General Occupational Tenure and Its Returns*

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Abstract

We show that the task specificity of human capital is in line with the occupational specificity of human capital, by studying the returns to occupational human capital using a task-based approach, more specifically, under the assumptions that all occupations are uniquely distinct and that occupational human capital is partially transferable. We name the associated tenure variable "General Occupational Tenure" and propose an empirical Transfer Rate function that relates its transferable portion with the occupation distance. Combining SIPP data and task information from the DOT, we perform generalized wage regressions under 1-, 2-, and 3-digit occupational classifications and find that "General Occupational Tenure" is more important than other tenure variables. Moreover, three salient patterns are revealed: returns to the General Occupational Tenure demonstrate great variation across occupations; the fixed return generally dominates the variable return; and the two are always negatively correlated. Finally we generalize this result by showing that they actually apply to a large family of convexly decreasing Transfer Rate functions: as the discounting becomes heavier these functions converge to the limiting case where the three patterns hold.

Keywords: Human capital, General Occupational Tenure, occupational returns, task approach

JEL Classification: J24, J31, J62

1 Introduction

The question of how general or how specific the human capital is has aroused as much debate as the interest it has attracted. As different answers have quite different

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economic and policy implications. The switches among employers, industries, and occupations are so frequently observed in the labor market. If human capital is quite general by nature, then the turnover cost is small for both individual workers and the aggregate economy, since a large fraction of human capital can be transferred during the switching process. In contrast, if the human capital is largely specific, then the switches are very costly and excessive mobilities in the labor market may be detrimental to the whole economy as well as to an individual. Indeed, the specificity of human capital sheds light on issues like lifecycle inequality (Sullivan (2010a)), wage inequality (Kambourov and Manovskii (2009a)), growth difference (Wasmer (2004)), trade effects (Ritter (2014)), and contract designs (Gibbons and Waldman (2006)), etc.

Various studies examine this issue using different methodologies and data (for instance, see Becker (1964) and Mincer (1974) for the discussions of general human capital, i.e. education and labor market experience; see Bartel and Borjas (1981), Altonji and Shakotko (1987), Abraham and Farber (1987), Topel (1991), and Altonji and Williams (2005) for the studies of firm specificity of human capital; see Neal (1995) and Parent (2000) for explorations of industrial specificity of human capital). The study of Kambourov and Manovskii (2009b) (KM henceforth) argues for the occupational specificity of human capital: they find that when the occupational tenure is accounted for, employer tenure and industrial tenure play a very little role. In their study, the treatment of occupational human capital is a standard one in the literature: it is accumulated within an occupation and it gets completely destroyed during a switch. Two recent studies provide new insights on the nature of occupational human capital with the help of task-based approach. Gathmann and Schonberg (2010) and Yamaguchi (2012) assume that there exist a small number of fundamental tasks, which are utilized in every occupation but with different intensities. For example, a set of basic tasks may include analytical task, interpersonal task, and motor task. And each occupation is a specific use of the bundle of these three fundamental tasks. Gathmann and Schonberg (2010) argue that the occupational human capital is more general than previously considered and it is transferable across occupations, exactly because it is comprised of the same set of task-specific human capitals and each individual task-specific human capital is accumulable and transferable. Yamaguchi (2012) demonstrates that great heterogeneity exists across occupations and the source of this heterogeneity is the different utilization of the task bundle. He explicitly models and estimates, as functions of the task intensity combination, the rewarding structure, skill accumulation, and non-pecuniary preference in every occupation and finds that the model fits data very well.

In this paper, we redo KM's exercise using data of the Survey of Income and Program Participation (SIPP) and verify their main findings. However, the conventional view that occupations are uniformly distinct, in some sense, is a simplifying strategy and stresses only the homogeneous aspect of occupational human capital (equally non-transferable). Indeed, Yamaguchi (2012) shows that occupations are so different in so

many dimensions and one needs to take their heterogeneity serious. Both Gathmann and Schonberg (2010) and Yamaguchi (2012) prove that the task-based approach provides a useful lens through which this heterogeneity can be examined. Hence, this article applies the task-based approach to study the heterogeneous returns across occupations. Specifically, we generalize KM's framework in two directions. First, we assume that occupational human capital, measured by tenure, is partially transferable and that the transferability depends on the similarity between the source and target occupations. Second, returns to occupational tenure are allowed to be different across occupations and are thus occupation-specific.

Under the assumption of partial transferability, the occupational human capital is something lying between the completely specific human capital, like the firm-specific human capital, and the completely general human capital, like the labor market work experience, and is therefore not only specific but also general. And so is the corresponding occupational tenure that is used to measure it. A new name, "General Occupational Tenure", is thus coined so as to distinguish it from the conventional occupational tenure that assumes uniform non-transferability, and to emphasize its (partially) transferable feature.

Conceptually, our "General Occupational Tenure" is similar to the "task tenure" in Gathmann and Schonberg (2010). But empirically, we use a very different approach. Gathmann and Schonberg (2010) decompose the conventional occupational tenure into individual task-associated tenures and keep track of them. when the "task tenure" is needed, they synthesize them to get the result. However, we apply a simpler black-box strategy. In particular, we propose an empirical Transfer Rate function which relates the transferable portion of General Occupational Tenure and the similarity between occupations, or occupation distance. At anytime, given the General Occupational Tenure and the associated occupation, the new General Occupational Tenure is readily obtainable if a target occupation is identified (so the occupation distance is known).

We adopt an angle measure based on the task-approach advocated in Gathmann and Schonberg (2010) to quantify occupation distance. To calculate it, occupation-specific task intensity data are required. We retrieve the task intensity information from the Dictionary of Occupational Titles (DOT) and apply the principal component analysis to generate task intensity indices. During the process, the augmented April 1971 Current Population Survey (CPS) is used to convert the DOT's ordinal scores into the cardinal-flavored values. Later, the CPS file is also used to match occupational titles between the SIPP and the DOT.

Yamaguchi (2012) shows that great return difference could exist among occupations and therefore we augment KM's wage regression by allowing for more flexible occupational heterogeneity. Specifically, we allow for occupation-specific returns not only in terms of constant coefficients, but also in terms of linear and quadratic coefficients on the General Occupational Tenure. In doing so, we can observe different return structures for dozens of 1- and 2-digit occupations and hundreds of 3-digit occupations. Traditional dynamic discrete choice structural models also admit return

heterogeneity when modeling occupational choices. However, due to the heavy computational burden imposed by the curse of dimensionality, they are forced to choose only a few occupations in the model,[1] while our reduced-form framework enables us to have a much larger occupation set.

This article contributes to the literature by helping reconcile two different views on the specificity of human capital. On the one hand, KM suggest that human capital tends to be occupation-specific. On the other, Gathmann and Schonberg (2010) and Poletaev and Robinson (2008) find that task-specific human capital is the most important source of wage growth. Using the task-approach to analyze occupational human capital, we show that there is essentially no conflict between the two views, because an occupation is equivalent to a specific usage of the basic task bundle. In this sense, there is no difference between occupational specificity of human capital and task specificity of human capital.

Moreover, we find three common patterns when examining occupation-specific returns for 1-, 2-, and 3-digit occupational classifications. First, there is considerable variation of the returns to General Occupational Tenure across occupations. Second, among the components that constitute the total return, the intercept part in general dominates the combination of linear and quadratic parts. Third, the intercept part is inversely related with the combination of linear and quadratic parts and thus a tradeoff exists between them.

It turns out that the above conclusion is rather general instead of merely valid for special cases where some specific functional form assumptions are made and where they are derived from. To show its generalization, we first consider an extreme case where occupational human capital is strictly non-transferable and so the General Occupational Tenure reduces to the conventional occupational tenure. The occupation-specific returns for 1-, 2-, and 3-digit classifications are investigated and the three patterns are still found valid. Then we show that a special family of convexly decreasing Transfer Rate functions converge to the extreme case considered as the discounting during the switching process becomes heavier. Finally, given that the initial and limiting cases share the same properties, they should apply to all the cases in between. Thus the three patterns tend to be a general result rather than just a narrow one.

In a relevant paper, Sullivan (2010b) demonstrates that great heterogeneity exists not only in returns to the occupational tenure, but also in returns to the industrial tenure across occupations. He extends the KM wage regression in two dimensions: by allowing for within-firm occupational mobility and by running wage regressions independently occupation by occupation; whereas in this paper we augment the KM wage regression by allowing for partial transferability of occupational human capital and for heterogeneous returns to occupational tenure variables. Note the two studies'

[1]For instance, Keane and Wolpin (1997) consider 5 alternatives which include schooling, home production, and 3 occupations; Hoffmann (2010) has 3 occupational choices plus unemployment; Sullivan (2010a) includes schooling, unemployment, and 5 occupations; Xiong (2015) considers 5 occupations.

second extensions point to the same direction, but theoretically Sullivan (2010b) is obviously more general. However, constrained by the data, his exercise can only be performed at the 1-digit level; while our regressions are run under 1-, 2-, and 3-digit levels. So empirically speaking, our conclusions are more robust. Despite the differences, both studies conclude that return structures differ a lot among various occupations.

The rest of the paper is organized as follows. In Section 2, we run wage regressions in a KM framework and compare our results and theirs. Section 3 introduces the notion of General Occupational Tenure and sets up a new econometrical framework to estimate its returns in every individual occupation. Section 4 discusses data and relevant procedures. In Section 5, we show the main empirical results. We turn to estimation and discussion of the limiting case as well as the generalization in Section 6. Conclusions are in the last section.

2 KM Wage Regression Revisited

Kambourov and Manovskii (2009b) perform the wage regression as follows:

$$\begin{aligned}\log w = {} & \beta_0 + \beta_{Edu}\text{Edu} + \beta_{EduSq}\text{Edu}^2 \\ & + \beta_{Exp}\text{WorkExp} + \beta_{ExpSq}\text{WorkExp}^2 + \beta_{ExpCb}\text{WorkExp}^3 \\ & + \beta_{Emp}\text{EmpTen} + \beta_{EmpSq}\text{EmpTen}^2 + \beta_{OJ}\text{OJ} \\ & + \beta_{Ind}\text{IndTen} + \beta_{IndSq}\text{IndTen}^2 + \beta_{IndCb}\text{IndTen}^3 \\ & + \beta_{Occ}\text{OccTen} + \beta_{OccSq}\text{OccTen}^2 + \beta_{OccCb}\text{OccTen}^3 \\ & + X'B + \zeta \end{aligned} \tag{1}$$

In the above regression, $\log w$ is the natural log of real wage; Edu is a worker's years of schooling; OJ (Old Job) is a dummy variable which equals one if one's employer tenure is equal to or greater than one year and zero otherwise; WorkExp, EmpTen, IndTen, and OccTen are a worker's work experience, employer tenure, industrial tenure, and occupational tenure, respectively; and finally X consists of the following regressors: 1-digit occupation dummies, 1-digit industry dummies, union dummy, marital status dummies, year dummies, region dummies, current and lagged county level unemployment rates. To solve the endogeneity problem, the authors apply Altonji and Shakotko (1987)'s instrumental variable method that is widely used in the literature (e.g. Parent (2000), Gathmann and Schonberg (2010)). In particular, they use WorkExp, EmpTen, OJ, IndTen, and OccTen's deviations from mean as their instruments. Take EmpTen as an example: suppose $\overline{EmpTen}$ is the average employer tenure a worker has with his/her current employer, then EmpTen is instrumented by $\widetilde{EmpTen} = EmpTen - \overline{EmpTen}$ and similarly EmpTen^2 is instrumented by $\widetilde{\text{EmpTen}^2} = \text{EmpTen}^2 - \overline{\text{EmpTen}^2}$. Finally, given the nature of panel data, the error terms are allowed to be serially correlated for a given individual. In summary, KM use an IV-GLS method.

Due to the differences in data and sample restrictions[2], this paper modifies the above regression equation slightly. In particular, the threshold for OJ to take on unity is 4 months, instead of one year, because the data we use have a frequency of 4 months while KM use the annual PSID (Panel Study of Income Dynamics) data.[3] Our regression does not include year dummies as our data spread a relatively short time (4 years from 1996 to 2000) compared to KM's (25 years from 1968 to 1993). And also county level unemployment rates are not included, for there is no county level residence information in the SIPP data. On the other hand, our econometrical model contains two sets of extra dummy variables: one set controls for race and the other controls for the interview group number. While KM restrict their sample to white people, we do not impose such a restriction. SIPP data are divided into four interview groups (called Rotation Groups) and information collected for each Rotation Group is based on a different reference time; the PSID does not have such a structure.

Table 1 lists the coefficient estimates for the wage regression in a KM framework. The three columns from left to right correspond to 1-, 2-, and 3-digit occupational (and industrial) classifications, respectively[4]. As the table shows, if a wage regression controls for a worker's occupational tenure, other tenure variables, specifically employer tenure and industrial tenure, are no longer important: their estimated coefficients are not significant at conventional significance levels. This finding is similar to that in KM.

Table 2 demonstrates the returns to 2, 5, and 8 years of various tenure variables: occupational tenure, industrial tenure, and employer tenure, respectively, assuming everything else being equal. Again the results are reported under 1-, 2-, and 3-digit occupational (and industrial) classifications. As can be seen in the table, in the presence of occupational tenure in a wage regression, the returns to industrial tenure and employer tenure are of minor importance and their p-values are much larger than their occupational tenure counterparts, consistent with the coefficient estimates in Table 1, and with the finding in KM[5]. And Table 2 shows that the return to the occupational tenure is hump-shaped with the peak appearing at 5 years. Specifically, 5 years of occupational tenure are associated with a wage increase of 2.4% to 3.2%. However, KM report that the returns to 2-, 5-, and 8-year occupational tenures are increasing monotonically and 5 years of occupational tenure would increase a worker's wage by 8.02% to 11.97%. One possible reason for the difference might be the different sampling times.

To summarize, we verify KM's finding using the SIPP data in this section: among different classes of specific human capital, occupational human capital is the most important one.

[2]A detailed description of the data along with the sample restrictions is in Section 4.1.

[3]The regressions are also performed with an OJ of the one-year threshold just as KM do, and the results are very similar.

[4]For a detailed discussion of occupational and industrial classifications, please refer to Section 4.4.

[5]Please refer to their Table 5.

3 The Concept of General Occupational Tenure and Its Returns

3.1 Occupation Distance and General Occupational Tenure

The KM framework assumes that all occupations are uniformly distinct: if a worker switches from one source occupation to *any* non-self target occupation, the loss of occupational human capital is 100%. However, the task-based approach (e.g., Gathmann and Schonberg (2010) and Yamaguchi (2012)) takes an alternative view of occupations and distances across them. Specifically, it assumes that there are a small number of elementary tasks, for instance, a set of two tasks: cognitive task and motor task. These tasks are fundamental in that they are used in every occupation, but with different combinations of task intensities. A unique combination of task intensities distinguishes one occupation from all the others and therefore *defines* an occupation. For example, a computer programmer's position requires mainly the cognitive task; a construction worker's position demands a very intensive motor task; while a cook's position may be in the middle: it needs some cognitive task but not as intensive as a computer programmer, and some motor task but not as intensive as a construction worker. More formally, suppose there exist n basic tasks and the intensity index of a given task can be expressed as a real number between 0 and 1 (after some normalization) and these indices are comparable across occupations, and then every point in the cube $[0,1]^n \subset R^n$ denotes an occupation.

Given the above definition of an occupation, occupations are no longer uniformly distinct. A subset of occupations may be more similar to one another than those outside of the subset, because they require similar combinations of task intensities; some occupations might be very dissimilar with one another, because they have very different requirements of task intensity combinations. It follows that the transfer loss of occupational human capital is not always 100%. It should depend upon the similarity of the source and target occupations. If they differ a lot, the loss is supposed to be big; if they are really similar, the loss should be small. In practice, there are different ways to measure the similarity, or "distance" between a pair of occupations. For instance, Yamaguchi (2012) uses the euclidean distance in a task space to denote the occupation distance. While in Gathmann and Schonberg (2010), the authors essentially measure the angle formed by the origin-source occupation ray and the origin-target occupation ray and consider it the occupation distance.[6] In this article, we follow Gathmann and Schonberg (2010) because we find it extremely intuitive. Specifically, it reflects the idea that it is the multi-tasking ability, or the ability to handle multiple tasks *simultaneously* that is valued in every occupation. When an upgrade or promotion takes place, the performance requirements rise for all the tasks at the same time. Similarly, when a downgrade or demotion takes place, the performance requirements

[6]The actual measure they use is one minus cosine of the angle.

fall for all the tasks at the same time. In these two scenarios, it seems reasonable to assume zero loss of occupational human capital. This is indeed the case when Gathmann and Schonberg (2010)'s measure is used, because the source and target occupations lie on the same ray and the distance angle is zero. Figure 1 illustrates the angle measure graphically under the assumption of R^2.

With all the task intensity indices ranging from zero to one, the angle distance ranges from 0 (the shortest distance) to $\pi/2$ (the longest distance). Please note that it is important that the task intensity indices be cardinal and be comparable across occupations, because only when the two conditions are met at the same time are the units of intensity indices, in the task space of occupations, consistent along a given axis and consistent across axes, so that the angle measure is not twisted and as a result, meaningful.

The task-based approach looks at occupations in a new perspective, and thus the occupational human capital, which is measured by tenure, should also be modified accordingly. Now in the new framework, when one switches occupation he or she will carry a fraction of the occupational human capital from the source occupation to the target occupation: the loss is not 100% any longer. To distinguish the new tenure variable from its conventional counterpart in the literature, we name it "General Occupational Tenure", which conceptually is close to the "task tenure" in Gathmann and Schonberg (2010) but appears more appropriate: first, what it really measures is a tenure associated with a particular occupation, more specifically, the target occupation, not a tenure associated with a particular task; second, the adjective "general" stresses its transferable nature, namely, a portion of it is valued in both the source and target occupations, and in this sense, it is general, though not completely so.

Generally there are two ways to track the General Occupational Tenure. Gathmann and Schonberg (2010) use a straightforward method. Suppose a worker is observed to work in an occupation for a period of time. Then this occupational tenure is decomposed into the tenures associated with all the individual tasks, and each task-related tenure is tracked separately. Whenever there is a need to calculate the General Occupational Tenure, one composes all the individual task-related tenures to get the result. Though straightforward, this method is somewhat tedious if the number of basic tasks is big and/or a worker switches occupation frequently in his or her lifecycle. Alternatively, a black-box method is used in this paper. In particular, we posit there exists a Transfer Rate function decreasing in the occupation distance, which yields fraction of the occupational tenure that can be transferred from the source to the target occupation, given any pair of occupations. This empirical object offers us a handy tool to track one's General Occupational Tenure without tracking his or her individual task-related tenures and therefore avoids frequent decomposition-composition manipulations. Intuitively, it is reasonable to assume that the Transfer Rate function is convexly decreasing in the occupation distance: occupational switches constitute a serious change in an individual's career path; even a small deviation from the source occupation implies a tremendous shift in the multi-tasking requirement and therefore

to a large extent the previous working aptitude is no longer useful; however, as the deviation becomes bigger, the marginal cost of occupational switch is decreasing because the bulk of cost has already been incurred by initial movements. In some sense, this is analogous to the evolution of marginal utility when one is saturating his or her desires.

The specific choice of the Transfer Rate function's form is an empirical issue. This article follows Xiong (2015) and assumes that

$$TransRate(\theta) = (-\frac{2}{\pi}\theta + 1)^5 \tag{2}$$

Equation (2) is convexly decreasing in the occupation distance and is based upon the linear function, $f(\theta) = -\frac{2}{\pi}\theta + 1$. When the occupation distance takes on the smallest value, namely, $\theta = 0$, the Transfer Rate equals 1, that is, 100% of occupational tenure can be transferred. When, in theory, the farthest possible switch takes place, namely, $\theta = \pi/2$, the Transfer Rate equals 0, namely, nothing is transferable. Xiong (2015) finds that the above funtional form yields a good calibration result. Hence, we take it here as the baseline functional form.[7] To be more concrete, let us show an example given in Gathmann and Schonberg (2010).[8] They assume there are two basic tasks called analytical and manual. A worker works in Occupation A (with analytical and manual intensity indices 0.5 and 0.5, respectively) for one year and then switches to Occupation B (with analytical and manual intensity indices 0.3 and 0.7, respectively). According to their equations, at the time when the switch takes place, the "task tenure" associated with Occupation A is $1 \times 0.5 \times 0.5 + 1 \times 0.5 \times 0.5/((0.5)^2 + (0.5)^2) = 1$, and the "task tenure" associated with Occupation B is $1 \times 0.5 \times 0.3 + 1 \times 0.5 \times 0.7/((0.3)^2 + (0.7)^2) = 0.862$. Therefore, the Transfer Rate is $0.862/1 = 0.862$. If the same transfer happens in our framework, the angle measure of distance between Occupations A and B is $arccos(0.5 \times 0.3 + 0.5 \times 0.7/(\sqrt{(0.5)^2 + (0.5)^2}\sqrt{(0.3)^2 + (0.7)^2})) = 0.380$. Plug θ into Equation (2) and we get a Transfer Rate of 0.250. It turns out that we discount a switcher's General Occupational Tenure more heavily than that in Gathmann and Schonberg (2010).

With a Transfer Rate function at hand, it is simple to trace a worker's General Occupational Tenure. Note that when one talks about the General Occupational Tenure, there is always a corresponding occupation with which it is associated.[9] To illustrate how to calculate the General Occupational Tenure, suppose one worker starts her career path by entering Occupation A, and she accumulates the General Occupational Tenure (associated with Occupation A) one for one when she works in Occupation A. At some point in time, she switches to a new occupation, Occupation B. Then she starts working with some endowed General Occupational Tenure (associated with

[7] Numerous Transfer Rate functional forms are experimented with and a relevant discussion is in Section 6.

[8] See Section IIID on P.16 in their paper.

[9] More specifically, it is the "target" occupation.

Occupation B). To calculate this endowment, we multiply her General Occupational Tenure associated with Occupation A, with the Transfer Rate determined by the occupation distance between occupation A, the source and occupation B, the target. Then on top of the endowment, she accumulates the General Occupational Tenure (associated with Occupation B) one for one when she works in Occupation B. And the process repeats itself until the end of the worker's career path. At any time, we need track only two objects: the General Occupational Tenure and the corresponding occupation. Thus the black-box method saves us a lot of efforts because there is no longer a need to track all the tenures associated with individual tasks.

3.2 Estimating Occupation-Specific Returns to the General Occupational Tenure

Because the General Occupational Tenure is necessarily affiliated with an occupation, its returns should be occupation-specific. Empirically, we modify Equation (1) and use the following econometric model to perform the wage regression:

$$\begin{aligned}\log w = {} & \beta_1 I_1 + \cdots + \beta_n I_n + \beta_{Edu}\text{Edu} + \beta_{EduSq}\text{Edu}^2 \\ & + \beta_{Exp}\text{WorkExp} + \beta_{ExpSq}\text{WorkExp}^2 + \beta_{Emp}\text{EmpTen} \\ & + \beta_{EmpSq}\text{EmpTen}^2 + \beta_{OJ}\text{OJ} + \beta_{Ind}\text{IndTen} + \beta_{IndSq}\text{IndTen}^2 \\ & + \beta_{Occ1} I_1 \times \text{GenOccTen} + \cdots + \beta_{Occn} I_n \times \text{GenOccTen} \\ & + \beta_{OccSq1} I_1 \times \text{GenOccTen}^2 + \cdots + \beta_{OccSqn} I_n \times \text{GenOccTen}^2 \\ & + X'B + \zeta \end{aligned} \tag{3}$$

In the above regression, as in Equation (1), $\log w$ is the natural log of real wage; Edu is a worker's years of schooling; OJ is a dummy variable which takes on unity if one's employer tenure is equal to or greater than 4 months and zero otherwise; WorkExp, EmpTen, and IndTen are a worker's work experience, employer tenure, and industrial tenure, respectively; and X consists of the following regressors: 1-digit industry dummies, union dummy, marital status dummies, region dummies, race dummies, and Rotation Group dummies. In addition, I_i is the indicator function for Occupation i, and it equals 1 if the worker examined works in Occupation i and 0 otherwise; GenOccTen is the General Occupational Tenure. And we continue to apply an IV-GLS approach that uses WorkExp, EmpTen, OJ, IndTen, and GenOccTen's deviations from mean as their instruments and that allows for serial correlation in the error term for a given individual.

Implicitly, there is a key difference between wage regressions (1) and (3). As argued before, Equation (1) treats occupations uniformly distinct and therefore emphasizes their homogeneous side with the focus on the return's time-series dimension, or the wage increment as time passes by. In contrast, Equation (3) starts with the view that every occupation is unique with its specific task intensity combination, and therefore stresses occupations' heterogeneous side with the focus on the return's cross-section

dimension, or the magnitude differences across occupations. Note that in Equation (3), for a given occupation i, its General Occupational Tenure's return, in the units of log real wage, has three parts: the constant part, β_i; the linear part, β_{Occi}GenOccTen; and the quadratic part, β_{OccSqi}GenOccTen^2. Borrowing terms from the fixed cost and the variable cost, I call the constant part the fixed return and the combination of linear and quadratic parts the variable return, since the latter depends upon the magnitude of General Occupational Tenure while the former does not. We continue discussion of the regression's empirical results in Section 5.

4 Data and Methods

In this section, we examine data that are used to run the wage regression under Equation (3) and that are used to retrieve the occupational characteristics, and the methods to construct task intensity indices for individual occupations and to classify 1-, 2-, and 3-digit occupations and industries.

4.1 Survey of Income and Program Participation

SIPP is designed by the U.S. Census Bureau to collect detailed information on income, employment, and government transfer programs' participation of the U.S. civilian non-institutionalized population. It selects a nationally representative sample of households and tracks them for several years. SIPP is administered in panels: from time to time, SIPP selects a new sample called a panel and keeps track of respondents in that panel. Within a SIPP panel, all the respondents are interviewed every 4 months (called a wave). The detailed information on individual's personal characteristics, family composition, assorted incomes, insurance coverage, program participation, employment and/or business, assets owned is recorded. Initially, the U.S. Census Bureau plans to start a new panel of around 20,000 households each year and continue a panel for 32 months, but the actual sample size and the panel duration vary significantly. There are 14 panels so far with the first one the 1984 Panel and the latest one the 2008 Panel. The number of sampled households varies from 12,425 to 44,200, and the panel duration varies from 12 months to 60 months. SIPP undergoes an overhaul in 1996 with two most eminent reforms. First, it introduces computer-assisted interviewing and as a result the data consistency improves greatly for the panels after 1996 than earlier panels. Second, it abandons the overlapping time design, that is, several panels (with different starting times and ending times) are operated at the same time. As a remedy, sample size increases significantly for panels after 1996 than those before 1996.

SIPP data have two unique advantages over other widely-used labor market panel data, such as PSID and National Longitudinal Survey of Youth (NLSY) in serving our study purpose. First, SIPP has a higher interview frequency (3 times per year) while most other popular surveys interview respondents annually. Thus SIPP provides

richer labor market dynamics information, which enables us to identify occupational turnovers that take place in the middle of a year. Second, SIPP asks respondents their occupational tenure in the first wave while other surveys don't. This information is of vital importance for us as respondents' direct answer to this question is more accurate than any indirect imputation that is forced to be applied when other data sets are used.

The choice of the 1996 panel (SIPP1996 henceforth) for our econometrical exercise is based on the following considerations. First, panels after 1996 have a higher data quality due to the introduction of computer-assisted interviewing. Second, to estimate returns for hundreds of (3-digit level) occupations, large sample size is necessary: there should be sufficient observations in each occupation cell to guarantee identification. So, recent panels are preferable to earlier panels. Third, the task intensity information for each occupation comes from the Dictionary of Occupational Titles (DOT), which was released in the 1970's. So there is a time gap between SIPP data and the DOT. To make the estimation sensible, we want to minimize the time gap. In this sense, earlier panels are more suitable than recent panels. As far as all above three factors are concerned, SIPP1996 is the best compromise.

The sample restrictions are as follows: male, aged between 18 and 64, not disabled, and not self-employed. For a given worker, only when the following three conditions are satisfied is his person-wave observation qualified for the wage regressions in Sections 2 and 3.2: he is working on a full-time job, that is, the weekly working hours are no less than 35 hours; his nominal hourly wage is no less than 4.25 dollars, the U.S. federal minimum wage rate in 1995; and moreover, he holds a job for at least two waves so that the IV-GLS method can be applied. In the end, the sample consists of 6,832 individuals with 45,320 person-wave observations. Summary statistics are listed in Table 3. A detailed description on how to construct various tenure variables can be found in Appendix A.

4.2 Dictionary of Occupational Titles

DOT is a large data set created by the U.S. Department of Labor to provide standardized occupational information for the purpose of matching job applicants with job vacancies. It contains rich information on requirements and features for over 12,000 finely defined occupations found in the U.S. labor market. Major part of the the DOT data come from job analysts through on-site observation of occupations when they are performed, and for those that are difficult to observe the data come from surveying related professional and trade associations. The first edition of DOT was released in 1939, and in 1949, 1965, and 1977 the following editions II, III, and IV (latest edition) were publicized. For a given occupation, up to 62 characteristics are recorded which fall into one of 7 broad categories: worker functions, general education development, specific vocational preparation, aptitudes, temperaments, physical demands, and environmental conditions.

Many characteristics are recorded using a multi-point rank system. The variable Reasoning gives a typical example (descriptions come from U.S. Department of Labor (1972)). This variable describes an occupation's requirement on workers' ability to perform reasoning tasks and takes on the integer value from 1 (simplest) to 6 (most difficult) with details as follows:

1. Apply commonsense understanding to carry out simple one- or two-step instructions. Deal with standardized situations with occasional or no variables in or from these situations encountered on the job.

2. Apply commonsense understanding to carry out detailed but uninvolved written or oral instructions. Deal with problems involving a few concrete variables in or from standardized situations.

3. Apply commonsense understanding to carry out instructions furnished in written, oral, or diagrammatic form. Deal with problems involving several concrete variables in or from standardized situations.

4. Apply principles of rational systems to solve practical problems and deal with a variety of concrete variables in situations where only limited standardization exists. Interpret a variety of instructions furnished in written, oral, diagrammatic, or schedule form.

5. Apply principles of logical or scientific thinking to define problems, collect data, establish facts, and draw valid conclusions. Interpret an extensive variety of technical instructions in mathematical or diagrammatic form. Deal with several abstract and concrete variables.

6. Apply principles of logical or scientific thinking to a wide range of intellectual and practical problems. Deal with nonverbal symbolism (formulas, scientific equations, graphs, musical notes, etc.) in the most difficult phases. Deal with a variety of abstract and concrete variables. Apprehend the most abstruse clauses of concepts.

Other characteristics are recorded by a binary variable. Take the variable Climb as an example. If the occupation involves its workers' climbing movement, then the variable takes on unity and zero otherwise.

4.3 Principal Component Analysis

We use the DOT to derive task intensity indices for individual occupations. However, if we include every single characteristic variable in the fundamental task set, then the task space has too many dimensions and it will impose too heavy a burden on computation. In fact, if taking a closer look at all the DOT characteristic variables, one finds that many of them are closely correlated and that they essentially measure a same thing. For instance, it seems acceptable to say that the Mathematical variable and the Numerical variable both measure an occupation's skill requirement on crunching numbers. In practice, economists use the technique of Principal Component Analysis

(PCA)[10] to summarize the DOT information and to lower the number of task space dimensions. The PCA is based on the assumption that the information contained in a large number of variables can be represented by a small number of synthesized variables, and a set of weight coefficients (called factor loadings) are estimated so that the variation in the original data is maximized in the framework of synthesized variables.

There exist two different PCA approaches used by previous studies, based on different assumptions. The first approach assumes that a subset of DOT variables measures only one task and not other tasks. The second approach assumes that all DOT variables measure all tasks and these tasks are orthogonally distributed. The former approach requires a priori knowledge on the nature of DOT variables and fundamental tasks. While this knowledge is not required by the latter approach, it is sometimes difficult to assign a meaningful task name to a synthesized variable. Research that applies the first approach include Autor et al. (2003), Bacolod and Blum (2010) and Yamaguchi (2012). Studies like Ingram and Neumann (2006) and Poletaev and Robinson (2008) use the second approach. There is no general conclusion on which approach is better than the other, as can be seen by the fact that researchers use both methods. This article follows Yamaguchi (2012) closely and takes the first approach. In Yamaguchi (2012), the author's assumptions are reasonable, and moreover he also performs a robustness check using the second approach, which yields very similar results.

In particular, we follow Yamaguchi (2012) by assuming that there exists a set of two fundamental tasks: cognitive task and motor task.[11] Moreover, we choose the same subset of DOT variables as in Yamaguchi (2012) for individual fundamental tasks. Specifically, 11 DOT variables are assumed to measure only the cognitive task: Data, People, Reasoning, Mathematical, Language, Intelligence, Verbal, Numerical, Influencing People, Accepting Responsibility for Direction, and Dealing with People; 15 DOT variables are assumed to measure only the motor task: Things, Motor Coordination, Finger Dexterity, Manual Dexterity, Eye-hand-foot Coordination, Spatial Perception, Form Perception, Color Discrimination, Setting Limits, Tolerance or Standards, Strength, Climb, Stoop, Reach, Talk, and See.

Note that all DOT characteristics are order variables or dummy variables, and are

[10] or factor analysis, a closely related technique, which in practice yields very similar results as the PCA though conceptually the two techniques are different.

[11] The choice of the task set is essentially an art, subject to a researcher's discretion. Autor et al. (2003) consider 4 tasks: nonroutine analytic, nonroutine interactive, routine cognitive, and routine manual. In Bacolod and Blum (2010), the set consists of cognitive, motor, people, and physical strength. Ingram and Neumann (2006) elect to use a set of 4 tasks: intelligence, fine motor, coordination, and strength. Poletaev and Robinson (2008)'s task set has 3 elements: general intelligence, fine motor, and physical strength. The specific choice depends firstly on the research objective. Researchers also have other considerations: the number of basic tasks should not be too small, otherwise some useful information contained in the DOT will be wasted; on the other hand, the number should not be too large, either, or the economic model's computational cost would be too high.

thus ordinal. However, as discussed in Section 3.1, to use the desired angle measure of occupation distance, it is important that the intensity indices be cardinal for each individual occupation and are comparable across tasks. In Autor et al. (2003) and Yamaguchi (2012)[12], the authors tackle the issue carefully and use a specific data set to help transform the original ordinal DOT scores to some cardinal values. The key data they use is the augmented April 1971 CPS file released by the National Academy of Sciences (2001), in which experts assign individual DOT occupation codes and characteristics to the 60,441 respondents in the sample. After getting the principal components from the DOT, they convert them into cardinal-flavored percentile scores[13] with the help of employment weights in the augmented April 1971 CPS file. We solve the problem in the spirit of their strategy but with a slight modification. In particular, we convert the original DOT ranking scores into percentile scores[14] using the employment weights in the augmented April 1971 CPS file before doing PCA. By this way we assure that all the obtained task intensity indices fall in the range of $[0, 1]$ and have a percentile meaning. As mentioned early and to be discussed in the next subsection, DOT is a much-finer occupational classification than 1-, 2-, and 3-digit occupational classifications. With DOT-level occupational task indices at hand, it is easy to aggregate them into the 1-, 2-, and 3-digit level task indices.

Table 4 lists summary statistics of the cognitive and motor intensity indices for 1-, 2-, and 3-digit occupations, respectively.[15] Take 3-digit occupations as an example, the physician's position (84) requires the most intensive cognitive skill, while the garbage collector's position (875) needs the least intensive cognitive skill; as for the motor task, the electrical and electronic equipment assembler's position (683) is the most demanding, whereas the religious worker, not elsewhere classified (177) is the least challenging.

Note that various occupations demonstrate different intensity combinations of the cognitive and motor tasks. The following four 3-digit occupational titles provide four extreme examples. Veterinarians (86) have high index numbers on both dimensions: 0.970 of cognitive intensity index and 0.980 of motor intensity index (this order of task intensity indice is followed by subsequent examples). The position of ushers (462) is an opposite example with both index numbers low (0.270 and 0.443). Religious worker, not elsewhere classified (177) gives an example of a high cognitive index and a low motor index (0.944, 0.235). Lastly, textile sewing machine operators (744) see the combination of a low cognitive index and a high motor index (0.291, 0.915).

Yamaguchi (2012) shows that great heterogeneity of task human capital exists in

[12]He follows the method in Autor et al. (2003).

[13]As a normalization, the scores are divided by 100 so that the results range from 0 to 1.

[14]Again, they are normalized by a division with 100.

[15]The results come from the PCA analysis of the April 1971 CPS file. However, some occupational titles are not observed in the CPS data. So the number of observed titles are sometimes less than that listed in various classifications. For 1-digit occupations, we have 20 observed vs. 20 listed; for 2-digit occupations, we have 56 observed vs. 58 listed; and for 3-digit occupations, we have 423 observed vs. 501 listed.

a given 1-digit occupational title. He finds that there is considerable task complexity variation of 3-digit occupations within a 1-digit occupational aggregate. He decomposes the total task complexity variance into the within-group and between-group variances and finds that the former accounts for more than 50% of the total variance for both the cognitive and motor tasks. He continues to draw 3-digit occupations that belong to two different 1-digit occupational groups on a same scatter plot and finds a significant overlap. So he argues that the idea that a certain 1-digit occupation is uniformly more skill-demanding than the other is debatable. Table 4 in the current article reinforces the above finding. Note that the 1-, 2-, and 3-digit occupations that require the most intensive motor task are construction and extractive occupations (16), veterinarians (27), and electrical and electronic equipment assemblers (683), respectively. However, the 3-digit occupation 683 does not belong to the 2-digit occupational group 27, and moreover, the 2-digit occupation 27 does not belong to the 1-digit occupational aggregate 16, either.

Table 5 lists summary statistics on the angle measure of occupation distance based on Equation (2). They are in the units of radians. The average non-self distances for 1-, 2-, and 3-digit classifications are 0.256, 0.298, and 0.456, respectively. For 1-digit occupations, the largest distance exists between social scientists, social workers, religious workers, and lawyers (4) and handlers, equipment cleaners, helpers, and laborers (20), and the smallest distance between registered nurses, pharmacists, dietitians, therapists, and physician's assistants (7) and technologists and technicians, except health (10). Among 2-digit occupations, the position of lawyers and judges (21) and the position of handlers, equipment cleaners, and laborers (87) lie farthest to each other, while the position of teachers, except postsecondary institutions (23) and the position of insurance, securities, real estate and business service sales occupations (41) lie closest to each other. For 3-digit occupations, the position of religious workers, not elsewhere classified (177) and the position of garbage collectors (875) generate the maximum distance, whereas the position of chemical technicians (224) and the position of general office clerks (379) constitute the minimum distance. The distances of some above pairs may not seem intuitive. But please bear in mind that this distance measure is based on the intensity combination of basic tasks, not the knowledge occupations make use of. And it is very difficult, if not impossible, to compare the distances among several sets of knowledge.

4.4 Occupational and Industrial Classifications

An occupational (industrial) classification is a collection of occupation (industry) titles and is usually organized using a hierarchical structure. For instance, the U.S. Census 1990 occupational classification, based on which SIPP codes its respondents' occupational affiliations, lists 501 finest occupational titles, and they are aggregated into 13 Major Groups and further into 6 Summary Groups. Because SIPP1996 is the main data set used in this paper and upon which the wage regressions are run, we take the

501-title classification as a reference and call it the 3-digit classification. The Census 1990 occupational classification in turn is built upon the 1980 Standard Occupational Classification (SOC1980) system. SOC1980 is an occupational classification of 4 layers: 664 Units, 224 Minor Groups, 58 Major Groups and finally 20 Divisions. In this article, we take the 20 Divisions and the 58 Major Groups as 1-digit and 2-digit occupations, respectively. Because the Census 1990 occupational classification is derived from SOC1980, the crosswalk is readily available. Appendix B lists the Census 1990 occupational classification and Appendix C shows the SOC1980 system.

Similarly, SIPP1996 adopts the U.S. Census 1990 industrial classification as the reference to code its respondents' industrial affiliations. The collection consists of 235 finest industrial titles, and they are aggregated into 13 Major Groups. I take the 235-title classification as a reference and call it the 3-digit classification. The Census 1990 industrial classification is developed from the 1987 Standard Industrial Classification (SIC1987) system, which, analogous to SOC1980, holds a four-layer hierarchical structure: 1503 Industries, 504 Industry Groups, 82 Major Groups and finally 10 Divisions. The current paper takes the 10 Divisions and the 82 Major Groups as 1-digit and 2-digit industries, respectively. Again, since the Census 1990 industrial classification is derived from SIC1987, the crosswalk is readily available.

There is a need to match the occupational titles in the SIPP1996 and in the DOT: the former is the main data set on which wage regressions are based, and the latter is the source to extract task intensity indices. We solve this technical difficulty in an indirect manner. The key is the augmented April CPS file. This data set can bridge the gap since in this file every worker's occupational affiliation is coded using both the DOT classification and the 1977 Standard Occupational Classification (SOC1977). Recall that the Census 1990 occupational classification, which SIPP1996 adopts as its benchmark, is developed from SOC1980. And SOC1980 is a revised version of SOC1977 and they are actually very similar. Therefore, we have been able to construct a crosswalk between them[16], so that the SIPP data and the DOT are finally linked.

5 Empirical Results of Returns to the General Occupational Tenure

5.1 Regression Results

Recall that we modify the KM wage regression framework to accommodate the new concept of General Occupational Tenure and to estimate its returns.[17] The new wage regression shares an important feature with the KM regression: for a wage regression, in the presence of occupational tenure variables (now the General Occupational Tenure), the returns to the industrial tenure and the employer tenure are not impor-

[16]The crosswalk between SOC1980 and SOC1977 is available upon request.

[17]Refer to Section 3.2 for details.

tant. As an example, Table 6 lists the coefficient estimates for the regression under 1-digit occupational classification. The coefficients on employer tenure, industrial tenure and their squared terms are in general insignificant with very large p-values. This is also true for regressions under 2- and 3-digit occupational classifications. Also note that the General Occupational Tenure is constructed under the assumptions that all occupations are uniquely distinct and that the General Occupational Tenure is partially transferable. Conceptually, the General Occupational Tenure is equivalent to the synthesized task-associated tenures. Therefore, our result also echoes Gathmann and Schonberg (2010)'s finding that it is the task-specific human capital that matters. Our approach, namely, studying the occupational human capital through the lens of task-specific human capital, turns out able to reconcile the two seemingly contradictionary views of the occupational specificity of human capital and the task specificity of human capital. If one eyes an occupation nothing more than a specific usage of the fundamental task bundle, then the two views are talking about the same thing and there is no conflict at all.

Just as the wave-particle duality of light, we have emphasized the duality of the General Occupational Tenure: it is both specific and general, specific because it is naturally associated with a ("target") occupation, and general because it is partially transferable. As the name indicates, we stress the general aspect in this paper, both because the specific aspect is intuitive and widely accepted, which serves as a logical foundation for the conventional occupational tenure; and because it is novel to investigate the occupational tenure using the task-approach and everything follows the two assumption deviations. Exactly due to this general aspect, we say that the occupational human capital is more portable than previously considered, which is reminiscent of Gathmann and Schonberg (2010)'s conclusion that human capital is more portable than people think.

As discussed in Section 3.2, the returns to the General Occupational Tenure consist of the fixed and the variable parts. For any given occupation, the fixed return is the estimated intercept, and the variable return involves the General Occupational Tenure and its squared terms. Table 7 lists the empirical results.[18] First, there is considerable variation of the returns to General Occupational Tenure across different occupations. The mean of General Occupational Tenure is roughly 13 years for all three occupational classifications and so we use it as a benchmark value. The summary statistics are calculated for a worker who has 13 years of General Occupational Tenure, for 1-, 2-, and 3-digit occupational classifications, respectively[19]. Take 3-digit occupations as

[18]All the values are calculated on the basis of point estimates of coefficients on the General Occupational Tenure-related variables in the wage regression Equation (3), with insignificant estimates (10% significance level) evaluated at zeros.

[19]The number of identifiable occupations is listed on the last row of Table 7. Some occupations' return coefficients cannot be identified because too few observations fall in their cells. This problem is especially pronounced for the 3-digit occupational classification due to its large number of occupational titles. In the end, 19 1-digit occupations, 37 2-digit occupations, and 274 3-digit occupations are identified.

an example, as Section A of Table 7 shows, given 13 years of General Occupational Tenure, the largest return a 3-digit occupation generates is 14.60 while the smallest -14.41. Compared to the mean return(0.88), its standard deviation (1.65) is big. Second, among the two components that constitute the total return, the fixed return in general dominates the variable return. Section B of Table 7 lists the fixed return. In Section C, the variable return is calculated according to 3 different levels of the General Occupational Tenure: 6 years (roughly 25 percentile of the General Occupational Tenure for all three occupational classifications), 12 years (50 percentile), and 19 years (75 percentile). It is evident that the mean fixed return is significantly larger than the mean variable return at all three levels, under all three occupational classifications. Moreover, the remark is strengthened by the fact that the fixed return has a smaller standard deviation than the variable return. Third, the fixed return and the variable return is inversely related and thus a tradeoff exists between the two components. Section D shows the coefficients of correlation between the fixed and variable returns at the 3 different levels that appear in Section C for 1-, 2-, and 3-digit occupational classifications, respectively. As can be seen in the table, in almost all cases, the two returns are strongly negatively correlated.

5.2 Discussion

The extended wage regression proposed in this paper, namely, using the General Occupational Tenure to replace the conventional occupational tenure, starts from a conceptual innovation, where occupations are analyzed using the task-based approach. But empirically, is General Occupational Tenure a better alternative to conventional occupational tenure? This subsection takes a closer look at this issue.

Firstly let us look at the distribution of conventional occupational tenure for a given level of General Occupational Tenure. Recall that the General Occupational Tenure comes from two sources: heritage from the previous occupations, and accumulation from the current occupation. If the accumulation part accounts for a big chunk, then the substitution of the General Occupational Tenure for the conventional occupational tenure will not make a big difference. On the other hand, if the heritage part plays an important role, then the replacement is meaningful.

Table 8 lists a set of summary statistics of the conventional occupational tenure, namely the accumulation part, given a specific General Occupational Tenure level, for 1-, 2-, and 3-digit occupations, respectively. In particular, for each General Occupational Tenure level, the table shows the mean and the coefficient of variation of the conventional occupational tenure. Moreover, the table also contains a statistic which equals the 50 percentile of the conventional occupational tenure divided by the given General Occupational Tenure. This statistic reveals an upperbound share of the accumulated part for half of the workers (or equivalently, one minus this statistic reveals a lowerbound share of the inherited part for half of the workers). And again, three representative General Occupational Tenure levels are considered in the table: 6 years

(25 percentile), 12 years (50 percentile), and 19 years (75 percentile).

Table 8 provides supportive evidence of the important role the heritage part plays. For instance, given 6 years of General Occupational Tenure, the mean accumulated part is only around 2.7 years for all three occupational classifications, or roughly 40% of the General Occupational Tenure. Moreover, the conventional occupational tenure demonstrates considerable dispersion with the coefficients of variation varying around 0.80 for all classifications. Furthermore, half of the workers accumulate less than one third of the given 6 years of General Occupational Tenure, or equivalently, half of the workforce obtains at least two thirds of the General Occupational Tenure from heritage. Although the table shows that as the General Occupational Tenure increases, importance of the accumulated part rises with its dispersion shrinking, the inherited part's role still cannot be ignored.

Secondly, we run some nested wage regressions which include both General Occupational Tenure and conventional occupational tenure as independent variables. It is found that, in the presence of General Occupational Tenure variables, the estimated coefficients on conventional occupational tenure variables are basically not significant. This finding tends to support that variation of the General Occupational Tenure is more important in accounting for variation of the log real wage and hence the General Occupational Tenure is a more suitable variable in a wage regression than the conventional occupational tenure.

More specifically, two groups of nested wage regressions are performed. The first group is a constrained nested wage regression by adding the General Occupational Tenure variable and its squared and cubed terms in the regression function (1). It is constrained in the sense that the return coefficients are restricted to be same across occupations. The second group is an unconstrained nested wage regression by adding the conventional occupational tenure variable and its squared term in the regression function (3). It is unconstrained because like (3), the return coefficients are occupation-specific and can be different across occupations. However, there is a limitation for the nested regressions: Altonji and Shakotko (1987)'s instrumental variable method cannot be used in this context. Because the instrument for the General Occupational Tenure is always the same as that for the conventional occupational tenure, the number of instruments are less than the number of endogenous variables and the system is underidentified. Therefore, only GLS is applied to take care of individual-level serial correlations. It is evident that the estimates would be biased. However, the aim of this exercise is not to obtain a set of consistent estimated coefficients. Due to that estimated coefficients on the General Occupational Tenure variables and on the conventional occupational tenure variables tend to be biased in the same direction, the biased estimates can still provide some clues on which occupational tenure variables, General or conventional, are more relevant in a wage regression.

Table 9 lists coefficient estimates on conventional occupational tenure variables and General Occupational Tenure variables for the constrained nested wage regression under all three occupational classifications. In general, the estimated coefficients

on General Occupational Tenure variables are significant; whereas the estimated coefficients on conventional occupational tenure variables are not. Table 10 reports summary statistics for the unconstrained nested wage regressions. Because the return coefficients are occupation-specific and the numbers of occupations are big under 2- and 3-digit classifications, the table only reports the percentages of significant estimates for different classes of tenure variables. It can be seen that for 1- and 3-digit occupations, the percentage of significant estimates is higher for General Occupational Tenure variables than for conventional occupational tenure variables, but for 2-digit occupations, the conclusion is reversed. Jointly, Tables 9 and 10 tend to convey the message that the wage variability is more closely related with variability of the General Occupational Tenure and therefore this new tenure variable is a more appropriate independent variable in a wage regression.

6 Limiting Case and Convergence

Recall that magnitude of the General Occupational Tenure depends crucially on the Transfer Rate function. Given a specific Transfer Rate function, Equation (2), we find the previous three patterns. A natural question is, do they still hold under other Transfer Rate function assumptions? To answer this question, we consider the extreme case and show that a family of convexly decreasing Transfer Rate functions converge to it as the discounting becomes increasingly heavy. For the limiting case, the three patterns are still valid. This tends to support a yes answer to the question raised, at least for the special set of Transfer Rate functions.

Consider the conventional assumption in the occupational literature, namely, occupational human capital is purely specific and not transferable across occupations. This simplifying scenario constitutes the limiting case of the General Occupational Tenure. When the discounting of a Transfer Rate function becomes infinitely heavy, an individual suffers 100% loss of his or her occupational human capital, measured by tenure, when he or she switches occupation. In this case, the wage regression (3) would reduce to an occupation-specific version of the KM wage regression (1).[20]

We perform the occupation-specific version of the KM wage regression for this extreme case and report the empirical results in Table 11, which has exactly the same layout as Table 7. It is obvious that all three conclusions based on Table 7 continue to hold for Table 11, the limiting case. Firstly, the variation of returns to (General) Occupational Tenure is still large across occupations. As Table 11's Section A shows, while 1- and 2-digit occupations see slightly less spreading in their return distributions than in Table 7, the 3-digit occupation's return demonstrates much more variation. Secondly, in most cases, the fixed return is significantly larger than the variable return. Comparing the numbers in Section B and in Section C, we find this is true for all three classifications. Thirdly, the fixed return and the variable return is still negatively

[20]More accurately, the cubed terms in the KM wage regression are removed.

correlated in Table 11 (Section D), though not as strongly as in Table 7 and so the tradeoff continues to exist.

As argued in Section 3.1, it is intuitively appealing to assume a convexly decreasing Transfer Rate function. In fact, the baseline Transfer Rate function $TransRate(\theta) = (-\frac{2}{\pi}\theta + 1)^5$ is a convex transformation of the linear function $TransRate(\theta) = -\frac{2}{\pi}\theta + 1$ which yields 1 when θ equals 0 and 0 when θ equals $\pi/2$. It is very easy to make this linear function more or less convex by changing its exponent, and so we focus on the family of Transfer Rate functions that are convexly transformed from the above linear function. In particular, we raise the power of the linear function to 3, 7, 11, and 15, respectively to achieve increasingly heavy discounting, in addition to 5, the baseline value. The limiting case can be reached by setting the power to plus infinity, where $TransRate(\theta)$ equals 1 when θ equals 0 and 0 when θ takes on all the other values.

Table 12, again under all three occupational classifications, lists the statistics based on various Transfer Rate function assumptions and clearly demonstrates a converging tendency. Each row indicates a Transfer Rate function and the numbers in the leftmost column are the values of the exponents for the corresponding Transfer Rate functions. There are 4 columns of statistics for a given occupational classification: from left to right, the first column lists the average non-self transfer rate which shows the degree of discounting, and as the value of the exponent turns bigger the discounting becomes heavier and thus the mean transfer rate smaller; columns 2 to 4 list the euclidean distances between the point estimates based on a given Transfer Rate function with the indicated exponent value and the point estimates based on the limiting case Transfer Rate function (exponent equal to plus infinity) for occupation-specific constant coefficients, linear coefficients, and quadratic coefficients, respectively. Recall that for wage regression of the General Occupational Tenure, Equation (3), the return for an individual occupation takes a quadratic structure. Because the constant, linear, and quadratic coefficients display obviously different orders of magnitude, the three groups' distances are calculated separately. As can be seen in Table 12, with the exponent value approaching plus infinity, the distances of the constant, linear, and quadratic coefficients become smaller and smaller, for 1-digit and 2-digit occupational classifications. Under 3-digit occupational classification, the pattern firmly holds for the constant distance and generally holds for the linear distance. However, the expected convergence does not appear for the quadratic distance, given the experimented values of exponents. It could be the case that the converging pattern resumes for the quadratic distance as larger exponents are tried.

Tables 11 and 12, in conjunction with Table 7, reveal an appealing finding. With the increase of the exponent value, the family of Transfer Rate functions investigated converge to the limiting-case Transfer Rate function with a plus infinity exponent. And the limiting case shares the same three patterns with the baseline model. Therefore, it is reasonable to argue that the three patterns of the returns to General Occupational Tenure apply to the whole family of Transfer Rate functions. It may not be too mistaken to conjecture that these results will also hold for a larger set of convexly

decreasing Transfer Rate functions, an even broader generalization.

The generalization basically lowers importance of the specific choice of the baseline exponent value, 5. As mentioned in Section 3.1, the value of 5 helps yield desirable calibration results in Xiong (2015). In this section, we further show that this is a satisfactory choice in a goodness-of-fit sense. Table 13 lists the Root Mean Squared Errors (MSE) for various choices of the exponent value in the Transfer Rate function under all three occupational classifications. In general, a smaller Root MSE indicates a better fit of the regression.[21] According to Table 13, it seems that as the exponent rises or the discounting becomes heavier, the Root MSE displays an inverse U shape for 1-digit occupations, a monotonically increasing trend for 2-digit occupations, and a U shape for 3-digit occupations. Because intuitively it is believed that a Transfer Rate function is convexly decreasing, the exponent value should be greater than unity. Among the choices listed in the table, 5 is acceptable under all three occupational classifications in that it helps generate a relatively low Root MSE in all three scenarios.

7 Conclusion

In this article, we show that the task specificity of human capital is in line with the occupational specificity of human capital, by studying the returns to occupational human capital using a task-based approach, more specifically, under the assumptions that all occupations are uniquely distinct and that occupational human capital is partially transferable. We name the associated tenure variable "General Occupational Tenure" and propose an empirical Transfer Rate function that relates its transferable portion with the occupation distance. Combining SIPP data and task information from the DOT, we perform generalized wage regressions under 1-, 2-, and 3-digit occupational classifications and find that "General Occupational Tenure" is more important than other tenure variables. Moreover, three salient patterns are revealed: returns to the General Occupational Tenure demonstrate great variation across occupations; the fixed return generally dominates the variable return; and the two are always negatively correlated. Finally we generalize this result by showing that they actually apply to a large family of convexly decreasing Transfer Rate functions: as the discounting becomes heavier these functions converge to the limiting case where the three patterns hold.

We start by repeating KM's econometrical exercise using the SIPP data and get a result analogous to theirs: including a worker's occupational tenure in a wage regression makes other tenure variables less important. This lends support to the view that human capital tends to be occupation-specific rather than firm-specific or industry-specific. we continue to extend KM's framework in two important aspects: the occupation-specific returns are allowed and the occupational tenure is assumed to

[21] The extended wage regression (3) does not contain a constant regressor and thus the conventional R^2 cannot be used here.

be partially transferable. The two extensions are actually based on one fundamental deviation from the traditional simplifying assumption that all occupations are uniformly distinct and so the occupational human capital is equally non-transferable. The new underlying assumption stresses the heterogeneity existing amongst occupations. Because occupations are very different, the returns should be occupation-specific. Because occupations are not uniformly distinct, some occupations are closer to each other and others are farther, and thus the occupation distance should determine how transferable the occupational human capital is between a given pair of occupations. Then the Transfer Rate function comes into play in tracking the General Occupational Tenure.

we face two technical challenges in this project. Firstly, in constructing the favored distance measure, it is important that the intensity indices be cardinal and comparable across tasks. We use the augmented April 1971 CPS file to tackle this problem. This data set codes individuals' occupations using both the DOT and other popular occupational classifications and it contains the DOT rank information for every respondent. Using the employment distribution across occupations, we compute the percentile of each DOT score for each respondent. Then we use the percentile-based value to replace the ordinal DOT score. Secondly, to link the SIPP data on which the wage regression is based and the DOT information where the task intensity indices come from, we must find a crosswalk between the two occupational classification systems. Although there is no direct crosswalk, we use an indirect approach. SIPP adopts the Census 1990 classification which in turn is based on the SOC1980, whereas April 1971 CPS contains SOC1977 codes. The SOC1980 is an update of the SOC1977 and they are similar, so we are able to construct a crosswalk between them.

Note that the limiting case for the convergence is a special version of the KM wage regression. It assumes nontransferability of human capital across occupations, same as KM do. But it allows for occupation-specific occupational returns. In this sense, it is a generalization of KM and KM provide an "average" estimate of occupational returns. But obviously, Equation (3) is a further generalization.

In the future research, if one can prove that a shock to occupational returns dissipates as occupation distance increases and can find an empirical relationship between them, then a scalar (occupation distance) can replace the occupational title and therefore a discrete occupational choice model can be turned into a continuous occupational choice model. As a result, the computational constraint will be no longer a major concern and the occupation set in a structural model can be greatly enlarged, such that it is closer to the real economy and more suitable for the policy analysis.

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Table 1: KM Wage Regressions Estimates

	1-Digit	2-Digit	3-Digit
EmpTen	-0.00197	-0.00188	-0.000857
	(0.00203)	(0.00209)	(0.00212)
EmpTenSq	0.0000581	0.0000527	0.0000173
	(0.0000821)	(0.0000854)	(0.0000872)
WorkExp	0.0848***	0.0856***	0.0858***
	(0.00799)	(0.00763)	(0.00782)
WorkExpSq	-0.00148***	-0.00156***	-0.00156***
	(0.000340)	(0.000335)	(0.000344)
WorkExpCb	0.00000962*	0.0000106**	0.0000101**
	(0.00000504)	(0.00000502)	(0.00000512)
IndTen	0.00431	0.00155	0.00178
	(0.00669)	(0.00671)	(0.00723)
IndTenSq	-0.000607	-0.000325	-0.000501
	(0.000573)	(0.000581)	(0.000587)
IndTenCb	0.00000717	0.00000148	0.00000626
	(0.0000123)	(0.0000124)	(0.0000121)
OccTen	0.0102	0.0127**	0.0112
	(0.00628)	(0.00642)	(0.00688)
OccTenSq	-0.00118**	-0.00139**	-0.00112*
	(0.000562)	(0.000572)	(0.000574)
OccTenCb	0.0000235*	0.0000282**	0.0000224*
	(0.0000122)	(0.0000123)	(0.0000120)
OJ	0.00353	0.00328	0.00327
	(0.00277)	(0.00281)	(0.00288)
Observations	45320	44098	42346
Individuals	6832	6680	6467

NOTES: The dependent variable is the log real wage. Other covariates include an intercept, years of schooling with squared term, 1-digit occupation and industry dummies, union dummy, marital status dummies, region dummies, race dummies, and Rotation Group dummies. IV-GLS estimation method is used. Refer to Regression Equation (1) in the text. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Returns to Tenure, KM Wage Regressions

	1-Digit			2-Digit			3-Digit		
	2 years	5 years	8 years	2 years	5 years	8 years	2 years	5 years	8 years
Occupation	.016	.024	.018	.020	.032	.027	.018	.031	.029
	(.135)	(.231)	(.474)	(.064)	(.119)	(.285)	(.123)	(.176)	(.294)
Industry	.006	.007	-.001	.002	-.000	-.008	.002	-.003	-.015
	(.583)	(.742)	(.978)	(.874)	(.992)	(.773)	(.897)	(.907)	(.624)
Employer	-.004	-.008	-.012	-.004	-.008	-.012	-.002	-.004	-.006
	(.329)	(.324)	(.322)	(.362)	(.353)	(.347)	(.677)	(.663)	(.649)

NOTES: P-values are in parentheses. Returns to various tenures are calculated based on the coefficient estimates of Regression Equation (1).

Table 3: Descriptive Statistics

	Mean	Std. Dev.
Age	38.30	10.61
Years of schooling	12.23	2.27
Percent married (%)	66.30	
Percent unionized (%)	28.47	
Percent white (%)	86.10	
WorkExp (yrs)	19.40	10.62
EmpTen (yrs)	5.48	7.54
OccTen (yrs)		
1-digit	9.31	9.53
2-digit	9.19	9.52
3-digit	8.93	9.53
IndTen (yrs)		
1-digit	9.55	9.54
2-digit	9.29	9.54
3-digit	9.19	9.55
GOccTen (yrs)		
1-digit	13.86	9.10
2-digit	13.36	9.08
3-digit	13.49	9.14

NOTES: WorkExp, EmpTen, OccTen, IndTen, and GOccTen refer to labor market work experience, employer tenure, occupational tenure, industrial tenure, and General Occupational Tenure, respectively. In principle, the 1-digit mean of GOccTen should be the largest, and the 3-digit mean the smallest, among the three. However, when wage regressions are performed, some occupations have too few observations in the cell and thus the corresponding workers are deleted. So the mean GOccTen is calculated based on 3 different samples for the 3 occupational classifications. Specifically, the 2-digit sample is a subset of the 1-digit sample, and the 3-digit sample is a subset of the 2-digit sample.

Table 4: Summary Statistics of Task Intensiveness Indices

	Cognitive Task		
	1-Digit	2-Digit	3-Digit
Max	1 (6)	1 (26)	1 (84)
Min	.257 (20)	.256 (87)	.194 (875)
Mean	.737	.736	.646
Std. dev.	.218	.227	.229
	Motor Task		
	1-Digit	2-Digit	3-Digit
Max	1 (16)	1 (27)	1 (683)
Min	.456 (4)	.354 (21)	.235 (177)
Mean	.798	.711	.742
Std. dev.	.164	.186	.174
Obs	20	56	423

NOTES: Results come from the PCA analysis of the augmented April 1971 CPS file. In parentheses are corresponding occupation codes. In particular, for 1-digit occupations, 6 refers to Health Diagnosing and Treating Practitioners; 20 refers to Handlers, Equipment Cleaners, Helpers, and Laborers; 16 refers to Construction and Extractive Occupations; and 4 refers to Social Scientists, Social Workers, Religious Workers, and Lawyers. For 2-digit occupations, 26 refers to Physicians and Dentists; 87 refers to Handlers, Equipment Cleaners, and Laborers; 27 refers to Veterinarians; and 21 refers to Lawyers and Judges. For 3-digit occupations, 84 refers to Physicians; 875 refers to Garbage Collectors; 683 refers to Electrical and Electronic Equipment Assemblers; and 177 refers to Religious Workers, n.e.c. (not elsewhere classified). In the data, the numbers of observed occupational titles for 1-, 2-, and 3-digit occupational classifications are 20, 56, and 423, respectively.

Table 5: Summary Statistics of Angle Occupation Distances (in radians)

	1-Digit	2-Digit	3-Digit
Max	.804 (4_20)	.894 (21_87)	1.050 (177_875)
Min	.007 (7_10)	.0001 (23_41)	.00000315 (224_379)
Mean	.256	.298	.456
Std. dev.	.175	.211	.278

NOTES: Theoretically, the angle occupation distance ranges from 0 to $\pi/2$. In parentheses are corresponding occupation pairs in terms of occupation codes. In particular, for 1-digit occupations, 4 refers to Social Scientists, Social Workers, Religious Workers, and Lawyers; 20 refers to Handlers, Equipment Cleaners, Helpers, and Laborers; 7 refers to Registered Nurses, Pharmacists, Dietitians, Therapists, and Physician's Assistants; and 10 refers to Technologists and Technicians, Except Health. For 2-digit occupations, 21 refers to Lawyers and Judges; 87 refers to Handlers, Equipment Cleaners, and Laborers; 23 refers to Teachers, Except Postsecondary Institutions; and 41 refers to Insurance, Securities, Real Estate and Business Service Sales Occupations. For 3-digit occupations, 177 refers to Religious Workers, n.e.c. (not elsewhere classified); 875 refers to Garbage Collectors; 224 refers to Chemical Technicians; and 379 refers to General Office Clerks.

Table 6: Generalized Wage Regression Estimates, 1-Digit

EmpTen	-0.000281	GOccTen17	-0.0101	GOccTenSq19	0.000314
	(0.0021)		(0.0125)		(0.0003)
EmpTenSq	-0.0000635	GOccTen18	-0.0157*	GOccTenSq20	-0.000356
	(0.0001)		(0.0093)		(0.0003)
WorkExp	0.0779***	GOccTen19	-0.0104	Occ1	0.819***
	(0.0067)		(0.0108)		(0.1423)
WorkExpSq	-0.000909***	GOccTen20	0.0110	Occ2	1.028***
	(0.0001)		(0.0109)		(0.3471)
IndTen	0.00330	GOccTenSq1	0.000955**	Occ3	0.128
	(0.0037)		(0.0004)		(0.3747)
IndTenSq	-0.000406***	GOccTenSq2	-0.000661	Occ4	0.534
	(0.0001)		(0.0010)		(0.3983)
GOccTen1	-0.0308**	GOccTenSq3	-0.00203	Occ5	1.334***
	(0.0121)		(0.0012)		(0.2522)
GOccTen2	0.00505	GOccTenSq4	-0.00232	Occ7	1.595***
	(0.0379)		(0.0029)		(0.2576)
GOccTen3	0.102**	GOccTenSq5	0.00124**	Occ8	0.493*
	(0.0452)		(0.0005)		(0.2697)
GOccTen4	0.0411	GOccTenSq7	0.000931	Occ9	0.719***
	(0.0850)		(0.0007)		(0.2347)
GOccTen5	-0.0704***	GOccTenSq8	-0.000855	Occ10	0.933***
	(0.0182)		(0.0009)		(0.1782)
GOccTen7	-0.0621**	GOccTenSq9	-0.00209**	Occ11	0.665***
	(0.0269)		(0.0010)		(0.1348)
GOccTen8	0.0268	GOccTenSq10	0.000865*	Occ12	0.554***
	(0.0346)		(0.0005)		(0.1380)
GOccTen9	0.0479	GOccTenSq11	0.000546	Occ13	0.548***
	(0.0318)		(0.0004)		(0.1212)
GOccTen10	-0.0255	GOccTenSq12	0.0000617	Occ14	0.414***
	(0.0172)		(0.0003)		(0.1571)
GOccTen11	-0.0192	GOccTenSq13	0.000469	Occ15	0.916***
	(0.0130)		(0.0004)		(0.1246)
GOccTen12	-0.00183	GOccTenSq14	-0.000348	Occ16	0.771***
	(0.0133)		(0.0004)		(0.1235)
GOccTen13	-0.0145	GOccTenSq15	0.000476*	Occ17	0.727***
	(0.0118)		(0.0003)		(0.1408)
GOccTen14	0.0157	GOccTenSq16	-0.0000282	Occ18	0.724***
	(0.0163)		(0.0003)		(0.1159)
GOccTen15	-0.0230**	GOccTenSq17	0.000359	Occ19	0.584***
	(0.0099)		(0.0004)		(0.1325)
GOccTen16	-0.00420	GOccTenSq18	0.000404	Occ20	0.525***
	(0.0099)		(0.0003)		(0.1207)
Obs			45314		

NOTES: The dependent variable is the log real wage. Other covariates include years of schooling with squared term, Old Job dummy, 1-digit industry dummies, union dummy, marital status dummies, region dummies, race dummies, and Rotation Group dummies. IV-GLS estimation method is used. Occi, GOccTeni, and GOccTenSqi indicate the coefficients before I_i, $I_i \times GenOccTen$, and $I_i \times GenOccTen^2$, respectively. Refer to Regression Equation (3) in the text. Return coefficients for Occupation 6 (Health Diagnosing and Treating Practitioners) cannot be identified due to too few observations. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Returns to General Occupational Tenure, $TransRate(\theta) = (-\frac{2}{\pi}\theta + 1)^5$

	1-Digit	2-Digit	3-Digit
A. Total return (13 yrs, in log real wages)			
Max	1.324	2.073	14.596
Min	0	0	-14.414
Mean	.647	.669	.881
St. dev.	.286	.394	1.649
B. Fixed return (in log real wages)	.703	.639	.840
	(.382)	(.516)	(1.465)
C. Variable return (in log real wages)			
6 yrs	-.029	-.0001	-.030
	(.196)	(.256)	(.720)
12 yrs	-.052	.024	.024
	(.386)	(.478)	(1.652)
19 yrs	-.073	.083	.193
	(.611)	(.711)	(4.032)
D. Corr(fixed, variable)			
6 yrs	-.772	-.730	-.793
12 yrs	-.753	-.711	-.594
19 yrs	-.716	-.667	-.312
Obs	19	37	274

NOTES: Standard deviations are in parentheses. The mean of General Occupational Tenure is roughly 13 years for 1-, 2-, and 3-digit occupational classifications. And the 25, 50, and 75 percentiles of General Occupational Tenure are roughly 6 years, 12 years, and 19 years, respectively, for all three occupational classifications. Corr(fixed, variable) denotes the coefficient of correlation between the fixed and variable returns at a given General Occupational Tenure level. The numbers of occupations whose returns are identifiable in a wage regression are 19, 37, and 274 for 1-, 2-, and 3-digit occupations, respectively.

Table 8: Summary Statistics of OccTen for a Given GOccTen

	1-Digit	2-Digit	3-Digit
6 yrs GOccTen			
Mean(%)	2.75(42.3%)	2.69(41.3%)	2.64(40.6%)
CV	0.79	0.79	0.82
50pctl OccTen/GOccTen	35.9%	30.8%	30.8%
12 yrs GOccTen			
Mean(%)	6.40(51.2%)	6.57(52.6%)	6.28(50.3%)
CV	0.68	0.67	0.71
50pctl OccTen/GOccTen	55.2%	58.7%	53.3%
19 yrs GOccTen			
Mean(%)	12.88(66.1%)	14.20(72.8%)	13.63(69.9%)
CV	0.50	0.40	0.45
50pctl OccTen/GOccTen	78.6%	83.8%	82.1%

NOTES: OccTen and GOccTen refer to the conventional occupational tenure and the General Occupational Tenure, respectively. CV denotes the coefficient of variation. The 25, 50, and 75 percentiles of General Occupational Tenure are roughly 6 years, 12 years, and 19 years, respectively, for all three occupational classifications.

Table 9: Constrained Nested Wage Regressions Estimates

	1-Digit	2-Digit	3-Digit
OccTen	0.00163	-0.00872	-0.00592
	(0.00570)	(0.00568)	(0.00589)
OccTenSq	0.000243	0.00107**	0.000946*
	(0.000480)	(0.000477)	(0.000491)
OccTenCb	-0.00000279	-0.0000169*	-0.0000156
	(0.00000964)	(0.00000940)	(0.0000100)
GOccTen	0.0159***	0.0182***	0.0157***
	(0.00572)	(0.00552)	(0.00572)
GOccTenSq	-0.00100**	-0.00131***	-0.00106**
	(0.000407)	(0.000410)	(0.000423)
GOccTenCb	0.0000136*	0.0000197**	0.0000150*
	(0.00000771)	(0.00000799)	(0.00000840)
Observations	47935	46708	43073
Individuals	8405	8254	7713

NOTES: The dependent variable is the log real wage. Other covariates include an intercept, years of schooling with squared term, employer tenure with squared term, work experience with cubed and squared terms, industrial tenure with cubed and squared terms, 1-digit occupation and industry dummies, union dummy, marital status dummies, region dummies, race dummies, Old Job dummy, and Rotation Group dummies. GLS estimation method is used. Standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Fractions of Significant Estimates for Unconstrained Nested Wage Regressions (%)

	1-Digit	2-Digit	3-Digit
OccTen	10.53	18.92	35.90
OccTenSq	15.79	32.43	34.43
GOccTen	26.32	13.51	38.83
GOccTenSq	36.84	16.22	39.93

NOTES: The dependent variable is the log real wage. Covariates include years of schooling with squared term, employer tenure with squared term, work experience with squared term, industrial tenure with squared term, 1-digit industry dummies, union dummy, marital status dummies, region dummies, race dummies, Old Job dummy, and Rotation Group dummies; and following occupation-specific variables: intercept, conventional occupational tenure with squared term, and General Occupational Tenure with squard term. GLS estimation method is used.

Table 11: Returns to General Occupational Tenure, Limiting Case

	1-Digit	2-Digit	3-Digit
A. Total return (9 yrs, in log real wages)			
Max	1.317	1.526	38.291
Min	.330	0	-19.534
Mean	.714	.666	.754
St. dev.	.236	.271	3.005
B. Fixed return (in log real wages)	.734	.673	.828
	(.218)	(.261)	(.830)
C. Variable return (in log real wages)			
1 yr	.004	.001	.0003
	(.033)	(.041)	(.100)
5 yrs	.004	.002	-.020
	(.147)	(.174)	(.986)
15 yrs	-.099	-.038	-.218
	(.408)	(.363)	(8.427)
D. Corr(fixed, variable)			
1 yr	-.421	-.411	-.676
5 yrs	-.461	-.439	-.330
15 yrs	-.483	-.446	-.104
Obs	19	37	274

NOTES: Standard deviations are in parentheses. The results are for the limiting case where the General Occupational Tenure is assumed to be not transferable. In this scenario, the mean of General Occupational Tenure is roughly 9 years for 1-, 2-, and 3-digit occupational classifications. And the 25, 50, and 75 percentiles of General Occupational Tenure are roughly 1 year, 5 years, and 15 years, respectively, for all three occupational classifications. Corr(fixed, variable) denotes the coefficient of correlation between the fixed and variable returns at a given General Occupational Tenure level. The numbers of occupations whose returns are identifiable in a wage regression are 19, 37, and 274 for 1-, 2-, and 3-digit occupations, respectively.

Table 12: Euclidean Distances to Limiting Case's Coefficients

Exp	1-Digit				2-Digit				3-Digit			
	Trans	D_cons	D_lin	D_qudr	Trans	D_cons	D_lin	D_qudr	Trans	D_cons	D_lin	D_qudr
3	.617	1.365	.091	.0076	.574	2.263	.187	.0128	.591	20.228	1.899	.6359
5	.478	1.148	.069	.0074	.439	2.025	.151	.0127	.456	14.406	2.052	.6290
7	.386	.813	.063	.0061	.353	1.817	.142	.0085	.369	12.485	2.410	.6824
11	.272	.735	.034	.0021	.254	1.581	.137	.0066	.265	9.743	1.817	.6970
15	.206	.702	.032	.0016	.199	1.494	.131	.0063	.206	8.410	1.715	.7088

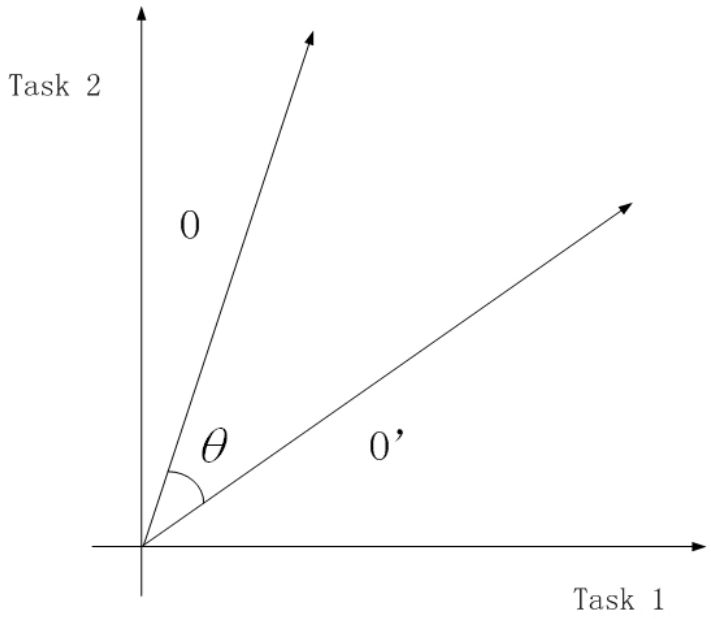
NOTES: Each row corresponds to a Transfer Rate function. Exp is the value of the exponent for a given Transfer Rate function, i.e. t in $TransRate(\theta) = (-\frac{2}{\pi}\theta + 1)^t$, with 5 the baseline value in this article. Trans denotes the average non-self transfer rate which shows the degree of discounting, and as the value of the exponent turns bigger the discounting becomes heavier and thus the mean transfer rate smaller. D_cons, D_lin, and D_qudr list the euclidean distances between the point estimates based on a given Transfer Rate function with the indicated exponent value and the point estimates based on the extreme-case Transfer Rate function (exponent equal to plus infinity) for occupation-specific constant coefficients, linear coefficients, and quadratic coefficients, respectively.

Table 13: Root MSEs for Generalized Wage Regressions

Exp	1-Digit		2-Digit		3-Digit	
	Trans	$\sqrt{MSE}$	Trans	$\sqrt{MSE}$	Trans	$\sqrt{MSE}$
1	.837	.4134	.810	.4203	.820	.4781
3	.617	.4183	.574	.4218	.591	.4564
5	.478	.4231	.439	.4259	.456	.4567
7	.386	.4267	.353	.4292	.369	.4593
11	.272	.4306	.254	.4329	.265	.4635
15	.206	.4321	.199	.4344	.206	.4656
∞	0	.4293	0	.4350	0	.4648
Obs	45314		44024		39795	

NOTES: Each row corresponds to a Transfer Rate function. Exp is the value of the exponent for a given Transfer Rate function, i.e. t in $TransRate(\theta) = (-\frac{2}{\pi}\theta + 1)^t$, with 5 the baseline value in this article. Trans denotes the average non-self transfer rate which shows the degree of discounting, and as the value of the exponent turns bigger the discounting becomes heavier and thus the mean transfer rate smaller. $\sqrt{MSE}$ is the Root Mean Squared Error for the generalized wage regression with a given exponent value. In general, a smaller Root MSE indicates better goodness-of-fit of a regression.

Figure 1: Distance Between Occupations: 2-Task Case



NOTES: The distance between the source occupation O and the target occupation O' is measured by θ, the angle formed by the O-origin ray and the O'-origin ray. The bigger θ is, the farther the 2 occupations are from each other. $\theta \in [0, \pi/2]$.

Appendices

A Procedures for Constructing Tenure Variables

The sample restrictions on SIPP1996 are as follows: male, aged between 18 and 64, not disabled, and not self-employed. For a given worker, only when the following three conditions are satisfied is his person-wave observation qualified for the wage regressions: he is working on a full-time job, namely, the weekly working hours are no less than 35 hours; his nominal hourly wage is no less than 4.25 dollars, the U.S. federal minimum wage rate in 1995; and moreover, he holds such a job for at least two waves so that the IV-GLS method can be applied. For a given individual, his labor market information is examined wave by wave.

We first construct WorkExp, the labor market work experience. In the data, some workers are observed to enter the labor market at as early as 15 years old. But some occupations, especially under 3-digit classifications, have explicit or implicit restrictions to young workers under 18. So in this paper, only work experience after 18 years old are considered. We initialize a worker's WorkExp by Age - 6 - Edu if his schooling years are no less than 12 and by Age - 18 otherwise (Edu is the years of schooling). After that, as long as the worker is observed to work full time for a wave, his WorkExp is increased by 1/3 year.

The second constructed tenure variable is EmpTen, the employer tenure. For a current incumbent worker, we initialize his EmpTen using his job's start date information. Specifically, it equals the start date of the interviewing wave minus the start date of the job. After that, as long as the employment relationship remains, the EmpTen is incremented by 1/3 year for every passing wave. If a worker is observed to start working for a new employer in a given wave, we initialize his EmpTen to zero. The subsequent EmpTen should equal the working time in the starting wave: we use the wave's end date to subtract the job's start date. After that, as long as the employment relationship remains, the EmpTen is incremented by 1/3 year for every passing wave. we exclude transitory full-time jobs from the regressions, which are defined by EmpTen less than 8 months (2 waves). Because the IV-GLS method requires a minimum of 2 observations for a given employer, but transitory job holders have only one.

Then we consider OccTen, the conventional occupational tenure. Recall that SIPP asks respondents for their occupational tenure information directly in the first wave, and we initialize OccTen with that value. After that, as long as the occupation affiliation does not change, we increase the OccTen in each following wave by the corresponding EmpTen, even when the employer changes. In case a worker is observed to start a new occupation, the OccTen is reinitialized to zero. And the tracking rule stays the same as before. Note that OccTen naturally has at least 2 observations for any given occupation, as it inherits this feature from EmpTen.

we continue to construct IndTen, the industrial tenure. Unlike OccTen, the indus-

trial tenure information is never solicited from its respondents by SIPP. We initialize IndTen with OccTen's first value. After that, as long as the industry affiliation does not change, we increase the IndTen in each following wave by the corresponding EmpTen, even when the employer changes. In case a worker is observed to start working in a new industry, the IndTen is reinitialized to zero. And the tracking rule is the same as before. Analogous to OccTen, IndTen naturally has at least 2 observations for any given industry, as it inherits this feature from EmpTen.

We do a consistency check after the tenure variable initializations. Logically, WorkExp should be no less than OccTen (IndTen) and OccTen (IndTen) should be no less than EmpTen. We take WorkExp as a reference, as it is derived from Age and Age should generally be recorded accurately. If OccTen's (IndTen's) initial value is greater than the corresponding WorkExp, we reevaluate OccTen (IndTen) to WorkExp. Similarly, if EmpTen's initial value is greater than the corresponding OccTen, we reevaluate EmpTen to OccTen.

Lastly, we construct GOccTen, the General Occupational Tenure, with the help of OccTen. Theoretically, we need to know a worker's occupation history since his entry into the labor market to obtain his GOccTen. However, for a large number of workers, we observe them only in the middle of their career path in the SIPP. To initialize GOccTen, we multiply the difference of initial WorkExp and initial OccTen with the average non-self Transfer Rate. The idea is that, before one's first observed occupational tenure, he is assumed to have done some "average" occupational switch. The way to track GOccTen is very simple, as discussed in the text, when an occupational switch takes place, we discount the current GOccTen using the Transfer Rate determined by the occupation distance between the source and target occupations to get the new GOccTen; when there is not an occupational switch, the GOccTen is incremented by the actual working time in the interviewing wave: the job's end date minus the wave's start date if an employer switch happens, 1/3 year otherwise.

B 1990 Census of Population Occupation Classification System[22]

The list presents the occupational classification developed for the 1990 Census of Population and Housing. There are 501 categories for the employed with 1 additional category for the experienced unemployed and 3 additional categories for the Armed Forces. These categories are grouped into 6 summary groups and 13 major groups. The classification is developed from the 1980 Standard Occupational Classification (SOC1980). "n.e.c." is the abbreviation for not elsewhere classified. In parentheses are corresponding SOC1980 codes.

1990 Census code	Occupation category
	MANAGERIAL AND PROFESSIONAL SPECIALTY OCCUPATIONS
	Executive, Administrative, and Managerial Occupations
3	Legislators (111)
4	Chief executives and general administrators, public administration (112)
5	Administrators and officials, public administration (1132-1139)
6	Administrators, protective services (1131)
7	Financial managers (122)
8	Personnel and labor relations managers (123)
9	Purchasing managers (124)
13	Managers, marketing, advertising, and public relations (125)
14	Administrators, education and related fields (128)
15	Managers, medicine and health (131)
16	Postmasters and mail superintendents (1344)
17	Managers, food serving and lodging establishments (1351)
18	Managers, properties and real estate (1353)
19	Funeral directors (pt 1359)
21	Managers, service organizations, n.e.c. (127, 1352, 1354, pt 1359)
22	Managers and administrators, n.e.c. (121, 126, 132-1343, 136-139)
	Management Related Occupations
23	Accountants and auditors (1412)
24	Underwriters (1414)
25	Other financial officers (1415, 1419)
26	Management analysts (142)
27	Personnel, training, and labor relations specialists (143)
28	Purchasing agents and buyers, farm products (1443)
29	Buyers, wholesale and retail trade except farm products (1442)
33	Purchasing agents and buyers, n.e.c. (1449)
34	Business and promotion agents (145)
35	Construction inspectors (1472)
36	Inspectors and compliance officers, except construction (1473)
37	Management related occupations, n.e.c. (149)
	Professional Specialty Occupations
	Engineers, Architects, and Surveyors

[22]Source: SIPP 1993 Panel, Longitudinal File Codebook, Appendix A-4.

43	Architects (161)
	Engineers
44	Aerospace (1622)
45	Metallurgical and materials (1623)
46	Mining (1624)
47	Petroleum (1625)
48	Chemical (1626)
49	Nuclear (1627)
53	Civil (1628)
54	Agricultural (1632)
55	Electrical and electronic (1633, 1636)
56	Industrial (1634)
57	Mechanical (1635)
58	Marine and naval architects (1637)
59	Engineers, n.e.c. (1639)
63	Surveyors and mapping scientists (164)
	Mathematical and Computer Scientists
64	Computer systems analysts and scientists (171)
65	Operations and systems researchers and analysts (172)
66	Actuaries (1732)
67	Statisticians (1733)
68	Mathematical scientists, n.e.c. (1739)
	Natural Scientists
69	Physicists and astronomers (1842, 1843)
73	Chemists, except biochemists (1845)
74	Atmospheric and space scientists (1846)
75	Geologists and geodesists (1847)
76	Physical scientists, n.e.c. (1849)
77	Agricultural and food scientists (1853)
78	Biological and life scientists (1854)
79	Forestry and conservation scientists (1852)
83	Medical scientists (1855)
	Health Diagnosing Occupations
84	Physicians (261)
85	Dentists (262)
86	Veterinarians (27)
87	Optometrists (281)
88	Podiatrists (283)
89	Health diagnosing practitioners, n.e.c. (289)
	Health Assessment and Treating Occupations
95	Registered nurses (29)
96	Pharmacists (301)
97	Dietitians (302)
	Therapists
98	Respiratory therapists (3031)
99	Occupational therapists (3032)
103	Physical therapists (3033)
104	Speech therapists (3034)
105	Therapists, n.e.c. (3039)
106	Physicians assistants (304)
	Teachers, Postsecondary

113 Earth, environmental, and marine science teachers (2212)
114 Biological science teachers (2213)
115 Chemistry teachers (2214)
116 Physics teachers (2215)
117 Natural science teachers, n.e.c. (2216)
118 Psychology teachers (2217)
119 Economics teachers (2218)
123 History teachers (2222)
124 Political science teachers (2223)
125 Sociology teachers (2224)
126 Social science teachers, n.e.c. (2225)
127 Engineering teachers (2226)
128 Mathematical science teachers (2227)
129 Computer science teachers (2228)
133 Medical science teachers (2231)
134 Health specialties teachers (2232)
135 Business, commerce, and marketing teachers (2233)
136 Agriculture and forestry teachers (2234)
137 Art, drama, and music teachers (2235)
138 Physical education teachers (2236)
139 Education teachers (2237)
143 English teachers (2238)
144 Foreign language teachers (2242)
145 Law teachers (2243)
146 Social work teachers (2244)
147 Theology teachers (2245)
148 Trade and industrial teachers (2246)
149 Home economics teachers (2247)
153 Teachers, postsecondary, n.e.c. (2249)
154 Postsecondary teachers, subject not specified

Teachers, Except Postsecondary

155 Teachers, prekindergarten and kindergarten (231)
156 Teachers, elementary school (232)
157 Teachers, secondary school (233)
158 Teachers, special education (235)
159 Teachers, n.e.c. (236, 239)
163 Counselors, educational and vocational (24)

Librarians, Archivists, and Curators

164 Librarians (251)
165 Archivists and curators (252)

Social Scientists and Urban Planners

166 Economists (1912)
167 Psychologists (1915)
168 Sociologists (1916)
169 Social scientists, n.e.c. (1913, 1914, 1919)
173 Urban planners (192)

Social, Recreation, and Religious Workers

174 Social workers (2032)
175 Recreation workers (2033)
176 Clergy (2042)
177 Religious workers, n.e.c. (2049)

Lawyers and Judges
178 Lawyers (211)
179 Judges (212)
Writers, Artists, Entertainers, and Athletes
183 Authors (321)
184 Technical writers (398)
185 Designers (322)
186 Musicians and composers (323)
187 Actors and directors (324)
188 Painters, sculptors, craft-artists, and artist printmakers (325)
189 Photographers (326)
193 Dancers (327)
194 Artists, performers, and related workers, n.e.c. (328, 329)
195 Editors and reporters (331)
197 Public relations specialists (332)
198 Announcers (333)
199 Athletes (34)
TECHNICAL, SALES, AND ADMINISTRATIVE SUPPORT OCCUPATIONS
Technicians and Related Support Occupations
Health Technologists and Technicians
203 Clinical laboratory technologists and technicians (362)
204 Dental hygienists (363)
205 Health record technologists and technicians (364)
206 Radiologic technicians (365)
207 Licensed practical nurses (366)
208 Health technologists and technicians, n.e.c. (369)
Technologists and Technicians, Except Health
Engineering and Related Technologists and Technicians
213 Electrical and electronic technicians (3711)
214 Industrial engineering technicians (3712)
215 Mechanical engineering technicians (3713)
216 Engineering technicians, n.e.c. (3719)
217 Drafting occupations (372)
218 Surveying and mapping technicians (373)
Science Technicians
223 Biological technicians (382)
224 Chemical technicians (3831)
225 Science technicians, n.e.c. (3832, 3833, 384, 389)
Technicians; Except Health, Engineering, and Science
226 Airplane pilots and navigators (825)
227 Air traffic controllers (392)
228 Broadcast equipment operators (393)
229 Computer programmers (3971, 3972)
233 Tool programmers, numerical control (3974)
234 Legal assistants (396)
235 Technicians, n.e.c. (399)
Sales Occupations
243 Supervisors and proprietors, sales occupations (40)
Sales Representatives, Finance and Business Services
253 Insurance sales occupations (4122)
254 Real estate sales occupations (4123)

255 Securities and financial services sales occupations (4124)
256 Advertising and related sales occupations (4153)
257 Sales occupations, other business services (4152)
Sales Representatives, Commodities Except Retail
258 Sales engineers (421)
259 Sales representatives, mining, manufacturing, and wholesale (423, 424)
Sales Workers, Retail and Personal Services
263 Sales workers, motor vehicles and boats (4342, 4344)
264 Sales workers, apparel (4346)
265 Sales workers, shoes (4351)
266 Sales workers, furniture and home furnishings (4348)
267 Sales workers; radio, TV, hi-fi, and appliances (4343, 4352)
268 Sales workers, hardware and building supplies (4353)
269 Sales workers, parts (4367)
274 Sales workers, other commodities (4345, 4347, 4354, 4356, 4359,4362, 4369)
275 Sales counter clerks (4363)
276 Cashiers (4364)
277 Street and door-to-door sales workers (4366)
278 News vendors (4365)
Sales Related Occupations
283 Demonstrators, promoters and models, sales (445)
284 Auctioneers (447)
285 Sales support occupations, n.e.c. (444, 446, 449)
Administrative Support Occupations, Including Clerical
Supervisors, Administrative Support Occupations
303 Supervisors, general office (4511,4513,4514,4516,4519,4529)
304 Supervisors, computer equipment operators (4512)
305 Supervisors, financial records processing (4521)
306 Chief communications operators (4523)
307 Supervisors; distribution, scheduling, and adjusting clerks (4522, 4524-4528)
Computer Equipment Operators
308 Computer operators (4612)
309 Peripheral equipment operators (4613)
Secretaries, Stenographers, and Typists
313 Secretaries (4622)
314 Stenographers (4623)
315 Typists (4624)
Information Clerks
316 Interviewers (4642)
317 Hotel clerks (4643)
318 Transportation ticket and reservation agents (4644)
319 Receptionists (4645)
323 Information clerks, n.e.c. (4649)
Records Processing Occupations, Except Financial
325 Classified-ad clerks (4662)
326 Correspondence clerks (4663)
327 Order clerks (4664)
328 Personnel clerks, except payroll and timekeeping (4692)
329 Library clerks (4694)
335 File clerks (4696)
336 Records clerks (4699)

Financial Records Processing Occupations
337 Bookkeepers, accounting, and auditing clerks (4712)
338 Payroll and timekeeping clerks (4713)
339 Billing clerks (4715)
343 Cost and rate clerks (4716)
344 Billing, posting, and calculating machine operators (4718)
Duplicating, Mail and Other Office Machine Operators
345 Duplicating machine operators (4722)
346 Mail preparing and paper handling machine operators (4723)
347 Office machine operators, n.e.c. (4729)
Communications Equipment Operators
348 Telephone operators (4732)
353 Communications equipment operators, n.e.c. (4733, 4739)
Mail and Message Distributing Occupations
354 Postal clerks, ext. mail carriers (4742)
355 Mail carriers, postal service (4743)
356 Mail clerks, ext. postal service (4744)
357 Messengers (4745)
Material Recording, Scheduling, and Distributing Clerks
359 Dispatchers (4751)
363 Production coordinators (4752)
364 Traffic, shipping, and receiving clerks (4753)
365 Stock and inventory clerks (4754)
366 Meter readers (4755)
368 Weighers, measurers, checkers and samplers (4756, 4757)
373 Expediters (4758)
374 Material recording, scheduling, and distributing clerks, n.e.c. (4759)
Adjusters and Investigators
375 Insurance adjusters, examiners, and investigators (4782)
376 Investigators and adjusters, except insurance (4783)
377 Eligibility clerks, social welfare (4784)
378 Bill and account collectors (4786)
Miscellaneous Administrative Support Occupations
379 General office clerks (463)
383 Bank tellers (4791)
384 Proofreaders (4792)
385 Data-entry keyers (4793)
386 Statistical clerks (4794)
387 Teachers aides (4795)
389 Administrative support occupations, n.e.c. (4787, 4799)
SERVICE OCCUPATIONS
Private Household Occupations
403 Launderers and ironers (503)
404 Cooks, private household (504)
405 Housekeepers and butlers (505)
406 Child care workers, private household (506)
407 Private household cleaners and servants (502, 507, 509)
Protective Service Occupations
Supervisors, Protective Service Occupations
413 Supervisors, firefighting and fire prevention occupations (5111)
414 Supervisors, police and detectives (5112)

415	Supervisors, guards (5113)
	Firefighting and Fire Prevention Occupations
416	Fire inspection and fire prevention occupations (5122)
417	Firefighting occupations (5123)
	Police and Detectives
418	Police and detectives, public service (5132)
423	Sheriffs, bailiffs, and other law enforcement officers (5134)
424	Correctional institution officers (5133)
	Guards
425	Crossing guards (5142)
426	Guards and police, exc. public service (5144)
427	Protective service occupations, n.e.c. (5149)
	Service Occupations, Except Protective and Household
	Food Preparation and Service Occupations
433	Supervisors, food preparation and service occupations (5211)
434	Bartenders (5212)
435	Waiters and waitresses (5713)
436	Cooks (5214. 5215)
438	Food counter, fountain and related occupations (5216)
439	Kitchen workers, food preparation (5217)
443	Waiters/waitresses assistants (5218)
444	Miscellaneous food preparation occupations (5219)
	Health Service Occupations
445	Dental assistants (5232)
446	Health aides, except nursing (5233)
447	Nursing aides, orderlies, and attendants (5236)
	Cleaning and Building Service Occupations, except Household
448	Supervisors, cleaning and building service workers (5241)
449	Maids and housemen (5242,5249)
453	Janitors andcleaners (5244)
454	Elevator operators (5245)
455	Pest control occupations (5246)
	Personal Service Occupations
456	Supervisors, personal service occupations (5251)
457	Barbers (5252)
458	Hairdressers and cosmetologists (5253)
459	Attendants, amusement and recreation facilities (5254)
461	Guides (5255)
462	Ushers (5256)
463	Public transportation attendants (5257)
464	Baggage porters and bellhops (5262)
465	Welfare service aides (5263)
466	Family child care providers (pt 5264)
467	Early childhood teachers assistants (pt 5264)
468	Child care workers, n.e.c. (pt 5264)
469	Personal service occupations, n.e.c. (5258, 5269)
	FARMING, FORESTRY, AND FISHING OCCUPATIONS
	Farm Operators and Managers
473	Farmers, except horticultural (5512-5514)
474	Horticultural specialty farmers (5515)
475	Managers, farms, except horticultural (5522-5524)

476 Managers, horticultural specialty farms (5525)

Other Agricultural and Related Occupations

Farm Occupations, Except Managerial

477 Supervisors, farm workers (5611)

479 Farm workers (5612-5617)

483 Marine life cultivation workers (5618)

484 Nursery workers (5619)

Related Agricultural Occupations

485 Supervisors, related agricultural occupations (5621)

486 Groundskeepers and gardeners, except farm (5622)

487 Animal caretakers, except farm (5624)

488 Graders and sorters, agricultural products (5625)

489 Inspectors, agricultural products (5627)

Forestry and Logging Occupations

494 Supervisors, forestry, and logging workers (571)

495 Forestry workers, except logging (572)

496 Timber cutting and logging occupations (573, 579)

Fishers, Hunters, and Trappers

497 Captains and other officers, fishing vessels (pt 8241)

498 Fishers (583)

499 Hunters and trappers (584)

PRECISION PRODUCTION, CRAFT, AND REPAIR OCCUPATIONS

Mechanics and Repairers

503 Supervisors, mechanics and repairers (60)

Mechanics and Repairers, Except Supervisors

Vehicle and Mobile Equipment Mechanics and Repairers

505 Automobile mechanics (pt 6111)

506 Automobile mechanic apprentices (pt 6111)

507 Bus, truck, and stationary engine mechanics (6112)

508 Aircraft engine mechanics (6113)

509 Small engine repairers (6114)

514 Automobile body and related repairers (6115)

515 Aircraft mechanics, ext. engine (6116)

516 Heavy equipment mechanics (6117)

517 Farm equipment mechanics (6118)

518 Industrial machinery repairers (613)

519 Machinery maintenance occupations (614)

Electrical and Electronic Equipment Repairers

523 Electronic repairers, communications and industrial equipment (6151, 6153, 6155)

525 Data processing equipment repairers (6154)

526 Household appliance and power tool repairers (6156)

527 Telephone line installers and repairers (6157)

529 Telephone installers and repairers (6158)

533 Miscellaneous electrical and electronic equipment repairers (6152, 6159)

534 Heating, air conditioning, and refrigeration mechanics (616)

Miscellaneous Mechanics and Repairers

535 Camera, watch, and musical instrument repairers (6171,6172)

536 Locksmiths and safe repairers (6173)

538 Office machine repairers (6174)

539 Mechanical controls and valve repairers (6175)

543 Elevator installers and repairers (6176)

544 Millwrights (6178)
547 Specified mechanics and repairers, n.e.c. (6177, 6179)
549 Not specified mechanics and repairers

Construction Trades

Supervisors, Construction Occupations

553 Supervisors; brickmasons, stonemasons, and tile setters (6312)
554 Supervisors, carpenters and related workers (6313)
555 Supervisors, electricians and power transmission installers (6314)
556 Supervisors; painters, paperhangers, and plasterers (6315)
557 Supervisors; plumbers, pipefitters, and steamfitters (6316)
558 Supervisors, construction n.e.c. (6311, 6318)

Construction Trades, Except Supervisors

563 Brickmasons and stonemasons (pt 6412, pt 6413)
564 Brickmason and stonemason apprentices (pt 6412, pt 6413)
565 Tile setters, hard and soft (pt 6414, pt 6462)
566 Carpet installers (pt 6462)
567 Carpenters (pt 6422)
569 Carpenter apprentices (pt 6422)
573 Drywall installers (6424)
575 Electricians (pt 6432)
576 Electrician apprentices (pt 6432)
577 Electrical power installers and repairers (6433)
579 Painters, construction and maintenance (6442)
583 Paperhangers (6443)
584 Plasterers (6444)
585 Plumbers, pipefitters, and steamfitters (pt 645)
587 Plumber, pipefitter, and steamfitter apprentices (pt 645)
588 Concrete and terrazzo finishers (6463)
589 Glaziers (6464)
593 Insulation workers (6465)
594 Paving, surfacing, and tamping equipment operators (6466)
595 Roofers (6468)
596 Sheetmetal duct installers (6472)
597 Structural metal workers (6473)
598 Drillers, earth (6474)
599 Construction trades, n.e.c. (6467, 6475, 6476, 6479)

Extractive Occupations

613 Supervisors, extractive occupations (632)
614 Drillers, oil well (652)
615 Explosives workers (653)
616 Mining machine operators (654)
617 Mining occupations, n.e.c. (656)

Precision Production Occupations

628 Supervisors, production occupations (67, 71)

Precision Metal Working Occupations

634 Tool and die makers (pt 6811)
635 Tool and die maker apprentices (pt 6811)
636 Precision assemblers, metal (6812)
637 Machinists (pt 6813)
639 Machinist apprentices (pt 6813)
643 Boilermakers (6814)

644 Precision grinders, filers, and tool sharpeners (6816)
645 Patternmakers and model makers, metal (6817)
646 Lay-out workers (6821)
647 Precious stones and metals workers (Jewelers) (6822, 6866)
649 Engravers, metal (6823)
653 Sheet metal workers (pt 6824)
654 Sheet metal worker apprentices (pt 6824)
655 Miscellaneous precision metal workers (6829)

Precision Woodworking Occupations

656 Patternmakers and model makers, wood (6831)
657 Cabinet makers and bench carpenters (6832)
658 Furniture and wood finishers (6835)
659 Miscellaneous precision woodworkers (6839)

Precision Textile, Apparel, and Furnishings Machine Workers

666 Dressmakers (pt 6852, pt 7752)
667 Tailors (pt 6852)
668 Upholsterers (6853)
669 Shoe repairers (6854)
674 Miscellaneous precision apparel and fabric workers (6856, 6859, pt 7752)

Precision Workers, Assorted Materials

675 Hand molders and shapers, except jewelers (6861)
676 Patternmakers, lay-out workers, and cutters (6862)
677 Optical goods workers (6864, pt 7477, pt 7677)
678 Dental laboratory and medical appliance technicians (6865)
679 Bookbinders (6844)
683 Electrical and electronic equipment assemblers (6867)
684 Miscellaneous precision workers, n.e.c. (6869)

Precision Food Production Occupations

686 Butchers and meat cutters (6871)
687 Bakers (6872)
688 Food batchmakers (6873,6879)

Precision Inspectors, Testers, and Related Workers

689 Inspectors, testers, and graders (6881, 828)
693 Adjusters and calibrators (6882)

Plant and System Operators

694 Water and sewage treatment plant operators (691)
695 Power plant operators (pt 693)
696 Stationary engineers (pt 693, 7668)
699 Miscellaneous plant and system operators (692, 694, 695, 696)

OPERATORS, FABRICATORS, AND LABORERS

Machine Operators, Assemblers, and Inspectors

Machine Operators and Tenders, Except Precision

Metalworking and Plastic Working Machine Operators

703 Lathe and turning machine set-up operators (7312)
704 Lathe and turning machine operators (7512)
705 Milling and planing machine operators (7313, 7513)
706 Punching and stamping press machine operators (7314, 7317,7514, 7517)
707 Rolling machine operators (7316, 7516)
708 Drilling and boring machine operators (7318, 7518)
709 Grinding, abrading, buffing, and polishing machine operators (7322, 7324, 7522)
713 Forging machine operators (7319, 7519)

714 Numerical control machine operators (7326)
715 Miscellaneous metal, plastic, stone, and glass working machine operators (7329, 7529)
717 Fabricating machine operators, n.e.c. (7339, 7539)

Metal and Plastic Processing Machine Operators

719 Molding and casting machine operators (7315, 7342, 7515,7542)
723 Metal plating machine operators (7343, 7543)
724 Heat treating equipment operators (7344, 7544)
725 Miscellaneous metal and plastic processing machine operators (7349, 7549)

Woodworking Machine Operators

726 Wood lathe, routing, and planing machine operators (7431,7432. 7631, 7632)
727 Sawing machine operators (7433, 7633)
728 Shaping and joining machine operators (7435, 7635)
729 Nailing and tacking machine operators (7636)
733 Miscellaneous woodworking machine operators (7434, 7439, 7634. 7639)

Printing Machine Operators

734 Printing press operators (7443, 7643)
735 Photoengravers and lithographers (6842, 7444, 7644)
736 Typesetters and compositors (6841, 7642)
737 Miscellaneous printing machine operators (6849, 7449, 7649)

Textile, Apparel, and Furnishings Machine Operators

738 Winding and twisting machine operators (7451, 7651)
739 Knitting, looping, taping, and weaving machine operators (7452, 7652)
743 Textile cutting machine operators (7654)
744 Textile sewing machine operators (7655)
745 Shoe machine operators (7656)
747 Pressing machine operators (7657)
748 Laundering and dry cleaning machine operators (6855, 7658)
749 Miscellaneous textile machine operators (7459, 7659)

Machine Operators, Assorted Materials

753 Cementing and gluing machine operators (7661)
754 Packaging and filling machine operators (7462, 7662)
755 Extruding and forming machine operators 7463, 7663)
756 Mixing and blending machine operators (7664)
757 Separating, filtering, and clarifying machine operators (7476, 7666, 7676)
758 Compressing and compacting machine operators (7467, 7667)
759 Painting and paint spraying machine operators (7669)
763 Roasting and baking machine operators, food (7472, 7672)
764 Washing, cleaning, and pickling machine operators (7673)
765 Folding machine operators (7474, 7674)
766 Furnace, kiln, and oven operators, ext. food (7675)
768 Crushing and grinding machine operators (pt 7477, pt 7677)
769 Slicing and cutting machine operators (7478, 7678)
773 Motion picture projectionists (pt 7479)
774 Photographic process machine operators (6863, 6868, 7671)
777 Miscellaneous machine operators, n.e.c. (pt 7479, 7665, 7679)
779 Machine operators, not specified

Fabricators, Assemblers, and Hand Working Occupations

783 Welders and cutters (7332, 7532, 7714)
784 Solderers and brazers (7333, 7533, 7717)
785 Assemblers (772, 774)
786 Hand cutting and trimming occupations (7753)

787 Hand molding, casting, and forming occupations (7754, 7755)
789 Hand painting, coating, and decorating occupations (7756)
793 Hand engraving and printing occupations (7757)
795 Miscellaneous hand working occupations (7758, 7759)
Production Inspectors, Testers, Samplers, and Weighers
796 Productioninspectors, checkers, and examiners (782, 787)
797 Production testers (783)
798 Production samplers and weighers (784)
799 Graders and sorters, ext. agricultural (785)
Transportation and Material Moving Occupations
Motor Vehicle Operators
803 Supervisors, motor vehicle operators (8111)
804 Truck drivers (8212-8214)
806 Driver-sales workers (8218)
808 Bus drivers (8215)
809 Taxicab drivers and chauffeurs (8216)
813 Parking lot attendants (874)
814 Motor transportation occupations, n.e.c. (8219)
Transportation Occupations, Except Motor Vehicles
Rail Transportation Occupations
823 Railroad conductors and yardmasters (8113)
824 Locomotive operating occupations (8232)
825 Railroad brake, signal, and switch operators (8233)
826 Rail vehicle operators, n.e.c. (8239)
Water Transportation Occupations
828 Ship captains and mates, except fishing boats (pt 8241, 8242)
829 Sailors and deckhands (8243)
833 Marine engineers (8244)
834 Bridge, lock, and lighthouse tenders (8245)
Material Moving Equipment Operators
843 Supervisors, material moving equipment operators (812)
844 Operating engineers (8312)
845 Longshore equipment operators (8313)
848 Hoist and winch operators (8314)
849 Crane and tower operators (8315)
853 Excavating and loading machine operators (8316)
855 Grader, dozer, and scraper operators (8317)
856 Industrial truck and tractor equipment operators (8318)
859 Miscellaneous material moving equipment operators (8319)
Handlers, Equipment Cleaners, Helpers, and Laborers
864 Supervisors, handlers, equipment cleaners, and laborers, n.e.c. (85)
865 Helpers, mechanics and repairers (863)
Helpers, Construction and Extractive Occupations
866 Helpers, construction trades (8641-8645, 8648)
867 Helpers, surveyor (8646)
868 Helpers, extractive occupations (86.5)
869 Construction laborers (871)
874 Production helpers (861, 862)
Freight, Stock, and Material Handlers
875 Garbage collectors (8722)
876 Stevedores (8723)

877	Stock handlers and baggers (8724)
878	Machine feeders and offbearers (8725)
883	Freight, stock, and material handlers, n.e.c. (8726)
885	Garage and service station related occupations (873)
887	Vehicle washers and equipment cleaners (875)
888	Hand packers and packagers (8761)
889	Laborers, except construction (8769)
	MILITARY OCCUPATIONS
903	Commissioned Officers and Warrant Officers
904	Non-commissioned Officers and Other Enlisted Personnel
905	Military occupation, rank not specified
	EXPERIENCED UNEMPLOYED NOT CLASSIFIED BY OCCUPATION
909	Last worked 1984 or earlier

C 1980 Standard Occupational Classification System[23]

The SOC1980 consists of 20 Divisions, 58 Majors, 224 Minors, and 664 Units for the employed workers. In addition, there are one Division/Major/Minor/Unit for the Military Occupations and one Division/Major/Minor/Unit for the Miscellaneous Occupations. In the list, 2-, 3-, and 4-digit codes refer to Majors, Minors, and Units, respectively. Titles without numerical codes correspond to Divisions.

Code	Title
	Executive, Administrative and Managerial occupations
11	Officials and Administrators, Public Administration
111	Legislators
112	Chief Executives and General Administrators
113	Officials and Administrators, Government Agencies
1131	Judicial, Public Safety and Corrections Administrators
1132	Human Resources Program Administrators
1133	Natural Resources Program Administrators
1134	Rural, Urban, and Community Development Program Administrators
1135	Public Finance, Taxation, and Other Monetary Program Administrators
1139	Officials and Administrators, Public Administration, Not Elsewhere Classified
12-13	Officials and Administrators, Other
121	General Managers and Other Top Executives
122	Financial Managers
123	Personnel and Labor Relations Managers
124	Purchasing Managers
125	Managers; Marketing, Advertising, and Public Relations
126	Managers; Engineering, Mathematics, and Natural Science
127	Managers; Social Sciences and Related Fields
128	Administrators; Education and Related Fields
1281	Administrators; Colleges and Universities
1282	Administrators; Elementary and Secondary Education
1283	Administrators; Education and Related Fields, Not Elsewhere Classified
131	Managers; Medicine and Health
132	Production Managers, Industrial
133	Construction Managers
134	Public Utilities Managers
1341	Communication Operations Managers
1342	Transportation Facilities and Operations Managers
1343	Electricity, Gas, Water Supply, and Sanitary Services Managers
1344	Postmasters and Mail Superintendents
135	Managers; Service Organizations
1351	Managers; Food Serving and Lodging Establishments
1352	Managers; Entertainment and Recreation Facilities
1353	Managers; Property and Leasing
1354	Managers; Membership Organizations
1359	Managers, Service Organization, Not Elsewhere Classified

[23]Source: U.S. Bureau of Labor Statistics, SOC Information Desk.

136	Managers; Mining, Quarrying, Well Drilling, and Similar Operations
137	Managers; Administrative Services
139	Officials and Administrators; Other, Not Elsewhere Classified
14	Management Related Occupations
141	Accountants, Auditors, and Other Financial Specialists
1412	Accountants and Auditors
1414	Underwriters
1415	Loan Officers
1419	Other Financial Officers
142	Management Analysts
143	Personnel, Training, and Labor Relations Specialist
144	Purchasing Agents and Buyers
1442	Buyers, Wholesale and Retail Trade, except Farm Products
1443	Purchasing Agents and Buyers, Farm Products
1449	Purchasing Agents and Buyers, Not Elsewhere Classified
145	Business and Promotions Agents
147	Inspectors and Compliance Officers
1472	Construction Inspectors
1473	Inspectors and Compliance Officers, except Construction
149	Management Related Occupations, Not Elsewhere Classified
	Engineers, Surveyors and Architects
16	Engineers, Surveyors and Architects
161	Architects
162-3	Engineers
1622	Aerospace Engineers
1623	Metallurgical and Materials Engineers
1624	Mining Engineers
1625	Petroleum Engineers
1626	Chemical Engineers
1627	Nuclear Engineers
1628	Civil Engineers
1632	Agricultural Engineers
1633	Electrical and Electronic Engineers
1634	Industrial Engineers
1635	Mechanical Engineers
1636	Computer Engineers
1637	Marine Engineers and Naval Architects
1639	Engineers, Not Elsewhere Classified
164	Surveyors and Mapping Scientists
1643	Land Supervisors
1644	Cartographers
1649	Surveyors and Mapping Scientists, Not Elsewhere Classified
	Natural Scientists and Mathematicians
17	Computer, Mathematical, and Operations Research Occupations
171	Computer Scientists
1712	Computer Systems Analyst
1719	Computer Scientists, Not Elsewhere Classified
172	Operations and Systems Researchers and Analysts
1721	Operations Researchers and Analysts
1722	Systems Researchers and Analysts, Except Computer
173	Mathematical Scientists

1732	Actuaries
1733	Statisticians
1739	Mathematical Scientists, Not Elsewhere Classified
18	Natural Scientists
184	Physical Scientists
1842	Astronomers
1843	Physicists
1845	Chemists, Except Biochemists
1846	Atmospheric and Space Scientists
1847	Geologists
1849	Physical Scientists, Not Elsewhere Classified
185	Life Scientists
1852	Forestry and Conservation Scientists
1853	Agricultural and Food Scientists
1854	Biological Scientists
1855	Medical Scientists
	Social Scientists, Social Workers, Religious Workers, and Lawyers
19	Social Scientists and Urban Planners
191	Social Scientists
1912	Economists
1913	Historians
1914	Political Scientists
1915	Psychologists
1916	Sociologists
1919	Social Scientists, Not Elsewhere Classified
192	Urban and Regional Planners
20	Social, Recreation, and Religious Workers
203	Social and Recreation Workers
2032	Social Workers
2033	Recreation Workers
204	Religious Workers
2042	Clergy
2049	Religious Workers, Not Elsewhere Classified
21	Lawyers and Judges
211	Lawyers
212	Judges
	Teachers, Librarians, and Counselors
22	Teachers; College, University and Other Postsecondary Institutions
2212	Atmospheric, Earth, Marine, and Space Science Teachers
2213	Biological Science Teachers
2214	Chemistry Teachers
2215	Physics Teachers
2216	Natural Science Teachers, Not Elsewhere Classified
2217	Psychology Teachers
2218	Economics Teachers
2222	History Teachers
2223	Political Science Teachers
2224	Sociology Teachers
2225	Social Science Teachers, Not Elsewhere Classified
2226	Engineering Teachers
2227	Mathematical Science Teachers

2228 Computer Science Teachers
2231 Medical Science Teachers
2232 Health Specialties Teachers, Not Elsewhere Classified
2233 Business, Commerce and Marketing Teachers
2234 Agriculture Teachers
2235 Art, Drama, and Music Teachers
2236 Physical Education Teachers
2237 Education Teachers
2238 English Teachers
2242 Foreign Language Teachers
2243 Law Teachers
2244 Social Work Teachers
2245 Theology Teachers
2246 Trade and Industrial Teachers
2247 Home Economics Teachers
2249 Teachers; Postsecondary, Not Elsewhere Classified
23 Teachers, Except Postsecondary Institutions
231 Prekindergarten and Kindergarten Teachers
232 Elementary School Teachers
233 Secondary School Teachers
235 Teachers; Special Education
236 Instructional Coordinators
239 Adult Education and Other Teachers, Not Elsewhere Classified
24 Vocational and Educational Counselors
25 Librarians, Archivists, and Curators
251 Librarians
252 Archivists and Curators

Health Diagnosing and Treating Practitioners

26 Physicians and Dentists
261 Physicians
262 Dentists
27 Veterinarians
28 Other Health Diagnosing and Treating Practitioners
281 Optometrists
283 Podiatrists
289 Health Diagnosing and Treating Practitioners, Not Elsewhere Classified

Registered Nurses, Pharmacists, Dietitians, Therapists, and Physician's Assistants

29 Registered Nurses
30 Pharmacists, Dietitians, Therapists, and Physicians Assistants
301 Pharmacists
302 Dietitians
303 Therapists
3031 Respiratory Therapists
3032 Occupational Therapists
3033 Physician Therapists
3034 Speech Pathologists and Audiologists
3039 Therapists, Not Elsewhere Classified
304 Physicians Assistants

Writers, Artists, Entertainers, and Athletes

32 Writers, Artists, Performers, and Related Workers
321 Authors

322	Designers
323	Musicians and Composers
324	Actors and Directors
325	Painters, Sculptors, Craft-Artists and Artist-Printmakers
326	Photographers
327	Dancers
328	Performers, Not Elsewhere Classified
329	Writers, Artists, and Related Workers; Not Elsewhere Classified
33	Editors, Reporters, Public Relations Specialist, and Announcers
331	Editors and Reporters
3312	Editors
3313	Reporters
332	Public Relations Specialists and Publicity Writers
333	Radio, Television and Other Announcers
34	Athletes and Related Workers
	Health Technologists and Technicians
36	Health Technologists and Technicians
362	Clinical Laboratory Technologists and Technicians
363	Dental Hygienists
364	Health Record Technologists and Technicians
365	Radiological Technologists and Technicians
366	Licensed Practical Nurses
369	Health Technologists and Technicians, Not Elsewhere Classified
	Technologists and Technicians, Except Health
37	Engineering and Related Technologists and Technicians
371	Engineering Technologists and Technicians
3711	Electrical and Electronic Engineering Technologists and Technicians
3712	Industrial Engineering Technologists and Technicians
3713	Mechanical Engineering Technologists and Technicians
3719	Engineering Technologists and Technicians, Not Elsewhere Classified
372	Drafting Occupations
373	Surveying and Mapping Technicians
3733	Surveying Technicians
3734	Cartographic Technicians
3739	Surveying and Mapping Technicians, Not Elsewhere Classified
38	Science Technologists and Technicians
382	Biological Technologists and Technicians, except Health
383	Chemical and Nuclear Technologists and Technicians
3831	Chemical Technologists and Technicians
3832	Nuclear Technologists and Technicians
3833	Petroleum Technologists and Technicians
384	Mathematical Technicians
389	Science Technologists and Technicians; Not Elsewhere Classified
39	Technicians; Except Health, Engineering, and Science
392	Air Traffic Controllers
393	Radio and Related Operators
396	Legal Technicians
397	Programmers
3971	Programmers, Business
3972	Programmers, Scientific
3974	Programmers, Numerical, Tool and Process Control

398	Technical Writers
399	Technicians, Not Elsewhere Classified
	Marketing and Sales Occupations
40	Supervisors; Marketing and Sales Occupations
401	Supervisors; Sales Occupations, Insurance, Real Estate and Business Services
402	Supervisors; Sales Occupations, Commodities Except Retail
403	Supervisors; Sales Occupations, Retail
41	Insurance, Securities, Real Estate and Business Services Sales Occupations
412	Insurance, Real Estate, and Securities Sales Occupations
4122	Insurance Sales Occupations
4123	Real Estate Sales Occupations
4124	Securities and Financial Services Sales Occupations
415	Business Service Sales Occupations
4152	Business Services, Except Advertising, Sales Occupations
4153	Advertising and Related Sales Occupations
42	Sales Occupations; Commodities Except Retail
421	Sales Engineers
423	Technical Sales Workers and Service Advisors
4232	Technical Sales Workers, Aircraft
4233	Technical Sales Workers, Agricultural Equipment and Supplies
4234	Technical Sales Workers, Electronic Equipment
4235	Technical Sales Workers, Industrial Machinery, Equipment, and Supplies
4236	Technical Sales Workers, Medical and Dental Equipment and Supplies
4237	Technical Sales Workers, Chemicals and Chemical Products
4239	Technical Sales Workers, Not Elsewhere Classified
424	Sales Representatives
4242	Sales Representatives; Commercial and Industrial Equipment and Supplies
4243	Sales Representatives; Garments and Related Textile Products
4244	Sales Representatives; Motor Vehicles and Supplies
4245	Sales Representatives; Pulp, Paper, and Paper Products
4246	Sales Representatives; Farm Products and Livestock
4249	Sales Representatives; Not Elsewhere Classified
43	Sales Occupations Retail
434-5	Salespersons, Commodities
4342	Salespersons; Motor Vehicles, Mobile Homes, and Supplies
4343	Salespersons; Musical Instruments and Supplies
4344	Salespersons; Boats and Marine Equipment and Supplies
4345	Salespersons; Sporting Goods
4346	Salespersons; Garments and Textile Products
4347	Salespersons; Books, Stamps, Coins, and Stationery
4348	Salespersons; Furniture and Home Furnishings
4351	Salespersons; Shoes
4352	Salespersons; Radio, Television, High Fidelity, and Household Appliances
4353	Salespersons; Hardware
4354	Salespersons; Cosmetics, Toiletries, and Allied Products
4356	Salespersons; Jewelry and Related Products
4359	Salespersons; Not Elsewhere Classified
436	Sales Occupations; Others
4362	Sales Clerks
4363	Counter Clerks
4364	Cashiers

4365	News Vendors
4366	Street Vendors, Door-to-Door Sales Workers, and Related Occupations
4367	Salespersons; Parts
4369	Sales Occupations; Services, Not Elsewhere Classified
44	Sales Related Occupations
444	Appraisers and Related Occupations
445	Demonstrators, Promoters, and Models
446	Shoppers
447	Auctioneers
449	Sales Occupations; Other, Not Elsewhere Classified
	Administrative Support Occupations, Including Clerical
45	Supervisors; Administrative Support Occupations, Including Clerical
4511	Supervisors; General Office Occupations
4512	Supervisors; Computer and Peripheral Equipment Operators
4513	Supervisors; Secretaries, Stenographers and Typists
4514	Supervisors; Information Clerks
4516	Supervisors; Correspondence Clerks and Order Clerks
4519	Supervisors; Record Clerks
4521	Supervisors; Financial Record Processing Occupations
4522	Supervisors; Duplicating, Mail and Other Office Machine Operators
4523	Chief Communications Operators
4524	Supervisors; Mail and Message Distribution Clerks
4525	Supervisors; Material Recording, Scheduling, and Distributing Clerks
4528	Supervisors; Adjusters, Investigators, and Collectors
4529	Supervisors; Miscellaneous Administrative Support Occupations
46-47	Administrative Support Occupations, Including Clerical
461	Computer and Peripheral Equipment Operators
4612	Computer Operators
4613	Peripheral Equipment Operators
462	Secretaries, Stenographers and Typists
4622	Secretaries
4623	Stenographers
4624	Typists
463	General Office Occupations
464	Information Clerks
4642	Interviewing Clerks
4643	Hotel Clerks
4644	Reservation Agents and Transportation Ticket Clerks
4645	Receptionists
4649	Information Clerks, Not Elsewhere Classified
466	Correspondence Clerks and Order Clerks
4662	Classified-ad Clerks
4663	Correspondence Clerks
4664	Order Clerks
469	Record Clerks
4692	Personnel Clerks, Except Payroll and Timekeeping
4694	Library Clerks
4696	File Clerks
4699	Record Clerks, Not Elsewhere Classified
471	Financial Record Processing Occupations
4712	Bookkeepers and Accounting and Auditing Clerks

4713 Payroll and Timekeeping Clerks
4715 Billing Clerks
4716 Cost and Rate Clerks
4718 Billing, Posting, and Calculating Machines Operators
472 Duplicating, Mail and Other Office Machine Operators
4722 Duplicating Machine Operators
4723 Mail Preparing and Handling Machine Operators
4729 Office Machine Operators, Not Elsewhere Classified
473 Communication Equipment Operators
4732 Telephone Operators
4733 Telegraphers
4739 Communications Equipment Operators, Not Elsewhere Classified
474 Mail and Message Distributing Occupations
4742 Postal Clerks, Except Mail Carriers
4743 Mail Carriers, Post Office
4744 Mail Clerks, Except Post Office
4745 Messengers
475 Material Recording, Scheduling, and Distributing Clerks
4751 Dispatchers
4752 Production and Planning Clerks
4753 Traffic, Shipping, and Receiving Clerks
4754 Stock and Inventory Clerks
4755 Meter Readers
4756 Weighers, Measures, and Clerks
4757 Samplers
4758 Expediters
4759 Materials Recording, Scheduling, and Distributing Clerks, Not Elsewhere Classified
478 Adjusters, Investigators, and Collectors
4782 Insurance Adjusters, Examiners, and Investigators
4783 Investigators and Adjusters, Except Insurance
4784 Clerks, Social Welfare
4786 Bill and Account Collectors
4787 License Clerks
479 Miscellaneous Administrative Support Occupations, Including Clerical
4791 Bank Tellers
4792 Proof Readers
4793 Data Entry Keyers
4794 Statistical Clerks
4795 Teacher Aides
4799 Administrative Support Occupations, Including Clerical, Not Elsewhere Classified

Service Occupations

50 Private Household Occupations
502 Day Workers
503 Launderers and Ironers
504 Cooks, Private Household
505 Housekeepers and Butlers
506 Child Care Workers, Private Household
507 Private Household Cleaners and Servants
509 Private Household Occupations, Not Elsewhere Classified
51 Protective Service Occupations
511 Supervisors; Service Occupations, Protective

5111	Supervisors; Firefighting and Fire Prevention Occupations
5112	Supervisors; Police and Detectives
5113	Supervisors; Guards
512	Firefighting and Fire Prevention Occupations
5122	Fire Inspection and Fire Prevention Occupations
5123	Firefighting Occupations
513	Police and Detectives
5132	Police and Detectives, Public Service
5133	Correctional Institution Officers
5134	Sheriffs, Bailiffs, and Other Law Enforcement Officers
514	Guards
5142	Crossing Guards
5144	Guards and Police, Except Public Service
5149	Protective Service Occupations, Not Elsewhere Classified
52	Service Occupations, Except Private Household and Protective
521	Food and Beverage Preparation and Service Occupations
5211	Supervisors; Food and Beverage Preparation Service Occupations
5212	Bartenders
5213	Waiters and Waitresses
5214	Cooks, Except Short Order
5215	Short-order Cooks
5216	Food Counter, Fountain and Related Occupations
5217	Kitchen Workers, Food Preparation
5218	Waiters'/Waitresses' Assistants
5219	Miscellaneous Food and Beverage Preparation Occupations
523	Health Service Occupations
5232	Dental Assistants
5233	Health Aides, Except Nursing
5236	Nursing Aides, Orderlies, and Attendants
524	Cleaning and Building Service Occupations, Except Private Households
5241	Supervisors; Cleaning and Building Service Workers
5242	Maids and Housemen
5244	Janitors and Cleaners
5245	Elevator Operators
5246	Pest Control Occupations
5249	Cleaning and Building Service Occupations, Not Elsewhere Classified
525-6	Personal Service Occupations
5251	Supervisors; Personal Service Occupations
5252	Barbers
5253	Hairdressers and Cosmetologists
5254	Attendants, Amusement and Recreation Facilities
5255	Guides
5256	Ushers
5257	Public Transportation Attendants
5258	Wardrobe and Dressing Room Attendant
5262	Baggage Porters and Bellhops
5263	Welfare Service Agents
5264	Child Care Workers, Except Private Household
5269	Personal Service Occupations, Not Elsewhere Classified
	Agricultural, Forestry and Fishing Occupations
55	Farm Operators and Managers

551 Farmers (Working Proprietors)
5512 General Farmers
5513 Crop, Vegetable, Fruit and Tree Nut Farmers
5514 Livestock, Dairy, Poultry and Fish Farmers
5515 Horticulture Specialty Farmers
552 Farm Managers
5522 Managers; General Farm
5523 Managers; Crop, Vegetable, Fruit and Tree Nut Farm
5524 Managers; Livestock, Dairy, Poultry and Fish Farm
5525 Managers; Horticulture Specialty Farm
56 Other Agriculture and Related Occupations
561 Farm Occupations, Except Managerial
5611 Supervisors, Farm Workers
5612 General Farm Workers
5613 Field Crop and Vegetable Farm Workers (Hand)
5614 Orchard and Vineyard and Related Workers (Hand)
5615 Irrigation Workers
5616 Farm Machinery Operators
5617 Livestock Workers
5618 Marine Life Cultivation Workers
5619 Nursery Workers
562 Related Agricultural Occupations
5621 Supervisors; Related Agricultural Workers
5622 Groundskeepers and Gardeners, Except Farm
5624 Animal Caretakers, Except Farm
5625 Graders and Sorters; Agricultural Products
5627 Inspectors; Agricultural Products
57 Forestry and Logging Occupations
571 Supervisors; Forestry and Logging Workers
572 Forestry Workers, Except Logging
573 Timber Cutting and Related Occupations
579 Logging Occupations, Not Elsewhere Classified
58 Fishers, Hunters, and Trappers
583 Fishers
584 Hunters, and Trappers

Mechanics and Repairers

60 Supervisors; Mechanics and Repairers
61 Mechanics and Repairers
611 Vehicle and Mobile Equipment Mechanics and Repairers
6111 Automobile Mechanics
6112 Bus and Truck Engine, and Diesel Engine Mechanics
6113 Aircraft Engine Mechanics
6114 Small Engine Repairers
6115 Automobile Body and Related Repairers
6116 Aircraft Mechanics (Except Engine Specialists)
6117 Heavy Equipment Mechanics
6118 Farm Equipments Mechanics
613 Industrial Machinery Repairers
614 Machinery Maintenance Occupations
615 Electrical and Electronic Equipment Repairers
6151 Communications Equipment Repairers

6152 Electric Motor, Transformer, and Related Repairers
6153 Electric and Electronic Repairers, Commercial and Industrial Equipment
6154 Data Processing Equipment Repairers
6155 Electronic Repairers, Home-entertainment Equipment
6156 Household Appliance and Power Tools Repairers
6157 Telephone Line Installer and Repairers
6158 Telephone Installers and Repairers
6159 Miscellaneous Electrical and Electronic Equipment Repairers
616 Heating, Air-conditioning, and Refrigeration Mechanics
617 Miscellaneous Mechanics and Repairers
6171 Camera, Watch, and Other Precision Instrument Repairers
6172 Musical Instrument Repairers and Tuners
6173 Locksmiths and Safe Repairers
6174 Office Machine Repairers
6175 Mechanical Controls and Valve Repairers
6176 Elevator Installers and Repairers
6177 Riggers
6178 Millwrights
6179 Mechanics and Repairers, Not Elsewhere Classified

Construction and Extractive Occupations

63 Supervisors; Constructions and Extractive Occupations
631 Supervisors; Construction
6311 Supervisors; Overall Construction
6312 Supervisors; Brickmasons, Stonemasons, and Hard Tile Setters
6313 Supervisors; Carpenters and Related Workers
6314 Supervisors; Electricians and Power Transmissions Installers
6315 Supervisors; Painters, Paperhangers, and Plasterers
6316 Supervisors; Plumbers and Pipefitters and Steamfitters
6318 Supervisors; Other Construction Trades
632 Supervisors; Extractive Occupations
64 Construction Trades
641 Brickmasons, Stonemasons, and Hard Tile Setters
6412 Brickmasons
6413 Stonemasons
6414 Tile Setters, Hard
642 Carpenters and Related Workers
6422 Carpenters
6424 Drywall Installers
643 Electricians and Power Transmissions Installers
6432 Electricians
6433 Electrical Power Installers and Repairers
644 Painters, Paperhangers, and Plasterers
6442 Painters (Construction and Maintenance)
6443 Paperhangers
6444 Plasterers
645 Plumbers, Pipefitters and Steamfitters
646-7 Other Construction Trades
6462 Carpet and Soft Tile Installers
6463 Concrete and Terrazzo Finishers
6464 Glaziers
6465 Insulation Workers

6466	Paving, Surfacing, and Tamping Equipment Operators
6467	Rail and Track Laying Equipment Operators
6468	Roofers
6472	Sheetmetal Duct Installers
6473	Structural Metal Workers
6474	Drillers, Earth
6475	Air Hammer Operators
6476	Pile Driving Operators
6479	Construction Trades, Not Elsewhere Classified
65	Extractive Occupations
652	Drillers, Oil Well
653	Explosive Workers
654	Mining Machine Operators
656	Extractive Occupations, Not Elsewhere Classified
	Precision Production Occupations
67	Supervisors; Precision Production Occupations
68	Precision Production Occupations
681-2	Precision Metal Workers
6811	Tool and Die Makers
6812	Precision Assemblers (Metal)
6813	Machinists
6814	Boilermakers
6816	Precision Grinders, Filers, and Tool Sharpeners
6817	Patternmakers and Model Makers (Metal)
6821	Lay-out Workers
6822	Precision Hand Molders and Shapers (jewelers)
6823	Engravers
6824	Sheet Metal Workers
6829	Miscellaneous Precision Metal Workers
683	Precision Woodworkers
6831	Patternmakers and Model Makers, Wood
6832	Cabinet Makers and Bench Carpenters
6835	Furniture Finishers
6839	Miscellaneous Precision Woodworkers
684	Precision Printing Occupations
6841	Precision Typesetters
6842	Precision Lithographers and Photoengravers
6844	Bookbinders
6849	Miscellaneous Precision Printing Occupations
685	Precision Textile, Apparel and Furnishings Workers
6852	Tailors and Dressmakers, Hand
6853	Upholsterers
6854	Shoemakers and Leather Workers and Repairers
6855	Precision Laundering, Cleaning, and Dyeing Occupations
6856	Apparel and Fabric Patternmakers
6859	Miscellaneous Precision Apparel and Fabric Workers
686	Precision Workers; Assorted Materials
6861	Precision Hand Molders and Shapers (Except Jewelers)
6862	Precision Patternmakers, Lay-out Workers and Cutters
6863	Detail Design Painters and Decorators
6864	Optical Goods Workers

6865	Dental Laboratory Technicians
6866	Gem and Diamond Working Occupations
6867	Precision Electrical and Electronic Equipment Assemblers
6868	Photographic Process Workers
6869	Miscellaneous Precision Workers, Not Elsewhere Classified
687	Precision Food Production Occupations
6871	Butchers and Meat Cutters
6872	Bakers
6873	Batchmakers (Candymakers, Cheesemakers, Etc.)
6879	Miscellaneous Precision Food Workers
688	Precision Inspectors, Testers, and Related Workers
6881	Precision Inspectors, Testers, and Graders
6882	Precision Adjusters and Calibrators
69	Plant and System Operators
691	Water and Sewage Treatment Plant Operators
692	Gas Plant Operators
693	Power Plant Operators
6931	Stationary Engineers
6932	Power Plant and Systems Operators, except Stationary Engineers
694	Chemical Plant Operators
695	Petroleum Plant Operators
696	Miscellaneous Plant or System Operators
	Production Working Occupations
71	Supervisors; Production Occupations
73-74	Machine Setup Operators
731-2	Metal Working and Plastic Working Machine Setup Operators
7312	Lathe and Turning Machine Setup Operators
7313	Milling and Planning Machine Setup Operators
7314	Punching and Shearing Machine Setup Operators
7315	Extruding and Drawing Machine Setup Operators
7316	Rolling Machine Setup Operators
7317	Press and Brake Machine Setup Operators
7318	Drilling and Boring Machine Setup Operators
7319	Forging Machine Setup Operators
7322	Grinding, Abrading, Buffing, and Polishing Machine Setup Operators
7324	Lapping and Honing Machine Setup Operators
7326	Numerical Control Machine Setup Operators
7329	Miscellaneous Metalworking and Plastic Working Machine Setup Operators
733	Metal Fabricating Machine Setup Operators
7332	Welding Machine Setup Operators
7333	Soldering and Brazing Machine Setup Operators
7339	Miscellaneous Fabricating Machine Setup Operators
734	Metal and Plastic Processing Machine Setup Operators
7342	Molding and Casting Machine Setup Operators
7343	Plating and Coating Machine Setup Operators
7344	Heating Equipment Machine Setup Operators
7349	Miscellaneous Metal and Plastic Processing Machine Setup Operators
743	Woodworking Machine Setup Operators
7431	Lathe and Turning Machine Setup Operators
7432	Router and Planer Machine Setup Operators
7433	Sawing Machine Setup Operators

7434 Sanding Machine Setup Operators
7435 Shaping and Joining Machine Setup Operators
7439 Miscellaneous Woodworking Machine Setup Operators
744 Printing Machine Setup Operators
7443 Printing Press Setup Operators
7444 Photoengraving and Lithographing Machine Setup Operators
7449 Miscellaneous Printing Machine Setup Operators
745 Textile Machine Setup Operators
7451 Winding and Twisting Machine Setup Operators
7452 Knitting and Weaving Machine Setup Operators
7459 Textile Machine Setup Operators, Not Elsewhere Classified
746-7 Assorted Materials: Machine Setup Operators
7462 Packaging and Filling Machine Setup Operators
7463 Extruding and Forming Machine Setup Operators
7467 Compressing and Compacting Machine Setup Operators
7472 Roasting and Baking Machine Setup Operators
7474 Folding Machine Setup Operators
7476 Still, Clarifying, and Precipitating Machine Setup Operators
7477 Crushing, Grinding and Polishing Machine Setup Operators
7478 Slicing and Cutting Machine Setup Operators
7479 Miscellaneous Machine Setup Operators
75-76 Machine Operators and Tenders
751-2 Metal Working and Plastic Working Machine Operators and Tenders
7512 Lathe and Turning Machine Operators and Tenders
7513 Milling and Planning Machine Operators and Tenders
7514 Punching and Shearing Machine Operators and Tenders
7515 Extruding and Drawing Machine Operators and Tenders
7516 Rolling Machine Operators and Tenders
7517 Press and Brake Machine Operators and Tenders
7518 Drilling and Boring Machine Operators and Tenders
7519 Forging Machine Operators and Tenders
7522 Grinding, Abrading, Buffing, and Polishing Machine Operators and Tenders
7529 Miscellaneous Metalworking and Plastic Working Machine Operators and Tenders
753 Metal Fabricating Machine Operators and Tenders
7532 Welding Machine Operators and Tenders
7533 Soldering and Brazing Machine Operators and Tenders
7539 Miscellaneous Fabricating Machine Operators and Tenders
754 Metal and Plastic Processing Machine Operators and Tenders
7542 Molding and Casting Machine Operators and Tenders
7543 Plating and Coating Machine Operators and Tenders
7544 Heating Equipment Machine Operators and Tenders
7549 Miscellaneous Metal and Plastic Processing Machine Operators and Tenders
763 Woodworking Machine Operators and Tenders
7631 Lathe and Turning Machine Operators and Tenders
7632 Router and Planer Machine Operators and Tenders
7633 Sawing Machine Operators and Tenders
7634 Sanding Machine Operators and Tenders
7635 Shaping and Joining Machine Operators and Tenders
7636 Nailing and Tacking Machine Operators and Tenders
7639 Miscellaneous Woodworking Machine Operators and Tenders
764 Printing Machine Operators and Tenders

7642 Typesetting and Composing Machine Operators and Tenders
7643 Printing Machine Operators and Tenders
7644 Photoengraving and Lithographing Machine Operators and Tenders
7649 Printing Machine Operators and Tenders, Not Elsewhere Classified
765 Textile, Apparel and Furnishings Machine Operators and Tenders
7651 Winding and Twisting Machine Operators and Tenders
7652 Knitting and Weaving Machine Operators and Tenders
7654 Textile Cutting Machine Operators and Tenders
7655 Textile Sewing Machine Operators and Tenders
7656 Shoe Machine Operators and Tenders
7657 Pressing Machine Operators
7658 Laundering and Dry Cleaning Machine Operators and Tenders
7659 Miscellaneous Textile Machine Operators and Tenders
766-7 Machine Operators and Tenders; Assorted Materials
7661 Cementing and Gluing Machine Operators and Tenders
7662 Packaging and Filling Machine Operators and Tenders
7663 Extruding and Forming Machine Operators and Tenders
7664 Mixing and Blending Machine Operators and Tenders
7665 Cooling and Freezing Equipment Operators and Tenders
7666 Separating and Filtering Machine Operators and Tenders
7667 Compressing and Compacting Machine Operators and Tenders
7668 Boiler Operators and Tenders (Low Pressure)
7669 Coating, Painting, and Spraying Machine Operators and Tenders
7671 Photographic Processing Machine Operators
7672 Roasting and Baking Machine Operators and Tenders
7673 Washing, Cleaning and Pickling Equipment Operators and Tenders
7674 Folding Machine Operators and Tenders
7675 Furnace, Kiln, and Oven Operators and Tenders
7676 Still, Clarifying, and Precipitating Operators and Tenders
7677 Crushing, Grinding and Polishing Machine Operators and Tenders
7678 Slicing and Cutting Machine Operators and Tenders
7679 Miscellaneous Machine Operators and Tenders, Not Elsewhere Classified
77 Fabricators, Assemblers, and Hand Working Occupations
771 Welders and Solderers
7714 Welders and Cutters
7717 Solderers and Brazers
772 Assemblers
774 Fabricators, Not Elsewhere Classified
775 Hand Working Occupations
7752 Hand Sewing Occupations
7753 Hand Cutting and Trimming Occupations
7754 Hand Molding and Casting Occupations
7755 Hand Forming And Shaping Occupations
7756 Hand Painting, Coating and Decorating Occupations
7757 Hand Engraving And Printing Occupations
7758 Hand Grinding and Polishing Occupations
7759 Miscellaneous Hand Working Occupations
78 Production Inspectors, Testers, Samplers, and Weighers
782 Production Inspectors, Checkers and Examiners
783 Production Testers
784 Production Samplers and Weighers

785	Graders and Sorters, Except Agricultural
787	Production Expediters
	Transportation and Material Moving Occupations
81	Supervisors; Transportation and Material Moving Occupations
811	Supervisors; Motorized Equipment Operators
8111	Supervisors; Motor Vehicle Operators
8113	Railroad Conductors and Yardmasters
812	Supervisors; Materials Moving Equipment Operators
82	Transportation Occupations
821	Motor Vehicle Operators
8212	Truck Drivers, Tractor-trailer
8213	Truck Drivers, Heavy
8214	Truck Divers, Light (Including Delivery and Route Drivers)
8215	Bus Drivers
8216	Taxicab Drivers and Chauffeurs
8218	Driver-Sales Workers
8219	Other Motor Transportation Occupations, Not Elsewhere Classified
823	Rail Transportation Occupations
8232	Locomotive Operating Occupations
8233	Railroad Brake, Signal, and Switch Operators
8239	Rail Vehicle Operators, Not Elsewhere classified
824	Water Transportation Occupations
8241	Ship Captains and Mates
8242	Boat and Barge Operators
8243	Sailors and Deckhands
8244	Marine Engineers
8245	Bridge, Lock, Lighthouse Tenders
825	Airplane Pilots and Navigators
828	Transportation Inspectors
83	Materials Moving Occupations, Except Transportation
831	Materials Moving Equipment Operators
8312	Operating Engineers
8313	Longshore Equipment Operators
8314	Hoist and Winch Operators
8315	Crane and Tower Operators
8316	Excavating and Loading Machine Operators
8317	Grader, Dozer, and Scraper Operators
8318	Industrial Truck and Tractor Equipment Operators
8319	Miscellaneous Materials Moving Equipment Operators
	Handlers, Equipment Cleaners, Helpers and Laborers
85	Supervisor; Handlers, Equipment Cleaners, Helpers, and Laborers
86	Helpers
861	Helpers; Machine Operators and Tenders
8611	Helpers; Metalworking and Plastic Working Machine Operators and Tenders
8614	Helpers; Metal and Plastic Processing Machine Operators and Tenders
8615	Helpers; Woodworking Machine Operators and Tenders
8616	Helpers; Printing Machine Operators and Tenders
8617	Helpers; Textile, Apparel and Furnishings Machine Operators and Tenders
8618	Helpers; Machine Operators and Tenders, Assorted Materials
8619	Helpers; Precision Production Occupations and Setup Operations
862	Helpers; Fabricators and Inspectors

863	Helpers; Mechanics and Repairers
8632	Helpers; Vehicle and Mobile Equipment Mechanics and Repairers
8633	Helpers; Industrial Machinery Repairers
8635	Helpers; Electrical and Electronic Equipment Repairers
8637	Helpers; Miscellaneous Mechanics and Repairers
864	Helpers; Construction Trades
8641	Helpers; Brickmasons, Stonemasons, and Hard Tile Setters
8642	Helpers; Carpenters and Related Workers
8643	Helpers; Electricians and Power Transmission Installers
8644	Helpers; Painters, Paperhangers, and Plasterers
8645	Helpers; Plumbers, Pipefitters and Steamfitters
8646	Helpers; Surveyor's
8648	Helpers; Other Construction Trades
865	Helpers; Extractive Occupations
87	Handlers, Equipment Cleaners and Laborers
871	Construction Laborers
872	Freight, Stock, and Materials Movers; Hand
8722	Garbage Collectors
8723	Stevedores
8724	Stock Handlers and Baggers
8725	Machine Feeders and Offbearers
8726	Freight, Stock, and Materials Movers, Not Elsewhere Classified
873	Garage and Service Station Related Occupations
874	Parking Lot Attendants
875	Vehicle Washers and Equipment Cleaners
876	Miscellaneous Manual Occupations
8761	Hand Packers and Packagers
8769	Manual Occupations, Not Elsewhere Classified
	Military Occupations
91	Military Occupations
	Miscellaneous Occupations
99	Miscellaneous Occupations