

Federal Reserve Bank of Cleveland

# In Search of the NAIRU

by David Altig and Paul Gomme

Few ideas arise more frequently in monetary policy discussions than the NAIRU, an acronym for the awkward phrase “nonaccelerating inflation rate of unemployment.” The NAIRU—or more precisely, its relationship to the unemployment rate—is presumed to be an inflationary bellwether. When the actual unemployment rate exceeds the NAIRU, the inflation rate falls; when the actual rate is below the NAIRU, inflation rises.

For the past several years, the U.S. unemployment rate has been lower than most NAIRU estimates. The 1998 *Economic Report of the President*, for example, gave a NAIRU estimate of 5.5 percent for 1997. The actual rate of unemployment, however, began the year at 5.3 percent and fell to 4.6 percent by year’s end. Yet, by almost any measure, inflation fell throughout 1997 (see table 1).

This is a perplexing combination of events because, loosely speaking, the NAIRU is thought to represent a natural “speed limit” for economic activity. In other words, it measures a nation’s sustainable production capacity. When the economy grows at a rate faster than its resources can support over the long run (which presumably occurs when the unemployment rate falls below the NAIRU for an extended period), price pressures build and, eventually, burst through to an acceleration of the inflation rate.

The NAIRU framework’s apparent failure to describe the evolution of inflation over the course of the current expansion has prompted some brave souls to proclaim the dawning of a new economic era, one in which “speed limits” have

blessedly been revoked forever. Critics of this view—economist/columnist Paul Krugman among them—argue that such a development would be tantamount to repealing the weather. However, these critics concede, it is true that sometimes it rains and sometimes it shines, and a logical interpretation of the recent discrepancy between “theory” and experience is that good fortune has given us a NAIRU that is, in fact, lower than most estimates imply.

This take on the situation has an air of plausibility because increased productivity, made possible by the maturation of the computer technology revolution, is one obvious source of our good fortune.<sup>1</sup> In essence, favorable technology advances have lowered the NAIRU, and the economy has begun operating with a new speed limit that allows us to enjoy lower unemployment rates without igniting a flare-up in inflation.

The only problem with this slant on events is that it is not obviously correct. In this *Economic Commentary*, we discuss what the modern theory of labor markets has to say about the effect of productivity shocks on notions like the NAIRU. We conclude that if the NAIRU framework is to survive as a viable tool for understanding monetary policy, more than an appeal to accelerated productivity growth will be needed to salvage it from its recent failures.<sup>2</sup>

## ■ Inflation, the NAIRU, and the “Natural” Rate of Unemployment

What, exactly, is the NAIRU? Strictly speaking, the definition is statistical, not theoretical: The NAIRU is the unemployment rate that experience tells us has, on average, been associated with stable inflation when matched by the actual rate of unemployment.

What do dating and Brad Pitt tell us about unemployment?

Why inflation-rate stability would require that there be no gap between actual unemployment rates and the NAIRU is not usually made explicit, which is just to say that the theoretical foundation of the NAIRU and its role in determining inflation is often fuzzy. Furthermore, using formal economic theory to clarify the relationship requires answering two not-so-easy questions: What determines the NAIRU? And how does the unemployment rate and its relationship to the NAIRU affect the inflation rate?

We will make no attempt to answer the second question, but, for the sake of argument, will take it as given that inflation rate changes result when the unemployment rate deviates from the NAIRU. Let's accept provisionally that the inflation rate falls when the unemployment rate rises above the NAIRU or, more pertinent to this discussion, when the NAIRU falls below the existing unemployment rate.

So, the question at hand is, What determines the NAIRU? To answer this question, we will treat the NAIRU as a synonym for the so-called "natural" rate of unemployment. At this point, you might think that we have begged the question by replacing one ill-defined concept with another, and to some extent you would be correct. For now, though, let's define the natural rate of unemployment as the level associated with the "normal" functioning of labor markets.

But what's normal? To that question we turn next.

### ■ The Dating Game: A Useful Metaphor

To understand labor markets better, we will take a slight detour and contemplate the age-old ritual of dating, which, at first blush, may seem worlds away from the unemployment question. But, as we shall see, the dating "market" has important parallels to the labor market, parallels that will help us define precisely what we mean by a normal (or natural) rate of unemployment.

To start, let's consider a highly stylized version of dating—an economic model, if you will. As with all economic models, we make certain abstractions to help isolate the essential characteristics of the behavior that interests us. The essentials of our particular dating market are these: First, the sole objective of dating is to

find an appropriate partner with whom to enter into a long-term relationship. Second, dating is a face-to-face encounter to evaluate "chemistry," that is, to determine whether the date would make a satisfactory partner (what a less romantically inclined economist might call assessing the quality of the match). Finally, dating is expensive because it takes time.

Now, let's consider the behavior of Jane, who is in the dating market. Like all other single people in the economy, she combs the personal ads for prospects and, on finding a promising one, sets a date to determine whether she chooses to enter into a (more or less) permanent relationship.

Jane, of course, has certain goals and expectations. As an illustration, suppose that she is unwilling to enter into a long-term relationship with anyone who is not at least of, say, Brad Pitt "quality," where quality is measured by a bundle of attributes such as looks, intelligence, neatness, sense of humor, and so forth.

In the jargon of economics, we might refer to Brad Pitt as Jane's "reservation partner." He represents the minimum quality of person whom Jane finds acceptable. If her date doesn't measure up to Brad Pitt standards, she will refuse to see him again, and return to the classifieds. However, if her date meets or exceeds these standards—and she meets his as well—Jane enters into a relationship and forsakes the dating scene.

The critical aspect of this example is that, although Jane's goal is to exit the dating market, she will only do so if she finds a suitable match (someone at least as good as Brad Pitt.) Thus, there will very likely be some time during which Jane *chooses* to be single.

### ■ Search and Equilibrium Unemployment

With a little imagination, it is easy to see the similarity between labor markets and the dating market just described. In particular, at any given time there will be unemployed persons who, like Jane, are forgoing possible long-term relationships in order to seek more desirable matches. An unemployed computer programmer, for example, might receive job offers from plenty of fast-food restaurants, but would refuse them because they do not meet a minimum standard, which we will summarize by the wage that is offered.

It is important to recognize that unemployment associated with the process described here is not necessarily a bad thing for the economy. It would clearly be inefficient for a skilled computer programmer to take an entry-level job in fast food. However, because information about potential job characteristics is imperfect, the search process takes time to yield the right match, just as Jane needs time to find the right long-term partner. And just as Jane will remain a dating single for a while before living happily ever after, our programmer will experience a spell of unemployment before finding the job that maximizes the expected fruits of her labor.

Loosely speaking, then, the natural rate of unemployment is the level that would result from the dynamic process of job creation and destruction, job market search, and a suitable matching of employers and employees.

### ■ Dating, Brad Pitt, and the "Reservation Wage"

In our earlier example, the length of time that Jane remains single depends partly on luck. If she's especially fortunate, she will quickly "draw" a date from the classifieds who meets her standards. It is possible, however, that she will endure a number of dates that she considers subpar before finally hooking up with Brad Pitt, his equal, or his superior.

But Jane's dating fortunes are not entirely beyond her control. She knows the likelihood of finding a Brad Pitt in the dating pool, and thus knows the *probability* of having a date that does not live up to her expectations. Although the process inevitably contains some element of chance, Jane can certainly increase the probability of beginning a long-term relationship on any given date if she simply lowers her standards. In other words, the time that she can expect to remain single will be reduced if the "reservation partner" she chooses—the minimally acceptable long-term mate—is of lesser quality than Brad Pitt.

So, how does Jane determine that Brad Pitt is her "reservation partner?" The calculation has two key components: First, she knows the probability that any given date will exceed some particular quality level. Second, she knows the cost of not accepting a long-term relationship and continuing to look. Thus, on any particular date, she knows the likely benefit of

**TABLE 1 VARIOUS MEASURES OF INFLATION**

	CPI		Core CPI	
	December to December	Year to Year	December to December	Year to Year
1996	3.3	3.0	2.6	2.7
1997	1.7	2.3	2.2	2.4
	PPI: Total Finished Goods		PPI: Finished Consumer Goods	
	December to December	Year to Year	December to December	Year to Year
1996	2.8	2.7	3.4	3.6
1997	-1.2	0.4	-1.0	0.7

**SOURCE:** *Economic Report of the President*, February 1998. Washington, D.C.: U.S. Government Printing Office, 1998.

sloughing the fellow off and looking elsewhere—which is determined by the probability of finding a higher-quality man in the future—as well as the costs of continued search. The reservation partner, then, is the one for whom the costs of continued dating just equal the expected return of continued dating. In Jane’s case, that person is Brad Pitt.<sup>3</sup>

The same logic applies to our unemployed computer programmer. Just as Jane calculates the benefits and costs of dating, the programmer calculates the probability of finding a better job than the one currently offered, and balances that against the cost of a longer spell of unemployment. The wage at which the benefits of continued job search just equal the costs of further search is called the *reservation wage*, which represents the minimum wage offer for which our programmer will choose employment over unemployment.

**■ Do Productivity Increases Lower the NAIRU?**

Now we are in a better position to evaluate the claim that significant productivity gains have lowered the natural rate, thus driving the NAIRU down below the actual unemployment rate and yielding the happy environment in which both the unemployment and inflation rates fall. As our earlier discussion makes clear, labor market theory says that this story can only be true if such productivity developments fundamentally change the cost-benefit calcula-

tions that unemployed workers use when searching for jobs.

Will this be the case? Let’s return once more to our dating metaphor. Suppose that the quality of all men magically increases by, say, 10 percent. Would the number of men Jane would accept as partners increase, thus reducing the time she can expect to remain single?

To address this question, it will help if we make our example a bit more specific. Suppose that after this wonderful 10 percent improvement, Dexter Pitt (Brad’s less desirable distant cousin) is of the same quality as Brad was before the transformation. Will Jane now be willing to enter into a relationship with Dexter?

In the absence of other changes, the answer is no. It’s true that the benefit of settling for Dexter has risen. But so has the cost, because Jane loses even more than before by not holding out for Brad, whose quality has risen as well. In fact, it turns out that revisions in costs and benefits offset one another: Jane’s reservation partner will still be Brad Pitt, and she will expect to spend exactly the same amount of time dating (remaining single) as she did before the pool of men miraculously improved.

And so it will be with an unemployed person’s reservation wage. To the extent that a productivity increase raises all potential wage offers by the same amount, say 10 percent, the benefits and costs of search also rise by 10 percent.

This equivalence occurs because the cost of continued searching is the opportunity cost of forgone wage offers. As a consequence, the minimum acceptable wage offer rises by 10 percent, leaving the expected spell of unemployment unchanged by the productivity improvement. Extending this logic to the entire labor force means, of course, that the natural rate of unemployment (NAIRU in the monetary policy context) is invariant—that is, unresponsive—to productivity increases.

**■ Can Productivity Growth Ever Change the NAIRU?**

Like all economic parables, this one’s moral depends on the details. Is it possible, in any well-constructed world, for productivity changes to alter the NAIRU? Yes, almost certainly, but getting to this conclusion requires a fancier story than the usual straightforward productivity tale.

One possibility is that workers fail to perceive how far their productivity has risen, and hence misjudge the wage that they can rationally expect to receive. If a productivity advance, for example, causes all potential wage offers to rise 10 percent, the logic of our earlier argument suggests that workers’ reservation wages should also increase 10 percent. If, however, job-seekers do not recognize the full extent of their good fortune, they may accept jobs at wages below what they would accept if they were fully aware of their improved circumstances. In other words, some people will take jobs that they should really reject because, unbeknownst to them, the true benefit of finding a better job exceeds their cost of remaining unemployed and continuing the search.

Thus, temporary confusion about wage prospects causes the NAIRU (or natural rate) to fall. The operative word here is *temporary*. Once the effects of productivity developments become known, the NAIRU will revert to its initial level, as in the story we developed in the preceding sections.

Another possibility is that recent productivity changes are not of the sort that raises *all* wages by 10 percent, but rather of the sort whose effects vary substantially across the range of jobs. Such a scenario would very likely change the NAIRU's level. However, both theory and experience are generally silent on the *direction* of such a change.

The moral of this story is that, although appeals to productivity growth could conceivably salvage the recent poor performance of NAIRU-based predictions, salvation from this source seems to require extremely persistent confusion on the part of workers or an appeal to predictions that are difficult to support by logic or facts. Maybe it can be rescued, but maybe—just maybe—it's simply time to replace the NAIRU with a more sophisticated framework for connecting the labor market to policy.

### ■ Footnotes

1 On the face of it, this view is not strongly supported by actual productivity numbers, prompting some of its adherents to claim that reality is being obscured by technical measurement problems. For a critical assessment of this argument, see John B. Carlson and Mark Schweitzer, "Productivity Measures and the 'New Economy,'" Federal Reserve Bank of Cleveland, *Economic Commentary*, forthcoming.

2. For a fuller development of the ideas in this *Economic Commentary*, see Paul Gomme, "What Labor Market Theory Tells Us about the 'New Economy,'" Federal Reserve Bank of Cleveland, *Economic Review*, forthcoming.

3. In general, Jane's calculation will involve the probability that her desire to enter into a long-term relationship will be reciprocated by her date. However, we have implicitly assumed that these desires will always be reciprocated, which probably means that Jane is herself a pretty good catch.

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