Who Feels the Boom? Labor Market Tightness and the Heterogeneous Employment Effects of Monetary Policy*

Nittai K. Bergman[†] Benjamin Born[‡] David Matsa[§] and Michael Weber[¶]

July 2025

Abstract

This paper analyzes the heterogeneous effects of monetary policy on workers with differing levels of labor force attachment. Exploiting variation in labor market tightness across metropolitan areas, we show that the employment of populations with lower labor force attachment—Blacks, high school dropouts, and women—is more responsive to expansionary monetary policy in tighter labor markets. The effect builds up over time and is long-lasting. We illustrate these results in a New Keynesian model with heterogeneous workers and conclude that a hawkish monetary policy especially hurts the employment prospects of workers with lower labor force attachment.

Keywords: Monetary Policy, Labor Markets, Heterogeneous Agents, Federal Reserve
JEL-Codes: E12, E24, E31, E43, E52, E58, J24

*We thank Felipe Alves, Gadi Barlevy, Hui Chen, Oren Danieli, Nicolas Crouzet, Yuriy Gorodnichenko, Nir Jaimovich, Leonardo Melosi, Kurt Mitman, Mathieu Pedemonte, Johannes Pfeifer, Federico Ravenna, Itay Saporta Eksten, Aysegul Sahin, Ofer Setty, Antonella Trigari, Gianluca Violante, Arlene Wong, as well as conference and seminar participants at the 2021 NBER Monetary Economics Spring Meeting, the 2021 CEPR ESSIM Conference, the Federal Reserve Bank of Cleveland, the 2021 CEBRA Conference, the 2021 Salento Macro Meetings, Tsinghua University, the Bank of Canada, the ECB, the 2023 VfS Monetary Economics Meeting, the Bank of Finland, and the 2023 CEBRA Conference for excellent feedback. We also thank Manav Chaudhary, Jonas Dalmazzo, Jiacheng Feng, Ayush Sinha, and Tiange Ye for excellent research assistance.

†Berglas School of Economics, Tel Aviv University, Tel Aviv, Israel. e-Mail: nbergman@tauex.tau.ac.il

‡Frankfurt School of Finance & Management, Frankfurt, Germany and CEPR. e-mail: b.born@fs.de

§Kellogg School of Management, Northwestern University, Evanston, IL, USA and NBER. e-Mail: dmatsa@kellogg.northwestern.edu

¶Booth School of Business, University of Chicago, Chicago, IL, USA and NBER. e-Mail: michael.weber@chicagobooth.edu.

With regard to the employment side of our mandate, our revised statement emphasizes that maximum employment is a broad-based and inclusive goal. This change reflects our appreciation for the benefits of a strong labor market, particularly for many in low- and moderate-income communities.

Jerome Powell, 2020 Jackson Hole Economic Policy Symposium

1 Introduction

Following its 2020 Monetary Policy Review, the Federal Reserve emphasized maximum employment as a "broad-based and inclusive goal," with Chairman Powell (2020) underscoring the need to sustain a strong labor market to generate employment gains more widely across society. The consideration of broad-based employment in the conduct of monetary policy is the subject of an ongoing debate. Amid this debate, monetary policy's heterogeneous effects on different segments of the labor market are not yet well understood. In this paper, we study how labor market strength intermediates the impact of monetary policy across different types of workers and demographic groups.

Our empirical analysis explores monetary policy's heterogeneous employment effects with respect to workers' race, education, and sex. We investigate how expansionary monetary policy promotes employment growth for each group across local labor markets with different tightness. We find that for demographic groups with lower average labor market attachment—Blacks, the least educated, and women—expansionary monetary policy has a larger effect on employment growth in tighter labor markets. Because expansionary monetary policy tightens labor markets (Coibion et al., 2017), this finding implies that sustaining expansionary monetary policy over more extended periods is particularly helpful to these demographic groups.

For each demographic group, we regress employment growth on the interaction between the federal funds rate and local labor market tightness, measured across 895 local labor markets in the U.S. between 1990 and 2019. The panel structure of our data allows us to include industry-by-quarter fixed effects, which control for industry-specific aggregate demand and absorb any unobserved, industry-level, temporal variation in employment growth that is common across locations.[1] All regressions also include industry-by-location fixed effects to control for time-invariant, location-specific variation in employment growth common to a given industry (driven, for example, by variation in the local supply of human capital or the

[1]The uninteracted effect of monetary policy on employment growth is not identified in the presence of these time fixed effects, but the differential effect of monetary policy in tight as compared to slack labor markets is identified.

quality of transportation systems). For a given demographic group, our analysis is therefore identified by comparing how monetary policy affects that group's employment growth in tight as compared to slack labor markets. To the best of our knowledge, this study is the first to use variation in labor market tightness across local labor markets to identify heterogeneous effects of monetary policy.

Our results show that for demographic groups with low average labor market attachment—Blacks, the least educated, and women—monetary expansions have a larger effect on employment growth in tight labor markets, which we measure using the local market's aggregate prime-age employment-to-population ratio. This effect is economically large. For example, we find that a one standard deviation drop in the federal funds rate increases subsequent two-year Black employment growth by 0.91 percentage points more in tight labor markets (90th percentile) than in slack labor markets (10th percentile). Similarly, for workers who did not complete high school, a one standard deviation drop in the federal funds rate increases employment growth over the subsequent two years by 0.39 percentage points more in tight labor markets than in slack ones. This additional impact of monetary policy in tight labor markets is sizable, corresponding to 9% and 18% of the mean employment growth rates for Blacks and high school non-completers over the sample period, respectively.

Whereas labor market tightness plays an important role in mediating the effect of monetary policy on employment for demographic groups with lower labor market attachment, this effect is muted or non-existent for groups with stronger labor market attachment. For example, the point estimate for White employment growth is less than one-quarter of the estimate for Blacks and not statistically significant. All of the differences in the effect of monetary policy—between Blacks and Whites, between less and more educated, and between women and men—are statistically significant.

The effects on less-attached workers are persistent. We find that monetary policy's incremental effect on less-attached workers' employment growth in tight labor markets peaks 7 to 9 quarters after interest rates decrease. Although monetary policy's incremental effect wanes over time, its cumulative effect is long-lasting. For example, the differential effect of monetary policy on cumulative Black employment growth in tight versus slack labor markets persists even four years after the federal funds rate decreases.

The fixed effects used throughout our analysis flexibly control for aggregate economic conditions that covary with monetary policy, including inflation and the output gap. To alleviate any remaining concerns about the endogeneity of monetary policy, we confirm the robustness of the results to estimating an instrumental variables two-stage least squares (2SLS) regression which, following Kuttner (2001), Gertler and Karadi (2015), Wong (2016), and Gorodnichenko and Weber (2016), exploits high-frequency innovations in the federal funds futures rate around Federal Open Market Committee (FOMC) announcements.

We then present a simple New Keynesian model with heterogeneous workers to analyze how monetary policy affects different parts of the labor market. In the model, worker types are differentiated by their productivity level, and more productive workers have greater labor force attachment. We do not model the sources of the variation in productivity, which could include differences in education levels, labor market experience, worker-firm match quality, on-the-job discrimination, or other factors. In each period, firms retain and hire workers with productivity above endogenous thresholds. Monetary policy affects these thresholds.

We show that expansionary monetary policy lowers the hiring and firing thresholds, resulting in greater employment, particularly among lower-productivity workers. Further, the expansionary effect of monetary policy on the employment of lower-productivity workers is stronger in tighter labor markets. This comparative static, which directly supports our empirical estimates, is driven by two forces. First, in tighter labor markets, marginal workers have lower productivity. Second, in tighter labor markets, employment expands more easily because screening for lower-productivity workers is less costly. Higher productivity workers also benefit from monetary expansions, but less so, and their employment is less sensitive to labor market tightness.

The analysis highlights the benefit of sustained expansionary monetary policy for workers with lower labor force attachment, which the central bank trades off against inflationary pressure. We then use the model to conduct a number of counterfactual analyses, including examining the impact of a flatter Phillips Curve, a more dovish central bank policy, and the use of average inflation targeting. The Federal Reserve's 2020 Monetary Policy review, which shifted policy from strict to average inflation targeting, enables the central bank to maintain lower rates during economic expansions. Following Svensson (2020), we model this new policy by replacing the current inflation rate in the central bank's Taylor rule with the average inflation rate over the current and eleven previous quarters. We show that average-inflation targeting results in larger declines in the hiring threshold and larger increases in employment. Lower productivity workers especially benefit from the average-inflation targeting policy, with larger increases in employment as compared to higher-productivity workers.

The flattening of the Phillips curve over the decades preceding the Covid-19 pandemic reduced inflationary pressure from tight labor markets, altering the tradeoff between output and inflation (see, e.g., Simon et al., 2013; Hall, 2013). We study this phenomenon in the model by varying the degree of price stickiness in the economy. When price stickiness is higher, and thus the Phillips curve is flatter, the central bank retains lower rates for longer, enabling greater labor force participation of lower-productivity workers over time.

We also study the heterogeneous effects of monetary shocks across worker types when the central bank employs a dovish policy that places more weight on employment versus inflation. While this more accommodating policy naturally raises inflation, our results show that it leads to greater employment gains for low-type workers than for high-type workers.

Taken together, our theoretical and empirical results both point to the importance of labor market tightness in mediating the impact of monetary policy on workers with low labor force attachment. Monetary expansions boost the employment of these workers the most when labor markets are tight. The results thus suggest that a more dovish monetary policy benefits segments of the labor force that have lower historical employment rates. Of course, optimal policy should consider this benefit of prolonging monetary expansions alongside the costs arising from the associated inflationary pressure.

Related Literature. Our paper is the first to study the role of local labor market tightness in transmitting monetary shocks differentially into employment growth among different demographic groups. We build on prior work that uses aggregate data to study the effect of monetary policy on wealth and consumption inequality (see, e.g., Romer and Romer, 1999; Zavodny and Zha, 2000; Thorbecke, 2001; Carpenter and Rodgers III, 2004; Coibion et al., 2017). In contemporaneous research, Amberg et al. (2022) and Peydró et al. (2023) use annual registry data from Sweden and Denmark to study the effect of monetary policy on consumption and wealth inequality. Coglianese et al. (2025) use Sweden's unexpected interest rate hike in 2010–2011 to show that workers with shorter tenure were hurt more than other workers. Exploiting the introduction of negative policy rates in Europe as a negative credit supply shock, Moser et al. (2021) show that this shock leads to lower employment and wages in Germany. Using aggregate data, Bartscher et al. (2022) find that expansionary monetary policy increases the employment of black households slightly more than that of white households, and Nakajima (2023) explains this response using a heterogeneous agent New Keynesian (HANK) model. Using time-series methods, Amir-Ahmadi et al. (2022) document substantial heterogeneity across individuals' sensitivity to monetary policy shocks in the U.S. Alves and Violante (2025) embed a frictional model of the labor market in a HANK model, in which the employment of low-skilled workers is more exposed to the business cycle, and confirm the model's predictions using aggregate U.S. data. We differ from these papers in that we study the role of labor market tightness at the local labor market level as an important mediating factor for monetary policy. Studying a large panel of local labor markets, we show that monetary policy's ability to increase employment varies with workers' labor market attachment and depends on local labor market tightness.

Our theoretical analysis builds on Blanchard and Diamond (1994) and Blanchard (1995), who describe so-called "ranking" effects in labor markets, and the vast New Keynesian literature studying the real effects of monetary policy. Early contributions adding labor markets into the New Keynesian model focus on the size and the persistence of the effects of monetary policy shocks (Walsh, 2003, 2005; Trigari, 2009). More recent research adds various labor market frictions to the baseline model to study normative questions such as how unemployment affects the design of optimal monetary policy.[2] These models do not, however, address the heterogeneous effects of monetary policy across worker types. Our model is related to Dolado et al. (2021), who study the distributional consequences of monetary policy between high-skilled and low-skilled workers. In contrast to their work, our research focuses on the role of labor market tightness in shaping the differential effects of monetary policy. Closest to our theoretical setup, Ravenna and Walsh (2012) model two types of workers competing for identical jobs, with firms screening workers to determine their productivity. They focus on understanding how productivity shocks affect the unemployment-inflation tradeoff by shifting the composition of who is unemployed. In contrast, we study monetary policy's effect on workers with different skill levels. Ravenna and Walsh (2022) extend their model to study the selection effect of the Covid-19 pandemic. Our analysis is also related to Baek (2021), who builds on Christiano et al. (2021) and derives optimal monetary policy in a New Keynesian model with regular and irregular workers without perfect insurance. Finally, a recent literature embeds a search-and-matching labor-market within a HANK model to study the interaction of monetary policy and endogenous unemployment risk (see, e.g., Challe, 2020; Ravn and Sterk, 2021; Gornemann et al., 2021; Broer et al., 2025).

While we focus on labor market tightness and workers' attachment, monetary policy also has heterogeneous effects through other channels. The growing HANK literature, for example, analyzes the role of households' financial portfolio liquidity in propagating monetary policy shocks (see, e.g., Krueger et al., 2016; Kaplan et al., 2018; Auclert, 2019; Bayer et al., 2019; Auclert et al., 2020; Bayer et al., 2024).

The remainder of the paper is organized as follows. Section 2 describes the data and empirical analysis. Section 3 presents the model setup, and Section 4 provides and interprets the simulation results. Section 5 concludes.

2 The Heterogeneous Effects of Monetary Policy on Employment Growth

In this section, we show that monetary policy has heterogeneous effects on employment across different demographic groups with varying degrees of labor market attachment. Exploiting

[2] See, e.g., Blanchard and Galí (2010); Faia (2008, 2009); Gertler et al. (2008); Christiano et al. (2010); Christiano et al. (2011); Galí (2011a); Galí (2011b); and Galí et al. (2012).

cross-sectional variation in labor markets, we examine how local labor market tightness mediates the effect of monetary policy on employment for different demographic groups.

Our empirical design, which exploits the data's panel structure, has a number of advantages. First, given the endogenous nature of monetary policy, it is crucial to control for time-series variation in national economic conditions, which is not possible when using national-level data alone. Second, with panel data, we can control for time-invariant, location-specific factors that can affect the relationship between monetary policy and employment growth. In comparing across demographic groups, we can also control for time-varying, location-specific factors. Finally, using cross-sectional data on local labor markets provides a larger range of observed labor market tightness, which increases the power of our tests.

We document a novel set of facts: employment growth of Blacks, less educated workers, and women is more sensitive to monetary policy in tighter labor markets. For these groups, which are less attached to the labor market, monetary policy expansions are associated with larger increases in employment growth when labor markets are tight as opposed to when they are slack. These effects build over time and last several years. In contrast, for Whites, more educated workers, and men, who, on average, have a stronger labor market attachment, the responsiveness of employment growth to monetary policy is less sensitive to the degree of labor market tightness.

2.1 Data

Our main data source is the United States Census Bureau's Quarterly Workforce Indicators (QWI) program. From QWI, we obtain quarterly local labor market level employment statistics for industry-worker demographics cells. These data, which cover the period Q1 1990 to Q1 2019, are ultimately sourced from a variety of administrative records, including state unemployment insurance systems, the Social Security Administration, and the Internal Revenue Service. The sample includes 895 local labor markets: 380 Metropolitan Statistical Areas and 515 Micropolitan Statistical Areas. For ease of exposition, we refer to these areas using the terms MSA-level and local-level interchangeably, although our analysis includes Micropolitan Statistical Areas as well.

Our analysis focuses on heterogeneity in employment growth within three demographic categories: race, education, and sex. Table 1 lists the groups that we analyze within each category along with their mean employment rate over the sample period. Labor force attachment varies considerably across the demographic groups. The average employment rate is lower for Blacks than for Whites (56.6% and 62.3%), lower for women than for men (55.2% and 68.5%), and increases monotonically with education. All of these differences are highly statistically significant.

[Table 1 about here.]

For each quarter t, we observe the number of individuals belonging to a given demographic group employed in the MSA in a given 2-digit NAICS industry. For each demographic group, MSA, and industry cell, we calculate the employment growth over the subsequent two years, from the beginning of quarter $t+1$ through the end of quarter $t+8$. We analyze employment growth over different horizons, from one to 16 quarters. To be included in the sample, we require an MSA-industry-group-quarter cell to have at least 50 employees. Employment growth is winsorized at its 1% tails.

We measure local labor market tightness using the prime-age employment-to-population ratio. The numerator in this ratio is the number of employees aged 25-54 in the MSA, obtained from QWI.[3] The denominator is the population of MSA residents aged 25-54, obtained from the U.S. Census Bureau Population Estimates Program. We use this measure for local labor market tightness because data on vacancies are only available for a small number of MSAs. Still, for the 18 MSAs where the vacancy-to-unemployment ratio is available from Q1 2001 onwards from the Job Openings and Labor Turnover Survey (JOLTS), the two measures exhibit a high correlation of 0.66. The measures are also highly correlated at the state and national levels. Using state-level data from JOLTS, which is available from Q1 2000, the average within-state, time-series correlation between the ratios is 0.67. At the national level, over our full sample period, the correlation between the prime-age employment-to-population ratio and the ratio of the Barnichon vacancy index to the number of unemployed workers is 0.65. Following logging and HP filtering of the two series, the correlation is 0.9.

Our analysis includes two measures of monetary policy: the federal funds rate and the history of unexpected high-frequency innovations in the federal funds futures. Data on the effective federal funds rate are from Federal Reserve Economic Data (FRED) at the Federal Reserve Bank of St. Louis. We calculate the average rate over a quarter using the four monthly federal funds rates spanning the quarter (i.e., the rates at the beginning of each month and the rate at the end of the quarter). Our data on high-frequency innovations in the federal funds futures market around FOMC meetings follows Kuttner (2001), Wong (2016), and Gorodnichenko and Weber (2016).

Let $ff_{t,0}$ denote the rate implied by the current-month federal funds futures on date t and assume that one FOMC meeting takes place during that month. t is the day of the FOMC meeting and D is the number of days in the month. We can then write $ff_{t,0}$ as a weighted average of the prevailing federal funds target rate, r_0, and the expectation of the

[3]Because the QWI does not include federal employees, we exclude the District of Columbia from the sample, but this exclusion does not meaningfully affect our results.

target rate after the meeting, $\mathbb{E}_t(r_1)$:

$$ff_{t,0} = \frac{t}{D} r_0 + \frac{D-t}{D}\,\mathbb{E}_t(r_1) + \mu_{t,0}, \tag{1}$$

where $\mu_{t,0}$ is a risk premium.[4] Gürkaynak et al. (2007) estimate risk premia of 1 to 3 basis points, and Piazzesi and Swanson (2008) show that they only vary at business-cycle frequencies. We focus on intraday changes to calculate monetary policy surprises and neglect risk premia, as is common in the literature.

We can calculate the surprise component of the announced change in the federal funds rate, v_t, as:

$$v_t = \frac{D}{D-t}(ff_{t+\Delta t^+,0} - ff_{t-\Delta t^-,0}), \tag{2}$$

where t is the time when the FOMC issues an announcement, $ff_{t+\Delta t^+,0}$ is the fed funds futures rate 20 minutes after t and $ff_{t-\Delta t^-,0}$ is the fed funds futures rate 10 minutes before t.[5] The $D/(D-t)$ term adjusts for the fact the federal funds futures settle on the average effective overnight federal funds rate.

When the event day occurs within the last seven days of the month, we follow Gürkaynak et al. (2005) and use the unscaled change in the next-month futures contract. This approach ensures small targeting errors in the federal funds rate by the trading desk at the New York Fed, revisions in expectations of future targeting errors, changes in bid-ask spreads, or other noise, which have only a small effect on the current-month average, are not amplified through multiplication by a large scaling factor. Following convention, we call monetary policy surprises expansionary when the new target rate is lower than predicted by fed funds futures before the FOMC meeting, that is, when v_t is negative; and we call positive v_t contractionary.

In a robustness test, we instrument for the federal funds rate using the running sum of these high-frequency monetary policy innovations. Whereas each innovation captures a change in the Federal Funds rate, their running sum is akin to the level of the Federal Funds rate. For each quarter t, we sum the innovations that occurred from the start of the sample period through t.

Table 2 shows summary statistics for various variables of interest. The average federal funds rate in the sample is 2.32%, whereas the average employment-to-population ratio is

[4] We implicitly assume date t is after the previous FOMC meeting. Meetings are typically around six to eight weeks apart.

[5] We implicitly assume in these calculations that the average effective rate within the month is equal to the federal funds target rate and that only one rate change occurs within the month.

0.67. The average two-year employment growth rate is 10.0% for Blacks and 6.1% for Whites. Employment growth is also more volatile for Blacks than for Whites (standard deviation of 21.8% as compared to 13.7%), which is consistent with Black employment growth being more cyclical.

[Table 2 about here.]

The average employment growth rate also varies with workers' education and sex. The average two-year employment growth rate is twice as high for workers without a high school degree (2.1%) as for those with a bachelor's degree (1.1%).[6] Average growth rates are more similar for men (7.0%) and women (6.5%).

2.2 Results

For each demographic group g, we run the following OLS regression relating the growth rate of employment to the federal funds rate and local labor market tightness:

$$EmplGrowth_{j,g,m,t} = \beta_1 \times FedFunds_t \times Empl/Pop_{m,t-1} + \beta_2 \times Empl/Pop_{m,t-1} + \theta_{j,m} + \delta_{j,t} + \epsilon_{j,g,m,t}, \quad (3)$$

where $EmplGrowth_{j,g,m,t}$ is the growth rate of employment for demographic group g from the beginning of quarter $t+1$ through the end of quarter $t+8$ in industry j and local labor market m; $FedFunds_t$ is the average federal funds rate during quarter t; and $Empl/Pop_{m,t-1}$ is the prime age employment-to-population ratio in labor market m at the beginning of quarter t. Industry-by-MSA fixed effects, $\theta_{j,m}$, absorb unobserved, time-invariant, location-specific variation in employment growth that is common to a given industry. These fixed effects control for variation in employment growth that is driven by, for example, the local supply of human capital, regulatory environments and legal infrastructure conducive to growth, and transportation systems. Industry-by-quarter fixed effects, $\delta_{j,t}$, absorb unobserved, industry-level, temporal variation in employment growth that is common across locations, including, for example, variation in the aggregate demand for a given industry's products. Throughout the analysis, the standard errors are adjusted for clustering at the local labor market level.

Although the industry-by-quarter fixed effects prevent us from identifying the main effect of monetary policy on employment growth, the MSA-panel nature of our dataset, which includes local labor markets with varying degrees of labor market tightness, enables us to identify the relation between employment growth and the interaction of monetary policy and

[6] In the QWI, education categories are defined for workers aged 25 and older, who have lower average employment growth rates than younger workers.

labor market tightness. For each demographic group, the coefficient of interest, β_1, captures how the sensitivity of employment growth to the federal funds rate varies with local labor market tightness, measured using the employment-to-population ratio. This coefficient is identified by comparing how employment growth for a given industry and locality responds differentially to variation in monetary policy in tight, as compared to slack labor markets.[7]

[Table 3 about here.]

Table 3 presents OLS estimates of equation (3). Each column in Table 3 examines the employment growth of a different demographic group. Panel A of the table examines heterogeneity with respect to workers' race, presenting results for Blacks in column 1 and Whites in column 2. For Blacks, the coefficient on the interaction between the federal funds rate and local labor market tightness, β_1, is negative, sizable, and statistically significant. This coefficient implies that a monetary easing is associated with greater Black employment growth in tight labor markets as compared to in slack ones. To assess the magnitude of this estimate, consider the effect of a one standard deviation (2.25 percentage point) decrease in the federal funds rate. Our estimate implies that, over the subsequent two years, this drop in the federal funds rate is associated with a 0.91 percentage point larger increase in Black employment growth in labor markets at the 90th percentile of employment-to-population (86%) than in labor markets at the 10th percentile of employment-to-population (49%). This additional boost in employment growth in tighter labor markets is sizable, corresponding to 9% of the mean two-year Black employment growth over the sample period.

[Figure 1 about here.]

To illustrate the heterogeneity in monetary policy's effect across labor markets implied by our estimates of equation (3), Figure 1 plots, for a given point in time, predicted Black employment growth across labor markets with different degrees of tightness. Specifically, the figure plots the predicted differential effect of a one standard deviation cut in the federal funds rate on two-year Black employment growth across labor markets in each decile of tightness in the fourth quarter of 2000.[8] We plot the additional employment growth predicted for each decile (based on its mean employment-to-population ratio) relative to that for the lowest decile. The figure shows the substantial heterogeneity across labor markets in the effect of a monetary expansion on subsequent Black employment growth: after a monetary expansion,

[7]The industry-by-quarter and industry-by-location fixed effects ensure that this identification is achieved after netting out the average rates of employment growth both in that location-industry over time and in that industry-quarter across locations.

[8]Figures for other points in time look similar with slight variations arising from the contemporaneous distribution of labor market tightness across deciles.

Black employment grows more rapidly in tighter labor markets. The estimates predict that a one standard deviation drop in the federal funds rate in Q4 of 2000 would have increased subsequent 2-year Black employment growth by a quarter percentage point more in labor markets in the second decile of tightness than in the first. The effect is larger in each incremental decile, with the relative effect being twice as large in the fourth decile than in the second decile, more than three times as large in the seventh decile, and more than five times as large in the tenth decile.

The employment response of Whites, however, differs from that of Blacks. Column 2 of Table 3 reports estimates of equation (3) for Whites. In contrast to Blacks, the β_1 coefficient for Whites is much smaller and not statistically significant. This coefficient implies that White employment growth's sensitivity to the federal funds rate does not depend on the degree of local labor market tightness. The difference in the Black and White coefficient estimates is highly statistically significant ($p < 0.01$).

Panel B of Table 3 presents a similar heterogeneity analysis with respect to educational attainment, reporting results for those who did not complete high school in column 3, high school graduates in column 4, those with some college education in column 5, and bachelor's degree holders in column 6.[9] We find that in response to a monetary easing, the increase in employment growth among workers who did not complete high school is larger when labor markets are tight than when they are slack (column 3). The β_1 coefficient implies that a one standard deviation drop in the federal funds rate is associated with 0.39 percentage point greater two-year employment growth in tight labor markets (90th percentile) than in slack ones (10th percentile). This magnitude is again sizeable and corresponds to approximately 18% of unskilled workers' mean two-year employment growth.

For workers with greater educational attainment, in contrast, the β_1 coefficient estimates are close to zero and not statistically significant (columns 4-6). The point estimates are similar across these three more educated groups, implying that the sensitivity of employment growth to monetary easing is less dependent on the degree of slack in the labor market for workers who completed high school. The coefficient for workers who did not complete high school is statistically different from the three remaining coefficient estimates. For example, the p-value of the difference between the coefficients for those who did not complete high school and those with a bachelor's degree is 0.001. The difference between these coefficients for each of the three groups with greater educational attainment is not statistically significant.

Panel C of Table 3 examines employment growth separately among men and women. We again find heterogeneous effects: The point estimates of the interaction coefficient, β_1, is an order of magnitude larger in absolute value for women than for men (-0.26 vs. -0.03).

[9] Data are not available in the QWI to conduct the analysis at the race-by-education level.

Although neither coefficient is statistically different from zero in this specification, the two coefficients are statistically different from one another (p-value = 0.02).[10]

Although groups less attached to the labor market often have lower employment bases than more attached groups, this difference does not explain the differences in β_1 across the groups. Table 4 repeats the analysis of Table 3 after changing the dependent variables from employment growth rates (i.e., the ratio of the change in group employment to the lagged group employment) to the change in group employment normalized by lagged *total* MSA employment (i.e., across all groups). The results are similar in Table 4 and in Table 3. The results' robustness to this alternative normalization indicates that differences in groups' employment bases do not drive our findings.

[Table 4 about here.]

As our identification strategy exploits cross-sectional variation in labor market tightness, one could be concerned that these local labor markets also differ along other dimensions and it is conceivable that these markets experience different shocks that happen to be correlated with labor market tightness. The analysis presented so far uses industry-by-MSA fixed effects to control for time-invariant, location-specific factors that differ across labor markets as well as industry-by-quarter fixed effects to absorb unobserved, industry-level, temporal variation in employment growth common across locations. As a further robustness test, we also control for MSA-by-quarter fixed effects. In these specifications, we base our inference on variation across individuals in the same labor market at the same time. These specifications alleviate concerns that different markets could be subject to different shocks in a manner that industry-by-quarter fixed effects do not capture.

When including MSA-by-quarter fixed effects in the analysis, the β_1 coefficients for each demographic group are not identified. However, we can identify the *difference* in β_1 coefficients across demographic groups. For example, pooling the data for Whites and Blacks allows us to identify the difference in the β_1 coefficients for these two groups. This difference captures how White and Black employment growth responds differentially to monetary policy across labor markets of varying tightness. More generally, with MSA-by-quarter fixed effects, our inference is based on comparing the employment growth rates of different demographic groups in the same MSA in the same quarter.

[Table 5 about here.]

Table 5 presents the results. For each demographic category – race, education, and sex – the table presents the difference in the β_1 coefficient across the different demographic groups

[10] As shown below, the β_1 coefficient for women is statistically significant in both reduced form and 2SLS specifications examining the effects of high-frequency monetary shocks.

in that category. Panel A reports the federal funds rate-labor market tightness interaction coefficient for Blacks relative to that for Whites, ${\beta_1}^{Blacks} - {\beta_1}^{Whites}$ (Column 1), Panel B presents the interaction coefficients for each education level relative to the coefficient for workers with a bachelors degree (Columns 3-5), and Panel C shows the interaction coefficient for females relative to that for males (Column 9). For comparison, the table also presents the analogous estimates from the baseline regressions without MSA-by-quarter fixed effects reported in Table 3.[11] Table 5 shows that including MSA-by-quarter fixed effects has no noticeable effect on most of the estimates. It moderates the estimate for Blacks relative to Whites, but the estimate remains sizable and highly statistically significant.

Next, we examine the persistence of the differential employment growth in tight versus slack labor markets. To study the short- and long-term dynamic responses of employment growth, we use a rolling window framework. Figure 2 depicts the impact of monetary policy on employment growth over a one-year horizon starting at different time periods following a change in monetary policy. For each time period p, beginning one quarter to 16 quarters out, we estimate the following specification:

$$\begin{aligned} EmplGrowth^{p}_{j,g,m,t} = \beta_1 \times FedFunds_t \times Empl/Pop_{m,t-1} + \\ \beta_2 \times Empl/Pop_{m,t-1} + \theta_{j,m} + \delta_{j,t} + \epsilon_{j,g,m,t}, \quad (4) \end{aligned}$$

where $EmplGrowth^{p}_{j,g,m,t}$ is the growth rate of employment for demographic group g from the beginning of quarter $t + p$ through the end of quarter $t + p + 3$ in industry j and local labor market m. All other variables are as in equation (3). Figure 2 plots the β_1 coefficients obtained from these one-year rolling window regressions.

[Figure 2 about here.]

The figure shows that the effects of monetary policy described in Table 3 have a long-term impact. Panel A, which presents the results by race, indicates that the differential incremental impact of monetary policy on Black employment growth in tight versus slack labor markets reaches a peak starting seven quarters after the monetary policy change. The β_1 coefficient declines in absolute value subsequently and is approximately zero by quarter 15. In contrast, the effect on White employment growth is consistently close to zero across all time periods. Panels B and C show similar results when examining differences by education and sex, respectively. The β_1 coefficient for workers without a high school diploma and for women declines in absolute value beginning in quarter 9.

[11] For example, in Table 3, the Black coefficient is -1.09 and the White coefficient is 0.10. The difference between these, -1.19, is reported in Table 5, Column (2).

Although monetary policy's incremental effect on Black, low-education, and female employment growth wanes over time, its cumulative effect is long-lasting. Figure 3 depicts the relation between cumulative employment growth and the interaction of the federal funds rate and labor market tightness. For each demographic group, we re-estimate equation (3) for cumulative employment growth measured over different horizons from one quarter up to 16 quarters. Figure 3 plots the β_1 interaction coefficients obtained from each of these regressions. The eight-quarter estimates are the same as those reported in Table 3. Panel A presents results by race, Panel B by education, and Panel C by sex. In all three cases, the heterogeneity in the cumulative effect is long-lasting. Focusing, for example, on Panel A, the figure shows that the differential effect of monetary policy on cumulative black employment growth in tight versus slack labor markets persists even four years following the shock. Further, β_1 is larger in absolute value for Blacks than for Whites at every horizon, with the difference between the coefficients statistically significant at the 1% level at every horizon longer than five quarters.[12]

[Figure 3 about here.]

Even though our analysis is at the MSA level and controls for economic conditions using industry-by-MSA and industry-by-quarter fixed effects, a potential concern is that developments in the federal funds rate are endogenous and correlated with variables affecting local employment growth. Because decreases in the federal funds rate tend to occur in response to deteriorations in the economy, the coefficients in Table 3 will be biased upwards (i.e., less negative) if employment growth in slack labor markets is more pro-cyclical. To alleviate this concern, we examine the effects of unexpected changes in monetary policy, identified using high-frequency movements in the federal funds futures rate around FOMC announcements, following Kuttner (2001) and others. We use the running sum of these high-frequency monetary shocks to instrument for the federal funds rate within a 2SLS framework. This 2SLS estimation is in the spirit of Gertler and Karadi (2015), who use these high-frequency monetary shocks as an external instrument within a structural VAR framework. Because the running sum of monetary shocks is highly predictive of the federal funds rate, it is a valid instrument under the assumption that no other news about the economy is revealed during the 30-minute window around the FOMC meeting.

As a first step in this analysis, we re-estimate our baseline specification (equation 3) after replacing the federal funds rate with the high-frequency shocks. In the instrumental variables approach, this specification is the reduced form regression, wherein we examine the

[12]This difference is statistically significant at the 5% level at every horizon longer than one quarter.

relation between the dependent variable and the instrument itself. We report the results in Table 6.

[Table 6 about here.]

Directly studying the differential impact of monetary shocks in tight versus slack labor markets yields qualitatively similar results as in our analysis that examines the federal funds rate in Table 3. Panel A of Table 6 shows that, whereas an expansionary monetary policy shock leads to higher Black employment growth in tighter labor markets (column 1; $p < 0.05$), White employment growth does not depend on labor market tightness in a statistically significant manner. Similarly, the education group least attached to the labor force—workers without a high school diploma—is more sensitive to monetary policy shocks in tight labor markets than in slack ones (Panel B). Further, whereas monetary expansions lead to greater employment growth in tighter labor markets for women, this effect is not statistically significant for men (Panel C). For each of these demographic categories, these differences across groups are statistically significant.

Finally, to measure the effect of changes in the federal funds rate itself, we run a 2SLS specification in which we use the high-frequency monetary policy shocks to instrument the federal funds rate. Specifically, we instrument for the interaction between the federal funds rate and the local employment-to-population ratio using the interaction between the monetary shocks and the local employment-to-population ratio. Panel A of Table 7 reports the results of the first stage equation:[13]

$$FedFunds_t \times Empl/Pop_{m,t-1} = \alpha_1 \times MonetaryShock_t \times Empl/Pop_{m,t-1} + \alpha_2 \times Empl/Pop_{m,t-1} + \theta_{j,m} + \delta_{j,t} + \eta_{j,g,m,t}, \quad (5)$$

where $MonetaryShock_t$ is the high-frequency monetary shock variable in quarter t. As Panel A shows, the coefficient of interest, α_1, is positive and highly statistically significant ($p < 0.001$). The first stage F-statistic is 4,984, leaving no concern that $MonetaryShock$ is a weak instrument.

[Table 7 about here.]

The remaining panels of Table 7 present the results of the instrumental variable analysis, which estimates a specification similar to equation (3) but that substitutes the predicted values from equation (5) for the interaction between the federal funds rate times the local

[13] Panel A reports the results of the first stage equation in the context of the analysis of Black employment growth, but we obtain very similar results for the samples corresponding to the other demographic groups.

employment-to-population ratio. Compared to the analogous OLS estimates reported in Table 3, the IV estimates in Table 7 are slightly larger in magnitude (i.e., more negative). The difference between the estimates suggests that the covariate of interest $FedFunds_t \times Empl/Pop_{m,t-1}$ might be positively correlated with an omitted determinant of employment growth in the OLS specification.[14]

Panel B of Table 7 reports results by race. Monetary policy expansions lead to larger increases in Black employment growth when the labor market is tighter (Column 2). The coefficient implies that a one standard deviation drop in the federal funds rate increases subsequent two-year Black employment growth by 1.02 percentage points more in tight labor markets (90th percentile) than in slack labor markets (10th percentile). This additional boost to employment growth in tighter labor markets is substantial, corresponding to 10.2% of the mean Black employment growth over the sample period. In contrast, the 2SLS coefficient for Whites (column 3) is statistically insignificant and trivial in magnitude. The difference between the two coefficients is statistically significant at the 1% level. These estimates imply that the impact of monetary easings on employment growth does not depend on labor market tightness for Whites as it does for Blacks.

Results across education groups are reported in Panel C. The coefficient for those who did not complete high school (column 4) is more than three times as large as the coefficients for each of the three other education groups (columns 5-7) and is statistically different from them. For example, the p-value of the difference between the coefficients for those who did not complete high school and those with a bachelor's degree is less than 0.001.[15] The point estimate implies that a standard deviation drop in the federal funds rate increases the two-year employment growth of workers who did not complete high school by 0.55 percentage points more in tight labor markets (90th percentile) than in slack ones (10th percentile). For these unskilled workers, this additional impact of monetary policy in tighter labor markets corresponds to 26% of their average two-year employment growth over the sample period.

Finally, Panel D shows IV estimates of the effects on females and males. The IV estimates are again larger in magnitude than the OLS estimates, and we continue to find heterogeneous effects. Monetary expansions boost women's employment more in tight labor markets than in slack ones (column 8). A one standard deviation drop in the federal funds rate is associated with a growth in female employment that is 0.37 percentage points higher in tight labor markets (90th percentile) than in slack ones (10th percentile). The coefficient estimate for

[14] Because the Fed eases monetary policy during economic downturns, we would expect the OLS estimates to be upward biased (i.e., less negative than the 2SLS results) if employment growth is more pro-cyclical in slack labor markets.

[15] The differences between the coefficients for the three groups with greater educational attainment are not statistically significant.

men is one-half of what it is for women, and the difference between the two coefficients is statistically significant at the 7% level.

Taken together, these results show consistent evidence that monetary policy has heterogeneous effects on employment across demographic groups. They also present a common pattern: expansionary monetary policy promotes employment of demographic groups with historically lower labor market attachment—Blacks, the least educated, and women—the most when labor markets are tight. For these groups, the impact of monetary policy in tight labor markets lasts several years. In contrast, this pattern is muted or nonexistent for groups with greater labor market attachment—Whites, skilled workers, and men.

The results thus suggest that sustained expansionary monetary policy, which allows the labor markets to tighten significantly, might be required to generate robust employment growth among workers who are less attached to the labor market. We show that, as long as labor markets are slack, the impact of monetary policy on Blacks, unskilled workers, and women is muted. Next, we explore the implications of this heterogeneity for monetary policy in the context of a heterogeneous agent New Keynesian model in which workers differ by their productivity.

3 Model

Our empirical results show that in tight labor markets less attached segments of the labor force are more sensitive to monetary policy shocks. In this section, we model an economy with heterogeneous workers to examine the underpinnings of this empirical regularity and to perform counterfactual analysis. In the model, workers differ in their productivity. We do not model the sources of variation in workers' productivity, which could stem from differences in education levels, labor market experience, worker-firm match quality, on-the-job discrimination, workplace harassment, or other factors. The model considers two types of workers whose worker-specific productivity is drawn from different subsets of the unit interval, leading to persistent differences in average productivity across workers of different types. All else equal, these different levels of average productivity map into different levels of steady-state employment, which is the model equivalent of labor force attachment.

Workers consume output and supply labor to firms. Following Galí (2011b), we assume labor is indivisible: in each period, an individual either works a fixed number of hours or does not work at all. All variation in labor input thus takes place at the extensive margin. Workers separate from firms for both exogenous and endogenous reasons. We model the search and hiring decisions following Ravenna and Walsh (2012). In this section, we introduce the different model ingredients and then calibrate the model in the next section to study how monetary policy shocks affect the employment of workers of different types.

3.1 Timing

The timing and information structure of the model are as follows:

1. Exogenous separation. A fraction $\delta \in [0,1]$ of workers separate from their firms.

2. Productivity revelation. Aggregate productivity A_t and each worker's period-specific individual productivity $a_{i,t}$ are realized. Aggregate productivity and workers' types are common knowledge. An individual worker's productivity level is i.i.d. over time and drawn from a distribution that depends on the worker's type. A worker's productivity level is observable to the firm that employs the workers.

3. Endogenous separation. Firms choose to fire workers based on each worker's productivity.

4. Hiring. Firms employ third-party agencies to select workers for them to hire. Unemployed workers—both those who entered the period unemployed and those who separated—search for work. Hiring agencies observe whether a worker was endogenously separated and choose whom to interview. The interviews reveal workers' productivity levels.

5. Production occurs and wages are paid.

3.2 Households

A representative household exists consisting of a continuum of workers of two types, high (h) and low (l), with a mass γ of high types and a mass $1-\gamma$ of low types. A high type's productivity is drawn from a uniform distribution on the support $[\underline{s}, 1]$, whereas a low type's productivity is drawn from the support $[0, \bar{s}]$, where $\underline{s} > 0$ and $\bar{s} < 1$.

We assume that utility is separable between consumption and the disutility of work. Individuals display habit formation over aggregate consumption, which leads macro quantities, including output, to exhibit humped-shaped responses to shocks. Utility is given by:

$$U_t = \frac{1}{1-\sigma}(C_t - \mathbb{h}C_{t-1})^{1-\sigma} - (N_{h,t}^{\chi} + N_{l,t}^{\chi})/\chi \ , \tag{6}$$

where σ is the intertemporal elasticity of substitution, $\chi \geq 1$ is a measure of disutility due to working, $\mathbb{h} > 0$ measures the strength of habit formation, and $N_{h,t}$ and $N_{l,t}$ are the number of high and low-type workers working in period t, respectively. Consumption and the aggregate price index, C_t and P_t, are given by:

$$C_t = \left(\int_0^1 C_t(i)^{\frac{\epsilon-1}{\epsilon}} di \right)^{\frac{\epsilon}{1-\epsilon}} \quad \text{and} \quad P_t = \left(\int_0^1 P_t(i)^{1-\epsilon} di \right)^{\frac{1}{1-\epsilon}} , \tag{7}$$

where $C_t(i)$ and $P_t(i)$ are the consumption and price, respectively, of goods produced by firm i; and ϵ is the elasticity of substitution between goods produced by different firms.

The demand for good i is given by:

$$C_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\epsilon} C_t \tag{8}$$

and the household budget constraint in each period is:

$$W_{h,t} N_{h,t} + W_{l,t} N_{l,t} + D_t = C_t P_t \ , \tag{9}$$

where $W_{h,t}$ and $W_{l,t}$ are the nominal wages of the high and low types, respectively, and D_t equal the profits of firms and the hiring agency that are paid as dividends to the household. The first-order conditions for labor supply and consumption are given by:

$$\frac{N_{k,t}^{\chi-1}}{Z_t} = \frac{W_{k,t}}{P_t} \quad \text{for } k = h, l \tag{10}$$

$$Q_t = \beta E_t \left(\frac{Z_{t+1}}{Z_t} \frac{P_t}{P_{t+1}} \right) , \tag{11}$$

where

$$Z_t = (C_t - \mathbb{h} C_{t-1})^{-\sigma} - \mathbb{h} \beta E_t (C_{t+1} - \mathbb{h} C_t)^{-\sigma} \tag{12}$$

is the marginal utility of consumption, Q_t is the stochastic discount factor, and β is the subjective time discount factor.

3.3 Labor Market

We denote by $\bar{a}_{k,t}$ the time t productivity threshold above which a worker of type k is profitable to hire, and $\underline{a}_{k,t}$ is the productivity threshold below which a worker is profitable to fire. Because of hiring costs, $\bar{a}_{k,t} > \underline{a}_{k,t}$. These thresholds are the model's key dynamic parameters.

The unemployment level immediately after exogenous separation is given by:

$$U_{h,t} = \gamma - (1-\delta)N_{h,t-1} \tag{13}$$
$$U_{l,t} = 1-\gamma - (1-\delta)N_{l,t-1}. \tag{14}$$

Total employment evolves according to:

$$N_{h,t} = P(a_{h,t} > \underline{a}_{h,t})(1-\delta)N_{h,t-1} + H_{h,t} = \left(1 - \frac{\underline{a}_{h,t} - \underline{s}}{1-\underline{s}}\right)(1-\delta)N_{h,t-1} + H_{h,t} \tag{15}$$
$$N_{l,t} = P(a_{l,t} > \underline{a}_{l,t})(1-\delta)N_{l,t-1} + H_{l,t} = \left(1 - \frac{\underline{a}_{l,t}}{\bar{s}}\right)(1-\delta)N_{l,t-1} + H_{l,t}\ , \tag{16}$$

where $H_{k,t}$ is the number of hires of type k in period t. Employment at time t equals employment at time $t-1$ minus time t exogenous and endogenous separations (governed by δ and $\underline{a}_{k,t}$, respectively) plus time t hires (governed by $\bar{a}_{k,t}$). For tractability, we assume the labor market is efficient, which implies that the agency interviews all eligible candidates and that all workers who exceed the hiring threshold are hired. Hence:

$$H_{h,t} = \left(1 - \frac{\underline{a}_{h,t} - \underline{s}}{1-\underline{s}}\right)U_{h,t} \tag{17}$$
$$H_{l,t} = \left(1 - \frac{\underline{a}_{l,t}}{\bar{s}}\right)U_{l,t}\ . \tag{18}$$

Therefore, the laws of motion of employment simplify to:

$$N_{h,t} = \frac{1}{1-\underline{s}}\left[\gamma(1-\bar{a}_{h,t}) + (1-\delta)(\bar{a}_{h,t} - \underline{a}_{h,t})N_{h,t-1}\right] \tag{19}$$
$$N_{l,t} = \frac{1}{\bar{s}}\left[(1-\gamma)(\bar{s} - \bar{a}_{l,t}) + (1-\delta)(\bar{a}_{l,t} - \underline{a}_{l,t})N_{l,t-1}\right]\ . \tag{20}$$

3.4 Hiring

Hiring is outsourced to a third-party agency that interviews workers for the firm. The firm specifies hiring thresholds, $\bar{a}_{h,t}$ and $\bar{a}_{l,t}$, for the agency to use when screening candidates and pays a fee per worker hired. In equilibrium, the hiring threshold is greater than the firing threshold, and so the agency chooses not to interview endogenously separated workers.

Interviewing a worker requires a fixed amount of labor F, with wages in the third-party agency pinned to $W_{k,t}$. The monetary cost of interviewing a worker is therefore

$$G_{k,t} = FW_{k,t}\ . \tag{21}$$

In expectation, because the hiring agency needs to conduct more interviews per hire when searching for workers with higher productivity, the expected cost per worker hired is increasing in the hiring threshold $\bar{a}_{k,t}$. Specifically, the expected cost per worker hired is $\frac{G_{h,t}}{1-\frac{\bar{a}_{h,t}-\underline{s}}{1-\underline{s}}}$ and $\frac{G_{l,t}}{1-\frac{\bar{a}_{l,t}}{\bar{s}}}$ for high and low types, respectively. To see this, note that the expected number of interviews to hire a high type is $\frac{1}{1-\frac{\bar{a}_{h,t}-\underline{s}}{1-\underline{s}}}$ and it is $\frac{1}{1-\frac{\bar{a}_{l,t}}{\bar{s}}}$ to hire a low type. Since the market for hiring agencies is perfectly competitive, $\frac{G_{h,t}}{1-\frac{\bar{a}_{h,t}-\underline{s}}{1-\underline{s}}}$ and $\frac{G_{l,t}}{1-\frac{\bar{a}_{l,t}}{\bar{s}}}$ are also the fees that the firm pays to hire workers with productivity above the hiring threshold.

We assume that the hiring agency rebates the money it earns to the representative household who owns the agency.

3.5 Intermediate Goods Firms

Intermediate firms of mass one operate in competitive markets and produce output using labor as the only factor of production. Each period, they set the hiring thresholds $\bar{a}_{h,t}$ and $\bar{a}_{l,t}$ equal to the minimum productivity levels for which it is profitable to hire workers. Similarly, firms set the firing thresholds $\underline{a}_{h,t}$ and $\underline{a}_{l,t}$ equal to the productivity level below which it is not profitable to retain a worker.

Intermediate firms have fully flexible prices and produce output $X_t(j)$ using a common technology, which is given by:

$$X_t(j) = A_t \psi_t(j) N_t(j) \ , \tag{22}$$

where A_t is the aggregate technology level that is common across firms, $\psi_t(j)$ measures the average worker productivity of firm j, and $N_t(j)$ is the number of workers hired.

We can rewrite $X_t(j)$ as:

$$\begin{aligned} X_t(j) \ &= A_t \Bigg\{ \frac{\gamma}{1-\underline{s}} \left[(1-\delta) \int_{\underline{a}_{h,t}}^{1} a \ da + \delta \int_{\bar{a}_{h,t}}^{1} a \ da \right] \\ &\quad + \frac{1-\gamma}{\bar{s}} \left[(1-\delta) \int_{\underline{a}_{l,t}}^{\bar{s}} a \ da + \delta \int_{\bar{a}_{l,t}}^{\bar{s}} a \ da \right] \Bigg\} \ . \end{aligned} \tag{23}$$

Simplifying, we get,

$$\begin{aligned} X_t(j) \ &= \frac{A_t}{2} \Bigg(\frac{\gamma}{1-\underline{s}} \left[(1-\delta)(1-\underline{a}_{h,t}^2) + \delta(1-\bar{a}_{h,t}^2) \right] \\ &\quad + \frac{1-\gamma}{\bar{s}} \left[(1-\delta)(\bar{s}^2-\underline{a}_{l,t}^2) + \delta(\bar{s}^2-\bar{a}_{l,t}^2) \right] \Bigg) \ . \end{aligned} \tag{24}$$

We assume firms have all bargaining power and hence only need to pay a wage that makes workers willing to participate in the labor force (see equation (10)). Firms and workers bargain every period, so the wage rate is determined by the bargaining problem on a period-by-period basis (see Pissarides (2000)). Because the labor market is efficient, workers always search and work if the participation condition is satisfied, and firms rebate any profits they make as dividends to the household that owns them.

At the firing threshold, $\underline{a}_{k,t}$, the firm is indifferent between firing and not firing the marginal worker of type k. The nominal wage is thus equal to the nominal benefit of retaining the marginal worker, which equals the sum of the worker's output in the current period and the option value, $V_{k,t}$, of retaining the worker and learning his or her updated productivity next period without conducting a hiring interview:

$$W_{k,t} = P_t^I A_t \underline{a}_{k,t} + V_{k,t} \ , \tag{25}$$

where P_t^I is the price index of intermediate goods and reflects the firm's marginal costs:

$$P^I = \gamma W_{h,t} \left[1 - \frac{\underline{a}_{h,t} - \underline{s}}{1 - \underline{s}} - \delta \frac{\bar{a}_{h,t} - \underline{a}_{h,t}}{1 - \underline{s}} \right] + (1 - \gamma) W_{l,t} \left[1 - \frac{\underline{a}_{l,t}}{\bar{s}} - \delta \frac{\bar{a}_{l,t} - \underline{a}_{l,t}}{\bar{s}} \right] \ . \tag{26}$$

Similarly, at the hiring threshold, $\bar{a}_{k,t}$, the firm is indifferent between hiring and not hiring the marginal worker of type k. The total cost (interviewing costs and wages) of hiring the marginal worker is thus equal to the total benefit (output and option value of retaining the worker) of hiring the worker:

$$\frac{G_l}{1 - \frac{\bar{a}_{l,t}}{\bar{s}}} + W_{l,t} = P_t^I A_t \bar{a}_{l,t} + V_{l,t} \tag{27}$$

$$\frac{G_h}{1 - \frac{\bar{a}_{h,t} - \underline{s}}{1 - \underline{s}}} + W_{h,t} = P_t^I A_t \bar{a}_{h,t} + V_{h,t} \ . \tag{28}$$

Given equation (25), the hiring thresholds thus satisfy:

$$\frac{G_{l,t}}{1 - \frac{\bar{a}_{l,t}}{\bar{s}}} = P_t^I A_t (\bar{a}_{l,t} - \underline{a}_{l,t}) \tag{29}$$

$$\frac{G_{h,t}}{1 - \frac{\bar{a}_{h,t} - \underline{s}}{1 - \underline{s}}} = P_t^I A_t (\bar{a}_{h,t} - \underline{a}_{h,t}) \ . \tag{30}$$

The option value $V_{k,t}$ is given recursively by:

$$V_{h,t} = \beta(1-\delta)\mathbb{E}_t\left[\frac{Z_{t+1}}{Z_t}\left[\left(1-\frac{a_{h,t+1}-\underline{s}}{1-\underline{s}}\right)(G_{h,t+1}+V_{h,t+1})\right]\right] \tag{31}$$

$$V_{l,t} = \beta(1-\delta)\mathbb{E}_t\left[\frac{Z_{t+1}}{Z_t}\left[\left(1-\frac{a_{l,t+1}}{\bar{s}}\right)(G_{l,t+1}+V_{l,t+1})\right]\right] \ . \tag{32}$$

For simplicity, we focus only on the next period's option value because the probability of worker retention beyond one period is small given i.i.d. productivity draws and exogenous separation δ:

$$V_{h,t} = \beta(1-\delta)\mathbb{E}_t\left[\frac{Z_{t+1}}{Z_t}\left[\left(1-\frac{a_{h,t+1}-\underline{s}}{1-\underline{s}}\right)G_{h,t+1}\right]\right] \tag{33}$$

$$V_{l,t} = \beta(1-\delta)\mathbb{E}_t\left[\frac{Z_{t+1}}{Z_t}\left[\left(1-\frac{a_{l,t+1}}{\bar{s}}\right)G_{l,t+1}\right]\right] . \tag{34}$$

Combining these equations with equation (25) allows us to describe the dynamics of the firing threshold.

3.6 Final Goods Firms

We follow Walsh (2005) and Blanchard and Galí (2010) and introduce final goods firms to avoid an interaction between wage and price setting. In particular, we assume that a continuum of final goods firms distributed on the unit interval produce varieties of differentiated products in monopolistically competitive markets using identical technology:

$$Y_t(i) = X_t(i) \ , \tag{35}$$

where X represents the quantity of intermediate goods used in the production of final goods. Final firms act like retailers: they purchase intermediate goods and sell them in final goods markets.

The real marginal cost of final goods firms is:

$$MC_t = \frac{P_t^I}{P_t} \ . \tag{36}$$

Market clearing dictates:

$$Y_t = C_t \ . \tag{37}$$

Assume that final-goods firms can only adjust their output price in each period with a constant Calvo probability of $(1-\theta)$. Hence, the aggregate price level is given by:

$$P_t = ((1-\theta)(P_t^*)^{1-\epsilon}) + \theta(P_{t-1})^{1-\epsilon})^{\frac{1}{1-\epsilon}}. \quad (38)$$

A firm able to reset prices in period t, P_t^*, will do so according to:

$$E_t\left\{\sum_{l=0}^{\infty}\theta^l Q_{t,t+l}Y_{t,t+l|t}\left(P_t^* - \frac{\epsilon}{1-\epsilon}P_{t+l}MC_{t+k}\right)\right\} = 0. \quad (39)$$

Let p_t, p_t^i and π_t be the log-linearized values of P_t, P_t^I and inflation, $\Pi_t = P_t/P_{t-1}$, respectively. The log-linearized New Keynesian Phillips Curve is given by:

$$\pi_t = \beta E_t[\pi_{t+1}] + \lambda(p_t^i - p_t), \quad (40)$$

where $\lambda = \frac{(1-\theta)(1-\beta\theta)}{\theta}$ and $p_t^i - p_t$ is final goods firms' log-linearized real marginal cost.

3.7 Monetary Policy

The central bank sets a short terms policy rate i with interest-rate smoothing following Coibion and Gorodnichenko (2012):

$$\begin{aligned} i_t^* &= \phi_\pi \pi_t + \phi_y y_t + \mu_t, \\ i_t &= (1-\rho_i)i_t^* + \rho_i i_{t-1}, \\ \mu_t &= \rho_\mu \mu_{t-1} + \epsilon_t, \end{aligned} \quad (41)$$

where ϕ_π and ϕ_y are the coefficients in the Taylor rule on log-linearized inflation π and output y, respectively. The parameter ρ_i governs the degree of policy smoothing in the nominal interest rate, the parameter ρ_μ governs the degree of persistence in interest rate shocks, and ϵ_i is an i.i.d. monetary policy innovation.

3.8 Model Parameterization

We parameterize the log-linearized version of the model at the quarterly frequency using the values listed in Table 8.[16] The preference parameters are standard. The average quarterly degree of price stickiness θ of 0.73 implies that price spells have an average duration of 1.4 quarters, consistent with evidence from microdata (Weber, 2015; Gorodnichenko and Weber, 2016). The monetary policy specification and shock persistence parameter follow

[16] See Appendix A for the log-linearized system of equations.

Coibion and Gorodnichenko (2012) and Pasten et al. (2020). Worker types only differ in their productivity distributions. The steady-state hiring threshold $\bar{a}$ equals 0.45 for both types. The Bureau of Labor Statistics estimates the total separation of workers to be 0.45 per year in 2019 using JOLTS. We thus assume an exogenous separation rate of 0.05 per quarter to leave room for the incidence of endogenous separation. The share of high- and low-type workers, γ, equals 0.5.[17] In the baseline calibration, high-type workers draw their i.i.d. productivity from the interval $[0.1, 1]$, while low-type workers draw their productivity from the interval $[0, 0.75]$. Hence, this calibration implies that a larger share of high-type workers are employed in steady state (see also Ravenna and Walsh, 2012). We discuss these differences in more detail below.

[Table 8 about here.]

4 Policy Simulations

Figure 4 reports impulse response functions (IRFs) to a one standard deviation expansionary monetary policy shock for output, the nominal interest rate, inflation, the hiring thresholds $\bar{a}_{l,t}$ and $\bar{a}_{h,t}$, the firing thresholds $\underline{a}_{l,t}$ and $\underline{a}_{h,t}$, the share of high- and low-type workers employed, and their wages.[18] In the baseline calibration (solid blue line), an expansionary monetary policy shock increases output, wages, and inflation on impact and leads to mostly persistent declines in the hiring and firing thresholds for both types of workers. The lower hiring and firing thresholds imply that an expansionary monetary policy shock results in more workers being hired and fewer such workers being fired.

[Figure 4 about here.]

Expansionary monetary policy differentially affects the employment of workers of different types. The hiring threshold declines more for low types than for high types. This effect builds up over time before the thresholds converge back to their steady-state levels. The firing threshold also initially decreases more for low types than for high types. The low-type threshold overshoots temporarily before converging back to its steady-state level. As a result of the changes in both thresholds, employment increases more for low types than for high types. In this way, expansionary monetary policy particularly benefits lower productivity workers.

[17] In robustness checks, we allow for a higher hiring threshold for low-productivity workers and reduce the share of high-type workers in the economy. As described below, both changes do not qualitatively change our results.

[18] Figure 4 plots log deviations from the steady state, except for the employment shares, for which the level response is also plotted in the bottom row.

Figure 4 also plots IRFs for labor markets with different degrees of initial labor market tightness. We achieve this variation by varying the support of the productivity draws of high- and low-types. We move $\underline{s}$, the lower bound of the support for high types, from 0.1 in the baseline to 0.125 in the tight labor market calibration (dash-dotted red line) and to 0.075 in the slack calibration (dashed black line). For low types, we move $\bar{s}$, the upper bound of the support, from 0.75 in the baseline to 0.725 in the tight calibration and to 0.775 in the slack calibration. These changes translate into different steady-state levels of employment and, thus, different labor market tightness. Whereas in the baseline calibration, the steady-state share of employment of high types is 80.9%, this number is 83.3% in the tight labor market calibration and 78.5% in the slack labor market calibration. For low types, the steady-state share of employment is 72.5% in the baseline calibration, 74.8% in the tight labor market calibration, and 71.2% in the slack labor market calibration.

The calibration in Figure 4 shows that low-type workers benefit most from expansionary monetary policy in tight labor markets: low-type workers' hiring threshold decreases more in the tight labor market than in the slack one. The decline in this threshold translates into larger employment gains for low-type workers when labor markets are tight. This holds for deviations from steady state as well as for employment levels (see the bottom row of the figure). In the slack labor market, the monetary shock increases the share of low-type workers who are employed from steady-state to its maximum level by 17 percentage points. In the tight labor market, this increase is 25 percentage points.[19] In contrast, the monetary shock's impact on high types is similar across markets with different initial levels of labor market tightness: the monetary shock increases high-type employment (from the steady-state to its maximum level) by 12.5 percentage points in the slack labor market and by 11.5 percentage points in the tight labor market.[20]

Hence, consistent with our empirical results, we find that expansionary monetary policy disproportionally benefits lower productivity workers in tight labor markets. This pattern arises for two reasons. First, in tighter labor markets, the marginal workers who join the labor force in response to the monetary shock have lower productivity levels. This is a straightforward ranking effect similar to Blanchard and Diamond (1994), whereby when filling vacancies, firms begin by hiring higher productivity workers. Second, in tighter labor markets, employment expands more easily in response to a monetary shock because screening for lower-productivity workers is less costly, as it takes fewer interviews to find a candidate

[19] In the slack labor market, the monetary shock increases low-type workers' employment from a steady-state value of 71.2% to a maximum value of 88.1%. In the tight labor market, this share increases from a steady-state value of 74.8% to a maximum value of 99.9%.

[20] High-type employment increases from steady-state values of 78.5% and 83.3% in the slack and tight labor markets, respectively, to maximum values of 91.0% and 94.7% after the monetary expansion.

whose productivity is above the hiring bar. Thus, the hiring cost, $\frac{G_t}{1-\bar{a}_{k,t}}$, is lower in tighter labor markets, leading a monetary shock to have a larger effect on the hiring threshold.

Figure 4 also shows that low-type workers' wages respond more strongly to monetary expansions in tight labor markets, although the magnitude of the difference is smaller than for employment. In contrast, high-types' wages, like their employment, exhibit little or no state dependence. The results thus indicate that monetary expansions lead to greater wage compression in tighter markets (see also Autor et al., 2024).

Our results are not driven by the model having a relatively symmetric parameterization. When we set the steady-state share of high-type workers to $\gamma = 0.3$ instead of 0.5, the results are almost unchanged (see Figure A.1). Furthermore, setting the steady-state hiring thresholds to $\bar{a}_l = 0.465$ and $\bar{a}_h = 0.435$, instead of the homogeneous steady-state hiring thresholds of $\bar{a} = 0.45$, increases the degree to which expansionary monetary policy boosts employment particularly of low-type workers and especially so in tight labor markets (see Figure A.2).

During the 2008 Financial Crisis and the 2020 onset of the Covid-19 pandemic, monetary policy makers aggressively cut policy rates to zero. Figure 5 examines the importance of the size of the monetary shock for different types of workers. While the larger monetary expansion naturally boosts inflation, the results show that it also particularly helps low-type workers. The larger monetary shock causes larger drops in the hiring and firing thresholds, particularly for low-type workers. As a result, while the large monetary expansion increases low-type employment by 11 percentage points more than the small one, the incremental effect of the large monetary expansion on high-type employment (from steady state to peak employment) is only 7 percentage points. Monetary policy that more aggressively lowers interest rates thus has the potential to help workers who are normally forced to the sidelines by pulling them into employment.

[Figure 5 about here.]

The slope of the Phillips curve also affects these relations. During economic expansions, central banks often start increasing interest rates preemptively to reduce inflationary pressure. Evidence suggests that the Phillips Curve flattened in the decades before the Covid-19 pandemic (see, e.g., Simon et al., 2013; Hall, 2013), giving rise to the criticism that preemptively increasing rates hurts minority employment and is unwarranted given the low inflationary pressure. For example, former Federal Reserve Board Governor Lael Brainard stated in September 2020 that "There was no need to pre-emptively withdraw, or prepare to withdraw, on the basis of an expectation of inflation materializing" referring to the increase in the federal funds rate in 2015 (Brookings, 2020).

We examine the importance of the Phillips curve in our model economy by varying the degree of price stickiness. Figure 6 plots the IRFs for three different degrees of price stickiness. Consistent with the notion that stickier prices result in a flatter Phillips curve, we find that monetary expansions in the economy with stickier prices result in less inflation and larger output gains. Importantly, the figure shows that, with stickier prices, a monetary expansion results in larger decreases in the hiring and firing thresholds, particularly for low-type workers. With a flatter Phillips curve, the central bank is able to keep interest rates lower for longer and tighten labor markets, allowing lower-productivity workers to enter and remain in the workforce.

[Figure 6 about here.]

We also examine the differential effects of a central bank policy that places more weight on employment versus inflation. To do so, we compare IRFs for low- and high-skilled workers under three different levels of the inflation response in the Taylor rule. Figure 7 presents the results. As expected, inflation and output increase more in response to the monetary expansion under a more dovish Taylor rule that is less responsive to inflation. Further, the figure shows that following a monetary expansion, hiring and firing thresholds exhibit larger declines when the central bank follows a more dovish policy, particularly so for the low-type workers. These larger declines translate into larger employment gains for low-type than for high-type workers when the central bank follows a more dovish rule. More dovish policies tighten labor markets, aiding employment growth, especially for low-type workers.

[Figure 7 about here.]

In its 2020 policy review, the Federal Reserve Board reinterpreted its monetary policy objective to focus on full and "inclusive" employment. As part of the change in its objective, the Federal Reserve Board adjusted its policy framework from strict to average inflation targeting. To examine the effects of this policy change, Figure 8 compares IRFs for when the central bank uses a standard Taylor rule to IRFs for when it uses a policy rule that targets average inflation. To capture average inflation targeting, we replace the current inflation rate in the Taylor rule with the average of the current inflation rate and its eleven lags, following Svensson (2020). Consistent with the Federal Reserve Board's stated motivation for changing its policy rule, we find that on impact, average inflation targeting results in a slightly larger increase in output, larger declines in the hiring and firing thresholds, and larger increases in employment. Average inflation targeting is especially beneficial for low-type workers, who enjoy larger increases in employment and wages than high-type workers. In unreported results, we obtain similar findings when we add fiscal policy to the model and examine the impact of government spending shocks: relative to high types, low types' employment responds more to these shocks when the central bank sets monetary policy using an average inflation targeting framework instead of using strict inflation targeting.

[Figure 8 about here.]

Taken together, these counterfactual exercises suggest that the Federal Reserve's 2020 policy framework promotes the employment of workers with lower average labor force attachment, especially in tight labor markets. Tight labor markets transmit monetary expansions toward workers with lower labor force attachment. The flattening of the Phillips curve enables monetary policy to amplify this effect, further benefiting less attached segments of the labor force.

These model simulations show that an off-the-shelf New Keynesian model with labor market frictions and two types of workers can successfully rationalize the differential employment growth of workers of different skills in tight versus slack labor markets. The counterfactual analysis highlights that low-type workers' employment growth is particularly pronounced when the feedback from economic slack to inflation is muted (as modeled by a flatter Phillips curve), when monetary policy is less responsive to inflation (i.e., when the central bank places less weight on inflation or targets average rather than strictly current inflation), and following a larger monetary shock. As labor markets tighten, monetary expansions allow less-attached, lower-productivity workers to join the labor force. These employment gains naturally come at the cost of added inflation and, hence, may not be optimal. A formal welfare analysis is beyond the scope of this paper and left for future research.

5 Conclusion

Expansionary monetary policy has heterogeneous effects on the labor force, with labor market tightness playing an important mediating role. We show empirically that expansionary monetary policy boosts the employment of workers with weak labor force attachment in tight labor markets more than in slack ones. This pattern holds across racial and education categories as well as by gender, as the employment benefits for Blacks, high school dropouts, and women increase with labor market tightness. The beneficial impact of monetary policy on less-attached workers is economically sizeable and long-lasting.

Using a New Keynesian model with workers of heterogeneous types, we analyze how labor market tightness transmits changes in monetary policy into employment growth for workers of different types. The model predicts that monetary policy's expansionary effect on less-attached workers' employment is stronger in tighter labor markets. We further show that a monetary policy that puts less weight on inflation particularly benefits less-attached workers. By keeping rates low for longer, employment becomes more inclusive. Similarly, a flatter Philips curve enables the central bank to maintain low rates, implying that expansionary monetary shocks lead to larger increases in employment for low labor force participation workers.

Our empirical and theoretical results both suggest that sustained expansionary monetary policy, which tightens labor markets, facilitates robust employment growth among less-attached workers. At the same time, expansionary monetary policy increases inflationary pressure and may also foster wealth inequality by raising asset prices (Amberg et al., 2022; Peydró et al., 2023). Managing the trade-off between broad-based employment goals, inflation targets, and wealth inequality is an important topic for further research.

References

Alves, F. and G. L. Violante (2025). Monetary policy under Okun's hypothesis. NBER Working Paper 33488.

Amberg, N., T. Jansson, M. Klein, and A. Rogantini Picco (2022). Five facts about the distributional income effects of monetary policy. *American Economic Review: Insights 4*(3), 289–304.

Amir-Ahmadi, P., C. Matthes, and M.-C. Wang (2022). What does monetary policy do to different people? Mimeo, Indiana University.

Auclert, A. (2019). Monetary policy and the redistribution channel. *American Economic Review 109*(6), 2333–67.

Auclert, A., M. Rognlie, and L. Straub (2020). Micro jumps, macro humps: Monetary policy and business cycles in an estimated HANK model. NBER Working Paper 26647.

Autor, D., A. Dube, and A. McGrew (2024). The unexpected compression: Competition at work in the low wage labor market. NBER Working Paper 31010.

Baek, C. (2021). Good jobs and bad jobs over the business cycle: Implications for inclusive monetary policy. Mimeo, Tufts University.

Bartscher, A., M. Kuhn, M. Schularick, and P. Wachtel (2022). Monetary policy and racial inequality. *Brookings Papers on Economic Activity Spring 2022*, 1–63.

Bayer, C., B. Born, and R. Luetticke (2024). Shocks, frictions, and inequality in US business cycles. *American Economic Review 114*(5), 1211–1247.

Bayer, C., R. Luetticke, L. Pham-Dao, and V. Tjaden (2019). Precautionary savings, illiquid assets, and the aggregate consequences of shocks to household income risk. *Econometrica 87*(1), 255–290.

Blanchard, O. J. (1995). Macroeconomic implications of shifts in the relative demand for skills. *Economic Policy Review 1*(1).

Blanchard, O. J. and P. Diamond (1994). Ranking, unemployment duration, and wages. *The Review of Economic Studies 61*(3), 417–434.

Blanchard, O. J. and J. Galí (2010). Labor markets and monetary policy: A New Keynesian model with unemployment. *American Economic Journal: Macroeconomics 2*(2), 1–30.

Broer, T., J. Drudahl, K. Harmenberg, and E. Öberg (2025). The unemployment-risk channel in business-cycle fluctuations. *International Economic Review* (forthcoming).

Brookings (2020). How the Fed will respond to the COVID-19 recession in an era of low rates and low inflation. Transcript, The Brookings Institution.

Carpenter, S. B. and W. M. Rodgers III (2004). The disparate labor market impacts of monetary policy. *Journal of Policy Analysis and Management 23*(4), 813–830.

Challe, E. (2020). Uninsured unemployment risk and optimal monetary policy in a zero-liquidity economy. *American Economic Journal: Macroeconomics 12*(2), 241–283.

Christiano, L. J., M. Trabandt, and K. Walentin (2010). DSGE models for monetary policy analysis. In *Handbook of Monetary Economics*, Volume 3, pp. 285–367. Elsevier.

Christiano, L. J., M. Trabandt, and K. Walentin (2011). Introducing financial frictions and unemployment into a small open economy model. *Journal of Economic Dynamics and Control 35*(12), 1999–2041.

Christiano, L. J., M. Trabandt, and K. Walentin (2021). Involuntary unemployment and the business cycle. *Review of Economic Dynamics 39*, 26–54.

Coglianese, J., M. Olsson, and C. Patterson (2025). Monetary policy and the labor market: A quasi-experiment in Sweden. *American Economic Review* (forthcoming).

Coibion, O. and Y. Gorodnichenko (2012). Why are target interest rate changes so persistent? *American Economic Journal: Macroeconomics 4*(4), 126–62.

Coibion, O., Y. Gorodnichenko, L. Kueng, and J. Silvia (2017). Innocent bystanders? Monetary policy and inequality. *Journal of Monetary Economics 88*, 70–89.

Dolado, J. J., G. Motyovszki, and E. Pappa (2021). Monetary policy and inequality under labor market frictions and capital-skill complementarity. *American Economic Journal: Macroeconomics 13*(2), 292–332.

Faia, E. (2008). Optimal monetary policy rules with labor market frictions. *Journal of Economic Dynamics and Control 32*(5), 1600–1621.

Faia, E. (2009). Ramsey monetary policy with labor market frictions. *Journal of Monetary Economics 56*(4), 570–581.

Galí, J. (2011a). The return of the wage phillips curve. *Journal of the European Economic Association 9*(3), 436–461.

Galí, J. (2011b). *Unemployment fluctuations and stabilization policies: A New Keynesian perspective.* MIT Press.

Galí, J., F. Smets, and R. Wouters (2012). Unemployment in an estimated New Keynesian model. *NBER Macroeconomics Annual 26*(1), 329–360.

Gertler, M. and P. Karadi (2015). Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics 7*(1), 44–76.

Gertler, M., L. Sala, and A. Trigari (2008). An estimated monetary DSGE model with unemployment and staggered nominal wage bargaining. *Journal of Money, Credit and Banking 40*(8), 1713–1764.

Gornemann, N., K. Kuester, and M. Nakajima (2021). Doves for the rich, hawks for the poor? Distributional consequences of systematic monetary policy. Institute Working Paper 50, Federal Reserve Bank of Minneapolis.

Gorodnichenko, Y. and M. Weber (2016). Are sticky prices costly? Evidence from the stock market. *American Economic Review 106*(1), 165–99.

Gürkaynak, R. S., B. P. Sack, and E. T. Swanson (2005). Do actions speak louder than words? The response of asset prices to monetary policy actions and statements. *International Journal of Central Banking 1*(1), 55–94.

Gürkaynak, R. S., B. P. Sack, and E. T. Swanson (2007). Market-based measures of monetary policy expectations. *Journal of Business & Economic Statistics 25*(2), 201–212.

Hall, R. E. (2013). The routes into and out of the zero lower bound. *Proceedings - Economic Policy Symposium - Jackson Hole*, 1–35.

Kaplan, G., B. Moll, and G. L. Violante (2018). Monetary policy according to HANK. *American Economic Review 108*(3), 697–743.

Krueger, D., K. Mitman, and F. Perri (2016). Macroeconomics and household heterogeneity. In *Handbook of Macroeconomics*, Volume 2, pp. 843–921. Elsevier.

Kuttner, K. N. (2001). Monetary policy surprises and interest rates: Evidence from the Fed funds futures market. *Journal of Monetary Economics 47*(3), 523–544.

Moser, C., F. Saidi, B. Wirth, and S. Wolter (2021). Credit supply, firms, and earnings inequality. CEPR Discussion Paper 16123.

Nakajima, M. (2023). Monetary policy with racial inequality. Working paper 23-9, Federal Reserve Bank of Philadelphia.

Pasten, E., R. Schoenle, and M. Weber (2020). The propagation of monetary policy shocks in a heterogeneous production economy. *Journal of Monetary Economics 116*, 1–22.

Peydró, J. L., A. L. Andersen, N. Johannesen, and M. Jørgensen (2023). Monetary policy and inequality. *Journal of Finance 78*(5), 2945–2989.

Piazzesi, M. and E. Swanson (2008). Futures prices as risk-adjusted forecasts of monetary policy. *Journal of Monetary Economics 55*(4), 677–691.

Pissarides, C. A. (2000). *Equilibrium unemployment theory.* MIT press.

Ravenna, F. and C. E. Walsh (2012). Screening and labor market flows in a model with heterogeneous workers. *Journal of Money, Credit and Banking 44*, 31–71.

Ravenna, F. and C. E. Walsh (2022). Worker heterogeneity, selection, and unemployment dynamics in a pandemic. *Journal of Money, Credit and Banking 54*(S1), 113–155.

Ravn, M. O. and V. Sterk (2021). Macroeconomic fluctuations with HANK & SAM: an analytical approach. *Journal of the European Economic Association 19*(2), 1162–1202.

Romer, C. D. and D. H. Romer (1999). Monetary policy and the well-being of the poor. *Economic Review-Federal Reserve Bank of Kansas City 84*(1), 21.

Simon, J., T. Matheson, and D. Sandri (2013). The dog that didn't bark: Has inflation been muzzled or was it just sleeping? *World Economic Outlook*, 79–95.

Svensson, L. E. (2020). Monetary policy strategies for the Federal Reserve. *International Journal of Central Banking 16*(1), 133–193.

Thorbecke, W. (2001). Estimating the effects of disinflationary monetary policy on minorities. *Journal of Policy Modeling 23*(1), 51–66.

Trigari, A. (2009). Equilibrium unemployment, job flows, and inflation dynamics. *Journal of Money, Credit and Banking 41*(1), 1–33.

Walsh, C. E. (2003). Labor market search and monetary shocks. *Elements of Dynamic Macroeconomic Analysis*, 451–486.

Walsh, C. E. (2005). Labor market search, sticky prices, and interest rate policies. *Review of Economic Dynamics 8*(4), 829–849.

Weber, M. (2015). Nominal rigidities and asset pricing. Mimeo, Chicago Booth.

Wong, A. (2016). Population aging and the transmission of monetary policy to consumption. 2016 Meeting Papers 716, Society for Economic Dynamics.

Zavodny, M. and T. Zha (2000). Monetary policy and racial unemployment rates. *Economic Review-Federal Reserve Bank of Atlanta 85*(4), 1.

A Appendix: Steady State and Log-Linearized System

We use lower case letters to denote the log-linearized versions of variables represented by capital letters with the exception of A_t, $\bar{a}_{k,t}$, and $\underline{a}_{k,t}$, whose log-linearized versions are denoted by $\hat{A}_t$, $\hat{a}_{k,t}$, and $\hat{\alpha}_{k,t}$, respectively. Furthermore, let $\bar{a}_k$ and $\underline{a}_k$ be the steady state values of $\bar{a}_{k,t}$ and $\underline{a}_{k,t}$, respectively. The log-linearized system of equations describing the model can then be written as follows:

Share of workers employed:

$$n_{h,t} = \frac{1}{1-\underline{s}}\left[\left(1-\delta-\frac{\gamma}{N_h^{ss}}\right)\bar{a}_h\hat{a}_{h,t} - (1-\delta)\underline{a}_h\hat{\alpha}_{h,t} + (1-\delta)(\bar{a}_h-\underline{a}_h)n_{h,t-1}\right] \tag{42}$$

$$n_{l,t} = \frac{1}{\bar{s}}\left[\left(1-\delta-\frac{1-\gamma}{N_l^{ss}}\right)\bar{a}_l\hat{a}_{l,t} - (1-\delta)\underline{a}_l\hat{\alpha}_{l,t} + (1-\delta)(\bar{a}_l-\underline{a}_l)n_{l,t-1}\right] \tag{43}$$

$$n_t = \frac{N_h^{ss}n_{h,t}+N_l^{ss}n_{l,t}}{N_h^{ss}+N_l^{ss}}, \tag{44}$$

where $N_h^{ss} = \frac{\gamma\left(\frac{1-\bar{a}_h}{1-\underline{s}}\right)}{1-(1-\delta)\left(\frac{\bar{a}_h-\underline{a}_h}{1-\underline{s}}\right)}$, $N_l^{ss} = \frac{(1-\gamma)\left(\frac{\bar{s}-\bar{a}_l}{\bar{s}}\right)}{1-(1-\delta)\left(\frac{\bar{a}_l-\underline{a}_l}{\bar{s}}\right)}$, and $N^{ss} = N_h^{ss} + N_l^{ss}$.

Marginal utility:

$$z_t = \frac{-\sigma}{(1-\mathbb{h})(1-\mathbb{h}\beta)}((c_t-\mathbb{h}c_{t-1}) - \mathbb{h}\beta(c_{t+1}-\mathbb{h}c_t)). \tag{45}$$

First-order condition for consumption:

$$c_t = \frac{\mathbb{h}}{1+\mathbb{h}^2\beta}c_{t-1} + \frac{\mathbb{h}}{1+\mathbb{h}^2\beta}\beta E_t[c_{t+1}] - \frac{(1-\mathbb{h})(1-\mathbb{h}\beta)}{\sigma(1+h^2\beta)}E_t[\sum_{j=1}^{\infty}(i_t - E_t\pi_{t+1})]. \tag{46}$$

Inflation:

$$\pi_t = p_t - p_{t-1}. \tag{47}$$

Nominal wage rate:

$$w_{h,t} = (1-\chi)n_{h,t} - z_t + p_t \tag{48}$$

$$w_{l,t} = (1-\chi)n_{l,t} - z_t + p_t. \tag{49}$$

Cutoff determination of the firing thresholds:

$$p_t^i + \hat{A}_t - w_{h,t} = -\hat{\alpha}_{h,t} - \frac{\beta(1-\delta)\left[\left(1 - \frac{a_{h,t+1} - \underline{s}}{1-\underline{s}}\right)(\chi \Delta n_{h,t+1} + \pi_{t+1}) - \frac{a_h}{1-\underline{s}}\hat{\alpha}_{h,t+1}\right]}{1 - \beta(1-\delta)\left(1 - \frac{a_{h,t+1} - \underline{s}}{1-\underline{s}}\right)F} \tag{50}$$

$$p_t^i + \hat{A}_t - w_{l,t} = -\hat{\alpha}_{l,t} - \frac{\beta(1-\delta)\left[\left(1 - \frac{a_{l,t+1}}{\bar{s}}\right)(\chi \Delta n_{l,t+1} + \pi_{t+1}) - \frac{a_l}{1-\underline{s}}\hat{\alpha}_{l,t+1}\right]}{1 - \beta(1-\delta)\left(1 - \frac{a_{l,t+1}}{\bar{s}}\right)F}. \tag{51}$$

Relation between hiring and firing thresholds:

$$w_{l,t} + \frac{\bar{a}_l}{\bar{s}\left(1 - \frac{\bar{a}_l}{\bar{s}}\right)}\hat{a}_{l,t} = p_t^I + \hat{A}_t + \frac{\bar{a}_l \hat{a}_{l,t} - \underline{a}_l \hat{\alpha}_{l,t}}{\bar{a}_l - \underline{a}_l} \tag{52}$$

$$w_{h,t} + \frac{\bar{a}_h}{(1-\underline{s})\left(1 - \frac{\bar{a}_h - \underline{s}}{1-\underline{s}}\right)}\hat{a}_{h,t} = p_t^I + \hat{A}_t + \frac{\bar{a}_h \hat{a}_{h,t} - \underline{a}_h \hat{\alpha}_{h,t}}{\bar{a}_h - \underline{a}_h}. \tag{53}$$

Market clearing:

$$y_t = c_t. \tag{54}$$

Output follows from the aggregation of equation (24) after applying market clearing:

$$\hat{y}_t = \hat{A}_t - 2\frac{\frac{\gamma}{1-\underline{s}}(1-\delta)\underline{a}_h^2\hat{\alpha}_{h,t} + \frac{\gamma}{1-\underline{s}}\delta\bar{a}_h^2\hat{a}_{h,t} + \frac{1-\gamma}{\bar{s}}(1-\delta)\underline{a}_l^2\hat{\alpha}_{l,t} + \frac{1-\gamma}{\bar{s}}\delta\bar{a}_l^2\hat{a}_{l,t}}{\frac{\gamma}{1-\underline{s}}\left[(1-\delta)(1-\underline{a}_h^2) + \delta(1-\bar{a}_h^2)\right] + \frac{1-\gamma}{\bar{s}}\left[(1-\delta)(\bar{s}^2 - \underline{a}_l^2) + \delta(\bar{s}^2 - \bar{a}_l^2)\right]}. \tag{55}$$

Finally, the log linearized model is closed with the New Keynesian Philips Curve (equation (40)) and the interest rate rule (equation (41)):

$$\pi_t = \beta E_t[\pi_{t+1}] + \lambda(p_t^i - p_t) \tag{56}$$

$$i_t^* = \phi_\pi \pi_t + \phi_y y + \mu_t \tag{57}$$

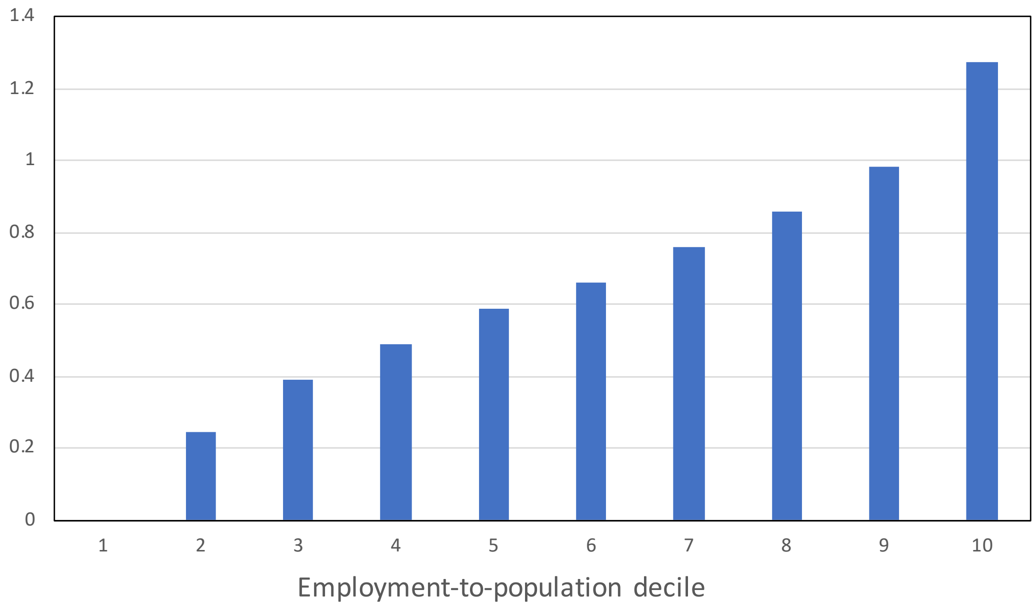
$$i_t = (1-\rho_i)i_t^* + \rho_i i_{t-1}. \tag{58}$$

B Robustness

[Figure 9 about here.]

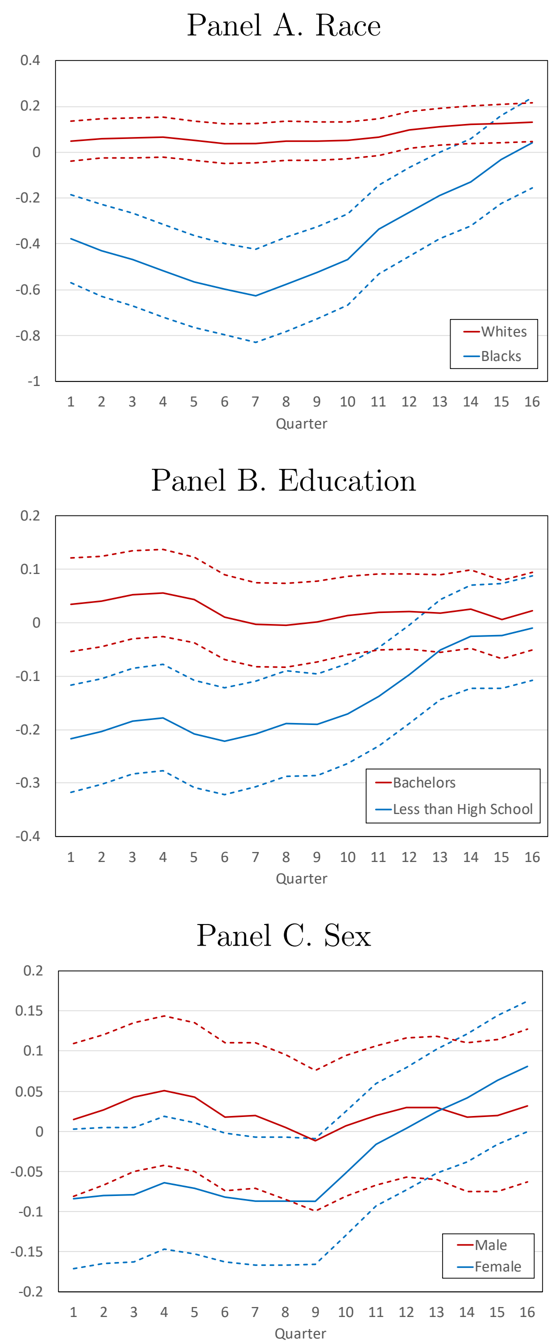
[Figure 10 about here.]

Figure 1: **Predicted Black Employment Growth by Labor Market Tightness, Fourth Quarter 2000**



This figure plots the predicted differential effect of a one standard deviation cut in the federal funds rate on subsequent two-year Black employment growth across labor markets of different tightness, measured using deciles of the employment-to-population ratio. The deciles of employment-to-population ratio (across MSAs) are calculated in the fourth quarter of 2000. For each decile, the figure plots the additional predicted employment growth relative to that predicted for the lowest employment-to-population decile. Predicted values are calculated from the estimates in Panel A of Table 3 using the mean employment-to-population ratio for each decile.

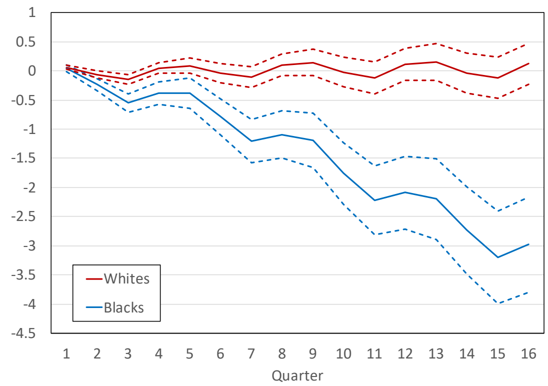
Figure 2: **Temporal Dynamics**



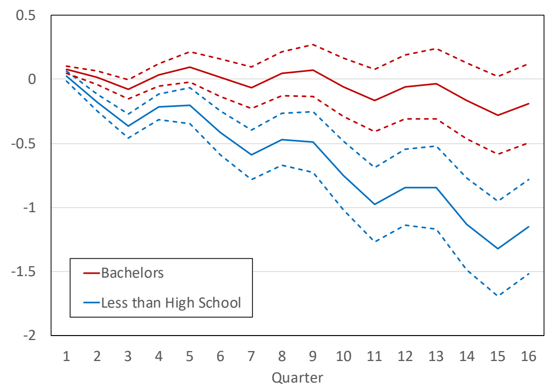
This figure depicts the temporal dynamics of the differential impact of monetary policy on employment growth in tight versus slack labor markets. The figure shows the impact of monetary policy over a one-year horizon starting in different quarters following the monetary policy rate change for different demographic groups within three categories: race (Panel A), education (Panel B), and sex (Panel C). For each quarter, beginning one quarter to 16 quarters out, the figure plots the coefficient on the interaction term between the federal funds rate and the local prime age employment-to-population ratio in equation (4). Dashed lines present one standard deviation confidence intervals.

Figure 3: **Long-run Impact**

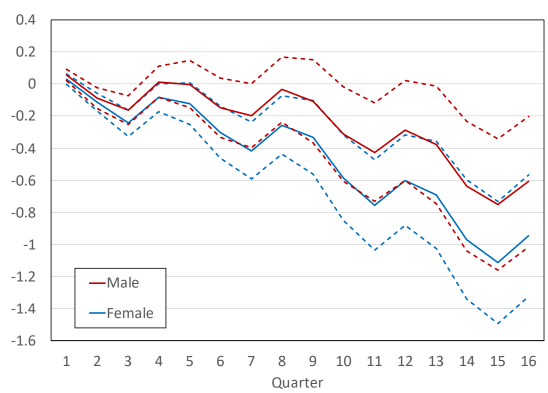
Panel A. Race



Panel B. Education

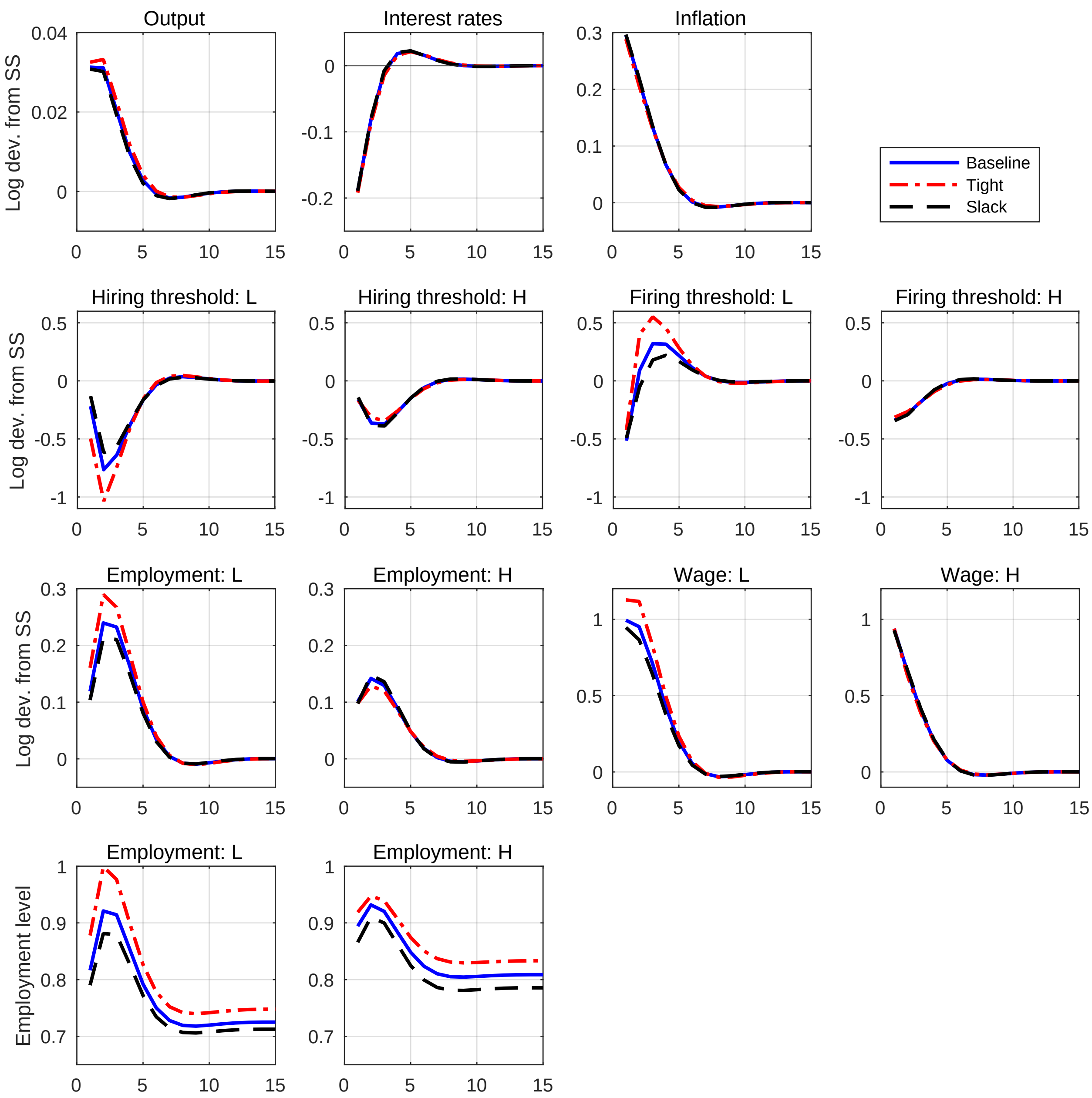


Panel C. Sex



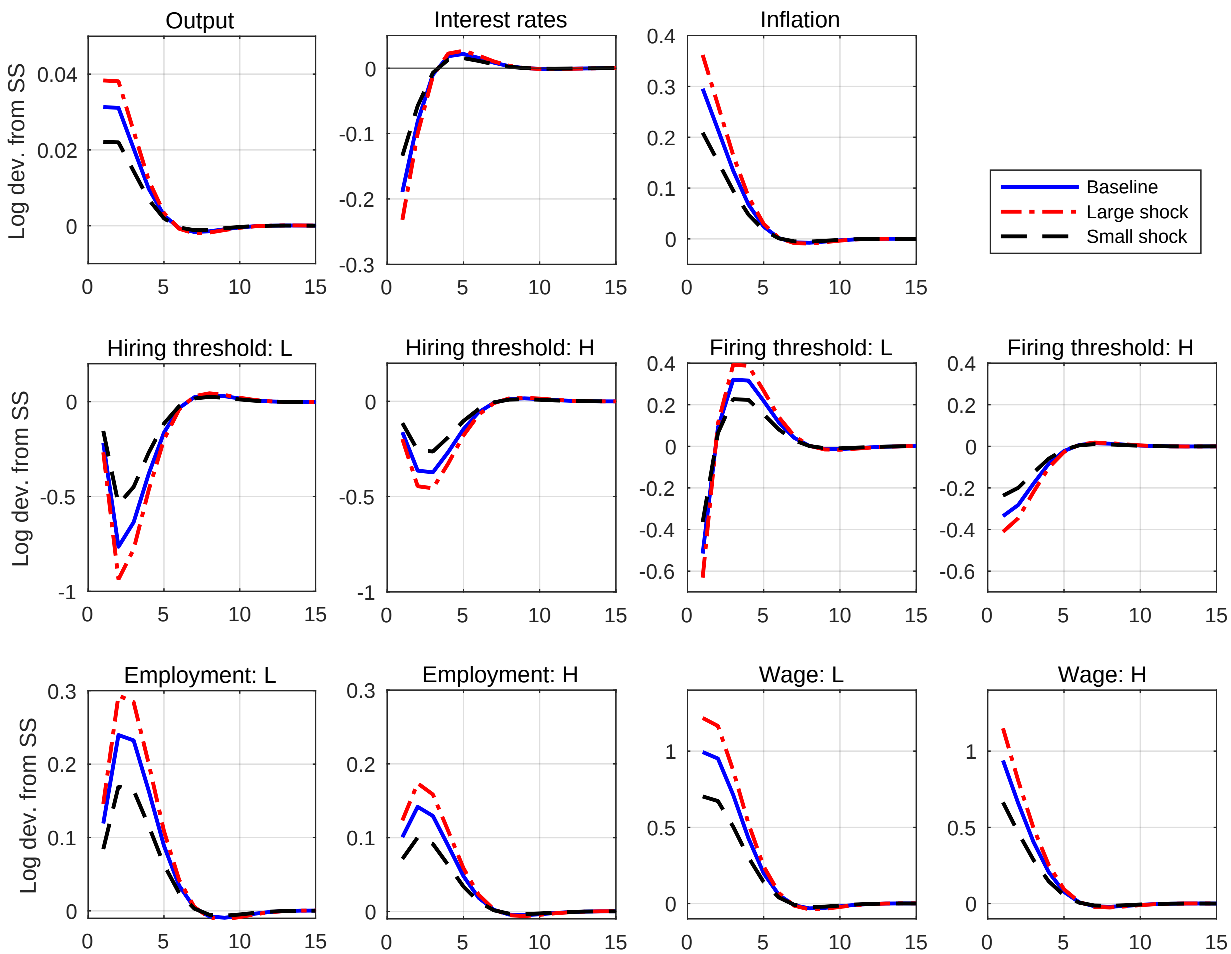
This figure depicts the cumulative impact over time of monetary policy on employment growth in tight versus slack labor markets for different demographic groups within three categories: race (Panel A), education (Panel B), and sex (Panel C). For each demographic group, the figure depicts the relation between cumulative employment growth and the interaction of the federal funds rate and labor market tightness over horizons of one to 16 quarters. For each such time horizon, the figure plots the interaction coefficient between the federal funds rate and the local-level prime age employment-to-population ratio in equation (3), with the dependent variable equal to cumulative employment growth over that time horizon. Dashed lines present one standard deviation confidence intervals.

Figure 4: **Impulse Response Functions: Different Steady-State Tightness**



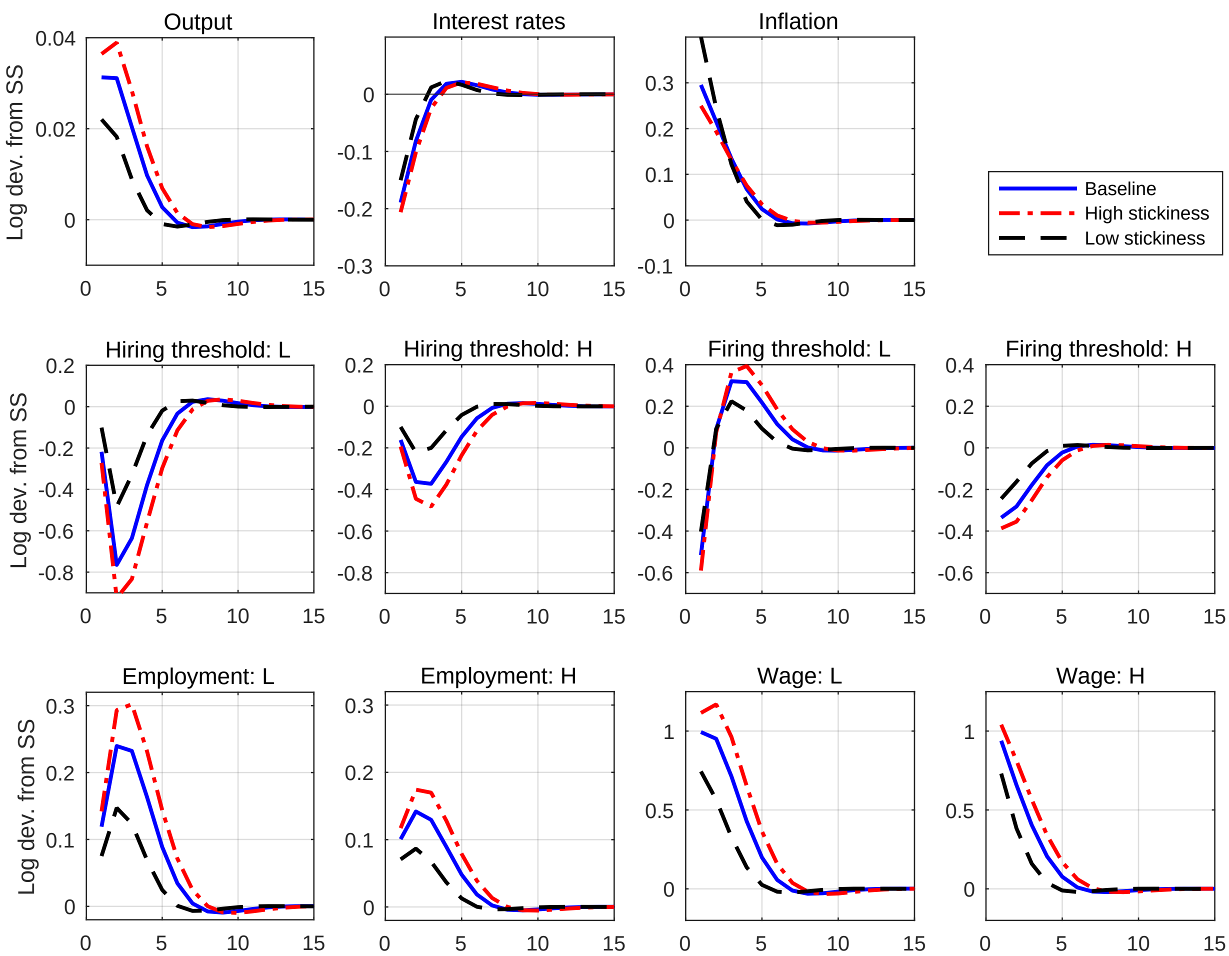
This figure plots impulse response functions for output, interest rate, inflation, hiring thresholds, firing thresholds, the fractions of workers employed, and wages for high (H) and low (L) type workers. The response functions are plotted for three different levels of steady-state employment, that is, labor market tightness (see text for details). The figure depicts log deviations from steady state, except for employment shares, where it also provides level responses (bottom row).

Figure 5: **Impulse Response Functions: Different Shock Sizes**



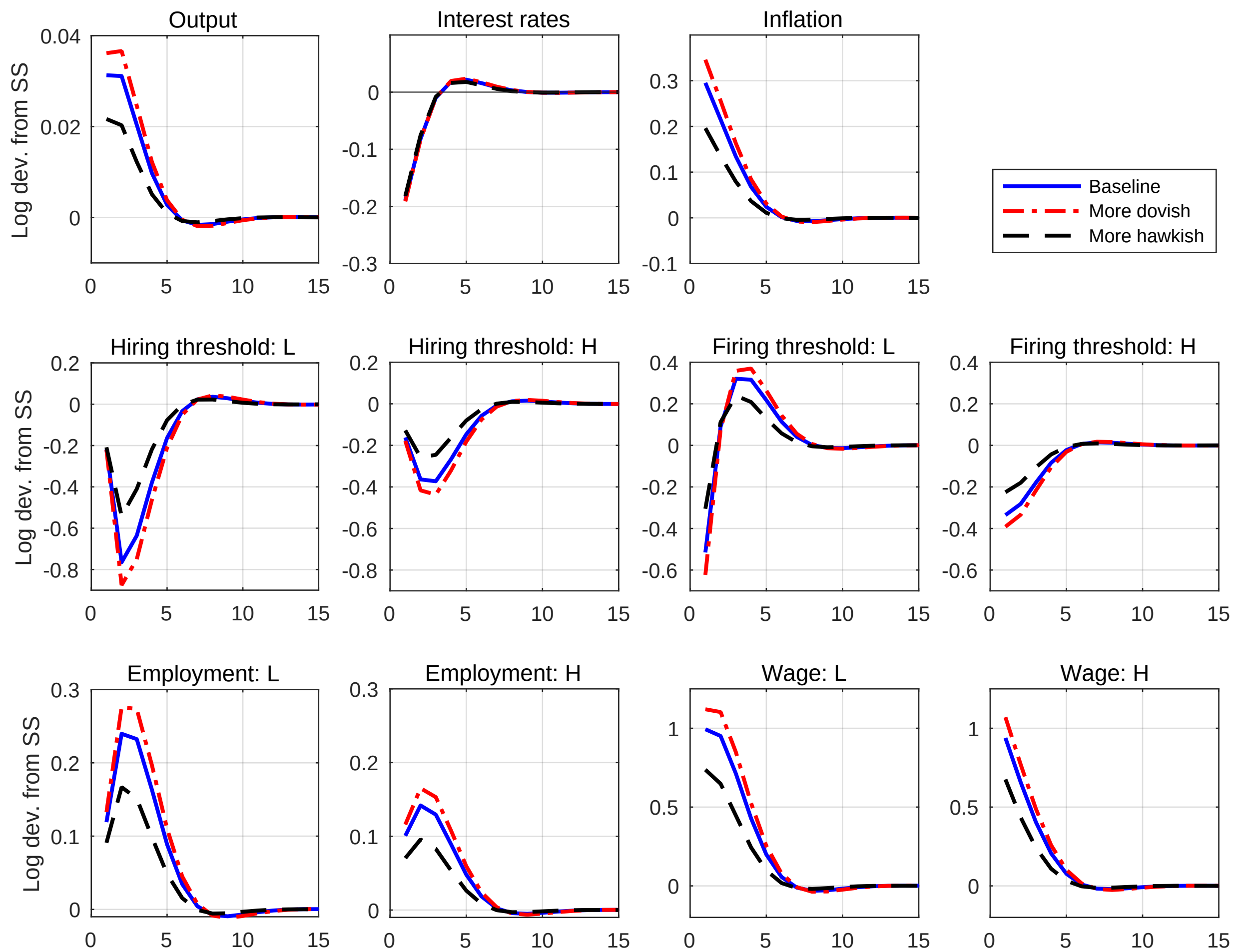
This figure plots impulse response functions for output, interest rate, inflation, hiring thresholds, firing thresholds, the fractions of workers employed, and wages for high (H) and low (L) type workers. Response functions are plotted for monetary policy shocks of different sizes: the value of $var(\epsilon^i)$ *is 1 in the baseline simulation (blue line), 1.5 in the large shock simulation (red line), and 0.5. in the small shock simulation.*

Figure 6: **Impulse Response Functions: Different Degrees of Price Stickiness**



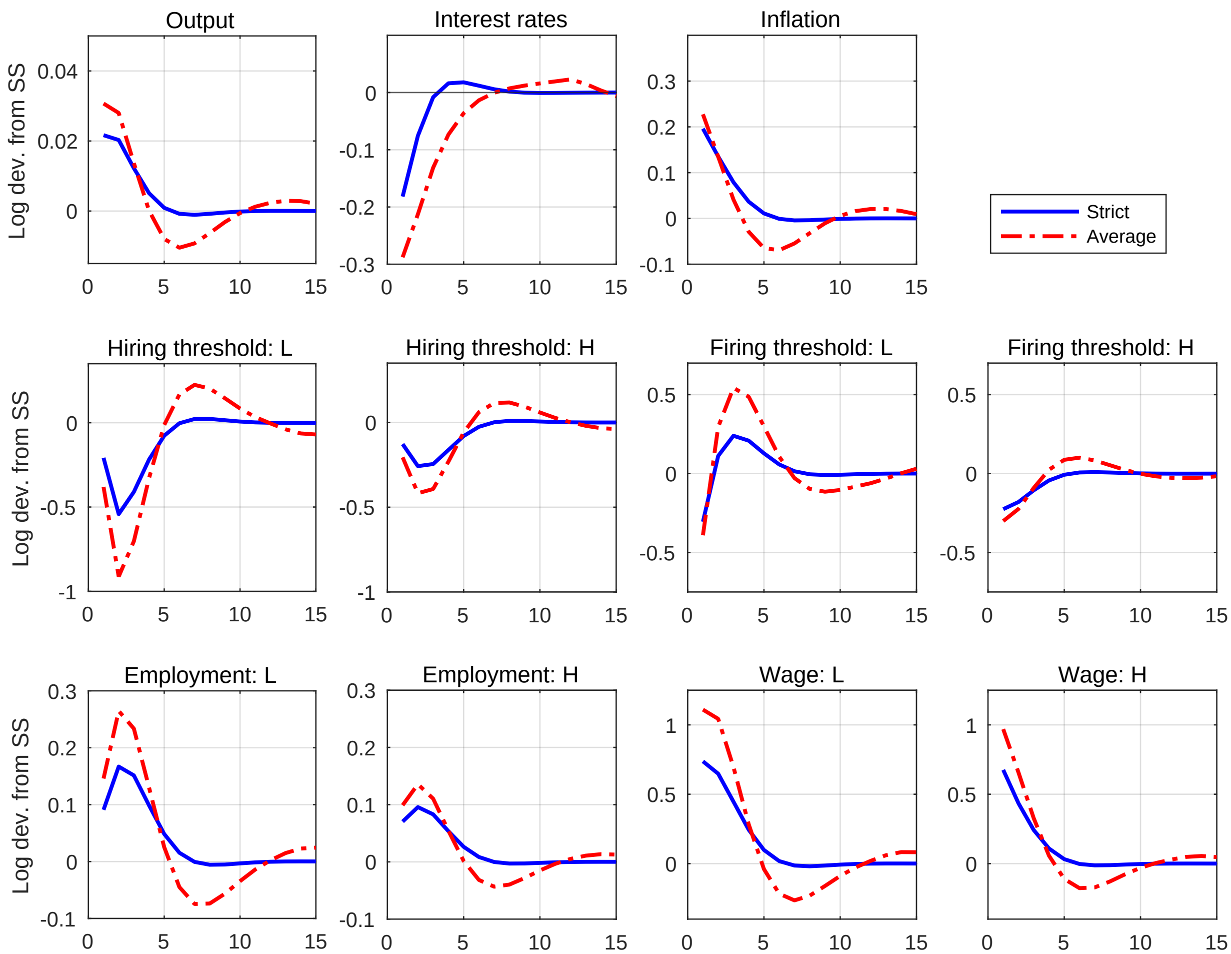
This figure plots impulse response functions for output, interest rate, inflation, hiring thresholds, firing thresholds, the fractions of workers employed, and wages for high (H) and low (L) type workers. Response functions are plotted for different levels of price stickiness: the level of price stickiness, θ, is 0.73 in the baseline simulation (blue line), $e^{-1/4}$ in the high stickiness simulation (red line), and $e^{-1/2}$ in the low stickiness simulation.

Figure 7: **Impulse Response Functions: Different Degrees of Inflation Response in Taylor Rule**



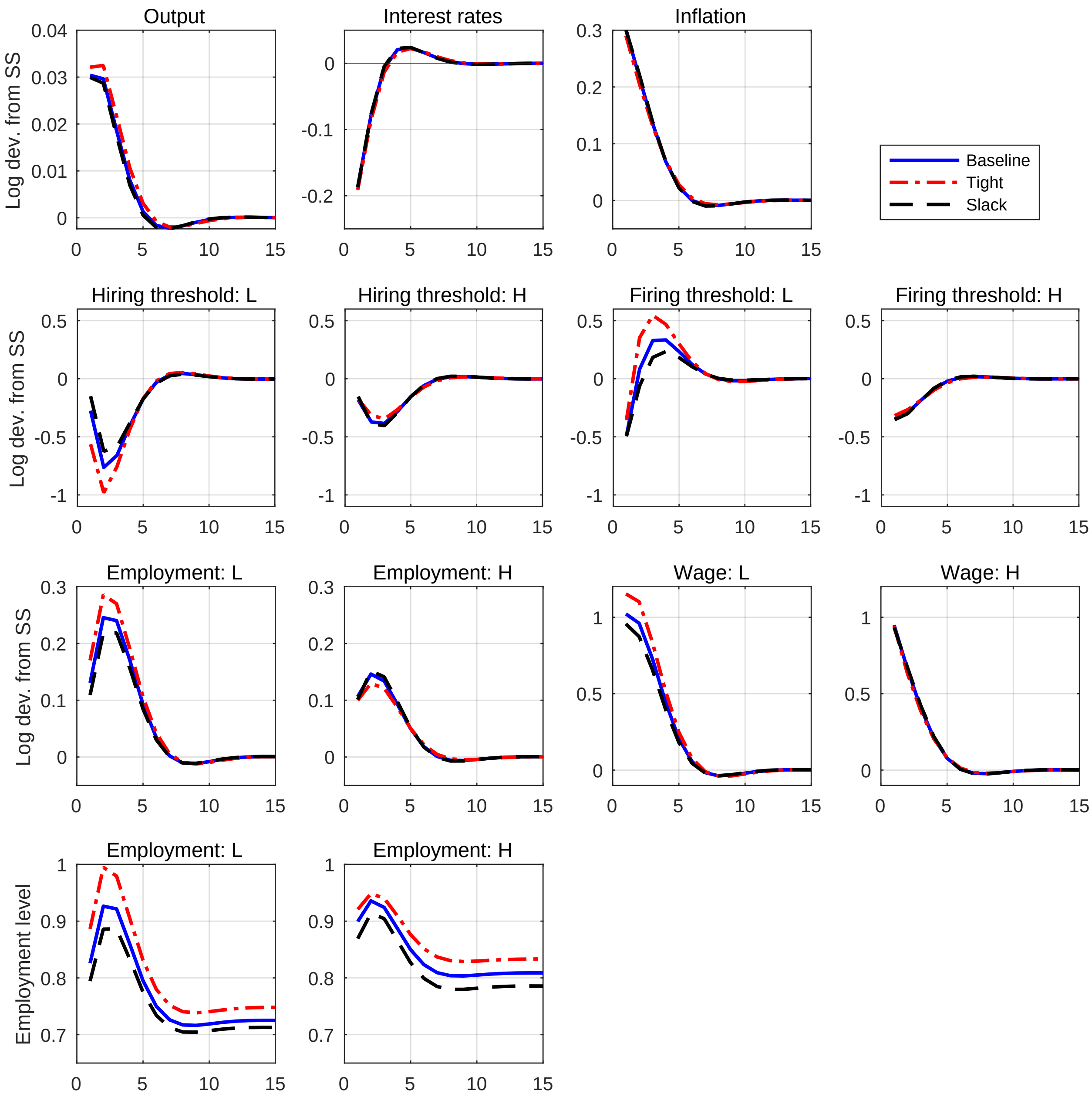
This figure plots impulse response functions for output, interest rate, inflation, hiring thresholds, firing thresholds, the fractions of workers employed, and wages for high (H) and low (L) type workers. Response functions are plotted for different levels of inflation response in the Taylor rule: ϕ_π is 1.24 in the baseline simulation (blue line), 1.04 in the more dovish simulation (red line), and 2.00 in the more hawkish simulation.

Figure 8: **Impulse Response Functions: Strict vs. Average Inflation Targeting**



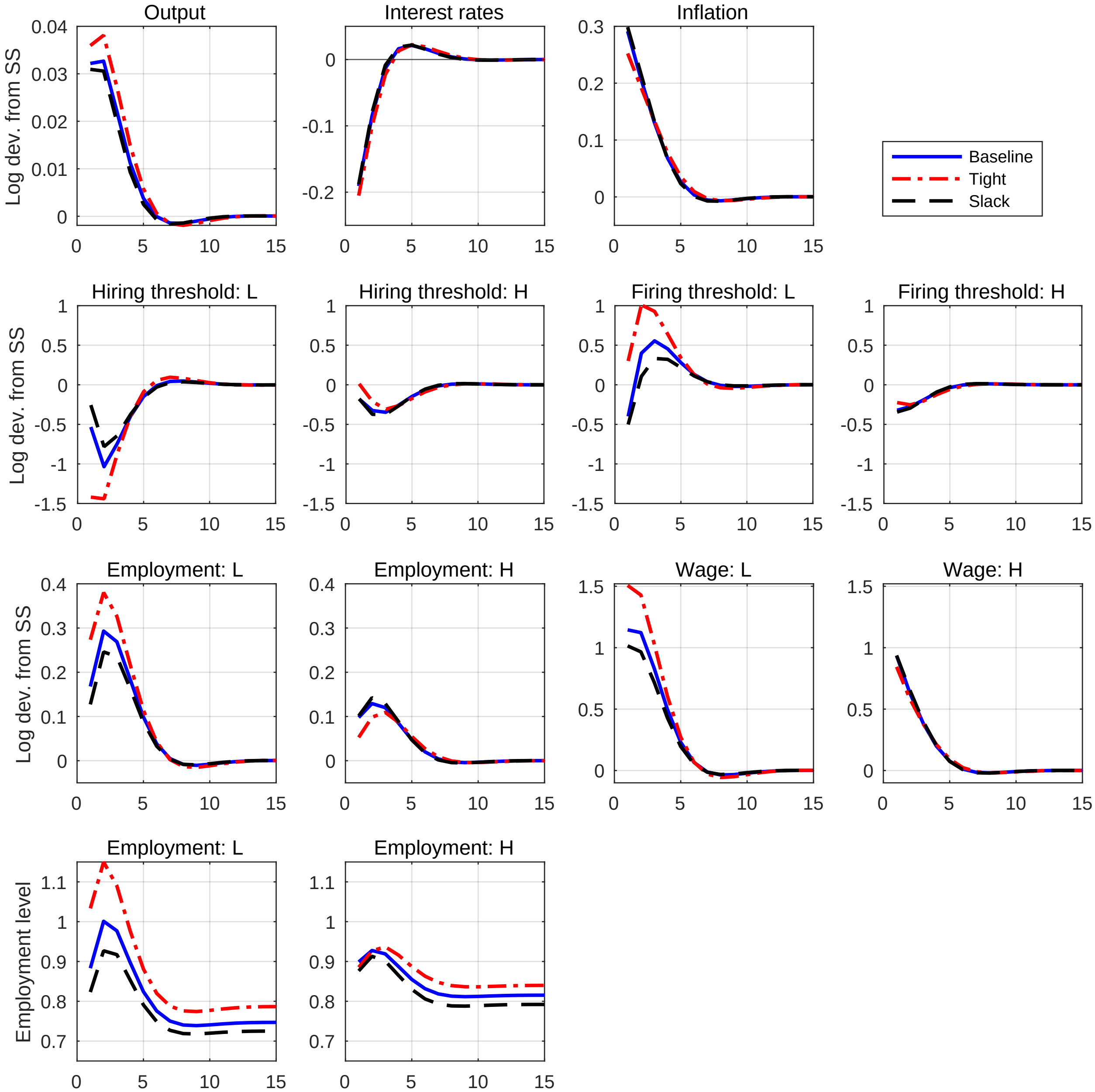
This figure plots impulse response functions for output, interest rate, inflation, hiring thresholds, firing thresholds, the fractions of workers employed, and wages for high (H) and low (L) type workers. Response functions are plotted for a standard Taylor rule with interest rate smoothing (blue line) and for a version that targets average inflation over the current period and eleven lags (red line).

Figure A.1: **IRF Robustness: Lower steady-state share of high types**



This figure plots impulse response functions for output, interest rate, inflation, hiring thresholds, firing thresholds, the fractions of workers employed, and wages for high (H) and low (L) type workers. The response functions are plotted for three different levels of steady-state employment, that is, labor market tightness (see text for details). The figure depicts log deviations from steady state, except for employment shares, where it also provides level responses (bottom row). Instead of the baseline steady-state share of high-type workers of $\gamma = 0.5$*, here we set* $\gamma = 0.3$

Figure A.2: **IRF Robustness: Heterogeneous steady-state hiring thresholds**



This figure plots impulse response functions for output, interest rate, inflation, hiring thresholds, firing thresholds, the fractions of workers employed, and wages for high (H) and low (L) type workers. The response functions are plotted for three different levels of steady-state employment, that is, labor market tightness (see text for details). The figure depicts log deviations from steady state, except for employment shares, where it also provides level responses (bottom row). Instead of homogeneous steady-state hiring thresholds of $\bar{a} = 0.45$*, we set* $\bar{a}_l = 0.465$ *and* $\bar{a}_h = 0.435$.

Table 1: **Average Labor Force Attachment by Demographic Group, 1990q1–2019q1**

	Mean	Standard Error
Blacks	56.6%	0.1
Whites	62.3%	0.1
Less than High School	40.3%	0.1
High School	58.9%	0.2
Some College	68.1%	0.2
Bachelors Degree	75.7%	0.1
Female	55.2%	0.1
Male	68.5%	0.2

Data are calculated from statistics reported by the Bureau of Labor Statistics.

Table 2: **Summary Statistics**

	N	Mean	SD	p10	p25	p50	p75	p90
Federal Funds Rate	1,204,974	2.32	2.25	0.09	0.16	1.52	4.81	5.42
Monetary Shock	1,204,974	-3.73	0.93	-4.58	-4.57	-3.70	-3.59	-2.19
Emp/Pop	1,204,974	0.67	0.14	0.49	0.58	0.67	0.77	0.86
Two Year Employment Growth								
Blacks	513,140	10.04	21.81	-12.71	-2.01	8.01	18.84	33.75
Whites	1,019,587	6.12	13.72	-7.55	-0.98	4.76	11.23	20.67
Less than High School	753,583	2.12	14.09	-12.68	-5.67	0.92	8.35	17.84
High School	1,031,445	0.60	12.54	-12.09	-6.08	-0.59	5.69	14.18
Some College	1,039,754	0.97	12.37	-11.53	-5.55	-0.24	5.88	14.35
Bachelors Degree	920,562	1.12	12.02	-11.39	-5.36	0.08	6.14	14.31
Female	1,082,355	6.53	15.74	-9.48	-1.67	5.04	12.51	23.34
Male	1,155,480	7.02	15.84	-8.76	-1.20	5.46	12.84	23.66

This table provides summary statistics for the main variables used in the analysis. The statistics are equal-weighted across MSA-industry-subgroup-quarter cells.

Table 3: **Two-Year Employment Growth and Federal Funds Rate by Labor Market Tightness**

Panel A: Race		
	(1)	(2)
	Blacks	Whites
Fed Funds Rate × Emp/Pop	-1.09***	0.10
	(0.40)	(0.18)
	[0.00]	
R^2	0.30	0.28
Observations	511,843	1,019,176

Panel B: Education				
	(3)	(4)	(5)	(6)
	Less than High School	High School	Some College	Bachelors Degree
Fed Funds Rate × Emp/Pop	-0.47**	0.00	0.02	0.05
	(0.20)	(0.17)	(0.16)	(0.17)
	[0.00]	[0.66]	[0.77]	
R^2	0.30	0.26	0.26	0.27
Observations	752,685	1,030,813	1,039,149	919,853

Panel C: Sex		
	(7)	(8)
	Female	Male
Fed Funds Rate × Emp/Pop	-0.26	-0.03
	(0.18)	(0.20)
	[0.02]	
R^2	0.28	0.24
Observations	1,081,865	1,155,071

All Regressions are run at the MSA-industry-quarter level and include MSA-industry fixed effects, industry-quarter fixed effects, and the non-interacted Employment-to-Population ratio (not reported). Standard errors adjusted for clustering at MSA level. p-value of difference from Whites (Panel A), from Bachelors Degree (Panel B), and from males (Panel C) in square brackets. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 4: **Two-Year Employment Growth and Federal Funds Rate by Labor Market Tightness: Alternative Normalization**

Panel A: Race

	(1) Blacks	(2) Whites		
Fed Funds Rate × Emp/Pop	-1.13***	0.10		
	(0.38)	(0.18)		
	[0.00]			
R^2	0.30	0.29		
Observations	505,162	947,208		

Panel B: Education

	(3) Less than High School	(4) High School	(5) Some College	(6) Bachelors Degree
Fed Funds Rate × Emp/Pop	-0.54***	-0.08	-0.07	-0.07
	(0.19)	(0.16)	(0.16)	(0.17)
	[0.00]	[0.87]	[0.98]	
R^2	0.30	0.27	0.26	0.28
Observations	752,609	1,030,395	1,038,016	918,320

Panel C: Sex

	(7) Female	(8) Male		
Fed Funds Rate × Emp/Pop	-0.35*	-0.10		
	(0.18)	(0.20)		
	[0.01]			
R^2	0.28	0.25		
Observations	1,081,787	1,154,768		

For each demographic group, the dependent is the two-year change in employment of the demographic group normalized by lagged *total* employment (i.e., across all demographic groups) in the MSA. All Regressions are run at the MSA-industry-quarter level and include MSA-industry fixed effects, industry-quarter fixed effects, and the non-interacted Employment-to-Population ratio (not reported). Standard errors adjusted for clustering at MSA level. p-value of difference from Whites (Panel A), from Bachelors Degree (Panel B), and from males (Panel C) in square brackets. * p<0.10, ** p<0.05, *** p<0.01

Table 5: **Two-Year Employment Growth and Federal Funds Rate by Labor Market Tightness, with MSA-by-Quarter Fixed Effects**

Panel A: Race

	(1) MSA-by-Quarter FE	(2) Baseline Regression
Diff. in Fed Funds Rate X Emp/Pop, Blacks vs. Whites	-0.81***	-1.19***
	(0.00)	(0.00)
R^2	0.41	0.30
Observations	1,530,981	1,531,019

Panel B: Education

	MSA-by-Quarter FE			Baseline Regression		
	(3) Less than High School	(4) High School	(5) Some College	(6) Less than High School	(7) High School	(8) Some College
Diff. in Fed Funds Rate X Emp/Pop, Omitted group = Bachelors Degree	-0.54***	-0.02	-0.03	-0.51***	-0.05	-0.03
	(0.00)	(0.83)	(0.72)	(0.00)	(0.66)	(0.77)
R^2	0.42	0.39	0.39	0.29	0.27	0.27
Observations	1,672,508	1,950,607	1,958,954	1,672,538	1,950,666	1,959,002

Panel C: Sex

	(9) MSA-by-Quarter FE	(10) Baseline Regression
Diff. in Fed Funds Rate X Emp/Pop, Female vs. Male	-0.23**	-0.22**
	(0.02)	(0.02)
R^2	0.37	0.26
Observations	2,236,936	2,236,936

Regression results present the difference in the interaction coefficient between the Fed funds rate and labor market tightness across different demographic groups within three different demographic categories – Race, Education, and Sex. All Regressions are run at the MSA-industry-quarter level and include MSA-industry fixed effects and industry-quarter fixed effects. Regressions in Columns 1, 3 through 5, and 9 are run with MSA-by-industry fixed effects. Columns 2, 6 through 8, and 10 present the analogous difference in the interaction coefficients across demographic groups without the inclusion of MSA-by-quarter fixed effects, and are calculated from Table 3. Standard errors adjusted for clustering at MSA level. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 6: **Two-Year Employment Growth and Monetary Shocks by Labor Market Tightness**

Panel A: Race

	(1) Blacks	(2) Whites		
Monetary Shock × Emp/Pop	-2.62**	0.11		
	(1.09)	(0.51)		
	[0.00]			
R^2	0.30	0.28		
Observations	511,843	1,019,176		

Panel B: Education

	(3) Less than High School	(4) High School	(5) Some College	(6) Bachelors Degree
Monetary Shock × Emp/Pop	-1.39***	-0.32	-0.36	-0.16
	(0.52)	(0.46)	(0.45)	(0.52)
	[0.00]	[0.58]	[0.42]	
R^2	0.30	0.26	0.26	0.27
Observations	752,685	1,030,813	1,039,149	919,853

Panel C: Sex

	(7) Female	(8) Male		
Monetary Shock × Emp/Pop	-0.91*	-0.45		
	(0.53)	(0.56)		
	[0.07]			
R^2	0.28	0.24		
Observations	1,081,865	1,155,071		

All Regressions are run at the MSA-industry-quarter level and include MSA-industry fixed effects, industry-quarter fixed effects, and the non-interacted Employment-to-Population ratio (not reported). Monetary Shock is the accumulated running sum of high-frequency innovations in the federal funds future (as in Kuttner, 2001) from the start of the sample period through each quarter t. Standard errors adjusted for clustering at MSA level. p-value of difference from Whites (Panel A), from Bachelors Degree (Panel B), and from males (Panel C) in square brackets. * p<0.10, ** p<0.05, *** p<0.01

Table 7: **Two-Year Employment Growth and Federal Funds Rate by Labor Market Tightness: 2SLS Estimates**

Panel A: First Stage

	(1) Fed Funds Rate × Emp/Pop
Monetary Shock × Emp/Pop	2.13***
	(0.03)
$F - statistic$	4,984.19
Observations	511,843

Panel B: Race

	(2) Blacks	(3) Whites
Fed Funds Rate × Emp/Pop	-1.23**	0.05
	(0.51)	(0.24)
	[0.00]	
R^2	0.00	0.01
Observations	511,843	1,019,176

Panel C: Education

	(4) Less than High School	(5) High School	(6) Some College	(7) Bachelors Degree
Fed Funds Rate × Emp/Pop	-0.66***	-0.15	-0.17	-0.08
	(0.25)	(0.22)	(0.22)	(0.25)
	[0.00]	[0.58]	[0.42]	
R^2	0.01	0.01	0.01	0.00
Observations	752,685	1,030,813	1,039,149	919,853

Panel D: Sex

	(8) Female	(9) Male
Fed Funds Rate × Emp/Pop	-0.44*	-0.22
	(0.25)	(0.27)
	[0.07]	
R^2	0.00	0.01
Observations	1,081,865	1,155,071

Panel A reports first-stage results of a 2SLS specification which instruments for the interaction between the federal funds rate and the local employment-to-population ratio using the interaction between the monetary shock variable and the local employment-to-population ratio. Monetary Shock is the accumulated running sum of high-frequency innovations in the federal funds future (as in Kuttner, 2001) from the start of the sample period through each quarter t. Panels B–D report results of the second stage regressions, which are run at the MSA-industry-quarter level and include MSA-industry fixed effects, industry-quarter fixed effects, and the non-interacted employment-to-population ratio (not reported). Standard errors adjusted for clustering at MSA level. p-value of difference from Whites (Panel B), from Bachelors Degree (Panel C), and from males (Panel D) in square brackets. * p<0.10, ** p<0.05, *** p<0.01

Table 8: **Baseline Calibration Parameters**

$\beta = 0.99$	Quarterly discount factor
$\sigma = 1$	Inverse Intertemporal Elasticity of Substitution
$\chi = 4$	Disutility of working
$\mathbb{h} = 0.8$	Habit formation
$\theta = 0.73$	Calvo parameter
$\phi_\pi = 1.24$	Taylor rule response to interest rate
$\phi_y = 0.33/4$	Taylor rule response to output
$\rho_i = 0.7$	Interest rate smoothing
$\rho_\mu = 0.1$	Interest rate shock persistence
$F = 0.25$	Hiring cost
$\delta = 0.05$	Exogenous separation rate
$\bar{a}_h = 0.45$	Steady-state hiring threshold H
$\bar{a}_l = 0.45$	Steady-state hiring threshold L
$\underline{s}$ =0.1	Lower bound on support of productivity of high type
$\bar{s}$= 0.75	Upper bound on support of productivity of low type
$\gamma = 0.5$	Share of high types