Measuring Tradable Services and the Task Content of Offshorable Services Jobs

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November 9, 2007
Revised

This paper was prepared for the NBER-CRIW conference on "Labor in the New Economy," November 16-17, 2007, in Washington DC. Lauren Malone provided excellent research assistance. Financial support was provided by the Labor and Employment Research Fund in the UC Office of the President, the Committee on Research, Academic Senate, UC Santa Cruz, the Alfred P. Sloan Foundation, and the National Science Foundation.

Introduction

The services offshoring debate reached headline status several years ago, fueled in large part by the 2004 Presidential campaign and the slow recovery of the labor market from the 2001 downturn. To (try to) be clear, services offshoring refers to the (potential) migration of jobs (but not the people performing them) across national borders (mostly from rich countries to poor ones, with imported products and activities flowing back to the US). The literature on services offshoring remains in its infancy, although the number of contributions is expanding rapidly. A non-exhaustive list of recent contributions includes: Amiti and Wei (2004); Arora and Gambardella (2004); Bardhan and Kroll (2003): Bhagwati, Panagariya, and Srinivasan (2004); Blinder (2006, 2007); Brainard and Litan (2004); Bronfenbrenner and Luce (2004); Jensen and Kletzer (2006); Kirkegaard (2004); Mankiw and Swagel (2006); 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 these business decisions.

There are a few prominent projections, advanced mostly by consulting firms. An early estimate of the likely scale of future job losses due to movement of jobs off shore is Forrester Research's "3.3 Million US Services Jobs To Go Offshore" (McCarthy (2002)).[1] Other estimates include: Deloitte Research estimates that by 2008 the world's largest financial service companies will have relocated up to two million jobs to low-cost offshore countries; Gartner Research predicts that by the end of 2004 10% of IT jobs at US IT companies and 5% of IT-jobs at non-IT companies will have moved offshore; another Gartner Research survey revealed that 300 of the Fortune 500 companies today do business with Indian IT services companies. Goldman Sachs estimates 300,000 to 400,000 services jobs have moved offshore in the past three years, and anticipates a monthly rate of 15,000 to 30,000 jobs, in manufacturing and services combined, to be subject to offshoring in the future. Bardhan and Kroll (2003) put out an estimate of 14 million jobs potentially at risk.

In an earlier paper (Jensen and Kletzer (2006)), we advanced a new empirical approach to identify, at a detailed level, service activities that are potentially exposed to international trade. The approach uses the geographic concentration of service activities within the U.S. to identify which service activities are traded domestically, and then classifies activities that are traded

[1] The Forrester projection was updated in 2004 to 3.4 million.

domestically as *potentially* tradable internationally. With the tradability classification, we developed estimates of the number of workers who are in tradable activities for all sectors of the economy. The paper offered comparisons of the demographic characteristics of workers in tradable and non-tradable activities and employment growth in traded and non-traded service activities. The tradability designation also allowed an examination of the risk of job loss and other employment outcomes for workers in tradable activities.

While we believe we made an important contribution to identifying tradable activities using the notion of geographic concentration, we recognize that the measure is not perfect. There are two potential problems with the geographic concentration methodology. The first potential problem is if something is tradable but not in an increasing returns activity, it might not be geographically concentrated. The second potential issue is that something might be geographically concentrated because of some feature of demand (though our methodology addresses this in principle) even though the activity is not tradable. For example, certain occupations appear concentrated in large metropolitan area or tourist areas even though they are not tradable (e.g. limousine drivers, manicurists). The task content approach will provide additional information for classifying activities as tradable and non-tradable.

This paper focuses on the task and activity content of jobs, to develop measures of the occupational job tasks, activities and characteristics associated with potential offshoring. The literature on offshoring notes that movable jobs are those with: little face-to-face customer contact; high information content, work process is internet enabled and/or telecommutable (see Bardhan and Kroll (2003); Dossani and Kenney (2003), and Blinder (2006)). More informally, it is commonly believed that if "it can be sent down a wire (or wireless)," it is offshorable. Empirically, this investigation tries to bring these basic principles of the characteristics of potentially offshorable jobs to detailed microdata on occupations. The task content investigation offers us a second and independent measure of potential tradability, to be used to refine the understanding obtained from our geographical concentration measure. More specifically, we can ask if the jobs identified as potentially internationally tradable, using geographic concentration, involve activities and characteristics that fit current notions of offshorability.

This paper begins with a summary of the methodology and findings in Jensen and Kletzer (2006). The next step involves an operational assessment of how the basic principles of offshorability (high information content, remote from customer, internet-enabled) match up to

the characteristics of "real" jobs. Detailed information on the content and context of jobs (occupations) is available from O*Net, a U.S. Department of Labor database of 450 occupations.[2] For each of hundreds of occupations, O*Net contains detailed qualitative information on job tasks, work activities (interacting with computers, processing information), and work context (face-to-face discussions, work with others, work outdoors). A very preliminary version of this paper focused on qualitative information, available from O*Net on-line. This version develops more quantitative and objective measures of offshorability using the information available from the publicly available and downloadable O*Net production dataset (version 11).

Briefly summarizing the results, based on job task content the occupational groups with large shares of employment in the highest potentially tradable group include: Business and Financial Operations (74.7 percent of employment); Computer and Mathematical Occupations (93.4 percent); Architecture and Engineering (80.8 percent), Life, Physical and Social Sciences (75.9 percent) and Office/administrative support (64.3 percent). The notable non-tradable occupational groups, with large shares of employment identified as least potentially tradable include: Education and Library (43.7 percent); Healthcare Practitioners (78 percent); Healthcare Support (94.4 percent), Food Preparation (100 percent). Overall for the service occupations, 27.4 percent of May 2005 employment was in the most potentially tradable group, while 43.8 percent of employment was in occupations rated as least potentially tradable. There is a considerable overlap between the job task content measure of potential tradable and our geographic concentration measure. We also find a positive correlation between skill (measured as educational attainment) and potential tradability – occupations with a greater share of workers with a college degree are more highly ranked as offshorable

1. Geographical concentration and tradability: empirical approach

To develop a measure of tradable services, our earlier empirical approach relied on the basic economic intuition that non-traded services will not exhibit geographic concentration in production. Goods that are traded tend to be geographically concentrated (to capitalize on increasing returns to scale, access to inputs like natural resources, etc), while goods that are not

[2]O*Net is the successor to the well-known Dictionary of Occupational Titles.

traded tend to be more ubiquitously distributed. We applied this same intuition to service production. With the identification of industries and occupations that appear to be traded within the U.S., the inference is that service activities that can be traded within the U.S. are also potentially traded internationally.

The intuition is described in Krugman (1991, pg. 65), where he 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."

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.

Measuring geographical concentration

Measures of geographic concentration are a way to implement the intuition presented in the Helpman and Krugman model. Most measures of concentration use the region's share of employment in an industry relative to the region's share of total employment. One issue with measures of concentration for our purposes is that they do not differentiate between the reasons activity is concentrated. In general, the reason for the concentration does not matter to us except for one instance. If a service is non-tradable and demand for the service is concentrated (industries that use the non-traded service are geographically concentrated), the service industry will be geographically concentrated and we will infer that the service is tradable. To incorporate this case, we extend the intuition from the framework. If a non-tradable industry provides intermediate inputs to a downstream industry, we would expect the geographical distribution of the non-traded intermediate industry to follow the distribution of the downstream industry.

Instead of being distributed with income, the non-traded good is distributed in proportion to the demand for that industry.[3]

We focus here on the Gini coefficient of geographic concentration.[4] The Gini coefficient (***G***) for the concentration of industry activity is given by:

$$\boldsymbol{G} = | 1 - \sum_i (\sigma Y_{i-1} + \sigma Y_i) * (\sigma X_{i-1} - \sigma X_i) |$$

Where i is an index for regions (sorted by the region's share of industry employment), σY_i is the cumulative share of industry or occupation employment in region i, σY_{i-1} is the cumulative share of industry or occupation employment in the region (i-1) with the next lowest share of industry employment, σX_i is the cumulative share of total employment in region i, and σX_{i-1} is the cumulative share of total employment in region i-1. We modify the Gini measure to:

$$\boldsymbol{G} = | 1 - \sum_i (\sigma Y_{i-1} + \sigma Y_i) * (\sigma IDS_{i-1} - \sigma IDS_i) |$$

where IDS_i is the region's share of demand for industry i.

Implementation

These measures were implemented using employment information from the 2000 Decennial Census of Population Public Use Micro Sample (PUMS) files. The geographic entity is the Consolidated Metropolitan Statistical Area or the Metropolitan Statistical Area where an individual reports working.[5] The use of worker level data to investigate economic concentration is somewhat unusual. One advantage of this strategy is that it allows consideration of 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

[3] To address this issue, we modify the general measures of geographic concentration by developing an industry-region specific measure of the concentration of demand for an industry. We construct a downstream industry weighted average demand for each industry-region using the input-output tables. More details on the construction of the weights are provided in Jensen and Kletzer (2006). The adjustment takes account of the concentration of downstream industry concentration and adjusts the "denominator" in the concentration measures accordingly.

[4] Our 2006 paper discusses a measure of economic concentration, ***EC,*** as described in Ellison and Glaeser (1997). The correlation between the ***EC*** measure and the ***G*** measure is quite high, .713 for industries and .732 for occupations.

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

of the service activities that are reportedly being globally sourced are tasks within the service "production" process (for example, the banking relationship is not relocated offshore, rather the customer service/call center component is moved); occupations correspond more closely to these types of activities than do industries. In addition, occupations have job task content and activities, while industries (often similar to products) do not.

2. Classifying industries and occupations as tradable vs. non-tradable

Industries

In our 2006 paper we discussed extensively how to determine a tradable vs. non-tradable distinction for industries and occupations. Starting with industry, where intuition tends to be stronger, we initially placed industries into 3 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 2-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 5 of the 92 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 non-traded because of a high weight to value ratio (e.g., 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 geographical concentration category (Gini class 1) as non-tradable seems appropriate for these sectors. [6] 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 non-tradable. Industries in the Transportation sector are mostly classified as tradable. For Public Administration, most activities

[6] There is a positive correlation between Gini class and mean trade share.

are non-tradable except for Public Finance and the military. For the Service sector, industries are balanced between non-tradable and tradable. Table 1 provides a complete list of service industries by 2-digit NAICS sector and the industry's Gini class.

Occupation Results

We constructed a similar demand-weighted Gini coefficient for each occupation, using the same Gini = .1 threshold for the non-tradable/tradable categorization. Table 2 shows the share of employment by Major Standard Occupational Classification group by Gini class. The groupings largely are 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).[7] The notable non-tradable occupational groups include Education and Library (99 percent non-tradable); Healthcare Practitioners (86 percent); Healthcare Support (97 percent), Food Preparation (96 percent). On the goods production side, 90 percent of employment in Installation, Maintenance and Repair is classified as non-tradable, as is 80 percent of Production[8] and 89 percent of Transportation and Material Moving.

Table 3 brings together information on industries and occupations for a selection of "white-collar" occupations. In the aggregate, across occupations, the share of workers in tradable occupations and non-tradable industries is not large, about 10 percent. However, as table 3 shows, for business and professional occupations, the share of workers in tradable occupations but non-tradable industries is much larger. The typical professional occupation has about 25 percent of employment in tradable occupations but non-tradable 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

[7] van Welsum and Reif (2006) offer a list of U.S. occupations (at the 3-digit level) identified as "potentially affected by offshoring," in Appendix table 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 between the two lists of occupations, although our method identifies a larger set of tradable occupations. van Welsum and Vickery (2005a) 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 (e.g., Dairy Stores, Liquor Stores, etc) included in their list.

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

tradable. This suggests that for service activities, the industry results on the share of workers potentially vulnerable to trade are probably understated. Outside of education and healthcare occupations, the typical "white-collar" occupation involves a potentially tradable activity.

From here, we focus on occupations and potential tradability, bringing in job task characteristics associated with offshorability.

3. Measuring task content of potentially tradable services occupations

The literature on offshoring posits that movable jobs are those with: little face-to-face customer contact; high information content, work process is internet enabled and/or telecommutable.[9] A great deal of attention is paid to internet-enabled: the expansion of broadband and wireless (and the broad use of "off the shelf" software programs) having greatly reduced the "transportation costs" of information. Having developed a set of tradable services occupations, the next step is to consider the detailed characteristics of these jobs and whether the characteristics fit a description of offshorability. Based on these offshorability characteristics, van Welsum and Vickery (2005a, b) perform a similar exercise for a selection of OECD countries. Their methodology is based on subjective judgments of the task content of jobs, not data on work activities or content.

The use here of O*Net is in the spirit of Autor, Levy, and Murnane (2003), who explored the spread of computerization, using the Dictionary of Occupational Titles (DOT) to measure the routine vs. non-routine, and cognitive vs. non-cognitive aspects of occupations. O*Net is the successor to the DOT. Information is organized by detailed occupation, at the Standard Occupational Classification level. The O*Net Content model identifies the most important types of information about work and jobs and integrates the information into a structured system of six major categories:[10]

- Worker Characteristics (Abilities; Occupational Interests; Work Values; Work Styles)
- Worker Requirements (Skills & Knowledge; Education)
- Experience Requirements (Experience & Training; Skills & Entry Requirements;

[9] See Bardhan and Kroll (2003) for a list of attributes.
[10] Information on the O*Net Context Model comes from National Center for O*Net Development (2006).

Licensing)

- **Occupational Requirements (Generalized and Detailed Work Activities; Organizational Context; Work Context)**
- Labor Market Characteristics (Labor Market Information; Occupational Outlook)
- Occupation-Specific Information (Tasks; Tools & Technology)

The first three categories (Worker Characteristics, Worker Requirements, Experience Requirements) are worker-oriented. The second three are the job-oriented categories, with Occupational Requirements as the focus of interest here. Occupational requirements are designed to cross occupations, at both a general and detailed level, while Occupation-specific Information is meant to be quite detailed and literally occupation-specific.

The domain/category **Occupational Requirements** is designed to provide ". . .a comprehensive set of variables or detailed elements that describe what various occupations require." (National Center for O*Net Development, 2006, pg. 20) The focus is on typical activities required across occupations. Within the Generalized and Detailed Work Activities sub-domain, we selected eleven measures to construct an index of offshorability/potential tradability:

On information content:
Getting information (+)
Processing information (+)
Analyzing Data or Information (+)
Documenting/Recording Information (+)

On Internet-enabled:
Interacting with computers (+)

On face-to-face contact:
Assisting or Caring for Others (-)
Performing or Working Directly with the Public (-)
Establishing or Maintaining Interpersonal Relationships (-)

On the routine or creative nature of work:
Making Decisions and Solving Problems (-)
Thinking Creatively (-)

On the "on-site" nature of work:
Inspecting equipment, structures or material (-)

The sign in parentheses [(+) or (-)] denotes our prior on whether the characteristic is positively related to offshorability or negatively related.

For each occupation, O*Net provides information on the "importance" and "level" required of each characteristic. Explaining the difference between the two terms is perhaps best done by example. For the attribute "Performing or Working Directly with the Public," data entry keyers are assigned importance (I) =43, and level (L) = 33. For Security Guards, I=74 and L=62. Importance appears to be literally just that: how "important" the attribute is to the job. Level appears to be "how much" of the attribute is involved in the job. Tables 3.1, 3.2 and 3.3 provide summary information on importance, level, and the various work activities.

Table 3.1 provides summary statistics across occupations on the eleven work activities and their importance and level. The various attributes that involve working with information via computers have higher scores on importance than the attributes involving working directly with the public or assisting and caring for others. Importance of attributes appears to vary more across occupations than level.

Tables 3.2 and 3.3 illustrate some of the work activities for two specific occupations. In table 3.2, mathematical technicians are profiled; in table 3.3 bookkeeping, accounting and auditing clerks are profiled. For each occupation, the tables list the work activities with the highest shares of importance. It is notable that for both occupations, interacting with computers and various aspects of processing information are the highest (most important) work activities.[11]

In constructing an index, it is not obvious how to weight importance and level. Starting (arbitrarily) with a weight of three-quarters to importance and one-quarter to level, a composite index of offshorability is the sum of the eleven components, using my priors on the sign of the attribute in regard to offshoring potential. Higher values of the index indicate more offshorability potential, yielding a ranking of all occupations for which the attributes are available.

The usefulness of the index is ordinal, not cardinal. Occupations are judged on their offshorability relative to each other, not compared to some absolute standard. Paralleling our discussion of economic concentration, we explore whether to divide potentially tradable/offshorable from "sticky" and non-tradable. Index values span a range of +1.777 (Mathematical technicians) to -1.889 (Barbers). Dividing the set of occupations roughly in thirds, we established "Index class 1" (low tradability) as index values less than -0.7, "Index class 2" (medium tradability) as values between -0.7 and zero (0.0), and "Index class 3" (high potential

[11] In the O*Net data, both importance and level are measured on a scale of 0 to 100. Table 3.1 and the constructed index transform both importance and level to measures ranging from 0 to 1.

tradability) as values greater than or equal to zero. Each class contains approximately 152-154 occupations.

Table 4 reports shares of employment (for May 2005), for major (SOC 2-digit) occupational groups, across the three index classes. The occupational groups with large shares of employment in the highest potentially tradable group include: Business and Financial Operations (74.7 percent); Computer and Mathematical Occupations (93.4 percent); Architecture and Engineering (80.8 percent), Life, Physical and Social Sciences (75.9 percent) and Office/administrative support (64.3 percent). The notable non-tradable occupational groups, with large shares in index class 1 (least potentially tradable) include: Education and Library (43.7 percent); Healthcare Practitioners (78 percent); Healthcare Support (94.4 percent), Food Preparation (100 percent). Overall for the service occupations, 27.4 percent of May 2005 employment was in the most potentially tradable group, while 43.8 percent of employment was in occupations rated as least potentially tradable.

The full listing of occupations, ranked by job task content, is presented in table 5. How "good" are the results? Occupations at the top of the list seem unsurprising: credit authorizers, data entry keyers, accountants, medical transcriptionists, market research analysts, bookkeeping and account clerks. One of the columns in the table indicates occupations identified as tradable by geographic concentration, and there is a close match both at the top of the table with most tradable and at the bottom of the table with least tradable. The O*Net information corrects some obvious misfits of geographic concentration: crossing guards, massage therapists, manicurists (see the bottom of the table).

With three economic concentration "classes" and three task content "classes," there is a natural question of how well the two measures match up. Overall, where the two measures can be constructed at the same detailed level, 41 percent of occupations match completely (index class 1 matches to Gini class 1; index class 2 matches to Gini class 2, etc.). Looking just at non-tradable occupations, 48 percent of the occupations classified as non-tradable using the economic concentration measure are also classified as non-tradable using the job task content measure. Similarly, 55 percent of the most tradable occupations, by Gini, are most tradable by job task content.

An alternative measure of fit simply counts the number of geographically concentrated "tradable" occupations within each task content class. In the highest task content class (most

tradable/offshorable by task content), 51.6 percent of those occupations are tradable by geographic concentration. In the middle task content class, 35.6 percent of occupations are "tradable" by the first of our measures, and in the lowest (least offshorable/tradable) task content class, 21.2 percent of occupations were previously denoted "tradable" by geographic concentration.

Potential offshorability and skill is of interest. The O*Net data offer information on educational attainment, based on BLS data on fractions of jobholders with varying levels of education. Table 5 offers two categories: percent with a high school diploma or less and percent with a BA degree or more. Using the BA category, the rank correlation between educational attainment and relative offshorability is +0.306 – occupations with a greater share of BA holders are more highly ranked as offshorable. The top quartile of jobs in the ranking has a mean percentage of BA+ degree holders of 61%, the second quartile, 53.7%, the third quartile 47.3% and the bottom quartile, 29.1%. The least offshorable jobs are the least formally educated and have lower median annual earnings.

Blinder (2007) explores a subjective index based on two characteristics: 1) can the work be delivered to a remote location; and 2) must the job be performed at a specific (US) location. In his subjective measure, Blinder concentrates one characteristic of the delivery of services, the separation of customer and supplier that he labels "impersonally-delivered services." Basically, impersonally-delivered services can be delivered electronically, incorporating the vast improvement in ICT. His measure does not incorporate any attributes related to the kind of work sent down the wire, such as information context or internet enabling. Most importantly, in terms of the area of traditional US comparative advantage, Blinder does not consider the creativity or routineness of work.[12] In an area that needs more exploration, there are many high-skill and high-value (creative) services, that while transmittable electronically, pose opportunities for American workers and firms to penetrate foreign markets.

Using both production and non-production occupations, Blinder estimates that 30 to 40 million workers are currently in potentially tradable jobs, based on May 2005 employment levels. Objective measures may well be preferred, given the number of occupations (>450) and desire for replication.

[12] The routineness of work, or the codification of tasks, is a characteristic emphasized by Autor, Levy, and Murnane (2003).

Drawing a line in table 5 is admittedly arbitrary. One starting point, entirely subjective, draws a line around the offshore rank of 236 (Real estate brokers) suggests 38 million potentially offshorable jobs; 55 million not (below the line).

Our focus here is on services occupations. One natural question is where the other major occupational groups lie within this ranking. The average Production occupation, with an index value of -0.310, lies at rank 214, just below "Sales Engineers." The average Farming, Forestry and Fishing occupation, with an index value of -0.441, lies at rank 238, just below "Hotel, Motel and Resort Desk Clerks." Similarly, the average Transportation & Material Moving Occupation, with index value -0.456, lies at rank 247, just below "Psychiatric Technicians." Finally Installation, Maintenance and Repair Occupations, with an average index value of -0.568, lies at rank 269, just below "Nursing Instructors."

One of the next steps will be to refine our estimates, within occupations. Not all jobs in an occupation will be offshored. Perhaps there will be variation by firm size and industry (some industries being more tradable than others).

There is an important question of timing, which is largely an unknown. It is clear that advancing technology will continue to increase the feasibility of providing services from remote locations. For now and perhaps the foreseeable future, however, most high-value work will require creative interaction among employees, interaction which is facilitated by physical proximity and personal contact. Moreover, in many fields, closeness to customers and knowledge of local conditions are also of great importance. The "how soon" question is very important for understanding the costs of adjustment. A process that takes 20 years to establish itself on a real scale allows for more adjustment than offshoring over a 5-year period.

4. Evidence on the risk of job loss, by industry, occupation and tradability

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 re-employment; re-employment industry and

occupation; and earnings changes. These surveys have been used extensively to study manufacturing job loss (see Kletzer (2001) and Farber (2005)).

Only the 2000 and later Census industry and occupational classifications allow study of the services and white-collar jobs of primary interest. This need for updated detail on industry and occupation (currently) limits our use of the Displaced Worker Surveys to the two most recent surveys, January 2004 and January 2006. Although we lose the ability to observe services and white job loss over an extended period of time, we gain the industry and occupational detail necessary for studying services offshoring.

Job loss rates by industry are reported in Table 6, with information presented for two 3-year periods, 2001-03 and 2003-05. Remembering that the 2001-03 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). The rate of job loss from manufacturing was .209 for this period. With stronger economic growth over 2003-05, the rate of job loss from Information fell, to .039, a rate very similar to other services sectors. Overall, the risk of job loss was lower in services than in manufacturing, and even more so for the 2003-05 period. Financial Services, Professional and Business Services, and Information all had much lower rates of job loss for 2003-05 than was the case for manufacturing.

There is (at least one) interesting difference between 2001-03 and 2003-05. For the earlier period, when we apply our tradable-non-tradable distinction to the overall economy, the rate of job loss is notably higher from tradable industries (.153) than from non-tradable industries (.076). Within the broad sectors of manufacturing and non-manufacturing, tradable industries also had higher rates of job loss. The tradable-non-tradable distinction was small within manufacturing, with tradable industries at a rate of job loss of .213, and non-tradable (of which there are few) at a rate of .192. Outside of manufacturing, the tradable distinction was large. Tradable non-manufacturing industries had a rate of job loss of .128, and non-tradable 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 non-tradable job loss rate was .075. For the later period, overall rates of job loss are much lower, with the tradable-non-tradable difference small (.056 compared to .030). In manufacturing, non-tradable industries had a higher rate of job loss (.174), compared to a tradable job loss rate of .116. Outside of manufacturing, the non-tradable job loss rate was slightly higher than the tradable rate. In the Information sector, the non-tradable

rate was .149, compared to the tradable rate of .035. In Professional and Business Services (another focus of attention in the services offshoring debate), the tradable rate of job loss was .048 (close to the overall economy-wide rate of .041), while the non-tradable rate was .018.

Job loss rates by occupation are reported in Table XXX. Workers in all occupational categories faced a higher rate of job loss in 2001-2003 than in 2003-05. Production workers faced the highest rate of job loss, at .210 (virtually the same across the two time periods). Some of the traditional "white-collar" occupational categories forecasted to be at risk of services offshoring had high job loss rates (but lower than Production workers), including Computer and Mathematical Occupations (.156) and Architecture and Engineering (.126).

For the overall economy, the difference in the rate of job loss between tradable and non-tradable occupations narrowed in 2003-05, compared to 2001-03. There is no clear pattern of exposure to the risk of job loss by tradability within detailed occupations.

Table 8 reports demographic and educational characteristics for workers displaced from tradable and non-tradable non-manufacturing industries for the two time periods, with (tradable) manufacturing industries offered as a reference group. Unsurprisingly, worker characteristics are fairly constant across the two short (and overlapping) time periods. As noted in Kletzer (2001), workers displaced from non-manufacturing industries are slightly younger, less tenured, less likely to be male, and considerably more educated than workers displaced from manufacturing. From tradable non-manufacturing workers, just under 75 percent of displaced workers had at least some college experience. That share for displaced manufacturing workers was .46.

Also evident in Table 8 is that for non-manufacturing industries, workers displaced from tradable industries were more educated, more likely to have health insurance, more likely to lose fulltime jobs, and have higher pre-displacement earnings than workers displaced from non-tradable industries. The educational attainment differences are stark: 41 percent of workers displaced from non-tradable non-manufacturing industries had a high school diploma or less, compared to 26 percent of workers displaced from tradable non-manufacturing industries. The educational differences show up in pre-displacement weekly earnings, and are consistent with the comparative advantage characteristics noted above.

In terms of post-displacement outcomes (also reported in Table 8), reemployment rates are higher slightly higher for displaced manufacturing workers for the 2003-05 period (.67) compared to the 2001-03 period (.64). For non-manufacturing, reemployment rates were lower

for the later period than seen in the earlier period. Reemployment rates were higher for tradable non-manufacturing than for non-tradable non-manufacturing.

With a stronger economy, the earnings cost of job displacement were lower for 2003-05 than seen in 2001-03. The median change in weekly earnings for manufacturing workers was a loss of 15 percent in 2001-03, compared to a loss of 5.4 percent for 2003-05. For non-manufacturing the median change was a smaller loss as well, comparing 2003-05 to 2001-03. Median earnings losses are smaller for non-manufacturing than for manufacturing, and a larger share of non-manufacturing workers experience no earnings loss. Consistent with lower pre-displacement earnings, workers displaced from non-tradable non-manufacturing industries experienced smaller earnings losses than workers displaced from tradable non-manufacturing industries.

5. Conclusions

In this paper we offer a second measure of tradability, built from common notions of job characteristics related to "offshorability." We find a selection of tradable occupations do indeed have characteristics of offshorability (internet-enabled, high information content, no face-to-face customer contact). The calculated index of offshorability offers strong potential for understanding jobs (tasks) at risk. The two measures of tradability and offshorability offer a combined potential to do the same. Future work will focus on high-skill tradable occupations and lower-skill occupations, and how they differ on these dimensions of offshorability. We will also examine the earnings implications of potential offshorability.

In our earlier paper, we provided evidence that service activities employ workers with higher education and more skill than non-tradable (service) activities and manufacturing. This seems to suggest that tradable services are consistent with U.S. comparative advantage in high skill production. Unlike Blinder's view that only personally-delivered services are likely to "stay" in the US, we consider it important to understand how tradable services can consistent with U.S. comparative advantage, with the expectation that as technology and policy allow for

more trade in these activities the U.S. should gain world market share in these activities, not lose it.[13]

[13] Though over the longer-term, if the U.S. ceases to make investments in education and training, it is possible that it would cease to have comparative advantage in high-skill activities.

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Figure 1

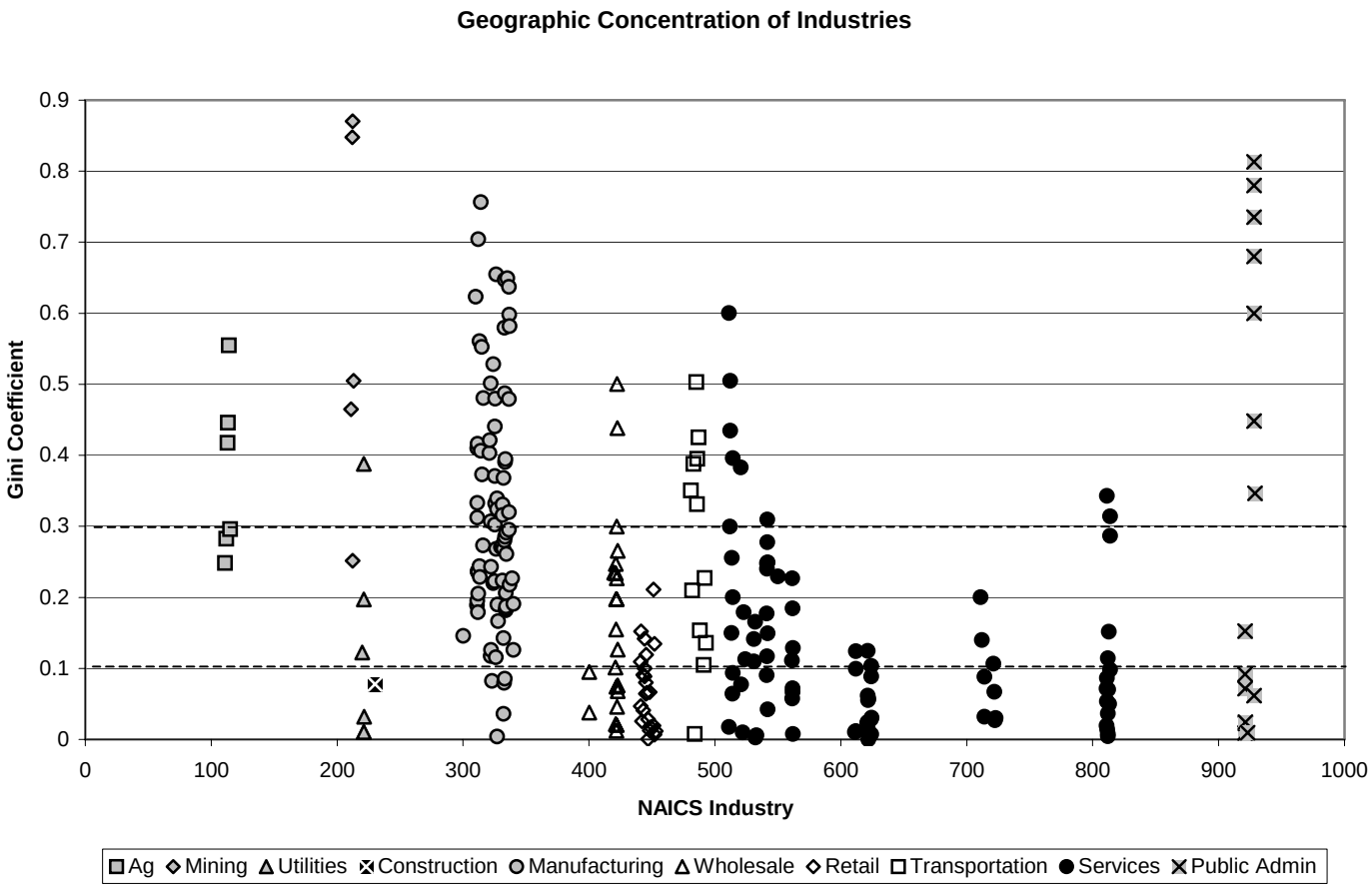
Geographic Concentration of Industries
Gini Coefficient
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
100
200
300
400
500
600
700
800
900
1000
NAICS Industry
Ag
Mining
Utilities
Construction
Manufacturing
Wholesale
Retail
Transportation
Services
Public Admin

Table 1
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	Non-depository credit and related activities	2
52	Securities, commodities, funds, trusts, and other financial investm	3
	Real Estate and Rental	
53	Video tape and disk rental	1
53	Other consumer goods rental	1
53	Commercial, industrial, and other intangible assets rental and leas	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
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	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 hous	1
72	Traveler accommodation	2

	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 mainte	1
81	Drycleaning and laundry services	1
81	Car washes	1
81	Electronic and precision equipment repair and maintenance	1
81	Civic, social, advocacy organizations, and grantmaking 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

Table 2
Share of Occupation Employment by Gini Class Coefficient
By Major Occupation Category

SOC	Description	Gini Class 1	Gini Class 2	Gini Class 3
11	Management	34.48	61.15	4.37
13	Business/Fin. Oper.	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 Sci.	16.32	58.61	25.08
21	Community/Social Svs.	100.00	0	0
23	Legal	3.78	96.22	0
25	Education and Library	99.54	0.46	0
27	Arts, Design, Entertain.	17.13	75.02	7.85
29	Healthcare Prac./Tech	86.56	13.10	0.34
31	Healthcare Support	96.73	3.27	0
33	Protective Service	59.83	40.17	0
35	Food Prep./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/Admin. 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	Install., Maint., Repair	90.00	8.89	1.11
51	Production	80.30	17.15	2.55
53	Trans./Material Moving	89.20	5.86	4.95
55	Military Specific	0	0	100.00
	All Occupations	**71.66**	**24.86**	**3.47**

Table 3
Share of Employment in Tradable Occupations and Industries by Major Occupation Category

Management Occupations (11)

	Non-tradable Occupations	Tradable Occupations
Non-tradable Industries	23.97	26.58
Tradable Industries	10.51	38.94

Business and Financial Operations Occupations (13)

	Non-tradable Occupations	Tradable Occupations
Non-tradable Industries	14.11	27.72
Tradable Industries	17.61	40.56

Computer and Mathematical Occupations (15)

	Non-tradable Occupations	Tradable Occupations
Non-tradable Industries	0	24.22
Tradable Industries	0	75.78

Architecture and Engineering Occupations (17)

	Non-tradable Occupations	Tradable Occupations
Non-tradable Industries	8.46	13.30
Tradable Industries	27.59	50.66

Life, Physical and Social Science Occupations (19)

	Non-tradable Occupations	Tradable Occupations
Non-tradable Industries	7.28	36.49
Tradable Industries	9.03	47.20

Legal Occupations (23)

	Non-tradable Occupations	Tradable Occupations
Non-tradable Industries	3.54	18.89
Tradable Industries	0.24	77.33

Table 3.1
Summary statistics for work activities, across occupations

Work Activity	Mean	Std. Deviation	Min	Max
Getting Information				
Importance	0.815	0.097	0.366	1
Level	0.548	0.152	0.118	0.951
Inspecting Equipment, Structures or Material				
Importance	0.606	0.173	0.2	0.966
Level	0.391	0.158	0	0.855
Processing Information				
Importance	0.651	0.156	0.2	1
Level	0.499	0.193	0.028	0.911
Analyzing Data or Information				
Importance	0.628	0.161	0.2	0.988
Level	0.451	0.194	0	0.951
Making Decisions and Solving Problems				
Importance	0.729	0.144	0.24	0.996
Level	0.547	0.178	0.071	0.94
Thinking Creatively				
Importance	0.603	0.183	0.2	0.992
Level	0.474	0.206	0.023	0.951
Interacting w/ computers				
Importance	0.604	0.243	0.2	1
Level	0.353	0.2	0	0.875
Documenting / Recording Information				
Importance	0.653	0.178	0.2	0.984
Level	0.436	0.179	0	0.8
Establishing & Maintaining Interpersonal Relationships				
Importance	0.683	0.167	0.2	0.976
Level	0.583	0.177	0.028	0.897
Assisting and Caring for Others				
Importance	0.528	0.182	0.2	1
Level	0.378	0.192	0	0.961
Performing for or Working Directly w/ Public				
Importance	0.56	0.221	0.2	0.984
Level	0.405	0.232	0	0.924

Source: O*Net

Table 3.2
Work Activities
15-2091.00 - Mathematical Technicians

Importance	Work Activity	Work Activity Description	Detailed Work Activity
100	Processing Information	Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.	compile numerical or statistical data; develop tables depicting data;
92	Analyzing Data or Information	Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.	analyze scientific research data or investigative findings
92	Getting Information	Observing, receiving, and otherwise obtaining information from all relevant sources.	collect scientific or technical data
88	Identifying Objects, Actions, and Events	Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.	
88	Interacting With Computers	Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process information.	develop or maintain databases; use computers to enter, access or retrieve data; use relational database or spreadsheet software;
75	Making Decisions and Solving Problems	Analyzing information and evaluating results to choose the best solution and solve problems.	resolve engineering or science problems
75	Updating and Using Relevant Knowledge	Keeping up-to-date technically and applying new knowledge to your job.	use interpersonal communication techniques; use knowledge of investigational techniques; quantitative research methods
67	Communicating with Supervisors, Peers, or Subordinates	Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.	
67	Documenting/Recording Information	Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.	

Source: National Center for O*Net Development

Table 3.3
Work Activities
43-3031.00 - Bookkeeping, Accounting, and Auditing Clerks

Importance	Work Activity	Work Activity Description	Detailed Work Activity
97	Interacting With Computers	Using computers and computer systems (including hardware and software) to program, write software, set up functions, enter data, or process	use accounting or bookkeeping software; use computers to access data; use word processing software;
82	Getting Information	Observing, receiving, and otherwise obtaining information from all relevant sources.	
80	Processing Information	Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.	compile data for financial reports; copute financial data; compute taxes; detect discrepancies; maintain balance sheets; prepare bank deposits
74	Establishing and Maintaining Interpersonal Relationships	Developing constructive and cooperative working relationships with others, and maintaining them over time.	
73	Organizing, Planning, and Prioritizing Work	Developing specific goals and plans to prioritize, organize, and accomplish your work.	
65	Communicating with Supervisors, Peers, or Subordinates	Providing information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person.	
58	Documenting/Recording Information	Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.	enter time sheet information; take messages
57	Making Decisions and Solving Problems	Analyzing information and evaluating results to choose the best solution and solve problems.	

Source: National Center for O*Net Development

Table 4
Share of occupational employment by offshoring index, by major occupation group
May 2005 employment totals

SOC 2-digit code	Description	Index class 1	Index class 2	Index class 3
11	Management	11.4	73.6	15.1
13	Business/financial operations	8.6	16.7	74.7
15	Computer/mathematical	0.0	6.6	93.4
17	Architecture/Engineering	0.9	18.2	80.8
19	Life, physical, social sciences	9.1	14.9	75.9
21	Community/social services	55.1	44.9	0.0
23	Legal	0.0	60.9	39.1
25	Education and library	43.7	52.4	3.9
27	Arts, design, entertainment	37.6	48.2	14.2
29	Health care practitioners/technicians	78.0	18.5	3.5
31	Health care support	94.4	2.8	2.8
33	Protective service	93.2	5.3	1.5
35	Food preparation/serving	100.0	0.0	0.0
37	Building maintenance	94.0	6.0	0.0
39	Personal care service	99.4	0.6	0.0
41	Sales and related	46.3	48.4	5.2
43	Office/administrative support	1.6	34.1	64.3
	All occupations	43.8	28.9	27.4

Source: O*Net

Table 5
Ranking of occupations by job task content offshorability index

Index ranking	Occupation title	Employment May 2005	Median annual earnings May 2005	Percent w/ HS diploma or less	Percent w/ BA or higher	Tradable by geographic concentration	Index value	Index class	SOC code
1	Mathematical Technicians	1,430	$36,470			1	1.777	3	152091
2	Biochemists and Biophysicists	17,690	$71,000			1	1.510	3	191021
3	Statisticians	17,480	$62,450	0.0	100.0	1	1.309	3	152041
4	Title Examiners, Abstractors, and Searchers	64,580	$35,120	57.4	2.1		1.304	3	232093
5	Credit Authorizers, Checkers, and Clerks	65,410	$29,330	44.1	34.5	0	1.030	3	434041
6	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	79,050	$25,310	61.0	0.0	0	1.026	3	435111
7	Data Entry Keyers	296,700	$23,810	77.7	0.7	0	1.016	3	439021
8	Accountants and Auditors	1,051,220	$52,210	2.0	92.2	1	1.010	3	132011
9	Medical Transcriptionists	90,380	$29,080	34.3	0.4	0	0.999	3	319094
10	Actuaries	15,770	$81,640	0.0	100.0	1	0.981	3	152011
11	Market Research Analysts	195,710	$57,300	0.0	60.5	1	0.928	3	193021
12	Astronomers	970	$104,670	0.0	100.0	1	0.923	3	192011
13	Bookkeeping, Accounting, and Auditing Clerks	1,815,340	$29,490	21.5	18.0	1	0.915	3	433031
14	Mechanical Drafters	74,650	$43,350	0.0	0.0	0	0.909	3	173013
15	Economists	12,470	$73,690	0.0	100.0	1	0.905	3	193011
16	Mathematicians	2,930	$80,920	0.0	100.0	1	0.905	3	152021
17	Sociologists	3,500	$52,760	0.0	100.0	1	0.905	3	193041
18	Operations Research Analysts	52,530	$62,180	0.0	100.0	1	0.886	3	152031
19	Survey Researchers	21,650	$31,140			1	0.883	3	193022
20	Credit Analysts	61,500	$50,370	29.3	56.8	1	0.881	3	132041
21	Payroll and Timekeeping Clerks	205,600	$31,360	42.3	8.4	0	0.873	3	433051
22	Cartographers and Photogrammetrists	11,260	$48,250	14.9	29.5	0	0.840	3	171021
23	Statistical Assistants	18,700	$28,950	2.2	62.0	0	0.828	3	439111
24	Paralegals and Legal Assistants	217,700	$41,170	10.9	29.1	1	0.809	3	232011
25	Geographers	810	$63,550	0.0	100.0	1	0.802	3	193092
26	Computer Systems Analysts	492,120	$68,300	1.1	64.1	1	0.773	3	151051
27	Financial Examiners	22,160	$63,090	2.2	94.9	1	0.755	3	132061
28	Petroleum Engineers	14,860	$93,000	0.0	100.0	1	0.753	3	172171
29	Budget Analysts	53,510	$58,910	0.0	96.4	1	0.742	3	132031
30	Court Reporters	17,130	$41,640	0.8	4.1	1	0.734	3	232091
31	Financial Analysts	180,910	$63,860	0.0	100.0	1	0.732	3	132051
32	Biologists	77,000	$51,150			1	0.719	3	191020
33	Political Scientists	5,010	$84,100	0.0	100.0	1	0.710	3	193094
34	Billing and Posting Clerks and Machine Operators	513,020	$27,780	50.6	6.9	0	0.700	3	433021
35	Historians	2,850	$44,400	0.0	82.0	1	0.693	3	193093

Index ranking	Occupation title	Employment May 2005	Median annual earnings May 2005	Percent w/ HS diploma or less	Percent w/ BA or higher	Tradable by geographic concentration	Index value	Index class	SOC code
36	Technical Writers	46,250	$55,160	1.6	93.2	1	0.678	3	273042
37	Database Administrators	99,380	$63,250	3.4	52.0	1	0.660	3	151061
38	Biological Technicians	67,080	$34,270	14.3	78.9	1	0.649	3	194021
39	Chemists	76,540	$57,890	0.0	84.8	1	0.641	3	192031
40	Computer Software Engineers, Applications	455,980	$77,090	0.0	67.7	1	0.633	3	151031
41	Nuclear Engineers	14,290	$88,290	0.0	92.3	1	0.631	3	172161
42	Financial Managers	471,950	$86,280	0.5	65.7	1	0.621	3	113031
43	Aerospace Engineers	81,100	$84,090	0.0	93.9	1	0.606	3	172011
44	Electrical and Electronics Drafters	30,270	$45,550	8.4	16.4	0	0.600	3	173012
45	Electro-Mechanical Technicians	15,130	$43,880	26.0	0.0	0	0.585	3	173024
46	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	8,810	$65,720	0.0	100.0	0	0.583	3	251051
47	Electronics Engineers, Except Computer	130,050	$78,030	0.0	84.1	1	0.575	3	172072
48	Administrative Law Judges, Adjudicators, and Hearing Officers	15,350	$70,680	17.0	66.4	0	0.574	3	231021
49	Radio Operators	1,190	$36,230			1	0.571	3	274013
50	Chemical Technicians	59,790	$38,500	22.8	33.3	1	0.568	3	194031
51	Epidemiologists	3,630	$52,170	0.0	94.2	1	0.554	3	191041
52	Tax Examiners, Collectors, and Revenue Agents	72,290	$44,210	28.3	41.0	1	0.544	3	132081
53	Anthropologists and Archeologists	4,790	$45,910	0.0	100.0	1	0.510	3	193091
54	Compensation, Benefits, and Job Analysis Specialists	97,740	$48,870	0.4	61.3	0	0.490	3	131072
55	Geoscientists, Except Hydrologists and Geographers	27,430	$71,640	0.0	99.9	1	0.489	3	192042
56	Computer Programmers	389,090	$63,420	3.4	81.4	1	0.484	3	151021
57	Order Clerks	259,760	$25,570	90.2	0.0	0	0.483	3	434151
58	Materials Scientists	7,880	$71,450	0.2	99.6	1	0.483	3	192032
59	Computer Software Engineers, Systems Software	320,720	$82,120	11.7	57.4	1	0.473	3	151032
60	Civil Engineering Technicians	90,390	$39,210	32.9	19.0	0	0.465	3	173022
61	Anthropology and Archeology Teachers, Postsecondary	5,320	$60,710	0.0	100.0	0	0.454	3	251061
62	Agricultural and Food Science Technicians	19,340	$31,360	38.1	37.7	0	0.450	3	194011
63	Computer Operators	129,160	$32,070	15.7	34.3	0	0.446	3	439011
64	Food Scientists and Technologists	7,570	$51,440	7.1	90.4	0	0.431	3	191012
65	Chemical Engineers	27,550	$77,140	0.0	100.0	1	0.424	3	172041
66	Electrical Engineers	144,920	$73,510	0.0	62.7	1	0.423	3	172071
67	Bill and Account Collectors	431,280	$28,160	30.6	0.1	0	0.414	3	433011
68	Personal Financial Advisors	108,640	$63,500			1	0.406	3	132052

Index ranking	Occupation title	Employment May 2005	Median annual earnings May 2005	Percent w/ HS diploma or less	Percent w/ BA or higher	Tradable by geographic concentration	Index value	Index class	SOC code
69	Appraisers and Assessors of Real Estate	63,800	$43,440	18.3	37.3	0	0.400	3	132021
70	Natural Sciences Managers	40,400	$93,090	0.0	100.0	1	0.397	3	119121
71	Geological and Petroleum Technicians	11,130	$43,750	9.7	46.2	1	0.390	3	194041
72	Atmospheric and Space Scientists	7,050	$73,940	0.0	100.0	1	0.372	3	192021
73	Tax Preparers	58,850	$25,700	39.0	41.1	0	0.352	3	132082
74	Electrical and Electronic Engineering Technicians	165,850	$48,040	4.6	13.3	0	0.350	3	173023
75	Insurance Claims and Policy Processing Clerks	239,120	$30,130	57.6	1.4	1	0.350	3	439041
76	Library Science Teachers, Postsecondary	3,960	$53,810	0.0	100.0	0	0.337	3	251082
77	Industrial-Organizational Psychologists	1,070	$84,690	0.0	100.0	0	0.321	3	193032
78	Industrial Engineering Technicians	73,310	$45,280	19.6	51.8	0	0.321	3	173026
79	Industrial Engineers	191,640	$66,670	0.0	86.8	0	0.316	3	172112
80	Forensic Science Technicians	11,030	$44,590	12.3	74.8	0	0.314	3	194092
81	Dispatchers, Except Police, Fire, and Ambulance	172,550	$31,390	77.2	0.8	0	0.299	3	435032
82	Medical Records and Health Information Technicians	160,450	$26,690	10.3	43.1	0	0.298	3	292071
83	Management Analysts	441,000	$66,380	8.6	75.8	1	0.290	3	131111
84	Microbiologists	15,250	$56,870	0.0	96.4	1	0.288	3	191022
85	Insurance Underwriters	98,970	$51,270	33.1	17.1	1	0.287	3	132053
86	Legal Secretaries	265,000	$37,750	15.5	0.0	0	0.281	3	436012
87	Materials Engineers	20,950	$69,660	0.0	100.0	1	0.278	3	172131
88	Economics Teachers, Postsecondary	12,670	$68,910	0.0	100.0	0	0.261	3	251063
89	Procurement Clerks	71,390	$32,210	33.1	12.8	0	0.248	3	433061
90	Environmental Science Teachers, Postsecondary	4,340	$60,880	0.0	100.0	0	0.233	3	251053
91	Hydrologists	8,360	$63,820	0.0	100.0	1	0.231	3	192043
92	Physicists	15,160	$89,810	1.7	93.6	1	0.226	3	192012
93	Mail Clerks and Mail Machine Operators, Except Postal Service	148,330	$22,870			0	0.215	3	439051
94	Mechanical Engineers	220,750	$67,590	11.7	81.7	1	0.212	3	172141
95	Nuclear Technicians	6,050	$61,120				0.200	3	194051
96	Computer Hardware Engineers	78,580	$84,420	4.2	93.8	1	0.200	3	172061
97	Animal Scientists	3,000	$43,170	0.0	96.3	0	0.199	3	191011
98	Production, Planning, and Expediting Clerks	287,980	$37,590	44.0	17.2	0	0.196	3	435061
99	Soil and Plant Scientists	10,100	$54,530	0.0	100.0	0	0.192	3	191013
100	Logisticians	52,220	$60,110	0.0	89.1	1	0.190	3	131081
101	Customer Service Representatives	2,067,700	$27,490	57.8	10.6	1	0.189	3	434051
102	Political Science Teachers, Postsecondary	13,710	$59,850	0.0	100.0	0	0.187	3	251065

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103	Mining and Geological Engineers, Including Mining Safety Engineers	5,680	$70,070	0.0	92.4	0	0.184	3	172151
104	Physics Teachers, Postsecondary	13,310	$65,880	0.0	100.0	0	0.183	3	251054
105	Loan Officers	332,690	$49,440	74.9	22.0	0	0.183	3	132072
106	Marine Engineers and Naval Architects	6,550	$72,920	0.0	92.3	1	0.180	3	172121
107	File Clerks	229,830	$21,430	48.5	0.0	0	0.179	3	434071
108	Cargo and Freight Agents	78,730	$35,860	58.0	36.6	1	0.175	3	435011
109	Aerospace Engineering and Operations Technicians	9,950	$52,450	27.1	56.7	0	0.165	3	173021
110	Environmental Engineering Technicians	19,900	$39,810	28.6	40.6	0	0.163	3	173025
111	Compensation and Benefits Managers	51,470	$69,130	0.3	48.3	0	0.158	3	113041
112	Surveyors	54,220	$45,860	41.2	6.9	0	0.155	3	171022
113	Telemarketers	400,860	$20,360	88.9	0.0	0	0.151	3	419041
114	Business Teachers, Postsecondary	67,420	$59,210	0.0	100.0	0	0.149	3	251011
115	Desktop Publishers	29,910	$32,800	51.7	4.8	0	0.147	3	439031
116	Brokerage Clerks	70,110	$35,450	22.5	32.5	0	0.144	3	434011
117	Commercial and Industrial Designers	31,650	$52,200	2.1	69.7	1	0.144	3	271021
118	Correspondence Clerks	17,990	$28,420	90.4	1.4	0	0.142	3	434021
119	Network and Computer Systems Administrators	270,330	$59,930	1.0	57.0	1	0.142	3	151071
120	First-Line Supervisors/Managers of Non-Retail Sales Workers	294,010	$61,970	23.9	67.4	0	0.138	3	411012
121	Postmasters and Mail Superintendents	26,120	$52,710	62.8	7.5	1	0.136	3	119131
122	Secretaries, Except Legal, Medical, and Executive	1,744,380	$26,670	39.6	3.8	0	0.126	3	436014
123	Forestry and Conservation Science Teachers, Postsecondary	2,990	$64,870	0.0	98.3	0	0.117	3	251043
124	Environmental Science and Protection Technicians, Including Health	32,460	$36,260	13.2	75.3	0	0.106	3	194091
125	Archivists	5,410	$37,420	23.9	43.0	1	0.099	3	254011
126	Compliance Officers, Except Agriculture, Construction, Health and Safety, and Tr	161,810	$49,360	19.0	67.5	0	0.098	3	131041
127	Law Clerks	40,620	$35,620	0.0	58.7	1	0.097	3	232092
128	Private Detectives and Investigators	33,720	$32,650			1	0.096	3	339021
129	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	7,970	$55,610	0.0	100.0	0	0.095	3	251062
130	Eligibility Interviewers, Government Programs	85,550	$33,740	52.6	10.0	0	0.091	3	434061
131	Computer and Information Systems Managers	259,330	$96,520	15.7	61.8	1	0.090	3	113021
132	Loan Interviewers and Clerks	231,700	$30,200	28.0	3.9	1	0.077	3	434131
133	Reporters and Correspondents	52,920	$32,270	2.2	86.4	1	0.077	3	273022

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134	Telephone Operators	29,290	$31,380			1	0.076	3	432021
135	Computer Support Specialists	499,860	$40,610	0.0	24.0	1	0.076	3	151041
136	Purchasing Agents, Except Wholesale, Retail, and Farm Products	267,410	$49,030	11.2	36.5	0	0.067	3	131023
137	Engineering Teachers, Postsecondary	34,500	$74,540	0.0	99.7	0	0.064	3	251032
138	History Teachers, Postsecondary	20,520	$54,780	0.0	100.0	0	0.064	3	251125
139	Gaming Surveillance Officers and Gaming Investigators	8,730	$25,870	94.7	0.0	1	0.063	3	339031
140	Environmental Engineers	50,140	$68,090	0.4	82.5	1	0.059	3	172081
141	Biological Science Teachers, Postsecondary	59,540	$63,570	0.0	100.0	0	0.052	3	251042
142	Editors	96,270	$45,510	1.6	88.0	1	0.047	3	273041
143	Office Clerks, General	2,997,370	$23,070	52.2	0.0	0	0.043	3	439061
144	Architectural and Civil Drafters	101,040	$40,390	14.0	23.8	0	0.040	3	173011
145	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	25,330	$65,210	0.0	100.0	0	0.030	3	172111
146	Court, Municipal, and License Clerks	102,060	$29,320	62.4	14.3	0	0.030	3	434031
147	Zoologists and Wildlife Biologists	16,440	$52,050	26.4	73.6		0.029	3	191023
148	Surveying and Mapping Technicians	63,910	$31,290	9.7	15.6	0	0.020	3	173031
149	Executive Secretaries and Administrative Assistants	1,442,040	$35,960	44.6	9.7	0	0.019	3	436011
150	Dietitians and Nutritionists	48,850	$44,940	2.8	88.7	0	0.011	3	291031
151	Human Resources Assistants, Except Payroll and Timekeeping	161,870	$32,730	32.7	30.9	0	0.008	3	434161
152	Environmental Scientists and Specialists, Including Health	72,000	$52,630	2.7	86.6	1	0.004	3	192041
153	Sociology Teachers, Postsecondary	14,980	$54,320	0.0	100.0	0	0.004	3	251067
154	Purchasing Agents and Buyers, Farm Products	12,970	$46,680			1	0.000	3	131021
155	Securities, Commodities, and Financial Services Sales Agents	251,710	$67,130	0.6	86.4	1	-0.010	2	413031
156	Geography Teachers, Postsecondary	4,250	$57,870	0.0	100.0	0	-0.013	2	251064
157	Medical Scientists, Except Epidemiologists	73,670	$61,730	0.0	99.2	1	-0.014	2	191042
158	Insurance Appraisers, Auto Damage	12,900	$48,090	30.9	32.0	0	-0.044	2	131032
159	Agricultural Sciences Teachers, Postsecondary	11,460	$71,330	1.1	98.4	0	-0.049	2	251041
160	Criminal Justice and Law Enforcement Teachers, Postsecondary	9,880	$49,240	0.0	100.0	0	-0.051	2	251111
161	Police, Fire, and Ambulance Dispatchers	94,060	$30,060	58.1	0.3	0	-0.052	2	435031
162	Mechanical Engineering Technicians	46,580	$44,830	17.0	44.5	0	-0.064	2	173027
163	Office Machine Operators, Except Computer	87,900	$23,990			1	-0.064	2	439071
164	Broadcast Technicians	30,730	$30,410	27.1	17.0	1	-0.065	2	274012

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165	Computer Science Teachers, Postsecondary	38,520	$54,270	0.9	98.2	0	-0.066	2	251021
166	Loan Counselors	28,030	$35,680	35.8	58.3	0	-0.073	2	132071
167	Judges, Magistrate Judges, and Magistrates	25,330	$97,570	5.9	92.6	0	-0.078	2	231023
168	Medical and Health Services Managers	230,130	$69,700	5.2	62.8	0	-0.081	2	119111
169	Foresters	10,750	$48,670	0.0	100.0	1	-0.086	2	191032
170	Network Systems and Data Communications Analysts	185,190	$61,750	0.0	34.4	1	-0.088	2	151081
171	Psychology Teachers, Postsecondary	30,240	$56,370	0.0	99.6	0	-0.093	2	251066
172	Shipping, Receiving, and Traffic Clerks	759,910	$25,180	55.7	0.0	0	-0.100	2	435071
173	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Pro	379,890	$60,760	10.6	53.3	1	-0.102	2	414011
174	Engineering Managers	187,410	$100,760	0.0	82.4	1	-0.110	2	119041
175	Receptionists and Information Clerks	1,088,400	$22,150	68.8	0.8	1	-0.119	2	434171
176	Proofreaders and Copy Markers	18,070	$25,590	5.1	88.0	1	-0.120	2	439081
177	Agricultural Engineers	3,170	$64,890	0.0	100.0	1	-0.127	2	172021
178	Word Processors and Typists	153,580	$29,020	70.3	0.0	1	-0.129	2	439022
179	Tellers	599,220	$21,300	66.7	0.0	1	-0.129	2	433071
180	Claims Adjusters, Examiners, and Investigators	234,030	$46,190	22.7	30.5	0	-0.130	2	131031
181	Law Teachers, Postsecondary	13,560	$89,790	0.0	100.0	0	-0.134	2	251112
182	Broadcast News Analysts	6,680	$42,810	6.8	78.2	1	-0.143	2	273021
183	Producers and Directors	59,070	$53,860	10.9	50.5	1	-0.150	2	272012
184	Occupational Health and Safety Specialists	35,460	$53,710	0.0	90.3	0	-0.151	2	299011
185	Chemistry Teachers, Postsecondary	19,520	$58,060	0.0	100.0	0	-0.158	2	251052
186	Rehabilitation Counselors	117,230	$28,330	54.5	43.5	0	-0.189	2	211015
187	Detectives and Criminal Investigators	85,270	$55,790	19.4	42.2	0	-0.200	2	333021
188	Multi-Media Artists and Animators	23,790	$50,290	14.7	56.9	1	-0.200	2	271014
189	Civil Engineers	229,700	$66,190	0.0	93.6	1	-0.212	2	172051
190	Biomedical Engineers	11,660	$71,840	0.0	48.3	1	-0.214	2	172031
191	Tree Trimmers and Pruners	29,790	$27,920			0	-0.222	2	373013
192	Librarians	146,740	$47,400	0.1	95.3	0	-0.226	2	254021
193	Marketing Managers	166,470	$92,680	6.4	75.7	1	-0.226	2	112021
194	Conservation Scientists	15,540	$53,350	5.8	78.1	1	-0.230	2	191031
195	Mathematical Science Teachers, Postsecondary	44,660	$53,820	0.0	100.0	0	-0.241	2	251022
196	Medical and Clinical Laboratory Technologists	155,250	$47,710	6.1	72.0	0	-0.242	2	292011
197	Meter Readers, Utilities	46,920	$29,310	99.0	0.0	1	-0.256	2	435041
198	Postal Service Clerks	78,710	$48,310	87.5	0.0	0	-0.265	2	435051
199	New Accounts Clerks	82,450	$27,420	72.4	0.1	1	-0.265	2	434141
200	Graduate Teaching Assistants	117,970	$27,340	0.9	99.1	0	-0.266	2	251191

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201	Museum Technicians and Conservators	9,370	$34,090	18.7	46.0	1	-0.267	2	254013
202	Education Teachers, Postsecondary	51,320	$50,380	0.0	100.0	0	-0.268	2	251081
203	Medical Secretaries	381,020	$27,320	73.1	0.0	0	-0.271	2	436013
204	Library Technicians	115,770	$25,650	16.2	19.5	0	-0.273	2	254031
205	Industrial Production Managers	153,950	$75,580	20.6	24.6	0	-0.278	2	113051
206	Communications Teachers, Postsecondary	22,320	$50,890	0.0	98.6	0	-0.287	2	251122
207	Radio and Television Announcers	41,090	$24,120	32.4	37.9	0	-0.292	2	273011
208	Lawyers	529,190	$98,930	0.0	100.0	1	-0.293	2	231011
209	Employment, Recruitment, and Placement Specialists	181,260	$41,780	26.2	45.0	0	-0.300	2	131071
210	Postal Service Mail Sorters, Processors, and Processing Machine Operators	208,600	$43,420	94.1	0.8	0	-0.302	2	435053
211	Architects, Except Landscape and Naval	96,740	$62,850	0.0	97.9	1	-0.303	2	171011
212	Transportation, Storage, and Distribution Managers	84,870	$69,120	46.3	29.7	0	-0.305	2	113071
213	Social Work Teachers, Postsecondary	7,440	$52,660	0.0	100.0	0	-0.307	2	251113
214	Sales Engineers	69,790	$74,200	0.0	62.7	0	-0.309	2	419031
215	First-Line Supervisors/Managers of Office and Administrative Support Workers	1,352,130	$42,400	27.9	39.9	0	-0.316	2	431011
216	Reservation and Transportation Ticket Agents and Travel Clerks	160,120	$28,120	87.3	0.0	0	-0.318	2	434181
217	Insurance Sales Agents	299,470	$42,340	35.5	5.8	1	-0.320	2	413021
218	Pharmacy Technicians	266,790	$24,390	65.9	0.3	0	-0.321	2	292052
219	Urban and Regional Planners	31,650	$55,170	0.0	63.6	1	-0.325	2	193051
220	Instructional Coordinators	112,880	$50,430	0.0	100.0	0	-0.326	2	259031
221	First-Line Supervisors/Managers of Correctional Officers	37,530	$48,570	71.6	0.8	0	-0.327	2	331011
222	Interviewers, Except Eligibility and Loan	201,790	$25,110	21.5	25.8	0	-0.333	2	434111
223	Interpreters and Translators	29,240	$34,800	12.0	55.3	1	-0.337	2	273091
224	Farmers and Ranchers	350	$34,140			1	-0.340	2	119012
225	Gaming Cage Workers	18,730	$22,380	90.0	0.0	0	-0.340	2	433041
226	Audio and Video Equipment Technicians	40,390	$32,940	10.5	25.0	1	-0.344	2	274011
227	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scienti	1,436,800	$47,380	28.2	25.1	0	-0.349	2	414012
228	Writers and Authors	43,020	$46,420	28.9	60.9	1	-0.350	2	273043
229	Parking Enforcement Workers	10,140	$29,070	46.6	13.5	1	-0.357	2	333041
230	Public Relations Specialists	191,430	$45,020	0.0	79.6	1	-0.362	2	273031
231	Home Economics Teachers, Postsecondary	4,010	$48,720	0.0	97.9	0	-0.374	2	251192

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232	Forest Fire Inspectors and Prevention Specialists	1,720	$34,270	3.3	90.1	0	-0.375	2	332022
233	Parts Salespersons	235,190	$26,450	76.1	0.0	0	-0.380	2	412022
234	Health Specialties Teachers, Postsecondary	108,680	$70,890	0.0	100.0	0	-0.382	2	251071
235	Art Directors	29,350	$63,950	0.0	23.6	1	-0.385	2	271011
236	Real Estate Brokers	41,760	$57,190	17.2	32.4	0	-0.385	2	419021
237	Occupational Health and Safety Technicians	9,510	$43,150			0	-0.387	2	299012
238	Hotel, Motel, and Resort Desk Clerks	207,190	$17,810	79.7	0.0	0	-0.391	2	434081
239	Library Assistants, Clerical	104,650	$21,140	52.8	19.3	0	-0.402	2	434121
240	Switchboard Operators, Including Answering Service	194,980	$22,060	66.1	6.6	1	-0.404	2	432011
241	Speech-Language Pathologists	94,660	$54,880	0.0	100.0	0	-0.405	2	291127
242	Travel Agents	88,590	$28,670	49.4	2.2	1	-0.411	2	413041
243	Pharmacists	229,740	$89,820	0.0	100.0	0	-0.416	2	291051
244	Education Administrators, Postsecondary	105,360	$70,350	0.7	97.9	0	-0.431	2	119033
245	English Language and Literature Teachers, Postsecondary	58,710	$49,480	0.4	99.3	0	-0.432	2	251123
246	Pharmacy Aides	46,610	$18,900	57.0	0.0	0	-0.445	2	319095
247	Psychiatric Technicians	62,040	$26,770	39.2	0.5	0	-0.447	2	292053
248	Gaming and Sports Book Writers and Runners	19,290	$18,440	79.8	9.0	1	-0.467	2	393012
249	Human Resources Managers	157,000	$75,960	19.7	59.8	0	-0.469	2	113040
250	Film and Video Editors	15,200	$46,930	4.8	47.5	1	-0.473	2	274032
251	Sound Engineering Technicians	12,680	$38,390	17.2	15.1	1	-0.483	2	274014
252	Forest and Conservation Technicians	29,940	$28,540	33.6	36.1	0	-0.490	2	194093
253	Couriers and Messengers	106,520	$20,870	88.1	0.9	0	-0.491	2	435021
254	Lodging Managers	31,040	$40,610	19.9	14.8	0	-0.493	2	119081
255	Philosophy and Religion Teachers, Postsecondary	18,340	$53,210	0.0	100.0	0	-0.493	2	251126
256	Music Directors and Composers	8,610	$34,810			1	-0.500	2	272041
257	Special Education Teachers, Preschool, Kindergarten, and Elementary School	214,060	$44,630	0.2	99.5	0	-0.503	2	252041
258	Foreign Language and Literature Teachers, Postsecondary	23,830	$49,570	4.3	95.7	0	-0.511	2	251124
259	General and Operations Managers	1,663,810	$81,480	18.0	47.6	0	-0.514	2	111021
260	Psychiatrists	23,450		0.0	100.0	0	-0.517	2	291066
261	Radiation Therapists	14,120	$62,340	0.0	40.2	0	-0.520	2	291124
262	Farm and Home Management Advisors	12,620	$41,890	0.0	100.0	0	-0.521	2	259021
263	Training and Development Specialists	206,860	$45,870	12.9	45.1	0	-0.531	2	131073
264	Chief Executives	321,300	$142,440	0.0	96.6	1	-0.533	2	111011

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265	Advertising Sales Agents	153,890	$41,770	50.5	8.1	0	-0.538	2	413011
266	Public Relations Managers	43,770	$76,450	59.7	35.9	1	-0.539	2	112031
267	Farm, Ranch, and Other Agricultural Managers	4,070	$51,160	1.6	93.6	1	-0.550	2	119011
268	Recreation and Fitness Studies Teachers, Postsecondary	16,530	$45,890	0.0	96.9	0	-0.555	2	251193
269	Nursing Instructors and Teachers, Postsecondary	37,020	$53,160	0.0	100.0	0	-0.556	2	251072
270	Athletes and Sports Competitors	12,230	$39,930			0	-0.571	2	272021
271	Obstetricians and Gynecologists	21,910		0.0	100.0	0	-0.573	2	291064
272	Interior Designers	50,020	$41,350	31.3	29.4	1	-0.577	2	271025
273	Purchasing Managers	69,300	$76,270	0.0	47.2	1	-0.589	2	113061
274	Administrative Services Managers	239,410	$64,020	24.3	25.7	1	-0.591	2	113011
275	Sales Managers	317,970	$87,580	19.0	23.4	1	-0.617	2	112022
276	Educational, Vocational, and School Counselors	214,160	$46,440	0.0	97.1	0	-0.617	2	211012
277	Special Education Teachers, Middle School	103,480	$45,490	0.0	100.0	0	-0.619	2	252042
278	Stock Clerks and Order Fillers	1,625,430	$20,100	87.2	0.5	0	-0.620	2	435081
279	Cashiers	3,481,420	$16,260	99.2	0.0	0	-0.630	2	412011
280	Child, Family, and School Social Workers	256,430	$35,350	2.6	93.2	0	-0.632	2	211021
281	Pesticide Handlers, Sprayers, and Applicators, Vegetation	25,770	$26,120	49.1	7.4	0	-0.637	2	373012
282	Medical Equipment Preparers	41,790	$24,880	78.6	7.5	0	-0.643	2	319093
283	Veterinary Technologists and Technicians	63,860	$25,670	31.9	0.0	0	-0.648	2	292056
284	Education Administrators, Elementary and Secondary School	213,250	$75,400	0.0	99.1	0	-0.652	2	119032
285	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers	10,970	$20,450			1	-0.656	2	419091
286	Elementary School Teachers, Except Special Education	1,486,650	$44,040	4.0	91.9	0	-0.662	2	252021
287	Mental Health Counselors	87,220	$34,010	16.7	75.9	0	-0.663	2	211014
288	Audio-Visual Collections Specialists	6,910	$40,260	0.0	75.3	0	-0.666	2	259011
289	Bailiffs	17,160	$33,800	60.4	0.3	0	-0.670	2	333011
290	Meeting and Convention Planners	40,040	$41,280	23.1	35.2	1	-0.679	2	131121
291	Respiratory Therapists	95,320	$45,140	0.0	14.4	0	-0.681	2	291126
292	Special Education Teachers, Secondary School	136,290	$46,820	0.0	100.0	0	-0.689	2	252043
293	Diagnostic Medical Sonographers	43,590	$54,370	0.0	2.8	0	-0.689	2	292032
294	Vocational Education Teachers, Secondary School	96,600	$47,090	2.5	72.0	0	-0.691	2	252032
295	Property, Real Estate, and Community Association Managers	154,230	$41,900	0.0	4.8	1	-0.692	2	119141

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296	Middle School Teachers, Except Special and Vocational Education	637,340	$44,640	1.7	98.3	0	-0.699	2	252022
297	Graphic Designers	178,530	$38,390	22.1	33.1	1	-0.700	2	271024
298	Emergency Management Specialists	11,240	$45,980	10.9	52.7	1	-0.704	1	131061
299	Slot Key Persons	14,700	$22,120	85.2	4.5	0	-0.707	1	391012
300	Training and Development Managers	28,720	$74,180	50.7	17.0	0	-0.711	1	113042
301	Cooks, Restaurant	791,450	$19,840	79.6	0.2	0	-0.712	1	352014
302	Set and Exhibit Designers	8,380	$37,390	0.0	74.7	1	-0.716	1	271027
303	Probation Officers and Correctional Treatment Specialists	90,600	$40,210	1.3	63.3	0	-0.717	1	211092
304	Medical and Public Health Social Workers	112,220	$41,120	0.0	100.0	0	-0.728	1	211022
305	Pediatricians, General	26,400	$136,600	0.0	99.4	0	-0.730	1	291065
306	Fish and Game Wardens	6,300	$42,850	8.6	74.3	0	-0.730	1	333031
307	Health Educators	51,970	$39,730	26.9	73.0	0	-0.736	1	211091
308	Transit and Railroad Police	5,090	$48,850	5.7	4.5	0	-0.737	1	333052
309	Secondary School Teachers, Except Special and Vocational Education	1,015,740	$46,060	0.0	100.0	0	-0.739	1	252031
310	Veterinary Assistants and Laboratory Animal Caretakers	69,890	$19,610	67.1	4.4	0	-0.742	1	319096
311	Agents and Business Managers of Artists, Performers, and Athletes	10,640	$53,800			1	-0.743	1	131011
312	Postal Service Mail Carriers	347,180	$46,330	91.8	0.0	1	-0.747	1	435052
313	Real Estate Sales Agents	150,200	$39,240	45.2	2.7	0	-0.751	1	419022
314	Teacher Assistants	1,260,400	$20,090	40.5	6.4	0	-0.761	1	259041
315	Correctional Officers and Jailers	411,080	$34,090	49.5	0.2	0	-0.764	1	333012
316	Dishwashers	498,620	$15,490	98.0	2.0	0	-0.768	1	359021
317	Fire Inspectors and Investigators	12,820	$47,090	10.8	27.4	0	-0.770	1	332021
318	Umpires, Referees, and Other Sports Officials	12,800	$21,610	71.2	21.1	0	-0.774	1	272023
319	Cardiovascular Technologists and Technicians	43,560	$40,420	1.1	20.8	0	-0.775	1	292031
320	Vocational Education Teachers, Middle School	15,380	$43,820	0.0	98.0	0	-0.785	1	252023
321	First-Line Supervisors/Managers of Police and Detectives	91,320	$65,570	57.9	12.9	0	-0.790	1	331012
322	Dental Assistants	270,720	$29,520	35.5	0.0	0	-0.795	1	319091
323	Licensed Practical and Licensed Vocational Nurses	710,020	$35,230	0.0	0.0	0	-0.799	1	292061
324	Advertising and Promotions Managers	41,710	$68,860	1.9	71.7	1	-0.799	1	112011
325	Substance Abuse and Behavioral Disorder Counselors	72,210	$32,580	1.3	80.1	0	-0.801	1	211011
326	Directors, Religious Activities and Education	13,610	$32,540			0	-0.801	1	212021

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327	Nuclear Medicine Technologists	18,280	$59,670	0.0	28.0	0	-0.812	1	292033
328	Motion Picture Projectionists	10,230	$16,780	96.8	3.2	1	-0.813	1	393021
329	Fashion Designers	12,980	$60,860			1	-0.814	1	271022
330	Internists, General	48,210		0.0	90.6	0	-0.819	1	291063
331	Police and Sheriff's Patrol Officers	624,130	$46,290	41.0	2.0	0	-0.820	1	333051
332	Kindergarten Teachers, Except Special Education	171,290	$42,230	0.0	100.0	0	-0.841	1	252012
333	Ushers, Lobby Attendants, and Ticket Takers	102,330	$15,400	74.7	0.1	0	-0.846	1	393031
334	First-Line Supervisors/Managers of Housekeeping and Janitorial Workers	186,870	$30,330	52.6	16.9	0	-0.846	1	371011
335	Dental Hygienists	161,140	$60,890	0.0	23.0	0	-0.847	1	292021
336	Retail Salespersons	4,344,770	$19,140	73.0	14.8	0	-0.850	1	412031
337	Registered Nurses	2,368,070	$54,670	0.0	23.3	0	-0.851	1	291111
338	First-Line Supervisors/Managers of Personal Service Workers	125,760	$31,390			0	-0.854	1	391021
339	Chiropractors	24,290	$67,200	3.1	93.1	1	-0.857	1	291011
340	Audiologists	10,330	$53,490	0.0	98.2	0	-0.861	1	291121
341	Adult Literacy, Remedial Education, and GED Teachers and Instructors	66,070	$41,270	2.6	97.4	0	-0.866	1	253011
342	Cost Estimators	204,330	$52,020	40.9	31.9	1	-0.868	1	131051
343	Physician Assistants	63,350	$72,030	0.0	100.0	0	-0.868	1	291071
344	Medical Assistants	382,720	$25,350	6.4	0.8	0	-0.869	1	319092
345	Opticians, Dispensing	70,090	$29,000	52.5	0.0	0	-0.871	1	292081
346	Nursing Aides, Orderlies, and Attendants	1,391,430	$21,440	70.2	0.0	0	-0.871	1	311012
347	Gaming Supervisors	24,180	$40,300			1	-0.887	1	391011
348	Veterinarians	47,870	$68,910	0.0	100.0	0	-0.888	1	291131
349	Demonstrators and Product Promoters	86,050	$20,730			1	-0.889	1	419011
350	Social and Community Service Managers	112,910	$49,500	0.0	67.8	0	-0.891	1	119151
351	Baggage Porters and Bellhops	51,300	$17,590	94.8	0.4	1	-0.897	1	396011
352	Cooks, Institution and Cafeteria	393,500	$19,640	81.4	0.0	0	-0.905	1	352012
353	Physical Therapists	151,280	$63,080	0.0	100.0	0	-0.908	1	291123
354	Orthodontists	4,820		0.0	100.0	0	-0.911	1	291023
355	Camera Operators, Television, Video, and Motion Picture	22,530	$41,610	40.1	29.7	1	-0.914	1	274031
356	Recreational Therapists	23,260	$33,480	26.8	66.1	0	-0.917	1	291125
357	Oral and Maxillofacial Surgeons	5,120		0.0	100.0	0	-0.920	1	291022
358	First-Line Supervisors/Managers of Food Preparation and Serving Workers	748,550	$26,050	78.3	6.4	0	-0.924	1	351012
359	Embalmers	9,840	$36,960	2.7	29.5	0	-0.931	1	394011

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360	Gaming Managers	3,310	$59,940	56.5	19.2	1	-0.933	1	119071
361	Psychiatric Aides	56,150	$22,920	52.8	21.2	0	-0.934	1	311013
362	Food Preparation Workers	880,360	$17,040	93.4	2.6	0	-0.934	1	352021
363	Cooks, Private Household	830	$20,820	32.1	3.6	0	-0.936	1	352013
364	Marriage and Family Therapists	18,500	$42,300	0.0	100.0	0	-0.940	1	211013
365	Residential Advisors	50,490	$21,850	0.7	61.1	0	-0.946	1	399041
366	Optometrists	23,720	$88,040	0.0	92.9	0	-0.949	1	291041
367	Family and General Practitioners	112,150	$140,400	0.0	100.0	0	-0.953	1	291062
368	Construction Managers	192,610	$72,260	4.8	21.6	1	-0.957	1	119021
369	Landscape Architects	20,220	$54,220	0.0	44.5	1	-0.960	1	171012
370	Gaming Change Persons and Booth Cashiers	28,590	$20,050	92.9	0.0	0	-0.971	1	412012
371	Physical Therapist Aides	41,930	$21,510	51.3	2.0	0	-0.976	1	312022
372	Merchandise Displayers and Window Trimmers	64,320	$22,590	81.3	2.9	1	-0.978	1	271026
373	Food Servers, Nonrestaurant	188,750	$17,210	71.4	0.0	0	-0.984	1	353041
374	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	328,930	$15,840	98.5	0.0	0	-0.985	1	359031
375	Locker Room, Coatroom, and Dressing Room Attendants	20,340	$17,940	99.8	0.0	0	-0.992	1	393093
376	Curators	8,790	$45,240	0.0	57.3	1	-0.995	1	254012
377	Concierges	16,810	$23,510			0	-0.997	1	396012
378	Surgeons	52,930		0.0	100.0	0	-1.014	1	291067
379	Security Guards	994,220	$20,760	76.3	0.1	0	-1.024	1	339032
380	Maids and Housekeeping Cleaners	893,820	$17,080	81.7	3.0	1	-1.027	1	372012
381	Emergency Medical Technicians and Paramedics	196,880	$26,080	30.6	0.0	0	-1.029	1	292041
382	Animal Control Workers	13,940	$26,780	46.3	0.0	0	-1.030	1	339011
383	Pest Control Workers	62,400	$27,170	93.9	0.2	0	-1.033	1	372021
384	Cooks, Fast Food	631,190	$15,080	82.4	17.6	0	-1.036	1	352011
385	Combined Food Preparation and Serving Workers, Including Fast Food	2,298,010	$14,790	91.9	0.3	0	-1.036	1	353021
386	Art, Drama, and Music Teachers, Postsecondary	69,260	$51,240	5.9	94.1	0	-1.037	1	251121
387	Mental Health and Substance Abuse Social Workers	120,140	$34,410	0.0	99.1	0	-1.044	1	211023
388	Makeup Artists, Theatrical and Performance	1,070	$23,480			1	-1.046	1	395091
389	Radiologic Technologists and Technicians	184,580	$45,950	0.0	8.8	0	-1.050	1	292034
390	Funeral Directors	21,960	$47,630	11.0	26.0	0	-1.054	1	119061
391	Physical Therapist Assistants	58,670	$39,490	0.0	2.3	0	-1.060	1	312021
392	Costume Attendants	3,900	$25,360	69.6	22.0	0	-1.062	1	393092

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393	Podiatrists	8,290	$100,550	0.0	100.0	0	-1.068	1	291081
394	Occupational Therapist Assistants	22,160	$39,750	13.7	22.6	0	-1.076	1	312011
395	Clinical, Counseling, and School Psychologists	98,820	$57,170	0.0	94.7	0	-1.080	1	193031
396	Occupational Therapist Aides	6,220	$24,310	31.2	19.5	0	-1.100	1	312012
397	First-Line Supervisors/Managers of Landscaping, Lawn Service, and Groundskeeping	106,280	$36,320	55.3	1.4	0	-1.111	1	371012
398	Prosthodontists	560		0.0	95.5	0	-1.121	1	291024
399	Athletic Trainers	15,110	$34,260	0.0	100.0	0	-1.121	1	299091
400	Floral Designers	63,920	$21,060	69.7	22.0	1	-1.124	1	271023
401	Nonfarm Animal Caretakers	100,550	$17,720	95.1	0.0	1	-1.139	1	392021
402	Waiters and Waitresses	2,274,770	$14,200	85.8	0.1	0	-1.157	1	353031
403	Education Administrators, Preschool and Child Care Center/Program	47,670	$37,010	8.8	78.9	0	-1.160	1	119031
404	Counter and Rental Clerks	473,090	$18,970	100.0	0.0	0	-1.162	1	412021
405	Travel Guides	3,120	$29,240			0	-1.166	1	396022
406	Food Service Managers	191,420	$41,340	63.3	10.6	0	-1.168	1	119051
407	Clergy	36,590	$38,540	14.1	60.0	0	-1.181	1	212011
408	Landscaping and Groundskeeping Workers	896,690	$20,670	78.2	4.4	0	-1.192	1	373011
409	Dentists, General	86,270	$125,300	7.6	85.2	0	-1.203	1	291021
410	Dining Room and Cafeteria Attendants and Bartender Helpers	391,320	$15,040	92.8	3.7	0	-1.213	1	359011
411	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	501,390	$15,820	99.6	0.0	0	-1.240	1	353022
412	Orthotists and Prosthetists	5,190	$53,760	0.0	87.1	0	-1.242	1	292091
413	Dietetic Technicians	23,780	$23,470	85.6	2.7	0	-1.243	1	292051
414	Anesthesiologists	27,970		0.0	100.0	0	-1.247	1	291061
415	Fire Fighters	282,180	$39,090	47.8	0.0	0	-1.260	1	332011
416	Occupational Therapists	87,430	$56,860	0.0	82.7	0	-1.268	1	291122
417	Home Health Aides	663,280	$18,800	93.0	0.0	0	-1.278	1	311011
418	Fine Artists, Including Painters, Sculptors, and Illustrators	10,390	$41,280	38.1	32.6	1	-1.279	1	271013
419	Social and Human Service Assistants	313,210	$25,030	24.0	38.1	0	-1.281	1	211093
420	Photographers	58,260	$26,100	64.0	3.8	0	-1.296	1	274021
421	Recreation Workers	264,840	$20,110	30.8	48.1	0	-1.332	1	399032
422	Skin Care Specialists	22,740	$23,340			0	-1.333	1	395094
423	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	2,107,360	$19,390	89.4	6.5	0	-1.345	1	372011
424	Funeral Attendants	30,220	$19,720	66.0	3.6	0	-1.353	1	394021

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425	Personal and Home Care Aides	566,860	$17,340	85.7	0.0	0	-1.354	1	399021
426	Tour Guides and Escorts	28,320	$19,990	40.9	18.9	0	-1.360	1	396021
427	Public Address System and Other Announcers	8,150	$23,290	86.7	2.7	0	-1.388	1	273012
428	First-Line Supervisors/Managers of Fire Fighting and Prevention Workers	53,490	$60,840	55.5	4.7	0	-1.390	1	331021
429	First-Line Supervisors/Managers of Retail Sales Workers	1,083,890	$32,840	93.1	2.7	0	-1.412	1	411011
430	Amusement and Recreation Attendants	232,030	$15,920	97.8	1.9	0	-1.421	1	393091
431	Cooks, Short Order	203,350	$17,230	99.9	0.0	0	-1.449	1	352015
432	Wholesale and Retail Buyers, Except Farm Products	132,900	$42,870	63.0	15.4	1	-1.475	1	131022
433	Coaches and Scouts	145,440	$25,990	0.7	91.1	0	-1.479	1	272022
434	Respiratory Therapy Technicians	22,060	$38,200			0	-1.493	1	292054
435	Musicians and Singers	50,410		26.3	41.4	1	-1.500	1	272042
436	Chefs and Head Cooks	115,850	$32,330	58.5	4.7	1	-1.502	1	351011
437	Transportation Attendants, Except Flight Attendants and Baggage Porters	24,810	$19,290			0	-1.506	1	396032
438	Bartenders	480,010	$15,850	74.6	0.4	0	-1.508	1	353011
439	Craft Artists	4,300	$22,430	51.5	18.2	1	-1.528	1	271012
440	Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	107,620	$16,910	94.1	0.6	0	-1.544	1	339092
441	Dancers	16,240		81.5	15.5	1	-1.578	1	272031
442	Choreographers	16,150	$32,950	40.0	40.0	1	-1.585	1	272032
443	Animal Trainers	8,320	$24,800	65.1	5.3	0	-1.585	1	392011
444	Self-Enrichment Education Teachers	141,650	$32,360	31.7	38.4	0	-1.607	1	253021
445	Child Care Workers	557,680	$17,050	62.9	15.0	0	-1.617	1	399011
446	Models	1,430	$22,700			1	-1.620	1	419012
447	Preschool Teachers, Except Special Education	348,690	$21,990	43.1	16.9	0	-1.626	1	252011
448	Fitness Trainers and Aerobics Instructors	189,220	$25,840	59.1	22.6	1	-1.646	1	399031
449	Surgical Technologists	83,680	$34,830	15.3	9.0	0	-1.681	1	292055
450	Crossing Guards	69,390	$20,050	96.4	0.0	0	-1.709	1	339091
451	Massage Therapists	37,670	$32,890	10.2	24.7	0	-1.719	1	319011
452	Gaming Dealers	82,320	$14,260	87.5	0.0	1	-1.753	1	393011
453	Actors	59,590		60.2	11.9	1	-1.890	1	272011
454	Manicurists and Pedicurists	42,960	$18,280	57.1	0.0	0	-1.962	1	395092
455	Hairdressers, Hairstylists, and Cosmetologists	338,910	$20,610	6.0	0.0	1	-1.981	1	395012
456	Flight Attendants	99,590	$46,680	48.2	16.8	0	-2.065	1	396031
457	Barbers	13,630	$21,760	27.1	0.0	0	-2.210	1	395011

Table 6
Job loss rates by industry, 2001-03 and 2003-05

	2001-03			2003-05		
	Overall	Tradable	Not tradable	Overall	Tradable	Not tradable
Agriculture	0.049			0.042		
Mining	0.127			0.115		
Construction	0.131			0.042		
Manufacturing	0.209	0.213	0.192	0.119	0.116	0.174
Wholesale & Retail Trade	0.113	0.077	0.091	0.065	0.168	0.053
Transport & Utilities	0.089			0.104	0.115	0.093
Information	0.232	0.317	0.075	0.039	0.035	0.149
Financial Services	0.081	0.08	0.081	0.041	0.033	0.125
Professional & Business Services	0.144	0.158	0.113	0.035	0.048	0.018
Education & Health Services	0.040	0.071	0.039	0.015	0.009	0.015
Leisure & Hospitality Services	0.105	0.083	0.113	0.144	0.102	0.168
Other Services	0.051	0.03	0.057	0.036	0.016	0.087
Public Administration	0.020			0.004	0.005	0.004
Total	0.103	0.153	0.076	0.041	0.056	0.030
Mfg. - Tradable	0.213			0.116		
Mfg. - Not tradable	0.192			0.174		
Non- Mfg. - Tradable	0.128			0.024		
Non- Mfg. - Not tradable	0.073			0.036		

Source: Authors' calculations from 2004 and 2006 Displaced Worker Surveys

Table 7
Job Loss rates by occupation, 2001-03 and 2003-05

	2001-03			2003-05		
	Overall	Tradable	Not tradable	Overall	Tradable	Not tradable
Management, Business, Financial (WC)	0.089	0.077	0.091	0.026	0.029	0.020
BusinessOperationsSpecialists	0.143	0.121	0.171	0.022	0.023	0.022
Financial Specialists	0.054	0.057	0.044	0.045	0.096	0.015
Professional & related (WC)	0.070	0.109	0.033	0.039	0.036	0.160
Computer & Math	0.177	0.177		0.156	0.156	
Architecture & Engineering	0.128	0.113	0.158	0.126	0.111	0.165
Life, Physical & Social Science	0.059	0.057	0.066	0.006	0.006	0.000
All Other Services (WC)	0.073	0.072	0.056	0.025	0.029	0.023
Sales (WC)	0.106	0.123	0.079	0.052	0.053	0.052
Office & Administrative Support (WC)	0.109	0.067	0.092	0.053	0.064	0.050
Farming, Forestry, Fishing (BC)	0.110	0.110		0.078	0.078	
Construction & Extraction (BC)	0.149	0.128	0.152	0.139	0.119	0.142
Installation, maintenance, repair (BC)	0.112	0.117	0.083	0.023	0.114	0.017
Production (BC)	0.206	0.163	0.169	0.210	0.242	0.188
Transport & Material Moving (BC)	0.117	0.057	0.096	0.143	0.128	0.147
Total	0.102	0.101	0.078	0.040	0.042	0.039

Notes: Agriculture, Forestry, Mining and Construction industries omitted
Source: Authors' calculations from 2004 and 2006 Displaced Worker Surveys

Table 8
Characteristics of displaced workers, by industrial sector and tradability

	2001-03			2003-05		
	Manufacturing tradable	Non-mfg tradable	Non-mfg not tradable	Manufacturing tradable	Non-mfg tradable	Non-mfg not tradable
Age (mean in yrs.)	41.6	39.6	38.1	42.9	41.5	39.6
Std. deviation	11.2	11.1	11.7	11.8	12.2	13.0
Job tenure (mean in yrs.)	7.1	4.4	4.3	7.6	5.3	4.7
Std. deviation	8.43	5.6	5.61	8.26	6.4	6.2
Job tenure > 10 yrs	0.23	0.12	0.14	0.24	0.13	0.13
Educational attainment: Share:						
HS dropout	0.14	0.05	0.11	0.15	0.04	0.1
HS grad	0.4	0.19	0.31	0.4	0.22	0.31
Some college	0.24	0.3	0.33	0.25	0.35	0.34
College +	0.22	0.45	0.25	0.2	0.38	0.25
Male	0.61	0.54	0.45	0.57	0.53	0.44
On pre-displacement job: Share w/ health insurance	0.75	0.66	0.47	0.69	0.58	0.42
Fulltime	0.96	0.9	0.82	0.95	0.85	0.76
If fulltime, real weekly earnings	$587.90	$760.55	$506.10	$723.21	$855.38	$605.10
Std. deviation	$515.75	$657.41	$465.42	$520.50	$573.17	$465.65
Share reemployed	0.64	0.77	0.75	0.67	0.74	0.66
Of reemployed, share fulltime	0.8	0.78	0.72	0.85	0.67	0.66
All reemployed: Change in ln earnings (mean)	-0.32	-0.3	-0.14	-0.17	-0.082	-0.073
Std. deviation	0.89	0.98	1.02	0.51	0.61	0.68
Median change	-0.15	-0.11	-0.03	-0.054	-0.028	0
Share no earnings loss	0.42	0.45	0.51	0.37	0.43	0.48
Fulltime to fulltime Change in ln earnings (mean)	-0.21	-0.21	-0.12	-0.016	0.0024	-0.002
Std. deviation	0.76	0.69	0.97	0.35	0.32	0.41
Median change	-0.1	-0.07	-0.03	0	0	0.028
Share no loss	0.42	0.46	0.52	0.47	0.48	0.53

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