhibit geographic concentration. This assumption comes from research on the goods sector, where returns to scale, access to transportation nodes, and proximity to natural resources lead goods producers to congregate near each other. Is it reasonable to extend this to service production?

Empirically, we can, without much effort, observe this concentration, or lack thereof. Silicon valleys and "research triangles" have appeared in numerous places over the past decades. Meanwhile, bowling alleys and child-care centers are scattered pretty much all over the place. In this regard, their transporting of this method of identifying tradable industries from goods to services does not seem a big stretch.

There are, however, some differences between goods and services that will lead some readers to wonder if scale economies and access issues loom large enough in services to motivate geographic clustering. For example, to transport cars or steel, manufactures have historically needed to locate near waterways. But it is hard to see why this constraint would hold for, to take a very relevant case, transmitting information across the Internet. In fact, it is the sharp decline in such costs that has allegedly motivated service firms to offshore data to extremely distant places.

So they may need to work a little harder to convince skeptics. What are the specific benefits they have in mind that motivate tradable services to locate near each other? Are there some case studies they could cite? As mentioned, it is not hard to point to areas where high-tech firms are concentrated, but there could be lots of reasons for that, including niche education and labor markets: California's Silicon Valley and North Carolina's Research Triangle, for example, are both near universities with specialties in computer science. And where I live, in northern Virginia, our silicon alley, out Route 66 in the Dulles corridor, likely grew out of the desire to be close to federal government contractors and purchasers.

What is the connection to international trade? And why shouldn't nongeographically clustered service industries offshore some of their jobs? Hospitals, for example, score in the authors' least geographically concentrated category, presumably because they are pretty pervasive across localities in our economy. But anecdotes suggest that hospitals are beginning to offshore some of their accounting services, certainly a plausible scenario (anecdotes also suggest hospitals are offshoring high-tech functions, like radiology services, but as the conference paper by Frank Levy and Ari Goelman (this volume) finds, this does not appear to be occurring).[1]

While I encourage them to work a little harder to convince the reader that their classification scheme is up to the task, a close look at their tables and figures reveals strong face validity. There are a few industries, such as hospitals, that seem questionably classified as nontradable (accounting, tax preparation, bookkeeping, and payroll services is another), but no such system will be perfect. In the case of the two examples I just mentioned, they are services that by their nature tend to be demanded in most localities and thus fly under the radar of their test. So perhaps Jensen and Kletzer can think of an added filter that would help address such industries.[2]

They presumably pick up some of these jobs in their occupational analysis. Their table 8, for example, shows that 11 percent of total employment is in tradable occupations in nontradable industries. Still, the apparent misclassification of a few industries may unsettle some readers.

1. Levy and Goelman show that both gatekeeper actions by U.S. radiologists and malpractice regulations explain why hospitals are hard-pressed to offshore such services.

2. I doubt anyone would squawk if they just added a few industries like hospitals and tax preparation services that are widely reported to be tradable services, even though they are not geographically concentrated.

They are careful to avoid the following mistake: suppose a nontradable upstream service provides an intermediate service to a tradable downstream service industry. If the upstream firms need to locate near the downstream firms, they will be misclassified as tradable services. For example, if a computer firm both offshores programming tasks to India and outsources payroll services to a nearby firm, the authors could end up mistakenly labeling the upstream industry as a tradable service. To avoid this, they use input/output tables to parse the upstream services from the downstream ones.

A final concern is in regard to the role of productivity growth in their method of using workers to identify where firms are clustered. If demand is constant, falling, or not growing too quickly, as was arguably the case over their period of study, firms with fast-growing productivity might be shedding workers. The impact of this on their analysis is not necessarily problematic, as long as the firms in such industries remain clustered (and it is hard to see why they would not). But this may be one reason why this type of analysis is usually based on more direct measures of industry output (one reason they are sticking with workers is because they want to examine occupations as well as industries).

Comparing the Characteristics of Workers in Tradable and Nontradable Jobs

As one might have expected, given the anecdotes in the newspapers, jobs in tradable services pay more than those in nontradable services: a 35 percent annual earnings differential in tradable services, unadjusted for worker differences, and a large adjusted differential, discussed next. Such workers are also more likely to be male and have higher educational attainment.

With a set of earnings regressions, the authors find a statistically and economically large premium associated with being in a tradable industry, a tradable occupation, and a combination of the two (in their later analysis on displacement, we see the downside of this—workers displaced from such jobs experience large relative losses). Relative to those in nontradable industries and occupations, the premium amounts to between 10 and 17 percent, depending on the sample.

What is interesting here is that the impact of being in such industries and occupations is modeled as a sort of interaction, as the regressions already control for industries and occupations. The coefficient of interest thus tests whether an earnings premium exists above that already accounted for by the underlying industries or occupations that are also included in the tradable services indicator.

Such interactions are difficult to interpret. The descriptive statistics reveal that workers in tradable services have characteristics that by themselves are all associated with positive and significant coefficients in such regressions: they are disproportionately male, nonminority, and have higher educational attainment. Combine these characteristics and you get a fairly hefty wage boost beyond that accounted for by any one characteristic alone. Are such workers truly more productive, or are there other factors, such as bargaining power and discrimination, that might explain their premium relative to those who lack this set of characteristics?

The result is also curious in relation to the tradable service categorization. One might expect that the wages of such workers face downward pressure from international competition relative to the wages of other workers with similar skill sets in nontradable industries and occupations. At least in these static regressions, that is not the case. It will be interesting to track the premium over time to see if this pressure develops.

At any rate, the important point is that service workers exposed to trade competition have a lot to lose. The last section helps to quantify that point. This part of the paper includes two tables on changes in employment levels by industry and occupation. The goal here is to determine the extent to which job losses have occurred in recent years in tradable services, a question that is a bit of a holy grail, given the nervousness regarding the impact of offshoring services. As such, I thought the section got short shrift.

This part of the analysis would have benefited from more discussion of the data and trying a little harder to separate out cyclical effects. On the first point, their sources for employment data are the Census Bureau's County Business Patterns and the BLS Occupational Employment Statistics (OES). Neither of these sources is typically used to track aggregate employment changes, and readers will legitimately wonder whether they reflect the stylized facts of employment trends over the years in question (1998–2003). In fact, given the difference in employment trends between the two surveys that are universally used for such analysis—the BLS Establishment and Household surveys—some will question whether the facts are "stylized" at all.

I took a cursory look at the total OES employment counts from 2000 through 2003, which seem to show a large growth of jobs over these years, which is hard to square with data from more reliable sources of aggregate employment growth (such as the Establishment survey).

Also, one of the biggest challenges regarding the question of the impact of offshoring on job loss over recent years is separating an offshoring effect from that of the cycle. This is particularly tough given the burst of the IT bubble in late

2000 and the resulting spike in layoffs in this sector. In table 12, the authors examine changes from 1998–2002, a period including a strong run-up in employment growth (1998–2000) and a recession (2001) and jobless recovery (2002).

At the least, the authors might consider breaking out these two periods to add some accounting for these cyclical effects. Better yet, given the caveats regarding these data sets for this purpose and the difficulty untangling cycle from offshoring effects, they might want to be more cautious about their claims here. For example, claims comparing the employment growth of tradable and nontradable services made it into their abstract and could be widely cited. There is also a claim here regarding employment losses at the lower end of the skill distribution in tradable services, but this change is essentially zero in table 12 and (if I calculated the standard error correctly) statistically insignificant (at the 5 percent level) in table 13.[3]

Displaced Workers in Tradable Services

The final section of the paper uses the Displaced Workers Survey (DWS) to examine the extent to which being in a tradable job raises a worker's chance of displacement. Because of coding changes on industries and occupations, the authors cannot do comparisons across this biennial survey. But using the most recent survey, covering the years 2001–03, they find that those in tradable services face significantly higher displacement rates than those in nontradable services. For example, 31.7 percent of those in the tradable sectors of information services were laid off (not for cause) over these years, but only 7.5 percent of those in the nontradable sectors.

Here again, the concern is that we are catching the cycle and the bursting of the tech bubble in the analysis, and thus not really isolating an offshoring effect. Information services includes both newspaper publishing (a nontradable service) and Internet publishing (a tradable service), and it is surely the case that a post-bubble, large negative spike in domestic demand affected the former more than the latter.

A simple difference-in-difference estimator might help to difference out the cycle, say using the changes in displacement in services that were nontradable. The problem is the introduction of new industry and occupation codes in the most recent DWS. However, the BLS has a version of the monthly CPS with

3. I divided the standard deviation by the square root of the number of industries, both given in the table (0.111/3.16) for a standard error of 0.035, which returns a t statistic of -1.85.

new sectoral codes starting in 2000, and although they could not track displacements, the authors should see if these files might enable them to compare wage and employment changes in tradable and nontradable services controlling for the cycle.

The DWS has long showed that among displaced workers who are reemployed at the time of the survey, blue-collar production workers take the biggest hit in wages (the pay gap between their old and new jobs is above the average loss). But Jensen and Kletzer find negative effects of a similar magnitude for displaced workers in tradable services. The difference between the old and new wage was, on average, about –30 percent for workers displaced from tradable jobs in both manufacturing and services, and about –14 percent for those displaced from nontradable services.

So workers in tradable services were more likely to be displaced during the recent downturn/jobless recovery, and for those who found new jobs at the time of the survey, these displacements were quite costly relative to nontradable services.

Summary

Faced with the question of how we identify service workers directly affected by offshoring, Jensen and Kletzer come up with an elegant solution: borrow the observation from the goods-producing literature that firms engaged in trade exhibit geographic concentration. While some might question how well this assumption travels across these different sectors, their results are, for the most part, intuitively satisfying and believable.

This aspect of the paper makes a useful contribution to what has been a major stumbling block in this fledgling literature, namely, identifying affected workers in tradable services. The paper's other major contribution is its documentation of the characteristics of these workers, including their relative earnings.

The paper has two shortcomings, both of which are evident in much work on offshoring. First, barring some attempt to control for cyclical effects, it is hard to know whether the job and wage loss effects they identify for workers in tradable services are due to their exposure to offshoring competition or to the protracted labor-market downturn over this period. While they get some traction in this argument by comparing tradable and nontradable services, the problem is that the negative cyclical demand shock was particularly acute in some of the same industries and occupations that have heavy weights in their tradable service category (like IT).

Second, from a policy perspective, economists need to look far beyond those directly affected by offshoring to grasp the magnitude of the challenge it poses. Compared to the number who are and will be affected in some way by the competitive pressures from this form of trade, the number of workers who lose their jobs is surely very small. This by no means should lead us to give up on those who take the "direct hit"—workers displaced by service trade. Their needs are often the most acute, and in this regard, ideas like wage insurance and expanding Trade Adjustment Assistance are meritorious.

But as Richard Freeman has discussed (this volume), the implicit supply shock from the introduction of millions of skilled workers into a relatively concentrated set of occupations and industries may have a significant impact on the wage structure of white-collar workers, just as the increase in trade in manufacturing goods has structurally altered the wage distribution of blue-collar workers, partially contributing to the post-1979 increase in wage inequality and real wage losses, particularly for men.

In this sense, Jensen and Kletzer may be overstating the breadth of their work by giving their piece the subtitle: "Understanding the Scope and Impact of Services Offshoring." They get us a long way, further than any previous forays, toward identifying the most visible victims of offshoring: those who lose their jobs. But if Samuelson and others are right about the impact of competitive pressures on the United States from trade with low-cost countries in sectors where we have held a comparative advantage, the scope and impact of offshoring could spill over far beyond those directly affected.

Robert C. Feenstra: This is a good paper that introduces a new technique for classifying service industries as tradable and nontradable and then pursues a number of applications. The technique involves looking at the geographic concentration of service industries, using the idea that a more concentrated industry is most likely tradable. Geographic concentration is measured using population census data from the PUMS files, which also allow us to track individuals' occupations as well as their industries of employment. So the paper not only introduces a new technique for measure of the tradability of industries or occupations, it also shows how it can be implemented on a dataset that is novel for trade economists.

I actually thought of using the geographic concentration of industries to measure something about trade some years ago, when reading a *Scientific American* article (Landy 1999) dealing with the distribution of stars in the universe. The "cosmological principle" states that the universe overall is homogeneous, so galaxies have no particular pattern. That is true on a very large scale, but on smaller scales, galaxies form into clusters that are fractal: even as the scale of observation is reduced, the basic pattern of galaxies is the same. The extent to which galaxies cluster together can be measured by their spatial correlation.

When reading that article I thought that the same should be true of the location of economic activity: we could use spatial correlation or some other technique to measure the clustering of industries. That is exactly what the authors do here, using the Gini coefficient and a second measure of concentration. They find that the clustering or concentration of many service industries is just as strong as for manufacturing industries, implying that these service activities must be traded.

While my reference to astronomy is just for fun, economists also use the concentration of industries to make conclusions about trade. Jean Imbs and Romain Wacziarg (2003) have shown, for example, that for developing countries the concentration of industries first falls and later increases as the countries mature, so the Gini coefficient follows a U-shaped pattern. For China, Alwyn Young (2000) found that after trade was opened the concentration of industries across provinces fell, which seemed to be contrary to comparative advantage, where we would expect regions to specialize. But later research found that industries in China later became more specialized across provinces, so the Gini coefficient also follows a U-shaped pattern in that country (see Naughton 2003; Poncent 2003). From these examples I conclude that using the concentration of industries to measure their trade orientation is well motivated and that the application to service industries is entirely new.

Let us now consider the results of the paper. Using the Gini coefficients of geographic concentration, the authors divide industries into three groups: those with a Gini of less than 0.1 being the least concentrated, and therefore nontradable; those with a Gini above or equal to 0.3 being the most concentrated, and therefore tradable, and those with a Gini between 0.1 and 0.3 in an intermediate category, but also treated as tradable. The classification of industries into these three groups is appealing: there are only a handful of nontraded manufacturing industries, including cement and concrete, whereas service industries are evenly divided between nontraded and traded activities. There are some anomalies, however: the education sector is very diversified geographically, so it is classified as nontradable, despite the fact that it is a principal service export of the United States. The geographic diversification of education holds for elementary and high schools, as well as colleges and universities (see Jensen and Kletzer's table 2), perhaps because of the land grant system in higher education.

Because the authors use census data on individuals from the PUMS files, they can also distinguish tradable *occupations* as opposed to tradable *industries*.

That is, they can measure the geographic concentration of job titles rather than just industries. These job titles are unfamiliar to trade economists, so some further explanation would be desirable. For example, occupational titles within the life, physical, and social sciences are mostly tradable; that is, these persons are geographically concentrated in their employment (see table 5). About half of these persons work in nontraded industries (such as education, which is not concentrated in space), and another half work in traded industries (see table 6). So at this point I could use some examples to understand the classifications: how can most of the employment in the life, physical, and social sciences be concentrated, when a significant number of these individuals work in education, which is not concentrated?

In the next part of the paper, the authors investigate the characteristics of workers as classified by the tradability of their industry and occupation. Workers in traded industries are more highly skilled and are paid more than in nontraded industries, and this is especially true in traded service industries. The same is true for occupations: workers in tradable occupations earn more and have more education than those in nontradable occupations. Even if we strip out the effect of higher education, a wage premium persists for the traded industries, especially for traded service industries: these workers command a premium over and above their education level and demographic characteristics. The premium is about 6 percent for traded manufacturing and 15 percent for traded professional service industries.

These results reminded me of two other related studies. First, Jeffrey Sachs and Howard Shatz (1998) made the point that services really are more skill-intensive than manufacturing. The characterization of service jobs as flipping hamburgers is not true on average, where the jobs are more likely to be professional. Second, I was reminded of the earlier studies on the wage premiums in manufacturing by Larry Katz and Larry Summers (1989a, 1989b). They found that capital-intensive industries in manufacturing pay higher wages, and since these industries have higher exports, there is a wage premium in exporting. Trade economists were always squeamish about this finding, since it runs the risk of implying that being an exporter leads to paying higher wages, therefore suggesting that a subsidy to exports might help. On the contrary, most of us would believe that being more productive at the plant level leads to being an exporter and paying higher wages, with little or no role for export subsidies (see Fernandez 1989).

The authors then investigate the *growth* across industries and occupations. In this I did not agree with the their expectations regarding which sectors would grow the most. For example, they state: "High-skill activities are consistent with

U.S. comparative advantage, and we would expect that as trade increases, economic activity would shift to activities consistent with U.S. comparative advantage. Thus we would expect higher-skill industries and occupations to have higher rates of employment growth." My difficulty with this logic is that it all depends on whether the United States is benefiting from increased export opportunities in the sectors where it has comparative advantage, or, on the contrary, whether it is facing new competition in those sectors. Paul Samuelson (2004) suggests that outsourcing could cause the United States to face competition in sectors where it formerly had comparative advantage. That is different from what Jensen and Kletzer have in mind.

What they actually find is that service employment expanded during the period 1998–2003 and manufacturing employment contracted, and this shift holds *regardless* of whether one looks at traded or nontraded industries. So on the issue of employment growth, the methods developed in this paper to measure tradability just do not give us any extra explanatory power. We are back to the hypothesis advanced by James Harrigan and Rita Balaban (1999) and also by Bernardo Blum (2004): namely, that it is the rise in the service sector in the United States, combined with the skill-intensity of that sector (Sachs and Shatz 1998), that explains the rising relative wages of skilled workers. We still do not know whether this shift toward services comes from demand pressure, trade, productivity, or some other cause. It would have been nice if the tradability of service industries gave us extra insight on this issue, but that is not what the empirical results here show.

In the final section of the paper the authors examine job loss and the characteristics of displaced workers. This is an issue that Lori Kletzer has written on extensively, and the results here complement her earlier findings. Workers in tradable industries face a notably higher rate of job loss than those in nontradables. That is particularly true in service industries and in white-collar occupations. Nevertheless, it is still true that production workers in the United States have a higher rate of job loss than those in nonproduction and white-collar occupations, including those occupations that we believe are being affected by services outsourcing.

General Discussion: Many participants commended the authors for their extremely creative and useful paper. The discussion also raised a variety of issues of interpretation and suggestions for further work, with some questioning how well domestic geographic concentration could capture international tradability. Perhaps not surprisingly, a number of speakers found the results surprising for particular industries or occupations.

Lael Brainard highlighted two reasons why the authors' concentration index approach to identifying tradability was particularly valuable. First, it can be applied across occupations as well as across industries. Second, it gets around the problem that direct measurement is more difficult for services than for goods production. Internationalization of services essentially entails linking domestic and foreign factors of production so that work moves between product or project teams. It is extremely difficult to quantify the value added from each step of the process. Brainard also wondered why the authors focused on a bivariate indicator (whether something was tradable or nontradable) in their empirical analyses instead of exploiting the continuous variable that they constructed. She and others saw their use of an essentially arbitrary threshold as throwing away potentially useful information. The revised version of the paper does provide the actual indicators for major sectors and occupations.

Some participants suggested that it would be helpful to compare the results of the tradability measure constructed here with other available alternatives. This would be one way to explore how well it captures what we mean by tradability. Brainard noted that we have direct tradability indicators for merchandise. She expected to find that some highly tradable goods, such as sugar, are not particularly highly concentrated. Catherine Mann wondered whether the approach by Brad Jensen and Lori Kletzer had implications similar to the work by Frank Levy and Richard Murnane, which classifies tasks in terms of routinization. Susan Collins asked how similar it was to the classification by Desirée van Welsum and Xavier Reif. The issue of comparability is partially addressed in the introduction to this volume.

Robert Lawrence advanced another way to look at the paper, focusing on agglomeration. The results show that even inside the United States, where firms are free to set up everywhere, they often choose not to, presumably because of the benefits of locating near one another. Clearly, if costs were different enough abroad, they would choose to relocate. But it may be that the more concentrated firms are now, the greater the agglomeration benefits and the less likely they are to move. From this perspective, we should see their concentration as comforting, not threatening. Lawrence also stressed that one should not jump from tradability in the sense of this paper to trade. For example, his work with Martin Baily finds considerable job loss in the computer industry, which is tradable. But their input-output table analysis concludes that this is overwhelmingly due to declines in domestic demand and that trade appears to have played a relatively minor role.

Other participants elaborated on Robert Feenstra's point that domestic tradability may be very different from international tradability. In particular, T. N.

Srinivasan noted that if transactions and transportation costs are much less for domestic than for international trade, then domestic tradability has no implications for international tradability.

Srinivasan also raised the point that often the same industry can produce using different technologies. For example, steel, which is certainly tradable, can be produced using both integrated mills that are quite concentrated and the more recent electronic processing mini-mills, which tend to be quite dispersed. He argued that it is important to consider technology in assessing whether concentration provides a good indicator of tradability. He also pointed out that occupation, and perhaps to some degree industry, is a matter of choice. Thus he suggested controlling for selection when estimating the earnings regressions.

Catherine Mann noted that regulations can play a very important role in some service sectors. This includes legal bar exams, state-specific insurance regulations, and others. There are also significant differences in cross-country regulations. Thus it would be interesting to explore whether changes in state-specific regulations that make a particular industry more easily traded have affected its occupational stratification or its concentration indicators. Changes in rules for interstate banking are one especially interesting recent example.

Mann also asked what the results in the paper could tell us about the risk versus expected return associated with particular occupations. Job loss is certainly very costly. However, her casual impression was that the empirical estimates find a relatively large wage premium for jobs in risky service industries and occupations, and it was worth exploring how this compared with the probability and expected costs of job loss. In contrast, manufacturing jobs are also risky but have been commanding a much smaller wage premium.

Lawrence Mishel raised concerns about drawing conclusions from simply comparing employment growth in traded and nontraded industries (or occupations) within a given time period. Because employment trends may be quite different, he thought it important to develop a more convincing counterfactual that incorporates information about previous trend behavior.

David Richardson suggested that it would be interesting to consider other concentration measures. For instance, the Ellison-Glaeser measure comes very close to an indicator of revealed comparative advantage. He also noted that the authors should be looking for both industries and occupations with very low concentration and those with very high concentration, because unusually low ratios for production to state GDP are also an indicator of (domestic) tradability.

Collins noted that it might be helpful to distinguish between different types of services, and that the domestic concentration approach could be more appropriate for some types than for others. The General Agreement on Trade in Services (GATS) distinguishes among four modes by which services are traded. For example, mode 1 includes services supplied from one country to another, such as telephone calls, while mode 2 includes consumers who use a service in another country, such as tourists and students studying at a foreign university. It seemed to her that domestic concentration might be a better indicator of tradability for mode 1 services than for mode 2.

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