

# Work Activities as Firm-Specific Human Capital: Estimates of the Effects on Wages

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June 1, 2005

**Abstract:** This paper provides an empirical examination of Lazear's (2003) skill-weighted approach to firm-specific human capital. We find evidence that primary and secondary work activities are general skills that have large effects on wages. In addition, returns to computer use as a primary or secondary work activity are lower than many other types of work activities suggesting that prior interpretations of the returns to computer use as skill-biased technological change may be overstated. When we control for individual ability in a sample of employer changers, returns are generally less than half of those when we do not use similar controls, which indicates a large portion of the returns to skills are either firm-specific or attributable to individual ability or the employer match quality. Finally, we find that fixed effects estimates are not significantly different from zero for individuals who change employer due to a layoff but remain positive and significant when individuals change employer for any other reason. Overall, our empirical results support Lazear's assumption that most firm-specific skills are actually general skills that earn different returns across firms.

**JEL Codes:** J22, J24, J31

**Key words:** Firm-Specific Human Capital, Wages, Time Use

**Acknowledgements:** This paper has been presented at the University of Colorado-Denver and the 2003 Southern Economic Association Conference. We thank seminar participants for useful comments. Any errors are our own responsibility.

## **I. Introduction**

The human capital model predicts that individuals' investment in general and firm-specific skills that earn returns on the job. Most empirical research on the human capital model has focused on the returns to general human capital as measured by schooling.<sup>1</sup> Far fewer studies have estimated the effects of firm-specific human capital on wages. When researchers have estimated the effects of firm-specific human capital on wages, they have used job tenure as a proxy variable [Altonji and Shakotko (1987); Topel (1991); Altonji and Williams (2005)]. Neither estimates of the returns to schooling nor job tenure measure actual skills used on the job. This paper provides an empirical investigation of the effects of firm-specific skills on wages. We use data from the National Survey of College Graduates (NSCG) and the Science and Engineers Statistical Data System (SESTAT) to investigate the effects of skills, measured by work activities, on wages. We find that work activities provide adequate measures of work skills and have significant effects on wages.

We begin this analysis with several goals in mind. First, we evaluate whether work activities are skills that earn separate returns from other human capital investments. Our analysis will allow us to distinguish skill prices net of previous investments in general human capital (schooling) and occupational choice. Second, we seek to empirically identify skills that earn the highest returns. In particular, we investigate the effects of working with a computer on earnings after controlling for unobserved individual characteristics in addition to thirteen other work activities. Third, we investigate how much of the returns to work activities result from individual ability or employer match quality by using panel data to control for unobserved characteristics.

The paper is organized as follows: section two discusses the previous literature; section

three discusses the data; section four provides a conceptual discussion of firm-specific human capital and the empirical specification; section five presents the results; and section six concludes.

## **II. Literature Review**

Although skills are rarely observed in data sets from the United States, recent research attests to the importance of skills as an explanation for firm- or occupation-specific human capital investments and the returns to working with a computer. In the first line of inquiry, Lazear (2003) develops a model of firm-specific human capital investment where firm-specific human capital results in the acquisition of general skills that are readily transferable across firms. Firms pay for these skills based on their different valuations, and a worker possesses a combination of skills that are useful in different proportions to various firms. The worker's investment in a firm-specific combination of skills is based on an expectation of leaving the current firm. If the expectation is high, the worker will invest in a combination of skills that are more highly valued by the market. Lazear (2003) provides no empirical examination of his theoretical model. In related work, Shaw (1984) argues that workers invest in occupational skills that are transferable across occupations. She develops a measure of occupational investment and shows that this investment yields a higher return than work experience.

Others have estimated the effects of work activities, especially working with a computer, on wages. Krueger (1993) used the Current Population Survey (CPS) to examine the correlation between wages and workers who use computers. He argued that the wage premium for working with a computer was the result of skill-biased technological change. Corroborating evidence of the effects computers have on wages comes from Europe. Oosterbeek (1997) used longitudinal

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<sup>1</sup> See Card (1999) for a recent review of the literature.

data from The Netherlands to estimate returns to computer use. He found approximately an 11 percent return to computer use, but this return did not increase with the intensity of computer use. In addition, Oosterbeek used a fixed effects model to regress the change in net hourly log wages on indicators of computer use and intensity, and found a 9.6 percent return to computer use. Entorf and Kramarz (1996) studied whether workers who use computer-related new technology are better paid because they are more able or because the technology increases their productivity. Using French data that matches individuals with firms, the authors determined that new technology workers who had no new technology experience did have a wage advantage over workers who did not use new technology. Finally, Dolton and Makepeace (2004) use British panel data and find an earnings premium for working with a computer in a subset of workers who change employers.

More recently, researchers have estimated the direct effects of skills on wages. In the United States, lack of sufficient data has made it difficult for any direct measure of returns to skills. Nevertheless, some researchers attempting to measure returns to skills have relied on proxy variables. Ingram and Neumann (2000) matched job characteristic data in the Dictionary of Occupational Titles (DOT) with employment and demographic data in the CPS to construct four skill factors using a structural factor model. Results of regressions with these proxies indicated the quantity of skilled labor and the return to skilled labor has risen dramatically since 1975, but workers who attend college without investing in practical job skills experienced no income growth over the same period. These results indicate that on-the-job skill acquisition may be an important determinant of wages. Autor, Levy, and Murnane (2003) use the DOT to classify jobs by broad skill requirements. They argue that computer capital substitutes for routine cognitive and manual tasks and complements non-routine problem-solving tasks. They

find that computerization and the resulting changes in tasks can explain 60 percent of the increase in relative demand for college labor.

In Britain, data sources allow for direct estimation of returns to skills. Borghans and ter Weel (2003) utilized the 1997 British Skills Survey to compare returns to computer skills with returns to writing and math skills. The authors controlled for both the level of sophistication of computer use to remove bias and work tasks to distinguish true skills from those that are obtained as a by-product of the tasks workers perform. They concluded that returns to computer skills exist only if advanced skills related to tasks such as programming and design are used. Dickerson and Green (2002) used both the 1997 and 2001 British Skills Surveys. They used factor analysis to construct skill indices that capture correlations between different job activities and facilitated a formation of generic job skills. The study indicated that high-level communication skills and computing skills carry positive wage premiums. Our research now considers the returns to skills as proxied by work activities.

### **III. The Data**

Our data include the 1993 National Survey of College Graduates (NSCG) and the 1993, 1995, 1997 and 1999 waves of the Science and Engineers Statistical Data System (SESTAT). These data sets contain information on employment, including occupation and years of work experience; education, including college major and highest college degree; and demographic characteristics of individuals in the United States who have a bachelor's degree or higher. The 1993 NSCG is a subset of individuals from all education and occupation fields from the 1990 Decennial Census. The 1993, 1995, 1997 and 1999 SESTAT waves are an integration of individuals from three different surveys for each year: the NSCG, the Survey of Doctoral

Recipients and the National Survey of Recent College Graduates. The SESTAT waves include only individuals who either work or are educated in a science or engineering field.

Both the 1993 NSCG and SESTAT waves contain variables that indicate general work activities occupying 10 percent or more of an individual's time at work in a typical work week. These work activities include accounting and finance, applied and basic research, computer use, development, design, employee relations, management, production operations, professional services, sales, quality management, teaching and other work activities. Separate variables indicate whether a work activity is primary--the activity on which the individual spends the most time, or secondary--the activity on which the individual spends the second most time. All individuals must choose a single primary work activity and may or may not choose a single secondary work activity. Table 1 provides a description for each work activity.

In the 1993 NSCG sample, we retain all males and females with complete surveys, who are aged 25 to 60, working full-time, working five years prior to 1993, not in school, not self-employed and not in the military. In addition, we exclude all records with imputed earnings; earnings below the annual full-time minimum wage (\$7,438 in 1993); imputed primary, secondary and general work activities; and imputed schooling. We apply the same restrictions to the four SESTAT waves except working five years prior to 1993. In addition, we include from the four SESTAT waves only those individuals from each year's NSCG. For all years, we adjust earnings to 1996 dollars using the deflator for Personal Consumption Expenditures.

We separate the 1993 NSCG into three samples: the full 1993 NSCG sample that includes both science and non-science individuals, a science sample of individuals who are in both the 1993 NSCG and 1993 SESTAT samples, and a non-science sample of individuals who are in the 1993 NSCG sample only. We construct pooled or panel samples from the four

SESTAT waves according to whether an individual changed employer since the last SESTAT wave. One sample includes records for individuals who did not change employer since the last SESTAT wave; one sample includes records for individuals who changed employer for any reason since the last SESTAT wave; one sample includes records for individuals who change employer because of a layoff since the last SESTAT wave; one sample includes records for individuals who changed employer for any reason other than a layoff since the last SESTAT wave. The records included in each sample depend on the empirical model applied to the sample. For pooled OLS models, pooled samples include records that immediately follow the change in employer. For fixed effects models, panel samples include records that immediately precede and immediately follow the change in employer.

Table 2 contains descriptive statistics for the full 1993 NSCG sample and a pooled SESTAT sample that includes records from all four waves regardless of whether an individual changed employer. Log weekly earnings, the percent of males, the percent of whites and the percent of individuals who have never been married are higher in the pooled SESTAT sample. The pooled SESTAT sample contains higher percentages of individuals with master's or professional degrees, and the full 1993 NSCG sample contains higher percentages of individuals with bachelor's or doctorate degrees. Management, teaching and computer use are the most prevalent primary work activities in the full 1993 NSCG sample whereas management, computer use and professional services are most prevalent in the pooled SESTAT sample. In both samples, basic research, employee relations, production and quality management are the least prevalent primary work activities. Finally, a significant number of people in each sample do not list a secondary work activity.

## IV. General Skills as Firm-Specific Human Capital—Theoretical and Empirical

### Approaches

#### A. *The Theory*

We use and somewhat modify a model by Lazear (2003) to examine the effects of work activities on wages. Lazear (2003) formulates a skill-weighted approach to firm-specific human capital. He argues that most firm-specific skills are actually general skills that are valued differently across firms. In a simple two-period model, a worker with skill set  $(A, B)$  can earn wages  $W$  at firm  $i$ :

$$W_i = \lambda_i A + (1 - \lambda_i) B \quad (1),$$

where  $\lambda_i$  is the value a firm places on the primary work activity (the task a worker does the most on the job) and  $(1 - \lambda_i)$  is the value a firm places on the secondary work activity. The  $\lambda_i$  reflects the fact that firm  $i$  may place a different value on the work activity than firm  $j$ .

These general skills may be enhanced on the job. The cost of investing in the skills is given by  $C(A, B, \mu)$ , where the cost is a function of the particular skill and individual learning ability,  $\mu$ . We assume that the costs of investing in skills are lower for more able individuals,  $\frac{\partial C}{\partial \mu} < 0$  and  $\mu$  does not vary across skills  $A, B$ .

Workers live for two periods. They invest in general skills in period one given that they work at firm 1 and knowing that there is a probability  $p < 1$  that they will remain at firm 1. A worker must choose an investment strategy for general skills. Let the random variable  $\lambda$  have a density of  $f(\lambda)$ . A worker at firm 1 chooses to invest in general skills  $A$  and  $B$  to maximize net earnings:

$$W_i = p[\lambda_1 A + (1 - \lambda_1)B] + (1 - p) \left[ \int_0^1 [\lambda A + (1 - \lambda)B] f(\lambda) d\lambda \right] - C(A, B, \mu) \quad (2).$$

A worker's investment decision depends upon the probability of separation,  $(1 - p)$ , and individual learning ability. The first order conditions with respect to skill investment are given by:

$$\begin{aligned} \frac{\partial W_i}{\partial A} &= p\lambda_1 + (1 - p)\bar{\lambda} - C_A = 0 \\ \frac{\partial W_i}{\partial B} &= p(1 - \lambda_1) + (1 - p)(1 - \bar{\lambda}) - C_B = 0 \end{aligned} \quad (3).$$

The Equations in (3) suggest that the investments in skills are a weighted average of the skill-weights valued inside the firm,  $\lambda_1$ , and valued by the market,  $\bar{\lambda}$ , where the relative investment depends upon the probability of separation. If the probability of separation is high (e.g.,  $p = 0$ ) then the individual's investment decision becomes

$$\begin{aligned} \bar{\lambda} - C_A &= 0 \\ (1 - \bar{\lambda}) - C_B &= 0 \end{aligned}$$

The individual will invest in skills that yield a high market return,  $\bar{\lambda}$ . If the probability of separation is low (e.g.,  $p = 1$ ) then the individual's investment decision becomes

$$\begin{aligned} \lambda_1 - C_A &= 0 \\ (1 - \lambda_1) - C_B &= 0 \end{aligned}$$

The worker will make investments in skills valued by the firm,  $\lambda_1$ .

One can conclude from the above formulation that the market return on skills is the average valuation of skills over all firms,  $\bar{\lambda}$ . Lazear suggests several testable implications of the model, and we examine a subset of these in this paper. First, there should be a significant return on the average valuation of skills over all firms,  $\bar{\lambda}$ , net of other human capital investments. Our

goal is to estimate  $\bar{\lambda}$  for the work activities described by our data and to determine whether these skills earn significant returns. Second, Lazear posits that people who change employers because of exogenous factors, such as layoffs, should earn lower returns on skills relative to those who remain with an employer or change employers for other reasons. Conversely, those who intend to change employers should earn higher returns on skills relative to those who remain with the same employer or change employers due to layoffs. Finally, Lazear indicates that the skill-weighted approach is consistent with the matching model of the labor market. Lazear indicates that matching can be interpreted as the value placed on an individual's skills that differ across firms. Additional testable implications will result from our empirical specification below.

### ***B. Empirical Specification***

Consider the following empirical specification given in equation (4) for individual  $i$  employed by  $j$  at time  $t$ :

$$W_{ijt} = \alpha + \beta X_i + \gamma V_{ijt} + \bar{\lambda} Skill_{ijt} + \varepsilon_{ijt} \quad (4).$$

Wages,  $W$ , are a function of individual, time-invariant characteristics,  $X$  (i.e., schooling and demographic variables); time-varying characteristics,  $V$  (i.e., work experience and occupation); time-varying work activities,  $Skill$ ; and an error term. We can decompose the error term into  $\varepsilon_{ijt} = \mu_i + \phi_{ij} + \nu_{ijt}$  where  $\mu_i$  is unobserved individual learning ability,  $\phi_{ij}$  is a fixed employer match quality measure, and  $\nu_{ijt}$  is a stochastic error term. We may obtain unbiased estimates of the effects of skills on wages using equation (2), provided that individual ability,  $\mu_i$ , or employer match quality,  $\phi_{ij}$ , does not influence skill acquisition. However, the theoretical formulation given above renders this unlikely. High-ability workers will be motivated to invest more in firm-

specific human capital in order to reap higher returns. Likewise, those with high employer match quality will be more likely to invest in firm-specific human capital.

Thus, we will exploit the panel aspect of our data to control for individual ability and employer match quality in equation (5) using sub-samples of those who change employers to estimate fixed effects models of the effects of skills on wages.

$$\Delta W = \gamma \Delta V + \bar{\lambda} \Delta Skill + \Delta \varepsilon \quad (5).$$

Equation (5) will provide unbiased estimates of the effects of skills on wages. If the skills embodied by work activities are purely firm-specific, then the estimated impact of work activities on wages will be zero regardless of the reason for employer changes. Likewise, if the returns on work activities reflect pure ability, we would expect little to no impact of work activities on wages for employer changers. If the returns on work activities reflect employer match quality, they will be larger for those who choose to change employers than for those subject to layoffs. However, if Lazear's assumption is correct, then the effects of skills on wages,  $\bar{\lambda}$ , will be non-zero for any type of employer change.

## V. Empirical Results

### A. *OLS Estimates of the Effects Work Activities Have on Wages*

We begin by examining the distribution of primary, secondary, and general work activities across occupations in the NSCG and SESTAT samples. It could be that work activities are highly correlated with occupations and are therefore proxies for occupational choice. Table 3 shows the mean primary work activities by occupation in the full 1993 NSCG sample. Table 4 shows the mean primary work activities by occupation for the pooled SESTAT sample that

combines all survey waves.

In both the full NSCG sample and the pooled SESTAT sample, each occupation has a predictable set of primary work activities. For example, design is the most prevalent primary work activity in the full NSCG sample's architecture/engineering occupation. Management and employee relations are primary work activities across a number of occupations. A notable exception to this reasonable distribution includes the high frequency of professional services as a primary work activity in the full NSCG sample's health occupation. We do find that some occupations and work activities are highly correlated. For example, over 90 percent of those working in an education occupation report teaching as a primary work activity.

Next, we estimate a series of wage regressions that include controls for demographic characteristics, education, employment and work activities using the full 1993 NSCG sample.<sup>2</sup> Figures 1 through 3 graph the effects of primary, secondary, and general work activities (relative to the omitted work activity of production) on wages. All primary and secondary work activities have positive, significant returns at the 1 percent level. Development, sales, and applied research earn the three highest returns to primary work activities.

The returns to secondary work activities in Figure 2 are lower than returns to the corresponding primary work activities. Sales, development, and management earn the highest returns to secondary work activities but the effects are about half the size of the primary work activities. The effects of general work activities on wages in Figure 3 vary considerably from the effects of primary and secondary activities. Almost half of the general work activities have

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<sup>2</sup> The actual specification regresses log weekly earnings on age, years of education, a quartic in experience, indicators for female, black, Hispanic, other race, midwest, south, west, widowed, separated, divorced, never married, master's degree, professional degree, doctorate degree, occupations, college majors, and primary, secondary and general work activities, including accounting, applied research, basic research, computer use, development, design, employee relations, management, professional services, sales, quality management, teaching, other and no secondary work activity. All specifications use the Huber-White correction for standard errors.

negative or zero effects on wages.

As a primary work activity, the return to computer use is only higher than three of the other twelve primary work activities—teaching, quality management, and employee relations. As a secondary work activity, the return to computer use is only higher than the return to employee relations. This suggests that research focusing purely on the returns to computers overlooks the effects of the returns to other skills on wages.

It could be that the effects of work activities on wages vary depending upon the types of general human capital in which an individual has invested. For example, those who study science or engineering in college may have a comparative advantage in working with a computer compared with those who do not. To examine this possibility, we split the full 1993 NSCG into two sub-samples: those who studied or work in a science or engineering field (the science sample) and those who do not (the non-science sample). Figures 4 and 5 graph the effect of primary and secondary work activities on wages for these two sub-samples. With the exception of computer use, the returns to primary work activities are higher for individuals in the non-science sample than individuals in the science sample. However, returns to all secondary work activities are much higher in the science sample. In general, these returns are significant at the one percent level across both samples. The highest returns go to management and the lowest returns are to teaching. We tested the null hypothesis that the returns to primary work activities are the same in the science and non-science samples. We reject the null hypothesis for all primary work activities at the five percent level. Thus, we find lower returns to primary work activities for those with general human capital investments in science or engineering.

Results from the OLS models indicate that work activities are general skills that earn a sizable market return. However, the return to computer use is lower than the returns to other

skills, suggesting that the interpretation of the returns to computer use as skill-biased technological change may be overstated. Given the larger impact of primary work activities on wages, the remainder of the paper focuses on these results.

### ***B. Effects of Employer Changes on the Returns to Work Activities***

Lazear's model predicts that as the probability of separation is zero, workers will make more firm-specific investments in general skills. Conversely, as the probability of separation approaches one, workers will make more general investments in skills to maximize the market return. Finally, those who experience an unanticipated employer separation will have made relatively larger investments in firm-specific components of skills and, thus, have lower returns in the case of a separation. The SESTAT data allow us to examine employer changers by reason for the change—layoffs or self-selected changes.

In Figure 6, we examine the returns to work activities using pooled OLS models for those who do not change employer, those who changed employer because of layoffs, and those who changed employer for reasons other than a layoff. Our results are consistent with Lazear's predictions. The returns to work activities are generally smallest for those who remain with their employer. In these cases, we assume the probability of separation is known by the individual to be low, so the individual makes investments in firm-specific skills. However, the average market returns to work activities are largest for those who change employers for reasons other than layoffs. In this case, we assume the probability of separation is known by the individual to be high, so the individual makes investments in skills that are more highly valued by the market. Likewise, the average market returns to work activities are lower for those who change employer due to layoffs than those who change employer for reasons other than layoffs. In this case, we

assume the probability of separation is not known by the individual to be high, so the individual makes investments in firm-specific skills.

***C. Fixed Effects Estimates of the Effects Work Activities Have on Wages***

As mentioned previously, the effects of work activities on wages may be the result of ability bias, employer match quality, or may reflect the return to a purely firm-specific human capital investment instead of the return on a general skill. In order to explore this possibility, we estimate pooled OLS and fixed effects models for those workers who changed employers (and in most cases work activities) from 1993 to 1999 using the SESTAT samples of employer changers. For the pooled OLS models, pooled samples include records from the SESTAT wave immediately following the change in employer. For the fixed effects models, panel samples include records from the SESTAT waves immediately preceding and immediately following the change in employer. Figure 7 compares the returns to primary work activities using pooled OLS and fixed effects models for individuals who changed employer for any reason. Fixed effects estimates are significant for all work activities with the exception of basic research, teaching, and other work activities. In general, the effects of work activities on wages in the fixed effects models fall by more than one-half relative to the pooled OLS models for primary work activities. These results indicate that some of the estimated effects of the computer use, design, development, employee relations, management, quality management, sales and other work activities may be the result of either individual ability, employer match quality, or are largely firm-specific. In results not reported here, we find a similar pattern for the return to secondary work activities.

These fixed effects estimates may reflect employer match quality because individuals

change employers for any reason. The SESTAT data allow us to differentiate employer changes by reason: layoffs or any other reason. We assume that layoffs represent an exogenous employer change allowing us to bypass the selection bias in employer changes for other reasons. Figure 8 compares the pooled OLS and fixed effects estimates of primary work activities for those who changed employer because of layoffs. We see a dramatic reduction in the fixed effects estimates with some work activities earning a negative return. In addition, none of the fixed effects estimates are significantly different from zero. This is consistent with Lazear's prediction that those who experience an unanticipated employer change lose a substantial proportion of their firm-specific investment in skills. At the same time, it is unexpected that the returns to work activities are not significantly different from zero since Lazear argues that these skills are general.

Next, we consider those who changed employer for reasons other than layoffs in Figure 9. As in previous figures, the fixed effects estimates are significantly smaller than the pooled OLS estimates. However, almost all of the fixed effects estimates of returns to primary work activities are statistically significant with the exception of basic research, other activities, and teaching. This is consistent with Lazear's prediction that the returns to work activities will be larger for those who expect to change employers. Figures 8 and 9 provide additional insight into the returns to work activities. As Lazear predicts, the returns to skills will be lower for those who suffer exogenous employer changes than those who do not. The returns to work activities for layoffs are not significantly different from zero but positive for other types of employer changes. The fixed effects layoff estimates in Figure 8 are purged of ability bias and employer match quality, whereas the estimates in Figure 9 are only purged of ability bias and reflect the self-selection of employers. Taken together, Figures 8 and 9 suggest that the returns to primary

work activities may represent the returns to employer match quality more than the returns to general skills.

## **VI. Conclusions**

This paper provides an empirical examination of Lazear's (2003) skill-weighted approach to firm-specific human capital. We find evidence that primary and secondary work activities are general skills that have large effects on wages. We find lower returns to work activities for scientists than for non-scientists. Likewise, returns to computer use as a primary or secondary work activity are lower than many other types of work activities suggesting that the interpretation of the returns to computer use as skill-biased technological change may be overstated.

In addition, we evaluate the impact of employer changes on the returns to skills. Consistent with Lazear's model, we find larger average returns to skills for those who choose to move compared with those who experience exogenous changes via layoffs or remain with the same employer. Investments in firm-specific skills should be smaller in the first case relative to investments in the latter two cases.

We use fixed effects models to control for individual ability bias and employer match quality using samples of individuals who changed employer for any reason. We find that the returns on most primary work activities remain positive and significant even when we control for individual ability and employer match quality. However, these returns are almost always less than half of those when we do not control for individual ability, which indicates a large portion of the returns to skills are either firm-specific, the result of individual ability, or the result of employer match quality.

Finally, we investigate whether the expectation of a change in employer affects returns

to skills by comparing fixed effects estimates for those who are laid off and those who change employers for any reason other than a layoff.. The fixed effects estimates are not significantly different from zero for layoffs whereas the estimates remain positive and significant for other reasons. Taken together, these results suggest that the returns on skills may reflect employer match quality. Overall, our empirical results support Lazear's predictions that firm-specific skills are actually general skills that earn different returns across firms.

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**Table 1: Descriptions of work activity variables used in the analysis\***

<b>Name</b>	<b>Description</b>
Accounting	accounting, finance, contracts
Applied research	study directed toward gaining scientific knowledge to meet a recognized need
Basic research	study directed toward gaining scientific knowledge primarily for its own sake
Computer use	computer applications, programming, systems development
Design	design of equipment, processes, structures or models
Development	using knowledge gained from research for the production of materials or devices
Employee relations	recruiting, personnel development, training
Management	management and administration
None	no secondary work activity
Other	other
Production	production, operations, maintenance (e.g., truck driving, machinist, mechanic, etc.)
Professional services	healthcare, financial services, legal services
Quality management	quality or productivity management
Sales	sales, purchasing, marketing
Teaching	primary, secondary, post-secondary teaching

\* Descriptions come from the 1993 National Survey of College Graduates.

**Table 2: Descriptive statistics for the full NSCG and the pooled SESTAT samples**

	<b>Full NSCG Sample</b>		<b>Pooled SESTAT Sample</b>	
	<b>Mean</b>	<b>Standard deviation</b>	<b>Mean</b>	<b>Standard deviation</b>
Number of observations	71,907		154,939	
<i>Earnings and Demographic Variables:</i>				
Log weekly earnings	6.81	.478	6.88	.500
Male	.64	.480	.72	.449
Female	.36	.480	.28	.449
White	.64	.480	.75	.432
Hispanic	.04	.201	.06	.228
Black	.08	.275	.07	.255
Other race	.24	.424	.12	.320
East	.22	.417	.22	.414
Midwest	.21	.409	.20	.401
South	.32	.466	.31	.463
West	.25	.430	.27	.443
Married	.74	.441	.73	.447
Widowed	.01	.087	.01	.072
Separated	.01	.119	.01	.110
Divorced	.08	.273	.07	.255
Never married	.16	.368	.18	.390
Age	41.28	8.439	40.96	8.850
Years of education	17.01	1.453	17.01	1.257
Years of experience	16.51	8.131	16.08	8.377
<i>Highest Degree Variables:</i>				
Bachelor's	.62	.487	.57	.495
Master's	.28	.448	.33	.471
Professional	.04	.203	.08	.263
Doctorate	.06	.246	.02	.152
<i>College Major Variables:</i>				
Management	.10	.307	.05	.219
Business/finance	.07	.255	.02	.143
Computer/math	.07	.250	.12	.320
Architecture/engineering	.18	.390	.31	.464
Life/physical science	.09	.293	.16	.368
Social science	.11	.318	.18	.382
Service	.05	.210	.02	.152
Legal	.02	.131	.03	.158
Education/library science	.11	.318	.02	.153
Arts/design/entertainment/sports	.08	.265	.01	.109
Health	.07	.250	.06	.240
Protective services	.01	.085	.00	.031
Sales	.02	.145	.01	.075
Farming/fishing/forestry	.01	.084	.00	.056
Other	.01	.078	.01	.067

*Occupation Variables:*

Management	.14	.345	.11	.310
Business/finance	.10	.298	.05	.226
Computer/math	.11	.311	.17	.373
Architecture/engineering	.16	.365	.25	.431
Life/physical science	.05	.230	.08	.264
Social science	.02	.133	.02	.148
Service	.05	.217	.04	.188
Legal	.01	.115	.02	.148
Education/library science	.11	.312	.04	.206
Arts/design/entertainment/sports	.02	.143	.01	.094
Health	.07	.254	.08	.265
Protective services	.01	.089	.01	.079
Food	.00	.040	.00	.049
Personal care	.01	.091	.01	.075
Sales	.07	.251	.06	.239
Administrative support	.03	.17	.02	.145
Farming/fishing/forestry	.00	.033	.00	.066
Trade	.02	.136	.01	.133
Other	.02	.162	.02	.139

*Primary Work Activity Variables:*

Accounting	.07	.247	.04	.196
Applied research	.06	.226	.06	.244
Basic research	.02	.132	.02	.144
Computer use	.12	.320	.16	.368
Design	.05	.222	.08	.270
Development	.04	.186	.05	.216
Employee relations	.03	.181	.02	.149
Management	.17	.375	.16	.364
Other	.07	.263	.06	.239
Production	.03	.172	.03	.175
Professional services	.11	.317	.15	.354
Quality management	.02	.156	.03	.167
Sales	.07	.260	.08	.262
Teaching	.14	.347	.06	.243

*Secondary Work Activity Variables:*

Accounting	.06	.240	.06	.245
Applied research	.06	.233	.07	.247
Basic research	.03	.169	.03	.170
Computer use	.10	.304	.11	.308
Design	.05	.220	.07	.263
Development	.06	.230	.06	.242
Employee relations	.08	.270	.06	.238
Management	.18	.383	.17	.375
None	.15	.359	.14	.341
Other	.03	.166	.02	.138
Production	.02	.148	.02	.147
Professional services	.04	.202	.04	.198
Quality management	.05	.210	.05	.218
Sales	.04	.198	.06	.236
Teaching	.05	.220	.04	.202

*General Work Activity Variables*

Accounting	.72	.449	.39	.488
Applied research	.25	.435	.27	.446
Basic research	.14	.351	.14	.351
Computer use	.43	.495	.47	.499
Design	.24	.426	.32	.467
Development	.25	.434	.27	.444
Employee relations	.37	.483	.33	.472
Management	.56	.496	.53	.499
Other	.12	.322	.09	.290
Production	.10	.294	.10	.300
Professional services	.27	.445	.27	.444
Quality management	.29	.454	.28	.449
Sales	.21	.409	.27	.445
Teaching	.30	.460	.20	.403

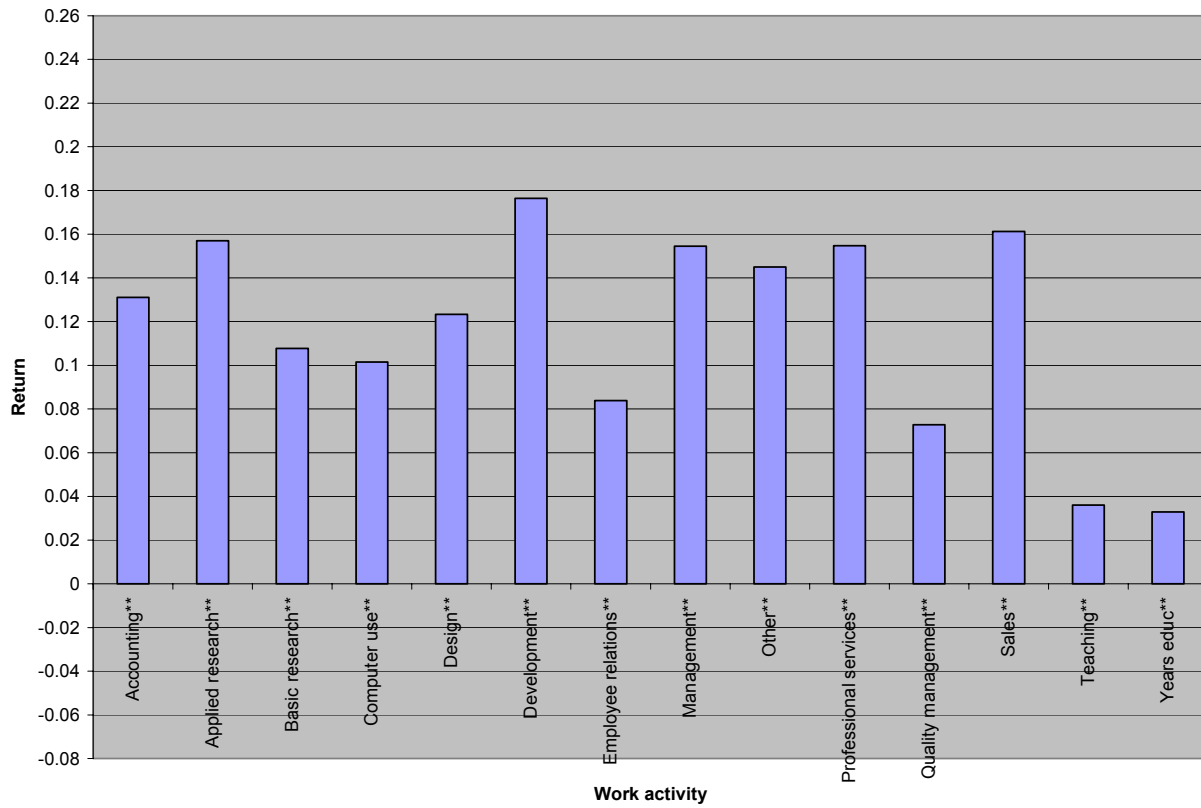
**Table 3: Means of primary work activities by occupation in the full NSCG sample**

	Administrative support	Architecture/Eng	Arts/Design/Entertain	Business/Finance	Community/Social service	Computer/Math	Education/Library	Farm/Fish/Forest	Food	Health	Legal	Life/Physical sci	Management	Other	Personal care	Protective services	Sales	Social sci	Trade
Accounting	0.24	0.02	0.01	0.36	0.01	0.01	0.00	0.08	0.03	0.00	0.03	0.01	0.08	0.06	0.04	0.02	0.04	0.01	0.02
Applied research	0.01	0.09	0.02	0.01	0.02	0.05	0.01	0.04	0.00	0.04	0.01	0.34	0.02	0.05	0.02	0.02	0.01	0.14	0.01
Basic research	0.01	0.01	0.02	0.00	0.01	0.01	0.00	0.03	0.00	0.01	0.00	0.16	0.00	0.02	0.01	0.01	0.00	0.06	0.01
Computer use	0.18	0.10	0.06	0.05	0.02	0.69	0.01	0.03	0.01	0.01	0.00	0.03	0.03	0.05	0.03	0.05	0.03	0.02	0.04
Design	0.00	0.27	0.02	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.01	0.03
Development	0.01	0.12	0.07	0.01	0.01	0.03	0.00	0.03	0.03	0.01	0.01	0.07	0.02	0.04	0.01	0.02	0.01	0.01	0.02
Employee relations	0.04	0.01	0.01	0.10	0.06	0.01	0.01	0.03	0.10	0.02	0.01	0.01	0.07	0.05	0.07	0.13	0.02	0.02	0.03
Management	0.11	0.14	0.08	0.22	0.13	0.06	0.03	0.30	0.14	0.07	0.04	0.08	0.58	0.13	0.13	0.18	0.07	0.07	0.08
Other	0.19	0.08	0.26	0.04	0.29	0.03	0.02	0.16	0.25	0.05	0.05	0.07	0.03	0.17	0.22	0.30	0.03	0.15	0.14
Production	0.05	0.05	0.04	0.02	0.00	0.01	0.00	0.12	0.10	0.01	0.00	0.03	0.02	0.07	0.09	0.02	0.01	0.01	0.50
Professional services	0.08	0.04	0.05	0.05	0.34	0.01	0.01	0.08	0.01	0.69	0.81	0.06	0.03	0.10	0.15	0.20	0.05	0.26	0.04
Quality Management	0.02	0.04	0.02	0.03	0.01	0.02	0.00	0.05	0.05	0.01	0.00	0.04	0.03	0.04	0.05	0.02	0.01	0.01	0.06
Sales	0.05	0.02	0.05	0.05	0.00	0.01	0.00	0.06	0.25	0.00	0.00	0.00	0.07	0.05	0.08	0.00	0.70	0.01	0.03
Teaching	0.01	0.02	0.29	0.03	0.10	0.03	0.91	0.01	0.03	0.06	0.03	0.08	0.01	0.18	0.08	0.03	0.00	0.24	0.01

**Table 4: Means of primary work activities in the pooled SESTAT sample**

	Administrative support	Architecture/Eng	Arts/Design/Entertain	Business/Finance	Community/Social service	Computer/Math	Education/Library	Farm/Fish/Forest	Food	Health	Legal	Life/Physical sci	Management	Other	Personal care	Protective services	Sales	Social sci	Trade
Accounting	0.18	0.02	0.01	0.26	0.01	0.01	0.00	0.04	0.03	0.01	0.02	0.01	0.06	0.04	0.03	0.01	0.05	0.02	0.03
Applied research	0.01	0.08	0.03	0.02	0.01	0.04	0.01	0.01	0.00	0.03	0.01	0.32	0.02	0.05	0.01	0.03	0.01	0.12	0.01
Basic research	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.15	0.00	0.03	0.01	0.01	0.00	0.04	0.00
Computer use	0.16	0.11	0.08	0.05	0.02	0.68	0.01	0.01	0.01	0.01	0.00	0.04	0.04	0.05	0.04	0.03	0.03	0.02	0.03
Design	0.01	0.27	0.02	0.02	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.01	0.03
Development	0.01	0.12	0.08	0.02	0.01	0.04	0.01	0.01	0.01	0.01	0.00	0.07	0.02	0.03	0.02	0.01	0.01	0.01	0.03
Employee relations	0.04	0.01	0.02	0.11	0.04	0.01	0.01	0.02	0.10	0.01	0.01	0.01	0.05	0.04	0.05	0.09	0.02	0.02	0.02
Management	0.10	0.14	0.08	0.20	0.13	0.07	0.03	0.24	0.29	0.05	0.03	0.09	0.59	0.16	0.14	0.23	0.08	0.06	0.19
Other	0.16	0.07	0.24	0.05	0.16	0.02	0.02	0.11	0.14	0.03	0.03	0.08	0.03	0.18	0.18	0.27	0.02	0.12	0.12
Production	0.04	0.04	0.04	0.01	0.00	0.01	0.00	0.40	0.07	0.01	0.00	0.03	0.02	0.13	0.08	0.03	0.01	0.00	0.42
Professional services	0.07	0.05	0.13	0.09	0.52	0.01	0.02	0.04	0.01	0.79	0.86	0.07	0.03	0.11	0.16	0.18	0.06	0.44	0.02
Quality Management	0.03	0.05	0.02	0.05	0.01	0.01	0.00	0.04	0.07	0.01	0.00	0.05	0.04	0.04	0.03	0.02	0.01	0.01	0.06
Sales	0.18	0.02	0.13	0.08	0.01	0.02	0.01	0.06	0.25	0.01	0.00	0.01	0.08	0.05	0.13	0.05	0.67	0.02	0.05
Teaching	0.01	0.01	0.11	0.03	0.06	0.03	0.86	0.01	0.01	0.03	0.01	0.06	0.01	0.08	0.12	0.03	0.00	0.12	0.01

**Figure 1: Returns to Primary Work Activities in the Full NSCG Sample\*\***

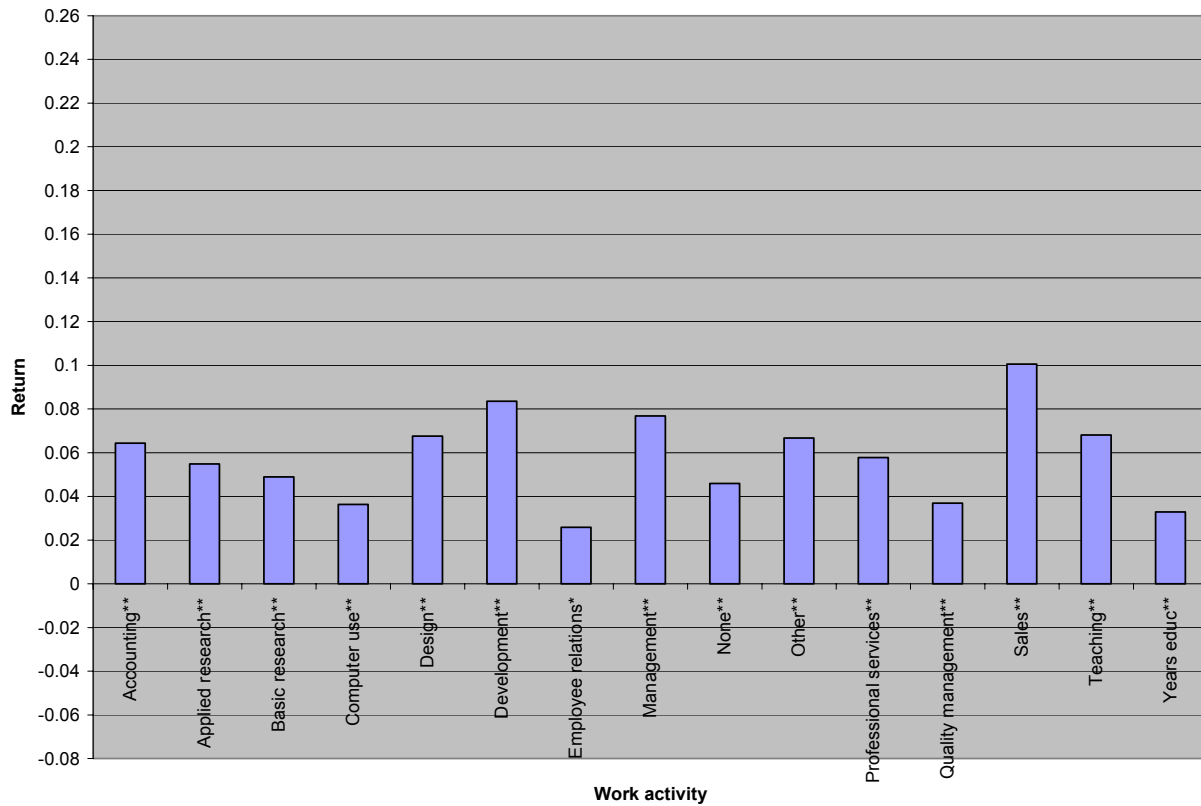


\* Statistically significant at the 5% level

\*\* Statistically significant at the 1% level

\*\*\* Results are from standard OLS regressions using the 1993 full NSCG sample. Years of education is included for reference. Production is the omitted work activity.

**Figure 2: Returns to Secondary Work Activities in the Full NSCG Sample\*\***

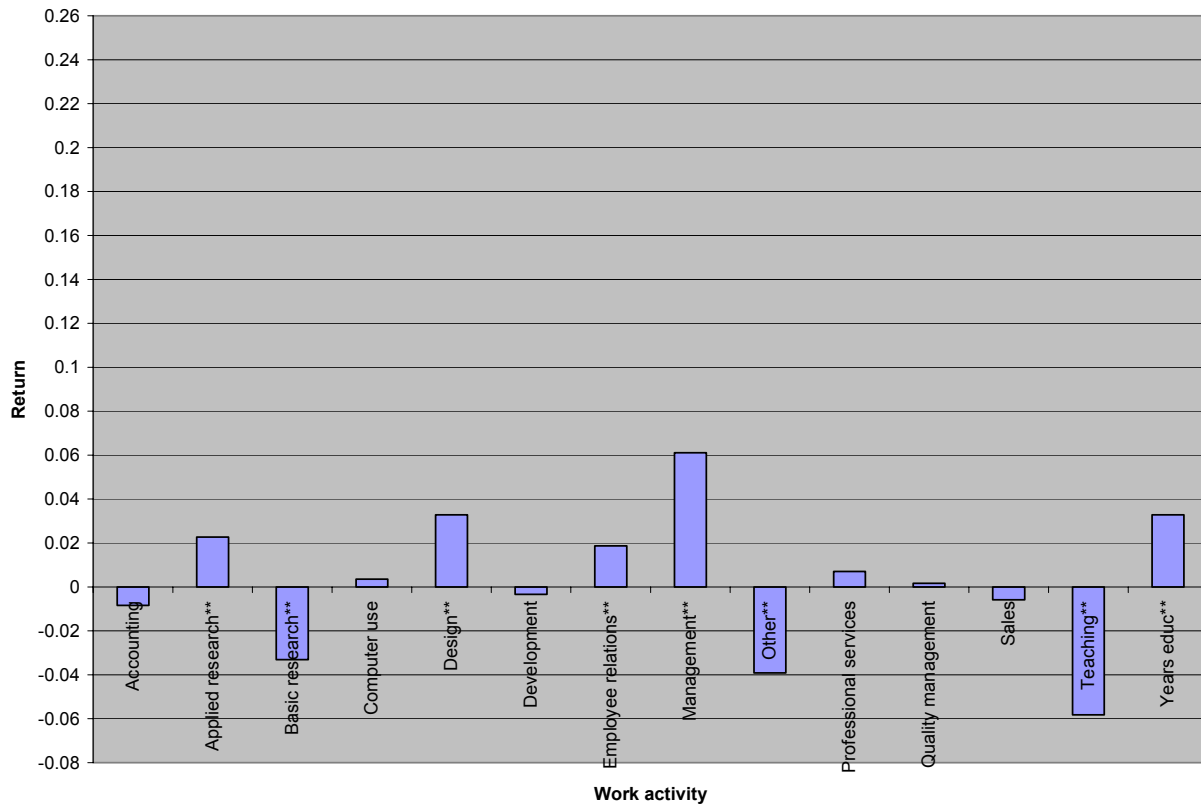


\* Statistically significant at the 5% level

\*\* Statistically significant at the 1% level

\*\*\* Results are from standard OLS regressions using the 1993 full NSCG sample. Years of education is included for reference. Production is the omitted work activity.

**Figure 3: Returns to General Work Activities in the Full NSCG Sample\*\***

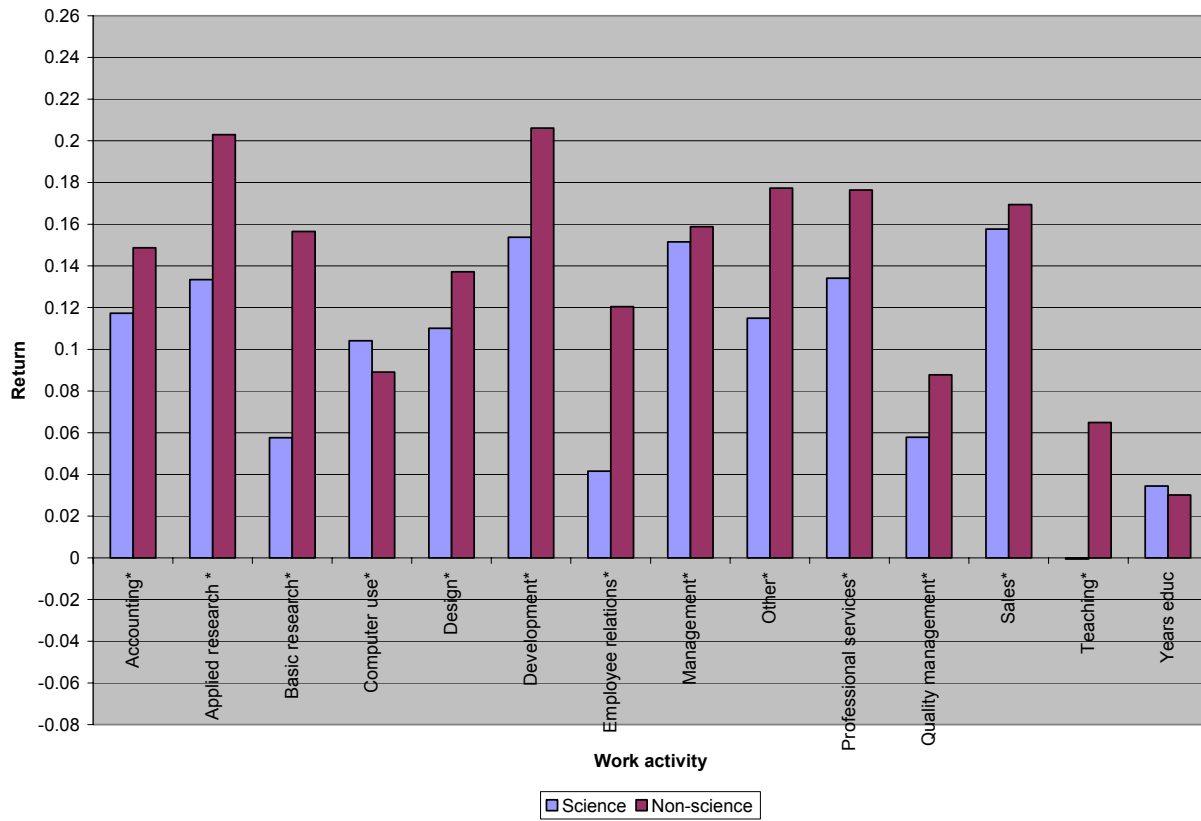


\* Statistically significant at the 5% level

\*\* Statistically significant at the 1% level

\*\*\* Results are from standard OLS regressions using the 1993 full NSCG sample. Years of education is included for reference. Production is the omitted work activity.

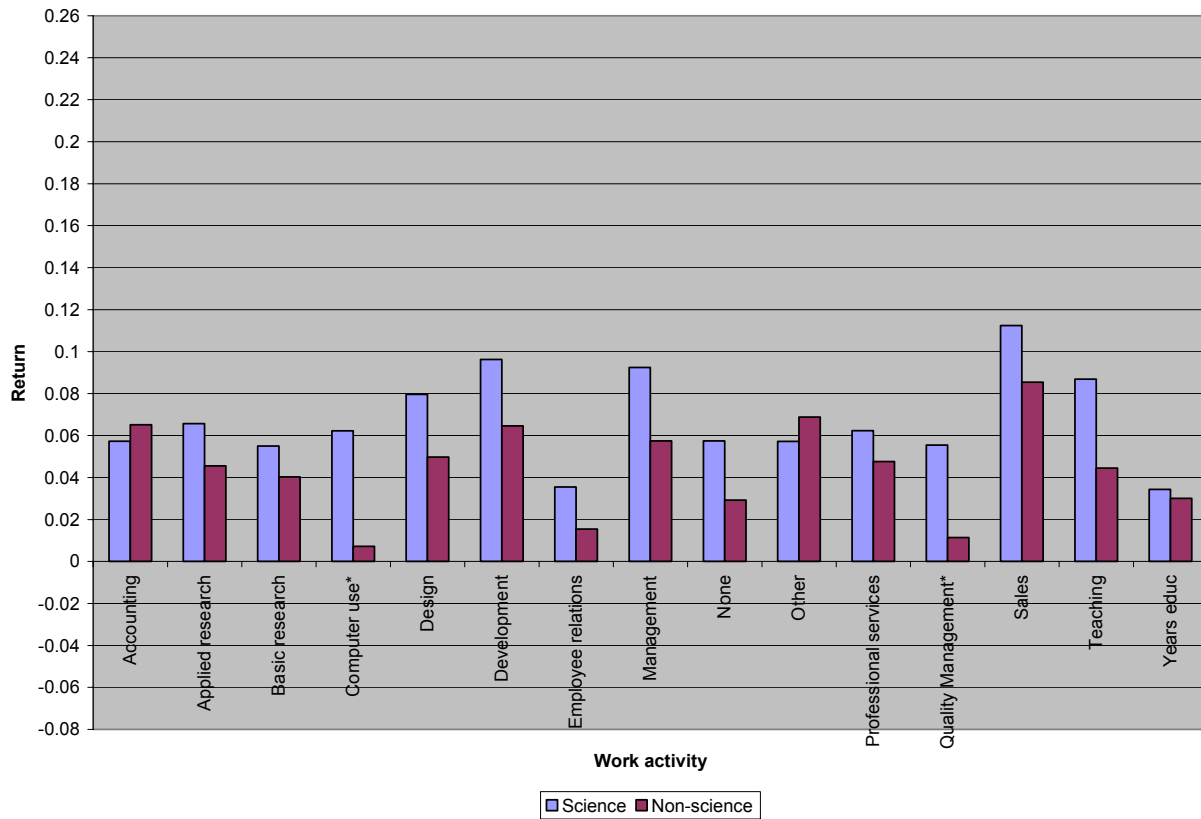
**Figure 4: Returns to Primary Work Activities in the Science and Non-science Samples\*\***



\* The difference in returns between the 1993 science and non-science NSCG samples is statistically significant at the 1% or 5% level

\*\* Results are from standard OLS regressions using the 1993 science and non-science NSCG samples. Years of education is included for reference. Production is the omitted work activity.

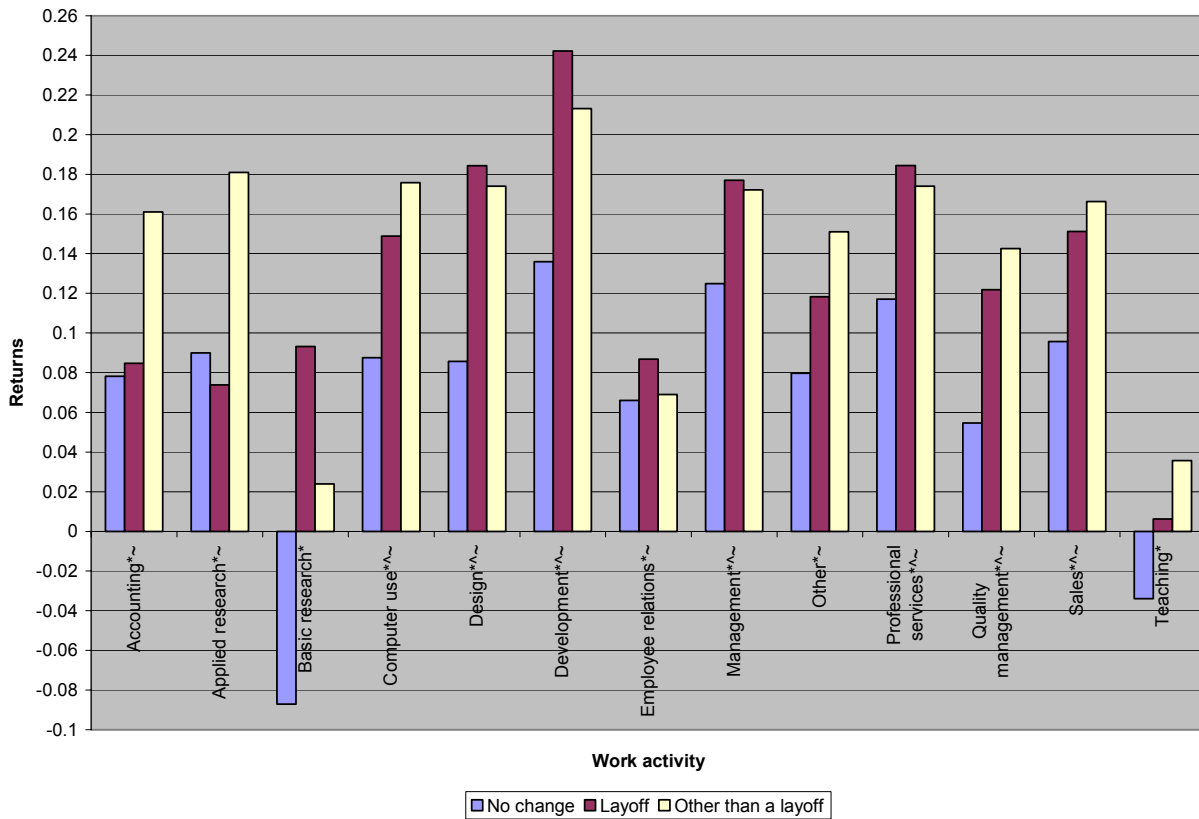
**Figure 5: Returns to Secondary Work Activities in the Science and Non-science Samples\*\***



\* The difference in returns between the 1993 science and non-science NSCG samples is statistically significant at the 1% or 5% level

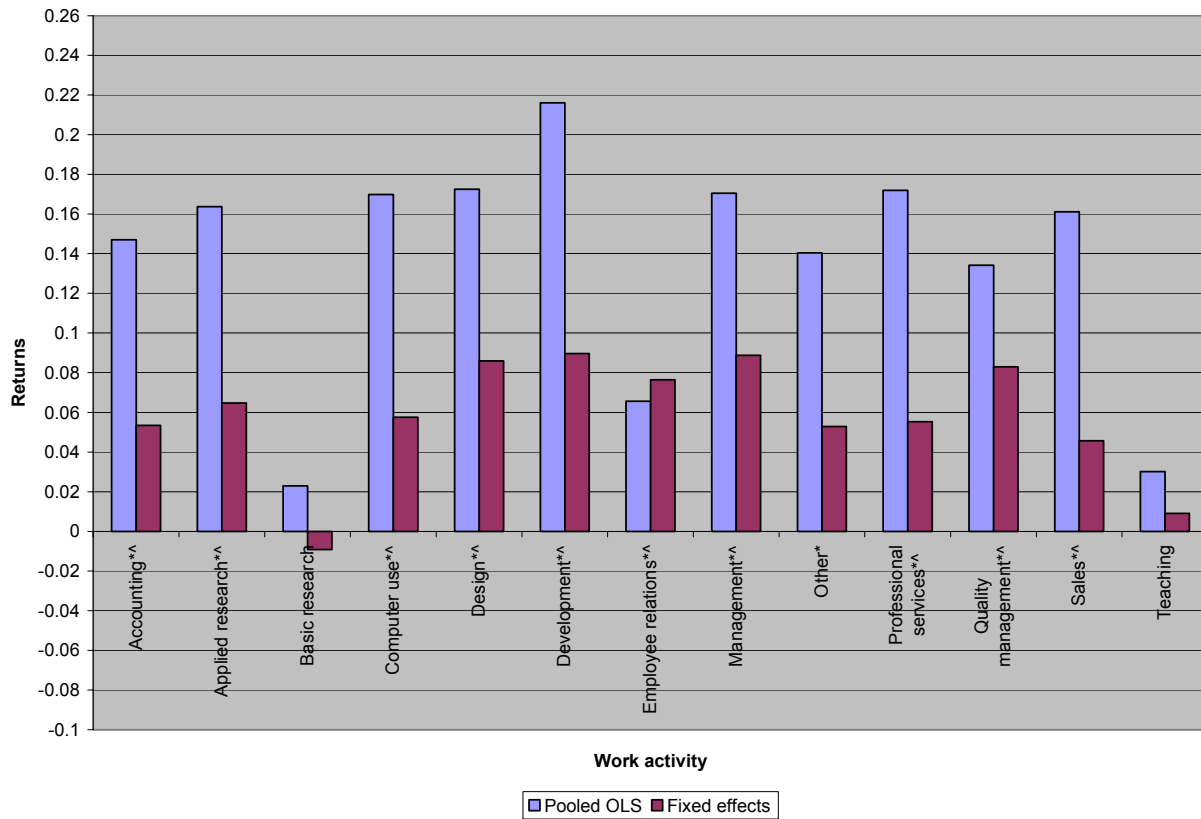
\*\* Results are from standard OLS regressions using the 1993 science and non-science NSCG samples. Years of education is included for reference. Production is the omitted work activity.

**Figure 6: Returns to Primary Work Activities in the Pooled OLS Models\*\***



\* Statistically significant at the 1% or 5% level in the sample included individuals who did not change employer  
 ^ Statistically significant at the 1% or 5% level in the sample including individuals who changed employer due to a layoff  
 ~ Statistically significant at the 1% or 5% level in the sample including individuals who changed employer for any reason other than a layoff  
 \*\* The samples for employer changers include the year of or following a change in employer for the specified reason. Production is the omitted work activity.

**Figure 7: Returns to Primary Work Activities for Employer Changers Due to Any Reason\*\***

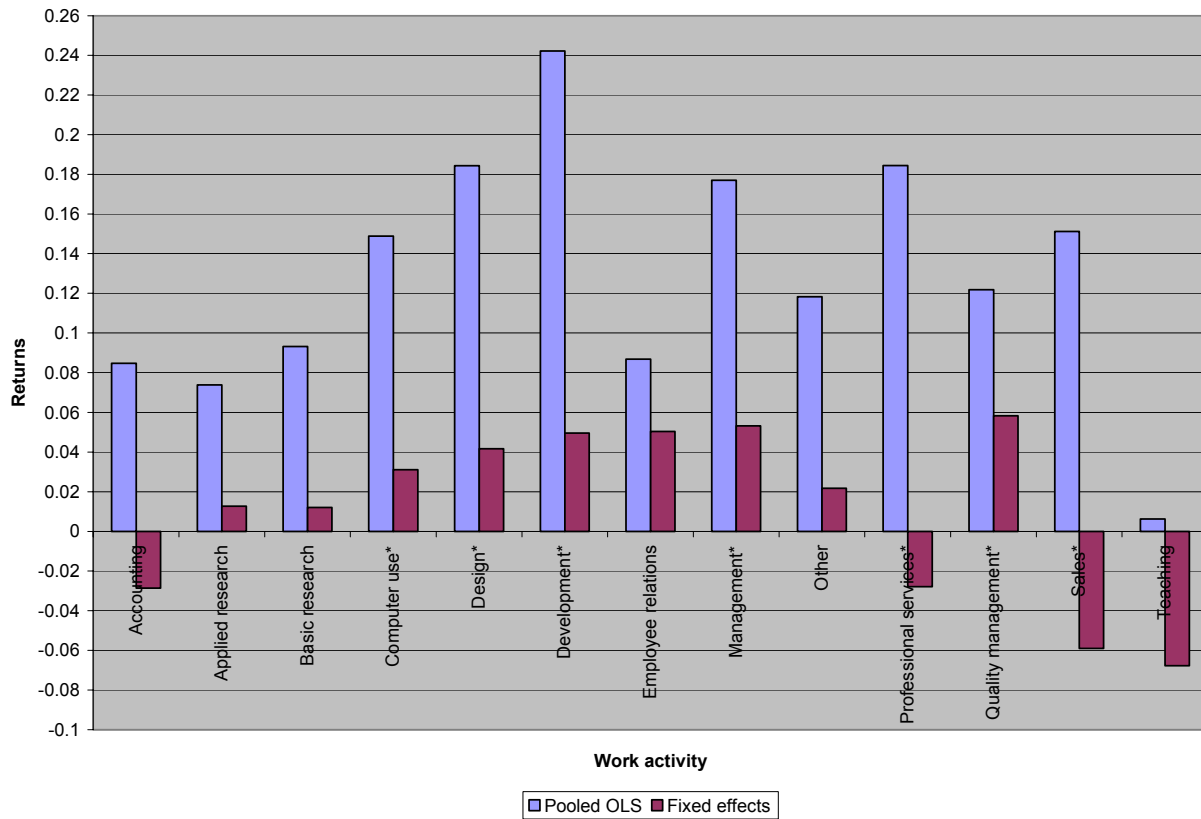


\* Statistically significant at the 1% or 5% level in the pooled OLS model

<sup>^</sup> Statistically significant at the 1% or 5% level in the fixed effects model

\*\* The sample for pooled OLS includes the year of or following a change in employer for any reason. The sample for fixed effects includes the year of or following a change in employer and the year of or preceding a change in employer for any reason. Production is the omitted work activity.

**Figure 8: Returns to Primary Work Activities for Employer Changers Due to a Layoff\*\***

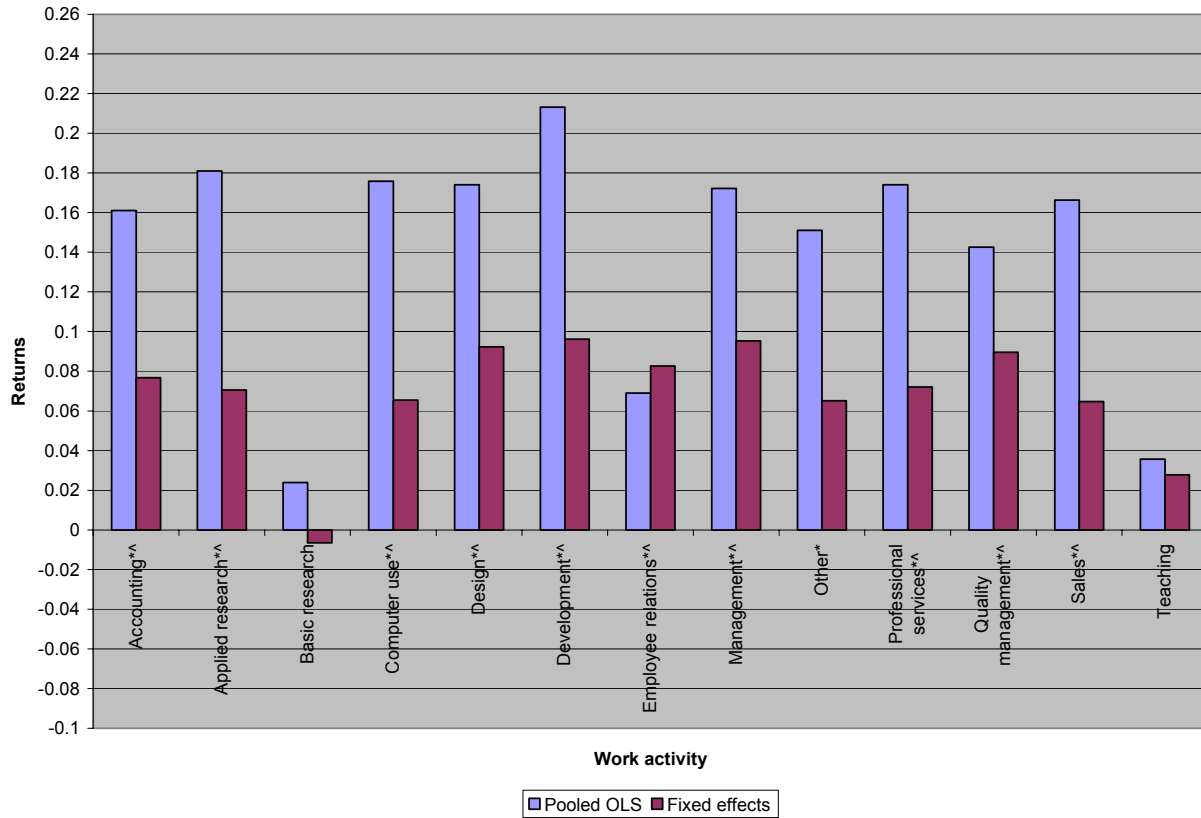


\* Statistically significant at the 1% or 5% level in the pooled OLS model

^ Statistically significant at the 1% or 5% level in the fixed effects model

\*\* The sample for pooled OLS includes the year of or following a change in employer due to a layoff. The sample for fixed effects includes the year of or following a change in employer and the year of or preceding a change in employer due to a layoff. Production is the omitted work activity.

**Figure 9: Returns to Primary Work Activities for Employer Changers Due to Any Reason Other than a Layoff\*\***



\* Statistically significant at the 1% or 5% level in the pooled OLS model

<sup>^</sup> Statistically significant at the 1% or 5% level in the fixed effects model

\*\* The sample for pooled OLS includes the year of or following a change in employer for any reason other than a layoff. The sample for fixed effects includes the year of or following a change in employer and the year of or preceding a change in employer for any reason other than a layoff. Production is the omitted work activity.