The Shifting Reasons for Beveridge-Curve Shifts

Gadi Barlevy, R. Jason Faberman, Bart Hobijn, and Ayşegül Şahin

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Gadi Barlevy
Federal Reserve Bank of Chicago*

R. Jason Faberman
Federal Reserve Bank of Chicago and IZA

Bart Hobijn
Federal Reserve Bank of Chicago

Ayşegül Şahin
University of Texas at Austin, NBER, and IZA

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Abstract

We discuss how the relative importance of factors that contribute to movements of the U.S. Beveridge curve has changed from 1960 to 2023. We review these factors in the context of a simple flow analogy used to capture the main insights of search and matching theories of the labor market. Changes in inflow rates, related to demographics, accounted for Beveridge curve shifts between 1960 and 2000. A reduction in matching efficiency, that depressed unemployment outflows, shifted the curve outwards in the wake of the Great Recession. In contrast, the most recent shifts in the Beveridge curve appear driven by changes in the eagerness of workers to switch jobs. We argue that, while the Beveridge curve is a useful tool for relating unemployment and vacancies to inflation, the link between these labor market indicators and inflation depends on whether and why the Beveridge curve shifted. Therefore, a careful examination of the factors underlying movements in the Beveridge curve is essential for drawing policy conclusions from the joint behavior of unemployment and job openings.

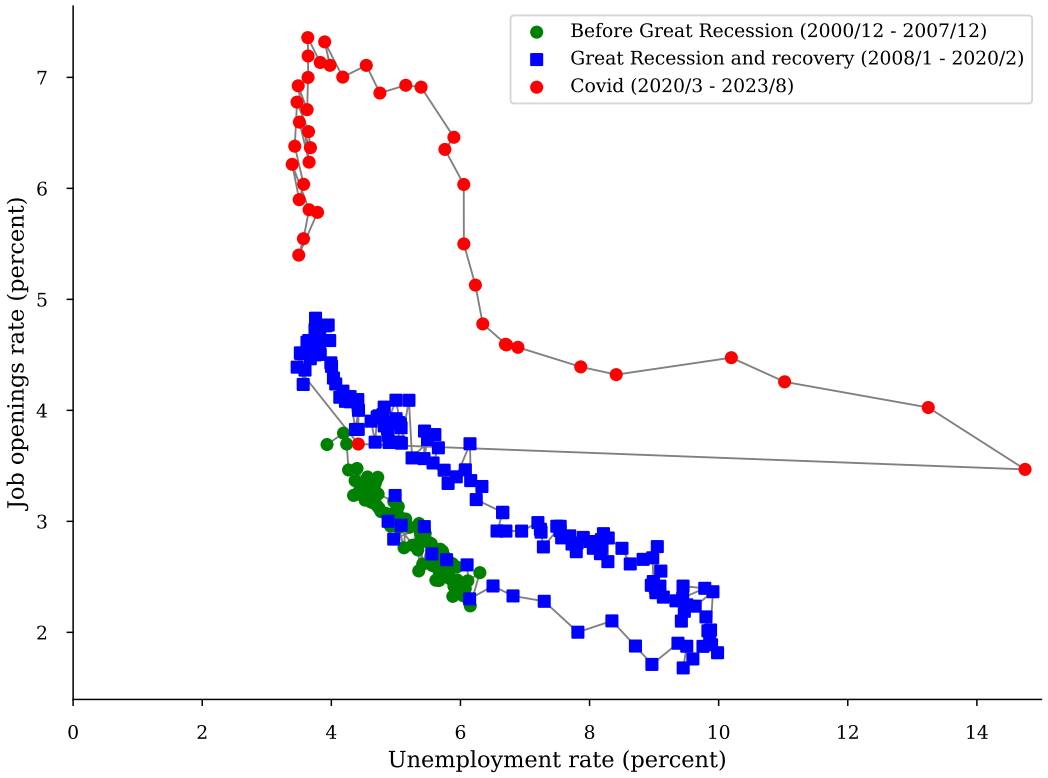
JEL classification codes: E52, J6, J20.
Keywords: Beveridge curve, inflation, job openings, unemployment.

*Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views Federal Reserve Bank of Chicago, Federal Reserve Board of Governors, or of any of the other institutions the authors are affiliated with.

In his groundbreaking analysis, Beveridge (1944) argued that most fluctuations in unemployment are driven by changes in the demand for workers and that job openings are a useful measure of this demand. This implies a negative relationship between job openings and the unemployment rate.

Though William Beveridge never plotted this relationship, the visual representation of it, as plotted in Figure 1 for the U.S. for December 2000 through August 2023, bears his name. A simple interpretation of the observed Beveridge curve would be that it captures how the unemployment rate changes in response to a change in the demand for labor, i.e. in the job openings rate.[1]

Figure 1: U.S. Beveridge curve: December 2000 - August 2023.



Source: Bureau of Labor Statistics (BLS) / Job-Openings and Labor-Turnover Survey (JOLTS)

While this interpretation might be useful and valid in theory, it runs into serious limitations in practice. Figure 1 shows that, even though the job openings and unemployment rates tend to move in opposite directions, the negative relationship between them is by no means stable over time. Thus, at any point in time, it is hard to assess how changes in the number of job openings translate into changes

[1] This is indeed the common theoretical textbook interpretation of the Beveridge Curve. It represents where the unemployment rate stabilizes at a given level of the job openings rate, holding everything else constant. See (Pissarides, 2000, Chapter 1) and Elsby *et al.* (2015) for an explanation of this interpretation.

in the unemployment rate. This has been especially the case since the start of the Covid pandemic in March 2020.

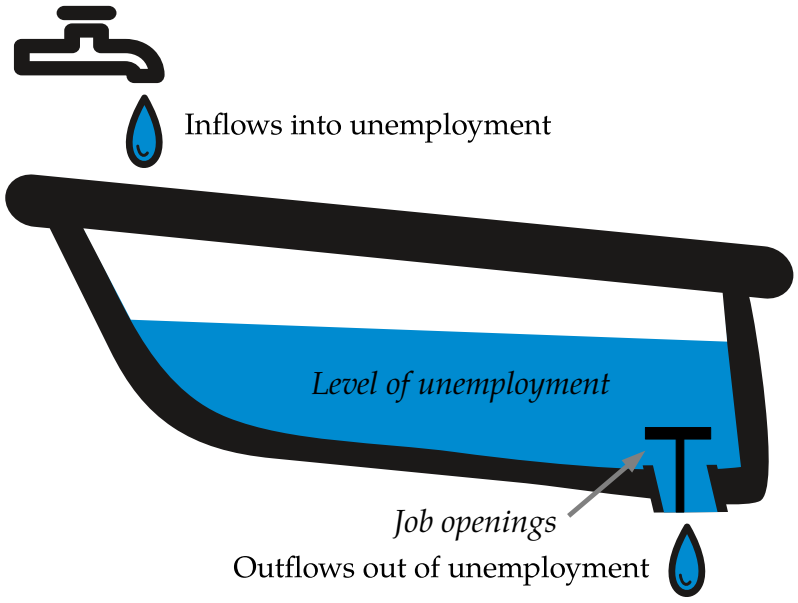
In order to understand how the unemployment rate relates to the number of job openings, we need to therefore understand why the Beveridge curve might shift over time. This understanding is especially crucial if, as is true in practice, policymakers look to the Beveridge curve to assess the potential tradeoff between inflation and unemployment and how policy actions designed to bring down inflation are likely to affect unemployment.

In this paper, we discuss how the relative importance of factors that contribute to movements of the U.S. Beveridge curve has changed over time. We review these factors in the context of a simple flow analogy used to capture the main insights of search and matching theories of the labor market.

To illustrate the shifting reasons for Beveridge-curve shifts, consider again Figure 1. The data in the figure uses all available data on job openings from the Job Openings and Labor Turnover Survey (JOLTS), which began in 2000. This period is marked by two shifts in the Beveridge curve. The first is a persistent outward movement in the curve after the Great Recession. We show this shift was driven by a long-lasting decline in unemployment outflows that can be attributed to a rise in mismatch between the needs of employers and the skills of the unemployed, a decline in the intensity of recruitment efforts by employers seeking workers, and a rise in the share of long-term unemployment that made it more difficult for workers to leave unemployment. The second shift happened after the onset of the Covid pandemic in 2020. We show this shift reflects a myriad of factors that include a surge in unemployment inflows followed by a rapid recovery and rehiring, as well as a rise in quits and people switching from job to job. We also discuss movements in the Beveridge curve that occurred before the inception of JOLTS using alternative data for job openings.

In the last section of this paper, we argue that, while the Beveridge curve is a useful tool for relating unemployment and vacancies to inflation, the link between these labor market indicators and inflation depends on whether and why the Beveridge curve shifted. Therefore, a careful examination of the factors underlying movements in the Beveridge curve is essential for drawing policy conclusions from the joint behavior of unemployment and job openings.

Figure 2: A Bathtub Analogy for Beveridge-Curve Flow Dynamics



1 Labor market frictions and the Beveridge curve

At the heart of the Beveridge curve is the coexistence of unemployment, i.e., workers who are not able to find jobs, and job openings, i.e., job opportunities for which employers are looking for suitable workers. The joint existence of these two phenomena implies that frictions, which prevent workers and employers from being matched instantaneously, are crucial to understanding the labor market. Many macroeconomic models of the labor market focus on modeling such frictions.[2]

One can understand the main intuition for why such models can generate a negative relationship between job openings and unemployment, without the underlying math, in terms of the commonly-used bathtub analogy for the flow dynamics of the labor market. Figure 2 provides an illustration of these dynamics.

The number of unemployed persons, i.e., the level of water in the tub in the figure, is a stock. Upward pressures on this stock are due to people flowing into unemployment, either because they lose their job or quit and look for another one, or because they decide to join the labor force and start looking for work. In terms of the bathtub, these flows are depicted as the drop coming from the faucet.

The water level in the tub is reduced by flows out of it. How much water flows out depends on how

[2]The importance of such models was recognized by the Nobel Prize Committee in 2010 (Royal Swedish Academy of Sciences, 2010). Pissarides (2000) provides a useful overview of this theoretical framework.

high the stopper is raised. In this context, the gap created by the stopper can be interpreted as the demand for workers as measured by the number of job openings. For a given level of job openings, the level of outflows will be higher when the unemployment level is higher. In terms of the bathtub, this is because a higher water level causes more flow pressure on the drain. In models with search frictions, it is easier for employers to find suitable unemployed workers to fill a job opening when there are more of them.[3]

Taking as given the level of inflows, for a given level of the stopper, i.e. of job openings, the water in the bathtub, i.e., unemployment, will settle when the outflows out of the tub equal the inflows into it. The tub in Figure 2 is drawn for this case. That is, the size of the outflows drop is the same as the size of the inflows drop.

The higher the stopper is raised, the lower the level at which the water in the tub settles. Translating this insight to the labor market: For a given level of inflows, the higher the level of the job openings rate, the lower the level at which the unemployment rate will stabilize. The Beveridge curve visualizes this level of the unemployment rate as a function of the job openings rate. The solid blue line in panel (a) of Figure 3 plots such a stylized conceptual Beveridge curve.

The curve in panel (a) of Figure 3 is depicted as convex; steep at low levels of unemployment and flat at high levels. When there are few unemployed and labor demand is high, it is difficult for firms to hire additional workers even if they posted more vacancies. Conversely, when unemployment is high and there are few job openings, each job opening is likely to be filled quickly and so reductions in job openings have a substantial impact on unemployment. This implies that the impact of a change in the job openings rate is much lower at a low unemployment rate than at a high one.

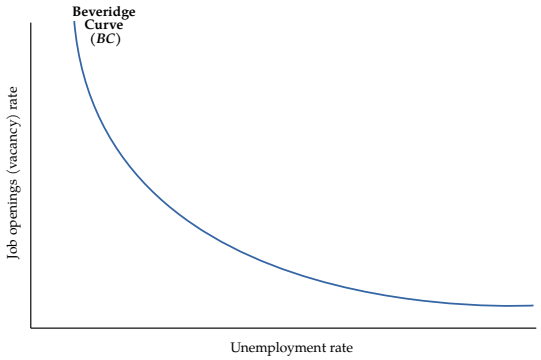
Where we are on the Beveridge curve is determined by a second curve. It is known as the Job Creation curve (JCC) and reflects the strength of labor demand, i.e., the job openings rate, at different levels of the unemployment rate. The JCC is generally assumed to be upward sloping. This is for two reasons. First, at a higher unemployment rate employers tend to be able to hire workers at lower wages. This makes hiring a worker more profitable. Second, employers find it easier to hire suitable candidates when the unemployment rate is higher simply because there are more people applying per job opening. The solid upward-sloping line in panel (b) of Figure 3, labeled JCC, plots the Job Creation curve.[4]

[3] In theoretical models, the relationship between the number of matches between employers and workers, the unemployment rate, and the job openings rate is often captured by a matching function (Petrongolo and Pissarides, 2001)

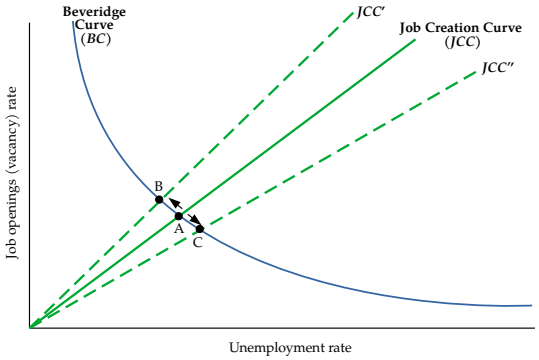
[4] We plot the JCC as going through the origin, which is the case in most standard theoretical search models (e.g. Mortensen and Pissarides, 1994). but it does not matter for the rest of our exposition. What matters is that it is upward

Figure 3: Theoretical Movements along the Beveridge Curve

(a) Conceptual Beveridge curve



(b) The Job Creation Curve and Equilibrium



The equilibrium combination of the unemployment and job openings rates that we observe in the data is the one where the JCC and BC intersect. This corresponds to point A in panel (b) of Figure 3.

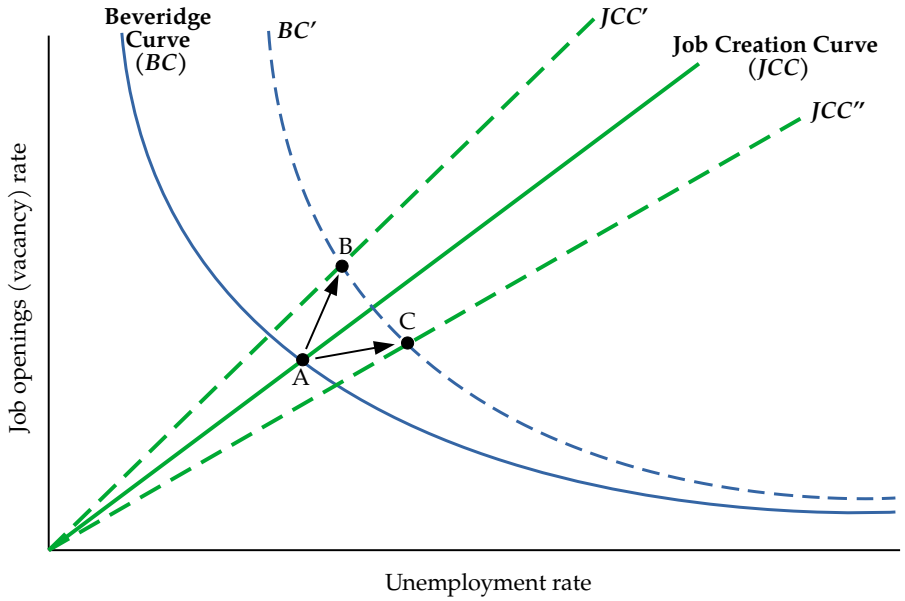
Changes in labor demand rotate the Job Creation Curve (JCC). If the Beveridge curve were stable and changes in unemployment were solely driven by movements in labor demand, then the observed data would trace out this stable Beveridge curve. To see this, consider the case where labor demand improves in panel (b) of Figure 3. In this case, the Job Creation curve shifts counterclockwise and up from JCC to JCC' and the new equilibrium is point B, higher up along the Beveridge curve. Similarly, if labor demand declines, the Job Creation curve shifts clockwise and down from JCC to JCC'', with a new equilibrium point at point C.

This simple case, however, is not borne out in the data. Figure 1 shows that the U.S. unemployment and job openings rates trace out an *empirical* Beveridge curve that is far from stable, especially during and after the Covid pandemic. This indicates that the U.S. Beveridge curve has shifted substantially between 2000 and 2023. To get a handle on the comovement of the job openings and unemployment rates, we thus have to understand the reasons behind these shifts.

The bathtub analogy from Figure 2 provides a useful insight here. There are only two things that can change the level in the bathtub conditional on a given job openings rate: (1) a change in inflows into the bathtub; and (2) an (un)clogging of the drain that alters the outflows from unemployment for a given height of the stopper. Translating this to the labor market, factors that alter either the unemployment inflow rate or outflow rate, independent of a change in the job openings rate, will

sloping.

Figure 4: Theoretical Shifts in the Beveridge and Job Creation Curves

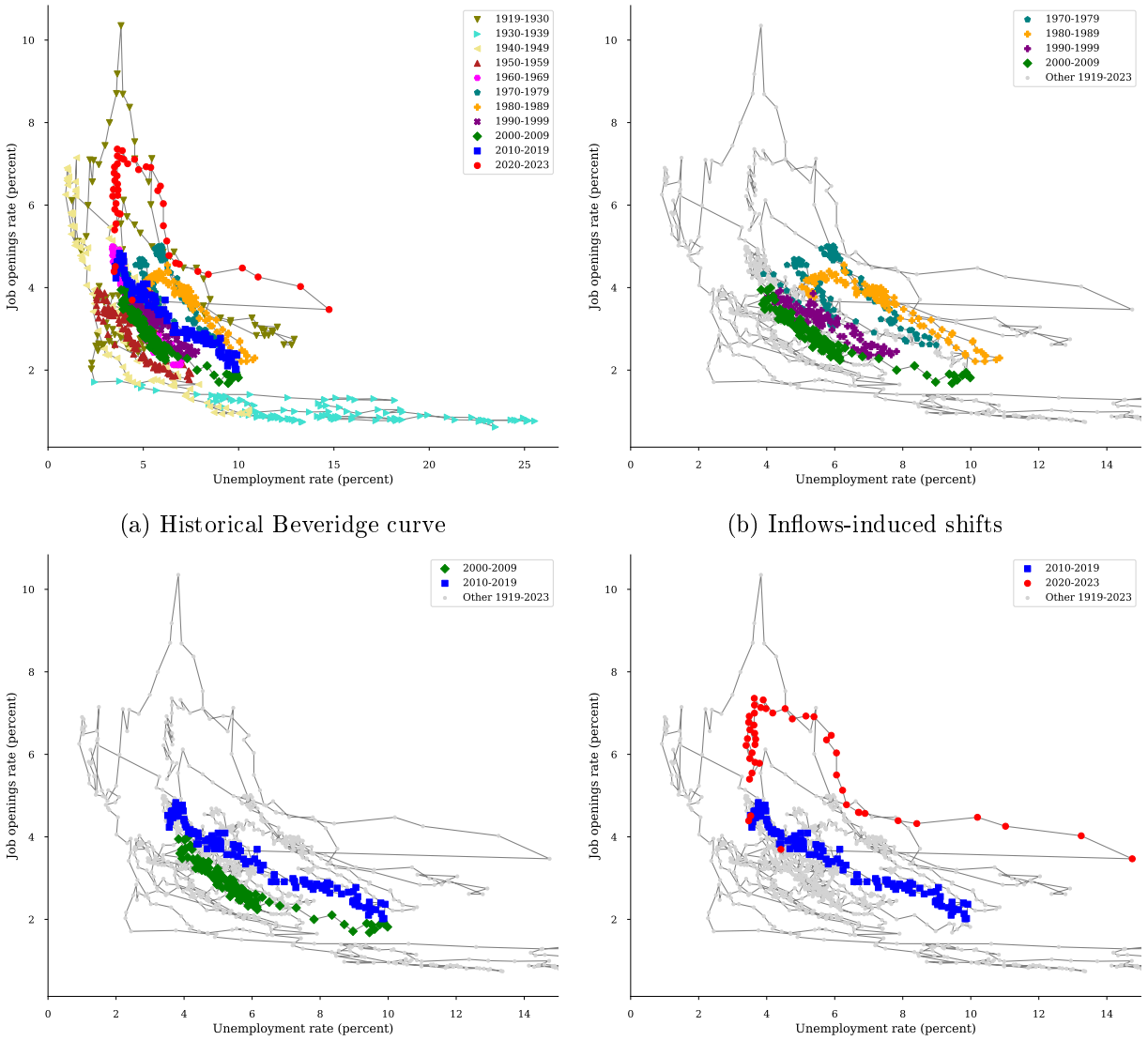


generate shifts in the Beveridge curve.

What is important for understanding the data on the empirical Beveridge curve for the U.S., plotted in Figure 1, is that joint movements in both the Beveridge and Job Creation curves can result in the job openings rate and the unemployment rates moving in the same rather than opposite directions. This is illustrated in Figure 4, which contains two cases. The first is where the Beveridge curve shifts outward from BC to BC' and the Job Creation curve moves upward from JCC to JCC'. In this case, the equilibrium moves from point A to point B in the diagram. The unemployment rate increases a little in spite of a large increase in job openings. The second case is when the Beveridge curve shifts outward from BC to BC' and the Job Creation curve moves down from JCC to JCC''. In this case, the equilibrium goes from point A to point C, resulting in a large increase in the unemployment rate even though the job openings rate increased slightly.

Unfortunately, the reasons for why the Beveridge curve shifts, and how and whether they also affect job creation, cannot be gleaned from movements in the unemployment and job openings rates alone. Additional evidence needs to be brought to bear. The bathtub analogy of Figure 2 suggests that data on labor market flows offer key insights on the reasons for why the Beveridge curve might have shifted.

Figure 5: The Historical Beveridge curve and specific episodic shifts



(a) Historical Beveridge curve

(b) Inflows-induced shifts

(c) Outflows-induced shifts

(d) COVID confluence of reasons

Source: Petrosky-Nadeau and Zhang (2021).

2 Reasons for Beveridge-curve shifts over time

Figure 1, which we used as our starting point, includes data from JOLTS that are available for 2000 onwards. However, longer historical time series on the job openings and unemployment rates are also available. Panel (a) of Figure 5 plots the historical U.S. Beveridge curve based on these data for 1919-2023. To accentuate medium-term movements in the curve, we have plotted each decade in a different color and with a different marker.

The historical Beveridge curve puts the shifts since 2000 in a useful perspective. In particular, large shifts in the Beveridge curve of the type seen during the Covid pandemic are not unprecedented. Similarly large shifts occurred back in the 1920s.[5]

Unfortunately, comprehensive data on labor market flows do not go back far enough to provide a full account of the reasons for all the Beveridge curve shifts over the past century. In this sectio,n we focus on the three most recent episodes for which we have detailed labor market data that allow us to illustrate the main drivers of the changing position of the U.S. Beveridge curve in the context of the inflow-outflow framework from our bathtub analogy.

The three episodes we focus on are highlighted in panels (b) through (d) of Figure 5. The first covers 1970-2009. We show that the shifts in the Beveridge curve in this period were associated with changes in unemployment inflows. The second is the rightward shift in the wake of the Great Recession. In this period, inflows into unemployment continued to fall, but outflows from unemployment were lower than expected based on their levels in the decade before the financial crisis. Finally, the Beveridge curve shifted during and after the Covid recession. In this period, both inflows and outflows into unemployment were relevant, but an additional factor – higher turnover among employed workers seeking to change jobs – appeared to play a role as well.

1970-2009: "Grand Gender Convergence" and aging of the Baby Boomers

Panel (b) of Figure 5 shows how, starting in 1970, the U.S. Beveridge curve moved rightward by about 3 percentage points of the unemployment rate. It stayed there throughout most of the 1980s and then, in the late 1980s, moved leftwards ending up further left in the 2000s than it started 30 years before.

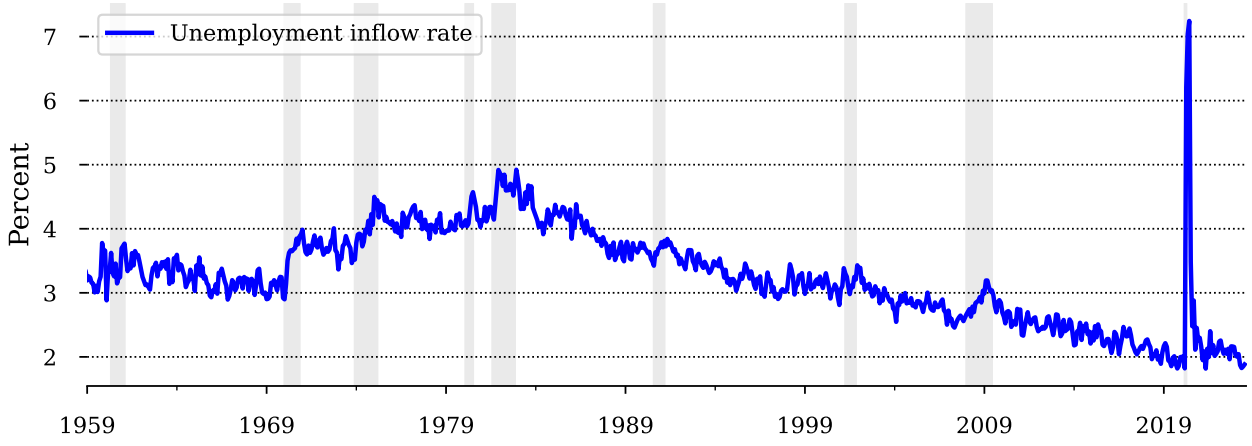
These medium-term movements in the Beveridge curve were driven by unemployment inflows. Panel (a) in Figure 6 shows the time series of an estimate of the monthly inflows into unemployment as a share of employment.[6] Two things about this series are worth noting for their impact on the Beveridge curve.

First of all, unemployment inflows tend to spike during the initial stages of recessions. This puts upward pressure on the unemployment rate. These spikes tend to only have a short-lived impact on the position of the Beveridge curve. Secondly, there have been sizable medium-run movements in the

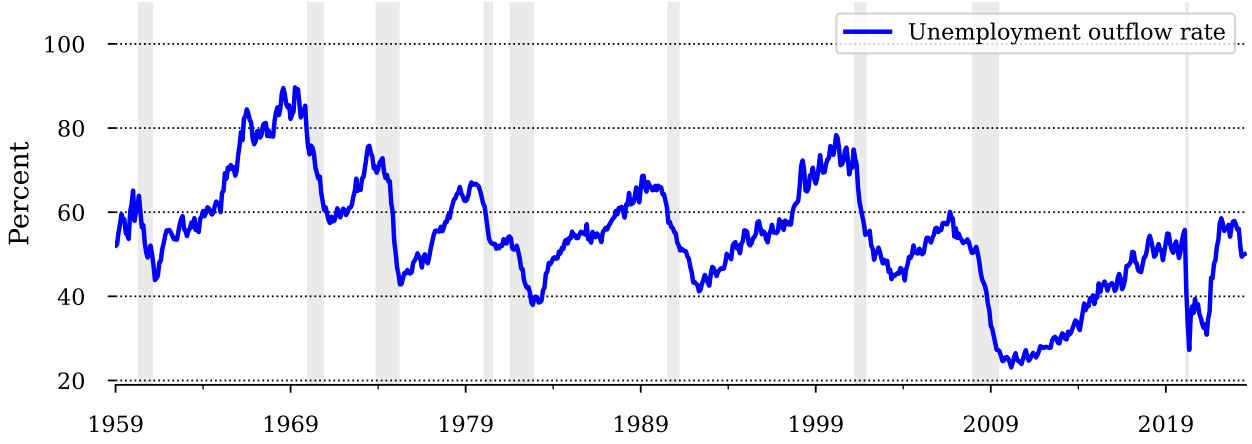
[5] One notable property of this historical Beveridge curve is that its position is not trending inwards, in spite of technological enhancements in labor market search technologies (Martellini and Menzio, 2020)

[6] This estimate is constructed using the methodology described in Shimer (2012). Alternative measures of unemployment inflows have similar properties to the those we emphasize for this one.

Figure 6: Unemployment in- and outflow rates



(a) Unemployment inflow rate



(b) Unemployment outflow rate

Source: BLS and authors' calculations.

Notes: 3-month moving averages of the monthly unemployment inflow rate (as a percent of labor force) and outflow rate (as a percent of unemployment) estimated using the methodology from Shimer (2012). Shaded areas represent NBER-dated recessions.

inflow rate. It trended up from the late 1960s through the mid 1980s. After that, the inflow rate into unemployment trended down, and its level in 2023 lies below its original level in 1960.

The trend in unemployment inflows can largely be traced to two important, and closely intertwined, factors: (*i*) the "Grand Gender Convergence", and (*ii*) the entry of the Baby Boom generation into the U.S. labor force and its subsequent aging.

During the "Grand Gender Convergence", the U.S experienced an increase in female labor force

participation from around 47% in 1976 to approximately 60% in 2000.[7] This influx of new participants initially put upward pressures on the unemployment inflow rate. However, as social norms changed and the availability of maternity leave increased in the late 1970s and 1980s, employment relationships of women became more stable. This meant fewer career interruptions, lowering the rate at which women dropped out of the labor force and subsequently flowed back in as unemployed, thus reducing the unemployment inflow rate.

The rise and subsequent decline in the unemployment inflow rate was not solely due to women. It coincided with the entry and aging of the Baby Boom cohort. In the 1970s, they were in their teens and twenties and, as usual with younger workers, had less stable jobs and frequent unemployment spells. This contributed to higher unemployment inflows. As Baby Boomers entered their prime ages and settled in more steady jobs in the 1980s and 1990s, their inflow rate into unemployment trended down.

To see why the medium-term movements in unemployment inflows shifted the empirical Beveridge curve in panel (b) of Figure 5, reconsider Figure 4. In this stylized example, an increase in unemployment inflows is captured by a rightward shift of the Beveridge curve, from BC to BC' in Figure 4. But, this is not the only impact of this increase. Higher unemployment inflows due to less stable employment relationships reduce the expected duration of job matches and, with that, the incentive to create jobs. In the context of Figure 4, the increase in the unemployment inflow rate between 1970 and 1985 can be interpreted as a clockwise rotation of the Job Creation curve from JC to JC'.[8] The result is that the equilibrium moves from point A to point C in Figure 4. This reflects an unambiguous increase in the unemployment rate, while the sign of the change in job openings is undetermined.[9]

The downward trend in the unemployment inflow rate that started in the mid-1980's resulted in it being lower in the 2000's than in the 1970's. Consistent with this, the empirical Beveridge curve in the 2000's was located to the left of the one in the 1970's (see Panel (b) in Figure 5). However, even though unemployment inflows continued their downward trend even in the 2010's, the Beveridge curve did not shift further inwards. Instead, it moved outwards in the wake of the Great Recession that started in 2008.

[7] See Goldin (2006) for a detailed discussion of the changing employment status of women in the U.S. over time.

[8] Elsby *et al.* (2015) provides a mathematical example of how an increase in the unemployment inflow rate both shifts the Beveridge as well as the Job Creation curve. It also provides a counterfactual empirical Beveridge curve that takes out the impact of variations in unemployment inflows.

[9] Several studies, including Shimer (1999), discuss the importance of demographic trends for the rise in the unemployment rate in the 1970's and 1980's and its decline in the 1990's.

2000-2019: Great Recession and match efficiency

The outward shift of the empirical Beveridge curve in the 2010's is shown in Panel (c) of Figure 5. Its persistent nature cannot be explained by changes in inflows, which were only elevated for the better part of two years during the recession. This observation implies that the persistent shift must be be traced back to a decline in outflows from unemployment.

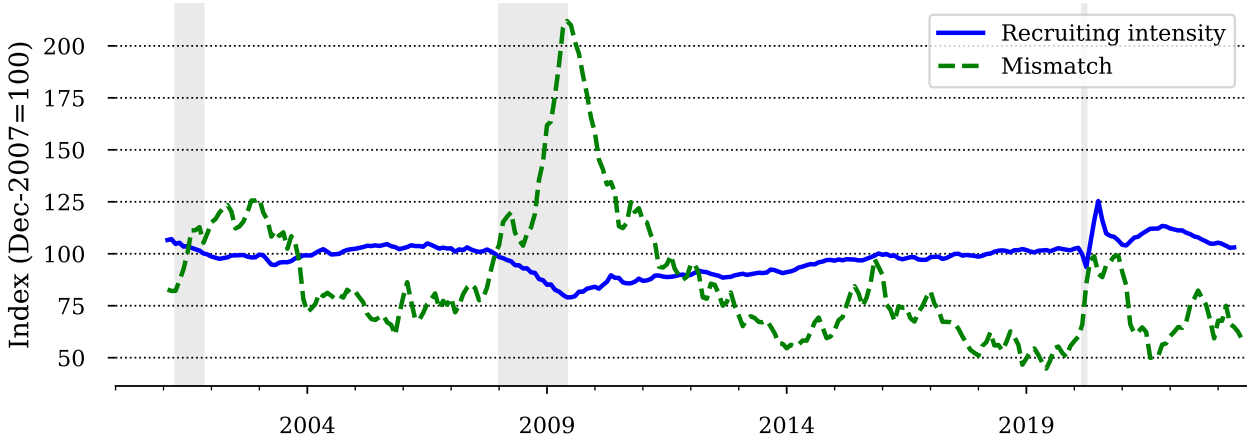
In the wake of the Great Recession the labor market seems to have become less efficient in matching unemployed workers with available job openings. To see this, consider Panel (b) of Figure 6, which shows the time series of the unemployment outflow rate. Prior to 2009 the outflow rate from unemployment followed a regular procyclical pattern. Although not in the figure, these fluctuations coincided with cyclical changes in the vacancy rate and can be interpreted as movements in job creation along a relatively stable Beveridge curve, as illustrated in panel (b) of Figure 3. By contrast, the decline in outflows during and after the Great Recession was unusually large, both by historical standards as well compared to the drop in job openings.

Before we dive into the possible causes of this atypical decline in unemployment outflows it is useful to first consider what our stylized framework from Figure 4 teaches us about how such a decline should affect the observed Beveridge curve.[10] Using the bathtub analogy, an unusual decline in unemployment outflows for a given job openings rate can be interpreted as a clogging of the drain. In terms of the labor market, this corresponds to a reduction in the productivity of the matching process, often referred to as a decrease in matching efficiency. During and after the Great Recession, this type of a decline pushed the Beveridge curve rightward from BC to BC'. Moreover, as it became harder for employers to fill job openings it also became less attractive to post them. This is reflected in a clockwise rotation of the Job Creation curve from JC to JC''. Just like in the case of the increase in the inflow rate we covered above, the net effect is that equilibrium moves from point A to point C in Figure 4. This again results in an unambiguous increase in the unemployment rate.

Economists have sought to identify the source of the persistent decline in matching efficiency and have offered several reasons behind it.[11] We will discuss four key potential contributors: (*i*) the impact of the repeated extensions of unemployment insurance (UI) benefits on the search behavior of the unemployed, (*ii*) an increase in hiring standards by firms, often referred to as a decline in "recruiting intensity," (*iii*) increased mismatch between the locations and qualifications of the unemployed relative

[10] This exposition is similar to that in Daly *et al.* (2012).
[11] See, for example, Daly *et al.* (2012), Elsby *et al.* (2015), and references therein.

Figure 7: Recruiting intensity and mismatch



Source: Authors' calculations.

Notes: 3-month moving averages of monthly seasonally-adjusted time series, measured as an index Dec-2007=100. Recruiting intensity constructed using method from Davis *et al.* (2013). Mismatch index calculated as described in Şahin *et al.* (2014).

to the available job openings, (*iv*) the "scarring" effect of the recession on the unemployed.

While it sounds plausible that the unemployed put less effort into finding a job when they can rely on extended UI benefits, various papers found this effect to be quantitatively unimportant.[12] In fact, search effort by those unemployed reached an all-time high during and after the Great Recession, which should have moderated the outward shift in the Beveridge curve instead of accounted for it.[13]

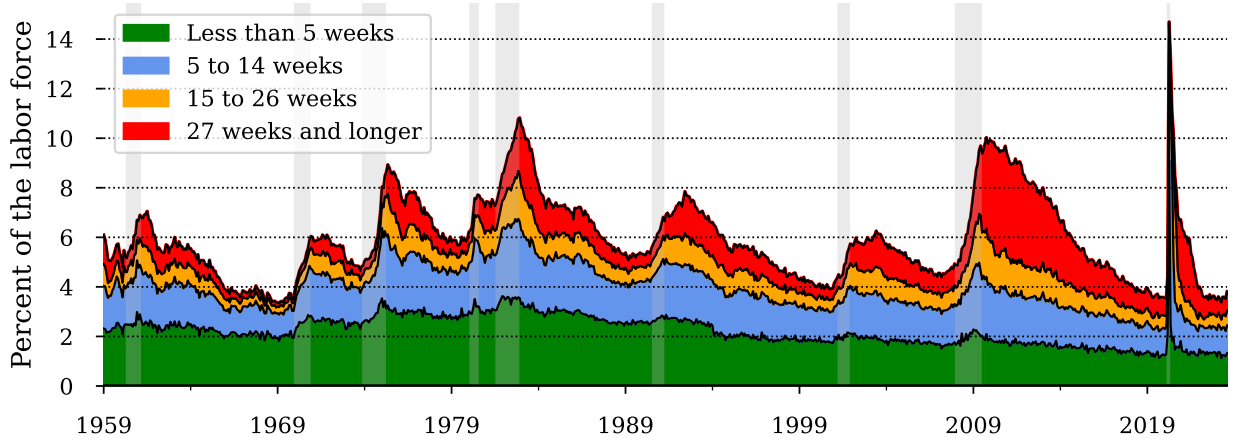
The second channel that has been identified as a potential factor is the decline in firms' recruiting effort, which could be interpreted as the flip side of workers' search effort. In our stylized framework, job openings capture firms' hiring efforts. However, firms may use other margins, besides the number of job openings posted, to adjust their hiring. For example, they can allocate fewer resources to recruiting, increase their hiring standards, or cut back on benefits. Several studies stress the importance of these additional margins in firms' recruiting processes and construct a measure of recruiting effort of firms which is often labeled as "recruiting intensity."[14] Figure 7 shows that the outward shift in the Beveridge curve coincided with a decline in recruiting intensity after the Great Recession. Formal quantitative analyses suggest that the reduction in recruiting intensity accounts for about 2 percentage points

[12] See, for example, Farber *et al.* (2015), Farber and Valletta (2015), and Chodorow-Reich *et al.* (2019).

[13] See Mukoyama *et al.* (2018) for an estimated time series of search effort.

[14] The measure we use here is from Davis *et al.* (2013). See Hershbein and Kahn (2018), Modestino *et al.* (2020), and Carrillo-Tudela *et al.* (2023) for alternative measures of recruiting intensity, such as hiring standards listed in online job ads and hiring standards, search effort, and wage offers reported in firm recruitment surveys.

Figure 8: Duration distribution of the unemployed



Source: BLS and authors' calculations

of the unemployment rate in 2010 and 1 percentage point of the unemployment rate in 2012 of the post-Great-Recession shift in the Beveridge curve.[15]

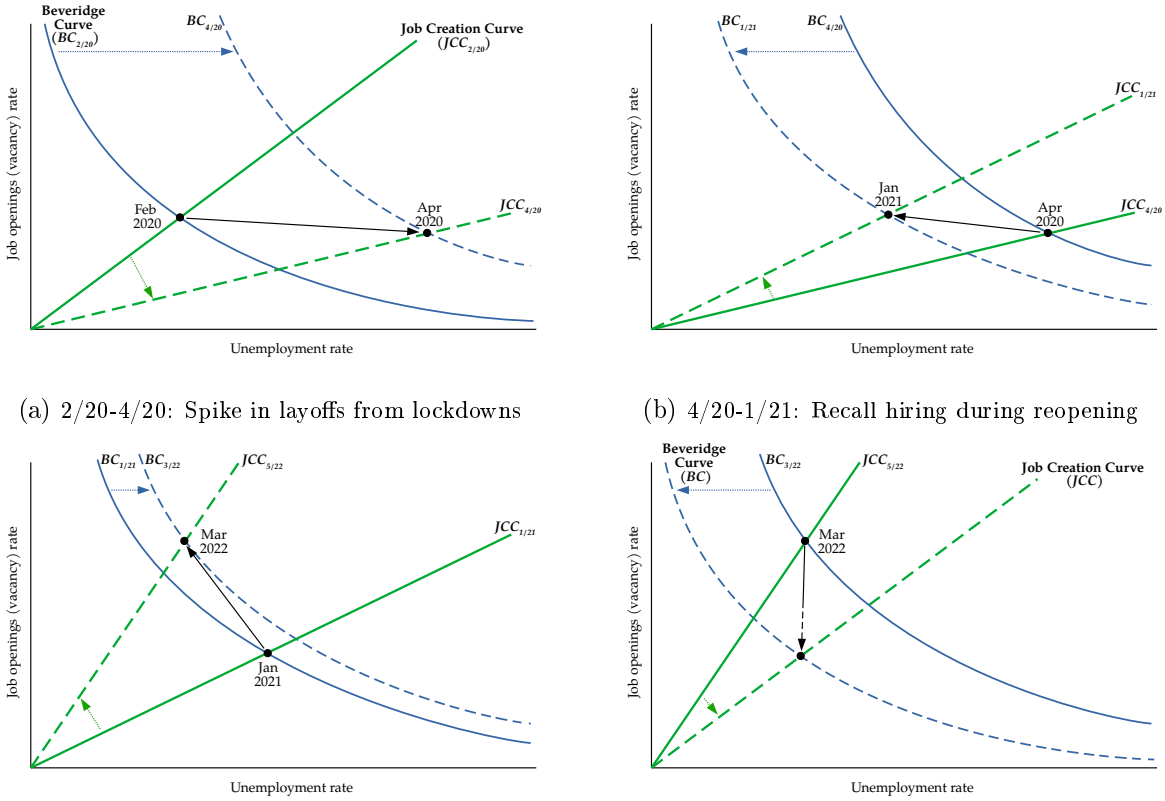
The third factor to consider is *mismatch*, which refers to the misalignment between the skills or locations of unemployed workers and available job openings. An increase in mismatch would lower the outflow rate since matching unemployed workers to job openings would be more difficult. Considering that around half of the job losses during the Great Recession were concentrated in just two industries—construction and manufacturing—it was likely that there was an increase in skill mismatch. Moreover, house prices declined drastically which made it harder for unemployed workers to move to pursue job opportunities. Figure 7 shows a measure of skill mismatch.[16] The sharp rise in skill mismatch is evident during the Great Recession. Şahin *et al.* (2014) find that it contributed to the horizontal shift in the Beveridge curve by about 1 percentage point of the unemployment rate in 2010. Interestingly, they find a quantitatively minor role for geographic mismatch.

The final reason for the decline in outflows from unemployment is that the Great Recession was a major disruption for worker's careers, with a record fraction of the labor force being out of a job for more than six months. This can be seen from Figure 8, which shows the duration composition of the unemployment rate. Long-term unemployment can result in a loss of job-related skills and networks and a negative stigma when searching for a new job. These "scarring" effects diminished the

[15] See for example, Crump *et al.* (2022).

[16] The measure is constructed using the methodology in Şahin *et al.* (2014), who use industry-level data on job openings and unemployed to quantify skill mismatch.

Figure 9: The Covid episode and the Great Resignation in stylized Beveridge space



(a) 2/20-4/20: Spike in layoffs from lockdowns

(b) 4/20-1/21: Recall hiring during reopening

(c) 1/21-3/22: Great Resignation and J2J transitions

(d) 3/22-onwards: Cooling of the labor market

reemployment prospects of a large fraction of the unemployed. As a result, the outflow rate remained depressed even as the economy recovered.[17]

2020-2023: Pandemic-related factors

The movements in the empirical Beveridge curve after the Great Recession depicted in panel (c) of 5 pale in comparison to those during and after the outbreak of the Covid pandemic shown in panel (d) of the same figure. As we explained above, the Beveridge curve shifts in panels (b) and (c) of the figure are clearly attributable to either unemployment inflows or outflows. Those in panel (d) are due to a combination of the two. It turns out to be useful to distinguish four different phases of pandemic-related factors that affected the empirical Beveridge curve. We discuss each of them separately below.

The first phase is the onset of the pandemic that coincided with broad-based lockdowns. When

[17] A more detailed discussion of the impact of this "scarring" effect on the Beveridge curve can be found in Elsby *et al.* (2015).

Covid broke out in March 2020 employers laid off a record number of workers. The result was a reduction in nonfarm payrolls of more than 20 million jobs. Because it was not clear how long the pandemic would last, many of these layoffs were temporary, with an explicit intend to rehire workers as circumstances improved. The record number of layoffs resulted in an unprecedented spike in unemployment inflows that can be seen in panel (a) of Figure 6. This resulted in a large outward shift in the Beveridge curve and a drastic decline in job creation reflected by a clockwise rotation of the JC curve, as illustrated in panel (a) of Figure 9. As a consequence, the unemployment rate rose to a post-war record level of 14.7%. The job openings rate barely dropped.

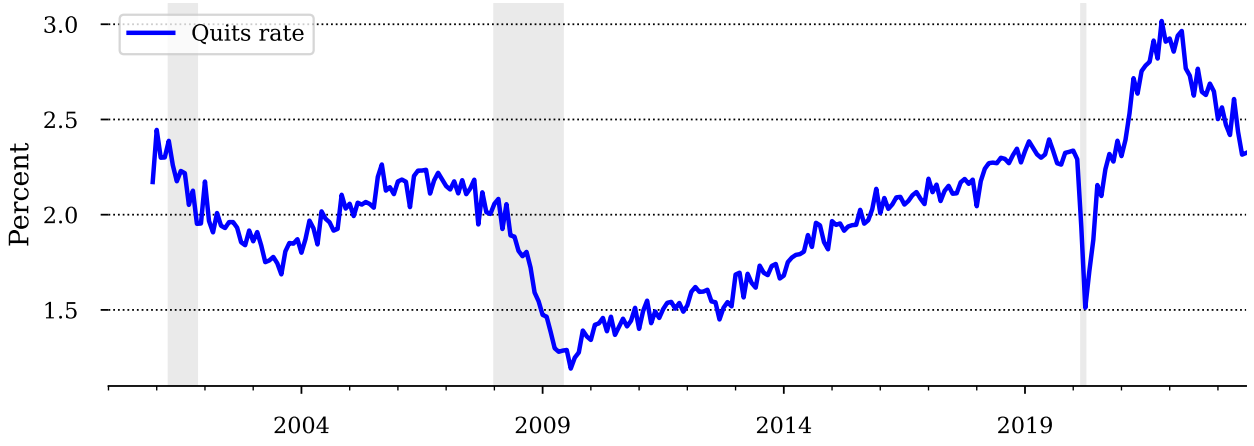
At first glance, it might seem surprising that the job openings rate did not drop much more given the drastic reduction in labor demand during the pandemic. However, panel (a) of Figure 9 provides a clear intuition for why this was the case. The change in the job openings rate is ambiguous when the Beveridge curve shifts outward and job creation declines. This reveals an important insight: Changes in the job openings rate only reflect changes in labor demand if the Beveridge curve is stable.

This drastic shift at the beginning of the pandemic was short-lived. During the summer and fall of 2020, covered in panel (b) of Figure 9, many of the workers that were laid off during the lockdown were recalled as the economy gradually reopened. Consequently, the unemployment rate retreated to 6.3% at the beginning 2021 without a notable increase in the job openings rate.[18] The latter half of 2020 represents a unique time period with large unemployment outflows driven by high matching efficiency as workers were "rematched" with their former employers. Panel (b) of Figure 9 depicts this period in the context of our stylized framework. It corresponds to a partial reversal of the rightward shift in the Beveridge curve. This reversal was only partial because the change in composition of demand away from in-person services created a gap between the needs of employers and skills of those unemployed. Consistent with this, mismatch was elevated in 2020 and early 2021, as can be seen in Figure 7. A limited renormalization of daily life resulted in some recovery in economic activity and, with it, the demand for workers. This is captured by a counterclockwise rotation of the Job Creation curve in our stylized framework.

The shifts in the Beveridge curve starting in 2021 are more puzzling than those in 2020. The job openings rate rapidly climbed from 4.8% in December 2020 to a post-war high of 7.4% in March 2022 while the unemployment rate declined from 6.3% to 3.6%—one of the lowest readings in half a

[18] See Hall and Kudlyak (2022) for a discussion of the importance of temporary layoffs during the Covid pandemic.

Figure 10: Quits rate



Source: BLS and authors' calculations
Note: The number of quits in a month in the nonfarm sector as a share of payroll employment. Monthly seasonally-adjusted data.

century. This period was followed by a decline in the job openings rate without a notable increase in unemployment, which continued throughout 2022 and 2023. Our stylized framework provides a potential narrative of these unusual movements in the Beveridge curve by recognizing the importance of another pandemic-related development as a plausible explanation that is consistent with other data on labor market flows: the "Great Resignation".

Starting in 2021, there was an unprecedented rise in quits, as many workers, after reevaluating their career choices and work-life balance, decided to switch jobs. Figure 10 shows the number of quits in a month as a share of total employment, known as the quits rate. It reached an all-time high of 3% in the spring of 2022. When more employed workers are actively looking for new job opportunities, it affects both the job-finding prospects of the unemployed workers and vacancy posting incentives of firms. First of all, for a given level of vacancies, the job-finding rate of the unemployed falls since they compete with the employed for jobs. The result is an outward shift in the Beveridge curve. However, this is not the sole effect at play. Firms' decisions to post vacancies are positively affected when there are more employed looking to change jobs.[19] Therefore, the job creation curve rotates further counterclockwise.

Panel (c) of Figure 9 provides a stylized illustration of the *on-the-job search* channel in Beveridge space between early 2021 and spring of 2022. It shows why the recovery in labor demand, together

[19] A more formal theoretical treatment of the impact of on-the-job search on the Beveridge and Job Creation curves can be found in Elsby *et al.* (2015).

with the Great Resignation, resulted in a stark increase in the job openings rate and a decline in the unemployment rate to 3.6% by March 2022.

Since the summer of 2022, the empirical Beveridge curve has exhibited what looks like a puzzling, vertical drop. However, panel (d) of Figure 9 provides an intuitive explanation for this within our framework. If labor market developments since early 2022 are interpreted as a partial reversal of the shifts in the Beveridge and Job Creation curves since the start of 2021, then the drop no longer appears perplexing. Since early 2022, the quits rate declined, which we take as an indication of a reduction in workers' eagerness to switch jobs. This contributed to a clockwise rotation of the Job Creation curve and an inward shift of the Beveridge curve. If the horizontal movements in the two curves offset each other, they combine to a vertical drop in the empirical Beveridge curve in which job openings decline while the unemployment rate remains constant.

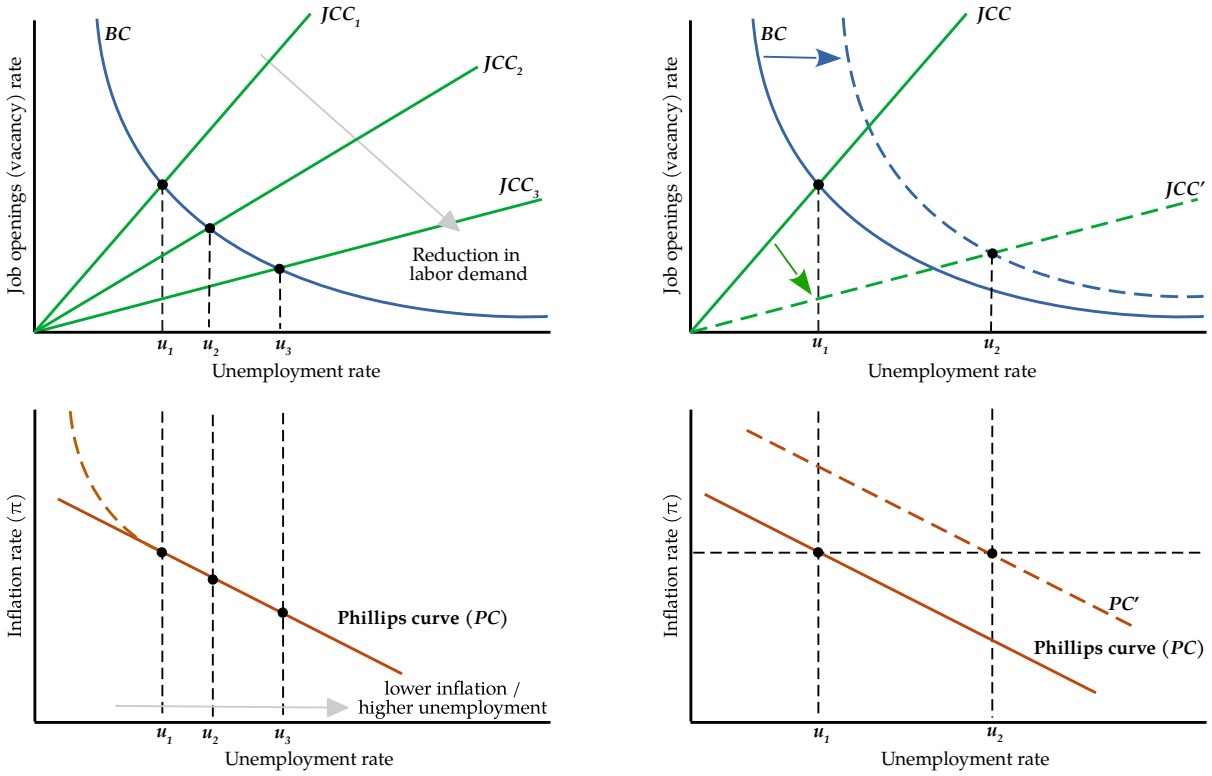
The main point is that the recovery from the pandemic is very different from the previous two episodes we considered. It was characterized not only by a rapid recovery in labor demand but also by a surge in workers actively looking for new jobs. The latter likely reduced the efficiency with which the unemployed were matched with job openings and may have induced employers to post more of them. The impact of this can only be understood if one takes into account the implied joint movements of the Beveridge and Job Creation curves.

3 Beveridge-curve shifts and the unemployment-inflation trade off

One reason policymakers have taken a keen interest in the Beveridge curve is the premise that it can provide information about the tradeoff between unemployment and inflation.[20] As central banks raised nominal interest rates to rein in inflation during the Covid recovery, a key concern was whether bringing down inflation necessitated a large rise in unemployment or whether it was possible to bring down inflation without a major increase in unemployment, a phenomenon known as *achieving a soft landing*. In this section, we relate the Beveridge curve to inflation. We show that if the Beveridge curve is stable, the question of whether raising the nominal interest rate can achieve a soft landing depends on the shape of the Beveridge curve. If the Beveridge curve shifts, whether inflation will fall for a fixed unemployment rate depends on the reason the Beveridge curve shifted.

[20] See, for example, Kocherlakota (2010), Bernanke (2012), and Figura and Waller (2022)

Figure 11: The link between the Beveridge and Phillips curves



(a) Beveridge, Job Creation, and Phillips curves

(b) Increase in long-run unemployment

A Framework for Analyzing Inflation

The starting point for analyzing inflation is not the Beveridge curve but another curve named after the economist who first conceived it — the Phillips curve. While Phillips (1958) studied the relationship between unemployment and nominal wage growth, the curve bearing his name has since come to refer to any relationship between some measure of economic activity, e.g., unemployment or output, and some measure of inflation. A Phillips curve relationship between output and inflation is one of the key pillars of the textbook New Keynesian model used to study monetary policy.[21]

To understand the textbook Phillips curve, consider what would happen if a central bank were to temporarily set a higher nominal interest rate. How this impacts output and inflation depends on the ability of producers to change their prices in response to the higher nominal borrowing cost. If firms can adjust prices in full, inflation would rise in tandem with the nominal interest rate. The real interest rate, which is the nominal interest rate net of inflation, would be unchanged. This should leave aggregate demand unaffected: Demand for goods and services in principle depends on the *real* interest rate, or the amount of consumption we need to give up tomorrow to consume today. In a frictionless world, increasing the nominal interest rate would raise inflation but would have no effect on the real interest rate, aggregate demand, or output.

In practice, firms may not be able to immediately and fully adjust their prices in response to a higher nominal interest rate. In that case, inflation would no longer rise in tandem with the nominal interest rate. The real interest rate would have to rise, dampening aggregate demand and reducing output. If firms produce fewer goods, their marginal cost of production would fall: For example, employers would not need to offer as high wages to attract workers when they produce fewer goods. A higher nominal interest rate would temporarily lower the marginal costs of production. Firms that can adjust their prices would set lower prices given their lower cost of production. In the short run, then, a higher nominal interest rate would lead to a higher real interest rate, lower aggregate demand and output, lower labor demand, and lower inflation. Eventually, firms would be able to adjust their prices, and the real interest rate, aggregate demand, and output would return to their long-run levels, i.e., the levels that prevail when prices are fully flexible.

Conceptually, then, the Phillips curve captures the effect of aggregate demand on inflation. But aggregate demand itself is not directly observed. In practice, economists have used variables that tend

[21] More precisely, the Phillips curve in the New Keynesian model involves the output gap, or the ratio of output to the long-run level of output that would prevail when prices are fully flexible. See Woodford (2003) and Galí (2015).

to comove with aggregate demand, such as the unemployment rate, when they study the Phillips curve empirically.

Relating Unemployment and Inflation with a Stable Beveridge Curve

To relate aggregate demand management by the central bank to unemployment, we can turn to the Beveridge curve.[22] When firms cannot fully adjust their prices, a higher nominal interest rate would lower aggregate demand, leading firms to require less labor. Demand for labor determines the location of the Job Creation curve. A higher nominal interest rate will shift the Job Creation curve down. If the Beveridge curve remained stable, such a move would lead to higher unemployment and fewer job openings. We can use the Beveridge curve to determine the unemployment rate for different nominal interest rates, as illustrated in the bottom of panel (a) in Figure 11.

Combining this with the inflation rate at different nominal interest rates, we would trace out a downward sloping relationship between inflation and unemployment. When a central bank raises the nominal interest rate, all else equal, it raises the unemployment rate by moving the Job Creation curve down along a fixed Beveridge curve.

Researchers have estimated versions of the curve depicted in the bottom of panel (a) of Figure 11 with pre-Covid data and found it is downward sloping but relatively flat with respect to unemployment.[23] This suggests that if a central bank temporarily increased the nominal interest rate to achieve a significant decline in inflation, it would have to tolerate a substantial increase in unemployment to bring down inflation, denying the possibility of a soft landing.

A caveat to this reasoning is that estimates of a flat Phillips curve are based on pre-Covid data. During the recovery from Covid, unemployment fell below its original levels before the pandemic. Recall that the Beveridge curve should in principle be steep at low levels of unemployment: When few workers are unemployed, posting more job openings cannot translate into a large change in unemployment. A shift in the Job Creation curve would then primarily affect job openings rather than unemployment.[24] The implication would be that at low levels of unemployment, the Phillips curve would also be steeper, as illustrated by the dashed line in the bottom of panel (a) of 11, rather than flat as depicted by the

[22] For a formal analysis of how to incorporate unemployment into the textbook New Keynesian model, see Blanchard and Galí (2010), and Galí (2011).

[23] Just as the Beveridge curve shifts around, so does the Phillips curve. Estimating a Phillips curve between inflation and unemployment requires accounting for these shifts, e.g., by controlling for changes in inflation expectations and in the natural rate of unemployment. See Crump *et al.* (2019) as one example of how to account for these variables.

[24] See Figura and Waller (2022) on the steepness of the Beveridge curve at low levels of unemployment, including a quantification of it.

solid line. Moving the Job Creation curve along the fixed Beveridge curve would then primarily affect job openings rather than unemployment, and it should be possible to lower inflation without a large rise in unemployment after all.

In short, if the Beveridge curve remains stable, whether a central bank can bring down inflation without raising unemployment depends on the steepness of the Beveridge and Phillips curves. But as we discussed in the previous section, the Beveridge curve was far from stable during the pandemic. This raises the question of how shifts in the Beveridge curve matter for the tradeoff between inflation and unemployment.

Implications of Shifts in the Beveridge Curve for the Phillips Curve

Some economists have argued that if both unemployment and job openings are important labor market variables, we can simply replace unemployment in the Phillips curve depicted in the bottom of panel (a) of Figure 11 with the ratio of job openings to unemployment to incorporate both of these variables. The ratio between the two is a key object in frictional search models, and using this ratio allows both variables to matter for inflation.[25] Although the ratio between job openings and unemployment is indeed a key object in these models, a Phillips curve that uses this ratio will not fully account for developments in the labor market. If the Beveridge curve were stable, changing from unemployment to the job openings to unemployment ratio shouldn't matter: For a fixed Beveridge curve, each unemployment rate is associated with a unique job openings to unemployment ratio, and the two should be equally informative about the state of the labor market.[26] With a shifting Beveridge curve, though, a Phillips curve that uses the job openings to unemployment ratio will only be useful if the relationship between inflation and the ratio remains fixed when the Beveridge curve shifts. We now show why this will not be true in general.

Consider an outward shift in the Beveridge curve that is due to a higher separation rate or to greater mismatch between the needs of employers and the skills of workers. Recall that these scenarios seem to account for shifts of the Beveridge curve before the pandemic as well as during the outset of the pandemic. As we explained above, in the long run, the central bank can only affect inflation and not the real interest rate, aggregate demand, or output. For any given Beveridge curve, this means that once firms fully adjust their prices in response to monetary policy, aggregate demand would settle

[25] See, for example, Ball *et al.* (2022), Bernanke and Blanchard (2023), and Crust *et al.* (2023).

[26] Indeed, Furman and Powell III (2021) confirm that for pre-pandemic data, inflation forecasts using unemployment are indistinguishable from those using the vacancy to unemployment ratio.

down to some long-run level. Suppose the Beveridge curve were to shift out from BC to BC' as in the top of panel (b) of Figure 11. If matches are more likely to break up or greater mismatch between the skills workers have and those employers need would make posting vacancies less profitable. Employers would then post fewer job openings at any given rate of unemployment, meaning the long-run job creation curve will fall. Graphically, the Job Creation curve will shift from JCC to JCC' as illustrated in panel (b) of Figure 11. The outward shift in the Beveridge curve will lead an increase in the long-run unemployment rate from u_1 to u_2.

If the central bank has a constant long-run target for inflation, as most central banks do in practice, the long run unemployment rates u_1 and u_2 should both be associated with the same target inflation rate. Since the Phillips curve traces short-run deviations in unemployment from its long run level, a shift in the Beveridge curve that raises the long run unemployment rate will shift the Phillips curve up to a new downward sloping curve around a higher long-run unemployment rate. This is illustrated at the bottom of panel (b) in Figure 11. Replacing unemployment in the Phillips curve with the job openings to unemployment ratio would still imply a shift in the Phillips curve, since the long-run ratio of job openings to unemployment would be lower given the shifts in the Beveridge curve and Job Creation curve. A stable Phillips curve does not accurately capture the tradeoff between labor market variables and inflation when the Beveridge curve shifts.[27]

As we discussed in the previous section, the Beveridge curve has shifted back from its position early on in the pandemic. To the extent that this shift back was driven by a return in matching efficiency to pre-pandemic levels, the same logic as above would imply a downward shift in the Phillips curve. That means lower inflation holding unemployment fixed, implying a soft landing would be possible. This soft landing would not be in response to changes in the nominal interest rate but to the downward shift in the Beveridge curve.[28] However, we argued in the previous section that some of the shifts in the Beveridge curve during the recovery phase cannot be easily explained by changes in match efficiency. Instead, we argued these shifts may have been driven by an increase in the willingness of employed

[27] Crump *et al.* (2022) provide independent evidence that long-run unemployment early in the pandemic rose in a way that is consistent with a shift up of the Phillips curve as depicted in panel (b) of Figure 11. Their approach uses data on unemployment, inflation, inflation expectations, and wage growth (as a measure of nominal costs) to infer long-run unemployment. They do not use data on vacancies or make any assumptions on whether or why the Beveridge curve shifted. Using the same approach, Crump *et al.* (2019) find that the previous shift of the Beveridge in the Great Recession was also associated with higher long-run unemployment due to rising mismatch and declining recruiting intensity. They argue this can help explain the "missing disinflation" at the time, i.e., why inflation barely fell despite a large rise in unemployment.

[28] Blanchard *et al.* (2022) observed that a downward shift of the Beveridge curve could in principle lead to lower inflation without a rise in unemployment, although they viewed such shifts as unlikely.

workers to search for new jobs as illustrated in as illustrated in panels (c) and (d) of Figure 9. As we now discuss, the implications of this scenario for inflation can be different.

Implications of an Increase in On-the-Job Search

Consider an increase in the willingness of workers to search on the job, as illustrated in panel (c) of Figure 9. One immediate difference from a decline in match efficiency as illustrated in panel (b) of Figure 11 is that the Job Creation curve shifts up rather than down: Employers find posting job openings more profitable when they can more easily hire workers from other jobs, rather than less profitable when it is harder to match with unemployed workers. The change in long-run unemployment in response to increased on-the-job search is ambiguous: More job openings will make it easier for the unemployed to find jobs, but they have to compete with more employed searchers for jobs. The implication of greater on-the-job search for the Phillips curve, relating inflation and unemployment, will similarly be ambiguous. However, when workers can search on the job, changes in the long-run unemployment will no longer be the only factors that influence the Phillips curve.

Understanding the implications of on-the-job search for inflation is at the frontier of current macroeconomic research. Recent work has argued that with on-the-job search, the relationship between inflation and economic activity depends on multiple factors beyond unemployment.[29] These include how many employed workers are searching for new jobs and the intensity with which they search. An increase in the willingness of workers to search while employed will affect these two variables, and, for reasons we discuss below, can appear as shifts of the Phillips curve.

One aspect of recent models with on-the-job search is the assumption that wages are determined through a process of offer matching. That is, the wage a worker earns depends on the different offers that worker received now and in the past. Since more productive employers are willing to pay higher wages, workers who choose to switch jobs will move to more productive employers. When workers move to more productive matches, their new employer must pay them at least what their previous, less-productive employer would have paid to retain them. Workers who change jobs will thus earn higher wages. These workers earn more, but they are not necessarily more expensive relative to their productivity. Over time, though, employers will be forced to match any outside offers their workers receive and will end up paying workers wages that are closer to their marginal product. Wage increases with the same employer imply workers are more expensive without becoming more productive. The

[29] See, in particular, work by Moscarini and Postel-Vinay (2022) and Faccini and Melosi (2023)

larger the share of workers who occupy jobs in which they are highly productive, the bigger the share of wage growth that is due to raises on a given job rather than to the wage increases associated with moves into jobs in which workers are more productive. Once workers have successfully moved to more productive jobs, there is more potential for rising labor costs without any productivity growth. Since inflation depends on changes in labor costs, such a market has more potential for higher inflation.

When workers choose to search for new jobs and employers respond by posting more job openings, we would expect more workers to move toward jobs in which they are more productive.[30] As workers move to more productive jobs, they will be less likely to move to still more productive jobs, and the wage growth they experience will likely come from their current employers in response to outside offers. This will appear as higher inflation even for the same level of unemployment, i.e., it would appear as an upward shift of the Phillips curve.

Since the force for higher inflation involves the share of workers who occupy relatively more productive jobs, inflationary pressures can remain even once workers succeed in finding better jobs and after employers' incentive to post job openings falls. That is, even in the phase corresponding to panel (d) in Figure 9 where job openings decline and the Beveridge curve appears to shift down, inflationary pressures can persist if the workers who moved to more productive jobs have yet to receive enough outside offers to align their wages with their productivity. Inflation can thus remain high even as the job openings rate declines. Eventually, workers will receive enough outside offers to align their wages with their productivity and labor costs will cease to rise. Nevertheless, the shift down in the Phillips curve may lag the shift down in the Beveridge curve, and inflation may not fall on its own as job openings fall and the Beveridge curve appears to shift down. In that case, central banks would have to increase the nominal interest rate to bring down inflation, and how that affects unemployment would depend on the slope of the Beveridge curve and whether reducing demand for labor is likely to affect job openings or unemployment.

Taking Stock

A key theme in our discussion above is that the Beveridge curve is a useful tool that we can use to relate unemployment (and job openings) to inflation under various scenarios. However, whether a soft landing is possible or not depends on the relevant scenario and how it affects the Beveridge

[30] The notion that greater vacancy posting would lead workers to move towards better matches was previously discussed in Barlevy (2002), although in his paper the higher vacancy rate was due to improved productivity rather than a greater willingness by workers to search on the job.

curve. When the Beveridge curve is stable, whether an increase in the nominal interest rate is likely to raise unemployment or lower job openings depends on the shape of the Beveridge curve. When the Beveridge curve shifts, we can try to determine what happens to the long-run unemployment rate and whether inflation might fall for a fixed unemployment rate. More generally, though, whether inflation can fall on its own for a fixed level of unemployment depends on the reason the Beveridge curve shifted. As we have discussed, the reasons the Beveridge curve shifted in the past have varied over time. To understand the potential tradeoff between inflation and unemployment in any particular period thus requires additional data beyond unemployment and job openings to ascertain why exactly the Beveridge curve shifted, including data on inflows and outflows from unemployment, mismatch, and on-the-job search.

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