ECONtribute
MARKETS & PUBLIC POLICY

ECONtribute
Discussion Paper No. 446

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Nittai K. Bergman
David Matsa
Benjamin Born
Michael Weber

November 2026

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Funding by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) under Germany's Excellence Strategy – EXC 2126/2 – 390838866 – is gratefully acknowledged.

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Abstract

We study how monetary policy affects employment across workers with differing labor-force attachment. Exploiting local labor-market variation, we find that monetary easing disproportionately boosts employment among Black workers, less-educated workers, and women in tighter markets, as measured by the prime-age employment-to-population ratio. A one-standard-deviation federal funds rate cut raises two-year Black employment growth by 0.6 percentage points more in markets at the 90th than the 10th percentile of tightness. These differences persist and are amplified by greater monetary-policy exposure. A model with heterogeneous workers shows how tightness shapes hiring composition while policy exposure determines demand responses. Tightness primarily shapes the distribution, not the magnitude, of employment gains.

Keywords: Monetary Policy, Labor Markets, Labor-Force Attachment, Federal Reserve
JEL-Codes: E24, E52, E58, J15, J21, R23

*Bergman: Berglas School of Economics, Tel Aviv University, nbergman@tauex.tau.ac.il. Born: University of Bonn and CEPR, b.born@uni-bonn.de. Matsa: Kellogg School of Management, Northwestern University, and NBER, dmatsa@kellogg.northwestern.edu. Weber: Daniels School of Business, Purdue University, and NBER, weber366@purdue.edu. 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, and various seminar and conference audiences for excellent feedback. We also thank Manav Chaudhary, Jonas Dalmazzo, Jiacheng Feng, Ayush Sinha, and Tiange Ye for excellent research assistance. Born would like to thank the German Research Foundation (DFG) for support under Germany's Excellence Strategy – EXC 2126/2 – 390838866 and through CRC TR 224 (Project C02).

1 Introduction

Following its 2020 Monetary Policy Review, the Federal Reserve emphasized maximum employment as a "broad-based and inclusive goal," with Chair Jerome 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.[1] Prior work finds that the labor-market outcomes of Black workers respond more to monetary policy than those of White workers (Bartscher et al., 2022; Petkov and Weise, 2026), and that less-advantaged groups may gain more than others when the labor market strengthens (Aaronson et al., 2019). However, the conditions under which these gains materialize are not yet well understood. In this paper, we study under which local economic conditions monetary expansions generate employment gains that reach workers with weaker labor-force attachment.

Our empirical analysis studies monetary policy's heterogeneous employment effects with respect to workers' race, education, and sex. Two local conditions matter for who is hired in an expansion: how tight the local labor market is when the expansion arrives, and how strongly local demand responds to the policy impulse, which we call local monetary-policy exposure. Beginning with tightness, we investigate how expansionary monetary policy promotes employment growth for each group across local labor markets with different tightness levels. We find that, for demographic groups with weaker labor-force attachment—Black workers, the least educated, and women—expansionary monetary policy has a larger effect on employment growth in tighter labor markets. By contrast, for groups with stronger labor-force attachment, the employment response to monetary easing does not increase with tightness and, if anything, moves in the opposite direction. Thus, whether monetary expansions generate broad-based employment gains depends on the state of the local labor market when the expansion occurs.

We use administrative employment data from the Census Bureau's Quarterly Workforce Indicators (QWI), which allow us to measure employment by local labor market and industry separately for workers of different races, education levels, and sexes. For each demographic group, we regress employment growth on the interaction between the federal funds rate and local labor market tightness, which we measure by the local prime-age employment-to-population ratio, across 895 local labor markets in the U.S. between 1990 and 2019. Industry-by-quarter fixed effects absorb aggregate and industry-level shocks, including the level effect of monetary policy, and industry-by-location fixed effects absorb persistent local differences.

[1] In August 2025, the Federal Open Market Committee revised its strategy statement, dropping the phrase "broad-based and inclusive goal" but noting that durably achieving maximum employment "fosters broad-based economic opportunities."

Our estimates therefore compare how the same monetary-policy movement affects a group's employment growth across local labor markets with different initial tightness, within the same industry and quarter.

The estimated effects are economically large. For Black workers, a one-standard-deviation decline in the federal funds rate is associated with approximately 0.56 percentage points greater two-year employment growth in a labor market at the 90th percentile of tightness than in one at the 10th percentile, about 6% of mean Black employment growth over the sample period. Pooling the data across demographic groups, we find that the differences in monetary-policy sensitivity across tight and slack labor markets—between Black and White workers, between workers without a high-school degree and those with a bachelor's degree, and between women and men—are all highly statistically significant. Across race, education, and sex, the differential effects build gradually and peak about two years after the policy change, and their cumulative effects persist for several years.

To organize these findings, we develop a simple model with heterogeneous workers based on the ranking logic of Blanchard and Diamond (1994). Firms rank potential workers according to their hiring value and employ those above a cutoff determined by local demand.[2] A monetary expansion raises labor demand and lowers this cutoff, extending employment further down the worker distribution. We assume that workers with weaker labor-force attachment become increasingly prevalent at lower hiring values. Labor market tightness, therefore, determines where along the worker ranking a monetary expansion begins. In tighter markets, firms are already hiring further down the ranking, where lower-attachment workers are relatively more prevalent, so these workers make up a larger share of those brought into employment by the expansion. How far the expansion moves hiring down the ranking depends on local monetary-policy exposure, that is, on how strongly local demand responds to a given policy change.

The model decomposes the effect of labor market tightness on a group's employment response to monetary policy into two effects: a total-response effect and an incidence effect. The *total-response effect* captures how tightness changes the response of total employment to monetary policy and affects each group in proportion to its representation at the hiring margin. The *incidence effect* holds the total employment response fixed and captures how tightness changes the distribution of the resulting employment gains across groups. The model does not impose a sign on either effect.

To distinguish between these two channels empirically, we examine whether the total employment response to monetary policy varies with labor market tightness. We find lit-

[2]We do not model the sources of the variation in workers' hiring value, which could include differences in education, labor market experience, match quality, employment costs, or discrimination.

tle evidence that the total employment response varies systematically with tightness: The interaction between the federal funds rate and tightness is small and statistically insignificant. This contrasts sharply with the large and statistically significant differences across demographic groups. Tighter labor markets amplify the response of lower-attachment workers, whereas the response of higher-attachment workers is, if anything, smaller. Viewed through the model's decomposition, these results point to the incidence effect, rather than the total-response effect, as the primary source of the heterogeneity we document.

Local monetary-policy exposure is also important. In the model, greater exposure generates a larger local demand response to a given monetary-policy impulse, moving hiring further down the worker ranking. Because workers with weaker labor-force attachment are overrepresented at the hiring margin relative to their share of employment, their percentage employment response increases by more. Empirically, we measure exposure by the share of local employment in durable-goods industries and by the price rigidity of the local industry mix, two channels central to theories of monetary transmission (see, e.g., Barsky et al., 2007; McKay and Wieland, 2021; Pasten et al., 2020).

We find that for workers with weaker labor-force attachment—Black workers, the least educated, and women—monetary easing generates larger employment gains in local economies with greater exposure to monetary policy. In both local economies with a larger durable-goods employment share and those with a more price-rigid industrial composition, monetary easing has larger employment effects for workers with weaker labor-force attachment than for those with stronger attachment, with all cross-group differences statistically significant. For example, a one-standard-deviation decline in the federal funds rate raises the employment-growth response of workers without a high-school degree relative to that of workers with a bachelor's degree by approximately 0.88 percentage points more in a local economy at the 90th percentile of local price rigidity than in one at the 10th percentile. As with tightness, these differences are long-lasting, especially for race and education.

Finally, we address concerns about the endogeneity of monetary policy by instrumenting for the federal funds rate using the high-frequency monetary-policy surprises of Bauer and Swanson (2023). The IV estimates continue to show stronger employment responses among workers with weaker labor-force attachment in all three comparisons.

Taken together, our results show that who gains from a monetary expansion depends on local economic conditions. Workers with weaker labor-force attachment benefit disproportionately when monetary easing occurs in tighter labor markets and in local economies that are more exposed to monetary policy. Across race, education, and sex, labor market tightness determines whether employment gains extend to these workers, and greater monetary-policy exposure amplifies the differences across workers. Because monetary policy is set nationally,

the same rate path reaches workers with weaker labor-force attachment to very different degrees across local labor markets.

Our paper is the first to study the role of local labor market tightness and monetary-policy exposure in transmitting monetary shocks differentially into employment growth among demographic groups. It contributes to the literature on the distributional effects of monetary policy across households and workers. Early work on the poor and minority workers reaches mixed conclusions (Romer and Romer, 1999; Zavodny and Zha, 2000; Thorbecke, 2001; Carpenter and Rodgers III, 2004). More recent work finds that Black labor-market outcomes respond more to monetary policy than White outcomes (Bartscher et al., 2022; Petkov and Weise, 2026), that the unemployment of men without a high-school degree responds more than the average (Amir-Ahmadi et al., 2022), that monetary policy shifts the distribution of income, consumption, and wealth (Coibion et al., 2017; Amberg et al., 2022; Andersen et al., 2023; Moser et al., 2021), and that a tightening raises unemployment more among workers with short job tenure (Coglianese et al., 2025). Heterogeneous-agent models attribute such differences to labor-market risk and asset holdings (Nakajima, 2023; Gornemann et al., 2021) and to the cyclical exposure of low-skilled workers (Alves and Violante, 2025).

Aaronson et al. (2019) examine whether disadvantaged groups gain disproportionately from further declines in unemployment once it is below its natural rate, mostly in national data, and report suggestive evidence of modest additional gains. Favara et al. (2025) find that monetary tightening raises labor-income inequality within U.S. metropolitan areas. None of these studies asks how the employment response of different groups to monetary policy depends on the tightness of the local labor market. Whereas the U.S. evidence on differences across groups comes mostly from national time series, we compare 895 local labor markets that face the same monetary policy, which allows us to identify when monetary expansions disproportionately reach workers with weaker labor-force attachment. Because we observe total employment and the employment of each group within the same local economy, we can separate how strongly local employment responds from which workers receive the gains.

Our paper also relates to research on heterogeneity in monetary transmission across regions and industries. Regional studies find that economic activity responds more to monetary policy where manufacturing, and durable-goods manufacturing in particular, is concentrated (Carlino and DeFina, 1998; Furceri et al., 2019), and relate regional differences to housing, credit, income, industry composition, and demographics (Beraja et al., 2019; Luck and Zimmermann, 2020; Herreño and Pedemonte, 2025; Bellifemine et al., 2026; Leahy and Thapar, 2022; Leahy and Ranošová, 2026). Industry studies find larger output responses in durable-goods industries (Dedola and Lippi, 2005; Peersman and Smets, 2005), and in industries with stickier prices (Henkel, 2020), and Singh et al. (2022) document the same ordering for

employment in the QWI data, with manufacturing and construction responding more than services. In multi-sector models, differences in price rigidity across sectors raise the real effects of monetary policy and determine which sectors carry them (Nakamura and Steinsson, 2010; Pasten et al., 2020). Whereas these studies compare how strongly regions and industries respond to monetary policy, we study which workers benefit from the resulting employment gains, using the durable-goods share and the price rigidity of the local industry mix as measures of exposure. Work on price rigidity has examined the output effects of monetary policy, not its employment effects or their incidence across workers. To our knowledge, the price rigidity of a local economy's industry mix has not been used to measure its exposure to monetary policy.

Finally, our model builds on the ranking logic of Blanchard and Diamond (1994), in which labor-market conditions determine which workers are at the margin of employment. Related models study worker selection and heterogeneous exposure to the business cycle in richer settings (Ravenna and Walsh, 2012; Alves and Violante, 2025); our model is deliberately simple, so that its decomposition into a total-response and an incidence effect maps into the coefficients we estimate for groups and for total employment.

The remainder of the paper is organized as follows. Section 2 develops the model of marginal hiring and derives its implications for the incidence of employment gains across workers. Section 3 describes the data and presents the empirical analysis of labor market tightness and local monetary-policy exposure. Section 4 concludes.

2 Marginal Hiring and the Incidence of Employment Gains

To guide our empirical analysis below, in this section, we develop a simple model with heterogeneous workers which follows the ranking logic of Blanchard and Diamond (1994) (see also Blanchard, 1995). Firms rank potential workers by the expected output of a match relative to its cost. When labor demand expands, firms work their way down this ranking. We assume that workers with weaker labor-force attachment are concentrated further down the ranking. In a tight labor market, they then make up a larger share of the workers an expansion brings into employment, because hiring is already deep in the distribution when the expansion begins. Local exposure to monetary policy enters separately: it determines how strongly local labor demand reacts to a given policy impulse, and therefore how far down the ranking firms move. The mechanism is closely related to the high-pressure-economy literature, in which strong labor markets improve opportunities for workers at the margin of employment (see, e.g., Aaronson et al., 2019; Alves and Violante, 2025).

2.1 Setup

Consider a local labor market m populated by a unit mass of workers. Workers belong to two groups, $g \in \{L, H\}$, where L denotes the group with lower average labor-force attachment and H the group with higher attachment. Population shares are $\pi_L + \pi_H = 1$ with $\pi_g \in (0, 1)$. Each worker i has an expected match productivity y_i and a total employment cost $w_i > 0$. Match productivity is the output the firm anticipates from the match, based on what it observes at the hiring stage (interviews, credentials, referrals); the employment cost, w_i, is the wage and other costs required to hire the worker.

Firms produce with a linear technology in local labor markets. Demand conditions in market m are summarized by a local demand shifter $B_m > 0$. A worker with match productivity y employed in market m generates expected revenue $B_m y$, so the expected profit from hiring worker i in that market is $B_m y_i - w_i$. The firm hires the worker whenever this profit is nonnegative. Dividing by the worker's employment cost gives the hiring rule

$$B_m \, a_i \geq 1 \ , \qquad a_i \equiv \frac{y_i}{w_i} \ . \tag{1}$$

We refer to a_i, expected match output per unit of employment cost, as the worker's *hiring value*. Firms rank workers by this ratio alone, and because the technology is linear, they hire every worker who clears the bar. A worker who satisfies the firm's hiring condition accepts employment, so employment is determined by the firm's hiring rule.

Within group g, hiring values are distributed according to F_g, with density $f_g > 0$ over the range of cutoffs considered below. Because hiring value depends on both expected match productivity and employment costs, differences across groups in either component are reflected in F_g. Group membership itself does not enter the hiring rule; the groups differ only through F_g, which may reflect differences in access to education and experience, in match quality, in how employers screen, in discrimination, or in workplace conditions, and therefore do not necessarily represent differences in workers' underlying productivity. We hold (π_g, F_g) fixed across markets, which differ only in demand conditions and their exposure to monetary policy.

The hiring rule implies a cutoff $c_m = 1/B_m$: workers with hiring values a_i above c_m are employed, while workers below it are not. Group employment is therefore

$$E_{gm} = \pi_g \left[1 - F_g(c_m)\right], \tag{2}$$

and total employment is $N_m = \sum_g E_{gm}$. Since the population is normalized to one, baseline employment is also our measure of labor market tightness, $T_m = N_m$; this is the model

counterpart of the prime-age employment-to-population ratio in the empirical analysis.

Denoting the density of workers at the hiring margin by

$$\bar{f}(c) = \sum_g \pi_g f_g(c),$$

we have that total employment is strictly decreasing in the cutoff, and inverting this relationship yields:

$$\frac{dc_m}{dT_m} = -\frac{1}{\bar{f}(c_m)} < 0. \tag{3}$$

A tight labor market is thus one in which demand is strong and firms are already hiring deep in the worker distribution.

2.2 Monetary Policy and the Incidence of an Expansion

Let x denote a monetary policy impulse, with $x > 0$ corresponding to an expansion. Local demand responds according to

$$B_m(x, z_m) = B_{m0} \exp\{\lambda(z_m)x\}, \tag{4}$$

where $B_{m0} > 0$ denotes demand in the absence of the policy impulse and z_m captures market m's exposure to monetary policy. We assume $\lambda(z) > 0$ and $\lambda'(z) > 0$, so an expansion raises demand in every market, with a larger response in more exposed markets. In the empirical analysis below, an expansionary impulse corresponds to a decline in the federal funds rate, while greater monetary exposure is associated with greater local price rigidity and a larger durable-goods employment share. We model the effect of monetary policy on local demand in reduced form, without taking a stand on the transmission mechanism. For simplicity, employment costs are held fixed as demand changes.[3]

Under these conditions, an expansion lowers the hiring cutoff,

$$\frac{\partial c_m}{\partial x} = -\lambda(z_m)c_m < 0,$$

so firms extend hiring to workers who did not meet the pre-expansion threshold. Differentiating group employment in equation (2), the response of group g's employment to the monetary-policy impulse is

$$\frac{\partial E_{gm}}{\partial x} = \pi_g f_g(c_m)\lambda(z_m)c_m,$$

[3]The results continue to hold as long as costs rise by less than revenues and by the same factor for all workers, so that an expansion still raises expected revenues relative to employment costs. Future work should study this aspect separately.

while the corresponding response of total employment is

$$\frac{\partial N_m}{\partial x} = \bar{f}(c_m)\lambda(z_m)c_m.$$

The ratio of the two gives

$$\frac{\partial E_{gm}}{\partial x} = q_g(c_m)\frac{\partial N_m}{\partial x}, \qquad q_g(c_m) \equiv \frac{\pi_g f_g(c_m)}{\bar{f}(c_m)}. \tag{5}$$

The term $q_g(c_m)$ is group g's share of workers at the hiring margin and therefore determines how a marginal employment expansion is distributed across groups. Equivalently,

$$\frac{dE_{gm}}{dN_m} = q_g(c_m). \tag{6}$$

Equation (5) thus separates the magnitude of the local employment response to the monetary-policy impulse, $\partial N_m/\partial x$, from its incidence across worker groups, $q_g(c_m)$.

2.3 Ranking and Worker Incidence

The key restriction of the model concerns how the two groups are positioned along the hiring ranking. We assume that throughout the common support of the two hiring-value distributions,

$$\frac{d}{da}\left[\frac{f_L(a)}{f_H(a)}\right] < 0. \tag{7}$$

Condition (7) imposes a monotone likelihood-ratio ordering: as hiring value declines, the relative density of lower-attachment workers rises. Because tighter labor markets lower the hiring cutoff and extend hiring further down the hiring-value distribution, lower-attachment workers become relatively more prevalent among marginal hires. The condition concerns relative densities and does not require the two groups to occupy distinct regions of the hiring distribution. Their distributions may overlap substantially, and the lower-attachment group does not necessarily need to constitute a majority at the hiring margin. This assumption is consistent with evidence that Black workers experience larger employment losses than White workers in downturns (Couch and Fairlie, 2010) and with the suggestive evidence that workers with weaker labor-force attachment gain more when the labor market is already tight (Aaronson et al., 2019).

Define the semi-elasticity of total employment with respect to the monetary-policy impulse as

$$A(T_m, z_m) \equiv \frac{1}{N_m}\frac{\partial N_m}{\partial x} = \lambda(z_m)\frac{c_m \bar{f}(c_m)}{T_m}. \tag{8}$$

The function $A(T_m, z_m)$ captures the percentage response of total employment to a unit monetary-policy impulse. It depends on both initial labor market tightness in the local market m, which determines the position of the hiring cutoff, and the local market's monetary-policy exposure, which determines how strongly local demand responds to the policy impulse.

To obtain the corresponding semi-elasticity of group g's employment with respect to the monetary-policy impulse, let

$$s_g(T_m) \equiv \frac{E_{gm}}{N_m}$$

denote group g's share of existing employment. Using the expression for group employment gains derived above, group g's employment semi-elasticity with respect to the monetary-policy impulse is

$$\frac{\partial \log E_{gm}}{\partial x} = A(T_m, z_m) \frac{q_g(c_m)}{s_g(T_m)}. \tag{9}$$

The ratio q_g/s_g compares group g's representation at the hiring margin with its representation in the existing employment stock. We refer to this object as group g's *marginal representation ratio*. Equation (9) implies that a higher marginal representation ratio translates a given total employment expansion into a larger percentage employment response for the group.

The ranking restriction in (7) determines how marginal representation ratios compare across groups. Because lower-attachment workers become relatively less prevalent as the hiring value rises, their representation at the hiring margin exceeds their average representation among employed workers. The opposite holds for higher-attachment workers.[4]

Hence,

$$q_L(c_m) > s_L(T_m), \qquad q_H(c_m) < s_H(T_m). \tag{10}$$

Combining (9) and (10) gives

$$\frac{\partial \log E_{Hm}}{\partial x} < A(T_m, z_m) < \frac{\partial \log E_{Lm}}{\partial x}. \tag{11}$$

Thus, monetary easing generates a larger percentage employment response for the lower-attachment group than for the higher-attachment group, with the total employment response lying between the two.

We next ask how each group's employment semi-elasticity varies with initial labor market tightness. Define

$$\gamma_g(T_m) \equiv \frac{d}{dT_m} \left[\frac{\partial \log E_{gm}}{\partial x} \right],$$

[4]The employment share $s_L(T_m)$ is the average of $q_L(a)$ over hiring values $a \geq c_m$, weighted by $\bar{f}(a)$. Under (7), q_L is decreasing in a, so this average lies below $q_L(c_m)$.

as the derivative of group g's employment semi-elasticity with respect to labor market tightness. A positive $\gamma_g(T_m)$ means that group g's percentage employment response to monetary easing becomes larger as the labor market tightens.

Because exposure is fixed in this section, we write $A(T_m)$ for $A(T_m, z_m)$ and, since the cutoff is a function of tightness, $q_g(T_m)$ for $q_g(c_m)$. Differentiating equation (9) with respect to labor market tightness gives

$$\gamma_g(T_m) = \underbrace{A'(T_m)\frac{q_g(T_m)}{s_g(T_m)}}_{\text{total-response effect}} + \underbrace{A(T_m)\frac{d}{dT_m}\left[\frac{q_g(T_m)}{s_g(T_m)}\right]}_{\text{incidence effect}}. \tag{12}$$

Equation (12) decomposes the effect of labor market tightness on each group's employment semi-elasticity into two channels. The first, the *total-response effect*, captures how the total employment response to monetary policy changes with tightness and passes through to group g in proportion to its marginal representation ratio, q_g/s_g. The second, the *incidence effect*, holds the total employment response fixed and captures how labor market tightness changes the group's representation at the hiring margin relative to its share of existing employment. Thus, a group's employment response can become more sensitive to monetary policy in tighter labor markets either because monetary policy generates a larger total employment response or because the incidence of a given employment expansion shifts toward that group.

The effect of tightness on the semi-elasticity of total employment with respect to monetary policy, $A'(T_m)$, is ambiguous in sign. As tightness rises, the hiring cutoff moves through different regions of the hiring-value distribution, and the density of workers at the margin may therefore rise or fall. At the same time, a given employment gain is measured relative to a larger initial employment stock. The total employment semi-elasticity may therefore increase or decrease with tightness. We leave the sign of $A'(T_m)$ unrestricted and estimate this object directly in the empirical analysis.

To understand how labor market tightness changes the *relative* monetary-policy sensitivity of the two groups, subtract the higher-attachment group's response from that of the lower-attachment group. Using equation (12):

$$\begin{aligned}\gamma_L(T_m) - \gamma_H(T_m) = &\underbrace{A'(T_m)\left[\frac{q_L(T_m)}{s_L(T_m)} - \frac{q_H(T_m)}{s_H(T_m)}\right]}_{\text{total-response effect}} \\ &+ \underbrace{A(T_m)\frac{d}{dT_m}\left[\frac{q_L(T_m)}{s_L(T_m)} - \frac{q_H(T_m)}{s_H(T_m)}\right]}_{\text{incidence effect}}.\end{aligned} \tag{13}$$

Equation (13) decomposes the effect of tightness on the difference in monetary-policy sensitivity between lower- and higher-attachment workers into the same two channels, a total-response effect and an incidence effect. As shown in Equation (10), lower-attachment workers have a higher marginal representation ratio than higher-attachment workers, which implies that the term in brackets in the total-response effect, $q_L/s_L - q_H/s_H$, is positive. The sign of the total-response effect is, therefore, determined by $A'(T_m)$, which measures how labor market tightness affects the sensitivity of total employment to the monetary shock. The total-response channel, therefore, widens the cross-group difference if $A'(T_m) > 0$, narrows it if $A'(T_m) < 0$, and contributes little if $A'(T_m)$ is close to zero.

The incidence effect in (13) holds the size of the total employment response fixed and captures how tightness changes the distribution of the resulting employment gains across groups, that is, the difference in the groups' marginal representation ratios. A positive incidence effect means that, as labor markets tighten, a given employment expansion tilts toward lower-attachment workers relative to their existing employment share. This effect is also ambiguous in sign. The lower-attachment share of the hiring margin rises with tightness, but so does the group's share of employment, and hence their ratio can move either way. Whether tightness shifts the incidence of employment gains toward lower- or higher-attachment workers is therefore an empirical question.

2.4 Monetary-Policy Exposure

Finally, we consider how variation in a local market's exposure to monetary policy affects the differential employment responses of lower- and higher-attachment workers. Recall that exposure z_m governs the strength of local monetary transmission through $\lambda(z_m)$, with $\lambda'(z_m) > 0$. Holding initial labor market tightness fixed, equation (8) implies

$$A_z(T_m, z_m) \equiv \frac{\partial A(T_m, z_m)}{\partial z_m} = \lambda'(z_m) \frac{c_m \bar{f}(c_m)}{T_m} > 0.$$

Greater exposure, therefore, increases the semi-elasticity of total employment with respect to a monetary-policy impulse.

The implications for group employment follow directly from equation (9). Unlike tightness, exposure does not change where along the ranking hiring starts: holding tightness fixed, the hiring cutoff, and hence the marginal representation ratio q_g/s_g, is unchanged, so exposure generates no separate incidence effect. It affects a group's employment semi-elasticity only through the total employment response:

$$\frac{\partial}{\partial z_m} \left[\frac{\partial \log E_{gm}}{\partial x} \right] = A_z(T_m, z_m) \frac{q_g(T_m)}{s_g(T_m)}. \tag{14}$$

Because the ranking restriction implies a larger marginal representation ratio for lower-attachment workers, greater monetary-policy exposure amplifies their percentage employment response by more:

$$\frac{\partial}{\partial z_m}\left[\frac{\partial \log E_{Lm}}{\partial x} - \frac{\partial \log E_{Hm}}{\partial x}\right] = A_z(T_m, z_m)\left[\frac{q_L(T_m)}{s_L(T_m)} - \frac{q_H(T_m)}{s_H(T_m)}\right] > 0. \tag{15}$$

The model thus predicts a larger differential employment response between lower- and higher-attachment workers in markets where monetary policy transmits more strongly.

2.5 Mapping the Model to the Empirical Design

In Section 3, we exploit cross-sectional variation in initial labor market tightness across local labor markets to study how the employment effects of a common monetary-policy movement vary with local labor market conditions. The panel structure allows us to absorb common time-series variation, including the level effect of monetary policy, with industry-by-quarter fixed effects, while industry-by-location fixed effects absorb persistent differences across local labor markets. The identifying variation comes from comparing how the same monetary-policy movement affects employment in markets that differ in their initial tightness.

Because the industry-by-quarter fixed effects absorb the level effect of monetary policy, the design does not identify the level semi-elasticities $\partial \log N_m/\partial x$ and $\partial \log E_{gm}/\partial x$, the percentage responses of total and group g employment to a unit monetary-policy impulse, but it identifies how these semi-elasticities vary with labor market tightness. For each demographic group g, the baseline specification estimates the empirical counterpart of $\gamma_g(T_m)$ in equation (12), which measures how the group's employment semi-elasticity changes with tightness. Pooling demographic groups allows us to estimate the corresponding cross-group difference, $\gamma_L(T_m) - \gamma_H(T_m)$. Applying the same design to total employment identifies the empirical counterpart of $A'(T_m)$, the effect of tightness on the total employment semi-elasticity.

Taken together, these estimates allow us to distinguish the two channels in equation (13). Because the ranking restriction implies that the lower-attachment group has the larger marginal representation ratio, the sign of $A'(T_m)$ determines the direction of the total-response effect. Absent incidence effects, the group estimates would therefore all share the sign of $A'(T_m)$ and differ only in proportion to the groups' marginal representation ratios. The remaining cross-group differential is informative about the incidence effect. In particular, when the total-response effect is close to zero, the cross-group differential maps directly into changes in incidence; when the total-response effect works against the observed cross-group differential, the incidence effect must be sufficiently strong to offset it.

We apply the same empirical logic to variation in monetary-policy exposure. Specifically, we use the local durable-goods employment share and local price rigidity as measures of z_m and replace labor market tightness with these exposure measures in the corresponding interaction specifications. The group-specific regressions identify the empirical counterparts of

$$\frac{\partial}{\partial z_m}\left[\frac{\partial \log E_{gm}}{\partial x}\right],$$

which measures how monetary-policy exposure changes group g's employment semi-elasticity with respect to monetary policy. The total-employment regression similarly identifies the empirical counterpart of $A_z(T_m, z_m) = \partial A(T_m, z_m)/\partial z_m$, which measures how exposure changes the semi-elasticity of total employment. Pooling demographic groups identifies the corresponding cross-group difference in equation (15). In the model, exposure affects group employment responses only through the strength of the total employment response. The exposure specifications, therefore, test whether markets in which monetary policy transmits more strongly exhibit both a larger total employment response and the larger relative response of lower-attachment workers implied by their higher marginal representation ratio.

3 The Heterogeneous Effects of Monetary Policy on Employment Growth

In this section, we examine how local economic conditions shape the employment effects of monetary policy across workers with different degrees of labor-force attachment.

3.1 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 reports the groups we analyze within each

Table 1: **Labor Force Attachment by Demographic Group**

	Employment rate (%)	
	Mean	SE
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
Bachelor's Degree	75.7	0.1
Female	55.2	0.1
Male	68.5	0.2

Notes: The table reports average employment rates for the indicated demographic groups over the period 1990Q1–2019Q1. Employment rates are expressed as percentages and calculated using data from the U.S. Bureau of Labor Statistics. Means and corresponding standard errors are reported for each group.

category, along with their mean employment rate over the sample period using data from the Bureau of Labor Statistics. Labor-force attachment varies considerably across the demographic groups. The average employment rate is lower for Black workers than for White workers (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.

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. For each demographic category, our baseline balanced sample further retains only MSA-industry-quarter cells for which all groups in that category satisfy this requirement, ensuring that cross-group comparisons are made on a common set of observations. Because each demographic group forms a separate observation within an MSA-industry-quarter cell, the observation counts reported for the groups in a category add up to more than the number of underlying cells. 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.[5] The denominator is the population of MSA residents aged 25-54, ob-

[5]Because the QWI does not include federal employees, we exclude the District of Columbia from the

tained from the U.S. Census Bureau Population Estimates Program. We use this measure of 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 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 (2010) vacancy index to the number of unemployed workers is 0.65. After logging and HP filtering of the two series, the correlation is 0.9. In the regressions, we lag the employment-to-population ratio by one quarter, so that tightness is measured before any potential changes in monetary policy.

We construct two MSA-level measures of local monetary-policy exposure based on the industrial composition of employment. First, we measure durable-goods exposure as the share of MSA employment in durable-goods industries, using QWI employment data.[6] Second, we construct a measure of local-level price rigidity using industry-level frequencies of price adjustment from Gorodnichenko and Weber (2016). These measures are constructed from confidential microdata underlying the Bureau of Labor Statistics Producer Price Index and capture the frequency with which firms adjust their output prices. For ease of exposition and to keep the direction of our exposure measures consistent, we multiply the industry-level price-flexibility measure by minus one, so that higher values correspond to greater price rigidity and, as with durable-goods share, to greater monetary-policy exposure. We construct MSA-level price rigidity as the employment-share-weighted average of this measure across three-digit NAICS industries in the local economy. The two measures capture central dimensions of monetary transmission: durable-goods demand is particularly sensitive to interest rates, whereas greater nominal price rigidity is associated with stronger real effects of monetary policy. As with labor market tightness, both exposure measures enter the regressions lagged by one quarter.

Our analysis includes two measures of monetary policy: the federal funds rate and monetary-policy surprises. 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 each quarter using the 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).

sample, but this exclusion does not meaningfully affect our results.

[6]Durable-goods industries are durable-goods manufacturing (NAICS 321, 327, and 331–339), as grouped by the Bureau of Labor Statistics, and construction (NAICS 23), the two sectors traditionally considered the most interest-rate sensitive (Willis and Cao, 2015).

Data on monetary-policy surprises are from Bauer and Swanson (2023), who construct them from high-frequency changes in interest rates around FOMC announcements. Because the window around each announcement is narrow, these changes reflect the policy news in the announcement rather than the state of the economy that the funds rate itself responds to.[7]

In our IV analysis, we instrument for the federal funds rate using the running sum of these high-frequency monetary-policy surprises. Whereas each surprise captures a change in monetary policy, their running sum is akin to the level of the federal funds rate. For each quarter t, we sum the Bauer–Swanson surprises that occurred from the start of the sample period through quarter t.

Table 2 shows summary statistics for various variables of interest. The average federal funds rate in the sample is 2.30%, whereas the average employment-to-population ratio is 0.67. The average two-year growth rate in total employment within an industry-MSA cell is 6.74%, compared with an average growth rate of 9.69% for Black workers and 4.88% for White workers. Employment growth is also more volatile for Black workers than for White workers (standard deviation of 20.2% as compared to 10.5%), consistent with Black employment growth being more cyclical.

The average employment growth rate also varies with workers' education and sex. The average two-year employment growth rate is higher for workers without a high-school degree (2.1%) than for those with a bachelor's degree (1.3%).[8] Average growth rates are more similar for men (7.0%) and women (6.5%). The table also shows substantial cross-sectional variation in labor market tightness and in both measures of local monetary-policy exposure, providing the variation that underlies our empirical analysis.

3.2 Labor Market Tightness

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:

$$EmplGrowth_{j,g,m,t} = \beta_1 \times FedFunds_t \times Empl/Pop_{m,t-1} + \beta_2 \times Empl/Pop_{m,t-1} + \theta_{j,m} + \delta_{j,t} + \epsilon_{j,g,m,t}, \quad (16)$$

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

[7] In the Appendix, we show that the results are robust to instead constructing monetary-policy surprises following Kuttner (2001); see Tables A.3–A.6.

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

Table 2: **Summary Statistics**

	N	Mean	SD	p10	p25	p50	p75	p90
Federal Funds Rate	1,241,022	2.30	2.24	0.10	0.16	1.52	4.81	5.42
Monetary Surprise	1,241,022	-0.18	0.28	-0.51	-0.38	-0.26	-0.02	0.31
Emp/Pop	1,241,022	0.67	0.14	0.50	0.58	0.67	0.77	0.86
Durable Share	1,241,022	0.14	0.07	0.07	0.09	0.13	0.17	0.23
Price Rigidity	1,241,022	-0.22	0.03	-0.26	-0.23	-0.22	-0.20	-0.20
Two Year Employment Growth								
Black	499,310	9.69	20.21	-12.28	-1.78	8.05	18.65	32.90
White	499,310	4.88	10.54	-6.25	-0.46	4.43	9.53	16.15
Less than High School	718,263	2.14	13.62	-12.15	-5.44	0.99	8.24	17.39
High School	718,263	0.19	11.10	-10.90	-5.64	-0.71	4.83	11.94
Some College	718,263	0.56	11.01	-10.42	-5.11	-0.36	5.03	12.18
Bachelor's Degree	718,263	1.30	11.46	-10.56	-4.75	0.40	6.09	13.81
Female	1,057,149	6.49	15.47	-9.30	-1.57	5.05	12.43	23.08
Male	1,057,149	7.05	15.06	-7.98	-0.79	5.61	12.68	22.88
All workers	1,241,022	6.74	15.52	-8.50	-1.16	5.17	12.27	22.79

Notes: The table reports summary statistics for the main variables used in the analysis. The federal funds rate is the quarterly average of the effective federal funds rate, and monetary surprise is the running sum of Bauer–Swanson high-frequency monetary-policy surprises. Emp/Pop is the lagged prime-age employment-to-population ratio. Durable Share is the lagged share of local employment in durable-goods industries. Price Rigidity is the negative of the lagged employment-share-weighted average of industry-level price flexibility. Two-year employment growth is measured for the indicated demographic group or all workers. Statistics are equally weighted across MSA-industry-subgroup-quarter observations.

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 end of quarter $t-1$. 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, 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 how the relation between employment growth and monetary policy varies with labor market tightness. For each demographic group, the coefficient of interest, β_1, captures this sensitivity. 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.[9] The model in Section 2 decomposes these group-specific interaction coefficients into two components: changes in the overall employment response to monetary policy and changes in the incidence of employment gains across worker groups. Motivated by this decomposition, we also estimate equation (16) using overall employment growth within the MSA-industry cell as the dependent variable.

Table 3 reports the results. Each column in the table examines the employment growth of a different demographic group. Panel A of the table examines heterogeneity with respect to workers' race, presenting results for Black workers in column 1 and White workers in column 2. For Black workers, the coefficient on the interaction between the federal funds rate and local labor market tightness, β_1, is negative, sizable, and statistically significant. The estimate 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 (2.24 percentage point) decrease in the federal funds rate. For reference, the increases in the federal funds rate between December 2015 and December 2018 add up to about one standard deviation. Our estimate implies that, over the subsequent two years, this drop in the federal funds rate is associated with a 0.56 percentage point larger increase in Black employment growth in a labor market at the 90th percentile of employment-to-population (86%) than in a labor market at the 10th percentile of employment-to-population (50%). This additional boost in employment growth in tighter labor markets is sizable, corresponding to approximately 6% of the mean two-year Black employment growth over the sample period.

To illustrate the heterogeneity in monetary policy's effect across labor markets implied by our estimates of equation (16), 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.[10] 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, Black employment grows more rapidly in tighter labor markets. The estimates predict that

[9]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.

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

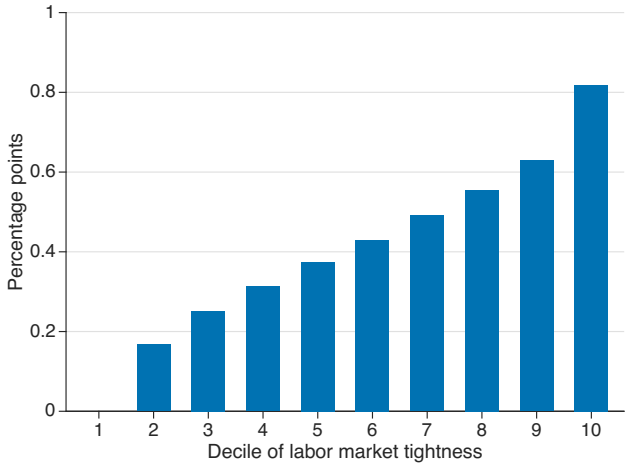
Table 3: **Heterogeneity by Labor Market Tightness: OLS Estimates**

Panel A: Race				
	(1) Blacks	(2) Whites		
Fed Funds Rate × Emp/Pop	-0.70**	0.29		
	(0.36)	(0.18)		
	[0.00]			
R^2	0.32	0.36		
Observations	499,310	499,310		
Panel B: Education				
	(3) Less than High School	(4) High School	(5) Some College	(6) Bachelor's Degree
Fed Funds Rate × Emp/Pop	-0.36*	0.34*	0.34**	0.30*
	(0.21)	(0.18)	(0.17)	(0.18)
	[0.00]	[0.69]	[0.56]	
R^2	0.31	0.32	0.31	0.29
Observations	718,263	718,263	718,263	718,263
Panel C: Sex				
	(7) Female	(8) Male		
Fed Funds Rate × Emp/Pop	-0.16	0.16		
	(0.18)	(0.20)		
	[0.00]			
R^2	0.28	0.25		
Observations	1,057,149	1,057,149		
Panel D: All Workers				
	(9)			
Fed Funds Rate × Emp/Pop	-0.14			
	(0.20)			
R^2	0.25			
Observations	1,241,022			

Notes: The dependent variable is two-year employment growth. Each column reports the coefficient on the interaction between the federal funds rate and the lagged prime-age employment-to-population ratio, which measures local labor market tightness, for the indicated demographic group. Panel D reports results for all workers. All regressions are estimated at the MSA-industry-quarter level using balanced samples and include MSA-industry and industry-quarter fixed effects, as well as the non-interacted employment-to-population ratio. Standard errors, adjusted for clustering at the MSA level, are in parentheses. Square brackets report p-values for tests of equality of the interaction coefficients relative to Whites (Panel A), workers with a bachelor's degree (Panel B), and males (Panel C). * p<0.10, ** p<0.05, *** p<0.01.

a one standard deviation drop in the federal funds rate in Q4 of 2000 would have increased subsequent 2-year Black employment growth by approximately 0.17 percentage points more in labor markets in the second decile of tightness than in the first. The effect is larger in each

Figure 1: **Predicted Effect of Monetary Easing on Black Employment Growth by Labor Market Tightness**



Notes: The figure plots the predicted additional effect of a one-standard-deviation decrease in the federal funds rate on two-year Black employment growth across local labor markets with different levels of tightness. Labor market tightness is measured by the prime-age employment-to-population ratio, with deciles calculated across MSAs in the fourth quarter of 2000. Predictions are based on the estimates in Table 3, Panel A, evaluated at the mean employment-to-population ratio within each decile. Values are expressed in percentage points relative to the lowest decile of labor market tightness.

incremental decile, with the relative effect being nearly twice as large in the fourth decile as in the second decile, nearly three times as large in the seventh decile, and approximately five times as large in the tenth decile.

The employment response of White workers, however, differs from that of Black workers. Column 2 of Table 3 reports estimates of equation (16) for White workers. In contrast to Black workers, the β_1 coefficient for White workers is positive, smaller in magnitude, 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 between the Black and White interaction coefficients is -0.99 and is highly statistically significant ($p < 0.01$). In economic terms, the estimate implies that a one-standard-deviation monetary easing increases the Black–White difference in subsequent two-year employment growth by approximately 0.80 percentage points more in a labor market at the 90th percentile of tightness than in one at the 10th percentile.

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.[11] 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 0.29 percentage point greater two-year employment growth in a tight labor market (90th percentile) than in a slack one (10th percentile). This magnitude is again sizeable and corresponds to approximately 14% of these workers' mean two-year employment growth.

For workers with greater educational attainment, in contrast, the β_1 coefficient estimates are all positive, similar in magnitude, and statistically significant (columns 4–6). Thus, for these more educated groups, the point estimates indicate that the employment-growth response to monetary easing becomes, if anything, smaller as labor markets tighten. The contrast with workers who did not complete high school is therefore pronounced: their interaction coefficient is negative, while those of all three more educated groups are positive. The difference between workers without a high-school degree and those with a bachelor's degree is highly statistically significant, whereas the reported differences among the more educated groups are small and statistically insignificant. This pattern could be produced by employers' use of a high-school diploma as a screening credential. Such a credential would place workers without a diploma further down the hiring ranking, while doing little to distinguish among workers who have one.

Panel C of Table 3 examines employment growth separately among men and women. We again find heterogeneous effects: The interaction coefficients are similar in absolute magnitude but opposite in sign with an estimate of -0.16 for women and 0.16 for men. Although neither coefficient is statistically different from zero, the difference between them is highly statistically significant ($p<0.01$).[12]

To interpret these cross-group differences, we return to the decomposition developed in Section 2, which separates the impact of labor market tightness on each group's monetary-policy employment response into two channels. First, tightness may change the overall employment response to monetary policy. Second, holding the overall response fixed, tightness may change the incidence of the resulting employment gains across worker groups relative to their employment shares. Panel D speaks directly to the total-response effect. We re-estimate equation (16) using the two-year growth of total employment across all workers in the MSA-industry cell as the dependent variable, thereby asking whether the overall employment response to monetary easing varies systematically with initial labor market tightness.

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

[12] In unreported results, we find that the β_1 coefficient for women is negative and statistically different than zero in both the reduced form and the 2SLS specifications examining the effects of high-frequency monetary surprises, which we analyze below.

Panel D shows that the overall employment response to monetary policy does not vary significantly with labor market tightness. The coefficient on the interaction between the federal funds rate and tightness is -0.14 and not statistically significant at conventional levels. Thus, the estimated total-response effect is small and statistically insignificant. By contrast, Panels A–C show large and statistically significant differences in the employment responses of different demographic groups across tight and slack labor markets. Viewed through the model's decomposition in Equation (13), the estimates point to the incidence effect, rather than the total-response effect, as the primary source of the cross-group differences in how employment responses vary with tightness. Moreover, the opposite signs of the group-specific interaction coefficients provide additional evidence that the incidence of employment gains changes with tightness. A total-response effect alone would give all group-specific coefficients the same sign, although with different magnitudes according to their marginal representation ratios, whereas the estimated coefficients differ in sign across groups. In particular, these estimates show that as labor markets tighten, the incidence of employment gains shifts toward Black workers relative to White workers, toward workers without a high-school degree relative to workers with a bachelor's degree, and toward women relative to men.

We also examine whether monetary policy's heterogeneous employment effects extend to payroll growth. Payroll provides a useful complementary outcome because, unlike employment, payroll is not mechanically bounded by the size of the demographic group. Appendix Table A.1 re-estimates our baseline specifications using two-year growth in QWI payroll as the dependent variable. The results closely mirror the employment findings: for Black workers, workers without a high-school degree, and women, monetary easing has a larger effect on payroll growth in tighter labor markets than for their higher-attachment counterparts. The results are economically meaningful. For example, applying the same calculation as for employment, a one-standard-deviation decline in the federal funds rate is associated with approximately 1.08 percentage points greater two-year Black payroll growth in an MSA at the 90th percentile of labor market tightness than in one at the 10th percentile, equal to 9.2 percent of the average two-year payroll growth among Black workers of 11.77 percent.

Returning to employment growth, we next examine the robustness of the cross-group differences in the tightness interaction to alternative specifications. Table 4 presents the results. For each demographic category—race, education, and sex—we pool the sample to include the relevant groups and estimate the difference in the β_1 coefficient across the groups. The first column of each panel reports the baseline specification, allowing the industry-by-MSA and industry-by-quarter fixed effects to differ across demographic groups, augmented to include MSA-by-quarter fixed effects. For race, for example, we pool the data for Black workers and White workers and interact the federal funds rate–labor market tightness term

Table 4: **Heterogeneity by Labor Market Tightness: IV Analysis**

Panel A: Race			
	(1) OLS	(2) RF	(3) IV
Diff. in Fed Funds Rate × Emp/Pop, Blacks vs. Whites	-0.99*** (0.24)		-0.94*** (0.27)
Diff. in Monetary Surprise × Emp/Pop, Blacks vs. Whites		-6.44*** (1.82)	
R^2	0.43	0.43	0.00
Observations	998,620	998,620	998,620
Panel B: Education			
	(4) OLS	(5) RF	(6) IV
Diff. in Fed Funds Rate × Emp/Pop, Less than HS vs. Bachelor's Degree	-0.67*** (0.14)		-0.77*** (0.16)
Diff. in Monetary Surprise × Emp/Pop, Less than HS vs. Bachelor's Degree		-5.26*** (1.06)	
R^2	0.45	0.45	0.00
Observations	1,436,526	1,436,526	1,436,526
Panel C: Sex			
	(7) OLS	(8) RF	(9) IV
Diff. in Fed Funds Rate × Emp/Pop, Female vs. Male	-0.32*** (0.08)		-0.34*** (0.10)
Diff. in Monetary Surprise × Emp/Pop, Female vs. Male		-2.34*** (0.69)	
R^2	0.39	0.39	0.00
Observations	2,114,298	2,114,298	2,114,298

Notes: The dependent variable is two-year employment growth. Reported coefficients represent differences between demographic groups in the interaction of labor market tightness with a monetary policy variable (Black minus White, less than high school minus bachelor's degree, and Female minus Male, respectively). The OLS columns use the federal funds rate, the RF columns report reduced-form estimates using the Bauer–Swanson monetary surprise, and the IV columns instrument the federal funds rate using the Bauer–Swanson monetary surprise. All regressions are estimated at the MSA-industry-quarter level and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

with an indicator for Black workers. The results are reported in Panel A. The coefficient on this triple interaction, -0.99, is exactly the difference between the two coefficients estimated separately in Table 3 (i.e., $\beta_1^{Blacks} - \beta_1^{Whites}$). Panels B and C analogously report the difference between workers without a high-school degree and those with a bachelor's degree, and between women and men, respectively.

Identification of cross-group differences in these specifications, which include MSA-by-quarter fixed effects, is based on comparisons across demographic groups within the same

labor market at the same time.[13] The estimated differences are therefore robust to any contemporaneous local demand shocks, business-cycle conditions, or other MSA-quarter shocks that affect employment growth equally across demographic groups. With MSA-by-quarter fixed effects, the β_1 coefficients for each demographic group are not separately identified. However, we can identify the differences in these coefficients across demographic groups.

Even though our empirical design differences out unobserved local shocks that are common across demographic groups, a remaining potential concern is that movements in the federal funds rate are endogenous and may be correlated with other economic developments that affect cross-group differences in employment growth. Because the federal funds rate often declines in response to deteriorating economic conditions, the OLS estimates in Table 4 may confound the causal effect of monetary policy with the effects of the economic conditions that prompted the policy response.[14] To address this concern, we examine the effects of unexpected changes in monetary policy using high-frequency monetary-policy surprises. Because the measurement window around each announcement is narrow, these surprises are designed to capture unexpected policy news rather than the broader economic conditions to which the federal funds rate responds. We use the running sum of these high-frequency monetary-policy surprises to instrument for the federal funds rate in a 2SLS framework. Our use of high-frequency surprises as instruments follows Gertler and Karadi (2015), who use surprises in federal funds futures around FOMC announcements as external instruments for monetary policy in a structural VAR. Whereas each surprise captures an unexpected change in monetary policy, the running sum is akin to a level measure of the monetary-policy stance.

As a first step, we re-estimate the triple-difference specification in the first column of each panel of Table 4, replacing the federal funds rate with the high-frequency monetary-policy surprises. For each demographic category, this specification allows the differential employment response to monetary shocks across groups to vary with labor market tightness. In an instrumental-variables framework, this specification corresponds to the reduced-form regression, which relates the outcome directly to the instrument. The results, reported in the second column of each panel of Table 4, closely mirror the baseline findings. Across race, education, and sex, expansionary monetary-policy surprises generate relatively larger employment gains for workers with weaker labor market attachment when labor markets are tighter. All three cross-group differences are statistically significant at the 1% level.

[13] Although we include MSA-by-quarter fixed effects, the balanced-sample design allows us to estimate the cross-group differential using comparisons across demographic groups within the same MSA-industry-quarter, even without these fixed effects. As a result, any unobserved time-varying local factor that is common across demographic groups within the same MSA-industry-quarter is mechanically differenced out.

[14] For example, the coefficients in Table 4 would be biased upward (i.e., less negative) if employment growth were more pro-cyclical in slack labor markets, particularly for Black workers relative to White workers.

To measure the effect of changes in the federal funds rate itself, we estimate a 2SLS specification in which we use the high-frequency monetary policy surprises as instruments. In the pooled regressions, our coefficient of interest is on the triple interaction between the federal funds rate, local labor market tightness, and the demographic-group indicator. We instrument this triple interaction using the triple interaction between the monetary policy shock, labor market tightness, and the demographic-group indicator. The lower-order interactions involving the federal funds rate are absorbed by the MSA-by-quarter and other fixed effects. The third column in each panel reports the resulting IV estimates.[15] The estimates remain negative and statistically significant for all three demographic comparisons and are broadly similar in magnitude to the corresponding baseline estimates. The Black-White differential is -0.94 in the IV specification compared with -0.99 in the baseline specification; the difference between workers without a high-school degree and those with a bachelor's degree is -0.77 compared with -0.67; and the female–male difference is -0.34 compared with -0.32. Thus, the cross-group heterogeneity documented in the baseline results is robust to instrumenting the federal funds rate with high-frequency monetary policy surprises.

Finally, 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. The left column of 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:

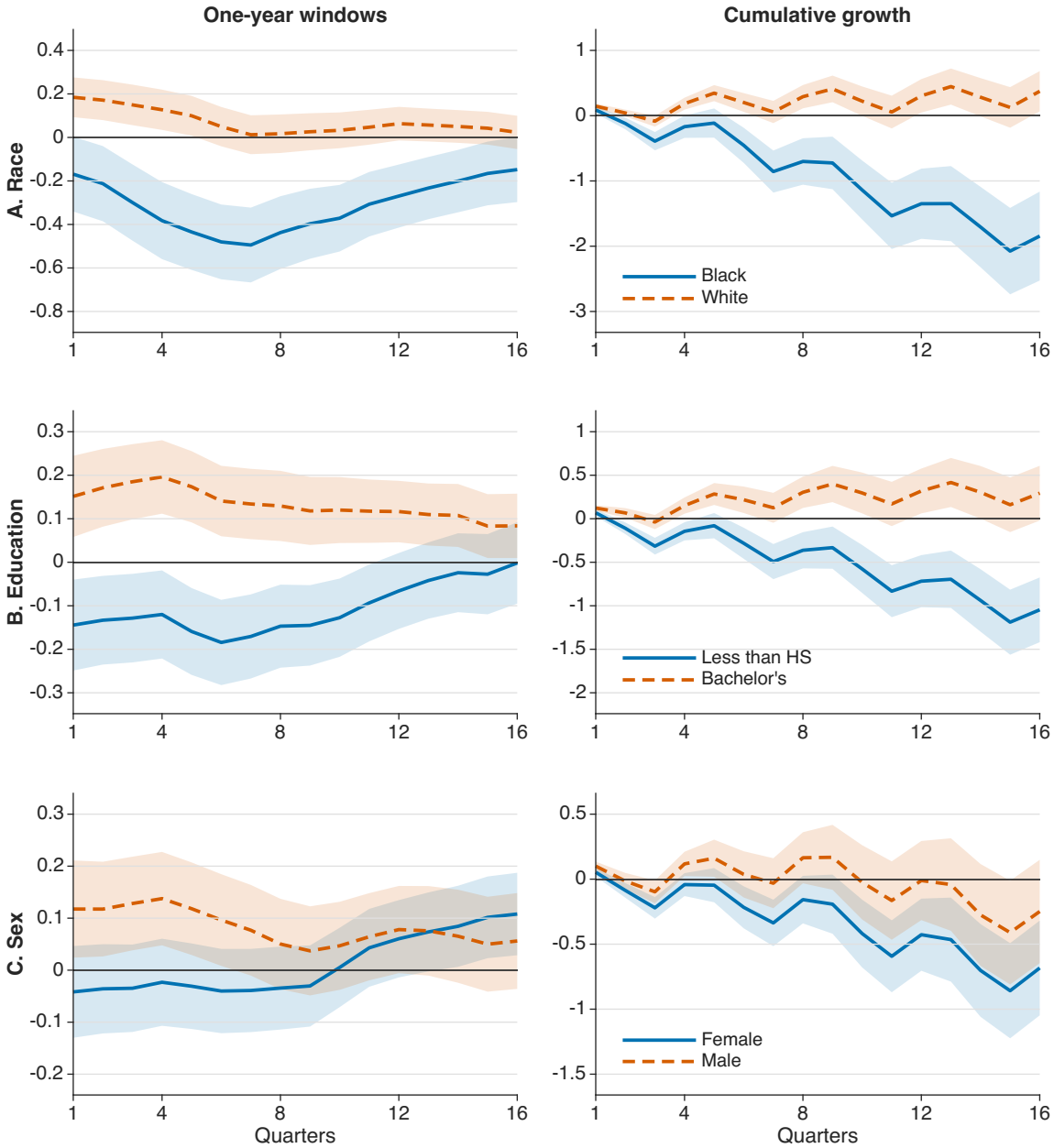
$$EmplGrowth^{p}_{j,g,m,t} = \beta_1 \times FedFunds_t \times Empl/Pop_{m,t-1} + \beta_2 \times Empl/Pop_{m,t-1} + \theta_{j,m} + \delta_{j,t} + \epsilon_{j,g,m,t}, \quad (17)$$

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 (16). The left column of Figure 2 plots the β_1 coefficients obtained from these one-year rolling window regressions.

The left column 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 seven quarters after the monetary policy change. The β_1 coefficient declines in absolute value thereafter, falling to roughly one-third of its peak magnitude

[15] Appendix Table A.2 reports the first-stage estimates, which are highly statistically significant.

Figure 2: **Dynamics of Employment Responses to Monetary Policy by Labor Market Tightness**



This figure depicts the dynamics of the differential impact of monetary policy on employment growth in tight versus slack labor markets for demographic groups within three categories: race (Panel A), education (Panel B), and sex (Panel C). The left column plots the coefficient on the interaction between the federal funds rate and the local prime-age employment-to-population ratio in equation (17), for employment growth over one-year windows starting one to 16 quarters after the monetary policy change. The right column plots the same interaction coefficient in equation (16), with cumulative employment growth over horizons of one to 16 quarters as the dependent variable. Shaded areas show ±1 standard-error bands. A negative coefficient means that a cut in the federal funds rate raises the group's employment growth more in tighter labor markets.

by quarter 15 and becoming statistically insignificant. For White workers, the coefficient is positive at the earliest horizons—implying that monetary easing is, if anything, less effective in tighter labor markets—but becomes statistically insignificant after the first few quarters, converges toward zero by around quarter 6, and remains small thereafter. Panel B shows that the coefficient for workers without a high-school degree reaches its largest magnitude around quarter 6 and then gradually attenuates. Panel C likewise shows that the differential pattern by sex fades over time, with the gap between the employment responses of women and men narrowing substantially at longer horizons.

Although monetary policy's incremental effect on Black, low-education, and female employment growth wanes over time, its cumulative effect is long-lasting. The right column of Figure 2 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 (16) for cumulative employment growth measured over different horizons from one quarter up to 16 quarters. The right column plots the β_1 interaction coefficients obtained from each of these regressions. The eight-quarter estimates are 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 on Panel A, for example, 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 for Black workers lies below that for White workers at every horizon, with the difference between the coefficients statistically significant at the 1% level at every horizon longer than two quarters.Thus, as labor markets tighten, the cumulative employment response to monetary easing becomes stronger for Black workers relative to White workers.[16]

Taken together, these results show consistent evidence that the employment effects of monetary policy vary across demographic groups and with labor market tightness: As labor markets tighten, the employment response to monetary easing becomes relatively stronger for groups with lower labor-force attachment—Black workers, the least educated, and women. For these groups, the impact of monetary policy in tight labor markets persists for several years. In contrast, for groups with greater labor-force attachment—White workers, more educated workers, and men—the relationship between labor market tightness and the employment response to monetary easing is substantially weaker or moves in the opposite direction. Since the *overall* employment response to monetary policy does not vary sig-

[16]The model in Section 2 is static and describes the initial employment response, whereas the estimated effects build over about two years and last several more. Part of this can reflect persistent demand. Effects that outlast the demand impulse need a mechanism through which employment itself raises later attachment, for example, skill accumulation on the job, as in Alves and Violante (2025).

nificantly with labor market tightness, the results also point to the incidence effect in the model's decomposition.

The results, therefore, suggest that the distributional reach of monetary policy depends on the state of the labor market. When labor markets are slack, the employment response to monetary easing is relatively muted for workers with weaker labor-force attachment. As labor markets tighten, however, the employment gains from monetary easing become increasingly tilted toward Black workers, the least educated, and women. Thus, allowing an expansion to continue into a tight labor market may broaden the incidence of its employment gains even if the overall employment response to monetary policy does not become larger.

3.3 Durable-Goods Exposure and Price Rigidity

Having examined how labor market tightness shapes the employment effects of monetary policy, we next turn to a second source of local heterogeneity: the strength of local monetary transmission. Tightness determines where firms begin along the hiring ranking, whereas monetary-policy exposure determines how strongly local demand responds to a given policy impulse. We use two characteristics of local economies as proxies for this exposure: the share of employment in durable-goods industries and the degree of local price rigidity. Both capture mechanisms central to standard theories of monetary transmission: durable-goods demand is especially interest-sensitive (see, e.g., Barsky et al., 2007), while nominal price rigidity governs the strength of monetary policy's real effects (see, e.g., Pasten et al., 2020). Following Section 2, we therefore predict that a larger durable-goods share and greater price rigidity amplify the employment response to monetary policy most for Black workers, the least educated, and women.

We begin by re-estimating our baseline specification in Equation (16), replacing labor market tightness with the local durable share. Table 5 reports the results. Panel A reveals a pronounced difference between Black and White workers. The coefficient on the interaction between the federal funds rate and durable share is -2.68 for Black workers and -0.97 for White workers; both are statistically significant, and their difference is statistically significant ($p<0.01$). Thus, monetary easing is associated with greater employment growth in more durable-goods-intensive local economies for both groups, but substantially more so for Black workers. The magnitude is economically large. A one-standard-deviation decline in the federal funds rate is associated with approximately 0.96 percentage point greater two-year Black employment growth in an MSA at the 90th percentile of durable share than in one at the 10th percentile. This differential corresponds to roughly 10% of mean two-year Black employment growth. For White workers, the p90–p10 difference in the two-year employment-growth response to the same monetary easing is only about 0.35

Table 5: **Heterogeneity by Durable-Goods Exposure: OLS Estimates**

Panel A: Race				
	(1) Blacks	(2) Whites		
Fed Funds Rate × Durable Share	-2.68***	-0.97**		
	(0.79)	(0.44)		
	[0.00]			
R^2	0.31	0.36		
Observations	499,310	499,310		
Panel B: Education				
	(3) Less than High School	(4) High School	(5) Some College	(6) Bachelor's Degree
Fed Funds Rate × Durable Share	-1.65***	-0.06	-0.11	-0.14
	(0.44)	(0.38)	(0.36)	(0.37)
	[0.00]	[0.70]	[0.88]	
R^2	0.31	0.31	0.30	0.28
Observations	718,263	718,263	718,263	718,263
Panel C: Sex				
	(7) Female	(8) Male		
Fed Funds Rate × Durable Share	-0.58	-0.28		
	(0.37)	(0.37)		
	[0.08]			
R^2	0.28	0.25		
Observations	1,057,149	1,057,149		
Panel D: All Workers				
	(9)			
Fed Funds Rate × Durable Share	-0.40			
	(0.36)			
R^2	0.25			
Observations	1,241,022			

Notes: The dependent variable is two-year employment growth. Each column reports the coefficient on the interaction between the federal funds rate and the lagged share of local employment in durable-goods industries for the indicated demographic group. Panel D reports results for all workers. All regressions are estimated at the MSA-industry-quarter level using balanced samples and include MSA-industry and industry-quarter fixed effects, as well as the non-interacted durable-goods share. Standard errors, adjusted for clustering at the MSA level, are in parentheses. Square brackets report p-values for tests of equality of the interaction coefficients relative to Whites (Panel A), workers with a bachelor's degree (Panel B), and males (Panel C). * p<0.10, ** p<0.05, *** p<0.01.

percentage points. Hence, moving from a low- to a high-durability local economy increases the Black–White employment-growth response to a one-standard-deviation monetary easing by approximately 0.61 percentage point.

Panel B shows a similar pattern across education groups. The interaction coefficient is −1.65 for workers without a high-school degree and is close to zero for each of the more educated groups. The coefficient for workers without a high-school degree differs significantly from that for workers with a bachelor's degree ($p<0.01$). A one-standard-deviation monetary easing is associated with approximately 0.59 percentage point greater two-year employment growth for workers without a high-school degree in an MSA at the 90th percentile of durable share than in one at the 10th percentile, or 28% of their mean two-year employment growth. Panel C provides evidence of heterogeneity by sex. The interaction coefficient is more negative for women than for men ($p<0.10$), implying that monetary easing generates relatively larger employment gains for women in more durable-goods-intensive local economies.

Panel D examines whether the total employment response to monetary policy is stronger in MSAs with a larger durable-goods share. The interaction coefficient is −0.40 but is not statistically significant. Viewed alongside Panels A–C, the results imply that the stronger employment effects associated with durable-goods exposure are concentrated among workers with weaker labor-force attachment, rather than reflecting a uniformly larger employment response across workers.

Table 6 presents robustness analysis for durable-goods exposure, paralleling the robustness specifications in Table 4. As in the tightness analysis, we pool the relevant demographic groups and estimate the cross-group difference in the federal funds rate–durable share interaction. We then re-estimate the differential response using the high-frequency monetary surprises in reduced-form and instrumental-variables specifications.

The results remain similar across specifications. In Panel A, the Black–White differential is −1.71 in the OLS specification and −1.15 in the IV specification, with both estimates statistically significant at the 5% level. In Panel B, the differential between workers without a high-school degree and those with a bachelor's degree is −1.51 in the OLS specification and −1.45 in the IV specification, with both estimates statistically significant at the 1% level. Finally, in Panel C, the female–male differential is −0.30 in the baseline specification and −0.33 in the IV specification, with both estimates statistically significant at the 10% level.

Turning to local price rigidity, Table 7 re-estimates the baseline specification but replaces labor market tightness with the MSA-level measure of price rigidity. Panel A shows that the employment response to monetary easing increases substantially more with price rigidity for Black workers than for White workers. The Black interaction is more than three times as large in absolute value, and the difference between the two groups is statistically significant ($p<0.05$). The magnitude is sizable: a one-standard-deviation monetary easing is associated with approximately 0.59 percentage point greater two-year Black employment growth in an MSA at the 90th percentile of price rigidity than in one at the 10th percentile, compared

Table 6: **Heterogeneity by Durable-Goods Exposure: IV Analysis**

Panel A: Race			
	(1) OLS	(2) RF	(3) IV
Diff. in Fed Funds Rate × Durable Share, Blacks vs. Whites	-1.71*** (0.52)		-1.15** (0.57)
Diff. in Monetary Surprise × Durable Share, Blacks vs. Whites		-7.79** (3.84)	
R^2	0.43	0.43	0.00
Observations	998,620	998,620	998,620
Panel B: Education			
	(4) OLS	(5) RF	(6) IV
Diff. in Fed Funds Rate × Durable Share, Less than HS vs. Bachelor's Degree	-1.51*** (0.27)		-1.45*** (0.31)
Diff. in Monetary Surprise × Durable Share, Less than HS vs. Bachelor's Degree		-9.74*** (2.05)	
R^2	0.45	0.45	0.00
Observations	1,436,526	1,436,526	1,436,526
Panel C: Sex			
	(7) OLS	(8) RF	(9) IV
Diff. in Fed Funds Rate × Durable Share, Female vs. Male	-0.30* (0.17)		-0.33* (0.20)
Diff. in Monetary Surprise × Durable Share, Female vs. Male		-2.20* (1.34)	
R^2	0.39	0.39	0.00
Observations	2,114,298	2,114,298	2,114,298

Notes: The dependent variable is two-year employment growth. Reported coefficients represent differences between demographic groups in the interaction of durable share with a monetary policy variable (Black minus White, less than high school minus bachelor's degree, and Female minus Male, respectively). The OLS columns use the federal funds rate, the RF columns report reduced-form estimates using the Bauer–Swanson monetary surprise, and the IV columns instrument the federal funds rate using the Bauer–Swanson monetary surprise. All regressions are estimated at the MSA-industry-quarter level and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

with about 0.17 percentage point for White workers.

Panel B shows a similar contrast across education groups. The employment response to monetary easing increases strongly with price rigidity for workers without a high-school degree, while the corresponding responses are considerably smaller for the more educated groups and reverse sign for bachelor's degree holders. The difference between workers without a high-school degree and those with a bachelor's degree is highly statistically significant ($p<0.01$). Economically, for workers without a high-school degree, a one-standard-deviation

Table 7: **Heterogeneity by Price Rigidity: OLS Estimates**

Panel A: Race				
	(1) Blacks	(2) Whites		
Fed Funds Rate × Price Rigidity	-4.38**	-1.27		
	(1.95)	(1.08)		
	[0.02]			
R^2	0.31	0.36		
Observations	499,310	499,310		
Panel B: Education				
	(3) Less than High School	(4) High School	(5) Some College	(6) Bachelor's Degree
Fed Funds Rate × Price Rigidity	-5.25***	-1.11	-0.55	1.29
	(1.02)	(0.92)	(0.83)	(0.90)
	[0.00]	[0.00]	[0.00]	
R^2	0.31	0.31	0.30	0.28
Observations	718,263	718,263	718,263	718,263
Panel C: Sex				
	(7) Female	(8) Male		
Fed Funds Rate × Price Rigidity	-2.08**	-1.10		
	(0.88)	(0.96)		
	[0.03]			
R^2	0.28	0.25		
Observations	1,057,149	1,057,149		
Panel D: All Workers				
	(9)			
Fed Funds Rate × Price Rigidity	-1.39			
	(0.99)			
R^2	0.25			
Observations	1,241,022			

Notes: The dependent variable is two-year employment growth. Each column reports the coefficient on the interaction between the federal funds rate and the lagged measure of local price rigidity for the indicated demographic group. Price rigidity is measured as the negative of the employment-share-weighted average of industry-level price flexibility. Panel D reports results for all workers. All regressions are estimated at the MSA-industry-quarter level using balanced samples and include MSA-industry and industry-quarter fixed effects, as well as the non-interacted measure of price rigidity. Standard errors, adjusted for clustering at the MSA level, are in parentheses. Square brackets report p-values for tests of equality of the interaction coefficients relative to Whites (Panel A), workers with a bachelor's degree (Panel B), and males (Panel C). * p<0.10, ** p<0.05, *** p<0.01.

monetary easing is associated with approximately 0.71 percentage point greater two-year employment growth in an MSA at the 90th percentile of price rigidity than in one at the 10th percentile. This differential effect is approximately one-third of their mean two-year

employment growth. Panel C shows a similar pattern by sex: the employment response to monetary easing increases more strongly with price rigidity for women than for men, and the difference is statistically significant ($p<0.05$).

Panel D examines whether price rigidity also strengthens the response of total employment to monetary policy. Similar to durable-goods exposure, the interaction coefficient is negative but statistically insignificant. Viewed alongside Panels A–C, the results again indicate that the stronger employment responses associated with greater monetary-policy exposure are concentrated among workers with weaker labor-force attachment.

Table 8 presents the IV analysis for price rigidity. The education and sex patterns are preserved: in both cases, the cross-group differential remains statistically significant when we replace the federal funds rate with the high-frequency monetary-policy measure and when we instrument the federal funds rate using that measure. The evidence for race is weaker. Although the baseline specification shows a sizable and statistically significant Black–White differential, the corresponding reduced-form and IV estimates are statistically insignificant. Thus, while the federal funds rate specification shows substantially stronger effects of monetary easing on Black employment in more price-rigid local economies, the high-frequency monetary-shock specifications do not confirm this pattern.

Finally, we examine the persistence of the monetary-policy exposure results. Following the tightness analysis in Section 3.2, we re-estimate the baseline specifications using cumulative employment growth measured over horizons from one to 16 quarters after the monetary-policy change. The left column of Figure A.1 presents the cumulative results for durable-goods exposure. The larger employment responses of Black workers and workers without a high-school degree persist well beyond two years, while the corresponding female–male difference is more modest. The right column of Figure A.1 presents the analogous results for price rigidity. The differential responses by race and education remain pronounced at longer horizons, with a smaller but persistent difference by sex. Overall, the figure shows that the heterogeneity in employment responses to monetary policy across more- and less-exposed local economies is long-lasting and accumulates over several years.

Taken together, the exposure results show that where monetary policy transmits more strongly, monetary easing raises the employment of workers with weaker labor-force attachment by more than that of other workers, consistent with the model's implications. For total employment, where the model predicts a larger response in more exposed markets, the estimates have the expected sign but are not statistically significant at conventional levels. Within MSA-industry cells, the industry-by-quarter fixed effects absorb each industry's own interest sensitivity, so these estimates capture only the exposure of the surrounding local economy.

Table 8: **Heterogeneity by Price Rigidity: IV Analysis**

Panel A: Race			
	(1) OLS	(2) RF	(3) IV
Diff. in Fed Funds Rate × Price Rigidity, Blacks vs. Whites	-3.11**		1.37
	(1.30)		(1.59)
Diff. in Monetary Surprise × Price Rigidity, Blacks vs. Whites		9.35	
		(10.84)	
R^2	0.43	0.43	0.00
Observations	998,620	998,620	998,620
Panel B: Education			
	(4) OLS	(5) RF	(6) IV
Diff. in Fed Funds Rate × Price Rigidity, Less than HS vs. Bachelor's Degree	-6.55***		-6.10***
	(0.68)		(0.82)
Diff. in Monetary Surprise × Price Rigidity, Less than HS vs. Bachelor's Degree		-41.25***	
		(5.52)	
R^2	0.45	0.45	0.00
Observations	1,436,526	1,436,526	1,436,526
Panel C: Sex			
	(7) OLS	(8) RF	(9) IV
Diff. in Fed Funds Rate × Price Rigidity, Female vs. Male	-0.98**		-1.11**
	(0.44)		(0.53)
Diff. in Monetary Surprise × Price Rigidity, Female vs. Male		-7.49**	
		(3.56)	
R^2	0.39	0.39	0.00
Observations	2,114,298	2,114,298	2,114,298

Notes: The dependent variable is two-year employment growth. Reported coefficients represent differences between demographic groups in the interaction of price rigidity with a monetary policy variable (Black minus White, less than high school minus bachelor's degree, and Female minus Male, respectively). The OLS columns use the federal funds rate, the RF columns report reduced-form estimates using the Bauer–Swanson monetary surprise, and the IV columns instrument the federal funds rate using the Bauer–Swanson monetary surprise. All regressions are estimated at the MSA-industry-quarter level and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

4 Conclusion

Analyzing a large cross-section of local labor markets, we show that expansionary monetary policy boosts the employment of workers with weaker labor-force attachment by more in tight labor markets than in slack ones. This pattern holds across race, education, and sex, as the employment gains for Black workers, workers without a high-school degree, and women increase with labor market tightness. The effect is economically sizable and long-lasting. The

same workers also gain more in local economies that are more exposed to monetary policy, as measured by the durable-goods share and local price rigidity.

We interpret these findings through a simple model in which firms rank workers and hire those above a cutoff determined by local demand. The model decomposes the effect of labor market tightness on a group's employment response into a total-response effect and an incidence effect. Because the total employment response to monetary policy does not vary systematically with tightness, the evidence points to the incidence effect: as labor markets tighten, the employment gains from monetary easing shift toward workers with weaker labor-force attachment, while the total gains remain largely unchanged. Furthermore, the differences across workers are larger where local exposure to monetary policy is greater.

Even though monetary policy is set nationally, our findings show that the same rate path can have very different distributional effects across local labor markets. In particular, we find that the extent to which monetary easing reaches workers with weaker labor-force attachment depends both on local labor market tightness and on local exposure to monetary policy. More broadly, these findings suggest that the extent to which monetary expansions generate broad-based employment gains depends on the local economic conditions under which they occur.

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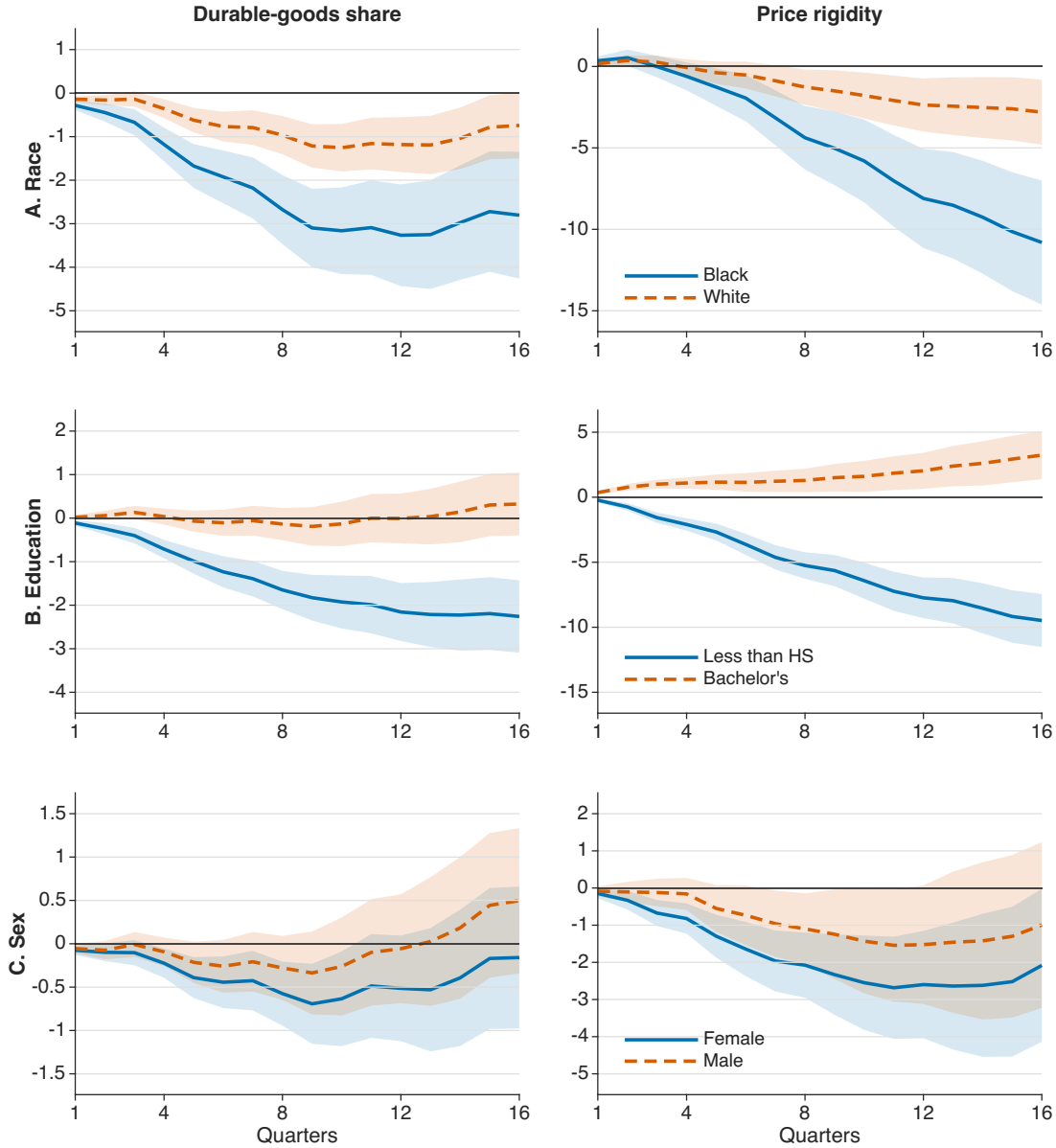
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Online Appendix

A Additional Tables and Figures

Figure A.1: **Cumulative Employment Responses to Monetary Policy by Durable-Goods Exposure and Price Rigidity**



This figure repeats the cumulative-effects analysis in the right column of Figure 2 for the two exposure measures. Each panel plots the interaction coefficients from regressions of cumulative employment growth over horizons of one to 16 quarters on the federal funds rate interacted with the durable-goods share (left column) or price rigidity (right column), by race, education, and sex. Shaded areas show ±1 standard-error bands. A negative coefficient means that a cut in the federal funds rate raises the group's employment growth more in more exposed local economies.

Table A.1: **Heterogeneity by Labor Market Tightness: Payroll Growth**

Panel A: Race				
	(1) Blacks	(2) Whites		
Fed Funds Rate × Emp/Pop	-1.34***	-0.18		
	(0.46)	(0.26)		
	[0.00]			
R^2	0.24	0.24		
Observations	515,638	515,638		
Panel B: Education				
	(3) Less than High School	(4) High School	(5) Some College	(6) Bachelor's Degree
Fed Funds Rate × Emp/Pop	-1.14***	0.04	0.34	0.54**
	(0.31)	(0.23)	(0.22)	(0.24)
	[0.00]	[0.00]	[0.06]	
R^2	0.29	0.25	0.23	0.18
Observations	728,289	728,289	728,289	728,289
Panel C: Sex				
	(7) Female	(8) Male		
Fed Funds Rate × Emp/Pop	-0.07	0.46**		
	(0.21)	(0.22)		
	[0.00]			
R^2	0.19	0.16		
Observations	1,071,271	1,071,271		

Notes: The dependent variable is two-year payroll growth. Each column reports the coefficient on the interaction between the federal funds rate and the lagged prime-age employment-to-population ratio, which measures local labor market tightness, for the indicated demographic group. All regressions are estimated at the MSA-industry-quarter level using balanced samples and include MSA-industry and industry-quarter fixed effects, as well as the non-interacted employment-to-population ratio. Standard errors, adjusted for clustering at the MSA level, are in parentheses. Square brackets report p-values for tests of equality of the interaction coefficients relative to Whites (Panel A), workers with a bachelor's degree (Panel B), and males (Panel C). * p<0.10, ** p<0.05, *** p<0.01.

Table A.2: **First-Stage Estimates: Bauer–Swanson Monetary Surprises**

Panel A: Labor Market Tightness			
	(1)	(2)	(3)
Diff. in Fed Funds Rate × Emp/Pop	Blacks vs. Whites	Less than HS vs. Bachelor's	Female vs. Male
Diff. in Monetary Surprise × Emp/Pop	6.83***	6.81***	6.82***
	(0.03)	(0.02)	(0.02)
$F-statistic$	63,240	105,012	107,261
Observations	998,620	1,436,526	2,114,298
Panel B: Durable Share			
	(4)	(5)	(6)
Diff. in Fed Funds Rate × Durable Share	Blacks vs. Whites	Less than HS vs. Bachelor's	Female vs. Male
Diff. in Monetary Surprise × Durable Share	6.77***	6.70***	6.69***
	(0.04)	(0.03)	(0.03)
$F-statistic$	27,815	38,643	40,580
Observations	998,620	1,436,526	2,114,298
Panel C: Price Rigidity			
	(7)	(8)	(9)
Diff. in Fed Funds Rate × Price Rigidity	Blacks vs. Whites	Less than HS vs. Bachelor's	Female vs. Male
Diff. in Monetary Surprise × Price Rigidity	6.82***	6.76***	6.77***
	(0.02)	(0.02)	(0.02)
$F-statistic$	97,557	138,983	130,842
Observations	998,620	1,436,526	2,114,298

Notes: The table reports first-stage estimates for the IV specifications. The dependent variable is the difference between demographic groups in the interaction of the federal funds rate with a local characteristic: labor market tightness (Panel A), durable-goods share (Panel B), and price rigidity (Panel C). Each column reports the coefficient on the corresponding interaction with the running sum of Bauer–Swanson monetary-policy surprises. The demographic comparisons are Blacks versus Whites, workers with less than a high-school education versus those with a bachelor's degree, and females versus males. All regressions are estimated at the MSA-industry-quarter level using balanced samples and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. F-statistics test the significance of the excluded instrument. * p<0.10, ** p<0.05, *** p<0.01.

Table A.3: **First-Stage Estimates: Kuttner Monetary Surprises**

Panel A: Labor Market Tightness			
	(1)	(2)	(3)
Diff. in Fed Funds Rate × Emp/Pop	Blacks vs. Whites	Less than HS vs. Bachelor's	Female vs. Male
Diff. in Monetary Surprise × Emp/Pop	2.13***	2.09***	2.09***
	(0.03)	(0.02)	(0.02)
$F-statistic$	4,722	7,431	8,806
Observations	998,620	1,436,526	2,114,298
Panel B: Durable Share			
	(4)	(5)	(6)
Diff. in Fed Funds Rate × Durable Share	Blacks vs. Whites	Less than HS vs. Bachelor's	Female vs. Male
Diff. in Monetary Surprise × Durable Share	2.18***	2.10***	2.11***
	(0.04)	(0.03)	(0.03)
$F-statistic$	2,623	4,230	4,698
Observations	998,620	1,436,526	2,114,298
Panel C: Price Rigidity			
	(7)	(8)	(9)
Diff. in Fed Funds Rate × Price Rigidity	Blacks vs. Whites	Less than HS vs. Bachelor's	Female vs. Male
Diff. in Monetary Surprise × Price Rigidity	2.09***	2.01***	2.03***
	(0.03)	(0.02)	(0.02)
$F-statistic$	4,159	7,556	7,562
Observations	998,620	1,436,526	2,114,298

Notes: The table reports first-stage estimates for the IV specifications. The dependent variable is the difference between demographic groups in the interaction of the federal funds rate with a local characteristic: labor market tightness (Panel A), durable-goods share (Panel B), and price rigidity (Panel C). Each column reports the coefficient on the corresponding interaction with the running sum of the Kuttner monetary-policy surprises. The demographic comparisons are Blacks versus Whites, workers with less than a high-school education versus those with a bachelor's degree, and females versus males. All regressions are estimated at the MSA-industry-quarter level using balanced samples and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. F-statistics test the significance of the excluded instrument. * p<0.10, ** p<0.05, *** p<0.01.

Table A.4: **Heterogeneity by Labor Market Tightness: Kuttner IV Analysis**

Panel A: Race			
	(1) OLS	(2) RF	(3) IV
Diff. in Fed Funds Rate × Emp/Pop,	-0.99***		-1.08***
Blacks vs. Whites	(0.24)		(0.31)
Diff. in Monetary Surprise × Emp/Pop,		-2.29***	
Blacks vs. Whites		(0.65)	
R^2	0.43	0.43	0.00
Observations	998,620	998,620	998,620
Panel B: Education			
	(4) OLS	(5) RF	(6) IV
Diff. in Fed Funds Rate × Emp/Pop,	-0.67***		-0.79***
Less than HS vs. Bachelor's Degree	(0.14)		(0.19)
Diff. in Monetary Surprise × Emp/Pop,		-1.65***	
Less than HS vs. Bachelor's Degree		(0.39)	
R^2	0.45	0.45	0.00
Observations	1,436,526	1,436,526	1,436,526
Panel C: Sex			
	(7) OLS	(8) RF	(9) IV
Diff. in Fed Funds Rate × Emp/Pop,	-0.32***		-0.27***
Female vs. Male	(0.08)		(0.10)
Diff. in Monetary Surprise × Emp/Pop,		-0.56***	
Female vs. Male		(0.22)	
R^2	0.39	0.39	0.00
Observations	2,114,298	2,114,298	2,114,298

Notes: The dependent variable is two-year employment growth. Reported coefficients represent differences between demographic groups in the interaction of labor market tightness with a monetary policy variable (Black minus White, less than high school minus bachelor's degree, and Female minus Male, respectively). The OLS columns use the federal funds rate, the RF columns report reduced-form estimates using the Kuttner monetary surprise, and the IV columns instrument the federal funds rate using the Kuttner monetary surprise. All regressions are estimated at the MSA-industry-quarter level and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table A.5: **Heterogeneity by Durable-Goods Exposure: Kuttner IV Analysis**

Panel A: Race			
	(1) OLS	(2) RF	(3) IV
Diff. in Fed Funds Rate × Durable Share,	-1.71***		-1.00
Blacks vs. Whites	(0.52)		(0.65)
Diff. in Monetary Surprise × Durable Share,		-2.18	
Blacks vs. Whites		(1.41)	
R^2	0.43	0.43	0.00
Observations	998,620	998,620	998,620
Panel B: Education			
	(4) OLS	(5) RF	(6) IV
Diff. in Fed Funds Rate × Durable Share,	-1.51***		-1.74***
Less than HS vs. Bachelor's Degree	(0.27)		(0.34)
Diff. in Monetary Surprise × Durable Share,		-3.65***	
Less than HS vs. Bachelor's Degree		(0.72)	
R^2	0.45	0.45	0.00
Observations	1,436,526	1,436,526	1,436,526
Panel C: Sex			
	(7) OLS	(8) RF	(9) IV
Diff. in Fed Funds Rate × Durable Share,	-0.30*		-0.32
Female vs. Male	(0.17)		(0.21)
Diff. in Monetary Surprise × Durable Share,		-0.67	
Female vs. Male		(0.45)	
R^2	0.39	0.39	0.00
Observations	2,114,298	2,114,298	2,114,298

Notes: The dependent variable is two-year employment growth. Reported coefficients represent differences between demographic groups in the interaction of durable share with a monetary policy variable (Black minus White, less than high school minus bachelor's degree, and Female minus Male, respectively). The OLS columns use the federal funds rate, the RF columns report reduced-form estimates using the Kuttner monetary surprise, and the IV columns instrument the federal funds rate using the Kuttner monetary surprise. All regressions are estimated at the MSA-industry-quarter level and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table A.6: **Heterogeneity by Price Rigidity: Kuttner IV Analysis**

Panel A: Race			
	(1) OLS	(2) RF	(3) IV
Diff. in Fed Funds Rate × Price Rigidity,	-3.11**		-0.40
Blacks vs. Whites	(1.30)		(1.69)
Diff. in Monetary Surprise × Price Rigidity,		-0.85	
Blacks vs. Whites		(3.53)	
R^2	0.43	0.43	0.00
Observations	998,620	998,620	998,620
Panel B: Education			
	(4) OLS	(5) RF	(6) IV
Diff. in Fed Funds Rate × Price Rigidity,	-6.55***		-7.18***
Less than HS vs. Bachelor's Degree	(0.68)		(0.89)
Diff. in Monetary Surprise × Price Rigidity,		-14.42***	
Less than HS vs. Bachelor's Degree		(1.74)	
R^2	0.45	0.45	0.00
Observations	1,436,526	1,436,526	1,436,526
Panel C: Sex			
	(7) OLS	(8) RF	(9) IV
Diff. in Fed Funds Rate × Price Rigidity,	-0.98**		-1.37***
Female vs. Male	(0.44)		(0.52)
Diff. in Monetary Surprise × Price Rigidity,		-2.78***	
Female vs. Male		(1.05)	
R^2	0.39	0.39	0.00
Observations	2,114,298	2,114,298	2,114,298

Notes: The dependent variable is two-year employment growth. Reported coefficients represent differences between demographic groups in the interaction of price rigidity with a monetary policy variable (Black minus White, less than high school minus bachelor's degree, and Female minus Male, respectively). The OLS columns use the federal funds rate, the RF columns report reduced-form estimates using the Kuttner monetary surprise, and the IV columns instrument the federal funds rate using the Kuttner monetary surprise. All regressions are estimated at the MSA-industry-quarter level and include MSA-quarter, MSA-industry, and industry-quarter fixed effects. Standard errors, adjusted for clustering at the MSA level, are in parentheses. * p<0.10, ** p<0.05, *** p<0.01