A Theory of Slack

How Economic Slack Shapes Markets, Business Cycles, and Policies

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Draft version: April 2026
Draft URL: pascalmichaillat.org/18/

CHAPTER 13.

Full employment and unemployment gap

We have seen that in a slackish market model there is no guarantee that the market is operating efficiently. This means that in theory, the labor market may be socially inefficient: the amount of unemployment might be inefficiently high or low. Is that the case in practice in the United States?

To answer this question, we compute the socially efficient rate of unemployment over the past century—which corresponds to the full-employment rate of unemployment (FERU). We then compare the FERU to the actual US unemployment rate to measure the unemployment gap: the distance of the US labor market from social efficiency. We will see that most of the time, the US labor market is inefficiently slack—operating below full employment.

13.1. Efficient labor market tightness

In this chapter, we produce a measure of the efficiency or inefficiency of the US labor market. To do that, we apply the efficiency analysis of chapter 10 to the labor market.

13.1.1. Social planner's problem

The social planner aims to organize production as efficiently as possible. This means that the planner must allocate as efficiently as possible across production, recruiting, and job seeking to maximize the amount of production on the labor market.

Our starting point is the labor market's productive capacity, which is given by the labor force: h workers.

There is slack in the labor market, so a share $u \in (0,1)$ of all workers remain unemployed. The other $(1-u)h$ workers are employed by firms.

However, labor is used not only for production but also for recruiting via job vacancies. Recruiting takes work: designing and advertising job vacancies, screening and interviewing candidates, and negotiating contracts. Workers involved in recruiting are unable to spend their entire time contributing to social welfare.

As usual, we assume that the labor market features a Beveridge curve. The Beveridge curve links the vacancy rate v—the number of job vacancies as a share of the labor force—to the unemployment rate u. The function $v(u)$ is strictly decreasing and convex.

Moreover, filling job vacancies requires resources, measured by the recruiting cost $\kappa > 0$. The recruiting cost is the number of workers allocated to one job vacancy per unit time.

We see that not all employed workers are directly productive. Some workers are instead devoted to recruiting and, as they do not produce output, they do not contribute to social welfare. So we must subtract the $\kappa v h$ recruiters from the $(1-u)h$ workers employed by firms to obtain the number of producers: $(1-u)h - \kappa v h$.

We assume that social welfare is determined by production on the labor market and thus by the number of producers. Accordingly, social welfare is given by

$$\mathcal{M}(u) = [1 - u - \kappa v(u)]\, h.$$

The social planner's problem is to pick an unemployment rate u to maximize social welfare $\mathcal{M}(u)$.

13.1.2. Sufficient-statistic formula

The social planner's problem is exactly the same as the market planner's in chapter 10. Hence, the efficiency formula is the same, given by equation 10.5:

$$\left(\frac{v}{u}\right)^* = \frac{1}{\beta\kappa}, \tag{13.1}$$

where κ is the amount of labor devoted to recruiting per job vacancy, β is the elasticity of the Beveridge curve. In the labor market model, the ratio v/u corresponds to the labor market tightness θ. Hence, the formula becomes

$$\beta\theta^*\kappa = 1. \tag{13.2}$$

13.1.3. Calibration of the sufficient statistics

We now calibrate the efficiency formula for the US labor market.

First, as we saw in figure 2.8, the labor-market Beveridge curve is a rectangular hyperbola, so we set the elasticity to $\beta = 1$.

Second, as we saw in chapter 2, it takes about 1 full-time worker to service a job vacancy, so $\kappa = 1$.

Since $\beta = 1$ and $\kappa = 1$, the efficient labor market tightness is therefore given by $\theta^* = 1$. Thus, the US labor market is inefficiently slack whenever labor market tightness is below 1, inefficiently tight whenever tightness is above 1, and efficient when tightness equals 1.

In section 10.7, we saw that the welfare analysis could be extended to include nonzero social value of unemployment. However, we noted in chapter 2 that beyond lost production, the idleness of labor generates significant psychological costs. We saw that the value of home production by unemployed labor minus the psychological cost of idleness is about zero, so the social value is about 0. This is why we keep things simple and do not insert a nonzero social value of unemployment here.

13.1.4. Interpretation of the efficiency condition

Social efficiency corresponds to a labor market tightness of 1, so it prevails when the unemployment and vacancy rates are equal ($u = v$). When they are not equal, the labor market is operating inefficiently. The labor market is inefficiently tight when there are more job vacancies than job seekers ($v > u$). In that case, increasing u and reducing v would increase social welfare. The labor market is inefficiently slack when there are more job seekers than job vacancies ($u > v$). Then, reducing u and increasing v would increase social welfare.

13.2. Equivalence between efficiency and full employment

Before applying the theory to US data, it is useful to note that the concept of efficiency studied in this chapter and the following ones is synonymous with the notion of full employment used in US laws. Accordingly, the unemployment gap computed in this chapter is a marker not only of the inefficiency of the labor market, but also of the distance from full employment.

13.2.1. Full employment in US law

In the United States, the federal government and its central bank are mandated to stabilize the labor market at full employment by the Employment Act of 1946, the Federal

Reserve Reform Act of 1977, and the Full Employment and Balanced Growth Act of 1978 (US Congress 1946, 1977, 1978).[1]

13.2.2. Full employment in the model

The Employment Act and Full Employment and Balanced Growth Act clearly state that achieving full employment is a way to maximize economic well-being, so we translate full employment in the model as social efficiency—a state of affairs in which social welfare is maximized. The Employment Act states for instance that reaching full employment is designed "to foster…the general welfare" (US Congress 1946, p. 1)—so in theoretical words, to reach efficiency. This is also the spirit of the Full Employment and Balanced Growth Act. US Congress (1978, p. 1888) was motivated to act by the fact that "the Nation has suffered substantial unemployment and underemployment, …over prolonged periods of time, imposing numerous economic and social costs on the Nation." The hope of the law is to ensure that in contrast, with appropriate policy, the country is not deprived of "the full utilization of labor…and the related increases in economic well-being that would occur under conditions of genuine full employment."

We therefore interpret full employment as the allocation of labor that maximizes social welfare. Using the result above, we can state that the labor market is at full employment whenever the unemployment and vacancy rates are equal ($u = v$).

13.2.3. Connection to Beveridge's criterion for full employment

Famously, Beveridge (1944, p. 18) defined full employment to mean that "unemployment is reduced to short intervals of standing by, with the certainty that very soon one will be wanted in one's old job again or will be wanted in a new job that is within one's powers." He then stated that "Full employment…means having always more vacant jobs than unemployed men, not slightly fewer jobs."

Beveridge's criterion has been used in academic research. Early on, Rees (1957, chart 5) applied Beveridge's criterion to the United States. He computed the ratio between number of vacancies and number of unemployed workers and examined under which conditions the US labor market reached full employment (a ratio above 1). More recently, Benigno and Eggertsson (2023) used Beveridge's criterion to explain the kink that they observed in the US Phillips curve.

Beveridge's criterion is well known in government circles as well. During a press conference in 2022, Jerome Powell, the chair of the Federal Reserve, was asked by jour-

[1] "Full employment" is sometimes referred to as "maximum employment." During the debate preceding the Employment Act, "maximum employment" was adopted as a less stringent goal than "full employment" (Duboff 1977, p. 6). In 1978, the Full Employment and Balanced Growth Act amended the Employment Act and replaced "maximum employment" by the more ambitious target of "full employment" (Weir 1987, p. 398).

nalist Howard Schneider which tightness the Fed might target, Powell (2022, pp. 12–13) responded: "So in terms of the vacancy-to-unemployment ratio, we don't have a goal in mind. . . . I think when we got to one-to-one in the, you know, in the late teens, we thought that was a pretty good number." A vacancy-to-unemployment ratio of 1 corresponds to Beveridge's criterion for full employment.

How did Beveridge come up with this criterion? The logic was simple: he interpreted job vacancies as unmet labor demand and accordingly defined full employment as the point where there would be enough labor demand for all workers, so the point where job vacancies exceed job seekers. Beveridge then explains that some workers are always unemployed "however high the demand for labor" because there always is some "frictional unemployment."

Our criterion for full employment shares some similarities but is more symmetric than Beveridge's criterion. Beveridge thought that the labor market could be either too slack, when $v < u$ or at full employment, when $v \geq u$. By contrast, we find that having more vacancies than job seekers is a sign of inefficient tightness, just like having more job seekers than vacancies is a sign of inefficient slack. We argue that full employment is achieved exactly when $v = u$, and that on either side of full employment, the labor market is operating inefficiently: either too slack, when $v < u$, or too tight, when $v > u$.

Although our full-employment criterion overlaps with Beveridge's, the logic is entirely different. We do not interpret vacancies as unmet labor demand, but we use vacancies as an indirect measure of the labor devoted to recruiting. In the United States, it takes roughly one recruiter to handle one vacancy, so the number of vacancies tracks the amount of labor devoted to recruiting. This empirical regularity is what we use in deriving the FERU. If we had a direct measure of man-hours devoted to recruiting, we would not even need vacancies to compute the FERU.

Indeed, in our theory of slack, job vacancies do not represent unmet labor demand: they represent recruiting effort—an effort to find new workers through the matching process. As we saw in chapter 11, if a firm wants to recruit one worker this month and knows that a vacancy is only filled with probability 1/2, the firm will post 2 different vacancies to hire one worker in expectation. And each vacancy will require time and effort from the firm's human-resource workers to be filled.

Our approach appears to be consistent with reality. ZipRecruiter's Julia Pollak explained in an interview with CBS News that firms routinely post several vacancies for each hire they are planning to make (Ivanova 2023):

> When you have fewer candidates per opening, you have to be more creative. The high openings figure does partly reflect recruiting intensity, and not actual roles and seats and slots.

13.3. Efficient, full-employment rate of unemployment

We have established that when the labor market operates efficiently—which corresponds to a state of full employment—labor-market tightness is 1. In this section, we construct the rate of unemployment at full employment—the FERU. Having the rate of unemployment when the labor market operates efficiently, at full employment, is useful because researchers and policymakers more commonly think about unemployment than about labor market tightness, and because the effects of stabilization policies on unemployment are better understood than those on labor market tightness.

To translate the efficient tightness into an efficient unemployment rate, we need to specify the Beveridge curve. As we discussed in chapter 2, since the Beveridge elasticity is 1, the Beveridge curve is a rectangular hyperbola:

$$vu = A,$$

where $A > 0$ governs the location of the Beveridge curve. At efficiency, the labor market tightness is 1, so $v^* = u^*$, which imposes

$$u^* = v^* = \sqrt{A}. \tag{13.3}$$

To derive the expression for the FERU, we start from equation (13.3) and substitute A out of it by using the Beveridge curve $A = uv$. We find that the FERU is the geometric average of the unemployment and vacancy rates:

$$u^* = \sqrt{uv}. \tag{13.4}$$

Since $uv = A > 0$, expression (13.4) implies that the FERU is strictly positive. Hence, full employment should not be interpreted as zero unemployment.

A first reason why full employment does not mean zero unemployment is that zero unemployment is infeasible. Indeed, the Beveridge curve prevents unemployment from ever reaching zero. Since vacancies require labor, the number of vacancies posted in the labor market is bounded above. Accordingly, the Beveridge curve $u = A/v$ implies that the unemployment rate is bounded below by some positive number.

The fact that labor market flows impose a minimum level of unemployment—and therefore that full employment cannot be zero unemployment—has been known for a long time. Beveridge (1944, p. 125) realized that "however great the unsatisfied demand for labor, there is an irreducible minimum of unemployment, a margin in the labor force required to make change and movement possible." As a result, "even under full employment, there will be some unemployment,. . . on each day some men able and willing to work will not be working." Robinson (1946, pp. 169–170) made the same observation: "In a changing world there are always bound to be, at any moment, some workers who have left one job and have not yet found another. . . . Changes in occupation for personal reasons will always be going on. So long as such shifts in employment are taking place there is always likely to be some unemployment even when the general demand for labor is very high."

A second reason why full employment does not mean zero unemployment is that zero unemployment is undesirable. Unemployment is clearly a waste of economic resources as people who would like to work are not able to be productive. Yet, reducing the unemployment rate to zero is not desirable because it would require diverting a vast amount of labor toward recruiting.

Equation (13.3) shows that full employment occurs when unemployment and vacancy rates are equal. The equation also shows that the location of the Beveridge curve, A, solely determines these rates at full employment. In a dynamic labor-market model the Beveridge curve's position is determined by the job-separation rate and the efficacy of the matching function (chapter 11). Any change in either parameter shifts the curve, affecting the FERU. However, which parameter causes the shift is irrelevant; only the shift itself matters for welfare and the FERU.

13.4. Inefficiency of the US labor market over the past century

In this section we investigate whether the US labor market has operated efficiently over the past century or not. We find that it has not.

13.4.1. Labor market tightness over the past century

We start by looking at the US labor market tightness over the past century. Over 1929–2024, labor market tightness averages 0.73. Tightness is extremely volatile before the end of World War 2. Tightness reached its most extreme values during that period: tightness plunged to 0.03 during the Great Depression and climbed all the way to 6.8 at the end of World War 2. Things are more quiet in the postwar period. Tightness peaked at 1.60 in 1953Q1, during the Korean War, and it bottomed at 0.16 in 2009Q3, during the Great Recession. Twice, the labor market reached full employment just before entering a recession. This happened before the 1973–1975 recession (tightness peaked at 0.99 in 1973Q3) and before the 2001 dot-com recession (tightness peaked at 1.01 in 2000Q1). In the aftermath of the coronavirus pandemic, the US labor market has become historically tight. In 2022Q2, tightness reached 1.98, a value which it had last reached in 1945.

A first finding is that over almost a century, tightness is generally inefficiently low, so the tightness gap is negative. Furthermore, this gap is exacerbated in recessions (figure 13.1). This means that the labor market does not generally operate efficiently. Instead, it is generally inefficiently slack, especially during recessions.

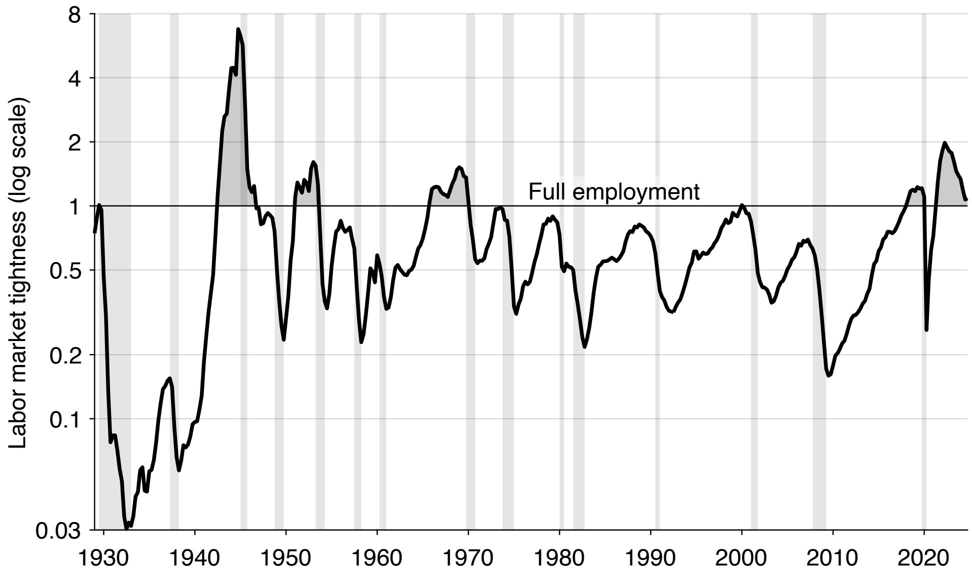


FIGURE 13.1. Labor market tightness in the United States, 1929–2024

Labor market tightness is v/u where the vacancy rate v comes from figure 2.5 and the unemployment rate u comes from figure 2.1. Shaded areas indicate recessions dated by the NBER (2023). The labor market is at full employment when tightness equals 1, inefficiently slack when tightness is below 1, and inefficiently tight when tightness exceeds 1.

The labor market is not always inefficiently slack, however. There are several episodes when it becomes inefficiently tight. And these episodes do not appear at random. Before 2018, the labor market had only been inefficiently tight during major wars—World War 2, the Korean War, and the Vietnam War. Keynes (1936, p. 322) doubted that a labor market could reach full employment in peacetime. He was essentially right: before 2018 the US labor market had only reached full employment in wartime.

Since 2018, the labor market has been inefficiently tight just before the coronavirus pandemic (2018Q3–2020Q1), and in the aftermath of the pandemic (2021Q3–2024Q4). The state of the labor market around the pandemic is therefore a rarity: it is the only peacetime episode during which it became inefficiently tight—the only episode of peacetime overheating.

13.4.2. FERU over the past century

Next, we combine the US unemployment and vacancy rates between 1929 and 2024 to compute the FERU. Given that the US labor market experienced extreme fluctuations during the entire period, especially in the first two decades, we plot the unemployment and vacancy rates, as well as labor market tightness and FERU, on logarithmic scales. Besides improving the readability of the figures, logarithmic scales have several advantages. First,

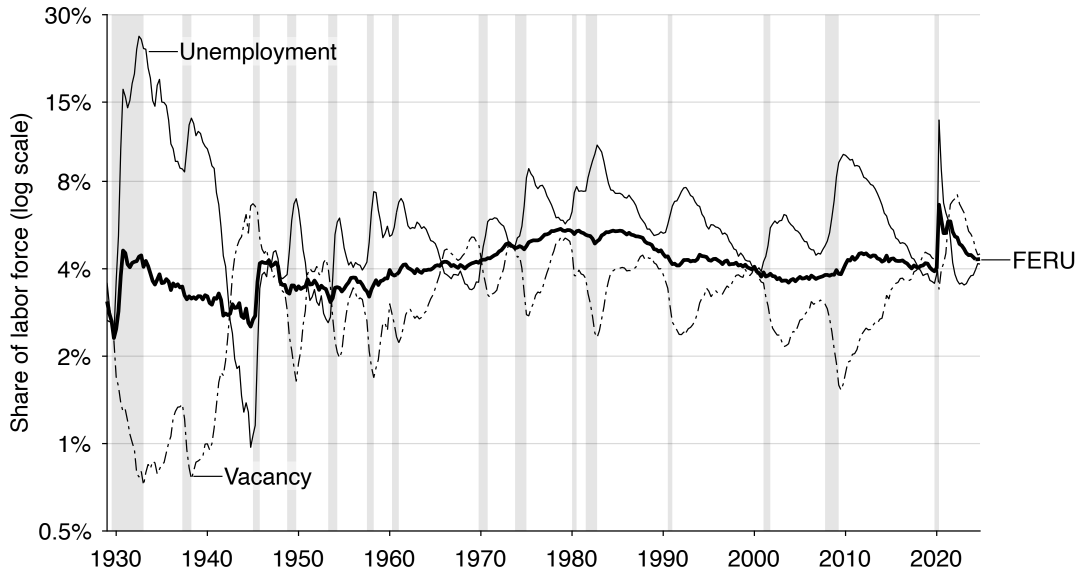


FIGURE 13.2. FERU in the United States, 1929–2024

The unemployment rate u comes from figure 2.1. The vacancy rate v comes from figure 2.5. The FERU is $u^* = \sqrt{uv}$, so on a logarithmic scale it is the midpoint between the unemployment and vacancy rates. Shaded areas indicate recessions dated by the NBER (2023).

the symmetry of the unemployment and vacancy movements on a logarithmic scale makes it clear that the Beveridge curve is a rectangular hyperbola. Second, the FERU is particularly easy to construct on a logarithmic scale. Indeed, the FERU is just the midpoint between the unemployment and vacancy rates: as $u^* = \sqrt{uv}$, then $\ln(u^*) = 0.5 \times \ln(u) + 0.5 \times \ln(v)$.

Over 1929–2024, the FERU averages 4.1% (figure 13.2). The FERU is quite stable over time, remaining between 2.3% and 6.7% over almost a century. Despite significant macroeconomic volatility during the prewar period, 1929–1947, the FERU is stable: it averages 3.4% and remains between 2.3% and 4.6%. The FERU is also stable during the postwar period, 1948–2019: it averages 4.2% and remains between 3.1% and 5.5%. The Beveridge curve shifts in and out during the postwar period (figure 2.7), but the shifts are not large enough to produce noteworthy changes in the FERU. Finally, the FERU temporarily rose above 6% during the pandemic, before falling back down below 5% in 2022 and below 4.5% in 2023.

The sharp increase of the FERU at the onset of the pandemic is unprecedented: the FERU increased by 2.7pp, from 4.0% in 2020Q1 to 6.7% in the following quarter. This sharp increase is explained by the gigantic outward shift of the Beveridge curve that took place in the spring of 2020 as the US economy was shut down by the coronavirus (figure 2.7). Indeed, the FERU is solely determined by the location of the Beveridge curve, so only an outward shift of the Beveridge curve can raise the FERU.

Two other notable increases in the FERU occurred during the two other major catastrophes of the century: the Great Depression and World War 2. At the onset of the Great Depression, the FERU increased by 2.3pp: from 2.3% in 1929Q4 to 4.6% one year later. At the end of World War 2, the FERU increased by 1.7pp: from 2.5% in 1944Q4 to 4.2% one year later. In both cases, the Beveridge curve also shifted outward in dramatic fashion, in response to the dislocation of the labor market that occurred when the US economy plunged into the depression and when veterans flocked back to the US labor market.

13.4.3. Unemployment gap over the past century

The inefficiency of the US labor market over the past century is clearly visible by computing the US unemployment gap, $u - u^*$ (figure 13.3).

Over 1929–2024, the unemployment gap averages +2.3pp. The unemployment gap was of course positive and very large during the Great Depression: the labor market was much too slack then. The unemployment gap reached +20.9pp in 1932Q3, its highest level on record. The labor market recovered only slowly from the depression. The labor market reached full employment in 1942Q3, a few quarters after the United States had entered World War 2. The unemployment gap kept falling during the war; it reached −1.6pp in 1945Q1, its lowest level on record.

In the postwar period, the unemployment gap peaked at +5.9pp in 2009Q4, during the Great Recession. At the end of the Volcker recession, in 1982Q4, the gap reached the slightly lower value of +5.7pp. The lowest value taken by the unemployment gap is −0.8pp, in 1969Q1, during the Vietnam War. During the Korean War, the unemployment gap was almost as low, reaching −0.7pp in 1953Q1.

While the unemployment gap averages 0 over the pandemic and post-pandemic period, the labor market experienced sharp departures from full employment. The unemployment gap was initially positive and large: the labor market was much too slack in the first year of the pandemic. The unemployment gap peaked at +6.3pp in 2020Q2, its highest level since 1945. But the labor market recovered quickly and reached full employment in the middle of 2021. The unemployment gap turned negative after that, reaching −1.5pp in 2022Q2, its lowest level since 1945. The gap then shrunk to −0.2pp in 2024Q4. So during 2022–2024, the labor market was well beyond full employment.

Because the US labor market has generally been inefficient, there is a role for the government to stabilize the labor markets and attempt to bring unemployment to its efficient level. Reassuringly, this result is consistent with US law. If the labor market always operated efficiently, then there would be no need to pass laws that say that the government and the central bank have to cooperate to maintain the labor market at full employment. Yet this is exactly what the Employment Act of 1946, the Federal Reserve

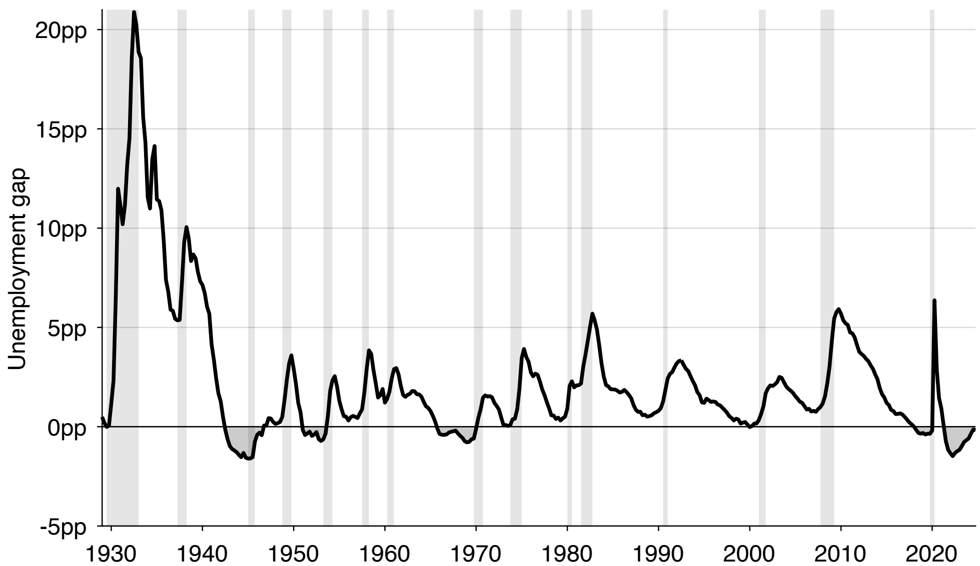


FIGURE 13.3. Unemployment gap in the United States, 1929–2024

The unemployment gap is $u - u^*$, where the unemployment rate u comes from figure 2.1 and the FERU u^* comes from figure 13.2. Shaded areas indicate recessions dated by the NBER (2023).

Reform Act of 1977, and the Full Employment and Balanced Growth Act of 1978 do.

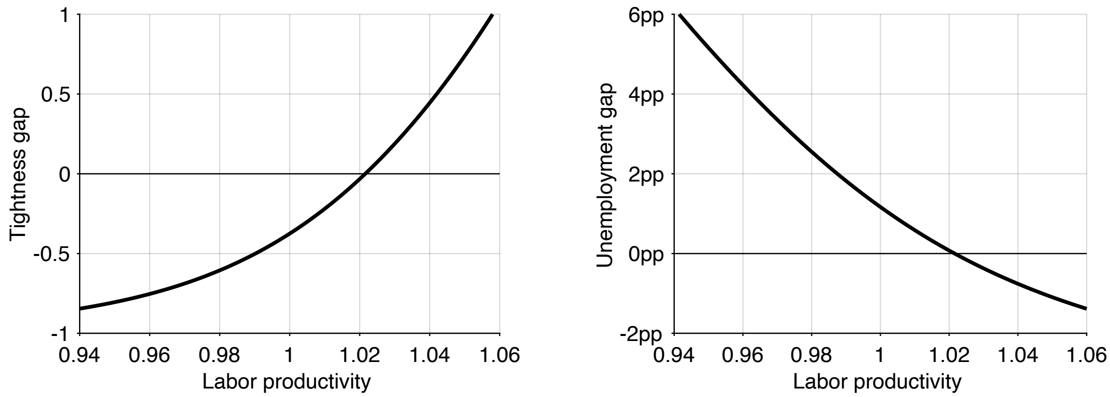
13.5. Explaining fluctuations in the unemployment gap

We have just established that the unemployment gap is countercyclical: it rises in recessions and recedes in expansions (figure 13.3). Is the pattern consistent with fluctuations in the slackish labor market model of chapter 11?

We saw that in the slackish labor market model, labor demand shocks—in the form of shocks to labor productivity—produce fluctuations that resemble US labor market fluctuations. They produce a procyclical labor market tightness, countercyclical unemployment rate, procyclical vacancy rate, and procyclical employment level. Moreover, the fluctuations in tightness in response to fluctuations in labor productivity are commensurate to the fluctuations observed in the US labor market.

In this section, we show that these shocks can also generate a countercyclical unemployment gap in the slackish labor market model.

First, we must apply the sufficient-statistic formula (13.2) to the slackish labor market model. It is not as easy as it might seem because in the model, in general, the Beveridge elasticity β is not fixed but is a function of tightness. So the formula really is $\beta(\theta^*)\theta^*\kappa = 1$ where $\beta(\theta)$ is given by equation (**??**). As equation (13.5) shows, with a Cobb-Douglas matching function, the efficient tightness is the solution to the following equation, which



A. Tightness gap

B. Unemployment gap

FIGURE 13.4. Tightness gap and unemployment gap in the slackish labor market model

The tightness gap is $\theta - \theta^*$, where labor market tightness θ comes from figure 11.5A and the efficient tightness is $\theta^* = 1.03$. The unemployment gap is $u - u^*$, where the unemployment rate u comes from figure 11.5B and the FERU is $u^* = 4.5\%$. The calibration of the model is described in table 11.2.

only involves two well-known function—the unemployment rate $u(\theta)$ and the recruiting wedge $\tau(\theta)$:

$$\frac{\tau(\theta^*)}{u(\theta^*)} = \frac{1-\sigma}{\sigma}. \tag{13.5}$$

So there is a tightness θ^* that is efficient and that does not respond to labor productivity shocks—as these do not affect any elements in the equation. In the calibration of table 11.2, the efficient tightness is not exactly 1 but close to it: $\theta^* = 1.03$. It is not exactly 1 because at θ^*, the Beveridge elasticity is not exactly 1 but $\beta(\theta^*) = 0.98$.

So in response to labor productivity shocks, the efficient tightness θ^* remains at 1.03. At the same time, the actual tightness θ responds sharply to labor productivity shocks. Hence, the simulated tightness gap $\theta - \theta^*$ is sharply procyclical, moving with tightness (figure 13.4A).

The FERU is just the efficient unemployment rate, $u(\theta^*)$. In the calibrated model, $u^* = 4.5\%$. Just as the efficient tightness, the FERU does not respond to productivity shocks. Accordingly, the simulated unemployment gap $u - u^*$ is sharply countercyclical, moving with the unemployment rate (figure 13.4B). Moreover, the amplitude of the simulated unemployment gap matches what we observe in figure 13.3. The highest simulated value is +6.0pp, close to the unemployment gap observed during the Great Recession; and the lowest value is −1.4pp, close to the unemployment gap observed after the coronavirus pandemic.

13.6. Existing unemployment targets do not capture full employment

In this final section, we briefly review other series that US policymakers have used to measure full employment: the natural rate of unemployment (NRU) and the nonaccelerating-inflation rate of unemployment (NAIRU).[2] We explain why this is an unsatisfactory choice.

Indeed, why should policymakers use the FERU if there are perfectly acceptable series such as the NAIRU or NRU to serve as full-employment targets? The main reason is that the NAIRU and the NRU have nothing to do with labor market efficiency, so they are not useful to measure full employment.

13.6.1. The NRU does not capture full employment

A first measure that the federal government, Federal Reserve, and other policymakers often use to measure full employment is the NRU. The NRU is a nebulous concept, but generally refers to some trend of the unemployment rate (Rogerson 1997). Specifically, policymakers often rely on the NRU series produced by the (CBO 2025).[3]

The CBO opened its doors in 1975 (US Congress 1974). It started producing estimates of the NRU shortly after that, which have become well known and widely used.[4] For example, when he was President of the Federal Reserve Bank of Boston, Rosengren (2014, p. 180) measured the departure of the Fed from its full-employment mandate by "the squared deviations of unemployment from an estimate of full employment utilizing the Congressional Budget Office assessment of the natural rate for each year."

The CBO's NRU is a slow-moving trend of the unemployment rate computed by assuming that the labor market was at full employment in 2005, and then by incorporating changes in the demographic composition of the labor force over time.[5] Although the NRU conveys information about the demographic forces exerted on the labor market, without a theory of full employment, it is impossible to know whether the US labor market was at full employment in 2005 or not, and by induction, whether the NRU in any year measures full employment. More generally, in a slackish labor market, there is no guarantee that the trend of unemployment is efficient (chapter 10). Thus, the NRU cannot be a satisfactory measure of efficiency and thus full employment.

[2]See Backhouse, Forder, and Laskaridis (2023) for a comprehensive history of the two concepts.

[3]The CBO rebranded the "natural rate of unemployment" as "noncyclical rate of unemployment" after 2021—leaving the acronym NRU unchanged and highlighting the fact that the natural rate is generally considered as the trend or noncyclical component of unemployment.

[4]See for instance this report produced by the CBO in January 1987: `https://www.cbo.gov/sites/default/files/100th-congress-1987-1988/reports/doc01b-entire_0.pdf`.

[5]The construction of the CBO's NRU is described in Shackleton (2018, appendix B) and reviewed in Bok et al. (2023).

13.6.2. The NAIRU does not capture full employment either

Another measure of full employment that policymakers sometimes use is the NAIRU. The concept of NAIRU was proposed by Modigliani and Papademos (1975), although in a slightly modified form—they introduced NIRU for "noninflationary rate of unemployment". The acronym NAIRU then appeared in Baily (1976) and Baily and Tobin (1977). These early papers also offered measures of the NAIRU for the United States, that could be used as targets for monetary policy.

Today, the Federal Reserve and government continue to use the NAIRU as a full-employment target. For instance, the Council of Economic Advisers (2024, p. 24) describes the concept of full employment as follows: "Modern economics has generally defined full employment by citing the theoretical concept of the lowest unemployment rate consistent with stable inflation, which is referred to as u^*, ...the non-accelerating inflationary rate of unemployment (termed NAIRU)." The quote is particularly meaningful because the Council of Economic Advisers was created by the Employment Act to ensure that the government achieved its full-employment mandate.

Although the NAIRU might contain information relevant to the Fed's price-stability mandate, there is absolutely no guarantee that the unemployment rate coming out of the NAIRU estimation measures the efficient rate of unemployment. Because the NAIRU is the unemployment rate at which inflation remains stable, it is measured by estimating accelerationist Phillips curves.[6] These estimation procedures therefore rely on price dynamics. They do not measure the social costs and benefits from unemployment, so they cannot produce an estimate of the efficient unemployment rate, or equivalently of full employment.

A secondary issue with the NAIRU is that its estimates are very imprecise (Staiger, Stock, and Watson 1997; Laubach 2001). The slackish Phillips curve developed in chapter 16 might explain why. In that model, inflation might be stable at any level, for different unemployment rates: the Phillips curve is not accelerationist in the slackish model. If unemployment is at full employment, inflation is stable at the target; if unemployment is above the FERU, inflation is stable below the target; and if unemployment is below the FERU, inflation is stable above the target. So the concept of NAIRU is not well defined under a slackish Phillips curve. Ball and Mankiw (2002) argue that the NAIRU concept is implicit in any model in which monetary policy influences both inflation and unemployment. But it's not present in a slackish business cycle model in which monetary policy affects inflation and unemployment. If the world is slackish, the NAIRU is not well defined, explaining why it might be very difficult to estimate.

[6] For different methods to estimate the NAIRU, see Staiger, Stock, and Watson (1997), Gordon (1997), Laubach (2001), and Ball and Mankiw (2002).

13.6.3. The NRU is higher than the FERU

Given that the NRU and NAIRU are defined entirely differently from the FERU, it is no surprise that their levels differ. But it is noteworthy that both NRU and NAIRU are generally markedly higher than the FERU.

Between 1949 and 2019, the CBO's NRU is always above the FERU (figure 13.5). During that period, the NRU averages 5.5%, which is 1.2pp above the average FERU. The fact that the NRU is above the FERU does not reflect a deep insight about the US labor market: it only results from the assumption made when constructing the NRU. The CBO constructs the NRU by assuming that the labor market was at full employment in 2005; indeed, the NRU and actual employment rate overlap at 5.0% in 2005:Q4. But the FERU was lower than that at the same time: in 2005:Q4, the FERU was 3.8%, so 1.2pp below the NRU. The gap between the NRU and FERU in 2005 then permeates throughout the entire period.

While the NRU is always above the FERU between 1949 and 2019, the gap between the two series is not constant over the entire period—reflecting the different forces driving the FERU and NRU. In the 1950s, the NRU was often more than 2pp above the FERU. For instance, the NRU stood 2.3pp above the FERU in 1953 and 2.2pp above the FERU in 1957. The FERU hovered between 3.1% and 3.7% during that decade, while the NRU was between 5.3% and 5.5%. In the 1960s, the gap between the two series was still significant: the FERU stayed between 3.8% and 4.2% during that decade, while the NRU was between 5.5% and 5.9%.

Interestingly, the values of the FERU for the 1950s and 1960s are in line with estimates of full employment produced by economists at the time, while the values of the NRU are much above this contemporaneous estimates. Indeed, from its creation in 1946 to 1956, the Council of Economic Advisers (CEA) used an unemployment rate of 3% as a marker of full employment (Duboff 1977, p. 8). Then the CEA started raising their unemployment target. In 1962, the CEA wrote that an unemployment rate of 4% was "a reasonable and prudent full employment target for stabilization policy" (Duboff 1977, p. 10). Then, in 1969, Bakke (1969, p. 280) reported that "Since the [CEA] identified an unemployment rate of 4% with a condition of practically full employment, this figure served as a constant in the equation for computing the potential output." These values of 3% in the 1950s and 4% in the 1960s are perfectly consistent with our FERU, but much below the CBO's NRU.

The gap between NRU and FERU closed in the 1970s and 1980s as the Beveridge curve drifted outward, and reopened in the 1990s and 2000s, as the Beveridge curve shifted back inward. The gap closed again in the 2010s.

In the aftermath of the coronavirus pandemic, 2020–2024, the NRU was actually below the FERU. This is because the dramatic outward shift of the Beveridge curve during the pandemic raised the FERU but did not affect the NRU.

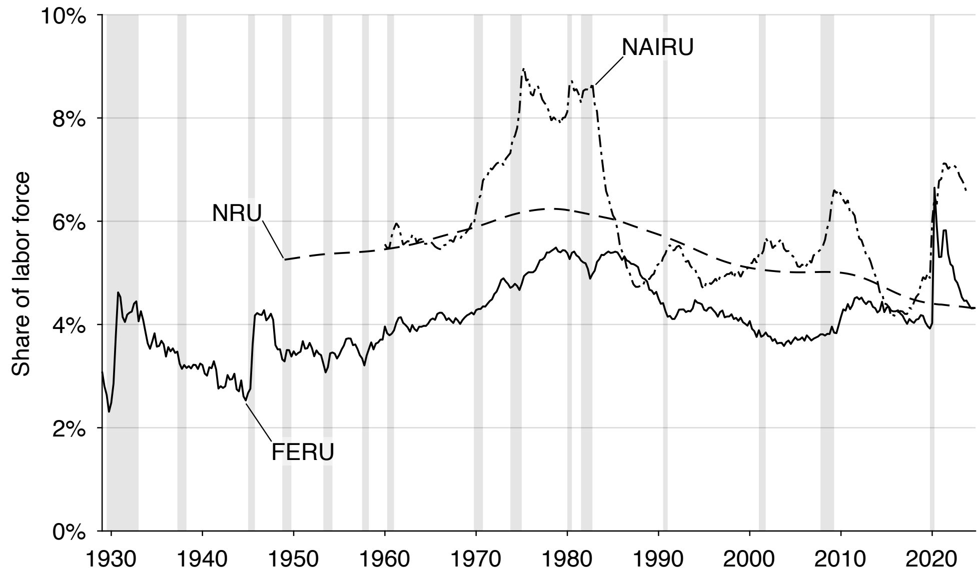


FIGURE 13.5. FERU, NRU, and NAIRU in the United States, 1929–2024

The FERU comes from figure 13.2. The NRU is constructed by the CBO (2025) for 1949–2024. The short-term NRU is constructed by the CBO (2021) for 1949–2020. The NAIRU is constructed by Crump et al. (2024, figure 2) for 1960–2023. Shaded areas indicate recessions dated by the NBER (2023).

13.6.4. The NAIRU is also higher than the FERU

There is no standardized time series for the NAIRU. Here, we use the NAIRU computed by Crump et al. (2024) using state-of-the-art techniques. That series covers 1960–2023.

Just like the NRU, the NAIRU is significantly higher than the FERU. Between 1960 and 2019, the NAIRU is above the FERU in all but a few quarters (figure 13.5). The NAIRU averages 5.9% over 1960–2019. This is 1.5pp more than the average FERU over the same period.

The gap between the NAIRU and FERU is particularly large around 1980. In the decade between 1974 and 1983, the NAIRU is on average 3.1pp above the FERU. In fact, the NAIRU reaches 9.0% in 1975, 8.7% in 1980, and 8.7% again in 1982. These are incredibly high numbers for what is supposed to be a measure of full employment.

The gap between NAIRU and FERU shrank in the late 1980s and 1990s, but it reopened again at the time of the Great Recession. Between 2007 and 2011, the NAIRU was on average 2pp above the FERU. In 2009, the gap between the two series reached 2.8pp, as the NAIRU climbed to 6.6% in 2009. The two series became quite close in the late 2010s, but the NAIRU diverged from the FERU again after the pandemic. In 2022, the NAIRU reached 7.0%. In 2022–2023, the gap between NAIRU and FERU averaged 2.1pp.

13.7. Summary

This chapter argues that the US labor market has seldom operated at its socially efficient level of unemployment. Using the efficiency framework of slackish markets, and combining it with the available empirical evidence, we find that in the United States efficient labor market tightness equals 1: full employment corresponds to one vacancy per job seeker. Historically, tightness has been well below unity, indicating pervasive inefficiency and excessive slack, except during wartime and, more recently, during the post-pandemic expansion when the market became inefficiently tight.

We also show how the efficient tightness can be translated into an efficient unemployment rate, which we call the full-employment rate of unemployment (FERU). In our slackish model, the FERU simply is the geometric mean of the unemployment and vacancy rates. The FERU formalizes the concept of full employment as a state of social efficiency rather than as zero unemployment. The FERU remains fairly stable over time—around 4%—despite decennial shifts of the Beveridge curve.

Although the Federal Reserve has a mandate to maintain the US labor market at full employment, there is no agreed-upon measure of the FERU, which makes it difficult for them to design policy to achieve full employment, and for observers to assess their performance. One contribution of this chapter is to propose a simple, welfare-based formula for the FERU that can be implemented in real time: $u^* = \sqrt{uv}$.

13.8. Onto business cycles

This chapter concludes our analysis of slackish markets. It raises three questions, which we will answer in the remainder of the book. To answer the questions, we will take an aggregate perspective and study not just individual markets and their fluctuations but the entire economy and business cycles.

13.8.1. Which shocks produce fluctuations in the unemployment gap?

The historical analysis reveals that the US labor market has been inefficiently slack for most of the past century, especially in slumps. The only exceptions are wartime mobilizations and the post-pandemic period. We have also seen that in the slackish labor market model, labor demand shocks generate fluctuations in the unemployment gap just like those that we observe in the United States: the gap swells in recessions and recedes in expansions. But labor demand shocks are not the end of the story: why do firms sometimes want to hire more labor and sometimes less? The first question therefore is: In the economy, what are the shocks that trigger countercyclical fluctuations in the unemployment gap? We will answer this question in part IV.

13.8.2. Can policy mitigate fluctuations in the unemployment gap?

We have seen that the US labor market is generally inefficiently slack, and furthermore that the unemployment gap is countercyclical, so that the labor market drifts further from efficiency in recessions. Such fluctuations in the unemployment gap open the door to stabilization policies: monetary and fiscal policy might be able to counter the shocks that lead to these fluctuations and bring unemployment closer to its efficient level. But this possibility raises a second question: Can monetary policy and fiscal policy mitigate fluctuations in the unemployment gap? In chapter 12 we saw that public employment is able to boost labor demand and reduce unemployment, so there clearly is scope for some form of fiscal policy. But the main stabilization policy in the United States is monetary policy; so how does monetary policy affect unemployment and can it shrink the unemployment gap? We will also answer this question in part IV.

13.8.3. Should policy mitigate fluctuations in the unemployment gap?

Because the historical analysis reveals that the unemployment rate has often drifted above the FERU, one wonders whether the US government has failed its legal mandate to maintain full employment. Things are not so simple, however, because the government and Federal Reserve have a dual mandate: not only full employment but also price stability. One possibility is that the actions that were required to maintain price stability forced the government and Fed to accept an elevated unemployment rate. More generally, stabilization policies come with tradeoffs, which raises a third question: To optimize social welfare over the business cycle, how should monetary and fiscal policy be conducted? We will also address this question in part V.

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