

Labor Market Response to Monetary Policy: Financing Frictions and the Wage Effect *

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Abstract

We study how monetary policy generates heterogeneous employment responses across firms with different degrees of financing frictions. Our main contribution is the {wage-spread channel: when wages fall after a monetary contraction, financially constrained firms borrow less to finance their payroll, which lowers their marginal borrowing spread and attenuates their employment contraction relative to unconstrained firms. This mechanism operates alongside the standard financial accelerator and marginal cost channels, and generates heterogeneous employment responses even when wages move uniformly across firms. We show that the wage-spread channel attenuates the employment response of financially constrained firms to monetary policy shocks, implying that these firms may contract less than unconstrained firms despite the presence of a strong financial accelerator.

JEL classification: E24, E52, J23, L25

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1 Introduction

Firms exhibit rich heterogeneity in their responses to monetary policy shocks. We study a model with financing frictions to show that changes in the labor cost encountered by all firms could lead to heterogeneous employment decisions across firms, depending on the degree of financing frictions they face.¹ Our theoretical contribution is to analyze the *wage-spread channel*: when wages decline following a monetary contraction, financially constrained firms experience not only a lower wage bill but also a reduction in their marginal borrowing spread, since they borrow less to finance their payroll. This additional margin of adjustment is absent for unconstrained firms, generating heterogeneous employment responses even when wages move identically across firm types. We show that the *wage-spread channel* weakens the responsiveness of financially constrained firms to monetary policy shocks, so that these firms may contract less than unconstrained ones even in the presence of a strong financial accelerator.

Financing constraints are a leading mechanism of monetary policy transmission in the literature. The main focus of this literature has been to study the effects of monetary policy on the investment and sales of heterogeneous firms, e.g., [Gertler and Gilchrist \(1994\)](#), [Chari, Christiano, and Kehoe \(2013\)](#), [Kudlyak and Sanchez \(2017\)](#), [Jeenas \(2019\)](#), [Crouzet and Mehrotra \(2020\)](#), [Ottonello and Winberry \(2020\)](#), [Howes \(2021\)](#), [Kroner \(2021\)](#), [Gnewuch and Zhang \(2025\)](#). Based on earlier findings that small firms face tighter financing constraints (e.g. [Fazzari, Hubbard, and Petersen, 1988](#)), [Gertler and Gilchrist \(1994\)](#) show that after tight money episodes sales and inventories of small (in terms of assets) firms are more responsive than those of larger firms, emphasizing the credit channel and the financial accelerator mechanism of [Bernanke, Gertler, and Gilchrist \(1999\)](#). Recent research by [Jeenas \(2019\)](#), [Ottonello and Winberry \(2020\)](#), and [Cloyne, Ferreira, Froemel, and Surico \(2023\)](#) explores the strength of the investment channel.

In our paper, we retain the structure of the models used for investment, to study the transmission of monetary policy to employment. Specifically, we use a model of heterogeneous firms that features a working capital constraint and a spread that financially constrained firms pay for financing their labor input. In the model, there are three channels through which the employment response of financially constrained firms to a monetary policy shock might differ from that of unconstrained firms. The first channel involves the upward-sloping marginal cost curve of [Ottonello and Winberry \(2020\)](#), which is flatter for unconstrained firms, causing them to contract more than constrained firms after a monetary policy tightening. The second channel relies on the financial accelerator mechanism of [Bernanke, Gertler, and Gilchrist \(1999\)](#), which,

¹Heterogeneous responses of firms' employment has been documented, e.g., by [Yu, 2021](#), [Bahaj et al., 2022](#), and [Singh et al., 2025](#).

in the presence of working capital constraints, causes the employment of constrained firms to react more to a monetary policy shock compared to unconstrained firms. These two opposing mechanisms through which monetary policy affects investment (Ottonello and Winberry, 2020) and employment (Bahaj, Foulis, Pinter, and Surico, 2022) have been previously emphasized in the literature. The third channel is our contribution, the wage-spread channel, discussed below.

When shifting the focus from investment to employment responses to monetary policy, changes in the wage rate, and their implications for firms' borrowing needs, become relevant. Empirically, we show that the average cost of hiring workers is impacted by monetary policy shocks. Prior research has incorporated wage adjustments into environments with financial constraints that study employment response to monetary policy. In Zervou (2014), monetary-policy-induced wage movements generate heterogeneous employment responses because constrained firms rely on external finance while unconstrained firms do not. In Manea (2020), heterogeneity arises because constrained firms must collateralize labor inputs, whereas unconstrained firms do not. Our mechanism differs from these channels. Here, heterogeneity in employment responses emerges because monetary-policy-induced changes in the average cost of hiring alter the marginal borrowing spread faced by firms. Thus, when wages decline, firms not only face a lower wage bill (the standard benefit as highlighted in Zervou, 2014 and Manea, 2020) but also a reduction in the marginal spread, further lowering the cost of hiring at the margin. We refer to this additional mechanism as the wage-spread effect. Ottonello and Winberry (2020) incorporate this mechanism in their analysis of investment but do not study employment. In Bahaj et al. (2022), who focus on employment, the mechanism is present but inactive, as they assume no wage response to monetary policy.

To illustrate the mechanism, consider a monetary contraction leading to a reduction in wages. Even if the wage decrease is uniform across firms, employment, and hiring responses vary. This divergence is due to the fact that financially constrained firms incur borrowing costs that include a spread, which falls as their borrowing decreases. Consequently, a lower wage cost reduces the borrowing spread, enabling constrained firms to expand hiring and employment. The *wage-spread channel* therefore adds another source of variation in employment dynamics between financially constrained and unconstrained firms.

The empirical literature on the response of wages mostly finds a procyclical response to monetary policy shocks pointing at decreases in wages paid to employees after monetary contractions. For example, Normandin (2006) for the US (among other countries), and McCallum and Smets (2007) for Europe, find that wages, nominal and real, decrease with a monetary policy contraction. We confirm this finding in our own empirical analysis and use the procyclical

response of wages as a key input to our partial-equilibrium model.

The paper is organized as follows. Section 2 introduces the model. Section 3 presents our empirical evidence on the effects of monetary policy shocks on the employee’s pay. Section 4 demonstrates how the *wage-spread channel* introduces heterogeneous employment responses among firms. Finally, Section 5 concludes.

2 Model

We present a theoretical model demonstrating how a homogeneous wage response to monetary policy shocks produces heterogeneous employment responses across firms with different degrees of financing frictions. We build on the partial equilibrium model of Bahaj, Foulis, Pinter, and Surico (2022), which studies employment in a heterogeneous-firm framework based on the monetary transmission channels of Ottonello and Winberry (2020) and Bernanke, Gertler, and Gilchrist (1999): (I) the convex marginal cost channel and (II) the financial accelerator channel, respectively. We introduce a third channel, (III) the wage-spread channel, motivated by the empirically observed response of employee earnings to monetary policy shocks.

Wages are often financed with working capital, a feature embedded in models of monetary transmission (Bahaj, Foulis, Pinter, and Surico, 2022), financial crises (Mendoza, 2010), and uncertainty shocks (Arellano, Bai, and Kehoe, 2019). Empirically, firms rely heavily on external financing to cover working capital needs, including payroll (Sufi, 2009; Gopinath et al., 2017). Originally introduced as a cash-in-advance constraint in production by Fuerst (1992), Schwartzman (2014) reinterprets it as a time-to-produce constraint, where firms hire and pay workers before revenue arrives, allowing broader applicability across firm types and contexts. In our model, we show that monetary policy affects the firms’ labor choices through the incorporated working capital constraint as previously in Zervou (2014), Manea (2020), and Bahaj et al. (2022); we emphasize however its effect on the spread paid by the firms, a mechanism that allows to connect with the existing investment financing models (e.g., Ottonello and Winberry, 2020), by activating an additional term in the labor demand response to monetary policy shocks.

2.1 Set-up

We present the basic setup of the model, which closely follows Bahaj, Foulis, Pinter, and Surico (2022), with some key extensions. Firms are heterogeneous, where each firm j produces good

Y^j using labor input N^j according to the Cobb-Douglas production function

$$Y_t^j = A_t^j (N_t^j)^\alpha,$$

where $\alpha \leq 1$, and A_t^j is the idiosyncratic stochastic productivity at the end of the period, with $E_t(A_t^j) = 1$. The final good is homogeneous across firms, and each firm sells output at price P_t . The firm enters the period with firm-specific liquid assets D_t^j , illiquid assets L^j , and Q_t is the price of the illiquid asset. We assume that while the liquid asset can be used to finance the operations of the firm, which faces working capital constraints, the illiquid asset cannot be. While Bahaj, Foulis, Pinter, and Surico (2022) consider land as an illiquid asset, we allow for a broader interpretation, in which it includes not only firms' land and physical capital, but also intangible capital, such as payback reputation or trust in repaying the loan. This broader interpretation allows treating firms' age or size as a proxy for L^j , differentiating firms' type.

We assume that some firms face a working-capital constraint and must borrow externally whenever their liquid assets D_t^j are insufficient to pay their labor input. A firm borrows B_t^j at the beginning of the period to pay their labor input, while their output is sold at the end of the period. It borrows $B_t^j = \max\{W_t^j N_t^j - D_t^j, 0\}$, where W_t^j is a firm-specific nominal wage. The wage paid by each firm is the same for all of its employees, so in the model firm-level wages and average employee earnings coincide.² We further assume that these assets are indeed insufficient, so that $W_t^j N_t^j > D_t^j$ and thus firms rely on external borrowing, consistent with the evidence in Sufi (2009). We also assume that the firm does not distribute dividends and cannot raise funds by issuing new equity.³

We follow Ottonello and Winberry (2020) and Bahaj et al. (2022), and assume that a firm that borrows pays the gross interest rate, $1 + i_t$, where i_t is the short-term nominal interest rate, and a spread, $\lambda(B_t^j, Q_t L^j) \equiv \lambda_t^j \geq 0$, which depends on both B_t^j and the value of the illiquid asset, $Q_t L^j$. The spread is assumed to increase with borrowing, $\frac{\partial \lambda_t^j}{\partial B_t^j} \equiv \lambda_1^j \geq 0$ at an increasing rate, $\lambda_{11}^j \geq 0$. It is also assumed to decrease with the value of the illiquid asset, $\frac{\partial \lambda_t^j}{\partial Q_t L^j} \equiv \lambda_2^j \leq 0$. However, the rate at which the spread increases with the firm's borrowing is decreasing with the value of the firm's illiquid assets, that is $\lambda_{12}^j \leq 0$. In addition, following the financial accelerator literature, we assume that $\frac{\partial Q_t}{\partial i_t} < 0$, i.e., the price of the illiquid asset decreases with the short-term nominal interest rate.

²We show later on that, in the presence of composition effects, average employee earnings can be used in place of wages.

³The assumptions of no dividend distribution and no new equity issuance are standard in models of financial frictions: they prevent firms from costlessly substituting equity for debt and thereby preserve the relevance of the working-capital constraint. See, for example, Bernanke, Gertler, and Gilchrist (1999).

The liquid asset of firm j in the next period equals its revenue $P_t Y_t^j$ net of the borrowing costs. If $B_j > 0$, it can be written as

$$D_{t+1}^j = P_t Y_t^j - (1 + i_t)(W_t^j N_t^j - D_t^j) - \lambda_t^j (W_t^j N_t^j - D_t^j). \quad (1)$$

In the model, the aggregate state is given by $S_t = \{P_t, i_t, Q_t\}$ and $\{W_t^j\}$. This is a partial equilibrium model where the wage is exogenous. However, when the monetary authority changes the nominal interest rate i_t , it impacts the aggregate state vector and the firm-specific wage, which is the main focus of this paper. We examine how the labor input cost changes in response to monetary shocks and study the implications for employment.

2.2 Firm's problem

The firm's problem is to choose the labor input to maximize its value $V(D_t^j; S_t)$

$$\max_{N_t^j} V(D_t^j; S_t) = \frac{1}{1 + i_t} \mathbb{E}_t[V(D_{t+1}^j; S_{t+1})], \quad (2)$$

subject to equation (1). We assume that the firm does not default.⁴

The first order condition, after simplifying and suppressing time subscripts, is given by:

$$\underbrace{P\alpha(N^j)^{\alpha-1}}_{\text{marginal product of labor}} = \underbrace{(1 + i) W^j}_{\text{marginal interest rate cost}} + \underbrace{\lambda^j W^j + (W^j N^j - D^j) \lambda_1^j W^j}_{\text{marginal spread cost}}. \quad (3)$$

The above expression states that the marginal product of labor, $MPN^j \equiv P\alpha(N^j)^{\alpha-1}$, equals the marginal cost of financing an additional unit of labor, which includes the interest rate paid for financing the wage paid to the worker and the spread. Note that the spread the firm pays for hiring an additional worker rises for two reasons: (i) the firm borrows more to pay the extra worker, adding $\lambda^j W^j$; and (ii) the spread itself increases with additional borrowing, captured by $\lambda_1^j \frac{\partial B_t^j}{\partial N_t^j} = \lambda_1^j W_t^j$, an element that amplifies monetary policy effects and is absent from [Zervou \(2014\)](#) and [Manea \(2020\)](#).

Taking logs of equation (3) and a first-order Taylor expansion of $i + \lambda^j + (W^j N^j - D^j) \lambda_1^j$

⁴We assume that L^j cannot be sold within the period to cover the wage bill. At the firm's optimal labor choice, we assume that the firm's revenue always cover repayment obligations even at the highest possible spread $\bar{\lambda}$; that is, $P_t (N_t^j)^\alpha \geq (1 + i_t + \bar{\lambda})(W_t^j N_t^j - D_t^j)$. Since this condition holds for all values of $\lambda^j \in [0, \bar{\lambda}]$, default is never optimal.

around zero, equation (3) simplifies to:

$$\underbrace{\log(MPN^j) - \log W^j - i}_{MB^j \equiv \text{net marginal benefit}} = \underbrace{\lambda^j + (W^j N^j - D^j) \lambda_1^j}_{MS^j \equiv \text{marginal spread}}, \quad (4)$$

where $MB^j \equiv \log(MPN^j) - \log W^j - i = \log P + \log \alpha + (\alpha - 1) \log N^j - \log W^j - i$ is the net marginal benefit from hiring an additional worker, and $MS^j \equiv \lambda^j + (W^j N^j - D^j) \lambda_1^j$ is the marginal spread on the borrowing cost to finance the wage of the marginal worker. That is, for all firms we have that $MB^j - MS^j = 0$, the net marginal benefit from hiring an extra worker, equals the marginal spread paid to hire this worker.⁵

2.3 Monetary policy shocks

We now study the effects of monetary policy shocks on firms' employment decisions. To see the impact of changes in the nominal interest rate on employment through the model, we use the implicit function theorem on equation (4). The resulting equation is given below:

$$\frac{dN^j}{di} = - \frac{\frac{\partial MB^j}{\partial i} - \frac{\partial MS^j}{\partial i}}{\frac{\partial MB^j}{\partial N^j} - \frac{\partial MS^j}{\partial N^j}}. \quad (5)$$

The terms in the denominator are given by

$$\frac{\partial MB^j}{\partial N^j} = \frac{\alpha - 1}{N^j} = - \frac{1 - \alpha}{N^j},$$

and

$$\frac{\partial MS^j}{\partial N^j} = \frac{\partial \lambda^j}{\partial N^j} + W^j \lambda_1^j + (W^j N^j - D^j) \frac{\partial \lambda_1^j}{\partial N^j} = (2\lambda_1^j + \lambda_{11}^j (W^j N^j - D^j)) W^j,$$

for $B_j > 0$. Incorporating how the marginal benefit and marginal spread changes in response to a change in labor input in equation (5), the labor response to a change in monetary policy is given by

$$\frac{dN^j}{di} = \frac{\frac{\partial MB^j}{\partial i} - \frac{\partial MS^j}{\partial i}}{\frac{1-\alpha}{N^j} + \left(2\lambda_1^j + \lambda_{11}^j (W^j N^j - D^j)\right) W^j}. \quad (6)$$

Note that the denominator in equation (6) is $\partial MS^j / \partial N^j - \partial MB^j / \partial N^j$, i.e., we have absorbed the overall negative sign of the implicit function expression into the denominator. Given diminishing marginal benefit ($\partial MB^j / \partial N^j = -(1 - \alpha) / N^j < 0$) and an increasing marginal spread

⁵For firms that do not need to borrow, i.e., $B^j = 0$, we have that $MS^j = 0$ so that the condition reduces to the standard equality between marginal product and marginal labor cost.

($\partial MS^j / \partial N^j = W^j [2\lambda_1^j + \lambda_{11}^j (W^j N^j - D^j)] \geq 0$), the denominator is positive and we assume that it is strictly positive so that the implicit function theorem holds.

In addition, for the firms that borrow it is true that the denominator is lower for firms with higher illiquid asset L^j . This is because, although a firm with more illiquid assets enjoys the same marginal benefit from hiring an extra worker as the firm with less illiquid assets, a firm with more illiquid assets has a lower cost of hiring the extra worker; it pays a lower spread for borrowing than a firm with a less illiquid asset.⁶ This is the effect analyzed by [Ottonello and Winberry \(2020\)](#) and the reason why firms with higher illiquid assets in the model, respond more to a change in the nominal interest rate (and in general).

We now focus on the numerator of equation (6). It depends on the responses of the net marginal benefit, MB^j , and of the marginal spread, MS^j , to nominal interest rate changes. This is where we incorporate our novel wage-spread effect, which introduces an additional channel for firms' differential response to monetary policy shocks. To do that we first provide empirical evidence in Section 3 on how labor input cost paid by firms responds to monetary policy shocks, and then incorporate our empirical findings and show the impact of financing frictions on the employment decisions of firms in Section 4.

3 Empirical evidence

In this section, we present empirical evidence that monetary policy contractions induce a decrease in employee earnings paid by firms.

3.1 Data and methodology

We use the Quarterly Workforce Indicators (QWI) dataset, derived from the Longitudinal Employer Household Dynamics (LEHD) program of the U.S. Census Bureau. This quarterly dataset from 1995:1-2019:2 includes all private, state, and local government (but not federal) employers covered by unemployment insurance in the U.S. and thus have good coverage. The data are seasonally adjusted using X-12-ARIMA method by the U.S. Census Bureau.

The QWI dataset includes information about the average earnings paid to newly hired employees, which allows us to measure changes in the relevant labor costs, not driven by previous wage contracts and negotiations. We consider two relevant variables. The first variable, *Earn-HirNS*, represents the average earnings of workers who began a job that lasted a full quarter. These hires were employed by an employer during the specified quarter but had not worked for

⁶This is because $\frac{\partial \left(\frac{1-\alpha}{N^j} + 2\lambda_1^j W^j + \lambda_{11}^j (W^j N^j - D^j) W^j \right)}{\partial L^j} = 2W^j \lambda_{12}^j Q \leq 0$ given that $\lambda_{12}^j \leq 0$.

that employer in any of the preceding four quarters. Additionally, in the appendix we present the results for the second variable, *EarnHirAS*, which also captures the average earnings of workers who started a job that turned into a full-quarter position. However, this variable includes workers who, during the specified quarter, were new hires but may have been employed by the same employer in some of the previous four quarters, excluding the immediate quarter before the current one. These workers may have experienced a temporary break in their employment with the same employer. We deflate both variables with the Producer Price Index (PPI).

In addition to the quarterly information on average employees' earnings, the QWI also provides information on firm characteristics such as size, location, and industry classification and employee characteristics such as education. In the dataset, there are five firm size categories: size one has 0-19 employees, size two has 20-49, size three has 50-249, size four has 250-499, and size five has more than 500 employees. We take advantage of the firm size information to examine whether the real earnings paid to employees by firms of different sizes respond differently to monetary policy shocks. We also account for the level of education of the employees to control for worker quality.⁷

Our monetary policy shock is the *federal funds rate factor* series constructed by [Swanson \(2021\)](#), based on the high-frequency futures market identification approach first developed by [Kuttner \(2001\)](#).⁸ We focus on the short-run effect of changes on the federal funds target rate surprises, using the series of [Swanson \(2021\)](#)'s federal funds rate (ffr) factor, which isolates the effect of the short-term movements in asset prices.⁹ Moreover, we aggregate the series to construct quarterly measures, as is common in the literature. Our analysis covers the period 1998:1-2019:2, starting our sample in 1998 to maximize coverage and concentrate on the monetary policy era of formal target announcements.

To measure the impact of federal funds factor shocks on the earnings of new employees, we employ the local projection method developed by [Jordà \(2005\)](#). Equation (7) below is our empirical specification on the aggregate QWI data:

$$\Delta_h w_{ise,t+h} = \alpha_{ise}^h + \beta_{ise}^h \epsilon_t^{ffr} + \Gamma_{ish}^h Z_t + u_{ise,t+h}^h. \quad (7)$$

⁷Data on earnings are split into four core educational attainment bins: Less than High School, High School or Equivalent, Some College or Associate Degree, Bachelor's Degree or Higher.

⁸The monetary policy shocks are constructed using the three principal components of the asset price responses to each announcement of the Federal Reserve's Federal Open Market Committee (FOMC) within the 30-minute window. See [Swanson \(2021\)](#) for more details.

⁹[Swanson \(2021\)](#) identifies three factors of monetary policy, the short-run federal funds rate, the forward guidance and the large-scale asset purchases factor present after the Great Recession. The latter factor is relevant only in the period after 2008, and therefore, we do not focus on it given our larger sample. The second factor has an unclear interpretation, given that it also includes, besides the forward guidance effect, a possible information effect, as pointed out by [Campbell, Evans, Fisher, and Justiniano \(2012\)](#). The third factor captures short-run movements in asset prices and is the relevant factor for measuring monetary policy shocks in this study.

The dependent variable is the cumulative growth rates of the real earnings of new hires, $\Delta_h w_{ise,t+h} \equiv \log w_{ise,t+h} - \log w_{ise,t}$, in industry i , in firms of size s , for employees with education e , h periods after the monetary policy shock in period t . We include industry (α_i^h), size (α_s^h) and level of education (α_e^h) fixed effects, α_{ise}^h .¹⁰ The coefficient of interest is β_{ise}^h which is used to construct the impulse response functions presented in Figures 1–3. The control variables in \mathbf{Z}_t are one lag of the dependent variable, four lags of the federal funds rate, four lags of the state unemployment rate, and capacity utilization. When presenting results for a specific industry, firm size, and/or worker’s education β_{ise}^h estimates are obtained by splitting the sample along the cross-sectional dimension. Since we are using the Jordà (2005)’s methodology, the errors are autocorrelated by construction. To control for those correlations in the panel setting, we use Driscoll and Kraay (1998) standard errors.

3.2 Empirical results

The purpose of this section is twofold: first, to establish that real earnings decrease following a monetary policy shock, and second, to demonstrate that this decline is remarkably consistent across firms with different characteristics, such as size and industry.

Figure 1 depicts the impulse response function to a monetary policy contraction, specifically measuring the effect on the growth rate of the real earnings paid to newly hired employees who have not worked for their employer in the last four quarters. The response exhibits a decline that is both immediate and persistent. A 100 basis point monetary policy surprise decreases the real earnings paid to these newly hired employees by approximately 4.9% the following period (quarter) and 12.9% after 6 periods (quarters). Note that this downward response is statistically significant.¹¹

The results are essentially unchanged relative to the unconditional counterpart presented in Figure A.5 of Appendix A.4, confirming the robustness of the baseline findings.

Figure 2 plots results for the real earnings for small (left panel), medium-sized (middle panel), and large (right panel) firms. For all three firm types, we find that the growth rate of real earnings paid to newly hired employees decreases after a monetary policy contraction. Specifically, a 100 basis point contractionary monetary policy surprise decreases the real earnings by 3.6% in small firms (left panel), 4.3% in medium-sized firms (middle panel) and 5.1% in large firms (right

¹⁰We exclude Agriculture, Forestry, Fishing and Hunting, and Public Administration and Finance and Insurance, and Real Estate (FIRE), and Rental and Leasing.

¹¹While the Swanson (2021) shocks have a sharp interpretation and are not influenced by forward guidance or information effects, they are rather small. As a result, we analyze and interpret our findings using both 68% and 90% confidence intervals. Larger intervals (corresponding to a one-standard deviation) are used in related literature, e.g., in Coibion, Gorodnichenko, Kueng, and Silvia (2017) and Graves, Huckfeldt, and Swanson (2023).

Cumulated responses (%) of real earnings to target shock

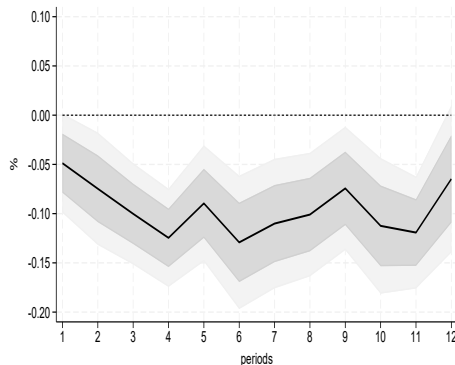


Figure 1: Response of the growth rate of real earnings paid to newly hired employees to a federal funds rate factor shock.

Notes: The figure plots the responses of the growth rate of average real earnings paid to newly hired employees in stable jobs to an 1bp increase in the federal funds rate factor shock. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (darker) and 90% (lighter) confidence bands.

panel) after 1 quarter. These decreases continue and after 6 quarters, real earnings are lower by 12.4% in small firms, 13.1% in medium-sized firms, and 13.7% in large firms. Importantly, these responses are similar across different firm sizes, and the differences are not statistically significant.

Following [Singh et al. \(2022\)](#) we also examine industry-specific results by estimating equation (7) separately for each industry. Figure 3 shows that a 100 basis point shock reduces real earnings in manufacturing and services by 4.8% and 5.3%, respectively, in the following quarter. After six quarters, real earnings paid to new employees decrease by approximately 11.6% in manufacturing and 13.2% in services. Since these industries differ systematically in average wage levels and cyclical exposure to monetary policy, this specification provides a cross-industry comparison of the new-hire earnings response.

In Appendix A.3, we further examine the earnings response by worker education level. Figure A.4 reports estimates for low and high-educated workers in manufacturing and services, and shows that the response is similar across education groups and industries, confirming that the decline in average new-hire earnings is broad. Overall, our empirical results show that a monetary contraction reduces the average earnings firms pay to new hires, a finding that is robust across firm size, industry, and worker education level. In the following section, we incorporate this evidence into the theoretical model and show how the employment decisions of constrained and unconstrained firms are affected differently.

Firm-size-specific Cumulated responses (%) of real earnings to target shock

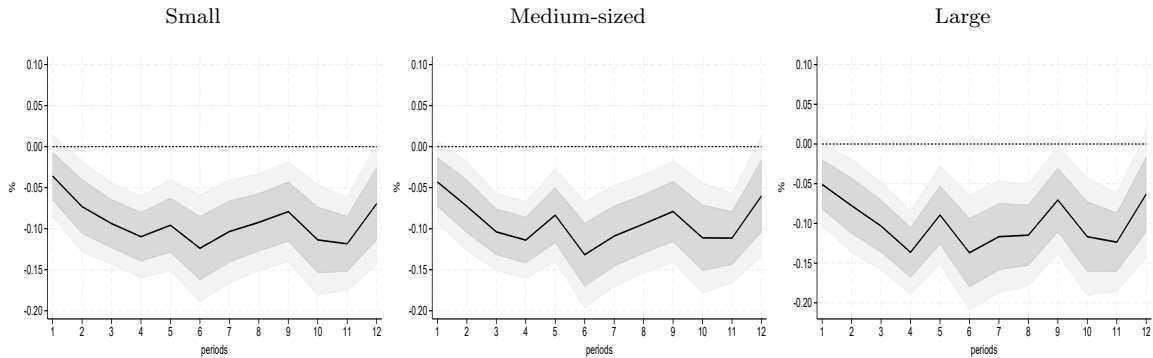


Figure 2: Response of the growth rate of real earnings paid to newly hired employees in small, medium-sized, and large firms to a federal funds rate factor shock.

Notes: The figure plots the responses of the growth rate of average real earnings paid to newly hired employees in stable jobs, for employees who have not worked for the employer in the last four quarters, in small firms (left panel), medium-sized firms (middle panel) and large firms (right panel), to an 1bp increase in the federal funds rate factor shock. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (darker) and 90% (lighter) confidence bands.

Industry-specific cumulated responses (%) of real earnings to target shock

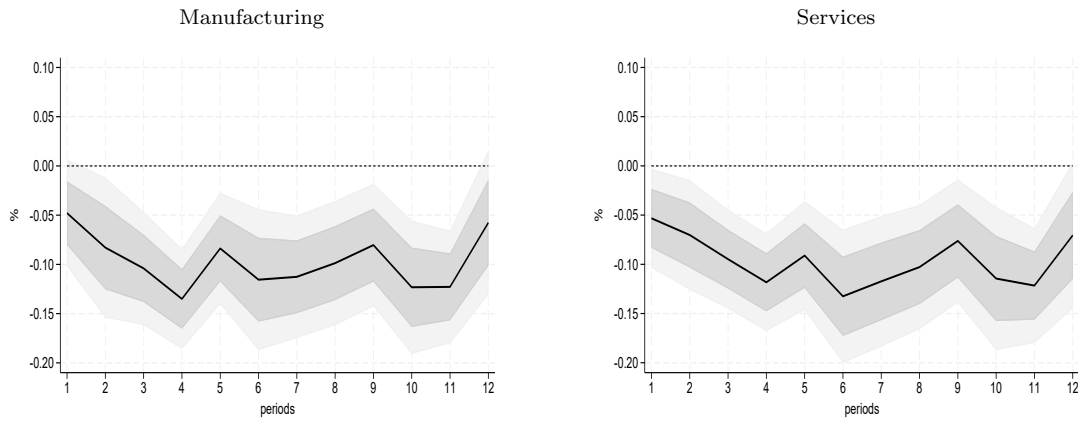


Figure 3: Response of the growth rate of real earnings paid to newly hired employees in manufacturing and service sectors to a federal funds rate factor shock controlling for industry effects.

Notes: The figure plots smoothed responses of the growth rate of average real earnings paid to newly hired employees in stable jobs, in manufacturing (left panel) and services (right panel), to an 1bp increase in the federal funds rate factor shock. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (darker) and 90% (lighter) confidence bands.

4 Homogeneous wage responses, heterogeneous employment responses

We now use the model to examine how a homogeneous wage response translates into heterogeneous employment responses across firms, and to assess the role of this channel relative to other competing channels of monetary transmission. We use firm size as a proxy for financing constraints.¹² Three forces influence the overall employment response of firms: (I) The marginal cost channel: a constrained firm has a steeper marginal-spread curve, so changes in employment are partially self-financed through a lower borrowing cost. (II) The financial accelerator channel: a tightening lowers the illiquid asset price, raising the marginal spread and amplifying the firm’s contraction. Both forces have been discussed in the literature.¹³ (III) The wage-spread channel, our contribution: a monetary-policy-induced wage decline lowers the firm’s working-capital bill and, through the convexity of the spread function, lowers its marginal spread, attenuating the contraction at constrained firms.

A comment on composition effects is in order, since those effects could prevent us from interpreting changes in average earnings (our empirical object) as changes in the per-worker wage (our modeling primitive). As discussed in [Gertler, Huckfeldt, and Trigari \(2020\)](#) and [Hazell and Taska \(2025\)](#), the response of average earnings need not coincide with the response of any individual wage; a contractionary shock that retains low-wage incumbents and lays off high-wage workers, for example, would lower average earnings even with no per worker wage adjustment. The wage-spread channel, however, operates on the firm’s total working-capital bill, $B^j = W^j N^j - D^j$, not on any individual wage. Whether the observed fall in $W^j N^j$ comes from a wage decline or from a composition shift, the firm’s required borrowing falls, the marginal spread λ^j falls, and the firm’s hiring incentive is attenuated; this is what matters for the wage-spread channel.¹⁴ We

¹²Firm size serves as a proxy for financial constraints, following earlier literature (e.g., [Gertler and Gilchrist, 1994](#); [Fazzari et al., 1988](#)). While direct measures of financial constraints, such as credit scores or liquidity ratios, would be preferable, no publicly available dataset jointly provides such measures alongside high-frequency, broad-coverage employment data for the US. The alternative, Compustat, contains firm-level financial information but covers only publicly traded firms and does not report employment at quarterly frequency, making it unsuitable for our purposes. We therefore rely on firm size as a proxy, acknowledging that it is an imperfect measure of financing constraints.

¹³See [Ottonello and Winberry \(2020\)](#) for the marginal cost channel applied to investment, and [Bahaj, Foulis, Pinter, and Surico \(2022\)](#) for the analogous employment channel.

¹⁴The borrowing constraint gives $B^j = W^j N^j - D^j$, where the total wage bill can be written as $W^j N^j = AE \cdot N^j$, with $AE = (1/N^j) \sum_{k=1}^{N^j} w^k$ denoting average earnings across all N^j workers. Differentiating with respect to i gives $\partial B^j / \partial i = (\partial AE / \partial i) \cdot N^j + AE \cdot (\partial N^j / \partial i)$. The wage-spread channel operates through the first term: $(\partial AE / \partial i) \cdot N^j < 0$ since $\partial AE / \partial i < 0$ in the data, so the firm’s required borrowing falls and its marginal spread λ^j falls, attenuating the employment contraction. This holds whether the decline in AE reflects a genuine reduction in per-worker wages or a compositional shift toward cheaper workers; in either case, the total wage bill falls and the channel operates. The second term, $AE \cdot (\partial N^j / \partial i)$, captures the employment response itself, which is the object of study.

use the industry and education information in our data to investigate the composition effect further. First, the industry-specific estimates in Figure 3 show that the earnings decline is present in both manufacturing and services and of similar magnitude, suggesting that a compositional shift across industries is unlikely to be the primary driver. Second, the results are essentially unchanged when industry fixed effects are removed (Figure A.5, Appendix A.4), indicating that between-industry reallocation does not account for the observed decline.¹⁵ Third, Figure A.4 in Appendix A.3 shows that the earnings response is similar across low and high-educated workers within manufacturing and services; a pure composition effect would be expected to produce more heterogeneous responses across education groups than we find. Taken together, these checks are consistent with the earnings decline reflecting at least in part a genuine reduction in per-worker wages, and support its use as a proxy for the wage response in the theoretical analysis.

4.1 Decomposition of employment response

We now describe the three terms that influence the overall response of employment to monetary policy shock.

The net marginal benefit, $\partial MB/\partial i$ response is given by:

$$\frac{\partial MB^j}{\partial i} = \frac{1}{P} \frac{\partial P}{\partial i} - \frac{1}{W^j} \frac{\partial W^j}{\partial i} - 1. \quad (8)$$

where a monetary tightening lowers MB^j both directly, through the financing cost paid on the wage bill (the -1 term), and indirectly, through changes in the real wage $w^j \equiv W^j/P$.¹⁶ In Section 3 we document that real average employees' earnings decrease after a monetary contraction, across all firms (Figure 1) and across small and large firms separately (Figure 2). The response is similar across firm types, with any differences being not statistically significant. For that, we assume in the model that the change in real wage is homogeneous across firms.

Nominal wages fall after a monetary tightening ($\frac{\partial W}{\partial i} < 0$), so the wage term $-\frac{1}{W} \frac{\partial W}{\partial i}$ is positive, partially raising MB . The price-level response, however, is empirically ambiguous and we do not impose a sign on $\frac{\partial P}{\partial i}$. We make instead the weaker assumption, that any price level increase is insufficient to offset the direct financing cost (-1 term), so that $\frac{\partial MB}{\partial i} \leq 0$: monetary

¹⁵The composition concern regarding industries operates at two levels. First, between-industry, a tightening could shift hiring away from high-paying industries toward low-paying ones, decreasing average earnings with no individual wage falling. Within-industry, a tightening can reshuffle the new-hire mix within a sector, e.g., reducing hires of engineers and skilled employees in construction while day-labor hires lower average earnings, absent any per-worker wage adjustment.

¹⁶In real-wage terms, $\partial MB^j/\partial i = -\frac{1}{w^j} \frac{\partial w^j}{\partial i} - 1$.

tightening lowers the net marginal benefit of hiring. We maintain this assumption throughout the analysis.

The marginal spread response $\partial MS^j/\partial i$ is given by

$$\frac{\partial MS^j}{\partial i} = \underbrace{\frac{\partial Q}{\partial i} L^j [\lambda_2^j + (W^j N^j - D^j) \lambda_{12}^j]}_{\text{financial accelerator: } \geq 0} + \underbrace{\frac{\partial W}{\partial i} N^j [2\lambda_1^j + \lambda_{11}^j (W^j N^j - D^j)]}_{\text{wage-spread: } \leq 0}. \quad (9)$$

The first term is the standard financial accelerator effect: a tightening lowers Q , and the spread is (weakly) decreasing in Q ($\lambda_2, \lambda_{12} \leq 0$), so the term is non-negative. The wage-spread channel works in the opposite direction: with $\partial W/\partial i < 0$, the firm's working-capital bill $B^j = W^j N^j - D^j$ falls, the spread λ^j falls, and, because the spread is convex in borrowing ($\lambda_{11} \geq 0$), the *marginal* spread falls by more than the spread itself. Zervou (2014) and Manea (2020) note that a monetary policy induced wage decline reduces firms' working-capital needs, but neither paper discusses the impact on the marginal spread. Bahaj et al. (2022) incorporate spread that is convex in borrowing but set the wage response to zero, leaving the channel inactive. Our contribution, after providing empirical evidence that labor costs respond to monetary policy, is to analyze the implications. Specifically, lower labor costs reduce constrained firms' borrowing needs; the resulting fall in the marginal spread attenuates the constrained firm's employment response, constituting the wage-spread channel.

The employment response $\frac{\partial N^j}{\partial i}$ is given by

$$\frac{\partial N^j}{\partial i} = \Lambda^j \left[\frac{\partial MB}{\partial i} - \frac{\partial MS^j}{\partial i} \right], \quad \Lambda^j \equiv \frac{1}{\frac{1-\alpha}{N^j} + (2\lambda_1^j + \lambda_{11}^j (W^j N^j - D^j)) W^j}. \quad (10)$$

The denominator of Λ^j is positive, so $\Lambda^j > 0$.¹⁷ Because the denominator increases with the spread terms λ_1^j and λ_{11}^j , larger values raise the slope of the marginal spread of hiring $W^j [2\lambda_1^j + \lambda_{11}^j B^j]$, thus Λ^j itself is decreasing in them: firms with a steeper marginal-cost curve have a smaller Λ^j , and hence a smaller employment response to a given shift in the net hiring incentive $MB - MS^j$. Equation (10) is the key equation underlying the comparative-statics analysis below where we compare Λ^j and $\partial MS^j/\partial i$ across firms.

¹⁷Equivalently, $\Lambda^j > 0$ requires $-(\partial MB^j/\partial N^j - \partial MS^j/\partial N^j) > 0$ at the optimum: the marginal benefit rises in N^j slower than the marginal spread. This is the standard second-order condition for an interior profit maximum, the MS^j schedule cuts MB^j from below at N^{j*} , guaranteed in our setup by diminishing returns to labor ($\partial MB^j/\partial N^j = -(1-\alpha)/N^j < 0$) together with a convex external-finance premium ($\partial MS^j/\partial N^j = W^j [2\lambda_1^j + \lambda_{11}^j B^j] > 0$).

Constrained versus unconstrained firms: Since the unconstrained firm, where $j = U$, does not pay a spread for the relevant employment levels considered in our analysis, $\lambda^U = MS^U = 0$ and $\partial MS^U/\partial i = 0$. However, for the constrained firm, where $j = C$ with $B^C > 0$, $\lambda^C > 0$, the $\partial MS^C/\partial i$ is given by (9). Because the unconstrained firm pays no spread, its marginal-cost curve is flatter, giving $0 < \Lambda^C < \Lambda^U$. The differential employment response decomposes into the three channels:

$$\begin{aligned} \frac{\partial N^C}{\partial i} - \frac{\partial N^U}{\partial i} = & \underbrace{(\Lambda^C - \Lambda^U) \frac{\partial MB}{\partial i}}_{\text{(I) Marginal cost: } \geq 0} - \underbrace{\Lambda^C \frac{\partial Q}{\partial i} L^C [\lambda_2^C + (W^C N^C - D^C) \lambda_{12}^C]}_{\text{(II) financial accelerator: } \leq 0} \\ & - \underbrace{\Lambda^C \frac{\partial W}{\partial i} N^C [2\lambda_1^C + \lambda_{11}^C (W^C N^C - D^C)]}_{\text{(III) wage-spread channel: } \geq 0}. \end{aligned} \quad (11)$$

Channels (I) and (III) imply that the employment response to a monetary policy tightening shock is such that $\partial N^C/\partial i > \partial N^U/\partial i$, while the converse is true for channel (II). The net sign of the differential impact determines whether the constrained firm’s employment response is larger or smaller than that of the unconstrained firm; the model is silent on the absolute magnitude of either. For the unconstrained firm, $\partial N^U/\partial i \leq 0$ follows directly from $\Lambda^U > 0$ and $\partial MB/\partial i \leq 0$; the sign of $\partial N^C/\partial i$ is not pinned down by the model. For expositional clarity, the discussion that follows frames the three channels under the empirically relevant case $\partial N^C/\partial i \leq 0$, so that “attenuate” (channels I and III) and “amplify” (channel II) refer to magnitudes of contractions; the algebra and the comparative-statics results themselves do not rely on this sign. In what follows, we discuss the three channels and provide a graphical representation.

Channel-by-channel intuition and graphical depiction: Figures 4–6 build up the three channels in turn. The vertical axes measure MB and MS ; the horizontal axes measure employment N . The downward-sloping MB curve is common to all firms, whereas the convex MS curves differ by firm type: steeper and blue for constrained firms, flatter and black for unconstrained ones.

(I) Marginal cost channel: A monetary tightening lowers the marginal benefit of hiring; MB shifts inward by the same amount for both firms under the homogeneous-wage assumption. How each firm restores $MB = MS$ depends on the slope of its MS . The unconstrained firm has $MS^U = 0$, so cutting workers brings no relief on the marginal-cost side and all the adjustment has to fall on N . The constrained firm lies on an upward-sloping MS^C ($\Lambda^C < \Lambda^U$): a small cut in N shrinks its borrowing, lowers the spread it pays, and restores optimality with a much smaller employment adjustment—the spread acts as a second margin that absorbs part of the shock.

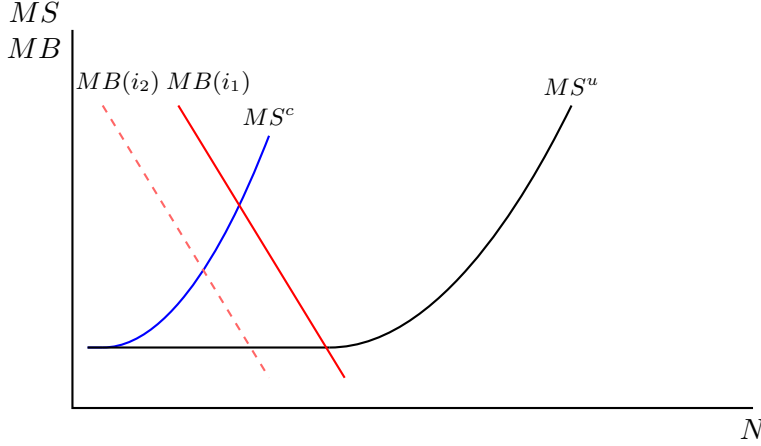


Figure 4: The figure plots MB , MS and the choice of labor of constrained (blue MS^c curve) and unconstrained (black MS^u curve) firms. The constrained firm's MS^c is drawn visibly steeper than MS^u , reflecting $\Lambda^C < \Lambda^U$. After a monetary contraction $i_2 > i_1$, the MB curve moves from red solid to dashed. Model without the accelerator effect and without the change in spread due to the change in employees' earnings.

Along this channel, emphasized by [Ottonello and Winberry \(2020\)](#), the financial constraint *attenuates* the contraction; this is term (I) in (11), which is non-negative.

Figure 4 isolates this channel: only the MB curve shifts inward (red solid to dashed), and the constrained firm scales down less than the unconstrained one because of its steeper MS^C .

(II) Financial accelerator channel: A monetary tightening lowers collateral values ($\partial Q/\partial i < 0$), which raises the marginal spread the constrained firm pays on its working capital, since λ is (weakly) decreasing in collateral ($\lambda_2, \lambda_{12} \leq 0$). The unconstrained firm pays no spread, so this force is absent for it. The constrained firm therefore contracts more than the unconstrained firm along this channel. This is term (II) in (11), which is non-positive. Figure 5 adds this channel: the constrained firm's MS curve shifts inward and steepens (blue solid to dashed), and analogously the unconstrained firm's (black solid to dashed). Drawn with a strong accelerator, the constrained firm now scales down more than the unconstrained one, i.e., the pattern emphasized by [Bahaj, Foulis, Pinter, and Surico \(2022\)](#).

(III) Wage-spread channel: A monetary tightening lowers wages ($\partial W/\partial i < 0$), which reduces the amount the constrained firm needs to borrow to finance its payroll. With a smaller working-capital bill $W^C N^C - D^C$, the firm pays a lower marginal cost on each unit of borrowing. The unconstrained firm pays no spread, so this force is absent for it. The constrained firm therefore contracts less than the unconstrained firm along this channel. This is term (III) in (11), which is non-negative. Figure 6 adds this channel: the wage decline flattens the MS curves (dashed blue to orange for constrained, dashed black to dark green for unconstrained). Even with a strong accelerator, which was dominating the response in Figure 5, the constrained firm contracts less than the unconstrained one once channel (III) is included, the central result of this section. The

figure is drawn so that channels (I) and (III), working in the same direction, together dominate the accelerator channel (II); whether this outcome obtains in general depends on the relative magnitudes of the three channels.

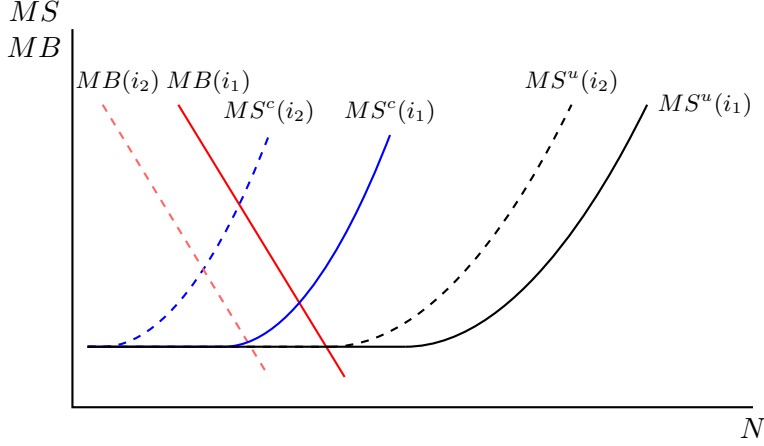


Figure 5: The figure plots MB , MS and the choice of labor of constrained (blue MS^c curve) and unconstrained (black MS^u curve) firms. The constrained MS^c is drawn steeper than MS^u , reflecting $\Lambda^C < \Lambda^U$. After a monetary contraction $i_2 > i_1$, the MB curve moves from red solid to dashed. The financial-accelerator effect shifts the constrained MS^c curve from solid blue to dashed blue and the unconstrained MS^u curve from solid black to dashed black. Model without the change in spread due to the change in employees' earnings.

4.2 Numerical example

To complement the graphical analysis in Figures 4-6, we provide a simple numerical example that suggests that the wage-spread channel is economically meaningful in magnitude. The illustration proceeds in the following steps. First, we adopt a parametric functional form for the financing spread that satisfies the conditions specified in Section 2.1. Second, we calibrate a small set of parameters. Third, we solve for baseline steady-state employment for each firm type. Fourth, we evaluate the employment-response formula in equation (11) analytically and decompose the differential response across firm types into the three distinct channels discussed above.

We specify the financing spread as a power function of leverage:

$$\lambda(B^j, Q_t L^j) = \kappa \left(\frac{B^j}{Q_t L^j} \right)^\varphi, \quad (12)$$

which satisfies all four conditions stated in Section 2.1: $\lambda_1 \geq 0$, $\lambda_{11} \geq 0$, $\lambda_2 \leq 0$, and $\lambda_{12} \leq 0$ for $\varphi \geq 1$.¹⁸ The marginal spread simplifies to $MS^j = (1 + \varphi)\lambda^j$.

We set a labor share of $\alpha = 0.60$ following Karabarbounis and Neiman (2014) and Elsby et al. (2013); also, we set $\varphi = 2$, and $\kappa = 0.05$. The baseline quarterly interest rate is $i_0 = 0.01$ (4%

¹⁸Denoting leverage by $\ell^j \equiv B^j/(Q_t L^j)$, $\lambda_1^j = \varphi \lambda^j / B^j$, $\lambda_{11}^j = \varphi(\varphi - 1)\lambda^j / (B^j)^2$, $\lambda_2^j = -\varphi \lambda^j / (Q_t L^j)$, and $\lambda_{12}^j = -\varphi^2 \lambda^j / (B^j Q_t L^j)$.

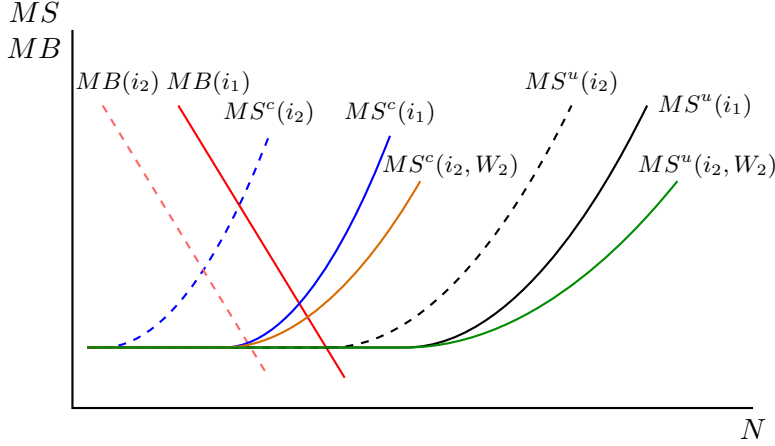


Figure 6: The figure plots MB , MS and the choice of labor of constrained (blue MS curve) and unconstrained (black MS curve) firms. After a monetary contraction $i_2 > i_1$, the MB curve moves from red solid to dashed. The financial-accelerator effect shifts the constrained MS curve from solid blue to dashed blue and the unconstrained MS curve from solid black to dashed black. Once the wage decline is incorporated, the spread curves emanate from the same base employment level as their pre-shock counterparts but are flatter, reflecting the lower marginal cost of hiring at the lower wage: orange for the constrained firm ($MS^c(i_2, W_2)$) and dark green for the unconstrained firm ($MS^u(i_2, W_2)$). The constrained firm's equilibrium shifts back to the right, so it contracts less than the unconstrained firm — the central result of this section. Model with homogeneous changes in earnings growth.

annually). We normalize the baseline wage and price level to $W_0 = P_0 = 1$ and the baseline price of the illiquid asset to $Q_0 = 1$. The constrained firm has near-zero liquid resources $D^C = 0.01$ and illiquid assets $L^C = 0.50$, so that it must borrow the entire wage bill; the unconstrained firm holds sufficient liquid assets so that $B^U = 0$.

We calibrate two semi-elasticities to empirical estimates. We calibrate the real wage semi-elasticity, $\partial w/\partial i = -5$ which corresponds to a 5% real-earnings decline per 100 basis points. This corresponds closely with the impact response we find in our empirical analysis in Section 3.2 and Figures (1)-(3). For the financial accelerator channel we use $\partial Q/\partial i = -4.68$, consistent with [Bernanke and Kuttner \(2005\)](#) (their Table 2, column (b)), who find that a 100 basis points surprise rate cut raises the Center for Research in Security Prices (CRSP) value-weighted index by 4.68% on impact; equivalently, a 100 basis points surprise tightening lowers it by 4.68%, giving $\partial Q/\partial i = -4.68$. A higher value will make the financial accelerator effect stronger in the numerical example.

The unconstrained firm's optimality condition $MB^U = 0$ (since $MS^U = 0$, $\lambda^U = 0$, and $B^U = 0$) yields

$$N^U = \exp\left(\frac{\log \alpha - i_0}{1 - \alpha}\right) \approx 0.272.$$

For the constrained firm, substituting $B^C = N^C - D^C$ and $MS^C = (1+\varphi)\kappa((N^C - D^C)/(Q_0 L^C))^\varphi$ into $MB^C = MS^C$ and solving numerically gives $N^C \approx 0.250$, with implied borrowing $B^C = 0.240$, leverage $\ell^C \equiv B^C/(Q_0 L^C) = 0.480$, and quarterly spread $\lambda^C \approx 1.15\%$.

The employment response multipliers follow from equation (10). For the unconstrained firm, $\Lambda^U = N^U/(1-\alpha) = 0.680$. For the constrained firm, $2\lambda_1^C + \lambda_{11}^C B^C = 0.288$, giving $\Lambda^C = 1/[(1-\alpha)/N^C + 0.288] = 0.530$ and therefore $\Lambda^C < \Lambda^U$. Therefore, the constrained firm's steeper marginal-spread curve reduces the sensitivity of its employment to shifts in net hiring incentives.

We evaluate equation (11) and show the decomposition of the overall effect into the three channels considered in our analysis. Channel (II), the financial accelerator, and (III), the wage-spread effect, are directly pinned down by the two calibrated semi-elasticities. Channel (I), the marginal cost channel, satisfies $(\Lambda^C - \Lambda^U) \partial MB/\partial i \geq 0$ since $\Lambda^C < \Lambda^U$ and under the assumption that $\partial MB/\partial i \leq 0$. That is, Channel (I) emphasizes that monetary tightening worsens hiring incentives, but the constrained firm is less sensitive to any given shift in those incentives, so it contracts less along this channel. For examining this channel, we will consider three different values of $\partial MB/\partial i \leq 0$.

The quantitative question is whether channel (III) alone, the wage-spread effect, pinned by our empirical estimates, is large enough to overturn a strong financial accelerator channel (II). In Table 1, we focus on channels (II) and (III) given baseline values of key parameters of equation (11).

Table 1: Channel Decomposition of Differential Employment Responses

Panel A. Baseline steady state		
N^U		0.272
N^C		0.250
B^C		0.240
λ^C		1.15%
Λ^U		0.680
Λ^C		0.530
Panel B. Channel contributions to $\partial N^C/\partial i - \partial N^U/\partial i$		
(I) Marginal cost:	$(\Lambda^C - \Lambda^U) \partial MB/\partial i$	≥ 0
(II) Financial accelerator:	$-\Lambda^C (\partial Q/\partial i) L^C [\lambda_2^C + B^C \lambda_{12}^C]$	-0.171
(III) Wage-spread:	$-\Lambda^C (\partial W/\partial i) N^C [2\lambda_1^C + \lambda_{11}^C B^C]$	+0.190
Panel C. Net effects		
Financial accelerator alone	(II)	-0.171
Financial accelerator + Wage-spread	(II)+(III)	+0.019
Financial accelerator + Wage-spread + Marginal cost*	(I)+(II)+(III)	+0.170

Notes. Parameters: $\alpha = 0.60$, $\varphi = 2$, $\kappa = 0.05$, $\partial Q/\partial i = -4.68$, $\partial W/\partial i = -5$, * $\partial MB/\partial i = -1.0$.

Without the wage-spread channel: The financial-accelerator channel alone contributes

-0.171 to the differential, that is, the decline in asset values raises the constrained firm's marginal spread, amplifying its contraction relative to the unconstrained firm.¹⁹ Channel (I) partially offsets this, but the differential remains negative whenever $(\Lambda^C - \Lambda^U) \cdot \partial MB/\partial i < 0.171$. Since $\Lambda^C - \Lambda^U = -0.150 < 0$, this simplifies to $\partial MB/\partial i > -0.171/0.150 = -1.14$. This threshold is well below zero, so given the assumption we have made that $\partial MB/\partial i \leq 0$, the financial accelerator channel (II) is stronger than the marginal cost channel (I). This is the outcome depicted in Figure 5, where the accelerator is drawn strong enough that the constrained firm scales down further than the unconstrained one.

With the wage-spread channel: Adding channel (III) contributes $+0.190$, which exceeds the financial-accelerator contribution of 0.171 in absolute value.²⁰ The net of channels (II) and (III) alone is already $+0.019 > 0$: even setting channel (I) to zero, the wage-spread channel is large enough to reverse the sign of the differential. The constrained firm contracts less than the unconstrained firm, the central result of this section, and the outcome depicted in Figure 6. Channel (I), which is non-negative for any $\partial MB/\partial i \leq 0$, only reinforces this conclusion.

The result can be represented in percentage employment terms as well. The percentage employment change for firm j is $(\Lambda^j/N^j) \cdot (\partial MB/\partial i - \partial MS^j/\partial i)$, where $\partial MS^U/\partial i = 0$ for the unconstrained firm. Table 2 reports the percentage responses at three illustrative values of $\partial MB/\partial i$.²¹ Those employment responses are similar in magnitude to responses found in the empirical literature, e.g., 2-6% for 100 basis points monetary policy shock in Bahaj et al. (2022) or in Singh et al. (2025). At $\partial MB/\partial i = -1$, the constrained firm contracts by 2.8% without channel (III) and only 2.0% with it, a reversal of 0.8 percentage points, while the unconstrained firm contracts by 2.5%.²²

Together, the example illustrates that the wage-spread channel is not merely a theoretical possibility: at a wage response of the range documented in Section 3, it is large enough to determine the direction of the differential employment response and reverse the financial accelerator channel.

¹⁹From equation (11), channel (II) equals $-\Lambda^C(\partial Q/\partial i)L^C[\lambda_2^C + B^C\lambda_{12}^C]$. Using $\lambda_2^C = -\varphi\lambda^C/(Q_0L^C) = -0.046$ and $\lambda_{12}^C = -\varphi^2\lambda^C/(B^CQ_0L^C) = -0.384$, this gives $\lambda_2^C + B^C\lambda_{12}^C = -0.138$, and hence $-0.530 \times (-4.68) \times 0.50 \times (-0.138) = -0.171$.

²⁰From equation (11), channel (III) equals $-\Lambda^C(\partial W/\partial i)N^C[2\lambda_1^C + \lambda_{11}^CB^C]$. Using $\lambda_1^C = \varphi\lambda^C/B^C = 0.096$ and $\lambda_{11}^C = \varphi(\varphi - 1)\lambda^C/(B^C)^2 = 0.400$, this gives $2\lambda_1^C + \lambda_{11}^CB^C = 0.288$, and hence $-0.530 \times (-5) \times 0.250 \times 0.288 = +0.190$.

²¹The three values are illustrative; the result holds for any $\partial MB/\partial i \in (-1.80, 0)$, the range over which the financial accelerator dominates the marginal cost channel in percentage terms without the wage-spread channel. The lower bound solves $(\Lambda^C \cdot \partial MB/\partial i - 0.171)/N^C = \Lambda^U \cdot \partial MB/\partial i/N^U$, giving $\partial MB/\partial i = -0.171/(0.250 \times 2.500 - 0.530) = -1.80$.

²²Channel (III) contributes $+0.190$ to the employment differential, exceeding the financial-accelerator contribution of 0.171 in absolute value, so the net spread shift favors the constrained firm. Since $\Lambda^C/N^C = 2.12 < \Lambda^U/N^U = 2.50$ as well, the constrained firm contracts less in percentage terms for any $\partial MB/\partial i < 0$.

Table 2: Employment Change (in %)

	$\partial MB/\partial i$		
	-0.5	-1.0	-1.5
Unconstrained	-1.25%	-2.50%	-3.75%
Constrained, without channel (III)	-1.74%	-2.80%	-3.86%
Constrained, with channel (III)	-0.98%	-2.04%	-3.10%
Differential (C-U), without channel (III)	-0.49 pp	-0.30 pp	-0.11 pp
Differential (C-U), with channel (III)	+0.27 pp	+0.46 pp	+0.65 pp

Notes. Parameters: $\alpha = 0.60$, $\varphi = 2$, $\kappa = 0.05$, $\partial Q/\partial i = -4.68$, $\partial W/\partial i = -5$.

5 Conclusion

In our paper we consider a theoretical model to study how monetary policy affects financially constrained and unconstrained firms differently, with a focus on the labor market, an area less explored compared to investment, in prior research. We incorporate into existing models of monetary transmission the effect of monetary policy on wages. We show how this additional effect influences firms' hiring behavior through financing constraints. We show that a uniform decrease in wages after monetary contractions leads to heterogeneous employment effects.

The mechanism operates through the borrowing spread: as wages fall during a monetary contraction, constrained firms' working-capital bill shrinks, lowering their marginal spread and easing their financing costs. Within the scope of the partial equilibrium model, this has implications for how one interprets the differential response of more financially constrained versus less financially constrained firms to monetary policy. Specifically, the wage-spread channel provides a counterforce to the financial accelerator during contractions, weakening constrained firms' relative disadvantage. Conversely, monetary expansions become a margin at which the relative position of constrained firms is more adversely affected.

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A Appendix

In this section we present the model details and derivations.

A.1 Derivations of Section 2.2

With starting point the maximization problem of the firm, that is, maximizing equation (2):

$$\max_{N_t^j} V(D_t^j; S_t) = \frac{1}{1+i_t} \mathbb{E}_t[V(D_{t+1}^j; S_{t+1})]$$

subject to equation (1):

$$D_{t+1}^j = P_t Y_t^j - (1+i_t)(W_t^j N_t^j - D_t^j) - \lambda_t^j (W_t^j N_t^j - D_t^j),$$

the first-order condition for firm j is as follows

$$\mathbb{E}_t[V'(D_{t+1}^j; S_{t+1})] \left[P_t A_t^j \alpha (N_t^j)^{\alpha-1} - (1+i_t) W_t^j - \left(\lambda_t^j W_t^j + (W_t^j N_t^j - D_t^j) \lambda_1^j \frac{\partial B_t^j}{\partial N_t^j} \right) \right] = 0.$$

The spread cost for hiring the additional worker (the bracketed term) increases both because the firm borrows more to pay the extra worker, i.e., $\lambda_t^j W_t^j$; and because the spread itself increases with extra borrowing, i.e., the $\lambda_1^j \frac{\partial B_t^j}{\partial N_t^j}$ term. Simplifying the above equation, suppressing time subscripts and substituting in $\frac{\partial B^j}{\partial N^j} = W^j$ we have:

$$\alpha P (N^j)^{\alpha-1} = \left[1+i + \left(\lambda^j + (W^j N^j - D^j) \lambda_1^j \right) \right] W^j.$$

Defining the expected value of the marginal product of labor as $MPN^j \equiv P\alpha(N^j)^{\alpha-1}$ and taking logs of the first-order condition, we get the following equation:

$$\log MPN^j = \log \left[(1+i) + \left(\lambda^j + (W^j N^j - D^j) \lambda_1^j \right) \right] + \log W^j.$$

Taking a first-order Taylor expansion of $i + \left(\lambda^j + (W^j N^j - D^j) \lambda_1^j \right)$ around zero we derive the following expression:²³

$$\log(MPN^j) - \log W^j - i = \lambda^j + (W^j N^j - D^j) \lambda_1^j.$$

²³Using a first-order Taylor approximation of $\log(1+i+x)$ around $i+x=0$, for a quarterly interest rate of about 0.01, gives $\log(1+i+x) \simeq i+x$. We use = in place of the formal \simeq for what follows.

The above equation is equation (4) in the main text, where we define

$$MB^j \equiv \log(MPN^j) - \log W^j - i = \log P + \log \alpha + (\alpha - 1) \log N^j - \log W^j - i,$$

as the marginal benefit from hiring an additional worker. Similarly, we define the marginal spread on the borrowing cost to finance the wage of the marginal worker as

$$MS^j \equiv \lambda^j + (W^j N^j - D^j) \lambda_1^j.$$

For all firms, we have that $MB^j - MS^j = 0$, with $MS^j = 0$ for firms that do not need to borrow, i.e. $B^j = 0$.

A.2 Alternative measure of real earnings

Figure A.1 shows the response to a monetary policy contraction of the growth rate of real earnings paid to all newly hired employees, including those who had taken a break and were rehired by the current employer (*EarnHirAS*). A surprised monetary policy contraction of 100 basis points decreases the real earnings paid to the employees by 12.1% after 6 quarters.



Figure A.1: Response of the growth rate of real earnings paid to all newly hired employees who managed to keep their job long enough for it to become stable to a federal funds rate factor shock.

Notes: The figure plots the responses of the growth rate of average real earnings paid to all newly hired employees in stable jobs to an 1bp increase in the federal funds rate factor shock. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (darker) and 90% (lighter) confidence bands.

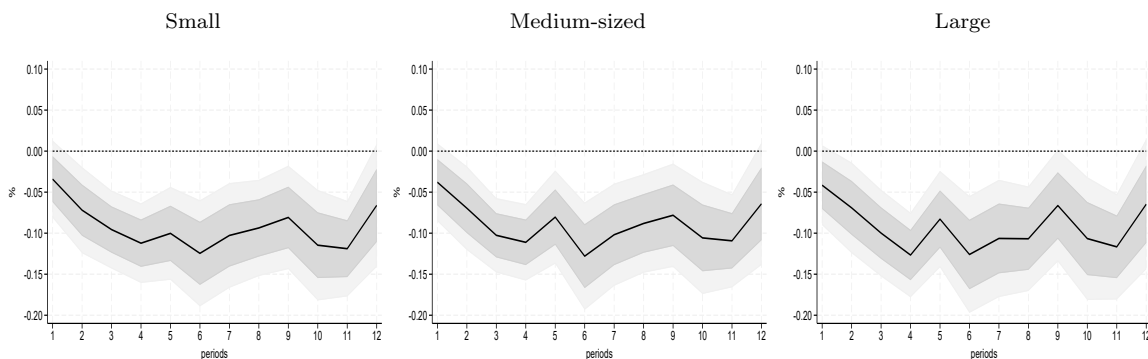


Figure A.2: Response of the growth rate of real earnings paid to all newly hired employees in small, medium-sized, and large firms to a federal funds rate factor shock.

Notes: The figure plots the responses of the growth rate of average real earnings paid to all newly hired employees in stable jobs, in small firms (left panel), medium-sized firms (middle panel) and large firms (right panel), to an 1bp increase in the federal funds rate factor shock. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (dark grey) and 90% (lighter grey) confidence bands.

Figure A.3 shows that after a 100 basis point tightening, the real earnings paid to the new employees decrease by about 12% in manufacturing and 12.4% in the service industry.

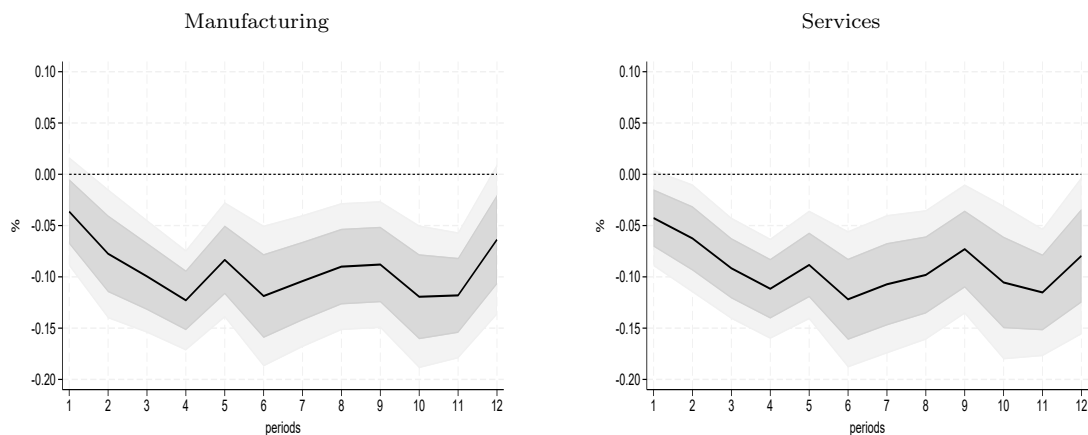


Figure A.3: Response of the growth rate of real earnings paid to newly hired employees in manufacturing and service sectors to a federal funds rate factor shock controlling for industry effects.

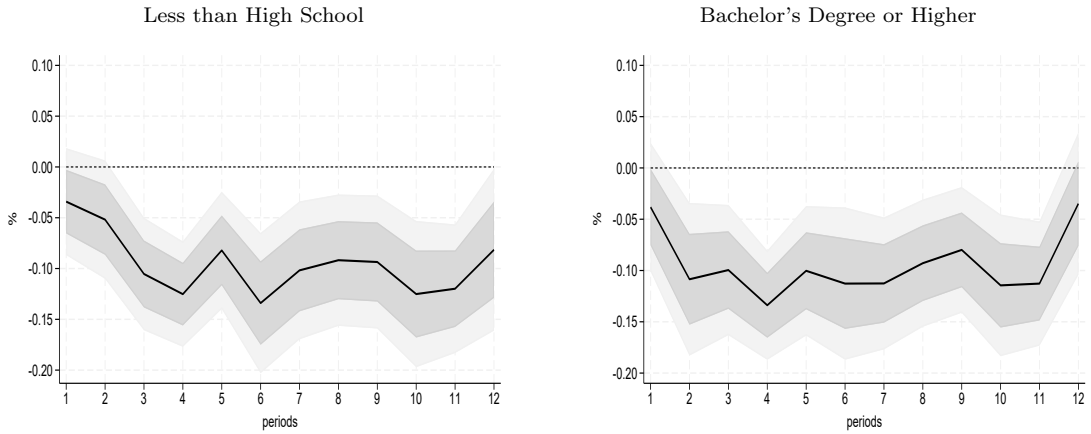
Notes: The figure plots smoothed responses of the growth rate of average real earnings paid to all newly hired employees in stable jobs, in manufacturing (left panel) and services (right panel), to an 1bp increase in the federal funds rate factor shock. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (darker) and 90% (lighter) confidence bands.

A.3 Education

To check for the presence of a composition effect in our sample, we estimate the impact of monetary policy surprises on the real earnings of low- and high-educated workers in the manufacturing and services sectors. The corresponding impulse response functions are displayed in Figure A.4. The figure shows that the effect of monetary policy on average earnings is similar across education levels and industries, which argues against a composition effect and supports the use of average new-hire earnings as a proxy for wages in the theoretical analysis.

Industry- and education-specific cumulated responses (%) of real earnings to target shock

Manufacturing



Services

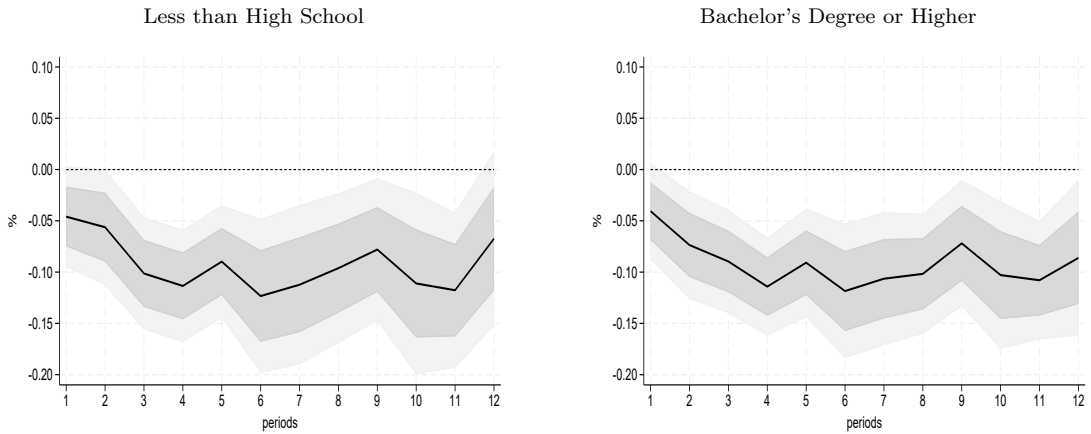


Figure A.4: Response of the growth rate of real earnings paid to newly hired employees in manufacturing and service sectors of employees with low and high level of education to a federal funds rate factor shock controlling for industry effects.

Notes: The figure plots smoothed responses of the growth rate of average real earnings paid to all newly hired employees in stable jobs, in manufacturing (top panels) and services (bottom panels) of employee with Less than High School education (left panels) and with Bachelor's Degree or Higher (right panels), to an increase in the federal funds rate factor shock. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (darker) and 90% (lighter) confidence bands.

A.4 Without industry effects

Here we show the simplified (former baseline) specification, which does not include industry fixed effects.



Figure A.5: Response of the growth rate of real earnings paid to newly hired employees without controlling for industry effects.

Notes: The figure plots smoothed responses of the growth rate of average real earnings paid to all newly hired employees in stable jobs to an 1bp increase in the federal funds rate factor shock without fixed effects. The horizontal axis shows quarters, the vertical axis the percent response to a one bp shock; shaded areas are 68% (darker) and 90% (lighter) confidence bands.