



Empirical evidence on occupation and industry specific human capital

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ABSTRACT

This paper presents instrumental variables estimates of the effects of firm tenure, occupation specific work experience, industry specific work experience, and general work experience on wages using data from the 1979 Cohort of the National Longitudinal Survey of Youth. The estimates indicate that both occupation and industry specific human capital are key determinants of wages, and the importance of various types of human capital varies widely across one-digit occupations. Human capital is primarily occupation specific in occupations such as craftsmen, where workers realize a 14% increase in wages after five years of occupation specific experience but do not realize wage gains from industry specific experience. In contrast, human capital is primarily industry specific in other occupations such as managerial employment where workers realize a 23% wage increase after five years of industry specific work experience. In other occupations, such as professional employment, both occupation and industry specific human capital are key determinants of wages.

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1. Introduction

A large literature has examined the sources of wage growth over the lifecycle, with considerable attention devoted to determining the relative importance of employer tenure and overall labor market experience in determining wages. According to this view of the human capital accumulation process skills are either firm specific or transferable across all jobs, but skills are not occupation or industry specific.¹ A different view of the human capital accumulation process is presented by Neal (1995) and Parent (2000), who both find that industry specific human capital is a key determinant of wages, while firm-specific human capital contributes little to wage growth. More recently, Kambourov and Manovskii (2009a) have challenged the view that human capital is primarily industry specific, finding that after controlling for occupation tenure both industry and firm tenure have little importance in determining wages.² Their results suggest that previous estimates of large returns to industry experience were driven primarily by the omission of occupation specific work experience from wage regressions, a variable that is highly correlated with industry experience.

This paper presents new evidence on the specificity of human capital by estimating the returns to firm, occupation and industry specific work experience using data from the 1979 Cohort of the National Longitudinal

Survey of Youth (NLSY). These explanatory variables are endogenous, so the wage equation is estimated using the instrumental variables approach developed by Altonji and Shakotko (1987). The empirical results demonstrate that the conclusions drawn about the specificity of human capital hinge on the treatment of within-firm occupational mobility. When within-firm occupational mobility is ruled out, the estimates confirm Kambourov and Manovskii's (2009a) finding that human capital is primarily occupation specific. However, this paper presents new empirical evidence on the validity of within-firm occupation changes by exploiting a change in the NLSY occupation coding scheme that was designed to more accurately detect within-firm occupation changes. Beginning in 1994 the NLSY occupation coding scheme changed so that within-firm occupation changes were allowed to occur only if workers directly reported a change in the type of work done on their job. In contrast, before 1994 NLSY respondents re-reported their occupation for all jobs, and were not directly asked whether or not they had switched occupations within their current firm. A comparison of pre and post 1994 data suggests that within-firm occupation changes do in fact reflect true changes in occupation, and are not simply the result of measurement error. When these within-firm occupational transitions are allowed, the empirical results point to a role for both industry and occupation specific human capital in determining wages.³

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¹ See, for example, Altonji and Shakotko (1987), Abraham and Farber (1987), Topel (1991), and Altonji and Williams (2005). Shaw (1984, 1987) appears to be one of the first researchers to investigate the importance of occupation specific investments in determining wages.

² Zangelidis (2008) also finds that occupation specific human capital is an important determinant of wages using British data.

³ This paper will use the term “human capital” when referring to wage growth. More precisely, these are experience effects, since experience is observed in the data, but of course actual human capital is unobserved. However, while there are many theoretical models that explain how wages could rise with firm tenure even if workers do not accumulate firm specific human capital (such as deferred compensation to reduce shirking), it is difficult to extend this type of explanation to account for wage growth that occurs within occupations or industries, since it is unclear how implicit contracts could exist between a worker and an occupation or industry.

This paper also expands on the existing literature by allowing the returns to human capital to vary across occupations, departing from previous work which has constrained the parameters of the wage equation to be the same for all occupations. This is a key extension of existing research because there is no reason to believe that the technology of skill production is the same across all occupations. In fact, the results show that the specificity of skills accumulated at a job varies widely across one-digit occupations. For example, craftsmen accumulate skills that are primarily occupation specific, experiencing a wage gain of 14% after five years of occupation experience. On the other hand, human capital is primarily industry specific for managers, who experience a wage increase of 23% after five years of industry experience. In contrast, professionals accumulate skills that are both occupation and industry specific, as they realize wage increases of 22% after five years of occupation experience and 14% after five years of industry experience. Finally, sales workers do not experience wage gains from either occupation or industry experience, but they realize large wage gains as they accumulate general work experience. The differences in the returns to human capital across occupations are large and statistically significant. Restricting these effects to be equal across occupations leads to misleading estimates of the effects of occupation and industry specific human capital on wages.

Whether wage growth over the career is due to the accumulation of skills that are specific to firms, occupations, industries, or completely general and transferable between all jobs is a fundamental question about the wage determination process. In addition, the finding that human capital is both occupation and industry specific has implications for a number of areas of current research. For example, it suggests that studies of career choice and career mobility should define careers using both occupation and industry codes since workers acquire skills that are specific to both occupations and industries.⁴ The specificity of human capital is also relevant for macroeconomic studies of wage inequality and aggregate productivity. For example, [Kambourov and Manovskii \(2009b\)](#) develop a theoretical model which shows that rising occupational mobility can explain a large fraction of the observed increase in wage inequality if human capital is largely occupation specific.

The specificity of human capital is also relevant when studying the impact of job displacement, a topic which has been the subject of a large amount of research by economists as well as a considerable amount of policy discussion. The value of firm, occupation, and industry specific skills relative to the value of general skills is an important determinant of the cost of displacement since the transferability of a worker's skills to a new job is a key determinant of the wage loss accompanying job displacement.⁵

2. Data

The National Longitudinal Survey of Youth (NLSY) is a panel dataset that contains detailed information about the employment and educational experiences of a nationally representative sample of young men and women who were between the ages of 14 and 21 when first interviewed in 1979. This study uses NLSY data ranging from 1979 to 2000. The employment data contain a weekly employment record that provides information about the durations of employment spells along with the wages, hours, and three-digit 1970 U.S. Census occupation and industry codes for each job. One important feature of the data is that in 1994 the NLSY switched from annual to biennial interviews. This change does not directly impact the availability of the variables used in this

⁴ [Neal \(1999\)](#) develops a career choice model which defines a career using occupation and industry codes, but the majority of career choice models use only occupation codes to define a career. See [Miller \(1984\)](#), [McCall \(1990\)](#) and [Keane and Wolpin \(1997\)](#) for examples.

⁵ See [Ruhm \(1991\)](#) and [Jacobson et al. \(1993\)](#) for evidence on the cost of displacement. [Carrington \(1993\)](#) shows that displaced workers who switch industries suffer larger wage losses than those who remain in the same industry.

Table 1
Descriptive statistics.

	Mean
Real hourly wage	\$7.72
Firm tenure (in years)	1.95
Occupation experience	2.53
Industry experience	3.35
Total experience	5.44
Years of schooling	12.9
Age	27.50
Number of observations	26,841
Number of individuals	1,932
Fraction of firm spells with a within-firm occupation switch	.185
Fraction of firm spells with a within-firm industry switch	.103

analysis, but it may impact the quality of the data since the recall period for the data increases from one year to two years.⁶

This analysis uses only white men ages 18 or older from the nationally representative core sample of the NLSY. Individuals who ever report serving in the military, working as farmers, or being self-employed are excluded from the sample. These sample restrictions closely follow those imposed in the related literature, see [Parent \(2000\)](#) for an example.

The NLSY work history files are used to construct a monthly history of each individual's primary employment using the weekly employment records. This analysis considers only full time employment, which is defined as a job where the weekly hours worked are at least 20. The intent of this analysis is to follow workers from the time they make a permanent transition to the labor market and start their career. There is no clear best way to identify this transition to the labor market, so this analysis follows people from the month they reach age 18 or stop attending school, whichever occurs later. Individuals are followed until the year 2000, or until they exit from the sample due to missing data.

The weekly labor force record is aggregated into a monthly employment record based on the number of weeks each full time job is worked at during each month. An individual's primary job for each month is defined as the one in which the most weeks were spent during that month. Transitions between firms are identified using the NLSY variables that differentiate between employers within years and allow employers to be linked across survey years. The monthly employment record is used to create a running tally of firm tenure for each worker. Occupation and industry experience are also computed using the monthly labor force record. Occupation (industry) experience in each month is simply the total amount of experience that a worker has accumulated in the current occupation (industry). Total work experience is also computed in this manner, so this study uses actual work experience, as opposed to the potential experience variable used in many studies.

The NLSY work history files provide information about weekly employment status, but wages are recorded at the yearly level. For example, suppose that a person works in the same job during all twelve months of a year. The constructed employer tenure variable will increase by one in each month, but the wage will remain constant over the entire year. If the job continues into the next year, a new wage will be observed. Given this feature of the data, only months that include a new wage observation for jobs are used in the wage regressions. Summary statistics for the data are presented in [Table 1](#). There are 1932 individuals in the sample who contribute a total of 26,841 observations to the sample. The one-digit occupation and

⁶ For example, under the annual interview scheme respondents provide a weekly employment history that covers a one year period. Under biennial interviews, respondents provide a weekly employment record that covers a two year period. See [Dugoni et al. \(1997\)](#) and Appendix B of this paper for a discussion of the effect of the interviewing change on the labor market data used in this paper.

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