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Unemployment Rate Benchmarks

Richard K. Crump, Christopher J. Nekarda, and Nicolas Petrosky-Nadeau

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The analysis in this paper was presented to the Federal Open Market Committee as background for its discussion of the Federal Reserve's review of monetary policy strategy, tools, and communication practices. The Committee discussed issues related to the review at five consecutive meetings from July 2019 to January 2020. References to the FOMC's current framework for monetary policy refer to the framework articulated in the Statement on Longer-Run Goals and Monetary Policy Strategy first issued in January 2012 and reaffirmed each January, most recently in January 2019.

Abstract

This paper discusses various concepts of unemployment rate benchmarks that are frequently used by policymakers for assessing the current state of the economy as it relates to the pursuit of both price stability and maximum employment. In particular, we propose two broad categories of unemployment rate benchmarks: (1) a longer-run unemployment rate expected to prevail after adjusting to business cycle shocks and (2) a stable-price unemployment rate tied to inflationary pressures. We describes how various existing measures used as benchmark rates fit within this taxonomy with the goal of facilitating the use of a common set of terms for assessments of the current state of the economy and deliberations among policymakers.

JEL classification: E24, E32, J60.

Key words: labor market, monetary policy, unemployment, business cycles.

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The gap between the unemployment rate and a benchmark rate often serves as a guidepost for policymakers assessing the current state of the economy as it relates to the pursuit of both maximum employment and price stability. A benchmark rate of unemployment is used when assessing the degree of economic slack and inflationary pressures in the short and medium runs or to provide a guide for normal economic activity in the longer run. To this end, policymakers and academics have made use of various measures of unemployment rate benchmarks, under many names.¹ The goal of this paper is to offer a taxonomy for unemployment rate benchmarks, facilitating the use of a common set of terms for assessments of economic conditions and deliberations among policymakers.

We propose two broad categories of unemployment rate benchmarks that could be viewed as consistent with the policy objectives of the Federal Open Market Committee (FOMC):

1. A longer-run unemployment rate (LRU): The rate of unemployment that is expected to prevail after the economy has fully adjusted to business cycle shocks.
2. A stable-price unemployment rate (SPU): The rate of unemployment prevailing when there are no upward or downward pressures on price inflation apart from those stemming from underlying inflation or arising from supply shocks.²

Section I describes these two categories in detail and discusses the relationship between them. Briefly, the gap between the unemployment rate and the LRU is an indicator of the cyclical position of the economy, while the SPU is the rate of unemployment at which there is no cyclical pressure on price inflation. Persistent forces

¹ For example, Rogerson (1997) compiles a list of terms from the literature that include “structural,” “long-run,” “frictional,” “average,” “equilibrium,” “normal,” “full-employment,” “steady-state,” “efficient,” and “natural.”

² Our use of “stable-price” in this definition is not meant to refer literally to a zero rate of inflation but instead reflects the FOMC’s long-standing commitment to a level of price inflation consistent with reasonable price stability. See, for example, Board of Governors of the Federal Reserve System (2012).

that affect the underlying structure of the economy, such as the changing demographics of the workforce or market structure, will affect both LRU and SPU benchmarks. Transitory factors relevant for price pressures, such as cyclical changes in the composition of the labor force or temporary labor market policies like the emergency extension of unemployment benefits, will affect only the SPU, thereby driving a temporary wedge between the two benchmarks. The resulting wedge may be sizable and persist long enough to be a relevant consideration in the setting of monetary policy.

Section II describes several prominent measures of unemployment rate benchmarks used within the System and elsewhere and attempts to map them into our broad categories. The benchmark unemployment rate used in the Federal Reserve Board staff's report to the FOMC on economic conditions and monetary policy (the Tealbook) is best described as an SPU.³ Most Reserve Banks look at measures that can be classified as LRUs, while some Reserve Banks also look at measures that can be classified as SPUs.

Section III discusses some potential benefits and costs associated with the scenario in which the unemployment rate is running below the LRU but above the SPU—that is, lower than thought to be sustainable in the longer run but not low enough to bring inflation back up to the Committee's inflation objective over the next several years. This scenario plausibly describes the conditions faced by the FOMC in 2019 when the unemployment rate was low and inflationary pressures appeared muted. When assessing potential costs and benefits, it is important to consider which ones conflict with attaining the dual mandate and which ones do not.

I. Broad Categories of Unemployment Rate Benchmarks

Longer-Run Unemployment Rate

The LRU is the rate of unemployment that is expected to prevail after the economy has fully adjusted to business cycle shocks. The LRU is largely determined by

³ The Tealbook is made available to the public after approximately five years. For further details, see https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm.

nonmonetary factors and evolves with the changing structure and dynamics of the economy but need not correspond to the Federal Reserve’s statutory mandate of achieving maximum employment.⁴

Of course, identifying “business cycle” shocks is challenging because it requires taking a stand on the nature and persistence of the driving forces. Thus, in practice, any particular measure of an LRU will depend on the economic framework used to inform it. These frameworks fall, broadly speaking, into two categories: reduced-form or statistical models and structural models.

In reduced-form or statistical models, the LRU is often estimated by a long-horizon forecast or by extracting a low-frequency trend. A common approach is to build estimates of the LRU up from the typical, or trend, rates of unemployment for different groups.⁵ This approach can be used to explicitly incorporate information on past and expected longer-lasting compositional changes in the labor force due to factors such as demographics, industrial and occupational structure, and educational attainment.

Structural models can more directly inform how specific changes to the economy and to labor market functioning would affect the rate of unemployment expected to prevail in the longer run. For example, a search-and-matching model of the labor market, which assumes frictions in matching the unemployed with job openings, would predict that a secular decline in worker bargaining power would put downward pressure on the LRU.⁶ By contrast, greater difficulty in matching workers and jobs, possibly due to a

⁴ Indeed, the Committee’s January 2019 Statement on Longer-Run Goals and Monetary Policy Strategy does not specify a fixed goal for maximum employment, and unemployment is only one of a wide range of indicators taken into consideration; see

https://www.federalreserve.gov/monetarypolicy/files/FOMC_LongerRunGoals.pdf.

⁵ For examples of this approach, see Tasci (2012), Aaronson and others (2015), Barnichon and Mesters (2018), Berge and Nekarda (2018), Crump and others (2019), Hornstein and Kudlyak (2019), and Tüzemen (2019).

⁶ Models of equilibrium unemployment, pioneered by Diamond, Mortensen, and Pissarides in the late 1970s and early 1980s, provided a model in which unemployment arises even though the labor market clears every period. This approach contrasted with the prevailing Keynesian and disequilibrium theories of the time. See Petrosky-Nadeau and Wasmer (2017) for a review of the evolution of this class of models for both policy and business cycle analysis. See also Daly and others (2012) for an application to estimating trends in the LRU.

persistent rise in the mismatch of skills and job requirements, would put upward pressure on the LRU in this framework. Finally, structural models may provide insights into the welfare costs and benefits of periods with unemployment deviating from the LRU.

Stable-Price Unemployment Rate

The gap between the unemployment rate and the LRU is an indicator of the cyclical position of the economy.⁷ But monetary policymakers also need gauges of cyclical pressures on price inflation, and the gap between the unemployment rate and the LRU is not necessarily the relevant benchmark for making this assessment. Indeed, to the extent that inflation reflects the influence of cyclical factors expected to disappear in the longer run, such as variation in firms' markups or changes in labor force participation and composition, an alternative benchmark would need to take these into account.

The SPU is the rate of unemployment such that there are no upward or downward pressures on price inflation apart from those associated with a constant rate of underlying inflation or arising from supply shocks. Informally, the SPU is the rate of unemployment at which there is no cyclical pressure on inflation. Underpinning this definition are two notions: first, that inflation is sensitive to the cyclical position of the economy, and, second, that the unemployment rate relative to the SPU captures the relevant cyclical contributions to price determination from domestic labor and product markets.⁸

In practice, a Phillips curve equation is the central framework for determining the SPU. Thus, a particular estimate of the SPU will depend on which supply shocks are accounted for in the specification and, more broadly, on the assumed nature of the inflation process. There is no consensus in the literature on how to accommodate supply

⁷ Indeed, Aaronson and others (2012) argue that the unemployment rate is the best single indicator of labor market conditions in most situations and explore some situations in which it is not. Fallick and Rudd (2012) provide a general discussion of assessing slack in the economy.

⁸ Instead of unemployment alone, some have advocated for looking at the ratio of job vacancies to unemployment, a measure of labor market tightness that captures the demand for labor as well as its supply. Recent research has generalized these types of empirical measures to account for variation in the availability of potential new hires and the intensity with which employers seek to fill their jobs; see Abraham and Haltiwanger (2019) and Faberman and others (2019). The taxonomy described in this paper could be adapted to these measures as well.

shocks in the Phillips curve. Common specifications seek to remove inflation movements resulting from certain types of cost shocks, such as changes in relative prices for energy and imports. There is less agreement on how to treat changes in trend productivity growth, which would tend to affect the tradeoff between unemployment and price inflation (at least temporarily). Unless these sorts of productivity-related influences explicitly enter in the Phillips curve specification, they could instead appear as movements in the SPU.⁹

Regarding the assumed nature of the inflation process, a common approach is to assume that inflation fluctuates around a long-run trend that is, in turn, tied down by well-anchored inflation expectations; this assumption appears to provide a good empirical characterization of inflation dynamics since the late 1990s.¹⁰ By “well-anchored inflation expectations” we mean that the public’s long-run expectations about inflation are largely invariant to the state of the economy—in particular to cyclical movements in inflation or the inflationary effects of supply shocks. Absent any other shocks—and as long as inflation expectations remain well anchored—a temporary rise in unemployment above the SPU will push inflation below its longer-run expected level; inflation will remain at this lower level as long as the unemployment gap persists, but it will return to its longer-run expected level once unemployment returns to the SPU.

Relationship between the Longer-Run Unemployment Rate and the Stable-Price Unemployment Rate

Relevant changes to the underlying structure of the economy that are expected to persist in the longer run will affect both the LRU and the SPU. However, certain kinds of

⁹ See Ball and Mankiw (2002).

¹⁰ The assumption of anchored inflation expectations is probably not reasonable before the late 1990s. Before this period, survey measures of longer-term inflation expectations did not appear to be stable. With fluctuations in longer-term inflation expectations, a more appropriate empirical specification for forecasting inflation might be a so-called accelerationist Phillips curve, in which the *change* in the inflation rate is related to the level of the unemployment rate. In this specification, the SPU is generally referred to as the nonaccelerating inflation rate of unemployment, or NAIRU, because temporary deviations of unemployment from the NAIRU push inflation permanently higher or lower.

An additional practical consideration that attends estimation of empirical inflation equations is whether there is a nonlinear relationship between inflation and the unemployment rate gap; for some recent investigations of this topic, see Babb and Detmeister (2017); Hooper, Mishkin, and Sufi (2019); and Ashley and Verbrugge (2019).

temporary factors can influence only the SPU, thereby driving a wedge between the two benchmarks. If the wedge between the SPU and LRU was expected to persist for several years, policymakers might view the appropriate benchmark for the current setting of monetary policy to be different from their estimates of the LRU. That said, in the long run the Committee achieves its inflation objective, and so unemployment would be equal to the SPU and the LRU.

Examples of transitory shocks that could drive a wedge between the SPU and the LRU include temporary changes in the following: desired markups or labor market functioning, trend productivity growth, and government policies that affect labor supply. A cyclical rise in firms' desired price markup causes the SPU to increase relative to the LRU.¹¹ An acceleration in trend productivity could lead to robust job creation without cost and inflationary pressures, thereby lowering the SPU relevant for current price pressures relative to the LRU.¹² A transitory increase in the degree of mismatch between the skill requirements of jobs and the skills of job seekers will increase the SPU relative to the LRU, as would a temporary extension of unemployment benefits.¹³

II. Selected Measures of Unemployment Rate Benchmarks

This section describes several prominent unemployment rate benchmarks, noting where we would place them in our taxonomy. We first consider measures used within the Federal Reserve System—namely, in the FOMC's Summary of Economic Projections (SEP), in the Board staff's Tealbook, and by the various Reserve Banks. We then describe measures reported by the Congressional Budget Office (CBO), those obtained

¹¹ In general, changes in the transmission of labor costs to pressures on prices will move the SPU. That is, the SPU entering a Phillips curve implicitly folds in cyclical price pressures from sources apart from those related to labor costs.

¹² The late 1990s is a recent example of a period with robust productivity growth, low rates of unemployment, and moderate price inflation. Indeed, Crump and others (2019) and Petrosky-Nadeau and Valletta (2019) show estimates of the SPU falling relative to the LRU and remaining below it until the start of the Great Recession.

¹³ Barnichon and Figura (2010) document a large movement in so-called matching efficiency during the Great Recession, which they attribute to a significant change in the composition of the pool of job seekers. See also Yellen (2016) and Hall and Schulhofer-Wohl (2018).

from dynamic stochastic general equilibrium (DSGE) models, estimates from state-space models, and measures reported in surveys of professional forecasters.

Summary of Economic Projections

The SEP is the quarterly economic projections of individual FOMC participants.¹⁴ Since 2009, the SEP had reported estimates of an LRU, which is described as the rate “to which a policymaker expects the economy to converge over time—maybe in five or six years—in the absence of further shocks and under appropriate monetary policy.” This description appears most consistent with the LRU in our taxonomy.

Tealbook

The benchmark unemployment rate in the Tealbook, which the Board’s staff calls the “natural rate of unemployment,” is a judgmental estimate that we think is best categorized as an SPU.¹⁵ In addition to being informed by the behavior of nominal wage growth and price inflation, the Tealbook’s estimate is informed by structural factors affecting the labor market, such as changes in the demographic and educational composition of the workforce, as well as by transitory factors, such as temporary extensions of unemployment insurance benefits or changes in the efficiency of matching job seekers and job vacancies.

Measures Used by Reserve Banks

Most of the Reserve Banks consider at least one measure that is best described as an LRU. In addition, several Banks also consider measures that can be categorized as SPUs. Some Banks also noted that they monitor estimates from surveys of professional forecasters.

A number of Banks rely on multiple measures for their policy discussions, with at least one SPU and one LRU. Many emphasized that SPU measures were helpful for

¹⁴ For further information, see <https://www.federalreserve.gov/monetarypolicy/timeline-summary-of-economic-projections.htm>.

¹⁵ For background on the Tealbook’s framework for analyzing inflation, see Detmeister, Laforte, and Rudd (2014). For a description of the various types of analysis that the Board’s staff considers when determining the natural rate of unemployment, see Fallick and Rudd (2012).

assessing cyclical pressures on price inflation. Many Banks primarily use measures that are best described as LRUs. A number of Banks in this group assess the LRU by evaluating trends in labor market outcomes for different groups and then adjusting a baseline measure to account for the past and expected future paths of these trends.

Congressional Budget Office

The CBO defines its natural rate of unemployment as “the rate [of unemployment] that arises from all sources other than fluctuations in demand associated with business cycles.”¹⁶ The CBO publishes two measures, a “long run” and a “short run” natural rate, though in practice the estimates are identical until 2008.

In our assessment, the CBO’s measures are hybrids of our two broad concepts. From 1948 to the mid-1980s, both of the CBO’s natural rates would seem to be versions of an SPU, as they are derived from a Phillips curve framework that uses the unemployment rate of married men as a single summary indicator of resource utilization. From the mid-1980s forward, the CBO’s long-run natural rate is an LRU because it evolves based on changes in the relative size and potential labor force participation rates of different groups (defined according to age, sex, education, and race). The long-run estimate is anchored to 2005, a period in which the CBO judges the labor market to have been roughly at its maximum sustainable level. The CBO’s short-run natural rate estimate is best characterized as an SPU, because it rises during the Great Recession to reflect extensions of unemployment insurance benefits and increases in mismatch and then falls back to the long-run estimate in 2014 when the influences of these factors are assumed to have returned to normal.¹⁷

Dynamic Stochastic General Equilibrium Models with Unemployment

Some macroeconomic models designed more specifically for the study of monetary policy—New Keynesian DSGE models with frictions in the setting of prices

¹⁶ Shackleton (2018) is the most recent publication describing the CBO’s natural rate.

¹⁷ Although the CBO’s long-run natural rate also exhibits an apparent transitory increase, we still consider it to be an LRU, as the CBO attributes those movements to *permanent* effects of the Great Recession, such as the erosion of skills and stigma that can result from long-term unemployment.

and nominal wages, for instance—have incorporated a labor market featuring unemployment. In these models, the LRU corresponds to the steady-state rate of unemployment, while the SPU is defined in different ways. In many instances, the model’s dynamics are obtained by linearly approximating the model in the neighborhood of the steady state, and the SPU in the model’s Phillips curve is the steady-state rate of unemployment; in other words, the SPU and the LRU are identical.¹⁸ Another approach is to define the SPU as the rate of unemployment that would result if wages and prices were fully flexible. In this case, the SPU will move with transitory shocks to the economy that alter the level of activity that would occur if wage and price setting were frictionless.¹⁹

State-Space Models

Because an unemployment rate benchmark is not observable, a common approach is to model it as a latent process within a larger state-space model. These models can be divided naturally into the two categories of our taxonomy. Models that estimate LRUs typically focus on trends in the labor market—for example, using data on labor market gross flows or disaggregated unemployment rates—and do not use information on price inflation or nominal wage growth.²⁰

There are also a number of state-space models that estimate versions of an SPU, insofar as the latent trend in unemployment is informed by data on price inflation, nominal wage growth, or both (typically through the inclusion of some type of Phillips curve relation).²¹ Finally, a few recent models estimate both an LRU and an SPU. In these models, detailed labor market information informs an estimate of the LRU, while

¹⁸ See, for example, Ravenna and Walsh (2008) and Galí (2011).

¹⁹ See, for example, Gertler, Sala, and Trigari (2008) and Galí, Smets, and Wouters (2012).

²⁰ Examples of models estimating LRUs include Tasci (2012) and Hornstein and Kudlyak (2019).

²¹ Examples of models estimating SPUs include King, Stock, and Watson (1995); Laubach (2001); Fleischman and Roberts (2011); Gordon (2013); Lubik and Matthes (2015); and the SS-PF model reported in the Tealbook.

data on inflation and inflation expectations inform the variation of the SPU around the estimated LRU.²²

Professional Forecasters

Estimates of unemployment rate benchmarks are also available from professional forecasters. For these surveys, such as the Blue Chip Economic Indicators or the Survey of Primary Dealers, a variety of forecast horizons are included in the survey.²³ Long-horizon forecasts from these surveys would be classified as LRUs, as the forecast horizon is either far in the future (for example, the five-year average beginning six to seven years in the future) or explicitly designated as the “longer run.” As another example, the Survey of Professional Forecasters queries respondents specifically about their estimate of a NAIRU. This concept therefore falls into the SPU category.

III. Risks Associated with Unemployment below the Longer-Run Unemployment Rate but above the Stable-Price Unemployment Rate

In general, there are potential costs and benefits associated with the unemployment rate deviating persistently from a benchmark rate, beyond the risks of undesirable inflation outcomes or the unanchoring of inflation expectations.²⁴ This section focuses on the scenario where the unemployment rate is below the level thought to prevail in the longer run, but not low enough to bring inflation back up to the Committee’s inflation objective over the next several years. This scenario plausibly describes the conditions faced by the FOMC in 2019 where the unemployment rate was low and inflationary pressures appeared muted.

In some structural models, an unemployment rate below the LRU is associated with various inefficiencies. For example, it might result in inefficient allocation of effort across work versus other endeavors such as human capital building, job search, and

²² See Berge and Nekarda (2018), Crump and others (2019), and Petrosky-Nadeau and Valletta (2019).

²³ The Blue Chip also occasionally includes a special question asking for respondents’ estimates of a NAIRU. The most recent survey with such a question was in April 2019.

²⁴ Aaronson and others (2019) provide an in-depth treatment of potential costs and benefits.

leisure.²⁵ These endeavors do not necessarily compromise attaining the Federal Reserve’s dual-mandate objectives, and so it is not clear what role they should play in monetary policy deliberations. However, there are other potential costs associated with unemployment below the LRU that arguably do have dual-mandate implications. For example, unemployment that is too low for too long could lead to excessive risk-taking in financial markets or could distort incentives in favor of short-term economic gains at the expense of longer-run investments.²⁶

Similarly, in some structural models, low unemployment may provide longer-run benefits over and above the likely short-term benefits it affords to many individuals.²⁷ For example, a tight labor market might raise labor force attachment (by creating more stable employment relationships), create incentives for firms to introduce training programs for workers, and improve job matches to better align worker and firm preferences.²⁸ Moreover, these benefits might accrue especially to disadvantaged groups or regions.²⁹ Alternatively, improvements in productivity might result from investments in labor-saving technologies.

IV. Conclusion

This paper proposed two broad categories of unemployment rate benchmarks for monetary policymaking, the LRU and the SPU. The LRU is the rate expected to prevail after the economy has fully adjusted to business cycle shocks. The SPU is the rate of unemployment such that there are no upward or downward pressures on price inflation apart from those stemming from underlying inflation or arising from supply shocks—that

²⁵ For empirical evidence on how school enrollment may change in response to a tight labor market, see Laeven and Popov (2016); Charles, Hurst, and Notowidigdo (2018); and Cascio and Narayan (2019).

²⁶ For example, unemployment running below the LRU may coincide with excessive borrowing by households or firms, or excessively compressed risk premiums in asset markets. Alternatively, unemployment persistently below the LRU could lead businesses to misjudge the sustainability of the current level of economic activity, with the result that they postpone investments (such as maintenance, reorganization of production, or research and development) that would be beneficial in the longer run. Outcomes such as these might occur, for example, because agents overweight the recent past relative to the historical norm and thus overextrapolate recent economic performance.

²⁷ For empirical evidence on whether the benefits of a tight labor market persist, see Fallick and Krolkowski (2018) and Fleischman, Gallin, and Smith (2018).

²⁸ See, for example, Akerlof, Rose, and Yellen (1988) and Devereux (2002).

²⁹ Okun (1973) is an early analysis of the benefits to a “high pressure” economy. See also Katz and Krueger (1999), Aaronson and others (2019), Weingarden (2017), and Cajner and others (2017).

is, the rate of unemployment such that there is no cyclical pressure on price inflation. In many situations, the two concepts will naturally coincide. For example, both measures change over time in response to structural changes in the economy, such as those related to demographics, industrial and occupational structure, or educational attainment. In addition, the SPU can change in response to certain *transitory* economic shocks—such as shocks to labor market functioning, trend productivity, desired markups, and temporary government policy changes that affect labor supply—causing the SPU to deviate from the LRU.

In practice, these unemployment rate benchmarks, like other concepts associated with the behavior of potential output, are not directly observed and are difficult to infer even with the benefit of hindsight—and harder still in real time. This difficulty presents a challenge because there are benefits and costs associated with persistent deviations of the unemployment rate from its benchmarks.³⁰ The most salient risks that we see as of the fall of 2019 are that unemployment is not sufficiently low to generate sustained inflationary pressure, possibly leading to a decline in long-run inflation expectations, but low enough to result in a buildup of financial imbalances or distort macroeconomic outcomes.

³⁰ Ajello and others (2020) conclude that it is likely preferable to err on the side of lower estimates of an SPU. The memo argues that the costs from assuming an SPU that is too high, which would induce a more restrictive policy stance to ward off inflationary pressures, are greater than assuming a lower value to the SPU in a low interest rate environment with zero-lower-bound concerns.

References

- Aaronson, Daniel, Luojia Hu, Arian Seifoddini, and Daniel G. Sullivan (2015). “Changing Labor Force Composition and the Natural Rate of Unemployment,” Chicago Fed Letter 338. Chicago: Federal Reserve Bank of Chicago, <https://www.chicagofed.org/publications/chicago-fed-letter/2015/338>.
- Aaronson, Stephanie R., Mary C. Daly, William L. Wascher, and David W. Wilcox (2019). “Okun Revisited: Who Benefits Most from a Strong Economy?” paper presented at the Brookings Papers on Economic Activity Conference, held at the Brookings Institution, Washington, March 7–8, <https://www.brookings.edu/wp-content/uploads/2019/03/Okun-Revisited-Who-Benefits-Most-From-a-Strong-Economy.pdf>.
- Aaronson, Stephanie, Bruce Fallick, Christopher Nekarda, and William Wascher (2012). “Assessing Conditions in the Labor Market,” memorandum to the Federal Open Market Committee, Board of Governors of the Federal Reserve System, Division of Research and Statistics, November 30.
- Abraham, Katharine G., and John C. Haltiwanger (2019). “How Tight Is the Labor Market?” paper prepared for the Conference on Monetary Policy Strategies, Tools, and Communications Practices, Federal Reserve Bank of Chicago, June 5, <https://www.chicagofed.org/~media/others/events/2019/monetary-policy-conference/how-tight-labor-market-abraham-haltiwanger-pdf.pdf>.
- Ajello, Andrea, Isabel Cairo, Vasco Curdia, Thomas Lubik, and Albert Queralto (2020). “Monetary Policy Tradeoffs and the Federal Reserve’s Dual Mandate,” Finance and Economics Discussion Series 2020-066. Washington: Board of Governors of the Federal Reserve System, August, 27.
- Akerlof, George A., Andrew K. Rose, and Janet L. Yellen (1988). “Job Switching and Job Satisfaction in the U.S. Labor Market,” *Brookings Papers on Economic Activity*, no. 2, pp. 495–594, https://www.brookings.edu/wp-content/uploads/1988/06/1988b_bpea_akerlof_rose_yellen_ball_hall.pdf.
- Ashley, Richard A., and Randal Verbrugge (2019). “Variation in the Phillips Curve Relation across Three Phases of the Business Cycle,” Working Paper Series 19-09. Cleveland: Federal Reserve Bank of Cleveland, May, <https://www.clevelandfed.org/en/newsroom-and-events/publications/working-papers/2019-working-papers/wp-1909-variation-in-the-phillips-curve-relation-across-business-cycle.aspx>.
- Babb, Nathan R., and Alan K. Detmeister (2017). “Nonlinearities in the Phillips Curve for the United States: Evidence Using Metropolitan Data,” Finance and Economics Discussion Series 2017-070. Washington: Board of Governors of the Federal Reserve System, June, <https://doi.org/10.17016/FEDS.2017.070>.

- Ball, Laurence, and N. Gregory Mankiw (2002). “The NAIRU in Theory and Practice,” *Journal of Economic Perspectives*, vol. 16 (Fall), pp. 115–36.
- Barnichon, Regis, and Andrew Figura (2010). “What Drives Movements in the Unemployment Rate? A Decomposition of the Beveridge Curve,” Finance and Economics Discussion Series 2010-48. Washington: Board of Governors of the Federal Reserve System, August, <https://www.federalreserve.gov/pubs/feds/2010/201048/201048pap.pdf>.
- Barnichon, Regis, and Geert Mesters (2018). “On the Demographic Adjustment of Unemployment,” *Review of Economics and Statistics*, vol. 100 (May), pp. 219–31.
- Berge, Travis, and Christopher Nekarda (2018). “Introducing the OUI Slack Model,” internal memorandum, Board of Governors of the Federal Reserve System, Division of Research and Statistics, October.
- Board of Governors of the Federal Reserve System (2012). “Transcript of Chairman Bernanke’s Press Conference,” January 25, <https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20120125.pdf>.
- Cajner, Tomaz, Tyler Radler, David Ratner, and Ivan Vidangos (2017). “Racial Gaps in Labor Market Outcomes in the Last Four Decades and over the Business Cycle,” Finance and Economics Discussion Series 2017-071. Washington: Board of Governors of the Federal Reserve System, June, <https://doi.org/10.17016/FEDS.2017.071>.
- Cascio, Elizabeth U., and Ayushi Narayan (2019). “Who Needs a Fracking Education? The Educational Response to Low-Skill Biased Technological Change,” unpublished paper, Dartmouth College, July, https://www.dartmouth.edu/~eucascio/cascio&narayan_fracking_latest.pdf.
- Charles, Kerwin Kofi, Erik Hurst, and Matthew J. Notowidigdo (2018). “Housing Booms and Busts, Labor Market Opportunities, and College Attendance,” *American Economic Review*, vol. 108 (October), pp. 2947–94.
- Crump, Richard K., Stefano Eusepi, Marc Giannoni, and Ayşegül Şahin (2019). “A Unified Approach to Measuring u^* ,” paper presented at the Brookings Papers on Economic Activity Conference, held at the Brookings Institution, Washington, March 7–8, <https://www.brookings.edu/wp-content/uploads/2019/03/A-Unified-Approach-to-Measuring-u.pdf>.
- Daly, Mary C., Bart Hobijn, Ayşegül Şahin, and Robert G. Valletta (2012). “A Search and Matching Approach to Labor Markets: Did the Natural Rate of Unemployment Rise?” *Journal of Economic Perspectives*, vol. 26 (Summer), pp. 3–26.

- Detmeister, Alan, Jean-Philippe Laforte, and Jeremy Rudd (2014). “The Staff’s Outlook for Price Inflation,” memorandum to the Federal Open Market Committee, Board of Governors of the Federal Reserve System, Division of Research and Statistics, January 17.
- Devereux, Paul J. (2002). “Occupational Upgrading and the Business Cycle,” *Labour*, vol. 16 (September), pp. 423–52.
- Faberman, R. Jason, Andreas Mueller, Ayşegül Şahin, and Giorgio Topa (2019). “The Shadow Margins of Labor Market Slack,” unpublished paper, May.
- Fallick, Bruce, and Pawel Krolikowski (2018). “Hysteresis in Employment among Disadvantaged Workers,” Working Paper Series 18-01. Cleveland: Federal Reserve Bank of Cleveland, February, <https://www.clevelandfed.org/en/newsroom-and-events/publications/working-papers/2018-working-papers/wp-1801-hysteresis-in-employment-among-disadvantaged-workers.aspx>.
- Fallick, Bruce, and Jeremy Rudd (2012). “The Staff’s Assessment of Economic Slack,” memorandum to the Federal Open Market Committee, Board of Governors of the Federal Reserve System, Division of Research and Statistics, August 28.
- Fleischman, Charles A., Joshua Galin, and Christopher L. Smith (2018). “Labor Market Persistence: A Cohort-Level Analysis,” unpublished paper, Board of Governors of the Federal Reserve System, Division of Research and Statistics.
- Fleischman, Charles A., and John M. Roberts (2011). “From Many Series, One Cycle: Improved Estimates of the Business Cycle from a Multivariate Unobserved Components Model,” Finance and Economics Discussion Series 2011-46. Washington: Board of Governors of the Federal Reserve System, October, <https://www.federalreserve.gov/pubs/feds/2011/201146/201146pap.pdf>.
- Galí, Jordi (2011). *Unemployment Fluctuations and Stabilization Policies: A New Keynesian Perspective*. Cambridge, Mass.: MIT Press.
- Galí, Jordi, Frank Smets, and Rafael Wouters (2012). “Unemployment in an Estimated New Keynesian Model,” in Daron Acemoglu and Michael Woodford, eds., *NBER Macroeconomics Annual 2011*, vol. 26. Chicago: University of Chicago Press, pp. 329–60, <https://www.nber.org/chapters/c12424.pdf>.
- Gertler, Mark, Luca Sala, and Antonella Trigari (2008). “An Estimated Monetary DSGE Model with Unemployment and Staggered Nominal Wage Bargaining,” *Journal of Money, Credit and Banking*, vol. 40 (December), pp. 1713–64.
- Gordon, Robert J. (2013). “The Phillips Curve Is Alive and Well: Inflation and the NAIRU during the Slow Recovery,” NBER Working Paper Series 19390. Cambridge, Mass.: National Bureau of Economic Research, August, <https://www.nber.org/papers/w19390.pdf>.

- Hall, Robert E., and Sam Schulhofer-Wohl (2018). “Measuring Job-Finding Rates and Matching Efficiency with Heterogeneous Job-Seekers,” *American Economic Journal: Macroeconomics*, vol. 10 (January), pp. 1–32.
- Hooper, Peter, Frederic S. Mishkin, and Amir Sufi (2019). “Prospects for Inflation in a High Pressure Economy: Is the Phillips Curve Dead or Is It Just Hibernating?” NBER Working Paper Series 25792. Cambridge, Mass.: National Bureau of Economic Research, May, <https://www.nber.org/papers/w25792.pdf>.
- Hornstein, Andreas, and Marianna Kudlyak (2019). “Aggregate Labor Force Participation and Unemployment and Demographic Trends,” Working Paper Series 19-08. Richmond: Federal Reserve Bank of Richmond, March, https://www.richmondfed.org/-/media/richmondfedorg/publications/research/working_papers/2019/wp19-08.pdf.
- Katz, Lawrence F., and Alan B. Krueger (1999). “The High-Pressure U.S. Labor Market of the 1990s,” *Brookings Papers on Economic Activity*, no. 1, pp. 1–87, https://www.brookings.edu/wp-content/uploads/1999/01/1999a_bpea_katz.pdf.
- King, Robert G., James H. Stock, and Mark W. Watson (1995). “Temporal Instability of the Unemployment-Inflation,” Federal Reserve Bank of Chicago, *Economic Perspectives*, vol. 19 (May), pp. 2–12, <https://www.chicagofed.org/publications/economic-perspectives/1995/04mayjune1995-part1-king-et-al>.
- Laeven, Luc, and Alexander Popov (2016). “A Lost Generation? Education Decisions and Employment Outcomes during the U.S. Housing Boom-Bust Cycle of the 2000s,” *American Economic Review*, vol. 106 (May), pp. 630–35.
- Laubach, Thomas (2001). “Measuring the NAIRU: Evidence from Seven Economies,” *Review of Economics and Statistics*, vol. 83 (May), pp. 218–31.
- Lubik, Thomas A., and Christian Matthes (2015). “Time-Varying Parameter Vector Autoregressions: Specification, Estimation, and an Application,” Federal Reserve Bank of Richmond, *Economic Quarterly*, vol. 101 (Fourth Quarter), pp. 323–52, <http://doi.org/10.21144/eq1010403>.
- Okun, Arthur (1973). “Upward Mobility in a High-Pressure Economy,” *Brookings Papers on Economic Activity*, no. 1, pp. 207–52, https://www.brookings.edu/wp-content/uploads/1973/01/1973a_bpea_okun_fellner_greenspan.pdf.
- Petrosky-Nadeau, Nicolas, and Robert G. Valletta (2019). “Unemployment: Lower for Longer?” FRBSF Economic Letter 2019-21. San Francisco: Federal Reserve Bank of San Francisco, August, <https://www.frbsf.org/economic-research/files/el2019-21.pdf>.

- Petrosky-Nadeau, Nicolas, and Etienne Wasmer (2017). *Labor, Credit, and Goods Markets: The Macroeconomics of Search and Unemployment*. Cambridge, Mass.: MIT Press.
- Ravenna, Federico, and Carl E. Walsh (2008). “Vacancies, Unemployment, and the Phillips Curve,” *European Economic Review*, vol. 52 (November), pp. 1494–521.
- Rogerson, Richard (1997). “Theory Ahead of Language in the Economics of Unemployment,” *Journal of Economic Perspectives*, vol. 11 (Winter), pp. 73–92.
- Shackelton, Robert (2018). “Estimating and Projecting Potential Output Using CBO’s Forecasting Growth Model,” Working Paper Series 2018-03. Washington: Congressional Budget Office, February, <https://www.cbo.gov/system/files/115th-congress-2017-2018/workingpaper/53558-cbosforecastinggrowthmodel-workingpaper.pdf>.
- Svensson, Lars E. O. (2015). “The Possible Unemployment Cost of Average Inflation below a Credible Target,” *American Economic Journal: Macroeconomics*, vol. 7 (January), pp. 258–96.
- Tasci, Murat (2012). “The Ins and Outs of Unemployment in the Long Run: Unemployment Flows and the Natural Rate,” Working Paper Series 12-24. Cleveland: Federal Reserve Bank of Cleveland, November, <https://www.clevelandfed.org/newsroom-and-events/publications/working-papers/2012-working-papers/wp-1224-the-ins-and-outs-of-unemployment-in-the-long-run-unemployment-flows-and-the-natural-rate.aspx>.
- Tüzemen, Didem (2019). “Job Polarization and the Natural Rate of Unemployment in the United States,” *Economic Letters*, vol. 175 (February), pp. 97–100.
- Weingarden, Alison (2017). “Labor Market Outcomes in Metropolitan and Non-Metropolitan Areas: Signs of Growing Disparities,” FEDS Notes. Washington: Board of Governors of the Federal Reserve System, September 25, <https://doi.org/10.17016/2380-7172.2063>.
- Yellen, Janet L. (2016). “The Federal Reserve’s Monetary Policy Toolkit: Past, Present, and Future,” remarks at “Designing Resilient Monetary Policy Frameworks for the Future,” a symposium sponsored by the Federal Reserve Bank of Kansas City, held in Jackson Hole, Wyo., August 26, <https://www.federalreserve.gov/newsevents/speech/files/yellen20160826a.pdf>.