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## Unemployment and Productivity

During the latter half of the 1990s, productivity grew at almost twice the pace of the preceding ten years. Widely attributed to developments in the information technology sector, this surge in productivity was accompanied by an unemployment rate that dropped to unusually low levels. Another example of this relationship between productivity and unemployment—though in the reverse direction—is the decade of the 1970s. Productivity growth slowed sharply in the early 1970s (and stayed low for several decades), while unemployment increased noticeably. While both productivity and unemployment do respond to other changes in the economy, these episodes make one wonder about the impact that independent (perhaps technology driven) changes in productivity might have on the unemployment rate. This *Letter* discusses some of the reasons put forward by economists to explain such a relationship. We begin by describing a theory of unemployment.

### The search theory of unemployment

The theory starts with the assumption that workers have different skills and that jobs have different skill requirements. Workers need to find well-paying, desirable jobs, while firms need to find the most productive workers. Neither firms nor workers have all the information they need about the options available to them, so they must engage in search. Since search is costly and time-consuming, both firms and workers must use some of their resources to find a good match.

Workers are assumed to search only when they are unemployed. They face an uncertain environment (just as firms do). When a worker gets a wage offer, for instance, she must decide whether to accept it or continue searching for a better offer. Accepting the offer means forgoing the chance of a higher wage offer later, while continuing the search means losing the wages she would have earned if she had accepted the offer and started working. The wage at which the worker is indifferent between continuing the search and accepting the current job is called the reservation wage. The worker accepts all job offers above this wage and turns down all offers below it.

When a search is successful, that is, when there is a match between the needs of the worker and the firm, the worker leaves unemployment. However,

existing matches sometimes fall apart, which leads to the worker becoming unemployed. At the equilibrium unemployment rate, the number of workers leaving unemployment equals the number of workers becoming unemployed.

### A temporary effect

The relative level of the reservation wage is obviously a crucial determinant of the level of unemployment in the economy. If the typical worker's reservation wage is significantly higher than the typical wage offer, she will tend to turn down more offers and spend more time searching for a job. Consequently, the unemployment rate will tend to be higher.

The wage offered by the firm is directly related to the worker's productivity. Assume, now, that there is an economy-wide increase in productivity that workers are not aware of. The higher productivity makes it more attractive for the firm to increase employment and allows it do so by increasing the wage it offers to workers. This, in turn, increases the likelihood that the average worker will find an acceptable job offer and reduces the time she is likely to spend searching. Thus, the unemployment rate will decline in response to the increase in productivity.

This drop in the unemployment rate is unlikely to be permanent, however, even if there is no subsequent decrease in productivity. This is because workers will come to realize that all firms are offering higher wages than before, and, consequently, their reservation wage will gradually adjust to the higher level of wage offers in the economy. As this occurs, the level of unemployment will gradually go back to the level that prevailed before the increase in productivity. Of course, the reservation wage could adjust slowly, and so it could take a while for the unemployment rate to go back up to its original level. Even so, the key implication is that a change in the level of productivity cannot have a permanent effect on the level of the unemployment rate.

A simple, intuitive way to see the force of this argument is to examine the long-run behavior of the unemployment rate relative to the level of productivity. Even if we confine ourselves to the last half of the 20th century, we find that productivity has grown by a large amount, with no evidence of a trend in the unemployment rate (see Figure 1).



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## Conclusions

Economic theory provides us with a number of reasons why the unemployment rate might be affected by a surge or a fall in the rate of productivity growth that is due to technological developments. However, at this point, we do not have a lot of evidence on the relative importance of the different links emphasized by different models. It will take further research to determine the relevant empirical magnitudes.

It is likely, though, that part of the decrease in unemployment during the second half of the 1990s represents a temporary response to the surge in productivity and the associated boom in the economy. To the extent that this is true, one should expect to see the unemployment rate stabilize above the lows seen during this expansion—even if productivity continues to grow at rates comparable to those achieved during the second half of the 1990s. The development of the Internet as a tool for job search, on the other hand, argues that the level of unemployment at which the economy settles—the equilibrium level—is likely to be lower

than before. Once again, at this point it is hard to say how much lower.

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## References

- Aghion, Phillipe, and Peter Howitt. 1998. *Endogenous Growth Theory*. Cambridge: MIT Press.
- Gomme, Paul. 1998. "What Labor Market Theory Tells Us about the 'New Economy'." Federal Reserve Bank of Cleveland *Economic Review* QIII, pp. 16–24.
- Manuelli, Rodolfo E. 2000. "Technological Change, the Labor Market and the Stock Market." NBER Working Paper 8022 (November).
- Mortensen, Dale T., and Christopher A. Pissarides. 1998. "Technological Progress, Job Creation, and Job Destruction." *Review of Economic Dynamics*, pp. 733–753.
- Pissarides, Christopher A. 2000. *Equilibrium Unemployment Theory*. Cambridge: MIT Press.
- Saving, Jason L. 2000. "The Effect of Welfare Reform and Technological Change on Unemployment." Federal Reserve Bank of Dallas *Economic and Financial Review* QII, pp. 26–34.

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