

Technology and Labor Markets

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Labor market developments receive a considerable amount of media coverage. Over the last two years there have been countless stories about the “jobless recovery.” Employment growth following the 2001 recession has been slow compared to previous business cycles, slower in fact than any other recovery since WWII. In fact, only in 2004 did the economy get to something we might consider a normal pace of employment growth for a period of expansion. Many observers see technology as the culprit in sluggish employment growth. By raising productivity, we are told, technology weakens the demand for labor, and allows firms to meet growing demand without adding workers. In the last year or so, there also have been widespread stories about the growing number of jobs lost to imports or outsourcing. Of course, this movement of jobs overseas has been facilitated by technological advances in communication and information processing, so there is a sense in which one can describe these jobs as being lost to technology as well.

North Carolina and the Triad region in particular have experienced labor market difficulties that have been in some ways more pronounced than at the national level. Employment losses locally were greater in percentage terms than national losses during the 2001 recession, and payrolls recovered faster in North Carolina than in the U.S. as a whole. State-wide employment growth in 2004 was similar to the national numbers, but the Triad continued to lag. Both the state and the region have a higher-than-average percentage of their workforce in manufacturing, which is in the midst of a long-term decline in employment. This is particularly notable in the Triad where the effects of layoffs in textiles and furniture are still being felt.

In addition to concerns about employment – the quantity of labor – there has been some anxiety as well about wages – the price of labor. Recent media coverage has focused on the extent to which new jobs do not pay as well as jobs that are being lost. The broad theme of most of this coverage, I believe, has been a sense that the benefits of the economic expansion are not being widely shared, and a general disappointment in the labor market outcomes being experienced by many workers.

Today I hope to provide you with a different perspective than the typical media coverage, a perspective that is grounded in economic research. In particular, I’d like to discuss U.S. labor markets from the point of view of the relationship between technological change and labor market outcomes. Certainly technological change has been occurring at a

breathhtaking pace in the last decade, and it wouldn't surprise you to learn that economists believe that technological change has had significant macroeconomic effects. But economists also believe that technological change has had significant effects within labor markets, and that those changes have been going on for several decades. In other words, the effects go back to well before the Internet revolution.

I want to start by reviewing some basic facts about U.S. jobs market. One of the most prominent is that the structure of wages in the U.S. economy has become more unequal over the last half-century. One popular measure of wage inequality is the "90-10 ratio." This ratio compares the wages of workers at the 90th and 10th percentiles. In 1970, workers at the 90th percentile earned a little more than three times what those at the 10th percentile earned. By 2000, this multiple had risen to five. This increase in inequality has been especially rapid since 1980. This doesn't necessarily mean that "the rich are getting richer and the poor are getting poorer," but it does mean that in terms of economic well-being, those at the top of the pay scale outpaced those at the bottom. There are many other measures of wage inequality, but all tell pretty much the same story over recent decades.

The growth of inequality in the latter part of the 20th century represents a reversal of trends from the first half of the century, when inequality was generally declining. So growing inequality is not an unavoidable feature of capitalist growth. The historical record shows that at times inequality widens and at times it narrows.

Economists usually presume a worker's compensation is tied closely to that worker's productivity – in other words, the value contributed to their employer's production process. For example, it's natural to suspect that higher-skilled workers are in general more productive and therefore paid more than those with lower skills, and this turns out to be true. Economists use the term "skill premium" to refer to the gap between the wages of workers at differing skill levels.

Can changes in the skill premium explain the increase in wage inequality over the last half-century? One broad measure of skill is a worker's educational attainment. And by this measure the skill premium has been rising. In 1970, the average wage of a male college graduate, employed full-time, was about one-third higher than that of a high school grad. By 2000, the average college grad was earning more than twice as much as a high school grad. The education premium for women also grew over this period, from about zero to about 50 percent. Another indicator of the relative value of worker productivity is the premium paid to more experienced workers. This "experience premium" has also increased in recent decades, but primarily among workers with less education.

Do these two productivity measures – the education premium and the experience premium – explain the increase in inequality since the 1970s? It turns out that these factors, together with various demographic characteristics, account for only about 40 percent of the rise in inequality. The remainder of the increase in inequality (more than half of the total) is in "residual inequality," the part not explained by any measurable

worker characteristics. That is, if one groups workers with given education and demographic characteristics, the within-group variation in wages has increased.

Let's sum up these labor market observations, then. First, wage inequality has steadily increased since the 1970s. Second, almost half of the increase is due to a rising "skill-premium" – the relative value of skilled and unskilled labor (as measured by education and experience). Third, the rest of the increase in inequality is due to greater variation in wages across workers with given education and demographic characteristics ("residual inequality").

What's behind these trends in the relative wages of different types of labor? The economist's typical, if somewhat hackneyed response is, "It's all supply and demand." But there's truth in this response. According to the logic of supply and demand, a rising relative value of skilled labor must mean a reduction in relative supply, an increase in relative demand, or both.

Taking the supply side first, has the supply of skilled labor fallen in recent decades relative to the supply of unskilled labor? No: The percent of the workforce with a college education rose steadily throughout the second half of the 20th century, reaching about 30 percent in 2000. That is, the relative supply of skilled workers has been increasing. By itself, this would imply a falling skill premium. The skill premium did indeed fall some in the 1970s, when the college-educated population was growing particularly rapidly. But other than that decade, the relative supply of skilled workers was rising at the same time the skill premium was rising.

Thus, we need to look to demand to understand the changing skill premium. The demand for labor, like that for other inputs of production, depends on the demand for final goods and on the technology used to turn inputs into final goods. Most economists think production technology (as opposed to shifting composition of demand) has been the main character of the story. We have obviously been living through a period of rapid technological innovation that has brought about dramatic changes in the way a wide range of goods and services are produced. And this is not a new phenomenon. Early in the 20th century, the spread of electrification and innovations in communications had profound effects on production processes.

But not all technical advances have the same effect on production processes, and in particular on the relative importance of different types of labor. Sometimes new technology favors unskilled labor. For example, the introduction of assembly-line techniques in manufacturing in the first part of the 20th century allowed the production of complicated machinery like automobiles to be broken into a series of simpler steps. The result was that some goods that had previously been produced in small shops by skilled workmen could now be mass-produced in factories employing unskilled workers. As I noted earlier, inequality was generally falling early in the 20th century. And it turns out that the skill premium was falling as well, suggesting that new technologies in that era enhanced the value of unskilled workers by more than they enhanced the value of skilled workers.

In other cases, technology has the opposite effect of favoring the use of skilled labor. For example, advances in manufacturing later in the 20th century, such as the introduction of computer-controlled machine tools, have often meant fewer workers on the factory floor. The remaining workers needed a higher level of skill to operate the increasingly sophisticated equipment. Technological advances have had similar effects on the workplace in a wide array of industries. Consider the division of labor between architects and draftsmen. Before the advent of computer-aided design (or “CAD”), a draftsman would create and revise plans under the guidance of an architect. With CAD, however, the architect can easily generate and manipulate plans on the computer, resulting in the employment of fewer draftsmen per architect and boosting the productivity of the overall design process.

In these examples, the new technology improves the productivity of skilled workers relative to unskilled workers. Economists call such technologies “skill-biased,” and they refer to the introduction of such technologies as “skill-biased technical change.” Research evidence indicates that the rising skill premium in the late 20th century has been driven by skill-biased technological change. Why should technological change be systematically different now than it was 100 years ago? Many observers have pointed to the information technology revolution as a prime example of skill-biased technical change in the late 20th century. Computers, after all, are good at doing (or at controlling other machines that do) certain types of tasks – tasks that can be described by a “program,” which is just a set of rules. These are tasks that were previously more likely to be performed by less-skilled workers. In sum, IT-related skill-biased technological change appears to be an important part of the explanation for rising wage inequality.

I want to turn now to another way in which technology affects labor markets. Technological change can be disruptive. New products and new ways of producing arrive, and skills that were tied to the old ways of doing things lose value, sometimes dramatically. This is what Schumpeter famously called the “perennial gale of creative destruction.” In this environment, some unskilled workers are doubly unlucky. First, skill-biased technological change can lower the relative demand for unskilled labor, reducing their wages relative to skilled workers. As I argued above, this is what happened in the late 20th century. Second, because less-skilled workers have less education, the skills they do have tend to be based on the specific experience they’ve accumulated. In other words, their skills may tend to be closely related to their particular job and their particular industry. When those skills do not transfer well to other sectors, these workers are more vulnerable to long-term earnings losses should their industries suffer declines.

The magnitude of creative destruction in job markets is huge, both in good times and bad. For example, during the last expansion, from 1992 to 2000, gross job creation averaged about 17 million per year, and gross job destruction averaged about 15 million per year. Net job growth, the difference between the two, was just about 2 million per year.

Jobs are continually being created and destroyed in a healthy, growing economy. In fact, that process is critical to our rising standards of living. Without shifting workers to

expanding, more productive industries, we would not be able to take full advantage of technological advances, and real income growth would be stifled. Thus, the fundamental economic forces driving the increase in wage inequality are the same forces raising our standard of living.

This process is not without dislocations, however. Workers who are displaced from declining or less productive industries and occupations can suffer significant wage losses. But the reduction in the costs of production raise the real value of existing income flows. As overall real incomes rise, so does the overall demand for goods and services, which in turn induces firms to pull in workers who have been displaced from other declining industries.

Most times, the economy manages to shift workers between industries fairly smoothly. In a typical recession, however, gross job destruction goes up, gross job creation goes down, and employment falls, on net. In the ensuing recovery, gross destruction and creation rates return to more normal levels, and net job growth resumes. Recessions, then, are times at which the shift of workers out of some industries increases, while the pace at which they are absorbed in other industries declines.

In the current recovery from the recession of 2001, gross destruction has returned to normal, so the typical bulge in job destruction is over. Job creation, however, has been slower than usual to pick up. Firms have been able to expand output without adding as many workers as would have been typical in the past. Thus, we have what has been called a “jobless recovery” – net employment growth has been relatively subdued coming out of this business cycle trough. Arithmetically this can only happen with an increase in productivity, so in this sense the jobless recovery reflects strong productivity growth. But this is consistent with widespread anecdotal reports that in recent years businesses have been focusing on extracting efficiencies from the capital infrastructure installed during the investment boom of the late 1990s.

So far, I’ve focused on the effects of technological change on labor markets and relative wages. But the last quarter of the 20th century was also a period of expanding international trade, as many countries lowered barriers to imports and as transportation and other trade-related transactions costs fell. Imports as a share of GDP grew from about five percent in 1970 to nearly 15 percent in 2002. Could it be that growing imports, especially from less developed countries, contributed to the growing disparity of wages between skilled and unskilled workers? This is what standard theory would predict, given the abundance of unskilled workers abroad. But how big is the effect of trade compared to the effect of technology? Here the estimates vary, but even researchers who see a significant impact of trade estimate that import growth can account for only about a quarter of the growth of the college premium. That still leaves technology as the dominant force behind recent relative wage trends.

While import growth does not appear to have been the driving force in labor market developments for the U.S. economy as a whole, it’s certainly the case that some industries and some regions have been affected quite significantly by trade. Here in the

Triad region, traditional manufacturing industries like furniture and textiles have seen particularly large growth in import competition and have also experienced painful declines in employment. Many observers have predicted large additional job losses in the wake of the expiration at the beginning of this year of the long-standing system of quotas on textiles and apparel imports. But even in the case of these industries, where import substitution is so visible, once you control for the effects of long-term technological trends, trade appears less important as a determinant of labor market conditions. This suggests that going forward, the same technological trends I've been talking about today are likely to be at least as important as developments in international trade in determining the direction of employment and wages in textiles and apparel manufacturing.

In any case, whether trade or technology is the major force, the message is the same. The world has become a much more challenging place for workers with lower skills and workers whose skills are largely specific to their job or industry. The weight of empirical evidence strongly suggests that erecting barriers to trade would ultimately prove a counterproductive response to this phenomenon. There is a fundamental congruence between the effects of trade and technology on labor market outcomes. Both can displace workers and force them to make the transition to other sectors. But both ultimately elevate standards of living. Few seriously propose impeding technological progress for the sake of jobs. We should be equally hesitant to impede trade.

The perspective on labor markets that I've described for you suggests that education and training are the keys to job market experiences. The more useful skills people can acquire, either before they enter the workforce or later in life, the better. But this perspective says a bit more as well. It suggests that adaptability will be increasingly important in the years ahead. A worker can no longer count on an initial occupation to maintain its relative position over time. They are quite likely to have to change jobs and industries over the course of their lifetime. Generalized skills – the type that are applicable in a wide range of settings and that enhance a worker's ability to learn new jobs later in life – are key.

Beyond emphasizing the importance of education, is there a role for the public sector to play in helping people adjust to the dislocations brought about by technology or trade? In a world of rapid technological change, job loss can imply long-term unemployment and/or persistently lower wages on re-employment. Such dislocations are often unanticipated – the typical 50-year-old textile worker could be forgiven for placing little probability on today's global textile market conditions when they entered the industry over 30 years ago. Households generally attempt to insulate themselves against fluctuations they might foresee in their earnings or expenses – whether by saving and borrowing to maintain their consumption as income varies or by obtaining insurance against some of the shocks that can upset household finances. In an ideal world, these mechanisms would work well enough to leave little room for improvements via public sector programs. The difficulty households can have in practice in insuring themselves against large and persistent income shocks is part of what gives rise to government unemployment insurance programs. Beyond regular unemployment insurance, some displaced workers have access to additional support in the form of “trade adjustment

assistance” – programs that provide income or training support to workers displaced by imports.

I have two observations to offer on such programs. The first is the economist’s obligatory reminder that such unemployment insurance programs have strong and well-documented incentive effects. The recipient’s incentive to search for new employment is reduced, and thus unemployment spells tend to be noticeably longer. In designing such programs, we need to balance our desire to assist those displaced by economic change against the cost of inefficient use of labor resources.

Second, trade adjustment assistance treats one part of the population of displaced workers more generously than the rest. I have argued that trade-related job losses are fundamentally no different from job losses arising out of the ongoing turbulence of technological change. It’s hard to see why one set of transitioning workers should be singled out for favorable treatment, except perhaps to reduce political opposition to trade liberalization. But if the goal is to alleviate the sense of anxiety workers feel about their earnings prospects, then trade adjustment assistance may be too limited. Any expansion of assistance, however, would also expand the costs resulting from adverse incentive effects.

Much of what I’ve said today relates to a very basic truth – that in a dynamic, growing economy, people are affected differently by shifting market forces. Any fundamental change creates some winners and some losers and forces some people into difficult transitions. But these fundamental changes are at the very heart of what drives the broad, sustained advance in standards of living. Understanding the causes and consequences of economic change are vital to creating a broadly accepted belief in the benefits of technological innovation, unrestricted trade, and the other drivers of economic progress.