Generating Productivity Growth:

A Review of the Role of Workplace Practices and Computers

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Introduction

Productivity in the United States is still the highest of any nation in the world. However, as shown in Figure 1, average annual productivity growth since 1973, after smoothing for cyclical fluctuations, has remained at a steady 1.1 percent. This is significantly lower than the 2.9 percent average annual growth rate of productivity between 1960 and 1973. Although manufacturing productivity growth has improved recently to 4.2 percent, it remains of the utmost importance to understand the determinants of productivity growth.

Investments in education and the skills development of workers are a way to ensure higher labor productivity growth without igniting wage inflation. This report summarizes new research that uses detailed establishment level data to examine the respective contributions of human capital investments, workplace practices, and computers on labor productivity.

Workplace Practices and Productivity

While there have been many studies on the impact of capital investments and R&D on firm productivity, there has been very little direct analysis of the impact of workplace practices on productivity. In addition, while there have been many studies done of the impact of human capital investments on individuals' wages, much less is known about the direct effect of human capital on the productivity of specific businesses. In a series of recent papers, economists Sandra Black and Lisa Lynch examine the link between labor productivity and a variety of workplace practices, human capital and computers for a representative sample of establishments in both the manufacturing and non-manufacturing sectors.

Black and Lynch use data from a unique survey called the Educational Quality of the Workforce National Employers Survey (EQW-NES). The EQW National Employers Survey was administered by the U.S. Bureau of the Census as a telephone interview in August and September 1994 to a nationally representative sample drawn from the Census database of private establishments. The survey oversampled establishments in the manufacturing sector and those with more than 100 employees. Businesses with less than 20 employees, public sector employers, not-for-profit institutions, and corporate headquarters were excluded from the sample.

In a recently published paper in the American Economic Review, Black and Lynch use data from the EQW-NES to examine the impact of human capital investments and workplace practices on productivity, controlling for a variety of factors including the size of the business, age of the business, labor inputs, material inputs, book value of the capital stock, age of the capital stock, experience of workers, capacity utilization, and industry. They find that:

- Increasing the educational level of employees in an establishment by one year raises productivity by as much as 8.5% in manufacturing plants and almost 13% in non-manufacturing establishments.

- Formal training done off-site increases manufacturing productivity.

- Training employees in computer skills greatly enhances the productivity of non-manufacturing establishments.

While this analysis provides new insight into the role of human capital on productivity, it only examined productivity at a point of time and was unable to control for unobserved characteristics of the employers.

In a study released today entitled, "How to Compete: The Impact of Workplace Practices and Information Technology on Productivity," Black and Lynch examine a subsample of manufacturing plants from the EQW-NES that they can match with longitudinal data from the Census Bureau for the period 1987-1993. In this way they are able to examine the factors that determine a plant's labor productivity over time, controlling for the size of the capital stock the use of materials, unobserved characteristics of the plant that do not vary over time, and observed workplace practices such as the use of computers, human capital investments, the use of high performance work systems, employee representation profit sharing, and recruitment strategies. Major findings from this study are summarized in Figure 2 and include:

- Increasing the average educational level of employees within a manufacturing plant by one year would increase labor productivity by 8 percent, everything else held constant.

- Increasing employee voice either through unionization or employee participation in decision making raises productivity. More specifically, simply adopting a Total Quality Management system has an insignificant effect on productivity but raising the proportion of workers involved in decision making within the plant either through regular meetings or unionization has a significant positive impact on labor productivity. In other words, it is not so much what you say you do, but how you do it that counts.

- Those manufacturing plants with profit sharing plans for non-managerial employees had 7 percent higher labor productivity than their competitors. Although there is a great deal of attention paid to the profit sharing arrangements of managers and CEOs of companies, this new study indicates that extending profit sharing to non-managerial workers has a more significant effect on productivity than even profit sharing plans for managerial employees.

- Those employers who had a research and development facility in their firm had on average 6 percent higher labor productivity.

- The use of benchmarking raised labor productivity by 6 percent. Previous work on the effectiveness of benchmarking has largely focused on the specific experience of certain firms in particular industries. This analysis shows that what has been found in case studies holds up in a more nationally representative sample of manufacturing establishments.

Computers and Productivity

The current economic recovery has been led by investment growth (see Figure 3) in which computers have played a significant role. Investments in equipment have grown by 55°/0 during this recovery and have accounted for 12% of the output growth. This is in contrast to the 1980s when equipment investment accounted for less than 7% of output growth. Investment in computers and other information technology has accounted for more than a third of the private sector's investment in equipment in the 1990s.

Given the dramatic expansion of the use of computers there should be a corresponding increase in productivity. But one of the paradoxes of the impact of computers on productivity is that in spite of the billions of dollars that companies have spent on computers, aggregate productivity growth has not responded in kind. As Robert Solow has said "You can see the computer age everywhere but in the productivity statistics." (NYTIMES Book review, 1987)

Oliner and Sichel (1993) argue that part of the reason why computers' contribution to overall economic growth is small because computing equipment has been a very minor share of the total capital stock. They argue evidence that adding in software and computer-services labor would roughly double the contributions that computer hardware makes to output growth.

When we switch from aggregate measures of productivity to analyses that use firm level data, a much different picture emerges of the importance of computers for productivity growth. For example, Brynjolfsson and Hitt (1993) find that computers have a large positive impact on the productivity of firms. This finding is also confirmed in new research by Sandra Black and Lisa Lynch.

- Black and Lynch find that raising proportion of nor-managerial workers using computers (in the manufacturing sector) from a third to two-thirds would increase labor productivity by 5.4 percent (see Figure 2).

- As mentioned earlier, Black and Lynch find that non-manufacturing firms that provided computer training to their workers have significantly higher productivity than similar competitors.

- In spite of the positive impact of computers on labor productivity, Black and Lynch (1995) find that not all employers are equally likely to provide computer training to their employees. For example, establishments with less than 250 employees are much less likely to offer computer training than larger businesses. Businesses with more educated and experienced workers are more likely to offer computer training as are those who use high performance work practices such as Total Quality Management systems or benchmarking.

Conclusions

Investments in education and training payoff in terms of higher productivity and non-inflationary wage growth. Black and Lynch find that raising the educational level of employees by a year results in 8-13 percent higher labor productivity. In addition they find evidence to support the view that employers who invest in computer training, especially in the non-manufacturing sector, have significantly higher productivity than their competitors.

But investing in human capital is not the only way in which employers can improve productivity. In a new paper released today, Black and Lynch find that while simply adopting a Total Quality Management system does little to improve overall productivity, the use of benchmarking, increasing the proportion of workers involved in discussing workplace issues, and having a union all raise labor productivity in the manufacturing sector. In addition they find some evidence that those manufacturing employers who provide profit sharing plans for their non-managerial employees have higher labor productivity.

Computer technology is generating many well paid high skilled jobs and has raised the productivity of many businesses. Alan Krueger (1993) has found that workers who use computers in their jobs are paid 15 percent more than similar workers who do not work with computers. The challenge remains to ensure that more workers are equipped with the skills that allow them access to these better jobs so that they can enjoy a rising standard of living and firms can achieve higher productivity growth. In addition, as this month's issue of the Monthly Labor Review shows, information technology has also resulted in job displacement. Therefore, investments in education and training for incumbent workers, especially for dislocated workers, are critical to minimize the costs of this displacement.

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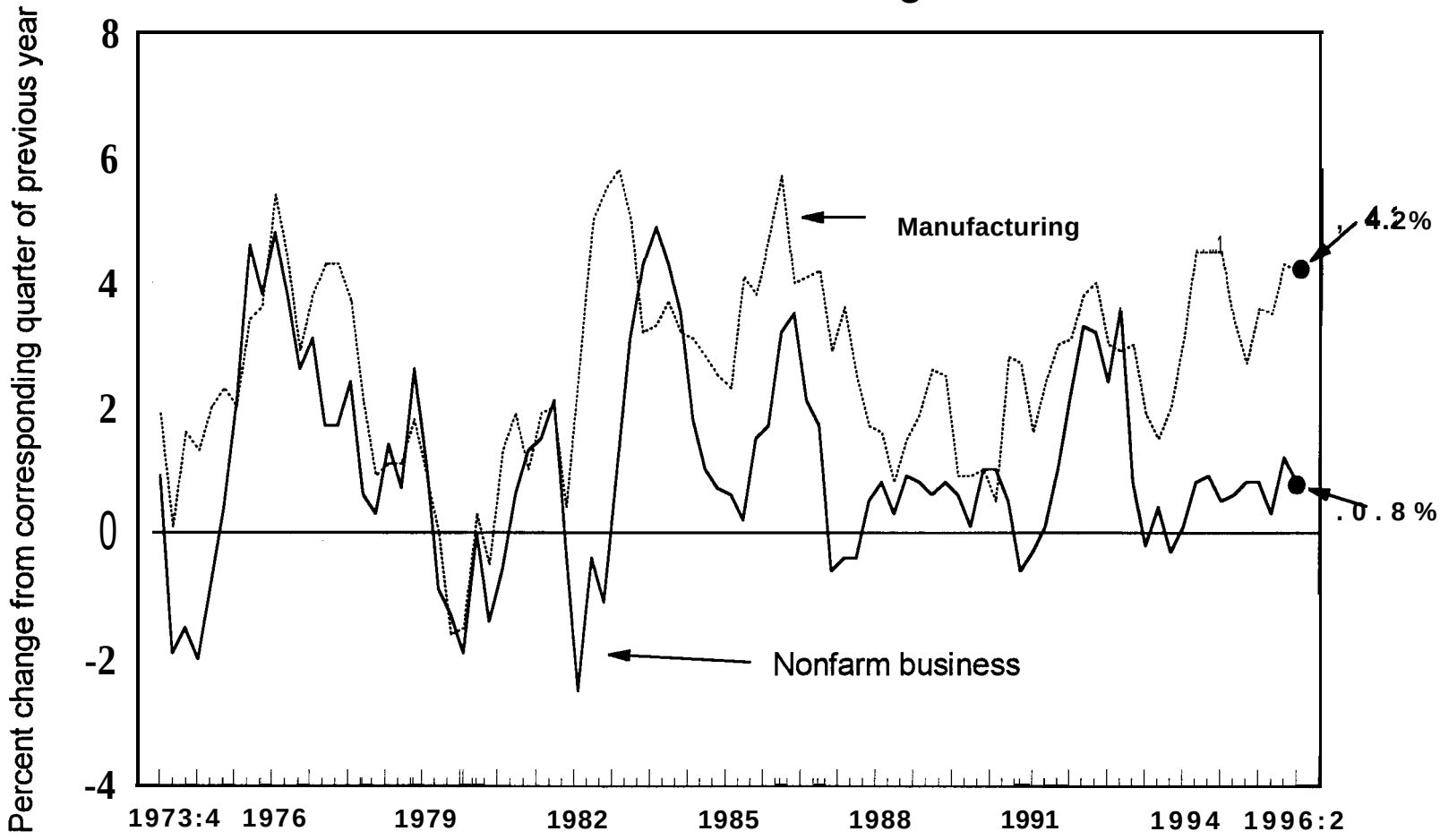
Figure 1
Quarterly Year-on-Year Changes in Productivity

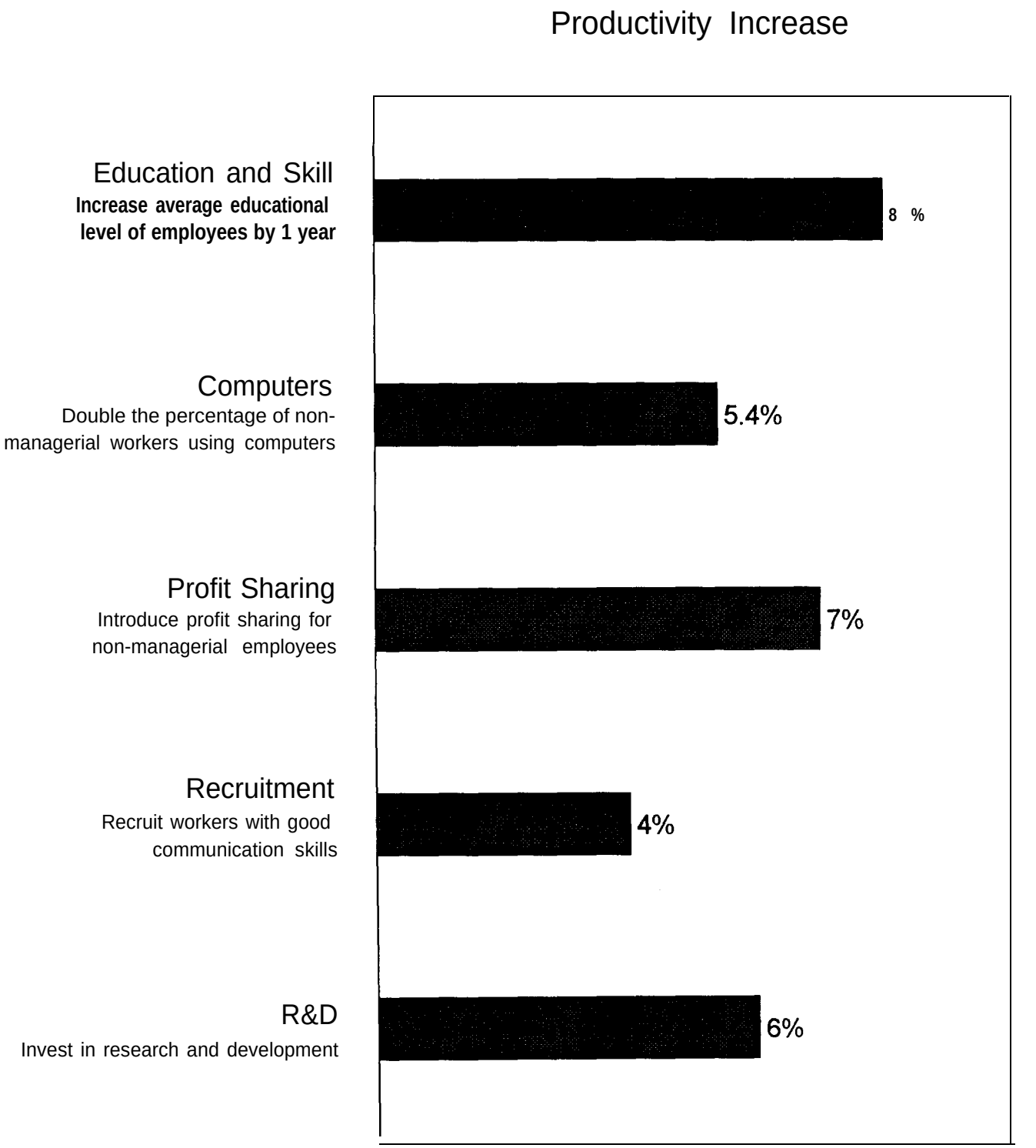
Total nonfarm business and manufacturing sectors, 1973:+1996:2



Source: Bureau of Labor Statistics.

Figure 2

Factors That Raise Labor Productivity

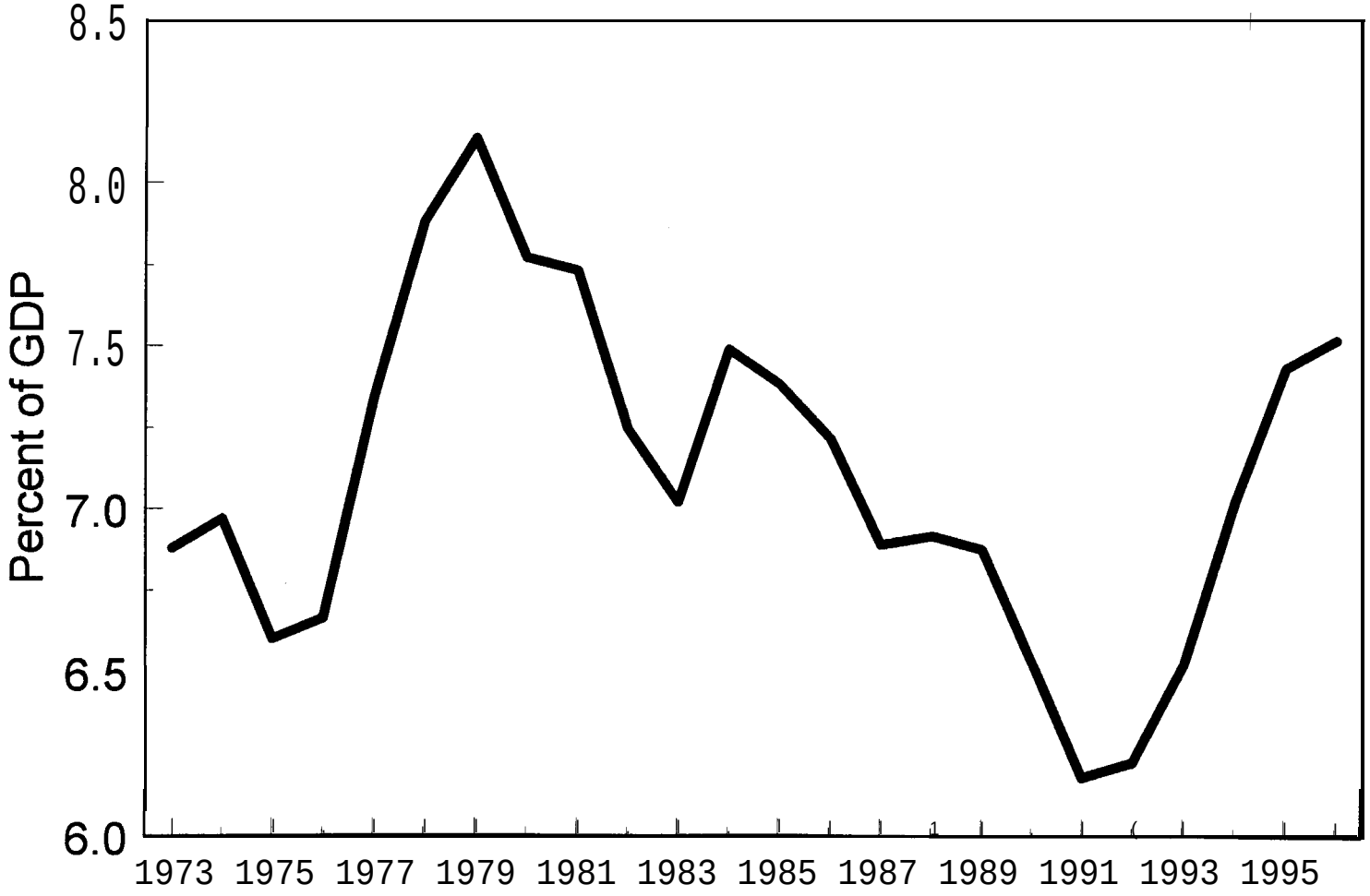


Source: Black and Lynch (1996)

Figure 3

Capital Spending is Back Up

Gross Equipment Investment as a Share of GDP, 1973-1996



Source: National Income and Product Accounts.
1996 figure is the average of the first half of the year.