Economy-Wide and Industry-Level Impact of Information Technology

U.S. Department of Commerce
Economics and Statistics Administration
Office of Policy Development
Office of Business and Industrial Analysis

APRIL 1997

ESA/OPD 97-3

PREFACE

ESA's analytic mission is to explain changes in the structure of U.S. industries and firms that affect the nation's overall economic performance. This study is one of a series of studies prepared by our Office of Business and Industrial Analysis to evaluate the role of information technology (IT) in improving productivity. This study was prepared by Gurmukh Gill, Kan Young, Dennis Pastore, Jess Dumagan, and Isaac Turk.

The authors estimated separate production functions for 58 industries, covering practically the entire private economy, over the period 1983-93, treating IT capital and labor as distinct inputs from non-IT capital and labor. Although the findings vary considerably across industries, they generally support the view that IT capital and labor exert a positive influence on productivity. Also, the production function for the aggregate economy was estimated from pooled data and results were all consistent with *a priori* expectations, confirming the positive impacts of IT capital and labor on the economy over and above those of non-IT capital and labor.

In ongoing research, the production function approach is being augmented and refined by assembling time series data going back to 1970 and forward to 1995 and by analyzing industry data, where possible, at the 3- or 4-digit Standard Industrial Classification (SIC) levels.

Everett M. Ehrlich
Under Secretary
for Economic Affairs

ABSTRACT

Efforts by economists to measure the contribution to output growth of investment in information technology (IT) equipment have proven inconclusive and studies of the productivity of IT workers are relatively scarce. In the present study, we attempt to fill this gap in our understanding of the impact of IT capital and labor in the production process. We use industry data to extend the previous studies in three ways: (i) by using more recent data (1983 to 1993), (ii) by covering manufacturing and non-manufacturing industries, including services, and (iii) by treating IT workers and non-IT workers as two distinct categories of labor.

We adopt a log-linear production function approach, usually used in conjunction with company data, but apply the model to industries. We first estimate the model for the aggregate economy by pooling eleven cross-sections for 58 industries after establishing that elasticities are invariant over 1983 to 1993. We find that all the economy-wide elasticities are positive and lie between zero and one, consistent with *a priori* expectations. Also, the sum of the elasticities is about 0.9, implying decreasing returns to scale. In the time-series analysis, the results focus on each of the 58 industries separately. For two-thirds of these industries, the estimated elasticities are non-negative with respect to IT equipment; for ten of them, marginal returns to IT equipment are statistically significant and quite high, with nine exhibiting annual rates of return in excess of 100 percent. Not surprisingly, average returns to IT investment for the entire economy and most of the major industry sectors are not only lower, but also more plausible, a consequence of averaging the diverse results from component industries. We obtain similar results in the case of IT labor. Two-thirds of all industries show non-negative elasticities, with ten showing statistically significant positive coefficients. In five of these industries, both the IT capital and the IT labor coefficients are positive and significant. Though the marginal products derived from the estimated coefficients seem inexplicably high, especially for IT workers, they suggest that the returns to IT labor are quite large in some industries. Marginal products estimated for the entire economy and for major industrial sectors, such as manufacturing and non-manufacturing, however, fall within plausible ranges.

TABLE OF CONTENTS

I. INTRODUCTION..1

II. THE MODEL 2

III. DATA 4
    Sources and Definitions 4
    Trends 5

IV. REGRESSION RESULTS..8
    Cross-Section Results..8
    Results for Industry Groups and Individual Industries.......................................9
    Are IT Capital and Labor Really Different from Other Capital and Labor? . 13
    Time Trend and Lagged Response 13
    Analysis of Synergies 14

V. SUMMARY AND CONCLUSIONS... 15

VI. REFERENCES 17

LIST OF TABLES

TABLE 1: ESTIMATED ECONOMY-WIDE ELASTICITIES AND AVERAGE AND MARGINAL PRODUCTS 8

TABLE 2: ESTIMATED OUTPUT ELASTICITIES WITH RESPECT TO IT EQUIPMENT 10

TABLE 3: ESTIMATED OUTPUT ELASTICITIES WITH RESPECT TO IT WORKERS 12

TABLE A-1: CAPITAL EQUIPMENT SHARES AND LABOR SHARES BY SUMMARY AND DETAILED INDUSTRIES 19

TABLE A-2: CAPITAL AND LABOR INTENSITY 20

TABLE A-3: SUMMARY OF REGRESSION RESULTS FOR DETAILED AND AGGREGATE INDUSTRIES 21

Economy-Wide and Industry-Level Impact of Information Technology

I. INTRODUCTION

Despite many studies in recent years, economists have been unable to demonstrate conclusively that the massive influx of information technology (IT) into the workplace is having a measurable positive impact on output growth. Some analysts suggest, in fact, that the opposite may well be true.[1] The apparent failure of researchers to reach a consensus on the matter, however, belies the speed with which information technology is transforming the American workplace. Business managers, workers, and government policy makers all stand to gain from a better understanding of how and under what conditions investment in IT and initiatives to boost IT skills of workers actually pay off.

We seek to answer the following question: have the absorption of IT-intensive equipment and techniques into the production process and the increase in the number of workers who generate or use information products served to increase output at the aggregate and the industry levels? As a first step, we examine productivity—defined as the rate of return, or marginal product—of both IT capital and IT workers at the economy and the industry levels. Our analysis indicates that, despite considerable diversity among industries, IT capital and labor make positive contributions to production at the industry level. Our results provide solid support of positive contributions from IT capital and labor for the private economy as a whole. Our findings also suggest that further research that takes into account the price structure of inputs will corroborate our strong sense, based on the results so far, that IT is helping forge a more productive American economy.

Most previous studies of IT productivity focus on IT capital alone,[2] and the results are mixed. Aside from a 1993 paper by Lichtenberg, published research on the productivity of IT related workers is scarce. Most of the studies tend to rely on company data, usually from large manufacturing firms. One notable exception is an analysis by Berndt and Morrison (1995) based on industry data. The authors examine the relationship between the rate of return on capital and the share of IT equipment in the capital stock at the two-digit SIC level for manufacturing industries from 1968 through 1986. This study and an earlier investigation by the same authors (1991) into cost reductions associated with IT investment may well be the only attempts to analyze systematically rates of return on IT investment across industries.

---

[1] Attewell (1994) and Landauer (1995).

[2] Examples are: Roach (1987 & 1989); Berndt, Morrison, and Rosenblum (1992); Brynjolfsson (1987); Brynjolfsson and Hitt (1994); and Berndt and Morrison (1995).

The current study extends the work of Berndt and Morrison and that of Lichtenberg in several directions:

- First, we examine data for all industries in the private sector of the economy, including services industries;
- Second, we estimate returns to capital and labor, distinguishing at the industry level between IT and non-IT equipment and IT and non-IT workers;
- Third, we use more recent (1983-1993) Bureau of Economic Analysis (BEA) and Bureau of Labor Statistics (BLS) data.

We also estimate the economy-wide contribution of IT capital and IT labor by pooling data across eleven annual cross-sections.

In section II, we present the theoretical basis of our analytical approach. Section III provides a description of the data. In Section IV, we discuss the results using our model at the aggregate and the individual industry levels, supplementing the analysis with insights from modified versions of the basic model: first, to estimate the effect of time and, second, to assess the possibility of a time-distributed lagged response. We also compare our findings with the results from similar research. In the conclusion, we evaluate our findings and recommend directions for further research.

II. THE MODEL

We use the common log-linear production function to test the relationship between the level of output and the levels of various inputs, including IT and non IT-related capital and labor.[3] This technique has significant practical advantages. First, data on quantities of inputs and outputs (in constant dollar terms) are more readily available and less controversial than the input price estimates needed to construct a meaningful cost function. Second, by expressing our model in log-linear form, the coefficients of the explanatory variables are also the elasticities with respect to output. We can then use these elasticities to determine the marginal products.

---

[3] Lichtenberg, along with many others, uses the same technique in his own analysis of the returns to IT capital and labor. Morrison and Berndt (1991) and Lau and Tokutso (1992), adopt a cost function approach. Although our data set more closely resembles the one used by Berndt and Morrison, our methodology is more in line with Lichtenberg's.

Our model is based on Lichtenberg's methodology. He tests the hypothesis that the marginal products (the additional output the firm can expect if it employs one additional unit of a specific input) of IT capital are larger than those of non-IT capital and that the marginal products of IT labor are larger than those of non-IT labor. First, he evaluates statistically whether the marginal products (or gross benefit) of IT capital and IT labor are positive.[4] If this proves to be the case, he estimates the marginal products of the IT and non-IT capital and labor variables. If the ratio of the marginal product of the IT input to its non-IT counterpart is larger than the ratio of their prices (rental value in the case of capital), the contribution to the firm's output of an additional unit of the IT input exceeds that of its non-IT counterpart.[5] Lacking data on input prices, we focus on determining whether the marginal products of the IT inputs and their net marginal returns are positive and significant. To do this, we first estimate the output elasticity of each input. Next, we calculate the associated average product. The marginal product of the input is then obtained by multiplying the elasticity by its average product.

For inter-industry comparisons of net benefit from a particular type of input, we need to assume only that its cost is similar across all industries. For example, in the case of net benefits, or rates of return, on investment in IT equipment, this condition requires that the costs of IT equipment across industries are relatively uniform, which is reasonable. Similarly, for inter-industry comparisons of the net benefits of hiring an additional IT worker, we make the assumption that wage rates within the same occupational category of labor are uniform across industries.

As the starting point for our analysis, we estimate a standard Cobb-Douglas production function in log-linear form, similar to the one used by Lichtenberg. The general form of this function is:

$$\ln Y = \alpha + \beta_0 \ln K_0 + \beta_1 \ln K_1 + \gamma_0 \ln L_0 + \gamma_1 \ln L_1$$

where Y represents value added of a specific industry in a single year; K_0 stands for IT capital stock; and K_1 stands for non-IT capital stock, with non-IT capital further broken down into non-IT equipment and total structures for purposes of estimation; L_0 is IT labor; and L_1 non-IT labor.[6] We estimate essentially the same model for a number of alternative data sets: simple time series of individual industries over the eleven years, cross-sections involving all industries in a single year, and pooled time series and cross-sections of selected industry groupings over eleven years.

---

[4] Since the rental prices of capital and wages are positive, a firm would hire additional quantities of capital or labor only if it expects that the net impact on output will be positive. After all, the net return to the firm from any input is the difference between its marginal product and marginal cost.

[5] Cost minimization requires that the two ratios be equal; otherwise, a firm could further reduce costs by reallocating inputs.

[6] We can also generalize this equation along the lines of the "translog" specification by adding interaction (i.e., cross-product) terms.

We first estimate the economy-wide production function using the entire data set, that is, pooling all of the 638 observations.[7] We then concentrate on estimating the production function for each of the 58 (approximately two-digit SIC level) industries using time series data and ordinary least squares (OLS) technique. Because, at this stage of our work, we must rely on observations covering only 11 years, we are able to explore only a few of the options theoretically possible. These include adding to the equation, alternately, a linear trend variable and a lagged version of the dependent variable and, separately, introducing interaction terms to test for associations between the various labor and capital variables.[8] The results from these and various other specifications[9] of the model provide useful analytical insights that enrich our understanding and interpretation of results.

III. DATA

Sources and Definitions

We assembled annual time-series data from 1983-1993 for 58 separate industries covering the full spectrum of the U.S. private economy. Industry estimates of value added and data on fixed reproducible capital stock, both expressed in constant 1987 dollars at approximately the two-digit SIC level, come from the National Income and Wealth Division of the Bureau of Economic Analysis (BEA). The industry level split between information and non-information occupations was based on employment data by industry and occupation published by the Office of Employment Projections of the Bureau of Labor Statistics (BLS) for 277 occupational categories of wage and salary workers. The data from each of these sources reflect activity at the establishment level.

The definitions we use in this study for both IT capital and IT labor are still tentative. IT capital consists of the four types of equipment collectively referred to in BEA publications as "information processing and related equipment": (1) office, computing, and accounting machinery; (2) communication equipment; (3) scientific and engineering

---

[7] Statistical tests show that the coefficients are time invariant.

[8] These are (1) the product of the logs of IT capital and IT labor and (2) the product of the logs of non-IT capital and non-IT labor.

[9] In estimating the production function for each of the 58 industries, we also do the same for each of the major sectors (such as agriculture, forestry, and fisheries; mining; manufacturing; and so on), which represent simple aggregations of corresponding industry-level data. Further, we examine the estimates obtained by pooling the data while imposing restrictions on the values of various parameters. We also test whether it makes sense from a statistical point of view to distinguish between IT and non-IT components of the capital and labor variables in setting up the production function.

instruments; and (4) photocopy and related equipment.[10] For employment data, we steer a middle ground between Baumol's broad definition of information workers[11] and examples of much narrower specifications discussed in Miles (1990).[12] Under our definition, IT occupations represent about a quarter of all private wage and salary workers.

We consider almost all of the jobs in the three occupational classes (1) executive, administrative, and managerial; (2) professional specialty; and (3) technicians and related support to be IT jobs. Together, they account for about 93 percent of all IT jobs. This implies that when we evaluate the importance of IT workers we are talking primarily about well to highly educated white-collar workers and, to a much lesser degree, about skilled technicians.[13]

Trends

From 1983 through 1993, real Gross Domestic Product (GDP) grew at an average annual rate of 2.8 percent. The total net capital stock, which includes both equipment and structures, increased at a 2.3 percent annual rate, with the value of equipment stocks rising more rapidly than the value of new structures: 2.7 percent compared with 1.9 percent per year.

In contrast to the record of rather moderate growth at the aggregate level, real net stocks of IT equipment more than doubled during the period, rising from $339 billion in 1983 to $748 billion in 1993. This corresponds to an annual growth rate of 8.2 percent. Even more impressive are the additions to the stock of office, computing and accounting machinery. This category alone accounted for $207 billion, or more than 50 percent of the increase in working IT capital over the eleven year period. The 21 percent annual growth this represents far exceeds the 5.6 percent increase recorded for stocks of communications equipment and the 5.7 percent rise for scientific and engineering equipment. The fourth IT asset, photocopy and related equipment, evidenced the weakest growth performance; at 2.1 percent per year, it was lower than the aggregate rate for all classes of equipment.

The share of equipment in total net capital stock, which includes both structures and equipment, increased moderately, rising from 45.4 percent in 1983 to 47.4 percent in 1993. In contrast, IT stock as a share of equipment stock alone jumped nearly 13 percentage points to account for almost 32 percent of the total net stock of equipment by

---

[10] Berndt and Morrison (1995) refer to these, alternately, as "high tech" capital and IT equipment.

[11] Baumol's "knowledge workers" generally include individuals who process data or make use of information. These accounted for more than 52 percent of all workers in 1980. See Baumol, Blackman, and Wolff, *Productivity and American Leadership: The Long View*, Cambridge, 1989, p. 148.

[12] Miles *et al* (1990), *Mapping and Measuring the Information Economy*, Cambridge, England.

[13] Even though virtually all technicians qualify as IT workers according to our definition, they represent less than four percent of the wage and salary workforce, in 1993.

1993. Within the IT group, office, computing, and accounting equipment increased in share from 11 percent in 1983 to 33 percent in 1993, while communications equipment, still the largest of the four components at the end of the period, dropped 14 percentage points to below 50 percent. Scientific and engineering instruments, with 13 percent, and photocopy and related equipment, with 6 percent, account for the remaining 18 percent in 1993—in both cases, a decline from 1983.

Employment of wage and salary workers in IT related occupations grew at an average annual rate of 2.6 percent between 1983 and 1993. This surpasses the 1.8 percent per year rate for workers in other occupations and the 2.0 percent average for all private sector jobs. The class of IT workers increased by about one-third from 21.8 million in 1983 to 28.1 million in 1993. Still, the IT share of the wage and salary workforce remained virtually unchanged.

The industry level data in Table A-1 in the appendix show that the equipment share of total capital stock remained essentially unchanged over the eleven years, rising on the average from 49.9 percent in 1983 to 50.3 percent in 1993. Gains and losses in specific industries, however, were quite large, explaining, in part at least, the diversity in estimated coefficients we observe later in this paper.

The period saw substantial increases in the shares of IT equipment in total equipment stock in almost all industries. The shares were highest in the communications and financial service sectors. IT equipment, for example, accounted for more than 85 percent of total equipment in the telephone and telegraph industry in both 1983 and 1993; while in the insurance agents, brokers, and services industry, the IT proportion jumped from 66 percent in 1983 to more than 84 percent in 1993.

Table A-1 also shows shares of IT workers in total employment by industry. On average, IT occupations account for just under 25 percent of all wage and salary workers in both years. Manufacturing industries are among those which experienced a sizable upward shift in the proportion of IT workers compared with that of non-IT workers.

Table A-2 in the appendix provides information on capital and labor intensities by industry in 1983 and 1993. IT capital intensities, measured as the ratio of IT-equipment stock to output (value added), increased between 1983 and 1993 for most industries. In 1993, the IT-equipment intensity was highest for industries in the communications sector, especially the telephone and telegraph industry. IT labor intensities, on the other hand, remained relatively stable on average. IT labor intensity declined for most industries, in contrast to the growing IT equipment intensity. In both 1983 and 1993, IT labor intensities were highest in educational services, health services, hotels and other lodging places, other services, and business services.

IV. REGRESSION RESULTS

The production function specified as equation (1) is estimated with our 1983-93 data for 58 industries in two ways. First, we estimated 11 cross-section regressions for each year and then combined them into one pooled regression after establishing the fact that the coefficients were time invariant over 1983-1993.[14] This aggregate production function reflects the overall performance of the entire U.S. private economy over the period. Second, to evaluate the impact of IT at the industry level, we estimated 58 time series regressions, each representing the production function of one industry. We discuss the cross-section results first, then examine the results of time series analysis for individual industries.

Economy Wide Results

The results of separate cross-section analyses for all eleven years are approximately the same.[15] When the data for all eleven years are pooled together, the estimated elasticities of output with respect to all inputs, including IT capital and labor as well as non-IT capital and labor, are statistically significant, with the values ranging from 0.03 to 0.36 (Table 1). We expect the values of these coefficients to be positive but less than one, because these values are elasticities which are the ratios of marginal products to average products. These ratios are expected to be less than one (i.e., marginal product less than average product), because if marginal product were larger than average product the firm would not be maximizing profits. Also, the sum of these elasticities, approximately 0.9, is less than 1, implying decreasing returns to scale. Thus, the elasticities estimated are consistent with *a priori* expectations from the economy-wide production function.

Using the estimated output elasticities, we calculate the marginal products of the various inputs for the private sector as a whole. First, we compute the average product of each input; i.e., the ratio of the total product of all industries to the total quantity of each input used by all industries. We then multiply the average product by its estimated elasticity to derive the economy-wide marginal product since elasticity with respect to an input is the ratio of its marginal product to its average product. The results are presented in Table

---

[14] We estimated four variations of the pooled cross-section model. The first model had year dummy variables and year dummy interaction terms; the second and third had one or the other; and the fourth had neither. The F-tests showed that we could not reject either separately or jointly the hypotheses that the coefficients of the year dummy variables and of the year dummy interaction terms were zero. Based on this result we excluded time variables in estimating an economy-wide cross-section production function.

[15] A recent study by R.B. Cohen ("The Impact of Information Technology," *Business Economics,* Vol. XXX, No. 4, October, 1995) also uses simple cross-section analyses to examine the relationship between the growth of productivity and the share of IT capital in total capital, and finds positive correlations between these two variables for the two periods studied.

1. For each input, the calculated marginal product is an estimate of the contribution attributable to an additional unit of the input across all industries.[16]

Table 1
Estimated Economy-Wide Elasticities and Average and Marginal Products

Inputs	Elasticities	Annual Average Products (1987 dollars)	Annual Marginal Products (1987 dollars)
IT Labor (per worker)	0.165 (7.679)	160,448	26,474
Other Labor (per worker)	0.359 (14.692)	58,637	21,051
IT Capital Equipment (per $ of net stock)	0.105 (8.422)	7.66	0.80
Other Capital Equipment (per $ of net stock)	0.031 (1.859)	2.63	0.08
Structures (per $ of net stock)	0.258 (16.262)	1.67	0.43

Note: The numbers in parentheses are t-values. In the above model, the adjusted R-square=0.894.

The estimated marginal product of IT equipment is $0.80, which means putting one additional dollar of IT capital stock into service for a year generates $0.80 of output. This indicates that the gross benefit of using an additional $1 of IT equipment is high compared with its rental price, or user cost, which is likely to be less than $0.80. Moreover, since the estimated marginal product of IT equipment is ten times as large as that of non-IT equipment (0.80 vs. 0.08), this finding also suggests that the rate of return to IT equipment is decidedly higher than that of non-IT equipment. The net marginal benefit of IT equipment is also higher than that for non-IT equipment, as the rental price of IT is unlikely to be larger than ten times the rental price of non-IT equipment.

The rental price of capital is generally only a fraction of the price of a capital asset since it is based primarily on interest, depreciation, and possible capital gain or loss. In the case of IT equipment, assuming an average asset life of 5 years (20 percent straight-line depreciation) its rental price is unlikely to exceed $0.5 (50 cents for every dollar worth of capital asset).[17] Any estimate of marginal product that exceeds this value implies that its net benefit is positive.

In a recent study, Brynjolfsson and Hitt (1994), using company data, found that net benefits of IT investment are so high that the hypothesis of zero net benefit is rejected even when the annual rental price is assumed to be as high as $0.69 per dollar of capital stock. They suggest that a reasonable estimate of the rental price of IT capital is $0.35 per dollar of IT capital. Although not strictly comparable, Harper *et.al.* (1987, Tables 8.1

---

[16] Notice that the IT inputs have higher marginal products than their non-IT counterparts.

[17] A comparison of the computer purchase price with its lease price will show that this is indeed the case. This information can be found in any commercial advertisement.

and 8.2.), using alternative methods for estimating rental prices of capital, found rental prices of metalworking machinery for the miscellaneous manufacturing industries to be between $0.20 to $0.60 for various years between 1971 and 1981.

The table also shows that the estimated marginal product of IT workers is about $26,500 (in 1987 dollars), considerably higher than the corresponding estimate of approximately $21,000 for non-IT workers. The results appear plausible, but do not necessarily imply that hiring IT workers is more profitable than hiring non-IT workers, since their wages and other form of compensation are quite different. The results, however, suggest that the services of an IT worker, on average, are more valuable than those of a non-IT worker.

Results for Industry Groups and Individual Industries

The simple cross-section pooled model is a reasonable average representation of the economy-wide production function. This formulation of the model, however, does not take into account industry by industry differences. We can determine the significance of these industry differences by examining the possible effects of industry dummy variables and industry dummy interaction terms. In contrast to the tests on time dummies, which are insignificant, the tests on industry dummies show that statistically significant differences exist among the 58 industry regression coefficients. Consequently, estimates of an overall pooled cross-sectional model (presented in Table 1) which ignores differences among industries are not applicable to any individual industries. The industry differences noted above, however, imply that there is significant variation across industries around the economy-wide average.

The emphasis in this section is on estimating marginal products of IT capital and IT labor for individual industries. We first discuss the empirical results of 58 industry regressions based on the basic specification equation. Later we discuss the rationale for separating IT capital and IT labor from other types of capital and labor. Finally, we review the insights gained from the four alternative specifications, addressing the issues related to time trend, lagged response, and associations between IT equipment and labor inputs.

Basic Specification: Marginal Product of IT Capital

As shown in appendix Table A-3, statistical fits for almost all 58 individual industry regressions are very good. With the exceptions of only seven industries,[18] the regressions have high explanatory power based on the F-tests (at the 10 percent level of significance). Approximately one-third of the regressions have adjusted R-squares larger than 0.90.[19]

---

[18] These are the petroleum and coal products; insurance carriers; personal services; oil and gas extraction; auto repair, services, and parking; educational services; and primary metal industries.

[19] In general, there are very few serious problems of positive serial correlations with these regressions. Only a few regressions have Durbin-Watson (DW) statistics smaller than 2.00. For example, tobacco manufactures has the DW statistics of 1.40 and transportation services, 1.72.

We begin by focusing on the elasticity of output with respect to IT capital. Although not all 58 estimated coefficients are significantly different from zero, two-thirds of the industries have the expected positive sign. Among these, the coefficients for the 10 industries in Table 2 are significantly different from zero (at the 10 percent level of significance). For these 10 industries, we have statistical evidence supporting the conclusion that increases in IT equipment led to significant increases in output.

Table 2
Estimated Output Elasticities With Respect to IT Equipment

Sic Code	Industry Description	Elasticity	t-Statistic
62	Security and commodity brokers*	3.33	2.14
07,08,09	Agriculture services, forestries, and fisheries*	2.01	2.77
36,38	Electronic and other electric equipment and instruments*	1.40	2.57
46	Pipelines, except natural gas	0.85	3.07
35	Industrial machinery and equipment*	0.79	11.29
41	Local and inter-urban passenger transportation	0.64	3.04
371	Motor vehicles and equipment	0.41	3.66
25	Furniture and fixtures*	0.39	5.90
34	Fabricated metal products	0.37	4.22
67	Holding and other investment offices	0.34	3.47

* Industries that have significant elasticities for both IT Equipment and IT Labor

Although three of these elasticity estimates appear quite large, none of these is statistically significantly different from 1—the expected upper limit. The values of the remaining seven estimated coefficients fall between zero and one, consistent with *a priori* expectation. The estimated marginal products, calculated at the mean level of output-to-IT equipment ratios for 1983-1993, for the 10 industries in Table 2, span a wide range, from $1.52 (holding and other investment offices) to $118.17 (pipelines, except natural gas). Even though these estimates are subject to considerable uncertainty, they provide evidence that investment in IT equipment in these industries has a very high gross benefit. For any reasonable rental price of IT equipment, the net benefits of IT investment are likely to be positive (i.e., benefit exceeds cost) in these industries and the IT rates of return are likely to be high.

Although gross benefits represented by the estimated marginal products for the 10 industries in Table 2 appear implausibly high in some cases, the corresponding net benefit still need not be statistically different from zero because of large standard errors. Statistical tests, however, show that all 10 industries have an estimated net benefit greater than and statistically significantly different from $0.5, the assumed rental cost per dollar of IT equipment.[20] Five of these industries are in the durable goods manufacturing sector

[20] Under competitive conditions, excessive returns can occur only temporarily or in industries with significant entry barriers, arising from various causes, such as regulations and economies of scale. Whether these industries share this characteristic or some other peculiar attribute (e.g., extraordinary dynamism and innovativeness), remains to be examined.

with relatively high IT equipment to total equipment ratios. However, the industries with apparent high returns to IT equipment also include local and interurban passenger transportation in the transportation sector and security and commodity brokers in the finance, insurance, and real estate sector, and are thus not limited to manufacturing.[21]

In summary, all of the 10 industries that have statistically significant marginal products of IT equipment have marginal products large enough to cover marginal costs. The estimated marginal products of IT equipment for most of the 10 industries also exceed the estimated marginal products of investing in non-IT equipment. Thus, marginal products of IT equipment, at least for these industries, compare favorably with those of other types of capital.[22] But the evidence does not allow us to draw the same conclusion for other industries.

Basic Specification: Marginal Product of IT Labor

Our second goal is to estimate marginal benefits or rates of return to IT employment. On this aspect of our investigation, we found virtually no study in the recent literature that addresses the issue from an individual industry perspective. The estimated coefficients associated with the logarithmic value of IT labor range from zero and one for 30 industries. The estimated elasticities of IT workers are statistically significant and positive for 10 industries, as listed in Table 3. Even though some of their elasticities appear to be quite large, none of them is statistically significantly different from 1—the expected upper limit. Though the derived marginal products for some of these industries are implausibly high, they have very large variances and therefore should not be interpreted literally. Nonetheless, the results suggest that the return for hiring an additional IT worker in some industries may indeed be very high. By comparison, elasticities for the aggregate economy or major industrial sectors, such as manufacturing and non-manufacturing, are all within plausible ranges.[23]

When we compare the industries in Table 3 with those in Table 2, we find that those marked by an asterisk appear in both. For industries marked with an asterisk in tables 2 and 3, we find strong evidence that increases in both IT equipment and IT workers contributed significantly to their output growth. With the exception of furniture and fixtures, output of these industries grew at rates exceeding 4.5 percent annually over the

---

[21] Among the 10 industries identified above, five are in the manufacturing sector, and a number of them, such as machinery and fabricated metals were also found to have a marginal benefit/cost ratio (similar to Tobin's "q" used in capital asset analysis) of greater than one for 1986 in a study of the manufacturing sector by Morrison and Berndt (1991, Table 2).

[22] The apparently substantial inter-industry differences in marginal products for the same type of capital, however, seem to suggest that inter-industry mobility of capital is small or that substantial differences in risk premiums exist among industries.

[23] Estimated marginal products of IT capital (per dollar of net capital stock), based on the pooled-cross-section estimates of elasticities, are 0.46 for manufacturing and 0.70 for the non-manufacturing sector. The corresponding estimated marginal products of labor (per IT worker) for the manufacturing sector is \$49,052 and for the non-manufacturing sector is \$19,651.

period. Their rates of growth of IT equipment are also high, ranging from 7.4 percent to 16.9 percent; but those of IT workers range from slightly negative to six percent, suggesting that each IT worker in these industries had progressively more IT capital to work with over the period.

Table 3
Estimated Output Elasticities With Respect to IT Workers

Sic Code	Industry Description	Elasticity	t-Statistic
481,482,489	Telephone and telegraph	1.94	2.78
07,08,09	Agriculture services, forestries, and fisheries*	1.70	2.30
24	Lumber and wood products	1.57	2.05
62	Security and commodity brokers*	1.41	2.15
35	Industrial machinery and equipment*	0.93	4.08
36,38	Electronic and other electric equipment and instruments*	0.91	3.01
25	Furniture and fixtures*	0.79	2.12
64	Insurance agents, brokers, and services	0.34	2.90
76	Miscellaneous repair services	0.28	2.68
60,61	Depository and nondepository institutions	0.27	5.56

* Industries that have significant elasticities for both IT Equipment and IT Labor

Comparison with Earlier Results

Studies of IT productivity based on the production function approach have relied mostly on data at the company level. Loveman (1994), using 1978-84 data from a sample of 60 divisions ("business units") of U.S. and Western European manufacturing companies, found that gross marginal benefits of increasing IT were not significantly different from zero. In contrast, Brynjolfsson and Hitt (1993, 1994) and Lichtenberg (1993), using 1988-92 data for Fortune 500 manufacturing and service companies, found that the gross marginal return to IT was over 60 percent. They further suggested that net marginal returns to IT were likely to be positive, based on various assumptions of depreciation rates. Hitt and Brynjolfsson (1995), found that the marginal return to IT (both capital and labor combined) was approximately 95 percent.

Morrison and Berndt (1991), using BEA data at the industry level for 20 manufacturing industries for 1968-86, found that net marginal benefits of IT were negative, suggesting an over-investment in IT. In their subsequent study, Berndt and Morrison (1995) found that rates of return to IT were not significantly related to the proportion of IT in capital. The estimated effects of IT share on rates of return in a log-linear specification were negative in thirteen industries and positive in seven industries. Among these, only four of the estimated coefficients were statistically significant: three negative and one positive. In contrast, our findings on rates of return to IT are non-negative in two-thirds of the 58 industries and positive and significant for 10 industries. Any anomalies or apparent contradictions between their findings and our own may derive primarily from variations in methodology and data, including differences in the selection of time periods and in the measurement of output.[24]

We have only limited evidence on complementarity or substitutability between IT capital and either of the two classes of labor.[25] But our results are consistent with Baily and Chakrabarti's (1988) speculation that IT capital and IT labor have low substitutability. This implies that production tends to become increasingly IT labor intensive as the price of IT capital declines over time, suggesting the two are complements.

Are IT Capital and Labor Really Different from Other Capital and Labor?

An important feature of our basic specification is the treatment of IT equipment as distinct from non-IT equipment and IT workers as distinct from non-IT workers. Although this is logical, it is still useful to examine whether there is some statistical evidence to confirm the merits of this approach. One statistical test to answer this question is to replace IT equipment stock, non-IT equipment stock, IT workers, and non-IT workers in our basic specification with total equipment, total employment, share of IT equipment in total equipment, and share of IT workers in total employment. If these regression results show that the coefficients of the shares of IT-equipment and/or workers are statistically significant, we would conclude that it is desirable to treat IT equipment and/or IT workers as distinct from non-IT capital or labor. Statistical tests generally indicate that splitting IT-equipment or IT-workers from non-IT capital or non-IT workers is desirable.[26]

Time Trend and Lagged Response

In addition to the basic specification of the model, we modify the equation on page 3 to test for the influence of time, adding a time trend variable in one case and a lagged dependent variable in the other.

Results of regressions with an additional trend variable show only eight industries have a statistically significant trend, indicating that time trend is not a significant variable for most industries.[27]

---

[24] Our study uses value added while Morrison and Berndt used gross output.

[25] See our discussion of the results from alternative specifications involving interaction terms: one to represent the interaction between IT capital and IT labor and another, the interaction between IT capital and non-IT labor.

[26] Tests show that one or the other of the estimated coefficients of the two share variables are statistically significant and positive for a total of 11 industries. Eight of these industries are among those that are found to have high marginal products or rates of return to IT capital or IT labor. These results indicate that the split between IT equipment or labor and non-IT equipment or labor is warranted, particularly for those industries where we find evidence of positive IT impacts.

[27] Evidence gained from estimations using year dummies, rather than a linear trend variable, and cross-sectional analysis confirms that we can largely ignore time as an explanatory variable.

We estimate another set of regressions using a modification of the equation on page 3 that includes the lagged dependent variable as an additional explanatory variable. This formulation considers rigidity in adjustment (the "partial adjustment hypothesis," i.e., the possible difference between short-run and long-run equilibrium). We estimate the "adjustment coefficient" (the fraction of adjustment completed within the current period) by subtracting the estimated coefficient of the lagged dependent variable from one. The value must range between zero and one. The value of zero for the estimated coefficient of the lagged dependent variable (i.e., that the adjustment coefficient is one) implies that the adjustment process is completed within the current time period.

Our regression results show that more than a third (22 out of 58 industries) of the estimated coefficients associated with the lagged dependent variable have the expected positive sign with a value of less than one. However, a large majority of them are not statistically significant, suggesting a true value of zero. Consequently, we conclude that adjustments, are made within one time period and our basic specification is statistically supported.[28]

Analysis of Synergies

Finally, we examine the interactions between IT equipment stock and the two categories of workers by computing two additional sets of regressions that incorporate into the equation the product of logarithmic values of IT equipment and IT workers, and the product of logarithmic values of IT equipment and non-IT workers. These two sets of regressions help determine whether the elasticity of output with respect to IT equipment, and thus its marginal product, tend to increase with the hiring of an additional IT or non-IT worker (and also whether the marginal product of either of the two categories of workers increases as the level of IT equipment increases). A significant positive coefficient for the interaction between IT equipment and IT worker suggests that they are complements; a significant negative sign, suggests that they are substitutes.

The estimated coefficients of the term representing the interaction between IT equipment and IT workers are generally not statistically significant.[29]Similarly, very few of the coefficients of the interaction variable between IT equipment and non-IT worker are

---

[28] The estimated coefficient of the lagged dependent variable is statistically significant for only three industries: tobacco manufactures, other services, and electric services. Further, under this formulation, the estimated short-run elasticity of IT equipment is positive, though not statistically significant, for tobacco manufactuers and electric services, as we would expect, but negative in the case of other services. The estimated coefficients of IT workers in the first two cases are negative, which seems improbable, though statistically significant in the case of tobacco manufactuers.

[29] They are positive and statistically significant only for two industries (motor vehicles and equipment; other transportation industries) and negative and statistically significant for six (transportation services; telephone and telegraph; chemicals and allied products; trucking and warehousing; tobacco manufactures; and gas services).

significant. Among all regressions, we find that only nine of the estimated coefficients of the interaction term are negative and statistically significant.[30]

Overall, we find that the interaction term between IT equipment and IT worker or non-IT worker in general is not statistically significant. Thus, we accept the basic model specification.

V. SUMMARY AND CONCLUSIONS

Evidence from previous studies on the contribution of increases in IT equipment to output growth is inconclusive, and studies of the productivity of IT workers are very limited. Using industry-level data for 58 industries for 1983-93, we estimate benefits of increases in IT equipment and IT workers, and compare them with the estimated returns to non-IT capital and labor. The study is unique in covering not only manufacturing but also non-manufacturing goods and services industries; in fact, the entire private economy.

We estimate the model for the aggregate economy by pooling eleven cross-sections for 58 industries after establishing that elasticities are invariant from 1983-1993. We find that all the economy-wide elasticities are positive and lie between zero and one, consistent with *a priori* expectations. Also, the sum of the elasticities is less than one, implying decreasing returns to scale.

We find that gross marginal benefits, measured as marginal products of IT equipment vary greatly among industries. From our 58 industry regressions, we find that 10 industries have estimated elasticities that are positive and statistically different from zero. All 10 industries show positive net marginal returns to IT equipment, and 9 of them may have annual rates of return in excess of 100 percent. They are: (1) pipelines (except natural gas); (2) security and commodity brokers; (3) furniture and fixtures; (4) agricultural services, forestry, and fisheries; (5) fabricated metal products; (6) motor vehicles and equipment; (7) electronic and other electric equipment and instruments; (8) industrial machinery and equipment; (9) local and inter-urban transit. We have found similar evidence on the benefits of hiring additional IT workers.

We find little evidence to establish whether IT equipment and IT workers are complements or substitutes but in a few industries we do see an indication that IT equipment and non-IT workers are substitutes.

---

[30] They are: (1) telephone and telegraph; (2) miscellaneous manufacturing industries; (3) trucking and warehousing; (4) gas services; (5) transportation services; (6) personal services; (7) primary metal industries; (8) petroleum and coal products; and (9) chemicals and allied products.

Further Research

We have been able to identify industries that appear to have relatively high marginal products or rates of return on IT capital and IT workers. It remains unclear, however, why certain industries at this level of aggregation should have such high returns to IT capital. Case studies of selected industries would no doubt shed more light on this matter. Additionally, we should carefully examine whether combining IT capital and IT labor into one input, as Brynjolfsson and Hitt (1994) have done, represents a reasonable and appropriate alternative.

Most important is to assess the feasibility of extending our current data forward to 1994 or 1995 and backward to at least 1977, possibly even 1968 and to examine whether reliable data for four-digit level industries and additional explanatory variables such as purchased material and services can be assembled. More disaggregated (say, 4 digit SIC level) data are likely to reveal more clearly the relationship between IT equipment and labor on the one hand and output on the other, as the true relationships are likely to be masked at the two-digit level by compensating differences across 4 digit industries. Moreover, if the quality and quantity of available data improve, we can apply more sophisticated econometric modeling techniques and investigate alternative approaches, including the cost function approach. This, for example, would make it possible to determine the relative contribution to additional output of various inputs *within* industries and thus provide valuable clues into whether IT investments and IT workers are making American companies more productive than they might otherwise have been.

We would also like to see how our results might change if we use gross output instead of value added as the measure of industry product, as in Berndt and Morrison (1991, 1995).

VI. REFERENCES

Attewell, P. (1994), "Information Technology and the Productivity Paradox," in *Organizational Linkages: Understanding the Productivity Paradox*, ed. Douglas Harris, Washington, DC: National Academy Press, pp. 13-60.

Baily, M. and A. Charabarti (1988), *Innovation and Productivity Crisis*, Washington, DC: Brookings Institution.

Baumol, Blackman, and Wolff (1989), *Productivity and American Leadership: The Long View*, Cambridge, p. 148.

Berndt, E., C. Morrison, and L. Rosenblum (1992), "High-Tech Capital Formation and Labor Composition in U.S. Manufacturing Industries: An Exploratory Analysis," NBER Working Paper No. 4010, March.

Berndt, E. and C. Morrison (1995), "High-Tech Capital Formation and Economic Performance in U.S. Manufacturing Industries: An Exploratory Analysis," *Journal of Econometrics*, 65, 9-43.

Brynjolfsson, E. (1993), "The Productivity Paradox of Information Technology," *Communications of the ACM*, Vol. 36, No. 12, 66-77.

Brynjolfsson, E. and L. Hitt (1994), "Information Technology as a Factor of Production: The Role of Differences Among Firms," MIT Sloan School Working Paper 3715, August.

Cohen, Robert B. (1995), "The Economic Impact of Information Technology," *Business Economics*, Vol. XXX, No. 4, October, 1995.

Harper, M. J., E. R. Berndt, and D. O. Wood, (1989), "Rates of Return and Capital Aggregation Using Alternative Rental Prices," in D. W. Jorgenson and R. Landau (eds.), *Technology and Capital Formation*, MIT Press, pp. 331-72.

Hitt, L. and E. Brynjolfsson (1995), "Creating Value and Destroying Profits? Three Measures of Information Technology's Contributions," MIT Sloan School Working Paper, May.

Lau, L. and I. Tokutso (1992), "The Impact of Computer Technology on the Aggregate Productivity of the United States: An Indirect Approach," Unpublished paper, Department of Economics, Stanford University, August.

Landauer, T. (1995), *The Trouble With Computers: Usefulness, Usability, and Productivity*, Cambridge and London: MIT Press.

Lichtenberg, F. R. (1993), "The Output Contributions of Computer Equipment and Personnel: A Firm-Level Analysis," NBER Working Paper No. 4540, November.

Loveman, G. W. (1994), "An Assessment of the Productivity Impact of Information Technologies," in, Allen T.J. and M. S. Scott Morton (ed.), *Information Technology and the Corporation of the 1990s: Research Studies*, Oxford University Press.

Miles *et al* (1990), *Mapping and Measuring the Information Economy*, Cambridge, England.

Morrison, J. C. and E. R. Berndt (1991), "Assessing the Productivity of Information Technology Equipment in U.S. Manufacturing Industries," NBER Working Paper No. 3583, January.

Roach, S. (1987), "America's Technology Dilemma: A Profile of the Information Economy," Special Economic Study, Morgan Stanley.

Roach, S. (1991), "Services Under Siege: The Restructuring Imperative," *Harvard Business Review*, Sept.-Oct., 82-92.

APPENDICIES

Table A- 1
Capital Equipment Shares and Labor Shares by Summary and Detailed Industries
(Percent

SIC Code	Industry Description	Equipment Share of Total Net Capital Stock		IT Equipment Share of Total Net Capital Stock of Equipment		IT Workers Share of Total Workers	
		1983	1993	1983	1993	1983	1993
01,02,07-09	Agriculture, forestry, and fisheries	49.3	44.8	1.2	7.7	5.40	5.70
01,02	Farms	46.9	38.3	0.1	0.2	5.40	5.70
07,08,09	Agricultrural services, forestries, and fisheries	74.5	73.1	8.8	24.6	5.40	5.70
10-14	Mining	32.3	27.3	8.1	15.7	24.56	25.37
10	Metal Mining	26.4	21.9	4.1	15.4	19.94	18.42
12	Coal Mining	45.5	31.3	6.8	17.5	12.03	10.94
13	Oil and gas extraction	30.1	25.4	9.6	18.1	31.40	34.72
14	Nonmetallic minerals, except fuels	47.7	46.9	0.2	0.5	11.01	11.97
15,16,17	Construction	60.9	60.1	4.7	12.7	12.27	13.70
20-39	Manufacturing	59.0	56.9	8.6	19.4	18.40	19.90
24,25,32-39	Durable goods	60.8	58.3	7.2	19.2	20.83	22.53
24	Lumber and wood products	50.5	42.0	6.2	18.9	6.94	8.48
25	Furniture and fixtures	36.5	35.7	3.9	17.1	7.38	8.82
32	Stone, clay, and glass products	60.6	56.1	6.1	25.6	11.64	11.44
33	Primary metal industries	70.7	70.8	5.5	9.3	12.62	13.45
34	Fabricated metal products	65.2	63.2	2.1	6.7	13.29	13.89
35	Industrial machinery and equipment	58.1	60.7	7.5	23.9	25.31	26.87
36,38	Electronic and other electric equipment and instruments	54.7	54.9	18.2	33.1	28.51	32.31
371	Motor vehicles and equipment	72.1	66.0	2.1	9.8	15.64	18.42
37 except 371	Other transportation equipment	48.0	43.4	6.8	15.9	35.65	38.26
39	Miscellaneous manufacturing industries	45.2	45.7	2.1	12.2	12.82	13.64
20-23,26-31	Nondurable goods	57.0	55.3	10.3	19.5	15.03	16.50
20	Food and kindred products	54.5	52.9	7.5	15.0	9.12	9.49
21	Tobacco manufactures	42.8	43.1	10.8	15.8	11.89	19.83
22	Textile mill products	61.2	56.2	4.3	14.8	6.86	6.76
23	Apparel and other textile products	44.5	33.7	1.9	3.5	5.00	5.58
26	Paper and allied products	74.3	73.2	1.6	6.6	13.06	14.07
27	Printing and publishing	50.6	49.6	4.3	22.8	22.32	23.10
28	Chemicals and allied products	62.0	55.7	21.2	32.8	33.29	37.11
29	Petroleum and coal products	40.3	45.3	11.2	19.6	38.93	42.43
30	Rubber and miscellaneous plastics products	58.1	56.0	3.0	10.6	11.49	11.09
31	Leather and leather products	43.2	36.9	3.8	14.4	6.38	7.21
40-42,44-47,48,49	Transportation and public utilities	43.5	41.8	32.7	39.1	23.26	22.25
40-42,44-47	Transportation	58.0	53.7	4.6	19.8	11.09	12.56
40	Railroad transportation	31.6	25.9	4.9	25.7	9.23	9.43
41	Local and interurban passenger transportation	78.0	85.0	22.4	39.7	13.94	18.85
42	Trucking and warehousing	76.3	73.7	2.7	5.1	6.70	7.55
44	Water transportation	94.4	80.9	1.5	13.9	9.88	9.05
45	Transportation by air	89.7	81.9	8.2	30.6	21.35	20.13
46	Pipelines, except natural gas	2.1	1.2	4.5	22.9	39.23	43.80
47	Transportation services	95.2	89.1	0.9	6.3	12.46	15.74
48	Communications	56.1	51.2	84.2	80.2	37.89	37.05
481,482,489	Telephone and telegraph	56.7	48.3	87.9	86.3	37.89	37.05
483,484	Radio and television	50.8	64.2	47.7	60.2	37.89	37.05
49	Electric, gas, and sanitary services	28.0	32.3	8.2	18.4	39.15	38.67
491,pt493	Electric services	31.0	34.6	7.2	14.2	41.42	42.40
492,pt493	Gas services	17.6	20.0	14.1	26.9	41.42	42.40
494,495,496,497	Sanitary services	16.4	36.5	19.9	46.8	15.99	20.67
50,51	Wholesale trade	51.9	63.5	31.2	53.8	17.46	18.43
52-59	Retail trade	39.6	47.7	23.6	44.2	9.92	8.58
60-67	Finance, insurance, and real estate	29.5	37.8	25.1	36.7	27.72	30.85
60,61	Depository and nondepository institutions	62.2	68.0	7.0	23.8	30.21	32.44
62	Security and commodity brokers	33.9	41.0	67.8	78.3	24.10	29.20
63	Insurance carriers	34.5	48.8	33.6	62.8	32.13	35.08
64	Insurance agents, brokers, and services	31.9	53.8	65.9	84.2	24.62	26.51
65	Real estate	19.1	22.5	40.4	43.4	16.57	22.64
67	Holding and other investment offices	29.6	37.1	61.9	77.6	46.92	48.04
70-79,80-87,89	Services	57.0	62.4	17.2	28.8	46.23	45.14
70	Hotels and other lodging places	15.4	13.6	14.8	29.7	41.46	41.59
72	Personal services	45.3	54.5	20.1	35.8	11.40	12.35
73	Business services	84.5	85.7	9.1	17.0	30.20	28.37
75	Auto repair, services, and parking	90.5	90.5	9.2	18.6	5.03	8.21
76	Miscellaneous repair services	70.2	66.7	3.2	20.6	10.49	14.09
78	Motion pictures	42.4	60.4	65.9	72.5	26.30	26.77
79	Amusement and recreation services	46.5	34.7	24.4	33.1	19.92	24.85
80	Health services*	44.3	44.7	51.2	52.5	51.15	52.25
81	Legal services	43.5	66.3	30.1	54.2	49.60	50.69
82	Educational services*	26.5	17.7	19.9	50.6	63.56	63.18
83,84,86,87,89	Other services	34.0	53.4	26.4	53.6	40.42	39.17

Notes: Net Capital Stock = Gross Capital Stocks - Accumulated Depreciation (straight-line method); share calculations based on constant (1987) dollars:
IT Equipment = Office, computing, and accounting machinery + Communications equipment + Instruments + Photocopy and related equipment.
IT Workers = Electrical and electronics engineers + Computer engineers, scientists, and systems analysts + Broadcast technicians + Computer programmers + Computer operators and peripheral equipment operators + Typists and word processing equipment repairers.
* Employment numbers for this industry include government workers.
Sources: Bureau of Economic Analysis and Bureau of Labor Statistics.

Table A- 2
Capital and Labor Intensity
(Based on 1987 dollars)

SIC Code	Industry Description	Capital/Output Ratio				Employees per Million $ of Output			
		Capital Intensity		IT Capital Intensity		Labor Intensity		IT Labor Intensity	
		1983	1993	1983	1993	1983	1993	1983	1993
01,02,07-09	Agriculture, forestry, and fisheries	3.31	1.64	0.02	0.06	23.46	16.43	1.27	0.94
01,02	Farms	3.85	1.92	0.00	0.00	21.60	14.02	1.17	0.80
07,08,09	Agricultrural services, forestries, and fisheries	1.32	0.99	0.09	0.18	30.07	21.78	1.62	1.24
10-14	Mining	3.71	1.88	0.10	0.08	13.35	6.43	3.28	1.63
10	Metal Mining	8.36	1.73	0.09	0.06	20.89	5.88	4.17	1.08
12	Coal Mining	2.74	1.31	0.09	0.07	18.97	6.49	2.28	0.71
13	Oil and gas extraction	3.79	2.07	0.11	0.09	11.30	5.62	3.55	1.95
14	Nonmetallic minerals, except fuels	2.46	1.72	0.00	0.00	19.30	13.85	2.12	1.66
15,16,17	Construction	0.33	0.25	0.01	0.02	23.44	22.50	2.88	3.08
20-39	Manufacturing	1.25	1.12	0.06	0.12	25.12	18.34	4.62	3.65
24,25,32-39	Durable goods	1.23	0.98	0.05	0.11	26.60	17.53	5.54	3.95
24	Lumber and wood products	0.94	0.79	0.03	0.06	29.80	29.68	2.07	2.52
25	Furniture and fixtures	0.64	0.62	0.01	0.04	36.42	29.66	2.69	2.62
32	Stone, clay, and glass products	1.42	1.10	0.05	0.16	24.58	20.41	2.86	2.34
33	Primary metal industries	3.09	2.00	0.12	0.13	25.76	16.86	3.25	2.27
34	Fabricated metal products	1.11	0.87	0.02	0.04	27.04	20.58	3.59	2.86
35	Industrial machinery and equipment	1.33	0.85	0.06	0.12	30.72	15.15	7.78	4.07
36,38	Electronic & other elec. Equip. & instruments	0.97	0.94	0.10	0.17	27.86	15.67	7.94	5.06
371	Motor vehicles and equipment	1.12	1.06	0.02	0.07	15.97	14.70	2.50	2.71
37 except 371	Other transportation equipment	0.85	1.04	0.03	0.07	23.37	17.30	8.33	6.62
39	Miscellaneous manufacturing industries	0.87	0.50	0.01	0.03	36.30	19.34	4.65	2.64
20-23,26-31	Nondurable goods	1.27	1.32	0.07	0.14	23.31	19.51	3.50	3.22
20	Food and kindred products	1.13	1.25	0.05	0.10	22.32	19.58	2.04	1.86
21	Tobacco manufactures	0.42	0.89	0.02	0.06	4.33	6.15	0.52	1.22
22	Textile mill products	1.31	0.96	0.03	0.08	40.97	28.59	2.81	1.93
23	Apparel and other textile products	0.44	0.33	0.00	0.00	57.02	38.62	2.85	2.16
26	Paper and allied products	1.65	1.62	0.02	0.08	19.01	14.75	2.48	2.08
27	Printing and publishing	0.53	0.86	0.01	0.10	23.65	26.34	5.28	6.09
28	Chemicals and allied products	1.74	1.80	0.23	0.33	15.31	12.24	5.10	4.54
29	Petroleum and coal products	3.00	2.42	0.14	0.22	9.01	6.29	3.51	2.67
30	Rubber and miscellaneous plastics products	1.27	0.98	0.02	0.06	34.88	23.88	4.01	2.65
31	Leather and leather products	0.51	0.39	0.01	0.02	48.79	27.57	3.11	1.99
40-42,44-47,48,49	Transportation and public utilities	3.01	2.24	0.43	0.37	14.10	11.06	3.28	2.46
40-42,44-47	Transportation	2.25	1.25	0.06	0.13	21.59	18.14	2.39	2.28
40	Railroad transportation	6.53	3.32	0.10	0.22	21.73	8.90	2.01	0.84
41	Local and interurban passenger transportation	0.63	0.48	0.11	0.16	34.69	38.59	4.84	7.27
42	Trucking and warehousing	1.05	0.46	0.02	0.02	23.41	20.62	1.57	1.56
44	Water transportation	3.48	2.42	0.05	0.27	22.24	21.93	2.20	1.99
45	Transportation by air	1.76	1.12	0.13	0.28	17.85	15.34	3.81	3.09
46	Pipelines, except natural gas	3.55	3.21	0.00	0.01	3.19	3.28	1.25	1.44
47	Transportation services	1.69	1.10	0.02	0.06	22.90	21.58	2.85	3.40
48	Communications	2.58	1.96	1.22	0.80	12.30	7.88	4.66	2.92
481,482,489	Telephone and telegraph	2.79	2.05	1.39	0.85	11.28	7.30	4.27	2.71
483,484	Radio and television	1.58	1.62	0.38	0.63	17.46	9.89	6.62	3.66
49	Electric, gas, and sanitary services	4.22	3.69	0.10	0.22	7.59	5.78	2.97	2.24
491,pt493	Electric services	6.23	4.31	0.14	0.21	9.34	5.40	3.87	2.29
492,pt493	Gas services	1.87	2.19	0.05	0.12	4.61	4.63	1.91	1.96
494,495,496,497	Sanitary services	2.86	3.98	0.09	0.68	16.09	13.61	2.57	2.81
50,51	Wholesale trade	0.66	0.69	0.11	0.23	23.57	17.14	4.12	3.16
52-59	Retail trade	0.63	0.75	0.06	0.16	42.69	38.58	4.24	3.31
60-67	Finance, insurance, and real estate	1.03	1.35	0.08	0.19	7.51	7.22	2.08	2.23
60,61	Depository and nondepository institutions	1.20	2.35	0.05	0.38	16.66	17.35	5.03	5.63
62	Security and commodity brokers	0.20	0.11	0.05	0.04	12.64	6.90	3.05	2.01
63	Insurance carriers	0.52	1.61	0.06	0.49	23.23	21.63	7.46	7.59
64	Insurance agents, brokers, and services	0.12	0.10	0.02	0.05	19.49	20.79	4.80	5.51
65	Real estate	1.13	1.29	0.09	0.13	2.10	2.19	0.35	0.50
67	Holding and other investment offices	0.94	0.82	0.17	0.24	11.46	11.43	5.38	5.49
70-79,80-87,89	Services	0.49	0.53	0.05	0.09	39.61	42.89	18.31	19.36
70	Hotels and other lodging places	1.54	1.29	0.04	0.05	33.86	34.67	14.04	14.42
72	Personal services	0.46	0.67	0.04	0.13	31.72	36.22	3.62	4.47
73	Business services	0.44	0.42	0.03	0.06	28.26	29.39	8.54	8.34
75	Auto repair, services, and parking	1.79	2.36	0.15	0.40	15.35	21.52	0.77	1.77
76	Miscellaneous repair services	0.53	0.65	0.01	0.09	17.52	16.37	1.84	2.31
78	Motion pictures	0.63	0.86	0.17	0.38	25.74	23.70	6.77	6.35
79	Amusement and recreation services	0.80	0.50	0.09	0.06	31.26	32.37	6.23	8.05
80	Health services*	0.22	0.31	0.05	0.07	33.04	40.27	16.90	21.04
81	Legal services	0.15	0.24	0.02	0.09	12.75	16.57	6.32	8.40
82	Educational services*	0.08	0.11	0.00	0.01	283.12	341.06	179.95	215.47
83,84,86,87,89	Other services	0.34	0.24	0.03	0.07	33.85	32.95	13.68	12.91

Notes: Capital Intensity = Net Capital equipment and Structures/Output
IT Capital Intensity = Net IT Capital Equipment/Output
Labor Intensity = Number of Employees/Output
IT Labor Intensity = Number of IT Employees/Output
* Employment numbers for this industry include government workers.
Source: Office of Business and Industrial Analysis calculations based on BEA and BLS data

Table A- 3
Summary of Regression Results for Detailed and Aggregate Industries

SIC Code	Industry Description	Intercept	IT Workers	Other Workers	IT Equipment	Other Equipment	Structures	*Adj-RSQ* *DW*

SIC Code	Industry Description	Intercept	IT Workers	Other Workers	IT Equipment	Other Equipment	Structures	*Adj-RSQ* *DW*
01,02,07-09	**Agriculture, forestry, and fisheries**	-48.45* *(-2.05)*	-0.27 *(-0.40)*	2.37 *(1.76)*	1.02* *(3.03)*	0.60 *(1.31)*	3.98* *(2.41)*	**0.88** 2.64
01,02	Farms	-25.43 *(-0.92)*	-1.83 *(-1.52)*	3.63 *(1.38)*	0.37 *(0.42)*	-1.57 *(-1.70)*	1.56 *(0.80)*	**0.52** 3.10
07,08,09	Agricultrural services, forestries, and fisheries	2.62 *(0.38)*	1.70* *(2.30)*	-1.22 *(-1.47)*	2.01* *(2.77)*	3.29 *(1.96)*	-6.44* *(-2.03)*	**0.95** 2.64
10-14	**Mining**	-3.33 *(-0.52)*	-0.21 *(-0.12)*	0.52 *(0.36)*	0.04 *(0.07)*	-1.59 *(-1.17)*	1.94 *(0.75)*	**0.40** 3.17
10	Metal Mining	2.28 *(0.15)*	0.67 *(0.29)*	0.10 *(0.04)*	-0.24 *(-0.99)*	-0.57 *(-0.23)*	-2.82 *(-0.58)*	**0.88** 3.07
12	Coal Mining	13.15 *(1.01)*	-0.09 *(-0.26)*	0.23 *(0.65)*	1.58 *(0.91)*	0.17 *(0.20)*	-4.72 *(-0.82)*	**0.88** 3.51
13	Oil and gas extraction	-4.18 *(-0.63)*	-2.12 *(-1.42)*	1.37 *(1.58)*	-0.89 *(-1.10)*	-3.53* *(-2.14)*	6.44 *(1.95)*	**0.06** 2.75
14	Nonmetallic minerals, except fuels	-9.83 *(-0.79)*	1.40 *(0.96)*	-0.03 *(-0.04)*	0.16 *(1.41)*	-0.82* *(-2.74)*	0.51 *(0.60)*	**0.48** 3.13
15,16,17	Construction	-3.94 *(-1.89)*	-0.01 *(-0.03)*	0.73* *(3.05)*	-0.05 *(-0.40)*	-0.89** *(-4.03)*	0.42 *(0.52)*	**0.90** 3.46
20-39	**Manufacturing**	3.08 *(1.27)*	0.19 *(1.83)*	0.99** *(7.46)*	0.69** *(14.72)*	-1.61** *(-7.29)*	-1.42** *(-7.53)*	**0.99** 2.87
24,25,32-39	**Durable goods**	0.93 *(0.75)*	0.18* *(2.04)*	1.13** *(10.99)*	0.68** *(18.43)*	-1.42** *(-5.01)*	-1.84** *(-10.10)*	**1.00** 2.52
24	Lumber and wood products	-19.53** *(-5.01)*	1.57* *(2.05)*	-0.11 *(-0.11)*	-1.07* *(-2.31)*	-1.02 *(-2.20)*	3.91 *(1.48)*	**0.70** 1.99
25	Furniture and fixtures	-4.32 *(-1.98)*	0.79* *(2.12)*	0.28 *(0.98)*	0.39** *(5.90)*	-0.51 *(-0.71)*	-2.28** *(-4.01)*	**0.88** 2.44
32	Stone, clay, and glass products	-20.06* *(-3.12)*	0.76 *(1.42)*	0.84 *(1.81)*	-0.04 *(-0.17)*	-0.72 *(-1.12)*	2.31 *(1.16)*	**0.44** 2.86
33	Primary metal industries	13.86 *(1.48)*	0.34 *(0.21)*	-1.19 *(-0.66)*	-0.05 *(-0.11)*	0.95 *(0.26)*	-0.61 *(-0.14)*	**-0.76** 2.44
34	Fabricated metal products	-2.01 *(-0.72)*	-0.68 *(-1.92)*	1.73 *(5.14)*	0.37** *(4.22)*	-0.49 *(-0.87)*	-2.75* *(-2.18)*	**0.91** 2.55
35	Industrial machinery and equipment	7.78* *(2.58)*	0.93** *(4.08)*	0.71 *(1.80)*	0.79** *(11.29)*	-4.64* *(-2.74)*	-2.48* *(-3.28)*	**0.98** 3.21
36,38	Electronic & other electric equip. & instruments	-22.60* *(-2.66)*	0.91* *(3.01)*	2.13* *(2.50)*	1.40* *(2.57)*	-7.79* *(-3.08)*	2.68* *(2.55)*	**0.93** 2.38
371	Motor vehicles and equipment	-14.23* *(-3.22)*	-0.53 *(-1.96)*	2.23** *(9.85)*	0.41* *(3.66)*	-0.41 *(-0.99)*	-1.49* *(-3.47)*	**0.83** 2.62
37 except 371	Other transportation equipment	1.26 *(0.20)*	-0.19 *(-0.33)*	-1.13 *(-0.93)*	-1.04 *(-1.14)*	8.22 *(1.54)*	-0.91 *(-0.93)*	**0.85** 1.58
39	Miscellaneous manufacturing industries	-34.08 *(-1.35)*	0.55 *(0.45)*	1.99 *(1.58)*	0.12 *(0.75)*	-0.89 *(-1.21)*	4.31 *(0.78)*	**0.56** 1.90
20-23,26-31	**Nondurable goods**	9.36 *(1.28)*	0.94* *(2.60)*	-0.32 *(-0.49)*	0.52* *(3.32)*	-1.74** *(-5.39)*	-0.78* *(-2.07)*	**0.95** 2.79
20	Food and kindred products	-3.44 *(-0.17)*	0.24 *(1.36)*	1.27 *(0.76)*	1.04 *(1.81)*	-2.12 *(-1.86)*	-1.83 *(-1.35)*	**0.74** 3.46
21	Tobacco manufactures	-2.74 *(-0.39)*	-0.38 *(-1.33)*	0.42 *(0.61)*	-1.02 *(-1.39)*	2.58* *(3.63)*	0.49 *(0.41)*	**0.95** 1.40
22	Textile mill products	-6.77 *(-1.01)*	0.70 *(1.35)*	0.29 *(0.69)*	-0.12 *(-1.21)*	-1.67* *(-3.38)*	1.10 *(1.03)*	**0.88** 2.24
23	Apparel and other textile products	-3.83 *(-0.50)*	0.34 *(0.88)*	0.16 *(0.20)*	-0.10 *(-0.34)*	-0.58* *(-2.26)*	0.86* *(2.32)*	**0.82** 1.27
26	Paper and allied products	10.08 *(0.96)*	0.26 *(0.64)*	-0.75 *(-1.32)*	0.15 *(1.49)*	0.14 *(0.25)*	-0.04 *(-0.05)*	**0.88** 2.22
27	Printing and publishing	-12.93** *(-4.38)*	-0.07 *(-0.24)*	1.35** *(7.11)*	0.07 *(0.83)*	0.34 *(1.63)*	-0.68* *(-2.75)*	**0.87** 2.79
28	Chemicals and allied products	32.68* *(2.44)*	0.19 *(0.33)*	-1.55 *(-1.47)*	1.40 *(1.86)*	-2.13** *(-4.04)*	-1.38 *(-1.54)*	**0.86** 2.77
29	Petroleum and coal products	-7.93 *(-0.55)*	1.61 *(1.57)*	0.74 *(0.61)*	0.46 *(0.57)*	-6.24 *(-1.42)*	0.94 *(0.34)*	**0.25** 2.33
30	Rubber and miscellaneous plastics products	-10.48 *(-0.97)*	-0.75 *(-0.75)*	1.55 *(1.20)*	0.04 *(0.16)*	-0.57 *(-0.33)*	1.14 *(0.94)*	**0.95** 2.96
31	Leather and leather products	-3.58 *(-0.60)*	0.89 *(1.16)*	-0.13 *(-0.13)*	0.22 *(1.09)*	1.11 *(1.30)*	-4.55* *(-2.68)*	**0.77** 2.18
40-42,44-47,48,49	**Transportation and public utilities**	3.74 *(0.63)*	-1.82* *(-2.92)*	2.61* *(3.56)*	0.92 *(1.23)*	-1.63** *(-5.59)*	-1.16 *(-0.62)*	**0.98** 3.06
40-42,44-47	**Transportation**	8.01 *(0.57)*	-0.19 *(-0.57)*	0.29 *(0.45)*	0.03 *(0.29)*	-0.83* *(-3.25)*	-0.20 *(-0.10)*	**0.96** 2.87
40	Railroad transportation	-1.58	-0.49	1.35	0.09	-0.94	-0.99	**0.89**

SIC Code	Industry Description	Intercept	IT Workers	Other Workers	IT Equipment	Other Equipment	Structures	*Adj-RSQ* / *DW*
		(-0.20)	*(-1.65)*	*(1.76)*	*(0.59)*	*(-1.51)*	*(-0.76)*	2.76
41	Local and interurban passenger transportation	-5.46	-0.05	0.79	0.64*	-1.53*	1.65	**0.73**
		(-0.43)	*(-0.26)*	*(0.72)*	*(3.04)*	*(-3.47)*	*(1.88)*	2.80
42	Trucking and warehousing	11.48	0.07	-0.35	0.25	-0.29	-0.88	**0.95**
		(1.61)	*(0.43)*	*(-0.72)*	*0.87)*	*(-0.49)*	*(-0.75)*	1.96
44	Water transportation	-9.62	0.06	0.73*	0.17	0.73	0.35	**0.81**
		(-3.06)	*(0.39)*	*(3.04)*	*(1.67)*	*(1.83)*	*(0.98)*	2.85
45	Transportation by air	-9.95	0.89	-0.49	-0.29	1.92*	1.71**	**0.94**
		(-1.18)	*(1.33)*	*(-0.97)*	*(-1.48)*	*(2.26)*	*(4.86)*	3.01
46	Pipelines, except natural gas	23.66*	0.44	0.77	0.85*	2.95**	-8.85*	**0.58**
		(2.36)	*(1.01)*	*(1.24)*	*(3.07)*	*(4.06)*	*(-3.66)*	3.06
47	Transportation services	-2.39	-0.03	0.67	0.09	-1.09	-0.05	**0.96**
		(-0.43)	*(-0.24)*	*(1.30)*	*(1.61)*	*(-1.81)*	*(-0.36)*	1.72
48	**Communications**	10.15	2.09*	-2.19*	-2.58*	-0.61	2.38**	**0.97**
		(1.02)	*(2.07)*	*(-2.26)*	*(-2.31)*	*(-1.93)*	*(4.69)*	2.77
481,482,489	Telephone and telegraph	24.71**	1.94*	-2.07*	-3.05**	0.21	-0.70	**0.98**
		(5.10)	*(2.78)*	*(-3.04)*	*(-5.58)*	*(1.02)*	*(-1.76)*	3.32
483,484	Radio and television	36.59*	-3.52	0.93	0.85	2.10	-3.76	**0.85**
		(2.56)	*(-0.63)*	*(0.17)*	*(-0.60)*	*(0.68)*	*(-1.56)*	2.21
49	**Electric, gas, and sanitary services**	-12.52	-1.69	1.71	-0.02	-0.80	3.43	**0.88**
		(-0.65)	*(-1.36)*	*(0.94)*	*(-0.03)*	*(-0.91)*	*(0.92)*	2.81
491,pt493	Electric services	17.84	-0.92	-0.80	0.43	-0.19	1.42	**0.90**
		(0.85)	*(-0.25)*	*(-0.23)*	*(0.62)*	*(-0.08)*	*(0.27)*	1.51
492,pt493	Gas services	-3.58	-0.77	0.55	-0.27	-0.16	2.40*	**0.44**
		(-0.23)	*(-0.27)*	*(0.16)*	*(-0.99)*	*(-0.19)*	*(2.23)*	1.81
494,495,496,497	Sanitary services	17.45	-0.54**	-1.50	-0.74*	1.82*	1.69*	**0.99**
		(1.38)	*(-4.49)*	*(-1.15)*	*(-2.62)*	*(2.34)*	*(2.81)*	2.49
50,51	Wholesale trade	1.04	-0.31	0.28	0.15	0.88	0.11	**0.94**
		(0.09)	*(-0.78)*	*(0.28)*	*-0.80*	*(1.10)*	*(0.32)*	2.54
52-59	Retail trade	-17.01	0.19	1.31*	0.07	0.21	-0.48	**0.92**
		(-1.91)	*(1.25)*	*(2.34)*	*(0.19)*	*(0.26)*	*(-0.94)*	2.82
60-67	**Finance, insurance, and real estate**	19.68**	-0.03	-0.70**	0.35**	0.54*	-0.99*	**0.98**
		(5.73)	*(-0.33)*	*(-4.12)*	*(4.09)*	*(2.36)*	*(-2.98)*	2.96
60,61	Depository and nondepository institutions	-8.68**	0.27**	0.65**	-0.07*	0.22*	-0.06	**0.99**
		(-10.98)	*(5.56)*	*(14.64)*	*(-3.23)*	*(3.85)*	*(-1.21)*	3.49
62	Security and commodity brokers	15.52	1.41*	-1.95	3.33*	-1.42	-4.52	**0.88**
		(0.67)	*(2.15)*	*(-1.09)*	*(2.14)*	*(-1.65)*	*(-1.72)*	3.26
63	Insurance carriers	50.37*	0.03	-3.66	-0.54	1.38	0.41	**0.24**
		(2.05)	*(0.02)*	*(-1.52)*	*(-0.79)*	*(0.88)*	*(0.80)*	2.83
64	Insurance agents, brokers, and services	-4.65	0.34*	0.22	0.12	-0.64	0.63	**0.86**
		(-0.68)	*(2.90)*	*(0.64)*	*(0.50)*	*(-0.60)*	*(0.43)*	3.03
65	Real estate	9.72	0.01	-0.35	0.61	-0.13	-0.11	**0.89**
		(0.90)	*(0.05)*	*(-0.45)*	*(1.45)*	*(-0.23)*	*(-0.18)*	2.33
67	Holding and other investment offices	-0.05	0.01	0.03	0.34*	-0.74*	0.98*	**0.99**
		(-0.03)	*(0.02)*	*(0.04)*	*(3.47)*	*(-3.69)*	*(2.23)*	2.96
70-79,80-87,89	**Services**	4.10	-1.65**	1.80**	0.29*	-0.92*	0.66*	**0.99**
		(1.63)	*(-4.59)*	*(5.21)*	*(3.33)*	*(-3.20)*	*(2.10)*	2.90
70	Hotels and other lodging places	-1.19	0.11	0.41	0.28	-0.09	-0.58	**0.96**
		(-0.25)	*(0.16)*	*(0.88)*	*(1.56)*	*(-0.73)*	*(-0.77)*	3.04
72	Personal services	-2.65	0.22	0.28	0.18	-1.00	0.58	**0.15**
		(-0.31)	*(0.94)*	*(0.39)*	*(0.42)*	*(-1.05)*	*(0.40)*	2.26
73	Business services	-8.37*	0.44	0.59	0.11	-0.53	0.15	**0.98**
		(-2.08)	*(0.74)*	*(1.72)*	*(0.66)*	*(-0.79)*	*(0.34)*	3.08
75	Auto repair, services, and parking	-11.58	0.11	1.12*	-0.13	0.30	-0.93	**0.05**
		(-1.28)	*(1.32)*	*(2.36)*	*(-0.85)*	*(0.17)*	*(-0.58)*	2.02
76	Miscellaneous repair services	-4.44	0.28*	0.31	-0.02	0.06	0.41	**0.89**
		(-1.39)	*(2.68)*	*(1.20)*	*(-0.12)*	*(0.15)*	*(0.39)*	2.70
78	Motion pictures	-11.78	0.11	1.15	0.70	-0.44	-1.20	**0.89**
		(-1.83)	*(0.12)*	*(0.80)*	*(0.17)*	*(-0.05)*	*(-0.20)*	2.50
79	Amusement and recreation services	-6.06	0.07	0.65	0.38	-0.18	-0.08	**0.96**
		(-1.32)	*(0.39)*	*(1.75)*	*(1.30)*	*(-0.53)*	*(-0.19)*	1.72
80	Health services***	-26.42	-0.64	3.07*	0.28	0.78	-2.23*	**0.71**
		(-1.52)	*(-0.55)*	*(2.14)*	*(0.28)*	*(1.09)*	*(-2.21)*	2.56
81	Legal services	-15.81**	-0.07	1.42*	-0.32*	-0.25	1.86**	**0.97**
		(-4.08)	*(-0.11)*	*(2.63)*	*(-2.96)*	*(-1.49)*	*(4.38)*	2.97
82	Educational services***	-43.17	1.13	1.95	0.10	-1.51	-1.75	**-0.09**
		(-0.94)	*(0.38)*	*(1.28)*	*(0.50)*	*(-1.66)*	*(-1.70)*	2.30
83,84,86,87,89	Other services	-11.71	2.34	-0.46	-0.11	-1.43	-2.32	**0.94**

SIC Code	Industry Description	Intercept	IT Workers	Other Workers	IT Equipment	Other Equipment	Structures	Adj-RSQ DW
		(-1.26)	(1.81)	(-0.33)	(-0.26)	(-0.96)	(-1.58)	1.8

Notes: * Significant at the 10 percent level.
**Significant at the 1 percent level.
***Employment numbers for this industry include government workers.
Source: Office of Business and Industrial Analysis.