The Distributional Effects of Monetary Policy

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Abstract

Much work has been done to quantify the heterogeneous effects of monetary policy, with the majority concluding that monetary policy shocks have more pronounced effects on the employment of marginal workers. However, few have been able to find any heterogeneity in earnings. In this paper, I begin by extending a previous micro-econometric approach to investigate any possible heterogeneity in the response of earnings to monetary policy shocks between black and white workers in aggregate data and am unable to find any evidence. So, I then look to panel data at the individual level and find empirical evidence that monetary policy has distributional effects across the income distribution. Contractionary monetary policy shocks cause the labor earnings growth rate of those in the bottom two-thirds to fall while those at the top are unaffected.

Introduction

Macroeconomists have pushed the envelope when it comes to quantifying the impact of monetary policy and the real economy. Sims and Zha (2006) use timing restrictions in a structural VAR framework to model the dynamics between monetary policy and inflation. Romer and Romer (2004) parse the wording and sentence structure of FOMC minutes to obtain of measures of monetary policy surprises. Areosa and Areosa (2016) throw unskilled private agents into a dynamic stochastic general equilibrium model to solve out the consequences of contractionary monetary policy shocks on income inequality. The increasing complexity is due to the fact that vanilla OLS rarely works when analyzing monetary policy. The Federal Reserve's policy instruments, such as the federal funds target, will be highly endogenous to the broader economy. A change in one is not only going to be caused by past economic variables but also by the expectation of those variables in the future, leading to a nightmare of reverse causality that *should* be impossible to disentangle—except for economists. To remove the endogenaity, economists typically resort to a version of the methods mentioned earlier. But, these methods—structural VARs and DSGE models in particular—usually come at the cost of broad assumptions about the structure of the economy, assumptions that often impose textbook theory onto real-world data—begging the question of whether these methods capture true relationships in the economy or are just squeezing blood out of a stone.

In this paper, I do not follow the assumption-heavy route and instead apply a micro-econometric approach to investigate whether monetary policy shocks have distributional effects on earnings. I begin by first extending the work of Bergman, Matsa and Weber (2022)—which finds that monetary policy has heterogeneous effects on employment growth across racial groups. My extension is unable to uncover this same heterogeneity in labor earnings. And so, I turn to the Panel Survey of Income Dynamics (PSID) where I do find empirical evidence that monetary policy has distributional impacts across the income distribution. A surprise 100bp increase in the federal funds rate causes labor earnings growth for the bottom two-thirds of earners in the PSID to fall by 2-4 percentage points while those in the upper one-third are unaffected. To my knowledge, no paper has employed panel data at the individual level and a micro-econometric framework together to study the relationship between earnings and monetary policy—instead often using VARs or survey data in their analysis. The appeal of taking a micro-econometric approach with individual-level panel data is that time-invariant characteristics, both observed and unobserved, can be easily controlled for. A micro-econometric approach also avoids the model selection issues of VARs. All this makes the PSID a novel opportunity to study the distributional impact of monetary policy.

Literature Review

Evidence for the Unequal Impact of Monetary Policy

A large body of research has detailed the secular rise in inequality over the last five decades. Since the 1970s, the black median earnings gap has surpassed its 1950s heights (Bayer and Charles, 2018), and the Gini coefficient for earnings has grown more than 40% (Kopczuk, Saez and Song, 2010). Much of the literature has offered changes in economic structures—rather than monetary policy—as explanations for the secular rise in inequality: skill-biased technological change (Krueger, 1993), rising global trade (Autor et al., 2014), and changes in union density (Farber et al., 2021). Textbook macro theory has little say about the potential distributional mechanisms of monetary policy—only to say that monetary policy doesn't affect the structure of the economy in the long run. But, different groups will have different structural relationships to the economy in the short run. During troughs of the business cycles, the Fed will typically engage in accommodative policy to boost employment—much of which occurs among marginal workers who have lower labor force attachment and are at higher risk of unemployment. Low-income and minority households make up most of the marginal workers in the United States (Carpenter and Rodgers, 2004). So, expansionary monetary policy would be expected to benefit low-income and minority households more so than white households. Indeed, Bartscher et al. (2022), using an instrumental variable–local projections (IV-LP) and data from the Survey of Consumer Finances (SCF), find empirical evidence that a shock decrease in the federal funds rate leads to stronger employment gains for blacks than whites. Rodgers

(2008) looks at the other side of the coin and, using a VAR, finds that black workers make up a disproportionate amount of the workers who become unemployed following a shock increase in the federal funds rate. In both directions of monetary policy, black workers are more strongly affected than whites.

Bergman, Matsa and Weber (2022) offer one of the few micro-econometric approaches to this part of the literature. They investigate how the effect of monetary policy is mediated by labor market tightness using the Census Bureau's Quarterly Workforce Indicators (QWI). Comparing white to black, men to women, and more educated to less educated, expansionary monetary policy shocks lead to significant and long-term employment gains only for the marginal groups. They also find that higher employment–to–population ratios enhance the employment gains for marginalized workers following a expansionary monetary policy shock.

Much of the monetary policy and inequality literature focuses on differential gains in employment, not wages. Bartscher et al. (2022) look into potential heterogeneity in the earnings channel and find no discernible difference in the black-white weekly earnings gap following expansionary monetary policy shocks within their VAR framework. They also don't find evidence that hours worked by blacks substantially change in response to monetary easing, implying that the employment gains for black workers are primarily driven on the extensive margin. Romer and Romer (1999) add to the evidence that monetary policy doesn't have any long-term impact on earnings in a cross-country analysis; they find that although expansionary policy can generate economic booms that reduce poverty, these reductions are temporary and wiped out once output returns to normal. So while a number of economists have shown accommodative monetary policy shocks improving the relative employment growth of marginal workers, few have shown similar gains in the wages of marginal workers.

However, conventional monetary policy tools—federal funds target, discount rate, reserve requirements—should have heterogeneous effects on different parts of the real economy depending on their sensitivity to rate changes. Microdata from the Current Population Survey (CPS) reveals that the number of workers participating in the temporary job market rises in response to contractionary monetary policy shocks as they move out of the regular labor force to take up irregular jobs (Baek, 2021). If these workers are disproportionately low-income and minorities, then the costs of monetary policy won't be distributed evenly. Moreover, workers' income may also respond differently to monetary policy shocks depending on their demographic and position on the income distribution. If individuals face varying levels of wage rigidity across the income distribution, potentially as a result of unionization, then only workers in certain industries will see their wages change in response to monetary policy. Changing interest rates can affect how much firms are willing pay in wages to substitute labor for capital, and monetary policy shocks may induce different labor supply responses across demographics and income groups (Coibion et al., 2017). The myriad of differences between workers across demographics and the income distribution—industry, labor force attachment, education—would suggest that their income might respond differently to monetary policy shocks. In other words, if monetary policy affects output, as we believe it to, then any change in total income should be distributed differently across the population.

Turning to the question of Fed's responsibility in widening inequality over the last 50 years, Galbraith (1998) posits that the rising wage inequality in the late 20th century can also be explained by a switch in Fed policy from a goal of full employment to one focused on using drastic rate hikes to tame inflation. These high interest rates, Galbraith argues, induced numerous recessions with high unemployment that disproportionately hurt marginal workers and suppressed wages at the bottom of the income distribution. One of the only pieces of research to investigate Galbraith's hypothesis is Coibion et al. (2017). Using the Consumer Expenditure Survey, the authors construct a VAR to investigate the dynamic responses of earnings inequality to monetary policy shocks. Unlike Bartscher et al. (2022), they find that monetary policy shocks do have statistically significant effects on earnings inequality: "contractionary monetary policy shocks... [lead to] higher earnings at the upper end of the distribution (90th percentile) but lower earnings for those at the bottom" (7). In other words, contractionary monetary policy widens inequality because low-income households now face lower wages at the same time that high-income households face higher ones.

Coibion et al. are unable empirically show what the underlying mechanism causing this heterogeneity is, i.e., whether it's driven by differences in age, industry, education, or other characteristics, but the authors do conduct a counterfactual of what income inequality would have been had the economy experienced no monetary policy shocks. They find that historical monetary shocks identified in their VAR contributed to at most 10-20% of the rise in earnings inequality. So, while monetary policy don't fully explain the secular rise in inequality since the 1970s, Coibion et al. do find empirical evidence that monetary policy shocks have heterogeneous effects on labor earnings across the income distribution. All in all, the US literature can be characterized by mostly VARs uncovering heterogeneous effects of monetary policy in employment growth; few are able to find the same heterogeneity in earnings.

Previous Work on Obtaining Exogeneity in Monetary Policy

Much of the work to estimate the causal effect of monetary policy faces an endogeneity problem. If one wants to estimate the effect of expansionary monetary policy on earnings via the federal funds rate, even after controlling for all necessary covariates, any estimate will be biased if interest rates are changing in anticipation of an economic decline. Economists have gotten around this by instead using monetary policy surprises as sources of exogenous policy change. These surprises can be measured via price movements in various financial contracts around the time of FOMC announcements. Kuttner (2001) made one of the first of these innovations by using the change in the current-month federal funds futures rate on days of FOMC meetings to measure any surprise component of policy rate changes. Federal funds futures will price in market expectations of Federal Reserve policy leading up to a meeting. If policy changes are correctly anticipated, then prices will move minimally. If not, then changes in futures contracts will reflect the degree to which market participants revised their expectations of Fed policy. For instance, at the June 2005 FOMC meeting, the market expected the Fed to ease the policy rate by 50 bp. Instead, the Fed announced it was lowering its federal funds target from 1.25% to 1.00%, only a 25 bp easing. Following the announcement, federal funds futures rates shot up to adjust for the unexpected tightening (Gertler and Karadi, 2015). Any change in the futures rate around an FOMC meeting will thus capture any surprise component of policy announcements. The surprise, however, need not be in the same direction as the change in the fed funds target. In this example, the change in the futures rate is positive so our measure of the *surprise* will be positive, but there was a negative change in the fed funds rate. This is because the market expected more expansionary policy than the Fed implemented, leading a surprise monetary tightening. So, the monetary policy shock is contractionary despite the actual policy change being expansionary.

Bauer and Swanson (2022*b*) extend this area of the literature by looking at both FOMC meetings and speeches by the Federal Reserve Chair from 1988 to 2019. At a high level, they use the change in Eurodollar futures contracts of varying maturities during a 30-minute window around the time of announcements (10 minutes before and 20 minutes afterwards) to capture surprise changes in Fed policy. It's unlikely that any other macroeconomic news is released during such a tight time window so any change in the Eurodollar futures contract will be responding solely to the unexpected aspects of the policy announcement. In the end, the authors produce over 300 data points of monetary policy surprises dating from 1988 to 2019. To then obtain exogenaity in the federal funds rate, Bergman, Matsa and Weber (2022) take a running sum of all monetary policy shocks[1] within a quarter and use it as an instrument for that quarter's federal funds rate. For instance, the monetary policy shock in 1990Q1 will be the sum any policy surprises that occurred in the quarter. Each policy shock represents a surprise change in the Federal Funds rate so their running sum is analogous to the cumulative *surprise* change in the policy rate. These shocks will be correlated with the federal funds rate, as it's the primary mechanism for policy change, but uncorrelated with variables related to the broader economy—producing exogenous change in the federal funds rate.

In addition to the Bauer and Swanson (2022*b*) shocks, I use a second series of monetary shocks from Romer and Romer (2004) that dates back to the 1960s—allowing me to use a larger sample of the PSID. The Romers construct their monetary policy shocks by regressing changes in the Fed's intended federal funds rate on growth

1. They use a shock series based on fed fund futures.

and inflation forecasts. The Romers then use the residuals—the unexplained changes in the intended federal funds rate according the economic forecasts—as their measure of monetary policy shocks. Essentially, the Romers orthogonalize changes in the intended federal funds rate from any endogenous movements to the two economic indicators the Fed is most strongly responding to: inflation and GDP.

Empirical Strategy

Bergman, Matsa and Weber Extension

The goal of this paper is to investigate potential heterogeneity in the effect of monetary policy on earnings[2] within a purely micro-econometric framework. So, I begin by modifying Bergman, Matsa and Weber 's regression to look instead at whether monetary policy shocks have differential effects on the average earnings of black and white workers. Equation (1) measures how earnings growth[3] is affected by labor market tightness and the interaction between labor market tightness and the federal funds rate. I run this regression for both black and white workers.

$$\begin{aligned}\text{\% Earnings Growth}_{g,d,i,t+h} = \beta_1 \ \widehat{\text{Fed Funds Rate}}_t \times \text{Emp-Pop Ratio}_{g,t-1} \\ + \beta_2 \ \text{Emp-Pop Ratio}_{g,t-1} + \phi_{t,i} + \gamma_{g,i} \quad (1)\end{aligned}$$

More specifically, it is measuring how earnings growth at some time horizon h in the future for demographic group d in industry i located in the geographic area g differs with varying levels of the employment-to-population ratio in geography g and the

2. All earnings are adjusted for inflation

3. Results are reported using earnings growth 6 quarters in the future but time horizons between 1 to 8 were also tested with no change change in significance

federal funds rate across time. It includes industry-by-quarter fixed effects $\phi_{t,i}$—which captures industry-specific time trends in earnings growth—and geography-by-industry fixed effects–which captures time-invariant, location-specific variation in earnings growth that for a given industry. I measure the federal funds rate using the average rate across the four months in quarter t according to the Board of Governors (1985-2019). Then, I follow Bergman, Matsa and Weber (2022) and use a running sum of monetary policy shocks within quarter t to instrument for the federal funds rate. The monetary policy shock series I employ is from Bauer and Swanson (2022*a*). I'd expect β_1 to be negative for black workers as contractionary monetary policy shocks should more significantly hurt marginal workers (Zavodny and Zha, 2000).

Due to data constraints, I will report results for this specification using two measures of labor market tightness and two definitions of geographic area. In addition to the employment–to–population ratio, I will use the hiring rate—which is measured more precisely at the geographic–, industry–, and demographic–level. The hiring rate is the number of newly employed at the beginning of the quarter divided by the previous quarter's number of employed. Hiring rates will rise with high turnover which is not always the case with the employment–to–population ratio. However, a higher hiring rate implies that workers are in demand as firms are expanding their workforce at a faster rate. Moreover, the two measures follow similar trends at the national level[4] (Census Bureau, 1990-2019; Bureau of Labor Statistics, 1990-2019), and are just serving as proxies for the ideal measure of labor market tightness—the ratio of unemployed workers to job openings—which is unavailable at the local level. The reason to stick with the employment–to–population ratio when possible is that it's highly correlated with vacancies-to-unemployment ratios at the national level and less susceptible to turnover. Using both will allow for different measures of labor market

4. The two measures do diverge at the start of the pandemic, but my time frame ends in 2019

tightness and allow us to expand the time horizon. I expect β_2 to be positive across both specifications as hotter labor markets—determined by either a high hiring rate or high employment-to-population ratio—should lead to greater earnings growth since new hires are in demand (high hiring rate) or there are fewer workers available (high employment–to–population ratio).

As for the geographic-level, I will report results at both the MSA– and county-level (I use the term MSA to refer to both Metropolitan Statistical Areas and Micropolitan Statistical Areas). The reason for two geographic–levels is that before 2010, I'm unable to find yearly MSA population estimates to compute the employment-to-population ratio. So, I use the hiring rate in order to expand the timeline to 1990Q1-2019Q4 at the MSA-level. Then, I use county-level population estimates to get back to using the employment-to-population ratio. The downside to looking at the county-level is that MSA borders are drawn to encompass areas with close economic ties whereas county borders might arbitrarily separate two labor markets.

PSID Approach

My next approach is to use panel data at the individual level to estimate the effect of monetary policy shocks across the income distribution. My identification strategy follows Guvenen et al. (2017), who develop a framework to estimate the risk exposure of workers' earnings to the aggregate economy in panel data. Equation (2) measures how individual-level yearly labor earnings growth are affected by surprise changes in the federal funds rate.

$$\frac{\mathrm{Labor\ Earnings}_{\mathrm{i,t+1}} - \mathrm{Labor\ Earnings}_{\mathrm{i,t}}}{\mathrm{Labor\ Earnings}_{\mathrm{i,t}}} = \alpha_{\mathrm{t}} + \beta_{\mathrm{t}}\ \widehat{\mathrm{FedFunds}_{\mathrm{t}}} \tag{2}$$

$$+ \text{GDP Growth}_{\text{t}}$$

I use the annual earnings of the household head to construct each labor earnings measure on the LHS. Since time-invariant characteristics, both observed and unobserved, are differenced out in a panel regression, there is no need to include controls like race. I calculate the federal funds rate for year t by averaging the effective federal funds rate across each month. I then instrument for it using a running sum of all monetary policy shocks in year t from Bauer and Swanson (2022*a*). To explain some of the year to year variation in labor earnings, I control for GDP growth. I also add the function $I_{\text{i,g,t}}$ in equation (3), which produces a 1 if individual i is in income group[5] g at time t and 0 otherwise. This allows monetary policy shocks to have heterogeneous effects across income groups.[6]. As mentioned previously, I reestimate equation (3) using Romer and Romer (2004)'s monetary policy shock series in order to use a longer sample of the PSID. With the Romer shocks, the empirical strategy is largely the same except that I don't instrument the federal funds rate. Since the Romer's series can already be interpreted as shocks—changes in the federal funds rate unexplained by growth and inflation forecasts—I simply replace $\widehat{\text{FedFunds}_{\text{t}}}$ with the the sum of all Romer shocks occurring in year t.

$$\frac{\text{Labor Earnings}_{\text{i,t+1}} - \text{Labor Earnings}_{\text{i,t}}}{\text{Labor Earnings}_{\text{i,t}}} = \sum_{g=1}^{3} I_{\text{i,g,t}} \times [\alpha_{\text{g}}^{\text{t}} + \beta_{\text{g}}^{\text{t}}\ \widehat{\text{FedFunds}_{\text{t}}}] \qquad (3)$$

$$+ \text{GDP Growth}_{\text{t}}$$

5. Observations are split into income terciles based on household head income
6. In all specifications, I winsorize earnings growth at the 5% level

Data

Bergman, Matsa and Weber Extension

For the Bergman, Matsa and Weber extension, I use the United States Census Bureau's Quarterly Workforce Indicators (QWI) program (Bureau of Labor Statistics, 1990-2019), which contains quarterly information on earnings and hiring rates that can be disaggregated at the demographic–, geographic–, and industry–level. The program collects employment data by sourcing them from various administrative records, including unemployment insurance and the Internal Revenue Service. I use a sample of the data from 1990Q1 to 2019Q4, which includes 921 MSAs[7] and 2991 counties, and use the 2-digit NAICS industry indicators. I use the average monthly earnings of employees who worked on the first day of the reference quarter as my measure of earnings. This is to allow maximum flexibility in the labor supply responses of workers to monetary policy shocks, i.e., workers of certain demographics or industries may switch jobs in the same quarter.[8] To compute employment–to–population ratios at the county– and MSA–level, I use yearly population estimates at both geographic–levels from the United States Census Bureau (1990-2019*a*, 2010-2019*b*). As mentioned in the empirical strategy, I could only find yearly MSA population estimates for 2010–2019. Before that, they're only available on a decentential basis. So, in order to expand the time horizon, I include the hiring rate as a measure of labor market tightness and use county as a second geographic–level.

7. I use the word MSAs refer to both Micro & Metro Statistical Area
8. Using average monthly earnings of employees with jobs that last the *full* quarter doesn't alter significance

PSID Approach

For my second approach, I use data from the Panel Survey of Income Dynamics (PSID), the longest running longitudinal household survey in the United States. It collects information from a nationally representative sample of over 18,000 individuals living in 5,000 families, including information on income and hours worked. The data is available from 1968–2020 and has both household– and individual–level information. I use a sample of of male heads from 1970 to 1996 (Romer shocks) and 1988 - 1996 (Bauer & Swanson shocks) who were not full-time students, had positive weeks worked and positive labor earnings in any survey year. I use annual labor earnings of the male head to measure YoY earnings growth.

The attractiveness of PSID is having earnings data for the same individuals across time. Other panel data on income are often restricted in access, i.e., tax records from the Internal Revenue Service. There is a concern over attrition from the survey but Fitzgerald, Gottschalk and Moffitt (1998) finds little evidence that this has distorted the PSID's representativeness or its cross-sectional validity. Bound et al. (1994) also find that response error minimally affects the survey's measures of changes in earnings. The PSID surveyed families annually until 1998 when it switched to interviewing every other year. Using observations past 1998 would require me to sum the monetary policy shocks over a two-year period when using Bauer and Swanson (2022*a*) shock series, a frequency that could be too large to uncover the transmission of monetary policy. And because the monetary policy surprises from Bauer and Swanson (2022*a*) start in 1988, I can only use a sample of the PSID from 1988–1996 when using Bauer & Swanson shocks. However, when I use the Romer and Romer (2004) shocks, I am able to use waves from 1970 to 1996. Figure 1 displays a table of means for the data used across both approaches. All earnings are adjusted for inflation.

Table of Means

	Mean	Std. Dev.	Min	Max	Observations
Monthly earnings (Micro & Metro Statistical Area)					
QWI					
White	3740.08	2425.74	912	624372	921
Black	2944.46	2234.57	232	588763	921
PSID					
1st quantile	16672.07	6928.61	3138.5	26795	3,823
2nd quantile	34671.07	5073.341	25298	45017.12	3,796
3rd quantile	74986.15	60568.36	43048	1246127	3,737
Federal Funds Rate					
1990–2019	3.02	2.66	.06	9.72	120
2010–2019	0.63	.8400361	.06	3.43	36
Employment–to–Population Ratio					
Metro & Micro Statistical Area (2010-19)	0.28	0.077	0.019	0.85	921
County (1990-2019)	0.33	0.15	0.32	0.73	2991
Hiring Rate (Metro & Micro Statistical Area)					
2010 – 2019	0.15	0.18	0.062	0.84	921
1990 – 2019	0.11	0.22	0.024	0.71	921

Figure 1: Table of Means

Results

Bergman, Matsa and Weber Extension

Although I expect the effect of contractionary monetary policy shocks on average earnings growth to be negative for black workers, the exact underlying mechanism is ambiguous since average wages incorporate changes in both the composition of workers still employed as well as changes in the wages of employed workers. If wages for employed workers are held constant, then the response of average wages will depend on the type of workers who leave/are fired following contractionary shocks. If the workers becoming unemployed (for any reason) are primarily paid lower wages, then average wages would temporarily spike following a contractionary shock—holding current wages constant. The opposite would be true if higher paid workers tend to become unemployed. However, average wages also incorporates changes in the wages of employed workers. If workers face lower wages at their current firms following contractionary shocks—perhaps because firms face higher credit costs and adjust salaries when negotiating new wage contracts—then average wages would be expected to fall. Both mechanisms are possible, but changes in the composition of workers is a more likely pathway as wages rarely fall and usually only stagnate during recessions (Bureau of Economic Analysis, 1960-2019). Indeed, MoM percent change in average hourly wages reveals that hourly earnings growth is positive during the most recent recessions (Bureau of Labor Statistics, 2006-2022). However, it's important to remember that recessions and contractionary monetary policy shocks are not one and the same. Contractionary shocks can happen in both recessions and expansions. Recessions are just a proxy for how we might expect contractionary monetary policy shocks to affect the real economy as both should cause some degree of economic contraction.

Nonetheless, while its unclear what the exact underlying mechanism might be, we see no significant change in the average earnings growth[9] in the QWI following contractionary monetary policy shocks for either black or white workers. No estimate for the interaction between $\widehat{\text{FedFunds}}$ and labor market tightness is significant across the three panels at the MSA-level (Figure 1) and the panel at the county-level (Figure 2), indicating that monetary policy has no within–group impact on earnings growth nor any heterogeneous effect across race. And because there's no significance, labor market market tightness is not acting as a mediator for the transmission of monetary policy to the real economy. This stands in contrast to the original findings of Bergman, Matsa and Weber (2022)—who find empirical evidence that contractionary monetary policy shocks decrease black employment growth but not white. So while employment growth for black and white workers are deferentially affected by monetary policy shocks, earnings growth appears not to be.

9. As previously mentioned, reported results use earnings growth rate 6 quarters out but time horizons of 2 to 8 quarters were also used with no change in significance

One possible explanation is that the workers becoming displaced are predominately paid the average wage of their industry and geography. If workers in the middle of the earnings distribution comprise the the majority of the newly unemployed, average earnings for that demographic d in geography g and industry i will move minimally. Moreover, the magnitude of Bergman, Matsa and Weber's empirical findings—although statistically significant—could be too small to translate into a fall in average earnings. Their results show that a contractionary monetary policy shock of 100bp is estimated to cause black employment growth to decline by 2.6% percentage points over 8 quarters. If that's predominantly occurring at the bottom of the earnings distribution, then wages for existing workers would only need to fall slightly to keep average wages the same. The opposite is true if job loss is predominantly happening at the upper end of the distribution. Some combination of relatively small job losses and layoffs predominately occurring for workers who have earnings at the average level for their their industry, geography, and demographic cohort can explain the lack of significance between average earnings growth and monetary policy shocks.

Heterogeneity by Race at MSA-Level

Panel A: **2010Q1–2019Q4**	Earnings Growth	
	(1)	(2)
VARIABLES	White	Black
Emp-Pop Ratio × $\widehat{\text{FedFunds}}$	-0.240	-0.910
	(0.559)	(0.999)
Emp-Pop Ratio	0.155	0.669
	(0.335)	(0.731)
Constant	0.0588**	0.0734
	(0.0229)	(0.104)
Industry–by–Quarter FE	✓	✓
MSA–by–Industry FE	✓	✓
Observations	562,228	502,056
R-squared	0.150	0.121

Panel B: **2010Q1-2019Q4**		
	(1)	(2)
VARIABLES	White	Black
Hiring Rate × $\widehat{\text{FedFunds}}$	-0.480	-0.0807
	(0.366)	(0.186)
Hiring Rate	0.386***	0.186
	(0.123)	(0.116)
Constant	0.0621***	0.0609***
	(0.00112)	(0.00191)
Observations	636,535	434,305
R-squared	0.105	0.132

Panel C: **1990Q1-2019Q4**		
Hiring Rate × $\widehat{\text{FedFunds}}$	-0.0677	-0.0596
	(0.0417)	(0.0391)
Hiring Rate	0.259***	0.295***
	(0.0957)	(0.0922)
Constant	0.0591***	0.0581***
	(0.00127)	(0.00259)
Industry–by–Quarter FE	✓	✓
MSA–by–Industry FE	✓	✓
Observations	1,650,374	1,071,916
R-squared	0.060	0.075

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 2: MSA-Level 1990Q1-2019Q4

Heterogeneity by Race at County-Level

	Earnings Growth	
	(1)	(2)
VARIABLES	White	Black
Emp-Pop Ratio × $\widehat{\text{FedFunds}}$	-0.00175	-0.0167
	(0.0106)	(0.0155)
Emp-Pop Ratio	-0.0161	0.0209
	(0.0248)	(0.0363)
Constant	0.0896***	0.107***
	(0.00184)	(0.00305)
Industry–by–Quarter FE	✓	✓
County–by–Industry FE	✓	✓
Observations	4,586,769	3,057,206
R-squared	0.059	0.058

1990Q1-2019Q4

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 3: County-Level

PSID Approach

Bauer and Swanson (2022a) Shocks

Turning to the PSID, however, uncovers heterogeneity in the relationship between surprise changes in the federal funds rate and labor earnings growth across the income distribution. In Figure 3, the dummy variable for the 1st quantile is dropped so the coefficient on $\widehat{\text{FedFunds}}$ is the causal effect of a surprise change in the federal funds rate on the 1-year labor earnings growth for the bottom $\frac{1}{3}$ of the income distribution. The subsequent interactions are the differences in the effect of $\widehat{\text{FedFunds}}$ for the two higher income groups relative to the bottom income group. The coefficient on $\widehat{\text{FedFunds}}$ is negative and statistically significant, meaning that a surprise increase in the federal funds rate of 100bp causes the year-to-year earnings growth rate of the bottom quantile to fall by 2.48 percentage points. For the second quantile (middle $\frac{1}{3}$ of the income distribution), the effect of a surprise change in the federal funds rate is not statistically different than the effect on the bottom $\frac{1}{3}$ of the income distribution.

Computing the estimated coefficient specifically for the 2nd quantile reveals that the causal effect is -.0317 and is significant at the 1% level, meaning that a surprise increase in the federal funds rate of 100bp causes the year-to-year earnings growth rate for the middle tercile to fall by 3.17 percentage points. The coefficient for the 3rd tercile interaction term, however, is positive and significant—indicating that the effect of a surprise change in the federal funds rate at the upper $\frac{1}{3}$ of the income distribution is different than the effect at the bottom $\frac{1}{3}$. Recomputing the coefficient on $\widehat{\text{FedFunds}}$ for the upper tercile reveals that the causal effect .0015 and is not significant at any level, meaning that a surprise change in the federal funds rate has no causal effect on the year-to-year earnings growth rate for the upper $\frac{1}{3}$ of the income distribution.

PSID 1988-1996

VARIABLES	Labor Earnings Growth
2nd Tercile	-0.352***
	(0.0934)
3rd Tercile	-0.853***
	(0.0925)
$\widehat{\text{FedFunds}}$	-0.0248**
	(0.0116)
2nd Tercile#$\widehat{\text{FedFunds}}$	-0.00606
	(0.0158)
3rd Tercile#$\widehat{\text{FedFunds}}$	0.0313**
	(0.0155)
GDP Growth	0.0738
	(0.250)
Constant	0.409***
	(0.0946)
FE	✓
Observations	9,460
Number of Male Heads	1,722
R-squared	0.179

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 4: Individual Level Panel Data (PSID)

The most immediate explanation for slower wage growth in the bottom two-thirds of the income distribution are differential responses to surprise changes in the federal funds rate at the firm and individual level. Individuals in the bottom two-thirds may supply less labor to market due to their specific household constraints, e.g., family obligations, becoming more strained following monetary policy shocks compared to those in the upper one-third. This can also manifest itself with more higher labor elasticises with respect to wage for those at the bottom of the distribution: as wages fall in response to surprise economic contractions, individuals in the bottom of the two-thirds may be more unwilling to supply the same amount of labor relative to those at the top. Moreover, those at the bottom two-thirds—which is below $34,671 on average across all years—may not have as much downward rigidity in their wage contracts as those in the upper one-third. For example, if the workers in the bottom two-thirds lack of strong unions, then when economic contractions happen (even via surprise credit tightening from the Fed), they may be more subject to slower wage growth than those in the top one-third. The specific type of work of those in the bottom two-thirds may rate-sensitive, e.g., deal flow for real estate workers might fall as less homes are put on the market. Or, their firm may be more willing reduce its labor force in the occupations these individuals occupy. For instance, lower-income workers may predominately occupy less essential functions within a firm that are the first to experience cuts when those firms face higher borrowing costs (or less profit because the their industry is rate sensitive).

We've discussed how contractions in the aggregate economy (due to surprise rate increases) might lead to heterogeneity in earnings growth, but it's also important to look at interest rates themselves as they are the primary policy tool of the Fed. Any surprise change in the federal funds rate will change the opportunity cost of capital firms face when making their investment decisions. A surprise increase will raise the opportunity cost while a surprise drop will lower it. One might argue a surprise 100bp increase in the federal funds rate should cause higher wage growth for workers—not lower as I observe—since the relative cost of labor has fallen. But, labor isn't necessarily the "next best alternative." For example, firms may save some of the original capital budget and invest in interest-bearing assets or put it towards non-labor augmenting capital. If firms change their capital investment behaviors following a monetary policy shock, and the workers employed by these firms are primarily in the bottom two-thirds of the income distribution, then slower wage growth could be explained by worker productivity declining as firms invest less in labor-augmenting capital. Less worker productivity might then depress the wages (or the rate of wage increases) that firms are willing to pay—slowing wage growth. All in all, the heterogeneous response of labor earnings growth to surprise changes in the federal funds rate lies somewhere between differential labor supply responses on the part of the individual and the specific factors of an individual's employment. To empirically show which underlying channel it is beyond mere differences in income groups will require further exploration and more data.

Romer and Romer (2004) Shocks

Using the Romer and Romer (2004) shocks confirm the negative effect of monetary policy shocks on real earnings but reveals less heterogeneity. The bottom tercile sees their wage growth rates fall by 2.25 percentage points following a 100bp increase in the federal funds rate that is unexplained by growth and inflation forecasts. The middle tercile is not as strongly impacted by monetary shocks, as the coefficient on the interaction term is positive and significant. However, unlike my earlier findings, the effect of monetary shocks on the wage growth rates for those in the 3rd tercile is not statistically different than the effect on the bottom tercile—implying that both the bottom and upper tercile are similarity affected by shock monetary contractions.

PSID 1970-1996

VARIABLES	(1) Labor Earnings Growth
2nd Tercile	-0.540***
	(0.00486)
3rd Tercile	-0.778***
	(0.00605)
Monetary Shock	-0.0275***
	(0.00301)
2nd Tercile#Monetary Shocks	0.00997**
	(0.00409)
3rd Tercile#Monetary Shock	0.00652
	(0.00408)
GDP Growth	0.181***
	(0.0653)
Constant	0.614***
	(0.00412)
Observations	115,239
Number of Male Heads	13,707
R-squared	0.154

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusion

In this paper, I have explored what micro-econometrics has to offer in terms of quantifying the heterogeneity in the effect of monetary policy shocks on labor earnings growth. My modification of Bergman, Matsa and Weber was unable to uncover any differences in the impact of monetary policy shocks between black and white earnings growth. However, by taking a panel regression approach using microdata from the PSID, I am able to find empirical evidence that monetary policy surprises have distributional effects across income groups. A surprise 100bp increase in the federal funds rate leads the year-to-year earnings growth of men in the bottom two-thirds of the distribution to fall by 2-4 percentage points. And although the PSID is a much smaller dataset the QWI, it is clear that panel microdata is more useful in quantifying the distributional impacts of monetary policy. It is still a representative sample of the United States,[10] and its implications for policy should not be ignored. Monetary policy can exacerbate inequality, and policymakers should weigh the slower earnings growth of marginal workers against the goal of price stability. Although the magnitude of my findings may be small, if marginal workers experience unemployment or stagnating wages as a result of monetary policy, it can have compounding effects if it forces those individuals permanently out of the workforce or into lower-paying occupations. Monetary authorities can still pursue the goal of price stability but should ensure that government transfer programs exist to offset slower labor earnings growth. Altogether, I am able to find empirical evidence that monetary policy has heterogeneous effects across the income distribution but more work needs to be done to more precisely identify the exact underlying mechanisms causing the heterogeneity.

10. In this case, a representative sample of men.

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