# Comments and Discussion

COMMENT BY

**HIE JOO AHN**[1] Michaillat and Saez develop a theoretical framework to estimate the unemployment rate at full employment, referred to as the FERU. The FERU represents the unemployment rate that achieves a socially efficient allocation of labor. Specifically, it is the unemployment rate at which social output is maximized by minimizing the unproductive uses of labor, such as job searching and recruiting. The FERU thus represents the solution to a social planner's optimization problem, where labor is allocated to maximize social welfare.

To derive the FERU, the authors make the following assumptions. First, the social planner allocates labor to maximize social welfare, with social output as the determinant of social welfare. Second, the social planner has the entire labor force at their disposal for production, assuming a fixed or acyclical labor force participation rate. Third, filling a job vacancy requires one full-time worker. Fourth, the net value of job seekers' home production, accounting for the psychological cost of idleness, is negligible. Fifth, the Beveridge curve has a rectangular hyperbolic shape, implying that unemployed job seekers and recruiters contribute equally to forming job matches. Sixth, the social planner seeks to maximize social output by minimizing the sum of the unemployment and vacancy rates, subject to the trade-off between the two rates as characterized by the rectangular hyperbolic Beveridge curve. Under these assumptions, the optimal market

1. I thank Stephanie Aaronson, Travis Berge, Andrew Figura, Glenn Follette, James Hamilton, and Jeremy Rudd for their helpful comments and suggestions for this discussion. Opinions expressed herein are those of the author alone and do not necessarily reflect the views of the Board of Governors of the Federal Reserve System.

tightness—the ratio of vacancy to unemployment—is one and the FERU is the geometric average of the unemployment and vacancy rates. Between 1930 and 2024, the FERU is fairly stable and suggests a generally slack labor market.

I appreciate the authors' work in developing a rigorous conceptual framework for an indicator of full employment. The formula for the FERU is simple and straightforward, making it accessible for policymakers and forecasters as a starting point for discussions on economic slack. While the validity of the FERU may be questioned due to several bold assumptions used to compute it, the transparent derivation presented in this paper, together with the authors' earlier paper (Michaillat and Saez 2021), provides a solid foundation for evaluating risks associated with the FERU estimate. With this valuable feature in mind, I examine the paper's assumptions and discuss their implications for assessing economic slack.

MATCHING FUNCTION ELASTICITY The assumptions about the matching function underlying the observed Beveridge curve are critical for estimating the FERU, as the optimal degree of labor market tightness depends primarily on the elasticity parameters of the matching function. Based on the observed relationship between the vacancy and unemployment rates, the authors posit that the structural Beveridge curve implied by the matching function is a rectangular hyperbola. This assumption implies that job seekers and recruiters contribute equally to job matching, with the elasticity parameters equal to 0.5 in a constant returns to scale (CRS) matching function. However, different matching functions can generate the observed rectangular hyperbolic Beveridge curve, as demonstrated below.

Consider a two-state model of unemployment with a time-varying separation rate and a CRS matching function of the following form:

$$H = m v^{1-\alpha} u^{\alpha},$$

where $H$ is hires as a fraction of the labor force, $v$ is the vacancy rate, $u$ is the unemployment rate, $\alpha$ is the matching elasticity with respect to unemployed job seekers, $1 - \alpha$ is the matching elasticity with respect to vacancy postings or recruiters, and $m$ is the matching productivity. For notational convenience, the time subscript is suppressed.

Dividing both sides by $u$, the job-finding rate $f$, is written as follows:

$$f = m\left(\frac{v}{u}\right)^{1-\alpha}. \tag{1}$$

Note that $\frac{v}{u}$ is the market tightness (θ). With the job separation rate ($s$), the unemployment rate is approximated with the following formula:

$$u = \frac{s}{s + f}. \tag{2}$$

Plugging equation (1) into equation (2), the unemployment rate is expressed as:

$$u = \frac{s}{s + m\left(\frac{v}{u}\right)^{1-\alpha}}. \tag{3}$$

One can solve for the equilibrium market tightness and unemployment rate given the vacancy and separation rates when the elasticity parameter and matching productivity are fixed. Equation (3) implies there exists a set of [$\alpha$, $m$, $s$] values that satisfy the rectangular hyperbolic Beveridge curve relationship, $uv = A$.[2] For instance, even when the structural Beveridge curve is not a rectangular hyperbola ($\alpha \neq 0.5$) and hence optimal market tightness is not one, this model with a time-varying $s$ can still produce a rectangular hyperbolic relationship between $v$ and $u$.

For example, consider an economy with $\alpha = 0.7$ and $m = 0.3$. In period 1, the vacancy rate is 4 percent and the separation rate is 1.25 percent, which results in a job-finding rate of 30 percent, an unemployment rate of 4 percent, and market tightness of one. Suppose that a contractionary shock hits the labor market in period 2, lowering the vacancy rate to 2 percent and raising the separation rate to 1.75 percent. The job-finding rate drops from 30 percent to 20 percent, and the unemployment rate rises to 8 percent. Note that the relationship between $v$ and $u$ still lies along a rectangular hyperbola, as the vacancy rate doubles when the unemployment rate is halved. In this economy, the social planner's problem is to minimize $(v + u)$ subject to $H_0 = mv^{0.3} u^{0.7}$, where $H_0$ is a constant. Since unemployed workers

2. Intuitively, plugging in $v = \frac{A}{u}$ into equation (3) gives the unemployment rate as a function of [$\alpha$, $m$, $s$]. Previous studies point to cyclicality in the job separation rate (e.g., Fujita and Ramey 2009; Ahn and Hamilton 2020) and in matching productivity (e.g., Barnichon and Figura 2015; Mukoyama, Patterson, and Şahin 2018).

contribute more to job matches than recruiters, the social planner wants a higher $u$ relative to $v$, resulting in optimal market tightness of $\theta^* = \frac{3}{7}$ and hence a higher FERU than the baseline. Note that market tightness at full employment is essentially determined by the elasticity parameters. The countercyclical separation rate helps fit a rectangular hyperbolic empirical Beveridge curve.[3]

This example demonstrates that the level of the FERU and the optimal level of labor market tightness can vary significantly depending on the structural characterization of the Beveridge curve. In this context, a more generalized matching function could offer additional insights into the determination of the FERU. The authors address some of these generalized cases in their 2021 paper and provide an interval of FERU estimates based on the structural parameterization in this paper, which I find very useful.

FULL EMPLOYMENT AND CYCLICALITY OF LABOR FORCE PARTICIPATION Using the FERU estimate, one can directly estimate the level of full employment, in particular the employment-to-population (EPOP) ratio at full employment. The EPOP ratio—a key cyclical indicator frequently referenced by policymakers and forecasters (Abraham and Kearney 2020)—is defined as follows:

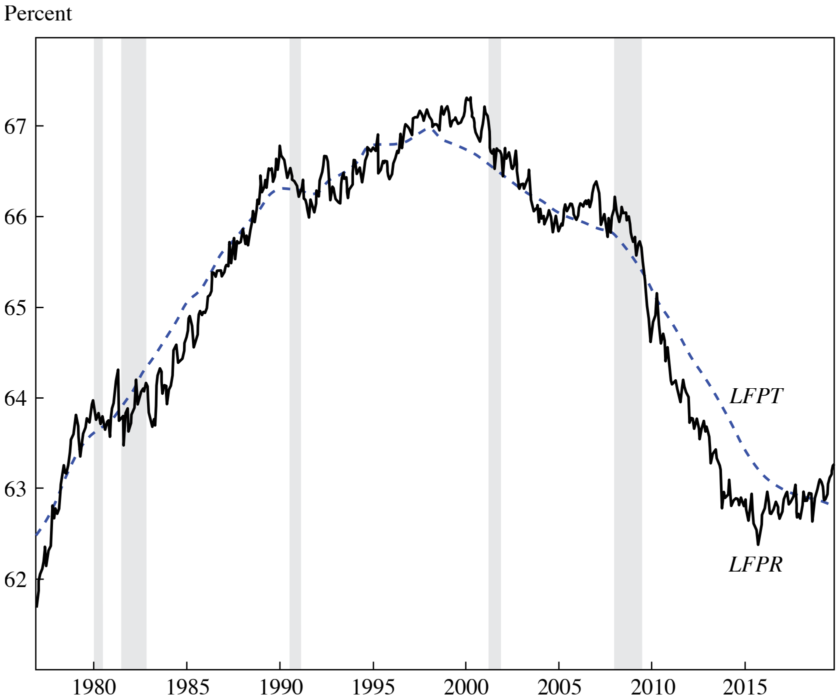
$$EPOP = \left(1 - u\right) \times LFPR, \tag{4}$$

where $u$ is the unemployment rate and the LFPR denotes the labor force participation rate. If the LFPR is acyclical, the EPOP ratio at full employment is primarily determined by the FERU. However, if the LFPR moves with the business cycle, the EPOP ratio at full employment could imply a different conclusion about the economy's cyclical position compared to what the FERU indicates.

Recent empirical research suggests that the LFPR is procyclical, though its cyclicality is muted relative to that of the unemployment rate (Cajner, Coglianese, and Montes 2021; Hobijn and Şahin 2021). Therefore, it is important to distinguish between the cyclical component of the LFPR and its long-term structural trend that reflects demographic or socioeconomic

3. This example benefited from valuable insights by Andrew Figura and is similar to a case discussed in Figura and Waller (2024). Ahn and Crane (2020) report an elasticity estimate that closely aligns with the one considered in this example.

**Figure 1.** LFPR and LFPR Trend (1976:M12–2019:M12)




Source: Current Population Survey and author's calculations.
Note: The solid line is the LFPR and the dashed line is the LFPT—the trend labor force participation rate from Hornstein and Kudlyak (2019) interpolated as a monthly series. Shaded areas denote NBER recessions.

changes in the population. Figure 1 displays the LFPR alongside its trend estimate (hereafter, LFPT) from Hornstein and Kudlyak (2019).[4] The LFPR tends to rise above its trend in the mature phase of an economic expansion.

To estimate the cyclically neutral portion of the EPOP ratio, I replace the LFPR with the LFPT and $u$ with the FERU ($u^*$) to calculate the full-employment EPOP ratio, referred to as the FEEP.

$$FEEP = \left(1 - u^*\right) \times LFPT. \tag{5}$$

4. The trend estimate from Hornstein and Kudlyak (2019) is available as an annual series. I interpolate the annual estimate into a monthly time series.

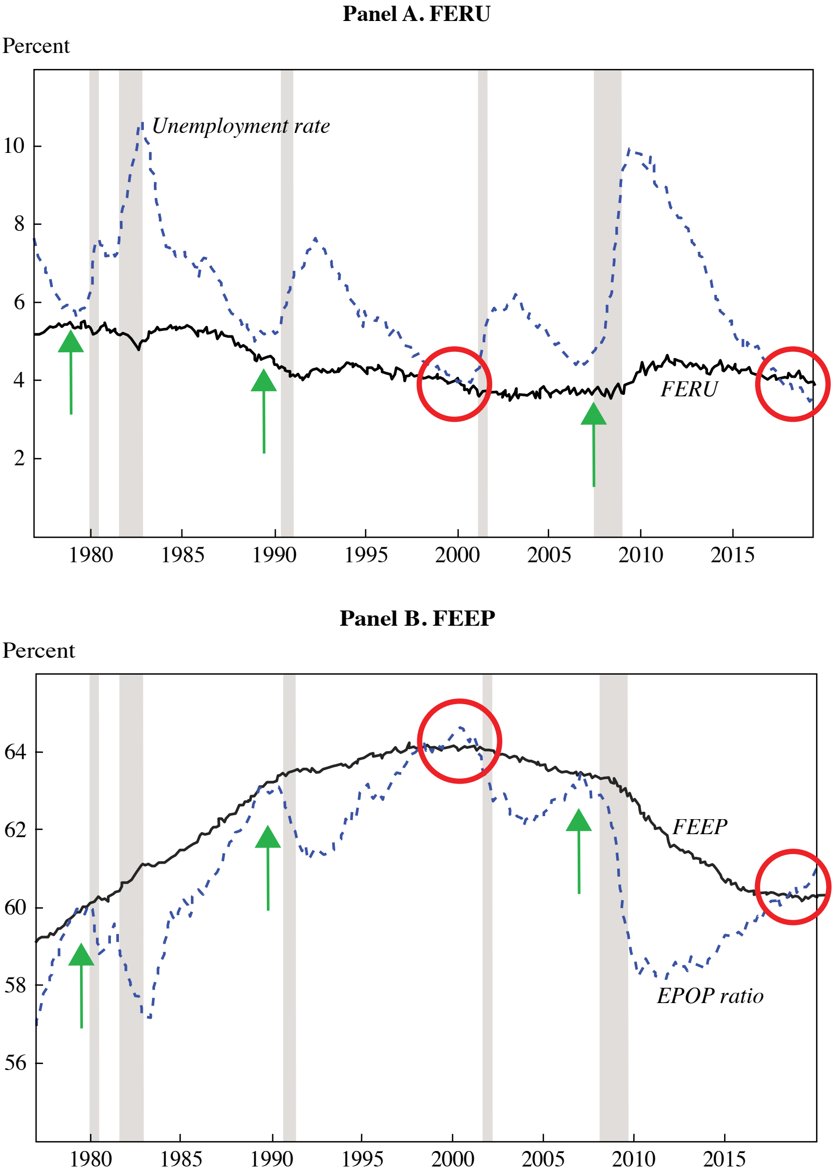
Figure 2 compares the cyclical position in the labor market as measured by the FERU (panel A) and the FEEP (panel B). The circles represent periods when both the FERU and the FEEP indicate full employment, while the arrows mark periods when the FEEP signals full employment but the FERU does not. As shown by the arrows, the FEEP indicates that the labor market reaches full employment toward the end of the expansions, while the FERU identifies fewer such episodes. This implies that the FERU may overestimate overall economic slack compared to the FEEP.

The growth of the FEEP can serve as a benchmark for payroll employment gains, a key indicator of cyclical momentum in the labor market. The cyclically neutral pace of employment gains offers a valuable insight into the economy's cyclical position. The FEEP gains are defined as the first difference in the level of full employment, calculated by multiplying the FEEP by the civilian noninstitutional population.[5] These gains represent the employment increases needed to sustain full employment when the LFPR is cyclically neutral and given population growth. Figure 3 compares the FEEP gains to total payroll gains, revealing a notable pattern: Payroll gains exceed the FEEP gains during economic expansions but fall below them during downturns. As an expansion matures and the economy approaches a recession, payroll gains converge toward the FEEP gains. This pattern suggests that the FEEP gains can indicate both the economy's cyclical position and the risk of a recession. Looking at the COVID-19 era in figure 4, the FEEP suggests that the economy was at full employment from 2022 (panel A), but the narrowed gap between payroll gains and FEEP gains in 2023 (panel B) signals an increased risk of an economic downturn in recent years.

Highlighting the benefits of the simple and transparent FERU formula and its practical utility, I have discussed how the authors' FERU can be extended to estimate the level of full employment. The cyclicality of the LFPR plays a crucial role in assessing full employment. While the authors demonstrate that their FERU formula remains robust to LFPR cyclicality, an extension of FERU that accounts for the cyclicality of participation would offer a more comprehensive evaluation of whether *employment* has reached full employment.

5. I do not explicitly address the difference between employment gains reported in the household survey and payroll gains from the establishment survey, as this difference varies significantly over time.

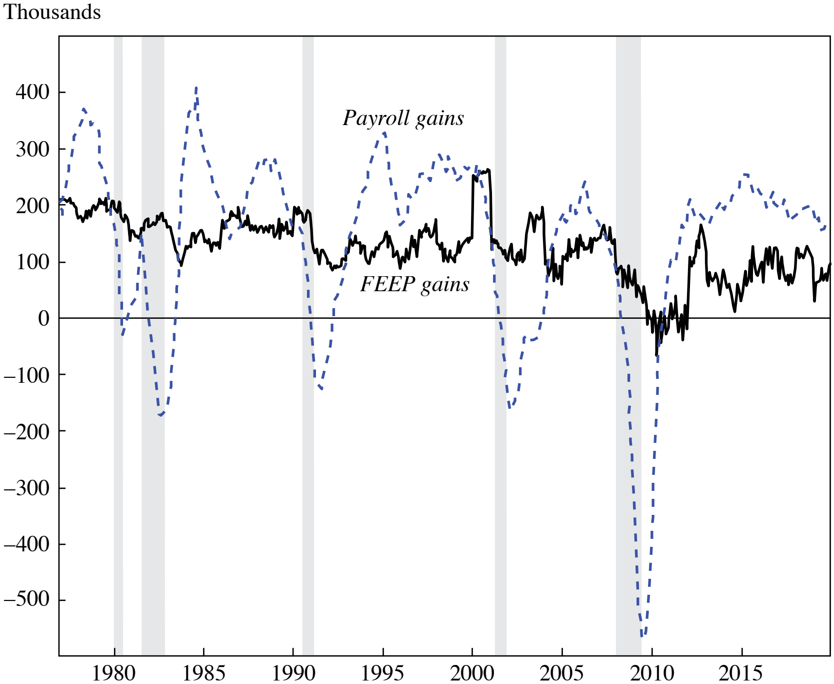
**Figure 2.** FERU and FEEP (1976:M12–2019:M12)




Source: Current Population Survey and author's calculations.

Note: In panel A, the dashed line represents the published unemployment rate, while the solid line shows the FERU. In panel B, the dashed line represents the published EPOP ratio, and the solid line depicts the FEEP. The circles highlight the periods when both measures indicate full employment, and the arrows mark the periods when the FEEP suggests full employment but the FERU does not. Shaded areas denote the NBER recessions.

**Figure 3.** FEEP Gains (1976:M12–2019:M12)

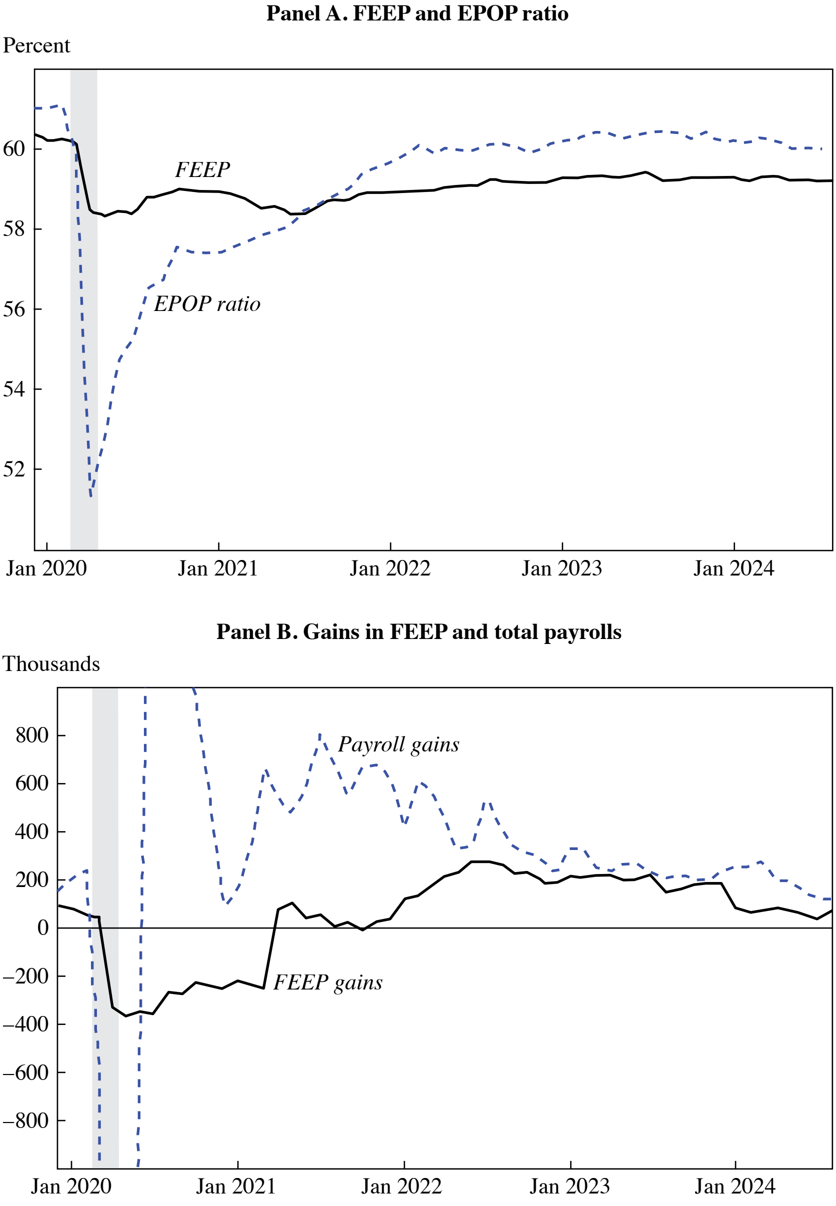



Source: Current Establishment Survey and author's calculations.
Note: The dashed line represents total payroll gains, while the solid line depicts the FEEP gains. Both series are presented as twelve-month moving averages. Shaded areas denote NBER recessions.

BROAD-BASED AND INCLUSIVE FERU Let me now discuss whether the FERU can serve as a benchmark for achieving broad-based and inclusive full employment in the labor market.[6] Reaching this goal requires policymakers to adopt an unemployment benchmark that comprehensively reflects labor market outcomes across diverse worker groups. Incorporating worker heterogeneity into an unemployment rate benchmark is not straightforward, as the authors acknowledge. In this section, I demonstrate that the FERU offers a valuable starting point for assessing the unemployment rate at full employment across different groups of workers.

6. The Federal Reserve updated its monetary policy framework in 2020, redefining maximum employment as a "broad-based and inclusive goal" (Federal Reserve Board 2020). This shift aims to ensure that monetary policy supports economic growth that benefits a wider and more diverse segment of the population.

**Figure 4.** FEEP and FEEP Gains During the COVID-19 Era (2020:M1–2024:M8)




Source: Current Establishment Survey, Current Population Survey, and author's calculations.

Note: In panel A, the dashed line is the EPOP ratio and the solid line is the FEEP. In panel B, the dashed line is total payroll gains and the solid line is the FEEP gains. The three-month moving average of total payroll gains and the twelve-month moving average of FEEP gains are plotted. The shaded areas depict the COVID-19 recession.

Let me begin by discussing race. Notably, the unemployment rates for both white and Black workers, as well as the overall vacancy rate, follow a rectangular hyperbolic Beveridge curve relationship (not shown).[7] Assuming that the core assumptions underlying the FERU hold for both racial groups, I estimate the FERU separately for white and Black workers.[8] Later, I discuss the caveats of this analysis and explore lessons for estimating a broad-based and inclusive FERU.

Figure 5 presents the FERU and unemployment rates by race, highlighting notable differences in the experience of full employment between the two racial groups. Since 1976, the unemployment rate for white workers has consistently reached its FERU during nearly all mature economic expansions except the one preceding the Great Recession. In contrast, the unemployment rate for Black workers did not reach its FERU level until 2019. This disparity suggests that the experience of full employment is significantly different between white and Black workers, and a policy that attempts to reduce the employment shortfall for Black workers may imply inflationary pressure for the overall economy.

However, there is an important caveat to this conclusion: Black workers have a significantly higher job separation rate compared to white workers, and the elasticity parameters in the matching function may differ between the two racial groups.[9] If the matching elasticity with respect to unemployment for Black workers is larger than that for white workers—if unemployed Black workers contributed more (relative to vacancies) to job match creation than unemployed white workers—then given Black workers' higher job separation rate relative to white workers', the FERU for Black workers could be higher than that for white workers.

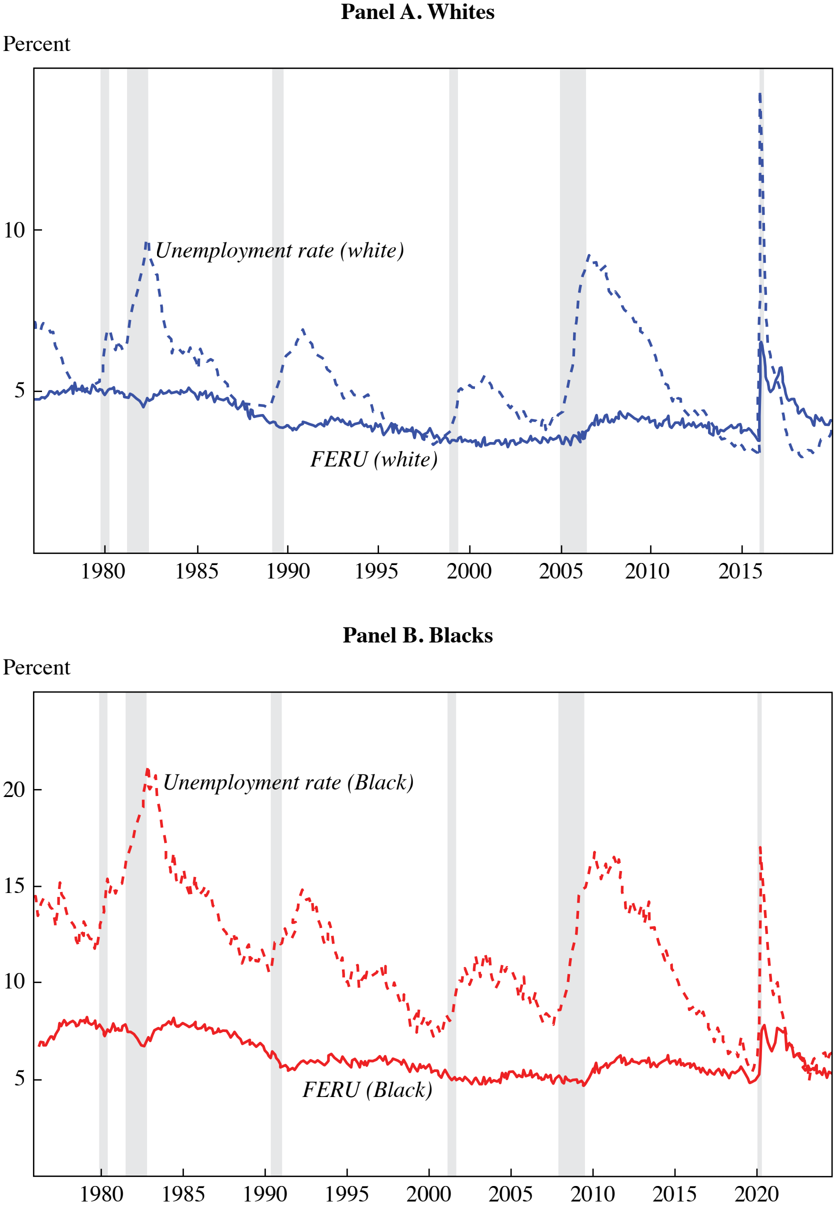
Of course, heterogeneity in labor market outcomes extends beyond race. Indeed, recent research has highlighted that latent heterogeneity not well captured with conventional data has an important effect on labor market dynamics and inequality. For instance, Ahn, Hobijn, and Şahin (2023) demonstrate that the US labor market has the structure of a dual labor market

7. If we take the natural logarithm of the unemployment rates for white and Black workers and compare these values to the logarithm of the vacancy rate, the two racial unemployment rates essentially mirror the logged vacancy rate—a characteristic of a rectangular hyperbola.

8. One assumption for this calculation is that there are no separate job vacancies for white workers and Black workers.

9. Cajner and others (2017) show that the job loss rate is higher among Black workers than white workers, with a significant portion of this disparity remaining unexplained even after accounting for factors such as demographics, education, industry, and occupation. Cairó and Lipton (2023) provide a structural interpretation of the empirical finding from Cajner and others (2017) and assess the effects of monetary policy.

**Figure 5.** FERU by Race (1976:M1–2024:M8)




Source: Current Population Survey and author's calculations.

Note: The solid lines represent the FERU for whites (panel A) and Blacks (panel B). The dashed lines depict unemployment rates for whites (panel A) and Blacks (panel B). Shaded areas are NBER recessions.

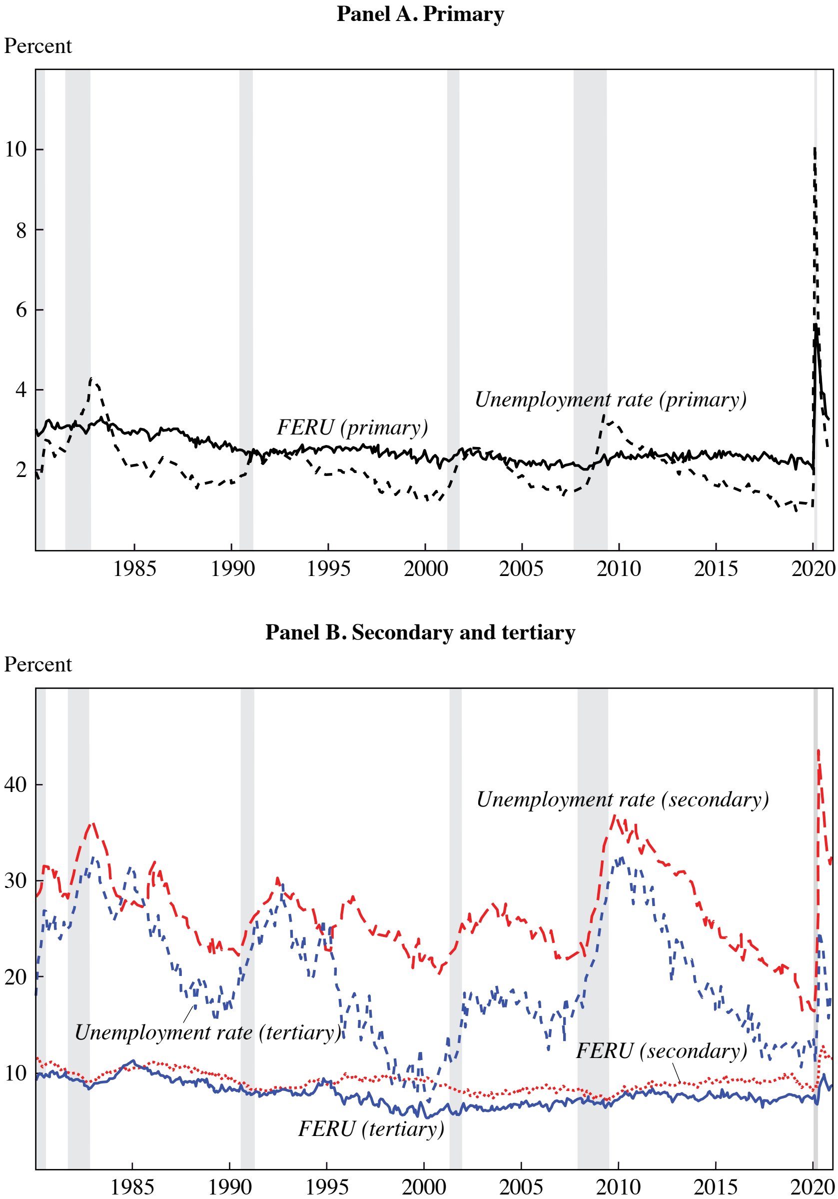
supplemented with a home production segment and hence can be approximated by three latent market segments: the primary market, characterized by job stability and an unemployment rate of around 2 percent; the secondary market, defined by job instability and an unemployment rate of around 25–30 percent; and the tertiary market, which essentially represents a home production segment with low labor force participation and a high unemployment rate of approximately 20 percent. While the unemployment rate of the primary segment is fairly stable, those of the secondary and tertiary markets exhibit strong countercyclicality. Let me make the very strong assumption that the FERU formula can be applied uniformly to all three segments, with workers in each market being exposed to the same aggregate vacancy rate (I will revisit this assumption later). I can then estimate the FERU for each market segment.[10]

Figure 6 displays the FERU estimates for the three segments. The full-employment experiences are very different across the segments. The primary market is almost always in full employment and workers in this segment rarely experience a slack market except in a few severe recessions. But the secondary and tertiary segments are always slack. If the assumptions made to obtain these results are close to the truth, the estimates essentially suggest that the baseline FERU may not represent anyone's full-employment experience.

I am not suggesting that the baseline FERU is not a useful guideline; rather, I want to emphasize that the strong assumptions underlying the analysis in the context of the dual labor market highlight several areas that need further consideration if we want to advance the FERU as a benchmark for broad-based and inclusive labor market growth. One area is heterogeneity in the functioning of labor market. The matching function can vary significantly across different groups of workers with different matching function elasticities among worker groups. Relatedly, job vacancies may be segmented by sector, and recruiting costs can vary across different types of jobs. In addition, the costs of unemployment and the value of home production also differ among workers, further contributing to heterogeneity in what would be full employment for a particular group. A more generalized approach, such as the one proposed in the authors' earlier paper (Michaillat and Saez 2021), could provide a valuable foundation for developing a conceptual framework that yields a broad-based and inclusive FERU.

10. The unemployment rates of the primary and tertiary segments exhibit a roughly rectangular hyperbolic relationship with the vacancy rate.

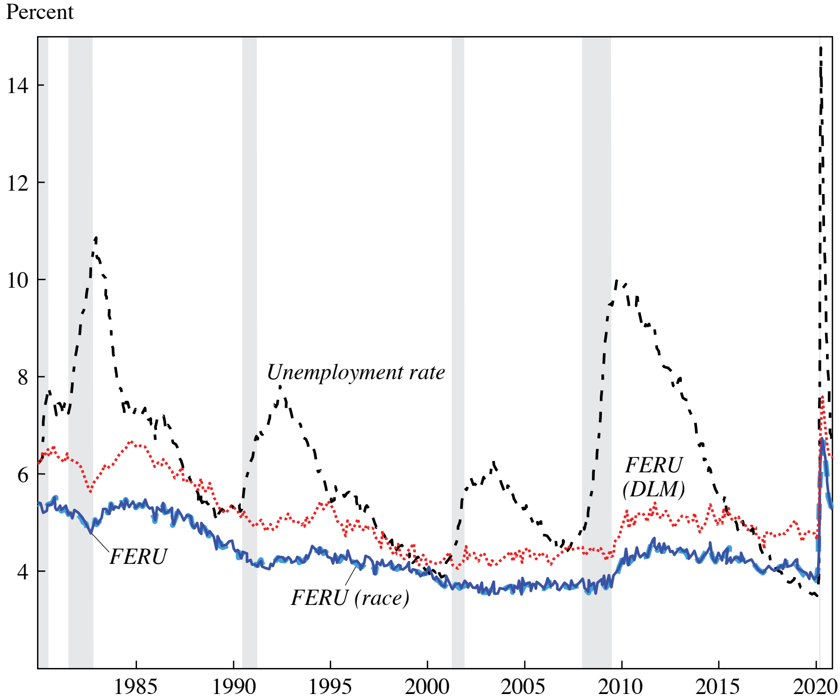
**Figure 6.** FERU by Segment (1980:M1–2020:M12)




Source: Author's calculations.

Note: In panel A, the solid line is the primary FERU, and the dashed line is the primary unemployment rate. In panel B, the dotted line is the secondary FERU, the long-dashed line is the secondary unemployment rate, the solid line is the tertiary FERU, and the short-dashed line is the tertiary unemployment rate. Shaded areas denote NBER recessions.

**Figure 7.** FERU and Heterogeneity (1980:M1–2020:M12)




Source: Author's calculations.

Note: The dash-dot line represents the unemployment rate, while the thick solid line depicts the baseline FERU. The dashed line shows the racial FERU, and the dotted line represents the DLM FERU. Shaded areas denote NBER recessions.

To evaluate the aggregate implications of omitted heterogeneity in the calculation of the FERU, I aggregate the FERU of racial groups and that of latent market segments using their respective population weights and then compare these estimates to the baseline.[11] I refer to the former as the racial FERU and the latter as the dual labor market (DLM) FERU. As shown in figure 7, the racial FERU essentially matches the baseline estimate, while the DLM FERU is notably higher. This finding suggests that the FERU could be higher than the baseline if labor market heterogeneity is comprehensively accounted for.

11. For this calculation, I consider three racial groups—whites, Blacks, and others—ensuring that the populations of these groups collectively sum to the total population.

MEASUREMENT ERRORS AND BIASES IN THE FERU Last, I discuss effects of data measurement errors on the estimation of the FERU. Previous research, including studies by Abowd and Zellner (1985), Feng and Hu (2013), and Ahn and Hamilton (2022), suggests that the unemployment rate is understated because of the presence of measurement errors.[12] These studies provide bias-adjusted estimates of the unemployment rate, which also exhibit a rectangular hyperbolic relationship with the total vacancy rate (not shown). Building on this empirical observation, I estimate the FERU using each bias-adjusted unemployment rate and examine the implications for assessing labor market slack.

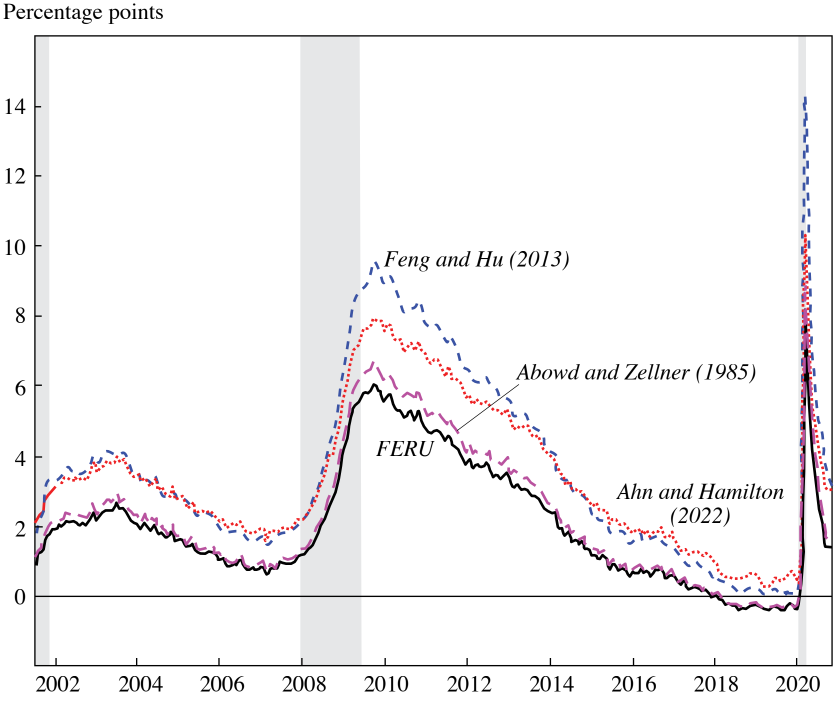
Figure 8 shows the differences between the bias-adjusted unemployment rates and the corresponding FERU estimates, referred to here as the bias-adjusted unemployment rate gaps. These gaps are larger than those calculated using the baseline FERU and the published unemployment rate, especially during periods of high unemployment rate, reflecting the effects of countercyclical measurement errors. This observation suggests that labor market slack may be greater than what is indicated by the baseline FERU when measurement errors are accounted for and highlights the importance of considering measurement errors in the data when assessing the cyclical position of the labor market.

SUMMARY AND CONCLUSION There is much to like about this paper. The simple formula and the transparent assumptions behind the model allow forecasters and policymakers to not only estimate the FERU but also to assess risks associated with the estimate, which is crucial for the risk management aspect of monetary policy. In this discussion, I provide such an assessment of the FERU. The measurement errors imply that the FERU may understate the slack, but all the other cases considered in this discussion suggest that the FERU may overstate the slack.

One final point: The authors have treated the FERU as conceptually distinct from the non-accelerating inflation rate of unemployment and natural rate of unemployment. However, these three measures can empirically coincide with each other. Identifying the theoretical conditions under which they align will be crucial for using the FERU to design and describe optimal monetary policy.

12. The declining response rates in both household and establishment surveys, and particularly in the Job Openings and Labor Turnover Survey (JOLTS), have raised concerns about potential biases in measured unemployment and vacancy rates.

**Figure 8.** Bias-Adjusted Unemployment Rate Gap (2001:M7–2020:M12)




Source: Author's calculations.

Note: The solid line at the bottom depicts the baseline FERU. The long-dashed line shows the FERU estimated using Abowd and Zellner's (1985) bias-adjusted unemployment rate; the dotted line above is the FERU estimated with Ahn and Hamilton's (2022) bias-adjusted unemployment rate; the top short-dashed line is the FERU estimated with Feng and Hu's (2013) bias-adjusted unemployment rate. Shaded areas indicate NBER recessions.

## REFERENCES FOR THE AHN COMMENT


Abowd, John M., and Arnold Zellner. 1985. "Estimating Gross Labor-Force Flows." *Journal of Business & Economic Statistics* 3, no. 3: 254–83.

Abraham, Katharine G., and Melissa S. Kearney. 2020. "Explaining the Decline in the US Employment-to-Population Ratio: A Review of the Evidence." *Journal of Economic Literature* 58, no. 3: 585–643.

Ahn, Hie Joo, and Leland D. Crane. 2020. "Dynamic Beveridge Curve Accounting." Finance and Economics Discussion Series 2020–027. Washington: Board of Governors of the Federal Reserve System.

Ahn, Hie Joo, and James D. Hamilton. 2020. "Heterogeneity and Unemployment Dynamics." *Journal of Business & Economic Statistics* 38, no. 3: 554–69.

Ahn, Hie Joo, and James D. Hamilton. 2022. "Measuring Labor-Force Participation and the Incidence and Duration of Unemployment." *Review of Economic Dynamics* 44: 1–32.

Ahn, Hie Joo, Bart Hobijn, and Ayşegül Şahin. 2023. "The Dual U.S. Labor Market Uncovered." Finance and Economics Discussion Series 2023–031. Washington: Board of Governors of the Federal Reserve System.

Barnichon, Regis, and Andrew Figura. 2015. "Labor Market Heterogeneity and the Aggregate Matching Function." *American Economic Journal: Macroeconomics* 7, no. 4: 222–49.

Cairó, Isabel, and Avi Lipton. 2023. "Labor Market Discrimination and the Racial Unemployment Gap: Can Monetary Policy Make a Difference?" Finance and Economics Discussion Series 2023–065. Washington: Board of Governors of the Federal Reserve System.

Cajner, Tomaz, John M. Coglianese, and Joshua Montes. 2021. "The Long-Lived Cyclicality of the Labor Force Participation Rate." Finance and Economics Discussion Series 2021–047. Washington: Board of Governors of the Federal Reserve System.

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.

Federal Reserve Board. 2020. "2020 Statement on Longer-Run Goals and Monetary Policy Strategy." Washington: Board of Governors of the Federal Reserve System. https://www.federalreserve.gov/monetarypolicy/review-of-monetary-policy-strategy-tools-and-communications-statement-on-longer-run-goals-monetary-policy-strategy.htm.

Feng, Shuaizhang, and Yingyao Hu. 2013. "Misclassification Errors and the Underestimation of the US Unemployment Rate." *American Economic Review* 103, no. 2: 1054–70.

Figura, Andrew, and Christopher J. Waller. 2024. "What Does the Beveridge Curve Tell Us About the Likelihood of Soft Landings?" Finance and Economics Discussion Series 2024–073. Washington: Board of Governors of the Federal Reserve System.

Fujita, Shigeru, and Garey Ramey. 2009. "The Cyclicality of Separation and Job Finding Rates." *International Economic Review* 50, no. 2: 415–30.

Hobijn, Bart, and Ayşegül Şahin. 2021. "Maximum Employment and the Participation Cycle." Working Paper 29222. Cambridge, Mass.: National Bureau of Economic Research.

Hornstein, Andreas, and Marianna Kudlyak. 2019. "Aggregate Labor Force Participation and Unemployment and Demographic Trends." Working Paper 2019–07. San Francisco: Federal Reserve Bank of San Francisco.

Michaillat, Pascal, and Emmanuel Saez. 2021. "Beveridgean Unemployment Gap." *Journal of Public Economics Plus* 2: 100009.

Mukoyama, Toshihiko, Christina Patterson, and Ayşegül Şahin. 2018. "Job Search Behavior over the Business Cycle." *American Economic Journal: Macroeconomics* 10, no. 1: 190–215.

COMMENT BY

**BART HOBIJN**[1] In this paper, with an Einsteinian title, Pascal Michaillat and Emmanuel Saez argue that a policymaker who aims for the efficient combination of unemployment and vacancies on a fixed Beveridge curve should choose that combination where $u^* = v^* = \sqrt{uv}$, that is, a vacancy-unemployment ratio equal to one and each rate equal to the square root of the product of the current unemployment and vacancy rates. This is a remarkably simple policy prescription. I take it as my task in this comment to highlight under which circumstances this policy prescription seems reasonable and when it might be a bit of an oversimplification.

THREE ASSUMPTIONS BEHIND THE SIMPLE POLICY PRESCRIPTION The simple policy prescription in this paper follows three assumptions made. To put these assumptions in the context of the Beveridge space that I will focus on in the rest of my discussion, consider figure 1.

The first assumption behind the policy prescription is that it is desirable for a policymaker to choose the unemployment, $u$, and vacancy, $v$, rates to minimize their sum. This means that there is a one-for-one trade-off between these two rates reflected by the isocost curves in figure 1, which are lines with a slope equal to minus one.

The policymaker cannot choose $u$ and $v$ independently. At the chosen unemployment rate, they need to choose the vacancy rate at which the unemployment rate remains constant. The combinations of $u$ and $v$ for which this is the case form the theoretical Beveridge curve. The second assumption made is that the policymaker's decisions keep the Beveridge curve fixed, that is, policies move the labor market equilibrium along the Beveridge curve and do not affect the position of the Beveridge curve.

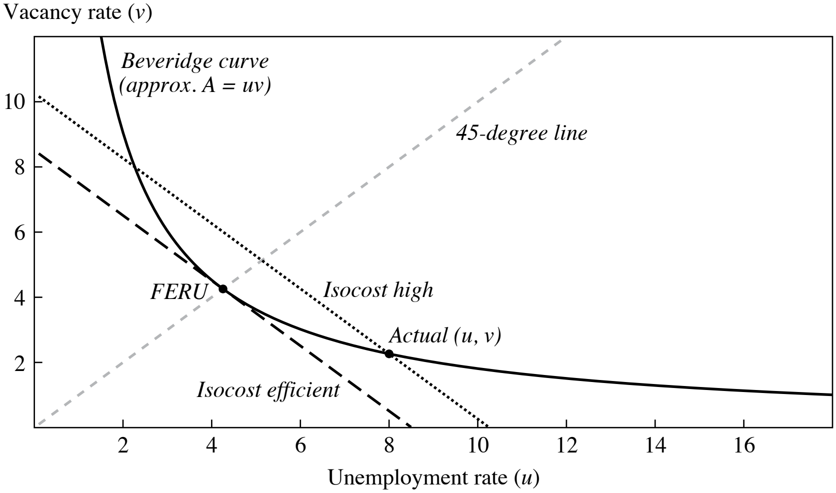
The third assumption is that the Beveridge curve is accurately approximated by the hyperbola on which the product of the unemployment and vacancy rates is constant, that is, $A = uv$.

These three assumptions yield the cost minimization problem, illustrated in figure 1, which determines the efficient levels of the unemployment and vacancy rates.

$$\text{(1)} \qquad \textit{Choose } (u, v) \textit{ to minimize } u + v \textit{ subject to } A = uv.$$

1. Preparation of these comments has benefited from extensive discussions with Gadi Barlevy, Andre Kurmann, Tristan Potter, and Ayşegül Şahin. Any opinions, findings, and conclusions or recommendations expressed in this material are my own and do not necessarily reflect the views of the Federal Reserve Bank of Chicago or the Federal Reserve Board of Governors.

**Figure 1.** Three Main Assumptions Behind Policy Prescription in Beveridge Space




Source: Author's calculations using illustrative parameter values.

The solution to this problem, $(u^*, v^*)$, is the FERU that satisfies $u^* = v^* = \sqrt{A} = \sqrt{uv}$. The latter is true if the current levels of the unemployment and vacancy rates, $u$ and $v$, are on the Beveridge curve themselves. In the rest of this comment, I discuss the three underlying assumptions that drive this simple policy prescription, explain when they hold and when not, and illustrate the impact of deviations from these assumptions.

SUM OF UNEMPLOYMENT AND VACANCIES AS OBJECTIVE In terms of efficiency and desirability, the main assumption of this paper is that a policymaker should aim to minimize the sum of the unemployment and vacancy rates. This implies a social marginal rate of transformation of one between unemployed persons and job openings that is constant over time. This is definitely a simple and transparent objective. But I don't think that its pursuit is socially desirable.

***Ambiguous unit of measurement of vacancies.*** Considering the sum of unemployment and vacancies suggests that they have the same unit of measurement. But this is not the case. The unit of measurement of vacancies is ambiguous. The measure of vacancies used in the paper is the series by Petrosky-Nadeau and Zhang (2021), which merges the job openings measure for the Job Openings and Labor Turnover Survey (JOLTS) with a composite help wanted measure of online and newspaper job postings. These two merged series themselves already have different units of measurement. But let me focus on the job openings measure from JOLTS.

The Bureau of Labor Statistics defines job openings in JOLTS as "all positions that are open (not filled) on the last business day of the month. A job is 'open' only if it meets all three of the following conditions: (1) A specific position exists and there is work available for that position. The position can be full-time or part-time, and it can be permanent, short-term, or seasonal, and (2) the job could start within 30 days, whether or not the establishment finds a suitable candidate during that time, and (3) there is active recruiting for workers from outside the establishment location that has the opening."[2]

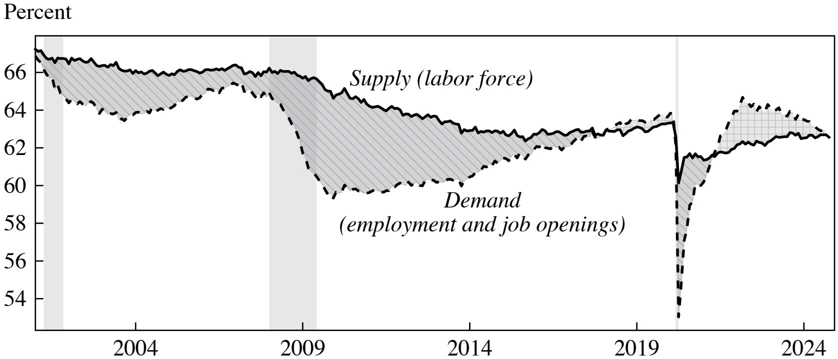
This definition is important because it points to why summing the number of job openings and the number of unemployed is problematic. First of all, the definition clearly states that job openings are measured in terms of jobs while unemployment is measured in terms of persons. Second, job openings are not limited to ones used to recruit persons out of unemployment. During the Great Resignation of 2021 and 2022, many job openings were filled with workers poached from other employers. Moreover, many job openings are posted to hire high school and college graduates who are out of the labor force rather than unemployed. Importantly, the cost per hire estimates used in this paper don't distinguish between costs for hiring an unemployed person versus someone from another employer or from out of the labor force.[3] Third, job openings in JOLTS capture vacancies for jobs in which workers can start within thirty days. This requirement excludes many vacancies. If you are a government employee or academic reading this comment, you most likely applied for a vacancy that did not satisfy this criterion. Finally, many people are hired without a job opening. For example, Davis, Faberman, and Haltiwanger (2013) report that, in the JOLTS data from 2001–2006, 42 percent of hires occur at establishments that do not report any vacancies.[4]

2. Bureau of Labor Statistics, "Job Openings and Labor Turnover Survey," under "How Does JOLTS Define Job Openings?" https://www.bls.gov/jlt/jltdef.htm.

3. Estimates of the distribution of cost per hire from the Society for Human Resource Management (SHRM) show that this distribution is severely right skewed with the mean being higher than the 75th percentile (Miller 2022). This suggests the average cost per hire estimates used in this paper are largely driven by hires of high-skilled workers from other employers, which are not part of the $u$ versus $v$ trade-off the paper considers. These costs are also countercyclical.

4. An alternative interpretation that Michaillat and Saez provide about the unemployment and vacancy trade-off that they focus on is that one unemployed worker is the equivalent of one worker spending time on filling a vacancy. But the evidence in Davis, Faberman, and Haltiwanger (2013) implies that a lot of recruitment efforts are not captured by vacancies. They also provide evidence that the intensity with which firms pursue filling vacancies varies over the business cycle and is not constant, as assumed in this paper.

**Figure 2.** Balance Between Supply and "Demand" in the Labor Market




Source: Bureau of Labor Statistics and author's calculations.

Note: Supply in the labor market is measured as the labor force and "demand" is measured as the number of persons employed plus the number of job openings for nonfarm payroll jobs. Both are measured as a percentage of the noninstitutional population of age 16 and over.

This means that I am not sure how to interpret the policy prescription of a vacancy to unemployment ratio, $v/u$, equal to one based on the JOLTS job openings measure in this paper. This is important for the conclusion in this paper that, on average, the unemployment rate in the United States has been inefficiently high.

To see this, consider figure 2, which has been used, in other contexts, to illustrate how labor supply and labor demand have come into better balance over the past year and a half. The labor demand measure in the figure interprets JOLTS job openings as the level of unmet labor demand, just as is done in this paper. By definition, the difference between supply and demand in the figure is the difference between the levels of unemployment and vacancies (as a share of the population). In this figure, balance in the labor market, that is, measured supply equals measured demand, happens when $u = v = \sqrt{uv}$ and the FERU condition introduced in this paper is satisfied.

Depending on how you interpret this figure, it indicates that, on average, there is excess supply in the labor market or that the unemployment rate is higher than the FERU, as Michaillat and Saez argue in this paper. But the interpretations rely on an incorrect interpretation of the JOLTS job openings measure. This imbalance is most likely the result of the JOLTS job openings measure not capturing all forms of unmet labor demand in the economy.

This does not mean the JOLTS measure of job openings is not useful. Many measures of unfilled vacancies and unmet labor demand move together. The high degree of comovement between the help wanted measure and JOLTS job openings is what inspired the splicing of help wanted with JOLTS data (Barnichon 2010, fig. 1). More recently, data on job postings by Indeed have moved similarly to the JOLTS measure as well. So, job openings in JOLTS are a good measure of the *fluctuations* in unmet labor demand but *not necessarily of its level*.

***Theoretical desirability of minimizing sum of unemployment and vacancies.*** The paper includes (in section II.H) an example of how the FERU can be derived in the context of the model from Pissarides (2000, chap. 1) in the particular case where the vacancy posting cost moves one-for-one with the productivity level in the economy. It shows that, if that is the case and the government policy is to choose a combination ($u$, $v$), then it would be optimal to choose the FERU. What the paper does not do is solve the equilibrium of a full version of the model with a labor demand part that generates a job creation curve.

A natural way to close the model to obtain such a full version is to impose the condition derived by Hosios (1990). It assures that all equilibrium points on the Beveridge curve are Pareto efficient.[5] Closing the stylized model and imposing the Hosios condition yields that, if the vacancy posting cost is proportional to the level of productivity, then there are no equilibrium fluctuations in the unemployment and vacancy rates in response to productivity shocks.

The intuition for this is that the constant returns to scale production and matching technologies mean that the relative allocation of workers between $u$ and $v$ does not change when both technologies shift at the same proportion. At first glance, this result might seem more of a theoretical curiosity.[6] But it illustrates that what is important for unemployment fluctuations in search and matching models is exactly the type of fluctuations in the relative cost of recruitment that the authors assume away when they argue the government should focus on minimizing the sum of the unemployment and vacancy rates.

Though the stylized model in the paper has counterfactual implications, it does provide a useful way to think about optimal policy in a search and

5. If the Hosios condition does not hold, points on the Beveridge curve are not (necessarily) Pareto efficient, and thus the assumption that optimal policy should choose a point on the Beveridge curve, made in this paper, is not necessarily correct.

6. This is a particular example of the importance of cyclical fluctuations in vacancy posting costs in these models emphasized by Pissarides (2009).

matching model. For example, one can think of the government choosing ($p$, $u$, $v$) to maximize steady-state welfare

$$(1-u)p - cv - \phi(p), \tag{2}$$

subject to the Beveridge curve

$$u = \frac{1}{1+\frac{\omega}{\lambda}\left(\frac{v}{u}\right)^{\alpha}}, \tag{3}$$

and the job creation condition

$$cv = \omega\left(\frac{v}{u}\right)^{\alpha} J(p,u). \tag{4}$$

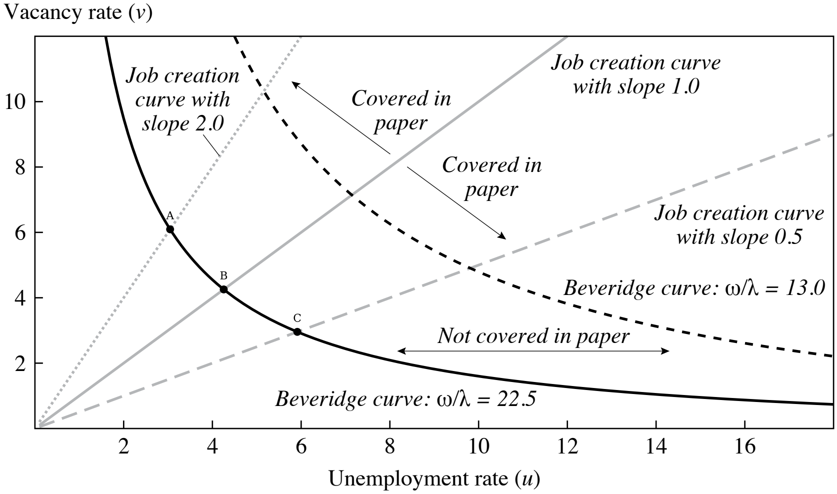
Here, equation (3) is the commonly used functional form for the Beveridge curve (e.g., Pissarides 2000, chap. 1), rather than the hyperbola approximation used by Michaillat and Saez. In particular, $\lambda$ is the separation rate out of employment, $\omega$ is the level of match efficiency, and $\alpha$ is the elasticity of the matching function. The function $J(p,u)$ is the value of a job match for an employer.

The additional term in the welfare function (2), $\phi(p)$, is included to capture welfare costs of stimulating labor demand, that is, choosing a higher $p$, beyond its impact on output and unemployment. For example, it includes the cost of inflationary pressures resulting from increases in the $v/u$ ratio due to rising labor demand (Ball, Leigh, and Mishra 2022; Barnichon and Shapiro 2024; Benigno and Eggertsson 2023).

Just like the welfare maximization problem solved by Michaillat and Saez, the above problem, through restriction—equation (3)—assumes that policies move the labor market equilibrium along the Beveridge curve. I consider this assumption next.

POLICIES THAT KEEP THE BEVERIDGE CURVE FIXED AND THAT SHIFT IT The simple policy prescription in this paper results from the policymaker choosing the optimal combination of unemployment and vacancies on a fixed Beveridge curve. Though the paper is not explicit about how this would be achieved, it suggests that this is done using policies that pin down job creation at the level at which it results in the desired equilibrium outcome. Michaillat and Saez call this outcome the FERU, because they interpret

**Figure 3. Policies Covered and Not Covered by Prescription in Beveridge Space**




Source: Author's calculations using illustrative parameter values.

it as the choice that the federal government and the central bank should implement to maintain the economy at "full employment," or "maximum employment," as mandated in the Employment Act of 1946, the Federal Reserve Reform Act of 1977, and the Full Employment and Balanced Growth Act of 1978.

But even if one thinks the social objective is to minimize the sum of unemployment and vacancies, the policy prescription in this paper is only applicable to policies that affect job creation and do not shift the Beveridge curve. Among the many policies that the federal government implements there are certainly some for which this might be the case. But many policies are specifically aimed at moving the Beveridge curve, and the optimal policy derived in this paper has little to say about the desirable outcomes for these programs.

To put this in context, consider figure 3. It shows a textbook diagram in Beveridge space. For a given Beveridge curve, for example, the solid curve in the diagram, the equilibrium combination of unemployment and vacancies is given by the intersection of this curve with the job creation curve. The figure shows three such curves. The policy prescription in this paper covers policies that solely move the job creation curve and do not affect the position of the Beveridge curve. It does not cover policies that shift the Beveridge curve.

***Policies that move the economy along the Beveridge curve.*** The position and shape of the Beveridge curve reflect unemployment inflows as well as search and matching technology in the labor market, as captured, for example, in the functional form used in equation (3). So, policies that do not affect these things will keep the Beveridge curve fixed.

Probably the most prominent example of this is monetary policy. For example, Figura and Waller (2022) consider the likelihood of a "hard landing" after the monetary tightening that started in 2022 by studying the shape of the Beveridge curve and how much job creation can decline, and the vacancy rate come down, before the Beveridge curve flattens out. Their analysis assumes that the Beveridge curve remains fixed in response to the monetary tightening.[7]

***Policies that move the Beveridge curve.*** The policy prescription in this paper is not meant to be solely applicable to monetary policy but to the federal government's maximum employment objective in general. It is important to realize, however, that many federal policies affect the position and shape of the Beveridge curve. The simple recipe provided in this paper is of limited use for evaluating the efficiency of those policies. For example, there is an extensive literature about the incentive effects of federal extensions of unemployment insurance (e.g., Farber, Rothstein, and Valleta 2015; Chodorow-Reich, Coglianese, and Karabarbounis 2019, among many). Though most studies find only limited disincentive effects, they do suggest that unemployment insurance extensions result in a small decline in match efficiency that shifts the Beveridge curve rightward. The method applied in this paper would spuriously interpret this rightward shift as an increase in the FERU. The question about the optimal level of unemployment insurance weighs the costs of benefit payments and longer unemployment spells, and a corresponding rightward shift in the Beveridge curve, against the benefits of a reduction in income uncertainty and a potential increase in the quality of matches—a very different policy trade-off than the unemployment versus vacancies choice considered in this paper.

The policy that is probably most directly focused on affecting the position of the Beveridge curve is the Workforce Innovation and Opportunity Act (WIOA).[8] Its main purpose is "to increase, for individuals in the United States, particularly those individuals with barriers to employment, access to and opportunities for the employment, education, training, and support

7. But "hard landings" after monetary tightening episodes often involve increases in the separation rate, which at least temporarily shift the Beveridge curve outward.

8. Workforce Innovation and Opportunity Act, Pub. L. 113–128, 128 Stat. 1425 (July 22, 2014).

services they need to succeed in the labor market" (sect. 2.1). As part of it, local workforce development boards work together with federal, state, and local governments, employers, educational institutions, and nonprofits to enhance economic opportunity for workers, including matching job searchers with local employers. It provides a decentralized nationwide institutional framework for active labor market policies in the United States.

Cross-country variation in institutions like WIOA, labor market regulations, education systems, and taxation has been studied extensively to understand differences in the locations and persistent shifts of Beveridge curves across countries. This has been particularly true when it relates to "Eurosclerosis," that is, the lasting increase in unemployment rates in many European countries following the recessions of the early 1980s (e.g., Nickell 1997; Blanchard and Wolfers 2000). Though "Eurosclerosis" has disappeared from the radar screen of most academic researchers, many of the current cross-country differences in unemployment rates between advanced industrialized economies are rooted in that period.

A normative framework to assess the relative efficiency of labor market outcomes across countries would be very useful to shape the policy discussion about these differences. Though the policy prescription in this paper cannot be used as such a framework, it does remind us of the importance of thinking about efficiency and desirability of labor market outcomes, not only in the United States but across countries.

QUALITY OF BEVERIDGE CURVE APPROXIMATION The third main assumption made in the paper is that the Beveridge curve is well approximated by the hyperbola on which the product of the unemployment and vacancy rates is a constant, $A = uv$. But conceptually, the Beveridge curve is given by the combinations of the unemployment and vacancy rates at which the inflows into unemployment equal the outflows and the unemployment rate is in its flow steady state.

Equation (3) captures these combinations for a constant separation rate, $\lambda$, and a Cobb-Douglas matching function with match efficiency $\omega$ and elasticity $\alpha$. This is the most commonly used functional form for the theoretical Beveridge curve. Taking the total differential of this curve, we obtain that along it

$$\left[1-\left(1-u\right)\alpha\right]d\ \ln u = -\left[\left(1-u\right)\alpha\right]d\ \ln v. \tag{5}$$

Thus, when $(1 - u)\,\alpha \approx 1/2$ then $d \ln u \approx -d \ln v$. In that case the product of the unemployment and vacancy rates is approximately constant along the curve. This is when the approximation of the Beveridge curve, $A = uv$, used in this paper works relatively well. As the authors point out in equation (4) of the paper, because $u$ is relatively small in the United States, this condition holds in the United States when the elasticity of the matching function is approximately equal to 1/2.

Of course, what is relevant for the policy recommendation is not how well the hyperbola, $A = uv$, approximates the Beveridge curve, but how close the policy prescription in the paper is to the one with the actual Beveridge curve. For the functional form in equation (3), the latter is the one that solves the problem

$$(6) \qquad \textit{Choose } (u, v) \textit{ to minimize } u + v \textit{ subject to equation (3).}$$

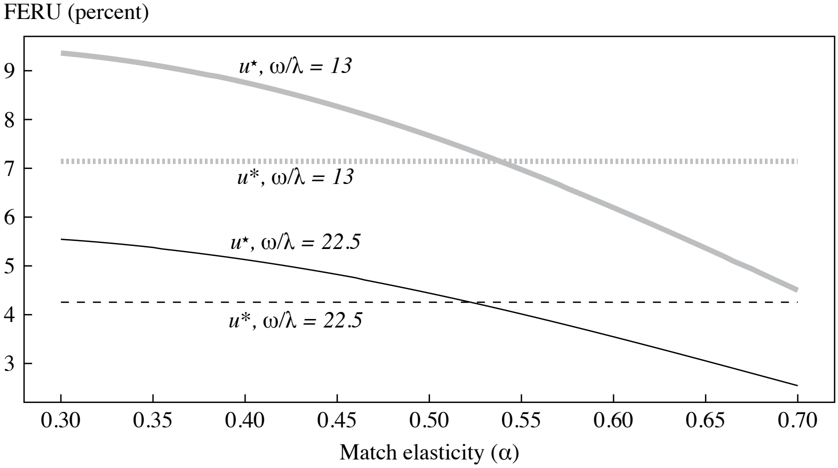
Its solution is given by

$$(7) \qquad u^\star = \frac{1}{1 + \frac{\omega}{\lambda}\left(\frac{v^\star}{u^\star}\right)^\alpha} \quad \text{and} \quad v^\star = \frac{\left(1 - u^\star\right)\alpha}{1 - \left(1 - u^\star\right)\alpha} u^\star.$$

This solution depends on two parameters: the ratio of match efficiency and the separation rate, $\omega/\lambda$, which determines the location of the Beveridge curve, and the elasticity of the matching function, $\alpha$, which determines its shape. The approximate solution in this paper, that is, the FERU solution, only depends on the location of the Beveridge curve and equals $u^* = 1/(1 + \omega/\lambda)$.

Figure 4 compares the actual solution, $u^\star$, with the approximate solution, $u^*$, for different locations and shapes of the Beveridge curve. The black lines in the figure correspond to the location of Beveridge curve that is similar to recent estimates for the United States. In that case, $u^\star = u^* = 4.25$ for $\alpha = 0.52$. At $\alpha = 0.5$, $u^\star = 4.40$, which is a relatively small 0.15 percentage point deviation from the approximation. However, at the value $\alpha = 0.3$, used by Figura and Waller (2022), $u^\star = 5.5$ and the approximation used in the paper is off by 1.25 percentage points—the equivalent of about two million unemployed persons. When the Beveridge curve is shifted further outward, $u^*$ approximates $u^\star$ less well. This can be seen from the gray lines in figure 4, which illustrate this for a case where $u^*$ is around 7 percent, as is approximately the case in France for example.

**Figure 4. Policy Prescriptions for Different Assumptions of Shape of Beveridge Curve**




Source: Author's calculations.

The point is that the hyperbola approximation that Michaillat and Saez use only yields a solution that is close to the FERU obtained using the most commonly used functional form for the Beveridge curve under a very limited set of parameter values.

TO SUMMARIZE The formula $u^* = \sqrt{uv}$ might not be the "$E = mc^2$" of economics. But the simple policy prescription in this paper serves as a useful starting point for furthering the discussion of how to think about the federal government's task of maximizing employment and what types of conceptual and normative frameworks provide context for it. This type of discussion is important if we would like to be more specific about what maximum employment means than "a broad-based and inclusive goal that is not directly measurable" (Federal Reserve Board 2020).

## REFERENCES FOR THE HOBIJN COMMENT

Ball, Laurence, Daniel Leigh, and Prachi Mishra. 2022. "Understanding US Inflation During the COVID-19 Era." *Brookings Papers on Economic Activity*, Fall: 1–54.

Barnichon, Regis. 2010. "Building a Composite Help-Wanted Index." *Economics Letters* 109, no. 3: 175–78.

Barnichon, Regis, and Adam Hale Shapiro. 2024. "Phillips Meets Beveridge." *Journal of Monetary Economics* 148 suppl.: 103660.

Benigno, Pierpaolo, and Gauti B. Eggertsson. 2023. "It's Baaack: The Surge in Inflation in the 2020s and the Return of the Non-Linear Phillips Curve." Working Paper 31197. Cambridge, Mass.: National Bureau of Economic Research.

Blanchard, Olivier, and Justin Wolfers. 2000. "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence." *Economic Journal* 110, no. 462: C1–C33.

Chodorow-Reich, Gabriel, John Coglianese, and Loukas Karabarbounis. 2019. "The Macro Effects of Unemployment Benefit Extensions: A Measurement Error Approach." *Quarterly Journal of Economics* 134, no. 1: 227–79.

Davis, Steven J., R. Jason Faberman, and John C. Haltiwanger. 2013. "The Establishment-Level Behavior of Vacancies and Hiring." *Quarterly Journal of Economics* 128, no. 2: 581–622.

Farber, Henry S., Jesse Rothstein, and Robert G. Valletta. 2015. "The Effect of Extended Unemployment Insurance Benefits: Evidence from the 2012–2013 Phase-Out." *American Economic Review* 105, no. 5: 171–76.

Federal Reserve Board. 2020. "2020 Statement on Longer-Run Goals and Monetary Policy Strategy." Washington: Board of Governors of the Federal Reserve System. https://www.federalreserve.gov/monetarypolicy/review-of-monetary-policy-strategy-tools-and-communications-statement-on-longer-run-goals-monetary-policy-strategy.htm.

Figura, Andrew, and Christopher J. Waller. 2022. "What Does the Beveridge Curve Tell Us About the Likelihood of a Soft Landing?" FEDS Notes. Washington: Board of Governors of the Federal Reserve System. https://doi.org/10.17016/2380-7172.3190.

Hosios, Arthur J. 1990. "On the Efficiency of Matching and Related Models of Search and Unemployment." *Review of Economic Studies* 57, no. 2: 279–98.

Miller, Stephen. 2022. "SHRM HR Benchmarking Reports Launch as a Free Member-Exclusive Benefit." Society for Human Resource Management (SHRM). https://www.shrm.org/topics-tools/news/benefits-compensation/shrm-hr-benchmarking-reports-launch-free-member-exclusive-benefit.

Nickell, Stephen. 1997. "Unemployment and Labor Market Rigidities: Europe versus North America." *Journal of Economic Perspectives* 11, no. 3: 55–74.

Petrosky-Nadeau, Nicolas, and Lu Zhang. 2021. "Unemployment Crises." *Journal of Monetary Economics* 117: 335–53.

Pissarides, Christopher A. 2000. *Equilibrium Unemployment Theory*. 2nd ed. Cambridge, Mass.: MIT Press.

Pissarides, Christopher A. 2009. "The Unemployment Volatility Puzzle: Is Wage Stickiness the Answer?" *Econometrica* 77, no. 5: 1339–69.

**GENERAL DISCUSSION** Robert Hall acknowledged the contributions of the authors to the growing literature demonstrating that, contrary to the characterization typical of monetary policy discussions, the natural rate of unemployment $u^*$ is an endogenous variable rather than a constant. He noted that the amount of variability of $u^*$ estimated by the authors is less than other estimates, including those in his working paper with Marianna Kudlyak.[1]

A number of participants commented on data and measurement issues regarding unemployment and vacancy rates. Hall described that during the COVID-19 pandemic, official statistics counted those workers who had kept their jobs but were only temporarily laid off as unemployed. Without accounting for this group, the Diamond-Mortensen-Pissarides (DMP) model appears to break down, when in reality, researchers are applying the model to the wrong group of people. Hall emphasized that this group is irrelevant to the matching process, as they remain attached to their employers. He pointed to his paper with Kudlyak that parses out this group in the unemployment data.[2]

Regarding vacancy rates specifically, Steven Davis reiterated the discussant Bart Hobijn's point that using the Bureau of Labor Statistics Job Openings and Labor Turnover Survey (JOLTS) vacancy data might underestimate the true level of unmet labor demand. He pointed to his previous work showing a systematic undercount of vacancies in the JOLTS data for two reasons.[3] First, respondents in the JOLTS sample underreport vacancies relative to hires. Second, the JOLTS sample misses the new and very young employers. These employers have high vacancies relative to their share of employment, because they are new and growing.[4] Based on his previous research, Davis speculated that the reported JOLTS vacancy rate is about 15–18 percent below the true vacancy rate. Taken together with Hall's point about measuring unemployment during the pandemic, Davis argued that there are significant first-order measurement issues to address in order to operationalize the formula the authors present.

Tara Sinclair stressed that if the authors' formulation is to be useful for real-time policymaking, it must take into account the distinct data revision processes of vacancies and unemployment. She also pointed out additional compositional challenges that arise when putting the unemployment and

1. Robert E. Hall and Marianna Kudlyak, "The Active Role of the Natural Rate of Unemployment," working paper 23117 (Stanford, Calif.: Hoover Institution, 2024).

2. Robert E. Hall and Marianna Kudlyak, "The Unemployed With Jobs and Without Jobs," *Labour Economics* 79 (2022): 102244.

3. Steven J. Davis, R. Jason Faberman, and John Haltiwanger, "The Establishment-Level Behavior of Vacancies and Hiring," *Quarterly Journal of Economics* 128, no. 2 (2013): 581–622.

4. More information on the methodology of JOLTS can be found at Bureau of Labor Statistics, "Job Openings and Labor Turnover Survey: Overview," https://www.bls.gov/opub/hom/jlt/home.htm.

vacancy rates together, further complicating the application of the authors' formula.

Pascal Michaillat clarified that the paper does not conceive of vacancies as a measure of unmet labor demand, as was originally suggested by Beveridge (1944).[5] Instead, the authors view it as a way to measure nonproductive labor in the form of recruitment, and it happens to be the case that it takes roughly one worker devoted to recruitment to fill one vacancy.

Participants also dug into various assumptions underlying the authors' model. Davis questioned the assumption that there are zero social benefits to unemployment. He pointed to an article in which he and Pawel Krolikowski survey individuals receiving unemployment insurance.[6] Two-thirds of those surveyed indicated that they would not be willing to continue their old jobs with a 25 percent pay cut. In their sample, the unemployment replacement rate is about 38 percent on average. This means that for at least two-thirds of the sample, their value of time (net of the unemployment benefit) is at least 35 percent of the wage they just lost, possibly much higher. Given this, Davis wondered how sensitive the authors' results are to the assumption that unemployment has zero social value.

Valerie Ramey also questioned the authors' assumption. She pointed to evidence of procyclical death rates since the 1970s, including evidence from Ruhm (2000).[7] Ramey also argued that the value of unemployment may be particularly high for those with dependents.

Michaillat responded by pointing to his previous work with Emmanuel Saez that relaxes many of the assumptions made in the current paper; for example, allowing for a social value of unemployment that is not zero and for varying costs of servicing a vacancy.[8] This work also includes a sensitivity analysis of the full-employment rate of unemployment (FERU) to these parameters and others. Using the range of values found in the literature for these parameters, it finds that FERU stays within 1.2 percentage points of the baseline results.

Several participants brought up the importance of inflation in discussions of full employment. William English was struck by the authors' figure

5. William H. Beveridge, *Full Employment in a Free Society* (London: George Allen & Unwin, 1944).

6. Steven J. Davis and Pawel M. Krolikowski, "Sticky Wages on the Layoff Margin," *American Economic Review* 115, no. 2 (2025): 491–524.

7. Christopher J. Ruhm, "Are Recessions Good for Your Health?" *Quarterly Journal of Economics* 115, no. 2 (2000): 617–50.

8. Pascal Michaillat and Emmanuel Saez, "Beveridgean Unemployment Gap," *Journal of Public Economics Plus* 2 (2021): 100009.

showing that the non-accelerating inflation rate of unemployment (NAIRU) measures are much higher than the authors' FERU measures. This reminded him of the work by Barro and Gordon (1983) and the idea that the socially efficient amount of labor may be higher than the amount of employment that can be sustained without generating inflation.[9] English wondered if this was captured in the authors' model.

Christina Romer took English's comments further, arguing that a concept of full employment that isn't consistent with stable inflation is not a sensible goal for policy. She noted that the marginal groups that get hired when unemployment is low are the same groups that lose their jobs when the Federal Reserve tightens monetary policy due to high inflation. She concluded that trying to divorce the concept of full employment from stable prices is not practical.

Joseph Gagnon discussed the usefulness of the authors' measured employment gap, despite the gap being almost always positive. He pointed to work by both Hobijn and Jón Steinsson showing that when there is downward wage rigidity, this bends the Phillips curve, giving it a flat segment.[10] As a result, the economy tends to operate above the natural rate of unemployment. Moreover, it becomes difficult for the central bank to estimate the natural rate of unemployment. This is another factor leading the economy to operate above the natural rate with no downward pressure on inflation, which can go on for years or even decades. Thus, Gagnon cautioned against dismissing the authors' results based on the persistently high unemployment gap. Gagnon further added to Hobijn's discussion of labor market institutions shifting the Beveridge curve. He argued that accounting for changes in labor market institutions would improve the model, especially when applying it to other countries.

In response to participants' comments on inflation—in particular, Romer's argument that any concept of full employment should consider stable prices—Michaillat argued that there is value to a measure of full employment free from inflation considerations. He noted that nothing guarantees that NAIRU aligns with a socially efficient level of unemployment; it only promises stable prices. He highlighted that the Federal Reserve's dual mandate to promote full employment and stable prices demands a measure

9. Robert J. Barro and David B. Gordon, "Rules, Discretion and Reputation in a Model of Monetary Policy," *Journal of Monetary Economics* 12, no. 1 (1983): 101–21.

10. Mary C. Daly and Bart Hobijn, "Downward Nominal Wage Rigidities Bend the Phillips Curve," *Journal of Money, Credit and Banking* 46, no. S2 (2014): 51–93; Stéphane Dupraz, Emi Nakamura, and Jón Steinsson, "A Plucking Model of Business Cycles," working paper, 2024, https://eml.berkeley.edu/~enakamura/papers.html.

of socially efficient unemployment in addition to a measure of unemployment consistent with stable prices. When there is a difference between these two measures, the Federal Reserve must face this trade-off earnestly. Saez added that the United States experienced a long period of relatively stable prices between the 1990s and 2020. In such periods, the Federal Reserve needs a measure of full employment to guide policy toward an efficient rate of unemployment.

To Hobijn's discussion on policies that shift the Beveridge curve, such as labor market institutions, Michaillat again pointed to the aforementioned work with Saez, which relaxes assumptions and derives a more complex formula that allows for the Beveridge curve to change shape over time. He acknowledged that unemployment insurance would move the Beveridge curve, complicating the analysis. Michaillat referred to his work with Saez and Camille Landais that considers the case of unemployment insurance.[11]

Oleg Itskhoki expressed surprise that the authors' measure of optimal unemployment did not require information about the nature of underlying shocks and frictions in the economy. He added that while much of the discussion has been framed around monetary policy, this is the relevant policy tool only if the underlying frictions are sticky prices or sticky wages. If unemployment was instead generated for other reasons, such as financial shocks or other structural issues, monetary policy would not be able resolve these problems, he argued. In this case, the knowledge of $u^*$ might be useful, but ultimately policymakers need to understand the frictions and shocks in the background to respond appropriately.

In response, Michaillat described how their model brings the concept of sufficient statistics, often used in public finance, to a macroeconomic setting. This allows the analysis to be consistent with many macroeconomic models irrespective of background shocks, so long as the model contains a Beveridge curve and so long as the Federal Reserve does not create other distortions.

John Haltiwanger appreciated that the authors' framework relied on the DMP model but also suggested it needs to be refined to match the data. In particular, he asserted that the standard matching function that specifies hires as a function of vacancies and unemployment does not perform well in matching the job-filling rate and the job-finding rate. Hence, he proposed that the authors consider a generalized matching function. He pointed

11. Camille Landais, Pascal Michaillat, and Emmanuel Saez, "A Macroeconomic Approach to Optimal Unemployment Insurance: Theory," *American Economic Journal: Economic Policy* 10, no. 2 (2018): 152–81.

to papers by Abraham, Haltiwanger, and Rendell (2020) and Hall and Schulhofer-Wohl (2018) that generalize the matching function to recognize heterogeneity among vacancies.[12] For example, recruiting and intensities vary across vacancies and across time, hires come from more than just the unemployed, and job search intensities vary dramatically within the unemployed.

12. Katharine G. Abraham, John C. Haltiwanger, and Lea E. Rendell, "How Tight Is the US Labor Market?" *Brookings Papers on Economic Activity*, Spring (2020): 97–138; Robert E. Hall and Sam Schulhofer-Wohl, "Measuring Job-Finding Rates and Matching Efficiency with Heterogeneous Job-Seekers," *American Economic Journal: Macroeconomics* 10, no. 1 (2018): 1–32.