Financing from Workers: Can Labor Market Power Mitigate Financial Frictions?*

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Abstract

We show that firms with labor market power can partially offset financial distress by obtaining financing from workers. Using U.S. Census quarterly employer-employee data, we find that workers in highly leveraged firms experience slower earnings growth following unexpected disinflation shocks that increase the real burden of firms' nominal debt. This response is stronger for firms with greater labor market power. We find no evidence of subsequent earnings compensation or increased worker separations, suggesting that workers remain despite relatively lower pay. We then develop a heterogeneous-firm model with labor market power and endogenous default risk. Quantitatively, labor market power mitigates about one-quarter of the negative effects of financial distress. Even the average wage declines less than in a competitive labor market. This mitigation arises because, with heterogeneous firms, labor market power allows firm-specific wage adjustment, which reduces misallocation and stabilizes the economy more effectively than a uniform equilibrium wage decline in a competitive labor market.

Keywords: Inflation, debt disinflation, financial friction, labor market power, business cycles, firm heterogeneity.
JEL Codes: E31, E32, E44, G32, J31, J42.

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1 Introduction

A large literature has established the consequences of firm financial frictions over business cycles, including their effects on firm dynamics, the amplification of recessions, and the need for policy interventions to subsidize distressed firms. Building on this literature, our paper studies an underexplored channel that can potentially mitigate the impact of financial frictions: firms exploit their labor market power to lower worker earnings growth during periods of financial distress. We label this channel *financing from workers*.

We investigate this channel in two steps. First, we provide micro-level empirical evidence supporting the hypothesis. Using U.S. Census employer–employee matched data, we document that workers in highly leveraged firms experience slower earnings growth following unexpected disinflation shocks that increase the real burden of firms' nominal debt. This response is stronger for firms with greater labor market power, as measured by a higher Herfindahl-Hirschman Index (HHI), higher local employment shares, and lower unionization rates. We find no evidence of subsequent earnings compensation or increased worker separations, suggesting that workers remain with their firms despite relatively lower pay, consistent with the presence of firms' labor market power.

Second, we quantify the aggregate implications of financing from workers by constructing a dynamic general equilibrium model with heterogeneous firms that possess monopsony power in the labor market and face endogenous default risk. When jobs are imperfectly substitutable across firms, firms face an upward-sloping labor supply curve. As a result, firms can pay lower wages to remaining workers when financial distress reduces their labor demand. Calibrated to U.S. firm financing patterns and job substitutability, the model shows that labor market power mitigates about one-quarter of the negative effects of financial distress relative to a counterfactual with competitive labor markets. In a perfectly competitive labor market, the equilibrium wage also falls when labor demand declines. However, with heterogeneous firms, firm-specific wage adjustments arising from labor market power stabilize the economy more effectively than a uniform wage decline.

Our main empirical analysis estimates how workers' earnings growth responds when firms are subject to adverse financial shocks. A key challenge is finding shocks that affect firms' financial conditions while leaving productivity or other conditions largely unchanged. This requirement rules out productivity shocks or monetary policy shocks. In addition, we prefer shocks that are observable and occur frequently over business cycles. Rare financial events—such as the Great Recession or the collapse of Lehman Brothers—are informative but occur too infrequently to generalize broadly across business cycles.

We find that unexpected disinflation shocks satisfy both criteria. Such shocks occur when realized inflation falls short of expectations formed when debt contracts were originated. Because most debt contracts are denominated in nominal terms and unindexed to inflation, such

shocks increase firms' debt burdens even when productivity remains unchanged (Fisher, 1933). Moreover, they generate substantial cross-firm variation in financial distress: firms with higher debt experience larger increases in their real debt burdens for the same disinflation shock. In this sense, disinflation acts as a general financial shock that reduces firms' net worth.

Motivated by the well-established debt-deflation channel, we construct quarterly unexpected inflation shocks as the difference between realized and expected inflation. We measure firm-level exposure to state-level inflation as the employment-weighted average of inflation across the states in which they employ workers, using state-level inflation data from Hazell, Herreno, Nakamura, and Steinsson (2022). Expected inflation is proxied by the median expectation from the Survey of Consumers, assuming financial markets are integrated across U.S. states so that expected inflation embedded in nominal interest rates is the same across states.

We then merge the constructed inflation shocks with two other quarterly datasets: the U.S. Census Bureau's Longitudinal Employer–Household Dynamics (LEHD) and Compustat Quarterly. These data allow us to track workers over time and link them to firm characteristics from Compustat. Using the local projection method, we regress individual workers' earnings growth on the interaction between firms' leverage and unexpected disinflation shocks. This specification exploits the variation that firms with higher ex-ante debt levels experience larger increases in their real debt burdens following disinflation. We include worker, firm, state, and sector-by-quarter fixed effects to control for unobserved heterogeneity. We also control for unemployment and monetary policy shocks that are typically correlated with inflation, as well as firm characteristics.

We find that workers in high-leverage firms experience relatively slower earnings growth following unexpected disinflation shocks. Standard implicit contract theory would interpret this pattern as implicit *borrowing* from workers, predicting that these workers should subsequently experience higher earnings growth to compensate for the initial losses. However, we observe no such compensation. Nor do we observe a significant increase in separations. Workers remain with their firms despite relatively lower pay. We therefore interpret these results as suggesting firms' labor market power: financially distressed firms can pay relatively lower earnings without significantly losing workers.

To test this hypothesis, we exploit variation in firms' labor market power, for which we construct three commonly used measures. Using LEHD data, for each local labor market defined as an industry within a commuting zone, we compute the HHI of employment across firms and each firm's local employment share. We also compute unionization rates at the state–industry level. Higher HHIs, larger employment shares, and lower unionization rates indicate greater monopsony power in the labor market. We then extend our baseline regression by including a triple interaction between a labor market power measure, firm leverage, and unexpected disinflation. Following unexpected disinflation shocks, high-leverage firms with greater labor market power exhibit even slower earnings growth among their workers across all

three measures of labor market power. These results support our hypothesis that *financing from workers* arises from firms' labor market power.

Our empirical analysis further shows that employment growth at high-leverage firms declines more following disinflation shocks. Given the insignificant response of worker separations, we examine firms' hiring and find that these firms reduce hiring more sharply, leading to slower employment growth. Taken together, the empirical results suggest that financially distressed firms pay relatively less to workers and downsize their workforce primarily by limiting new hiring rather than by separating from existing workers.

To quantify the aggregate implications of the financing-from-workers mechanism, we develop a dynamic general equilibrium model with heterogeneous firms. The model features both labor market power and financial frictions. Labor market power arises because jobs are imperfectly substitutable across firms, so each firm faces an upward-sloping labor supply curve. Financial frictions arise because firms borrow through state-uncontingent debt contracts and have the option to default, with default being costly. Firms choose employment and commit to nominal wage payments before productivity shocks are realized, making employment a risky commitment that affects default risk.

Either labor market power or financial frictions in isolation leads to inefficiently low employment. Labor market power generates both aggregate and allocative inefficiency. On the aggregate margin, firms pay wages at a markdown relative to the marginal product of labor and employ fewer workers than under perfect competition. On the allocative margin, more productive firms employ more workers but must pay higher wages along their upward-sloping labor supply curves. Their marginal products of labor therefore become higher than those of less productive firms, rather than being equalized at a common wage as under perfect competition. This dispersion in marginal products generates misallocation of labor.

Financial frictions also reduce efficiency. Firms commit to employment before productivity shocks are realized, making labor a risky investment. When realized productivity is low, a firm may be unable to cover its wage bill and debt repayments, forcing it into default. As a result, when choosing employment, firms not only weigh the standard trade-off between the marginal cost of labor and its expected marginal product, but also account for the additional marginal cost associated with higher default risk. Default risk therefore creates a labor wedge in firms' employment decisions, pushing employment below the efficient level. This wedge varies across firms depending on their financial conditions, also generating allocative inefficiency.

The interaction of the two frictions, however, mitigates allocative inefficiency during financial distress. An adverse financial shock, such as unexpected disinflation, erodes firms' net worth and raises default risk, discouraging employment especially at highly leveraged firms. Labor market power provides an additional margin of adjustment: along an upward-sloping labor supply curve, firms can lower wages for remaining workers as they reduce employment. Thus,

firms need not cut employment as much to manage default risk. Lenders also recognize this mitigation channel and offer more favorable bond pricing schedules, which lower borrowing costs and further alleviate financial distress.

We calibrate the model to U.S. data on firm financing patterns and job substitutability. The calibrated model reproduces the heterogeneous responses observed in the data: following a disinflation shock that increases firms' real debt burdens, firms with higher ex-ante leverage reduce wages by more. To quantify the aggregate implications of the financing-from-workers mechanism, we compare our benchmark model with a counterfactual model with perfectly competitive labor markets. Both models are calibrated to the same empirical targets, including leverage and credit spread moments. Their stationary distributions are therefore comparable along these dimensions.

We compare the two models' responses to an unexpected disinflation shock. In general equilibrium, competitive wages can also fall, easing firms' financial constraints even without labor market power. Even so, the benchmark model with labor market power exhibits a substantially milder contraction: the declines in output and employment are smaller by 24.6% and 21.7%, respectively, and the lifetime welfare loss is reduced by 25.1%. Counterintuitively, although labor market power allows individual firms to lower wages, the decline in average wages is also 21.7% smaller than in a competitive labor market.

The key is firm heterogeneity. Financial frictions generate firm-specific distortions: financially constrained firms cut employment more, and some high-productivity firms are forced to exit. Labor market power allows firms to make firm-specific wage adjustments based on their own financial conditions. More financially constrained firms shrink more and reduce wages by more, while less constrained firms adjust less. These wage adjustments allow labor costs to respond more closely to firms' financial conditions, preserving employment at productive but financially constrained firms and mitigating the misallocation generated by financial frictions.

As a result, labor market power stabilizes the economy more effectively than a uniform equilibrium wage decline in a competitive labor market. The smaller contraction in aggregate labor demand reduces the decline in average wages. Financing from workers thus operates differently at the micro and macro levels: at the firm level, it shifts adjustment from employment to wages; at the aggregate level, it improves allocation and stabilizes both employment and average wages.

Related Literature. Our paper contributes to several strands of the macro-finance and macro-labor literature. First, our model builds on the large literature studying the macroeconomic consequences of firm financial frictions (e.g., Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Cooley, Marimon, and Quadrini, 2004; Arellano, Bai, and Zhang, 2012; Buera and Shin, 2013; Khan and Thomas, 2013; Midrigan and Xu, 2014; Moll, 2014; Gomes, Jermann, and Schmid, 2016; Gilchrist, Schoenle, Sim, and Zakrajšek, 2017; Arellano, Bai, and Kehoe, 2019; Ottonello

and Winberry, 2020; Wang, 2026; Bai, Lu, Tian, and Wang, 2026). This literature shows how borrowing constraints and default risk shape firm dynamics and amplify business cycle fluctuations. We introduce labor market power as a mechanism through which firms can partially relax financial constraints. Our contribution is to quantify the extent to which labor market power alleviates financial distress, with the model disciplined by micro-level data.

Second, our study is motivated by the growing body of research on firms' labor market power. Manning (2021), Rossi-Hansberg, Sarte, and Trachter (2021), Berger, Herkenhoff, and Mongey (2022), and Yeh, Macaluso, and Hershbein (2022) estimate the degree of firms' monopsony power in the U.S. Researchers examine its implications along multiple dimensions, including worker mobility (Bagga, 2023), wage pass-through (Chan, Mattana, Salgado, and Xu, 2023), inequality (Deb, Eeckhout, Patel, and Warren, 2024), competition for workers (Jarosch, Nimczik, and Sorkin, 2024), selection (Nevo, 2024), comparative advantage (Bils, Kaymak, and Wu, 2025), the transmission of monetary policy (Bardóczy, Bornstein, Maggi, and Salgado, 2025), and information frictions (Cheremukhin and Restrepo-Echavarria, 2025). We complement this literature by highlighting the interaction between labor market power and financial frictions. While each distortion is inefficient in isolation, we show that labor market power can partially offset financial frictions by allowing financially distressed firms to finance through workers.

Third, a considerable amount of research has shown that firms provide insurance to workers against shocks to their productivity, largely because firms typically have better access to financial markets (e.g., Baily, 1974; Azariadis, 1975; Guiso, Pistaferri, and Schivardi, 2005; Rute Cardoso and Portela, 2009; Souchier, 2025). In contrast, our study asks: do workers insure firms during financial distress? Our findings suggest the answer is yes. Using U.S. employer–employee matched data, we find that firms facing adverse financial shocks can partially finance through workers via their labor market power.

Fourth, more recent work studies credit within firms (Michelacci and Quadrini, 2009; Guiso, Pistaferri, and Schivardi, 2013; Michaels, Page, and Whited, 2019; Malgieri and Citino, 2024; Wang, 2025). Existing studies primarily analyze cross-sectional patterns and document a "*borrowing*-from-worker" mechanism, in which new employees accept lower initial wages in exchange for steeper future wage growth—an intertemporal contract akin to a loan from workers to firms. We take a different approach: using quarterly data, we estimate local projections to trace workers' earnings dynamics at business cycle frequencies. We do not find evidence that firms "repay" workers. Instead, workers in financially distressed firms experience persistently lower earnings growth, without later compensatory increases. This suggests that "*financing*-from-workers" does not necessarily require backloaded wages through implicit contracts, but can instead arise directly from firms' monopsony power.

Lastly, our work complements the large literature on wage dynamics. One strand studies rent sharing between firms and workers (e.g., Abowd and Lemieux, 1993; Blanchflower, Oswald, and Sanfey, 1996; Card, Cardoso, Heining, and Kline, 2018). While this literature interprets wage

responses as the sharing of firm rents, we show that wage adjustments can also arise from firms using labor market power to manage expected default risk. Another strand of the literature studies wage rigidity (e.g., Favilukis, Lin, and Zhao, 2020; Fukui, 2020; Schoefer, 2021; Bertheau et al., 2022; Afrouzi et al., 2024; Blanco et al., 2025; Hazell and Taska, 2025). Our "financing-from-workers" mechanism does not contradict existing evidence on downward wage rigidity. Empirically, we compare relative earnings growth across firms, while nominal wage levels need not decline. In fact, our equilibrium model suggests that the average wage declines less during a financially driven recession when firms have labor market power.

The rest of the paper proceeds as follows. Section 2 documents empirical evidence using U.S. Census employer-employee matched data. Section 3 develops a heterogeneous firm model with labor market power and firm default risk. Section 4 quantifies the model to explore aggregate implications of financing from workers. Section 5 concludes.

2 Empirical Analysis

This section starts with a simple model to motivate our empirical analysis, followed by a description of the data, the regression specifications, and the empirical evidence.

2.1 Motivating Simple Model

Here, we present a simple static model to illustrate the mechanism and motivate our empirical design. Firms produce output y using labor n according to $y = zn^{\alpha}$, where $z \in [\underline{z}, \bar{z}]$ denotes productivity. Firms also face financial shocks ζ that reduce their profitability. Each firm observes its financial shock ζ and then chooses its labor input n before productivity z is realized.[1]

Firms have monopsony power and face an upward-sloping labor supply curve $w(n) = n^{\frac{1}{\eta}}\bar{w}$. Due to financial frictions, firms cannot take on new debt or issue new equity, which corresponds to a non-negative dividend (NND) constraint:

$$zn^{\alpha} - w(n)n - \zeta \geq 0, \ \forall z. \tag{1}$$

We illustrate the roles of financial frictions and labor market power by comparing three cases: (i) an efficient benchmark without frictions, (ii) a case with financial frictions alone, and (iii) a case with both financial frictions and labor market power.

[1] This timing assumption is specific to the static model. In the full dynamic model (Section 3), firms choose labor before observing either shock.

Proposition 1 (Efficient Case) *When firms have no labor market power and face complete financial markets, the optimal labor n^* is independent of financial shocks ζ and satisfies*

$$\alpha\,\mathbb{E}(z)(n^*)^{\alpha-1} = \bar{w}. \tag{2}$$

Proof: Appendix A. With a competitive labor market, all firms pay the same wage $\bar{w}$. Under complete markets, firms can use state-contingent debt to ensure non-negative cash flows in every state. As a result, the non-negative dividend condition never binds. The firm's problem reduces to choosing labor to maximize expected profit before the realization of shocks: $\max_n \mathbb{E}\left(zn^\alpha - \bar{w}n - \zeta\right)$. This implies that equation (2) holds: the expected marginal product equals its marginal cost. Clearly, financial shocks ζ have no impact on the optimal labor under complete financial markets.

Now suppose labor markets remain competitive, but firms face financial frictions: they can neither borrow nor issue equity. In this case, firms choose labor to maximize expected payoff and must satisfy the NND condition (1). Namely,

$$\max_n \mathbb{E}\left(zn^\alpha - \bar{w}n - \zeta\right), \;\; \text{s.t. } \; zn^\alpha - \bar{w}n - \zeta \geq 0, \; \forall z. \tag{3}$$

Proposition 2 (Financial Frictions Only) *With financial frictions but no labor market power, a firm's optimal labor satisfies*

$$\alpha\,\mathbb{E}(z)n^{\alpha-1} = \frac{1+\gamma}{1+(\underline{z}/\mathbb{E}\,z)\gamma}\bar{w}, \tag{4}$$

where $\gamma \geq 0$ is the Lagrangian multiplier associated with the NND condition. Furthermore, larger financial shocks reduce labor.

Proof: Appendix A. The key mechanism is the pre-committed labor choice combined with linearly increasing labor costs: firms that choose larger labor inputs face greater default risk when productivity z realizes at low values. The efficient labor n^*—which maximizes expected profit—may be too risky for low realizations of z, potentially leading to insolvency (e.g., $\underline{z}(n^*)^\alpha - \bar{w}n^* - \zeta < 0$). Thus, firms consider both marginal profit and insolvency risk when making decisions, yielding the first-order condition in equation (4). The *labor wedge* $\frac{1+\gamma}{1+(\underline{z}/\mathbb{E}\,z)\gamma}$ captures the gap between the firm's marginal product of labor and the wage $\bar{w}$, reflecting the distortion caused by financial frictions. When $\gamma > 0$, the optimal labor is smaller than efficient labor n^* since $\underline{z} < \mathbb{E}\,z$, and firms choose labor to satisfy the NND condition under the lowest z: $\underline{z}n^\alpha - \bar{w}n - \zeta = 0$.

Now, financial shocks ζ directly affect firm labor choices. A larger financial shock tightens the NND condition, increases the multiplier γ, thereby amplifying the labor wedge and reducing employment.

We next consider the case with both labor market power and financial frictions. To compare

the two cases, we start from the same employment and wage, with the NND condition binding in both cases.

Proposition 3 (Both Financial Frictions and Labor Market Power) *With both frictions, the firm's optimal labor satisfies*

$$\alpha \mathbb{E}(z) n^{\alpha-1} = \frac{1+\gamma}{1+(\underline{z}/\mathbb{E}\, z)\gamma} \frac{1+\eta}{\eta} w(n). \tag{5}$$

Starting from the same employment and wage with binding NND constraints, a larger financial shock reduces both firm-specific wages and labor. However, the response of labor to financial shocks is smaller than under financial frictions alone.

Proof: Appendix A. As before, a larger financial shock tightens the NND condition, raising γ, which amplifies the labor wedge and reduces labor. With an upward-sloping labor supply curve, however, the reduction in employment lowers the wages of all remaining workers since $w(n) = n^{\frac{1}{\eta}} \bar{w}$. This wage decline partially relaxes the NND condition and lowers γ, so the required reduction in labor is smaller than it would be without labor market power. We refer to this mechanism as *financing from workers*.

2.2 From Model to Data

The three cases in our simple model demonstrate a key feature of the financing-from-workers mechanism: firm-specific wages fall in response to adverse financial shocks. To test this prediction, we need to find shocks that tighten firms' financial conditions. Nominal debt contracts provide a way to do so. Nominal repayments are fixed when contracts are signed. If inflation turns out to be lower than expected (*unexpected disinflation*), the real burden of debt rises (Fisher, 1933; Gomes, Jermann, and Schmid, 2016). For a given disinflation shock, firms with more outstanding nominal debt face a larger increase in real debt burden.[2] We use this difference in exposure to study how wages respond when firms' financial conditions tighten.

2.2.1 Deriving the Wage Response to Unexpected Disinflation

We extend the simple model to incorporate nominal debt and disinflation shocks. Suppose firms borrow a nominal amount B_t in period $t-1$ at gross nominal interest rate $(1+i_{t-1}) = (1+r_{t-1})\pi_t^e$, where $1+r_{t-1}$ is the gross real interest rate and π_t^e is the expected gross inflation rate for period t formed in period $t-1$. Firms choose labor after observing realized inflation but before their idiosyncratic productivity shock z_t materializes.[3] Let P_t be the price level at period t. The firm's

[2] Consistent with this debt-disinflation channel, prior empirical work finds that firms with more debt benefit more from inflation (Chen, Liu, and Luo, 2022; Bhamra, Dorion, Jeanneret, and Weber, 2023; Fabiani and Piersanti, 2023; Corhay and Tong, 2025).

[3] In our full dynamic model, firms choose labor before the realization of all shocks, including inflation shocks.

nominal dividend is $P_t z_t n_t^\alpha - P_t w_t n_t - (1 + i_{t-1})B_t$. We define real debt as $b_t = B_t/P_{t-1}$ and inflation $\pi_t = P_t/P_{t-1}$.

Firms solve the following problem

$$\max_{n_t} \mathbb{E}\left(z_t n_t^\alpha - w(n_t)n_t - (1 + r_{t-1})\frac{b_t}{\pi_t/\pi_t^e}\right), \text{ s.t. } z_t n_t^\alpha - w(n_t)n_t - (1 + r_{t-1})\frac{b_t}{\pi_t/\pi_t^e} \geq 0, \ \forall z. \quad (6)$$

When $\pi_t/\pi_t^e < 1$, the economy experiences unexpected disinflation, which raises the real burden of both principal and interest payments, acting as a financial shock in our simple model. Suppose an unexpected disinflation shock causes the NND condition to bind. Then n_t solves $\underline{z} n_t^\alpha - w(n_t)n_t - (1 + r_{t-1})\frac{b_t}{\pi_t/\pi_t^e} = 0$, which implies

$$d \ln w = \frac{1}{\eta} \frac{(1 + r_{t-1})}{\alpha \underline{z} n_t^\alpha - \frac{1+\eta}{\eta} w(n_t)n_t} b_t \times d\left(\frac{1}{\pi/\pi^e}\right). \quad (7)$$

We can prove that under the constrained optimal labor, the marginal profit under $\underline{z}$ is negative, i.e., $\alpha \underline{z} n_t^\alpha - \frac{1+\eta}{\eta} w(n_t)n_t \leq 0$. Thus, the wage growth Δwage has the following property:

$$\Delta\text{wage} = \beta \times \text{ debt} \times \text{disinflation}, \quad (8)$$

where $\beta = \frac{1}{\eta} \frac{(1+r_{t-1})}{\alpha \underline{z} n_t^\alpha - \frac{1+\eta}{\eta} w(n_t)n_t} \leq 0$ captures the markdown and the negative marginal profit.

The equation predicts that, for a given disinflation shock, wages fall more at firms with more debt. These firms face a larger increase in the real value of their debt payments. This tightens the NND constraint and leads them to reduce employment. As they move down their upward-sloping labor supply curves, wages fall. This prediction guides the local projections in Section 2.4.

To give a real-world example, we compare how two oil producers with different leverage responded to the 2014–2016 oil bust (see Appendix B). During the bust, the global oil price fell by more than 70%, sharply reducing the revenue producers earned per barrel. Denbury Resources entered the bust with high leverage. As oil prices fell, it cut employment, froze base salaries, and reduced bonuses. ExxonMobil entered the bust with substantially lower leverage and showed more resilient performance. In October 2015, S&P lowered Denbury's credit rating from BB to BB− and maintained ExxonMobil's AAA rating.

2.2.2 Why Use Unexpected Disinflation?

We use unexpected disinflation as an adverse financial shock for four reasons.

First, unexpected disinflation helps us isolate the financial channel through which wages

can fall. The shock itself does not directly affect the marginal product of labor. Demand shocks, by contrast, are not suitable. For example, although the oil bust provides a useful case study, oil prices fell relative to input costs. This acted much like an adverse demand shock for oil producers. It lowered the marginal revenue product of labor, so even producers facing no financial frictions would cut employment and wages. Productivity shocks have a similar problem. We also exclude monetary policy shocks because they affect wages through several channels, including changes in demand and borrowing costs.

Second, the debt-disinflation mechanism yields a clear prediction: for a given disinflation shock, wages fall more at firms with higher leverage. We can test this prediction by comparing firms with different levels of pre-shock leverage. This comparison does not require a direct measure of firms' financial constraints, which is empirically challenging.

Third, the coefficient β in equation (8) has an interpretation beyond unexpected disinflation. Consider any financial shock ζ that reduces a firm's cash on hand. When the NND constraint $\underline{z}n^{\alpha} - w(n)n - \zeta = 0$ binds, $\beta/(1 + r_{t-1})$ is the semi-elasticity of wages with respect to ζ.

Fourth, unexpected disinflation is measurable and occurs frequently across business cycles. This allows us to run panel regressions over a long sample period. Rare financial events—such as the Great Recession or the collapse of Lehman Brothers—are informative, but they occurs too infrequently to generalize broadly across business cycles.

2.3 Data

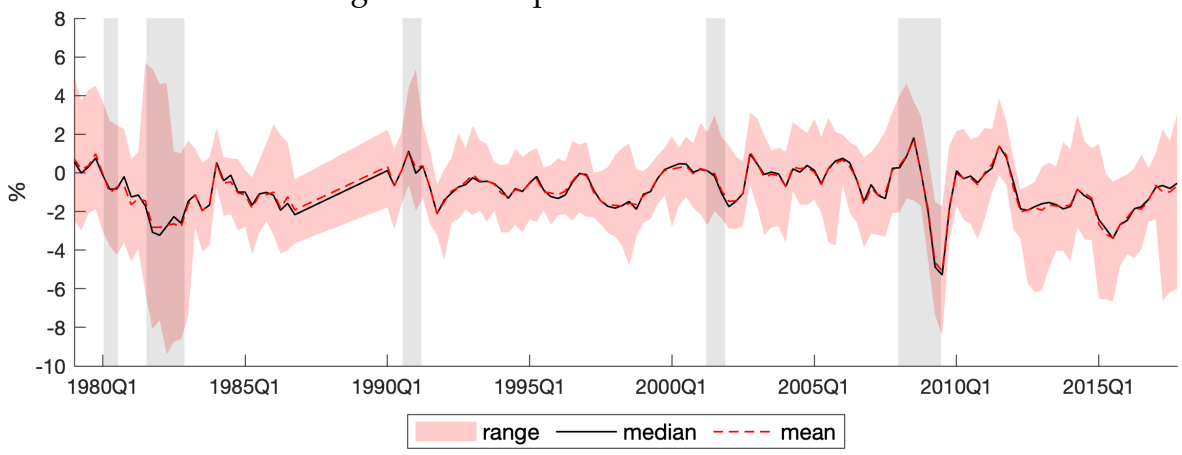
We use data from three main sources: the U.S. Census Longitudinal Employer-Household Dynamics (LEHD), Compustat, and macro-level data as supplements. This allows us to build a quarterly panel that matches employers and employees, providing detailed information on individual workers' earnings and job separations, as well as firms' financial conditions and shocks.

We randomly draw 10% of workers from the LEHD Snapshot 2021, which provides employees' quarterly earnings and firm identifiers.[4] We use a 10% sample rather than the full sample to alleviate the computational burden of high-dimensional fixed-effects regressions. The LEHD is based on UI wage records, recording any job with positive earnings. Unlike datasets that only report total wage bills, the LEHD provides individual workers' earnings, enabling us to control for worker heterogeneity in regressions and avoid the compositional effects of heterogeneous employees on firms' wage bills.

Using firm identifiers in the LEHD, we merge worker-firm data from the LEHD with Com-

[4] We have access to workers' earnings records for 24 states in the LEHD: Arizona, California, Colorado, Connecticut, Delaware, Indiana, Kansas, Maine, Maryland, Massachusetts, Missouri, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Utah, Virginia, and Wisconsin. However, we can observe whether each worker in our sample receives earnings in any state in the United States.

Figure 1: Unexpected Inflation Shocks



Note: This figure plots the state-level unexpected inflation $\epsilon^{\pi}_{st} = \pi_{st} - E_{t-4}\pi_t$. The solid black line shows the median across states, the dashed red line represents the mean, and the red shaded area depicts the min-max range.

pustat Quarterly through the Longitudinal Business Database (LBD) and the Compustat-SSEL Bridge (CSB). Compustat Quarterly provides firm-level balance sheet data. Our primary measure of firms' financial condition is leverage, defined as the ratio of total debt to total assets, where total debt is the sum of a firm's short-term and long-term debt.

Next, we construct inflation shocks. A natural candidate is aggregate inflation minus expected inflation; however, this measure faces several challenges. First, inflation shows little variation at the aggregate level, making estimates highly sensitive to model specification and measurement choices (Mavroeidis, Plagborg-Møller, and Stock, 2014; Hazell, Herreno, Nakamura, and Steinsson, 2022). Second, since monetary policy targets national inflation, variation at the aggregate level is further dampened (McLeay and Tenreyro, 2020; Fitzgerald and Nicolini, 2014). Third, relying on aggregate inflation increases the risk of omitted variable bias, as many factors may move simultaneously at the aggregate level.

To address these concerns, we construct firm-level exposure to state-level inflation shocks using an employment-weighted (shift-share) measure:

$$\epsilon^{\pi}_{jt} = \sum_{s} \omega^{j}_{st} \pi_{st} - E_{t-4}\pi_t, \tag{9}$$

where j indexes firms, s represents states, and t denotes quarter. The first term, $\sum_s \omega^j_{st}\pi_{st}$, is firm j's exposure to state-level inflation, constructed as the employment-weighted average of inflation across the states in which the firm employs workers. We obtain state-level 12-month CPI inflation, π_{st}, at a quarterly frequency from Hazell, Herreno, Nakamura, and Steinsson (2022), which covers the period from 1978 to 2018. Using Census LEHD data, we compute each firm's employment shares across states as $\omega^j_{st} = \frac{n^j_{st}}{\sum_s n^j_{st}}$, where n^j_{st} denotes firm j's employment

Table 1: Summary Statistics

Variables	Notation	N (observations)	Mean	St. Dev.
Worker earnings growth	$\Delta \ln w_{ijt}$	29,700,000	0.055	0.327
Firm-level exposure to unexpected inflation	ϵ^{π}_{jt}	29,700,000	-0.007	0.013
State-level unexpected inflation	ϵ^{π}_{st}	29,700,000	-0.008	0.015
Firm leverage	lev_{jt}	29,700,000	0.268	0.181
Worker separation indicator	$\mathbb{1}^{\text{separation}}_{ijt}$	48,980,000	0.078	0.269

This table shows the summary statistics of the main variables used in the regressions. This research was performed at a Federal Statistical Research Data Center under FSRDC Project Number 2652. (CBDRB-FY22-P2652-R9856) The numbers are rounded according to the Census Bureau's disclosure avoidance requirements.

in state s at time t.

The second term, $E_{t-4}\pi_t$, is the median expected inflation over the next 12 months from the University of Michigan's Survey of Consumers. Using this measure assumes that financial markets are integrated within the United States and that there is no arbitrage, so that expected inflation embedded in nominal interest rates is common across states.

To visualize the range of inflation shocks, we compute state-level unexpected inflation as $\epsilon^{\pi}_{st} = \pi_{st} - E_{t-4}\pi_t$. Figure 1 plots its range over time, showing significant variation across states and over time. By construction, firms' employment-weighted unexpected inflation, ϵ^{π}_{jt}, lies within this range.

Lastly, we obtain state-level unemployment from Hazell, Herreno, Nakamura, and Steinsson (2022) and monetary shocks from Gürkaynak, Karasoy-Can, and Lee (2022) as control variables in our regressions. The merged sample spans from 1989 to 2017. It contains 29,700,000 observations, including 2,071,000 unique workers and 6,400 unique firms. Table 1 reports summary statistics for the main variables used in the regressions.

2.4 Local Projections

Our goal is to test whether firms can finance through workers when facing adverse financial shocks. Motivated by our simple model, we use the interaction between a firm's leverage and disinflation shocks to capture adverse financial shocks. Intuitively, disinflation increases firms' real debt burden and worsens their financial situations, especially for firms with ex-ante high leverage. To alleviate such financial pressure, firms may reduce the growth of wage payments to workers.

2.4.1 Responses of Worker Earnings

Motivated by eq. (8) in our simple theory, we estimate the following local projection regression (Jordà, 2005) to examine the heterogeneous responses of workers' earnings growth to increases in firms' real debt burden:

$$\ln w_{ijt+h} - \ln w_{ijt-4} = \beta_h (lev_{jt-5} - \mathbb{E}_j[lev_{jt}])(-\epsilon^{\pi}_{jt-1}) + \Gamma_h' Z_{jt-1} + \alpha_{ih} + \alpha_{jh} + \alpha_{sh} + \alpha_{cth} + e_{ijth}, \ h \geq 0, \tag{10}$$

where $\ln w_{ijt+h} - \ln w_{ijt-4}$ is the earnings growth of worker i in firm j from time $t-4$ to $t+h$, with h denoting the forward-looking horizon. lev_{jt-5} is firm j's leverage in $t-5$, which is lagged to capture ex-ante leverage and avoid overlap with the left-hand side earnings growth. $\mathbb{E}_j[lev_{jt}]$ is the average leverage of firm j, so the demeaned leverage, $lev_{jt-5} - \mathbb{E}_j[lev_{jt}]$, represents within-firm leverage variations, following Ottonello and Winberry (2020). ϵ^{π}_{jt-1} denotes firm j's unexpected inflation shock at quarter $t-1$, with the one-quarter lag mitigating simultaneity between inflation and earnings growth.

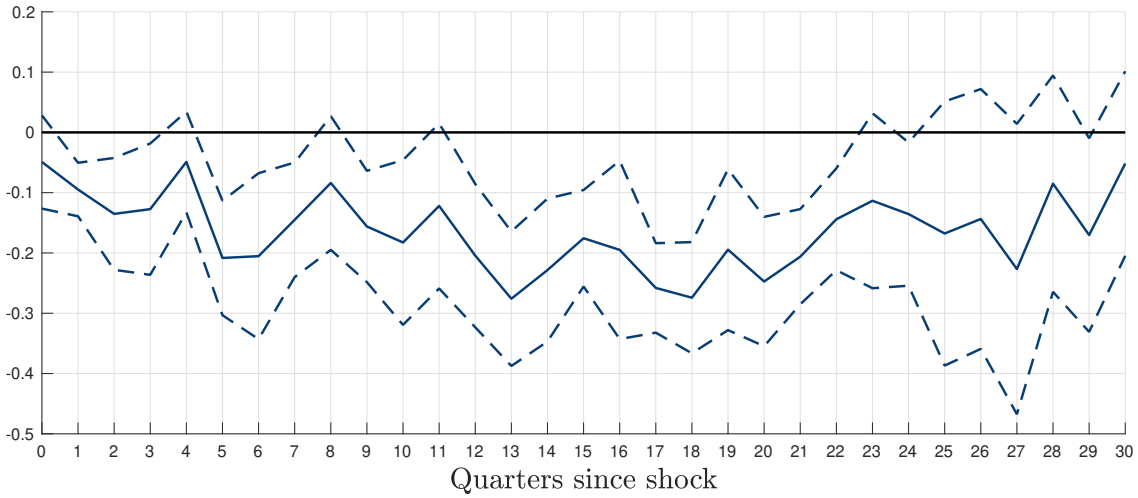
The vector of control variables, Z_{jt-1}, includes lagged firm-level exposure to unexpected inflation, ϵ^{π}_{jt-1}; the corresponding lagged employment-weighted unemployment rate across states, u_{jt-1}; demeaned leverage, $lev_{jt-5} - \mathbb{E}_j[lev_{jt}]$; the interaction between demeaned leverage and lagged exposure to state-level unemployment; and the interaction between demeaned leverage and lagged monetary policy shocks from Gürkaynak, Karasoy-Can, and Lee (2022). In addition, following Ottonello and Winberry (2020), we include lagged total assets, lagged sales growth, lagged current assets as a share of total assets, and a fiscal-quarter dummy. The regression also includes worker fixed effects α_{ih}, firm fixed effects α_{jh}, state fixed effects α_{sh}, and sector-by-quarter fixed effects α_{cth}. The error term is denoted by e_{ijth}. Standard errors are two-way clustered by firm and quarter, as in Ottonello and Winberry (2020).

The coefficient of interest is β_h. We make two adjustments to facilitate its interpretation. First, we include a minus sign in front of ϵ^{π}_{jt-1}, so β_h captures the heterogeneous responses to unexpected disinflation. Second, we standardize the demeaned leverage to have a mean of zero and a standard deviation of one.

Figure 2 presents the estimated β_h along with the 90% confidence intervals for the regression specification (10). The coefficient β_h is significantly negative in 21 quarters. Specifically, a 1-percentage-point unexpected disinflation reduces earnings growth by approximately 0.1% on impact for workers at firms with one standard deviation higher leverage. It takes about five years for these workers' earnings to fully recover, as the estimated coefficient stops being significant.

Cumulatively, relative to workers at firms with mean leverage, workers at firms with one standard deviation higher leverage experience an earnings loss equivalent to 3.96% of one quarter's baseline earnings. Suppose the higher-leverage firm received a cash transfer equal to this earnings loss across its workforce. Our back-of-the-envelope calculation suggests that the

Figure 2: Heterogeneous Responses of Worker Earnings Growth



Note: The figure plots the estimated coefficients (β_h) with their corresponding 90% confidence intervals from equation (10), showing the heterogeneous responses of workers' earnings growth to unexpected disinflation shocks, conditional on firm leverage.

transfer would offset roughly 29% of the increase in its real debt burden.[5]

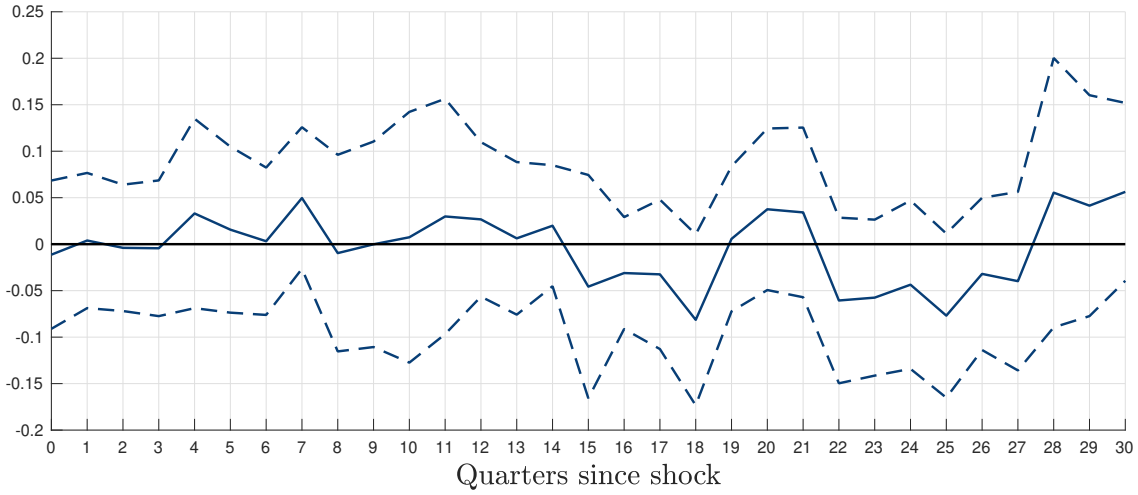
Importantly, our empirical finding does not suggest that firms *borrow* from workers. As shown in Figure 2, the estimated β_h remains negative for around 21 quarters before becoming statistically insignificant, and it never turns significantly positive. This pattern indicates that workers in high-leverage firms experience persistently lower earnings growth relative to those in low-leverage firms, without subsequent compensation in the form of higher earnings growth. We interpret this as evidence of firms exercising monopsony power to *finance* from workers, rather than backloading repayment.

2.4.2 Responses of Worker Separations

We further study the heterogeneous responses of separations. We re-estimate regression (10), replacing the dependent variable with the separation indicator $\mathbb{1}^{\text{sep}}_{ijt+h}$, which equals one if worker i has positive earnings from firm j in quarter $t+h$ but no earnings from firm j in $t+h+1$. Figure 3 presents the results, showing no significant heterogeneous responses of separations to unexpected disinflation. This suggests that while highly leveraged firms provide relatively

[5] According to the BLS, the average quarterly wage from 1989 to 2023 is \$10,556.8. In Compustat, the average firm employs 8,511 workers. The cumulative earnings loss is 3.96% of one quarter's baseline earnings, reducing payroll by \$3.56 million on average ($10{,}556.8 \times 8{,}511 \times 3.96\% \div 10^6$). Average debt in Compustat is \$763.65 million, and average assets are \$2,525.44 million. Holding assets fixed, a one-standard-deviation increase in leverage (0.181) raises debt to \$1,220.75 million ($763.65 + 0.181 \times 2{,}525.436$). A 1% unexpected disinflation therefore increases the higher-leverage firm's real debt burden by \$12.21 million. Thus, a cash transfer of \$3.56 million would offset roughly 29% ($3.56 \div 12.21$) of the increase in the debt burden.

Figure 3: Heterogeneous Responses of Worker Separations



Note: The figure plots the estimated coefficients (β_h) with their corresponding 90% confidence intervals from equation (10), replacing the dependent variable with the separation indicator $\mathbb{1}^{\text{sep}}_{ijt+h}$. It shows the heterogeneous responses of workers' separation probability to unexpected disinflation shocks, conditional on firm leverage.

lower earnings in response to unexpected disinflation, workers still remain working in these firms—further supporting the presence of monopsony power.

These empirical results validate our hypothesis that firms can finance through workers by reducing workers' earnings growth when facing financial distress. Note that these findings do not contradict the literature on downward wage rigidity, as our focus is on relative earnings growth across firms with different leverage, so absolute nominal wages may not necessarily decline.

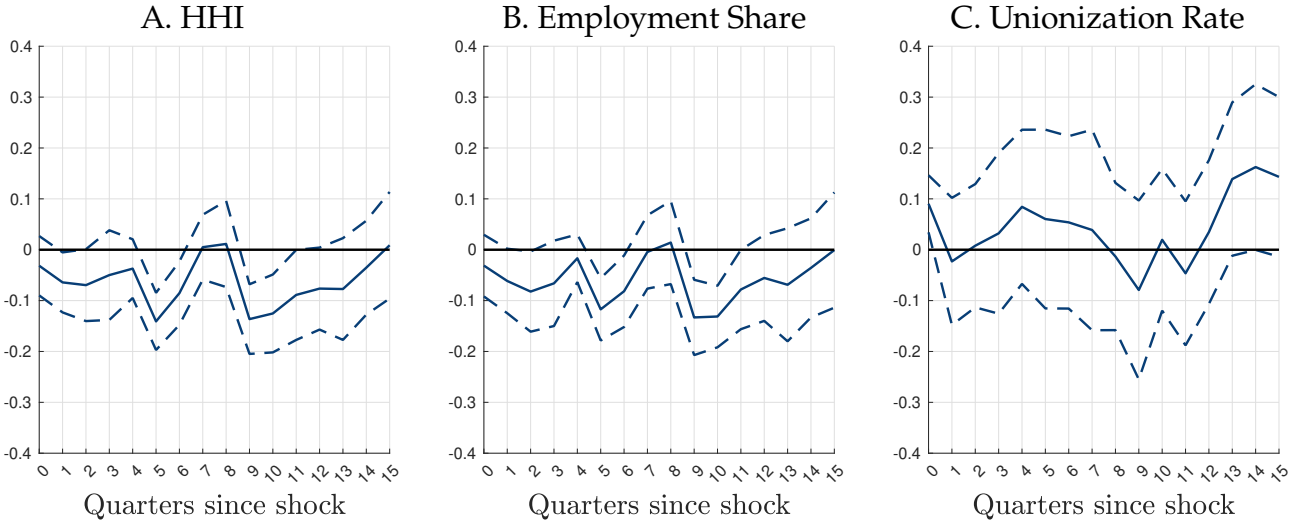
2.4.3 Roles of Labor Market Power

If our hypothesis is correct, then firms with greater labor market power should exhibit larger declines in worker earnings growth following adverse financial shocks. To test this prediction, we extend the benchmark regression (10) by including a triple interaction term—along with the corresponding double interactions—to capture how the response to leverage and disinflation varies with firms' labor market power:

$$\left(lev_{jt-5} - \mathbb{E}_j\left[lev_{jt}\right]\right) \times \left(-\epsilon^{\pi}_{jt-1}\right) \times \left(LMP_{ijt-5} - \mathbb{E}_j\left[LMP_{ijt}\right]\right),$$

where LMP_{ijt-5} denotes measures of labor market power. We consider three commonly used measures: the Herfindahl-Hirschman Index (HHI) of the job's local labor market, employment share of firm j in the job's local labor market, and the unionization rate. As with leverage, all labor market power measures are lagged and demeaned at the firm level.

Figure 4: Responses of Earnings Growth Conditional on Firms' Labor Market Power



Note: The figures plot the coefficients of the triple interaction $\left(lev_{jt-5} - \mathbb{E}_j\left[lev_{jt}\right]\right)\left(-\epsilon^{\pi}_{jt-1}\right) \times$ labor market power from an extension of equation (10) with this triple interaction, under three different measures of labor market power. Panel A uses the Herfindahl-Hirschman Index, Panel B uses the employment share in the local labor market, and Panel C uses the unionization rate to approximate a firm's labor market power. Note that a higher HHI, a higher employment share, or a lower unionization rate implies higher labor market power. Dashed lines are 90% confidence intervals.

Specifically, a firm's labor market power increases with its Herfindahl–Hirschman Index (HHI) and local employment share, and decreases with the unionization rate. HHIs and employment shares are computed using LEHD data, where a local labor market is defined as the firm's industry within the commuting zone in which the job pair ij is located. Unionization rates are obtained from the Current Population Survey (CPS), aggregated to the state–industry level, and merged using firms' industry classifications and job locations.

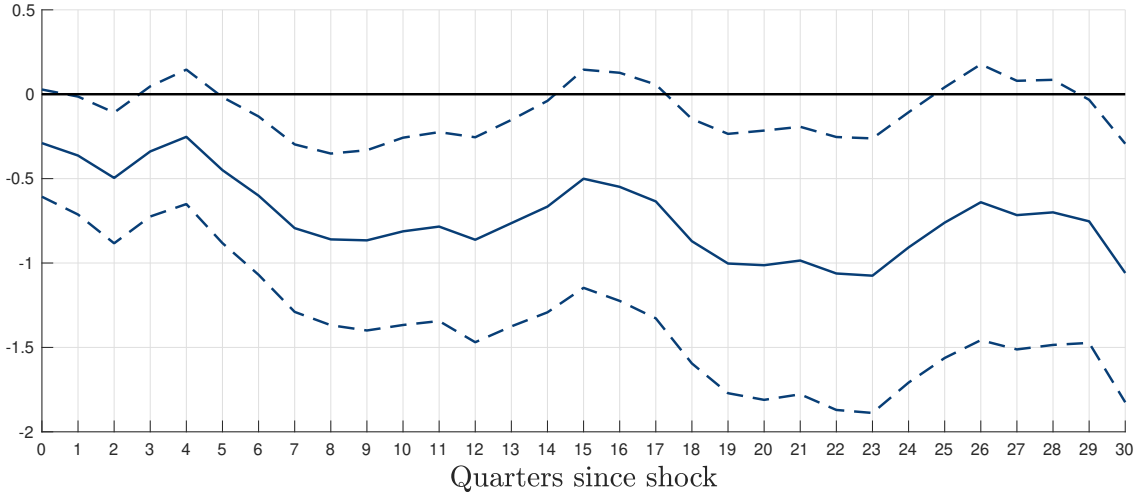
Figure 4 displays the coefficients on the triple interaction across all three labor market power measures. The results consistently show that workers experience larger earnings growth declines when employed by firms with higher leverage and greater labor market power during disinflation shocks. Estimates using unionization rates have larger standard errors, as the underlying survey data are noisier. These findings further support our hypothesis that firms rely on labor market power to finance through workers.

2.4.4 Responses of Firm-Level Employment and Hiring

We next analyze the heterogeneous response of firm employment to the disinflation shocks. We consider a firm-level regression as

$$\ln n_{jt+h} - \ln n_{jt-4} = \beta_h(lev_{jt-5} - \mathbb{E}_j[lev_{jt}])(-\epsilon^{\pi}_{jt-1}) + \Gamma_h' Z_{jt-1} + \alpha_{jh} + \alpha_{sh} + \alpha_{cth} + e_{jth},\ h \geq 0, \quad (11)$$

Figure 5: Heterogeneous Responses of Firms' Employment Growth



Note: The figure plots the estimated coefficients (β_h) with their corresponding 90% confidence intervals from equation (11), showing the heterogeneous responses of firms' employment growth to unexpected disinflation shocks, conditional on firm leverage.

where the dependent variable, $\ln n_{jt+h} - \ln n_{jt-4}$, is the employment growth rate of firm j from period $t-4$ to period $t+h$. The explanatory variables remain the same as in the previous specifications, except for the removal of worker fixed effects. Figure 5 reveals how employment responds to unexpected disinflation shocks: highly leveraged firms exhibit significantly lower employment growth, with the decline most pronounced around the 8th quarter after the shock.

Taken together with the earnings decline in Figure 2, the employment response suggests that firms face upward-sloping labor supply curves—earnings fall as employment declines. Motivated by this, our model incorporates an upward-sloping labor supply curve to capture firms' labor market power.

The combination of reduced employment growth and no significant changes in separations (Figure 3) indicates that firms primarily adjust their workforce through reduced hiring rather than increased separations. To test this, we define new hires in the LEHD as workers with positive earnings from the firm in the current period but none in the previous period. We re-estimate the firm-level regression in equation (11), using hiring growth as the dependent variable. Panel A of Figure C.7 in the Appendix confirms that highly leveraged firms reduce hiring growth more than other firms following a disinflation shock.

2.4.5 Robustness and Other Results

Here we present a series of robustness checks and explore alternative shocks and firm-level outcomes. For our baseline regression on worker earnings growth, we (i) replace firm-level exposure to state-level inflation with aggregate inflation; and (ii) use inflation in firms' head-

quarters states instead of the employment-weighted average across states. To test for asymmetries in the debt-deflation channel, we separately examine unexpected inflation and unexpected disinflation shocks. We also investigate heterogeneous responses to monetary policy shocks and disentangle the roles of leverage and debt maturity. In addition, we examine the responses of worker layoffs (involuntary separations), apart from overall separations. Finally, we extend the analysis to study how firm-level investment responds to unexpected disinflation shocks.

Alternative Disinflation Measures. Our baseline regression uses firm-level exposure to state-level disinflation shocks, which provides greater variation and reduces concerns about omitted variable bias relative to aggregate measures. Nevertheless, to account for the possibility that some firms set prices based on national inflation conditions, we conduct a robustness check using aggregate CPI inflation to construct inflation shocks common to all firms. Figure C.1 in the appendix plots the estimated coefficients β_h from equation (10) using aggregate unexpected disinflation. The results are similar to our baseline findings: workers' earnings growth declines in response to unexpected disinflation shocks when they are employed by highly leveraged firms.

Another hypothesis is that firms set product prices based on inflation in the state where their headquarters are located, rather than on inflation in all states in which they have employees. To accommodate this possibility, we use firms' headquarters-state inflation as our measure of realized inflation and construct unexpected disinflation shocks accordingly. This approach also introduces meaningful cross-state variation in inflation shocks that is less subject to aggregate monetary-policy smoothing. Figure C.2 in the appendix reports the regression results, which are similar to our baseline findings: workers employed by highly leveraged firms experience lower earnings growth following an unexpected disinflation shock.

Responses to Inflation and Disinflation Shocks. To examine whether workers' earnings growth responds differently to inflation and disinflation shocks, we decompose ϵ^{π}_{jt-1} into unexpected inflation shocks, $\epsilon^{\pi}_{jt-1}\mathbb{1}\{\epsilon^{\pi}_{jt-1} \geq 0\}$, and unexpected disinflation shocks, $\epsilon^{\pi}_{jt-1}\mathbb{1}\{\epsilon^{\pi}_{jt-1} < 0\}$. We then run the regression with leverage interactions for both components. Figure C.3 presents the estimated coefficients for the two interaction terms in Panels A and B, respectively. The results indicate that earnings responses are statistically significant for both inflation and disinflation shocks; the estimated coefficients for inflation shocks are larger in magnitude but are accompanied by larger standard errors.

Monetary Policy Shocks. The literature has emphasized the effect of monetary policy shocks on firm investment in the presence of financial frictions. To account for this channel, our baseline regression includes monetary policy shocks and their interaction with firm leverage as controls. Figure C.4 shows that the coefficient on this interaction is insignificant, indicating no heterogeneous response of workers' earnings growth to monetary policy shocks.

Debt Maturity. Following Gomes, Jermann, and Schmid (2016), who emphasize the importance

of long-term debt for firms' investment decisions, we test the robustness of our results using a measure of debt maturity—defined as the ratio of long-term debt to total debt. Panel A of Figure C.5 shows that incorporating debt maturity does not materially affect the baseline coefficients on the interaction between leverage and disinflation shocks. Panel B further shows that the interaction between debt maturity and disinflation shocks is statistically insignificant.

Layoffs. Figure 3 shows that the response of worker separations is statistically insignificant. Note that separations include both voluntary and involuntary separations (i.e., layoffs). To assess whether layoffs respond differently, we re-estimate regression (10), replacing the dependent variable with a layoff indicator, $\mathbb{1}^{\text{lay}}_{ijt+h}$. Although the LEHD data do not directly distinguish layoffs from other separations, we define the layoff indicator to equal one if worker i has positive earnings from firm j in quarter $t + h$ but has no earnings from firm j in $t + h + 1$ and no earnings from any other firm in the U.S. Hyatt, McEntarfer, McKinney, Tibbets, and Walton (2014) show that this definition closely matches layoff patterns observed in the Job Openings and Labor Turnover Survey (JOLTS). Figure C.6 shows that the response of layoffs to unexpected disinflation shocks is also statistically insignificant.

Firm-Level Investment. Finally, we examine heterogeneous firm-level investment responses to disinflation shocks. Since investment does not directly involve workers, we estimate the firm-level regression in equation (11), using investment as the dependent variable. Investment is measured as the log change in firms' capital stock from Compustat. Panel B of Figure C.7 presents the estimated coefficients for the interaction between firm leverage and disinflation shocks. We find no statistically significant investment response. Accordingly, we abstract from capital in our model.

In summary, using employer–employee matched data and firm-level exposure to unexpected disinflation shocks, we find that workers experience slower earnings growth following disinflation shocks when employed by highly leveraged firms, which also exhibit larger declines in employment growth. This heterogeneity in earnings responses is more pronounced for firms with greater labor market power. Our findings are robust across a range of alternative specifications and empirical setups. Taken together, the results reveal a novel mechanism through which firms, during periods of financial distress, obtain financing from workers by exercising monopsony power.

To assess the macroeconomic implications of this mechanism, below we construct a heterogeneous firm model incorporating both labor market power and firm-level default risk. Using this model, we can quantify the aggregate impact of financing from workers and evaluate the extent to which it helps the economy insure against financial distress.

3 Model

This section explores how labor market power interacts with financial frictions. We consider a closed economy with a representative household and a continuum of measure-one firms. The model features three key elements: (i) households view jobs across firms as imperfect substitutes, giving firms *labor market power* and firm-specific wages; (ii) firms face *financial frictions*: they can only borrow through state-uncontingent bonds and may default; and (iii) the *timing* assumes employment and nominal wages to be set before shocks are realized, making employment a risky commitment that affects default risk. We abstract from aggregate uncertainty, except for a one-time unexpected disinflation shock, and study the subsequent perfect-foresight transition in Section 4.4.

3.1 Households

Aggregate labor supply is a CES aggregate of labor supplied to individual firms,

$$N_t = \left[\int_0^1 n_{jt}^{\frac{\eta+1}{\eta}} dj \right]^{\frac{\eta}{\eta+1}}, \tag{12}$$

where η is the elasticity of substitution and $1/\eta$ reflects firms' labor market power. When $\eta \to \infty$, the labor market becomes perfectly competitive. As discussed in Berger, Herkenhoff, and Mongey (2022), this imperfect substitutability across jobs can be micro-founded with workers' preferences over firms, different amenities offered by firms, or the cost of switching jobs, etc.

The representative household has per-period utility $u(C_t, N_t)$ and discount factor β. It supplies labor n_{jt} to firm j, with aggregate labor N_t defined in equation (12). In period $t-1$, firm j contracts employment n_{jt} and the nominal wage W_{jt} for period t, before period-t shocks are realized. Let P_t denote the price level and $\pi_t \equiv P_t/P_{t-1}$ gross inflation. Define $w_{jt} \equiv W_{jt}/P_{t-1}$, so that the real value of the wage rate in period t is $W_{jt}/P_t = w_{jt}/\pi_t$.

The household owns firms. Let s_{jt} denote its beginning-of-period holdings of firm j's shares, p^e_{jt} the real ex-dividend price per share, and d_{jt} the real dividend per share. The household finances firms' borrowing through domestic financial intermediaries, which purchase firm bonds and issue Arrow–Debreu securities contingent on the next-period aggregate state. Let $A_{t+1}(S')$ denote the portfolio's nominal payoff in state S' and $q^a_t(S')$ the time-t price per unit of nominal payoff. Define $a_{t+1}(S') \equiv A_{t+1}(S')/P_t$.

The household also receives real lump-sum transfers T_t. Taking wages, asset prices, dividends,

and transfers as given, the household solves

$$\max_{\{C_t, n_{jt}, a_{t+1}(\cdot), s_{j,t+1}\}_{t\geq 0}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(C_t, N_t) \tag{13}$$

$$\text{s.t. } C_t + \sum_{S'} q_t^a(S') a_{t+1}(S') + \int_0^1 p_{jt}^e s_{j,t+1}\, dj = \int_0^1 \frac{w_{jt} n_{jt}}{\pi_t}\, dj + \frac{a_t(S_t)}{\pi_t} + \int_0^1 (d_{jt} + p_{jt}^e) s_{jt}\, dj + T_t,$$

the labor aggregator (12), and a no-Ponzi condition, given initial asset holdings and labor commitments. Labor for period t is chosen using period-$(t-1)$ information, whereas consumption and asset purchases are chosen in period t.

Let $u_{C,t}$ and $u_{N,t}$ denote the marginal utilities of consumption and aggregate labor. The first-order condition for equity holdings determines firms' equity prices:

$$p_{jt}^e = \mathbb{E}_t \left[\Lambda_{t+1} (d_{j,t+1} + p_{j,t+1}^e) \right], \tag{14}$$

where $\Lambda_{t+1} \equiv \beta u_{C,t+1}/u_{C,t}$ is the household's real stochastic discount factor. The first-order condition for Arrow–Debreu securities gives

$$q_t^a(S') = \Pr_t(S') \frac{\Lambda_{t+1}(S')}{\pi_{t+1}(S')}, \tag{15}$$

where $\Pr_t(S')$ is the conditional probability of next-period aggregate state S'. We use these state prices to derive the firm bond pricing schedule below.

The household's optimal labor supply to firm j satisfies

$$w_{jt} = \frac{-\mathbb{E}_{t-1}[u_{Nt}]}{\mathbb{E}_{t-1}[u_{Ct}/\pi_t]} \left(\frac{n_{jt}}{N_t} \right)^{\frac{1}{\eta}}. \tag{16}$$

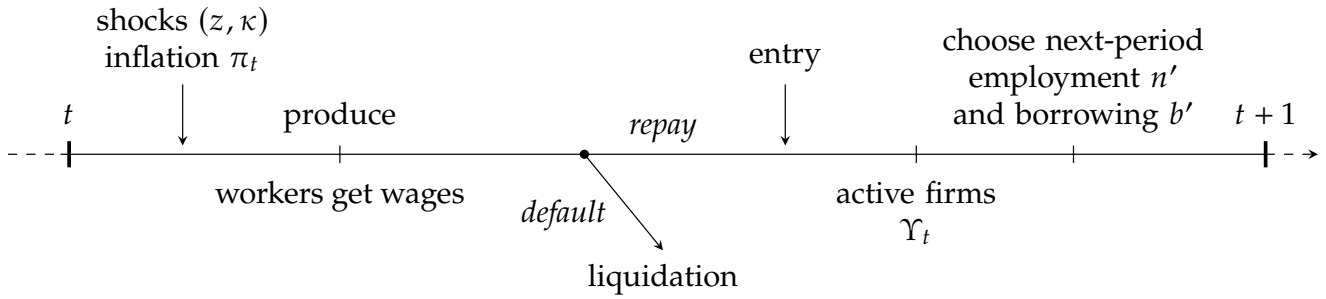
This optimality condition consists of two key terms. The first term, $\frac{-\mathbb{E}_{t-1}[u_{Nt}]}{\mathbb{E}_{t-1}[u_{Ct}/\pi_t]}$, reflects the trade-off between labor and consumption. The expectation operator $\mathbb{E}_{t-1}[\cdot]$ highlights the timing friction: labor contracts, specifying both employment n_{jt} and wages w_{jt}, are signed in period $t-1$. This timing matters at the onset of the unexpected shock because the household has already committed to labor supply before observing period-t outcomes, even though the subsequent transition follows a perfect-foresight path.

The second term, $(n_{jt}/N_t)^{\frac{1}{\eta}}$, captures the imperfect substitutability of labor across firms. Define the aggregate wage index $\bar{W}_t \equiv \frac{-\mathbb{E}_{t-1}[u_{Nt}]}{\mathbb{E}_{t-1}[u_{Ct}/\pi_t]}$. The inverse labor supply curve facing firm j is then

$$w_t(n_{jt}) = (n_{jt}/N_t)^{\frac{1}{\eta}} \bar{W}_t, \tag{17}$$

which is increasing in firm employment n_{jt}. That is, hiring more workers requires paying higher

Figure 6: Timing



Notes: This figure illustrates the timing of the economy.

wages to all workers. Conversely, reducing employment allows the firm to pay lower wages to its remaining workers. This firm-specific wage adjustment is central to the financing-from-workers mechanism.

3.2 Firms

Firms are competitive in the product market. They produce using labor under a decreasing-returns-to-scale technology, $y_{jt} = z_{jt} n_{jt}^{\alpha}$. They face two idiosyncratic shocks: productivity z_{jt} and a fixed operating-cost shock κ_{jt}.

Productivity follows a log AR(1) process:

$$\log z_{jt+1} = \rho_z \log z_{jt} + \sigma_z \epsilon_{jt}^z, \quad \epsilon_{jt}^z \sim \mathcal{N}(0,1). \tag{18}$$

The fixed operating-cost shock is i.i.d. across firms and over time, independent of productivity, and normally distributed:

$$\kappa_{jt} \sim \mathcal{N}(\bar{\kappa}, \sigma_\kappa^2), \tag{19}$$

with cumulative distribution function denoted by $\Phi(\kappa)$.

Each firm j can issue a one-period, state-uncontingent nominal bond with face value $B_{j,t+1}$ at price Q_{jt} per unit of face value. The real repayment obligation on outstanding debt is $B_{jt}/P_t = b_{jt}/\pi_t$, where $b_{j,t} \equiv B_{j,t}/P_{t-1}$. Thus, an unexpected disinflation raises the real burden of outstanding nominal debt, weakening firms' balance sheets.

A firm's state consists of (z, κ), predetermined employment n, and outstanding debt b. Given prices, the firm decides whether to default on its outstanding debt. Default triggers exit, leaving shareholders with zero value and creditors with zero recovery. A defaulting firm uses its current output net of the operating cost κ to pay workers. The government covers any shortfall and rebates any surplus through lump-sum transfers to households. Conditional on repayment, the firm continues operating and chooses next-period employment n' and debt b'. This timing

follows Ottonello and Winberry (2020) and is illustrated in Figure 6.

Due to heterogeneous default risk, bond prices are firm-specific and reflect expected losses from default. The bond price $Q_{jt} = Q_t(z, n', b')$ depends on current productivity z and the firm's employment and borrowing choices (n', b'), since they determine future default risk. The time subscript t captures dependence on the aggregate state along the perfect-foresight transition. Because κ is i.i.d., its current realization provides no additional information about future default risk and therefore does not enter the bond pricing schedule.

Firms cannot issue new equity and therefore face a non-negative dividend constraint:[6]

$$div = zn^{\alpha} - \frac{w_t(n)n}{\pi_t} - \frac{b}{\pi_t} - \kappa + Q_t(z, n', b')b' \geq 0. \tag{20}$$

Since repayment yields non-negative current and future dividends, whereas default yields zero value, the firm repays whenever it can satisfy the non-negative dividend constraint $div \geq 0$. Default therefore arises from a liquidity constraint: when the fixed-cost shock κ is too high, sales and new borrowing cannot cover costs and debt obligations. Thus, the firm defaults if and only if κ exceeds the threshold

$$\kappa_t^*(z, n, b) = zn^{\alpha} - \frac{w_t(n)n}{\pi_t} - \frac{b}{\pi_t} + \max_{n', b'}\{Q_t(z, n', b')b'\}. \tag{21}$$

Firms discount future dividends using the household's stochastic discount factor multiplied by $1 - \delta$. This additional discounting makes firms less patient than households and creates an incentive to borrow. Conditional on repayment, the firm solves

$$\boldsymbol{V}_t(z, \kappa, n, b) = \max_{div, n', b'} \left\{ div + \mathbb{E}_t \left[\Lambda_{t+1}(1 - \delta) \int_{-\infty}^{\kappa_{t+1}^*(z', n', b')} \boldsymbol{V}_{t+1}(z', \kappa', n', b')\, d\Phi(\kappa') \right] \right\}, \tag{22}$$

subject to the upward-sloping labor supply curve (17), the non-negative dividend constraint (20), and the restrictions $n' \geq 0$ and $b' \geq 0$. The latter rules out saving by firms.

3.3 Bond Price Schedule

Competitive domestic financial intermediaries purchase firm bonds and finance these purchases by issuing state-contingent claims to households. They diversify idiosyncratic default risk and price bonds to break even, using the household's stochastic discount factor and accounting for

[6] This assumption simplifies computation. An alternative is to allow firms to issue equity at a cost. However, Ferrante, Prestipino, and Schott (2026) estimate that this cost is high enough to generate dynamics similar to those when firms cannot issue new equity.

losses in default. The bond price schedule is given by

$$Q_t(z, n', b') = \mathbb{E}_t \left[\frac{\Lambda_{t+1}}{\pi_{t+1}} \Phi\big(\kappa^*_{t+1}(z', n', b')\big) \right], \tag{23}$$

where $\Phi(\kappa^*_{t+1}(z', n', b'))$ is the repayment probability conditional on next-period aggregate conditions, productivity z', and the firm's choices (n', b'). Bond prices therefore reflect default risk and the household's valuation of real repayments, with inflation eroding the real value of nominal bond payments.

3.4 Firm Entry and Equilibrium

3.4.1 New Entrants

All potential entrants start with the same productivity z_e and draw an initial nominal debt obligation B_e owed to financial intermediaries. Define $b_e \equiv B_e/P_{t-1}$, so that the real repayment obligation at entry is b_e/π_t. We assume that b_e follows a log-normal distribution with cumulative distribution function Φ_e. The proceeds associated with this initial debt are transferred to the household. Entry therefore involves no real resource cost.

Entrants do not produce or incur operating costs in the period of entry. They choose employment and borrowing for the following period. The entrant's problem is therefore a special case of the incumbent firm's problem (22), with $z = z_e$, $\kappa = 0$, $n = 0$, and $b = b_e$. The non-negative dividend constraint (20) becomes $div = -b_e/\pi_t + Q_t(z_e, n', b')b' \geq 0$. Thus, entry is successful if and only if $b_e \leq b^*_{e,t}$, where

$$b^*_{e,t} \equiv \pi_t \max_{n' \geq 0,\, b' \geq 0} \{Q_t(z_e, n', b')b'\}. \tag{24}$$

Conditional on entry, the entrant's value is

$$\boldsymbol{V}^e_t(z_e, b_e) = \boldsymbol{V}_t(z_e, 0, 0, b_e). \tag{25}$$

3.4.2 Firm Distribution

Let Υ_t denote the measure of active firms after default and entry, with $\int d\Upsilon_t = 1$. We represent states and choices on discrete grids and write $\Upsilon_t(z, \kappa, n, b)$ for the mass at each state. In this subsection, Φ and Φ_e denote the corresponding discretized distributions, $\phi(\kappa)$ denotes the probability mass of the operating-cost shock, and integration with respect to dz' denotes summation over the productivity grid.

Each defaulting firm is replaced by a successful entrant. We assume a sufficiently large pool

of potential entrants. By the law of large numbers, the mass of potential entrants needed equals the mass of defaulting firms divided by the probability of successful entry:

$$m_{e,t+1} = \frac{\int\int\int \mathbf{1}\{\kappa' > \kappa^*_{t+1}(z', n'_t, b'_t)\}\pi_z(z'|z)\, d\Phi(\kappa')\, dz'\, d\Upsilon_t(z, \kappa, n, b)}{\int \mathbf{1}\{b_e \le b^*_{e,t+1}\}\, d\Phi_e(b_e)}. \tag{26}$$

Here, $n'_t(z, \kappa, n, b)$ and $b'_t(z, \kappa, n, b)$ denote firms' optimal employment and borrowing policies. We suppress the policy arguments for notational simplicity.

The firm distribution evolves according to

$$\begin{aligned}
&\Upsilon_{t+1}(z', \kappa', n', b') \\
&\quad = \int \mathbf{1}\{n'_t = n', b'_t = b'\}\mathbf{1}\{\kappa' \le \kappa^*_{t+1}(z', n', b')\}\pi_z(z'|z)\phi(\kappa')\, d\Upsilon_t(z, \kappa, n, b) \\
&\qquad + m_{e,t+1}\int \mathbf{1}\{z' = z_e, \kappa' = 0, n' = 0, b' = b_e\}\mathbf{1}\{b_e \le b^*_{e,t+1}\}\, d\Phi_e(b_e).
\end{aligned} \tag{27}$$

The first term captures surviving firms, and the second captures entrants.

3.4.3 Equilibrium

Equilibrium requires clearing in four markets. First, the *Arrow–Debreu securities market* clears when

$$a_{t+1} = \int\int b'_t\, \Phi\big(\kappa^*_{t+1}(z', n'_t, b'_t)\big)\, \pi_z(z'|z)\, dz'\, d\Upsilon_t(z, \kappa, n, b), \tag{28}$$

where we omit the dependence on S' because the aggregate state is deterministic along the perfect-foresight transition. Second, normalizing each firm's outstanding shares to one, *equity market* clearing requires

$$s_{j,t+1} = 1, \quad \forall j. \tag{29}$$

Third, the *labor market* clears when household labor supply equals firms' labor demand, with aggregate employment given by

$$N_{t+1} = \left[\int {n'_t}^{\frac{\eta+1}{\eta}}\, d\Upsilon_t(z, \kappa, n, b)\right]^{\frac{\eta}{\eta+1}}. \tag{30}$$

Lastly, the *goods market* clears when

$$C_{t+1} = Y_{t+1} - \bar{\kappa} = \int\int z'\, {n'_t}^{\alpha}\pi_z(z'|z)\, dz'\, d\Upsilon_t(z, \kappa, n, b) - \bar{\kappa}. \tag{31}$$

Definition 1 *Given an initial firm distribution Υ_0, initial asset holdings, predetermined labor contracts,*

and an inflation path $\{\pi_t\}_{t\geq 0}$, an equilibrium consists of household decisions $\{C_t, n_{jt}, a_{t+1}, s_{j,t+1}\}$; firm value functions $\boldsymbol{V}_t(z,\kappa,n,b)$, default thresholds $\kappa_t^*(z,n,b)$, and decision rules $\{div_t(z,\kappa,n,b)$, $n_t'(z,\kappa,n,b)$, $b_t'(z,\kappa,n,b)\}$; wage schedules $w_t(n)$, bond-price schedules $Q_t(z,n',b')$, equity prices p_{jt}^e, securities prices q_t^a, and the stochastic discount factor Λ_{t+1}; lump-sum transfers T_t; and firm distributions $\Upsilon_t(z,\kappa,n,b)$ such that, for all t: (i) households optimize; (ii) firms optimize; (iii) financial intermediaries price bonds to break even; (iv) the firm distribution evolves consistently with firms' policies, idiosyncratic shocks, and entry; and (v) all four markets clear and the government budget balances.

3.5 Mechanism: Financing From Workers

To illustrate how labor market power interacts with financial frictions, we examine the firm's first-order condition for next-period employment n'. At an interior optimum,

$$-(1+\gamma)\frac{\partial Q_t}{\partial n'}b' = \mathbb{E}_t\Bigg[\Lambda_{t+1}(1-\delta)\left(\alpha z'(n')^{\alpha-1} - \frac{1+\eta}{\eta}\frac{w_{t+1}(n')}{\pi_{t+1}}\right) \times\left\{\int_{-\infty}^{\kappa_{t+1}^*}[1+\gamma'(z',\kappa',n',b')]\,d\Phi(\kappa') + V_{t+1}^*\phi(\kappa_{t+1}^*)\right\}\Bigg], \tag{32}$$

where γ and $\gamma'(z',\kappa',n',b')$ are the current and next-period multipliers on the non-negative dividend constraint (20), and ϕ is the density associated with Φ. The default threshold and firm value at the threshold are evaluated at the chosen policies (n',b'): $\kappa_{t+1}^* = \kappa_{t+1}^*(z',n',b')$ and $V_{t+1}^* = \boldsymbol{V}_{t+1}(z',\kappa_{t+1}^*,n',b')$.

This optimality condition balances the current and future effects of employment. The left-hand side captures the marginal effect on current financing: higher next-period employment n' increases the wage bill and raises default risk in low-productivity states, worsening bond prices today.

The right-hand side captures two effects on next-period firm value. First, the marginal profit in each future state is $\alpha z'(n')^{\alpha-1} - \frac{1+\eta}{\eta}\frac{w_{t+1}(n')}{\pi_{t+1}}$. The firm pays wages at a constant markdown of $\eta/(1+\eta)$ and faces a firm-specific wage schedule $w_{t+1}(n')$ that rises with employment. Second, the expression in braces captures the value of these marginal profits. Conditional on repayment, additional cash is valued at $1+\gamma'$, reflecting the shadow value of relaxing the non-negative dividend (NND) constraint. When the firm defaults, it loses the value of continuing at the default threshold, V_{t+1}^*, weighted by the density $\phi(\kappa_{t+1}^*)$.

3.5.1 Only Labor Market Power

To isolate the mechanism, we set next-period inflation to zero, $\pi_{t+1} = 1$, and consider two counterfactual cases. In the first, we remove financial frictions, so $\gamma = \gamma' = 0$ and $\partial Q_t/\partial n' = 0$.

The optimality condition (32) simplifies to

$$\mathbb{E}_t\left[\alpha z'(n')^{\alpha-1}\right] = \frac{1+\eta}{\eta} w(n'). \tag{33}$$

We use an economy with a competitive labor market ($\eta \to \infty$) as the efficient economy for comparison. Relative to this economy, labor market power generates two types of inefficiency: aggregate and allocative. Aggregate inefficiency arises from the wage markdown $\eta/(1+\eta)$, which depresses overall employment below the efficient level. Allocative inefficiency arises because firms face upward-sloping labor supply curves $w(n')$ that limit employment expansion at more productive firms. In a competitive labor market, all firms face the same wage and equalize their expected marginal products of labor. With labor market power, however, more productive firms have higher expected marginal products of labor, creating misallocation. Both inefficiencies reduce aggregate employment.

3.5.2 Only Financial Frictions

In the second case, we retain financial frictions but remove labor market power. All firms face the same competitive wage $\bar{W}$. The labor FOC is similar to (32), with $w(n') = \bar{W}$ and $\eta \to \infty$:

$$\mathbb{E}_t\left[\alpha z'(n')^{\alpha-1}\right] = \bar{W} + \frac{1+\gamma}{\mathbb{E}_t[M']}\left(-\frac{\partial Q_t}{\partial n'}\right) b' - \frac{\mathrm{Cov}_t\left(\alpha z'(n')^{\alpha-1}, M'\right)}{\mathbb{E}_t[M']}, \tag{34}$$

where $M' = \Lambda_{t+1}(1-\delta)\left[\int_{-\infty}^{\kappa^*_{t+1}} [1+\gamma'(z',\kappa',n',b')]\, d\Phi(\kappa') + V^*_{t+1}\phi(\kappa^*_{t+1})\right]$ is the discounted marginal value of future profits, accounting for the future NND constraint and default risk.

The left-hand side is the expected marginal product of labor. The right-hand side consists of three terms. The first is the competitive wage $\bar{W}$. The second term, $\frac{1+\gamma}{\mathbb{E}_t[M']}(-\frac{\partial Q_t}{\partial n'})b'$, captures how employment affects current bond prices Q_t and, in turn, the tightness of the current NND constraint, measured by γ. The third term reflects the covariance between future productivity and the value of future profits, $\mathrm{Cov}_t(\alpha z'(n')^{\alpha-1}, M')$, which tends to be negative since high-productivity states are associated with lower default risk.

Although all firms face the same wage, these financial distortions vary with firm productivity, indebtedness, and the tightness of financing constraints. In particular, when $\frac{\partial Q_t}{\partial n'} < 0$, a binding NND constraint ($\gamma > 0$) raises the marginal cost of labor and discourages employment. Financial frictions therefore generate firm-specific marginal costs of labor and differences in marginal products, creating allocative inefficiency.

3.5.3 Mitigation Effect

With both labor market power and financial frictions, the optimal labor decision reflects their interaction:

$$\mathbb{E}_t\left[\alpha z'(n')^{\alpha-1}\right] = \frac{1+\eta}{\eta} w(n') + \frac{1+\gamma}{\mathbb{E}_t[M']}\left(-\frac{\partial Q_t}{\partial n'}\right) b' - \frac{\mathrm{Cov}_t\left(\alpha z'(n')^{\alpha-1}, M'\right)}{\mathbb{E}_t[M']}. \tag{35}$$

The right-hand side reflects labor market power through the first term and financial frictions through the last two terms. Although each friction distorts labor allocation on its own, their interaction allows labor market power to mitigate financial distress.

Consider an unexpected adverse financial shock, such as disinflation, that tightens the current NND constraint (20). For constrained firms, the resulting increase in γ raises the financing cost in the second term of (35), discouraging next-period employment n'. As a firm cuts employment, wages adjust downward along its upward-sloping labor supply curve $w(n')$, lowering the future wage bill by more than the reduction in employment alone would imply. This wage decline lowers marginal labor cost in the first term, partially offsetting the increase in financing costs. Financial intermediaries also recognize that labor market power allows firms to lower future wage payments and reduce default risk, resulting in lower borrowing costs through higher bond prices Q_t. This eases the current NND constraint and reduces its shadow cost γ, further mitigating the employment decline.

The discussion above focuses on firm-level comparative statics. In general equilibrium, weaker labor demand also lowers wages and eases financial constraints, even without labor market power. We therefore turn to a quantitative analysis to assess the additional mitigation from labor market power. We find that firm heterogeneity is key, as discussed in Section 4.4.

4 Quantitative Analysis

Our quantitative analysis proceeds in four steps. First, we calibrate the model in its stationary equilibrium. Second, we illustrate the mechanism through firm decisions and bond prices, comparing models with and without labor market power. Third, we validate the benchmark model by showing that it reproduces the differential earnings responses documented in our empirical analysis. Fourth, we compare the two models' aggregate responses to an unexpected disinflation shock to quantify the role of labor market power.

Because the model is highly nonlinear and features occasionally binding constraints, we solve it using a global method. Appendix D details the computational algorithm.

4.1 Parameters and Moments

Preferences. We assume households have GHH preferences (Greenwood, Hercowitz, and Huffman, 1988):

$$u(C, N) = \log\left(C - \chi \frac{N^{1+1/\nu}}{1+1/\nu}\right). \tag{36}$$

Under GHH preferences, the marginal rate of substitution between consumption and labor is independent of consumption.

Assigned Parameters. We assign six parameters externally, as summarized in Panel A of Table 2. The first two are related to production. We set the production function curvature to $\alpha = 0.66$, reflecting the average U.S. labor share. We set quarterly productivity persistence to $\rho_z = 0.95$, following Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2018).

The remaining four parameters are related to preferences. We set the Frisch elasticity of labor supply to $\nu = 1$, following Bianchi (2016). We normalize the labor disutility parameter to $\chi = 0.02$, so that employment ranges from 0 to 30 for computational convenience. The quarterly discount factor is set to $\beta = 0.99$, implying an annual risk-free rate of approximately 4%. We adopt the estimated job substitutability elasticity of $\eta = 10.85$ from Berger, Herkenhoff, and Mongey (2022), which is a conservative estimate for firms' labor market power in the literature. This value implies that, holding the aggregates fixed, a 1% reduction in a firm's employment allows it to lower wages for all remaining workers by approximately 0.1%.

Fitted Parameters. We calibrate the remaining parameters by matching empirical moments in a stationary equilibrium, where the firm distribution is time-invariant and gross inflation equals one ($\pi_t = 1$ for all t). Panel B of Table 2 reports the calibrated parameters. Panel C shows that the model closely matches the targeted empirical moments. All parameters are calibrated jointly. To facilitate identification, we select moments that are closely linked to particular parameters. We explain these links below.

The standard deviation of productivity innovations, σ_z, is primarily disciplined by the interquartile range (IQR) of firm sales growth rates. We target an IQR of 0.19, as calculated by Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2018) using Compustat data.

We use leverage and credit spread moments to capture firms' financing patterns. Since the model abstracts from capital, we measure leverage as debt relative to annual sales: leverage $= (b/\pi)/(4zn^{\alpha})$. We target a median debt-to-sales ratio of 0.26, which Arellano, Bai, and Kehoe (2019) calculate using Compustat data. Firm leverage is closely linked to the additional firm discount factor, $1 - \delta$: a lower discount factor makes firms less patient and increases their incentive to borrow. This parameter serves as a reduced-form way to capture the tax advantage of debt, agency frictions, and other motives for borrowing. Matching the median debt-to-sales ratio requires a relatively low additional firm discount factor, $1 - \delta = 0.82$, consistent with

Table 2: Parameters and Moments

Panel A. Externally Assigned Parameters

Parameters	Notation	Value	Source or Rationale
Production function curvature	α	0.66	Labor share
Productivity persistence	ρ_z	0.95	Bloom et al. (2018)
Frisch elasticity	ν	1	Bianchi (2016)
Disutility of working	χ	0.02	Normalization
Discount factor	β	0.99	Approx. 4% annual risk-free rate
Job substitutability elasticity	η	10.85	Berger, Herkenhoff, and Mongey (2022)

Panel B. Parameters from Moment Matching

Parameters	Notation	Benchmark	No Labor Market Power
SD of productivity innovations	σ_z	0.084	0.068
Additional firm discount factor	$1-\delta$	0.82	0.81
Mean of operating costs	$\bar{\kappa}$	0.001	0.001
SD of operating costs	σ_κ	0.095	0.087
Entrants' relative productivity	$z_e/\bar{z}$	0.76	0.76

Panel C. Moments

Moments	Data	Benchmark	No Labor Market Power
IQR of firm sales growth	0.19	0.19	0.19
Median debt-to-sales ratio	0.26	0.26	0.26
25th-percentile credit spread (%)	1.0	1.5	1.4
Median credit spread (%)	1.5	2.0	1.9
75th-percentile credit spread (%)	2.8	2.1	2.1
Entrants' relative productivity	0.75	0.75	0.76

Note: This table reports the parameters and matched moments for the benchmark model with labor market power and the counterfactual model without labor market power. Panel A lists the externally assigned parameters, which are common to both models except for the job substitutability elasticity, η, which equals 10.85 in the benchmark model and is infinity in the model without labor market power. Panel B reports the internally calibrated parameters, and Panel C compares the data and model moments. Data sources: Bloom, Floetotto, Jaimovich, Saporta-Eksten, and Terry (2018) and Arellano, Bai, and Kehoe (2019).

incomplete markets models featuring uninsurable risks. An alternative approach would be to explicitly model agency frictions, as in Arellano, Bai, and Kehoe (2019), which could generate similar leverage with a higher discount factor.

Conditional on leverage, the mean and standard deviation of operating costs, $\bar{\kappa}$ and σ_κ, govern firms' default risk and therefore the distribution of credit spreads. The annualized credit spread in the model is defined as $4 \times [1/Q(z, n', b') - 1/\beta]$. We target the 25th percentile, median, and 75th percentile of credit spreads, as calculated by Arellano, Bai, and Kehoe (2019) using Moody's spread data.

We choose entrant productivity, z_e, to match the productivity of entrants relative to incumbents. We target a ratio of 0.75, as reported by Lee and Mukoyama (2015) using data from the U.S. Census Bureau's Annual Survey of Manufactures (ASM). For entrants' initial debt distribution, $\Phi_e(b_e)$, we assume $\log b_e \sim \mathcal{N}(\mu_e, \sigma_e^2)$. Lacking suitable empirical moments, we pin down these two parameters by equating the mean and standard deviation of entrants' cash on hand to those of incumbents with productivity z_e. Cash on hand is defined as $x_e = -b_e/\pi_t$ for entrants and $x = zn^\alpha - w_t(n)n/\pi_t - b/\pi_t - \kappa$ for incumbents. It is a sufficient state variable summarizing firms' financial conditions (see Appendix D.1.1 for details). Given the other parameters, we have $\mu_e = -0.26$ and $\sigma_e = 0.15$ (not reported in the table).

4.2 Illustration of the Mechanism

In our model, the upward-sloping labor supply curve enables financing from workers and distinguishes the model from canonical models of firm financial frictions. To quantify the importance of this mechanism, we consider a reference model that retains financial frictions but eliminates labor market power. All firms in this model face the same competitive wage rate and thus a horizontal labor supply curve (i.e., $\eta \to \infty$).

We recalibrate the reference model to also match the empirical moments. Without recalibration, the reference model would feature unrealistically high credit spreads and lower leverage, as it lacks financing from workers as a buffer. Table 2 reports the recalibrated parameters and moments. The two models generate similar firm financing patterns in stationary equilibrium. To achieve this, the reference model requires less uncertainty in productivity and operating costs, as well as a slightly lower firm discount factor.

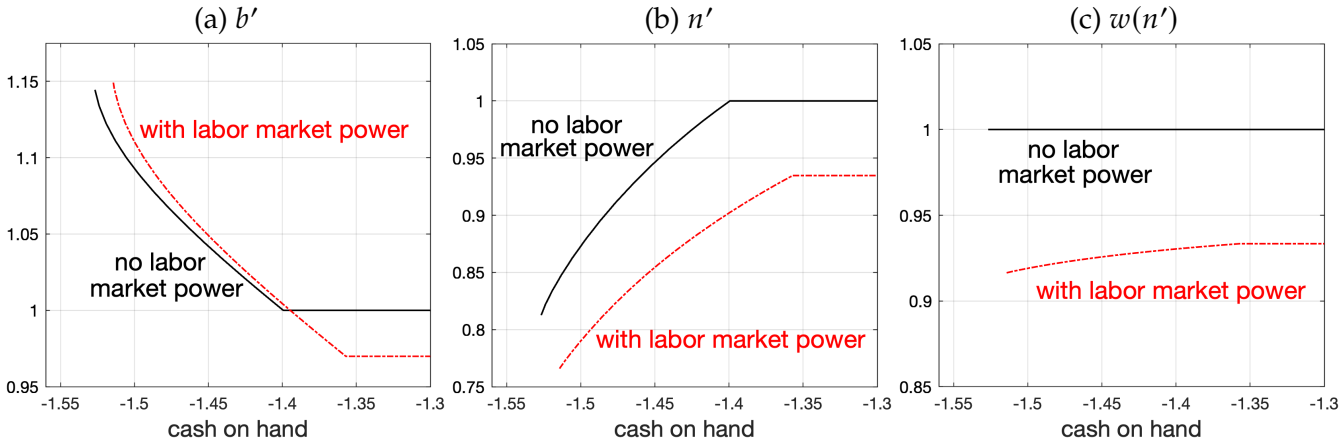
Section 3.5.3 highlights two channels through which financing from workers cushions adverse financial shocks: firm-level wage adjustment and better borrowing terms. In this section, we illustrate them in the calibrated model using firm decision rules and bond price schedules.

4.2.1 Firm Decision Rules

Figure 7 shows the optimal policies as a function of cash on hand for a firm with average productivity. Cash on hand is defined as $x = zn^\alpha - w_t(n)n/\pi_t - b/\pi_t - \kappa$. Given productivity, it serves as a sufficient state variable summarizing the firm's financial position. The panels plot borrowing b', next-period employment n', and the wage rate $w(n')$. In each panel, both curves are normalized by the rightmost value in the model without labor market power.

We begin by examining the model without labor market power (solid black lines), which features only financial frictions. As shown in panel (b), the firm's employment choice depends on its cash on hand. When cash on hand is sufficiently high, the non-negative dividend constraint

Figure 7: Firm Decision Rules



Note: This figure displays the optimal policies as a function of cash on hand for a firm with average productivity. Cash on hand is defined as $x = zn^{\alpha} - w_t(n)n/\pi_t - b/\pi_t - \kappa$. The panels plot borrowing b', next-period employment n', and the wage rate $w(n')$. Red dash-dot lines represent the benchmark model with labor market power; black solid lines represent the reference model without labor market power. In each panel, both curves are normalized by the rightmost value of the black curve.

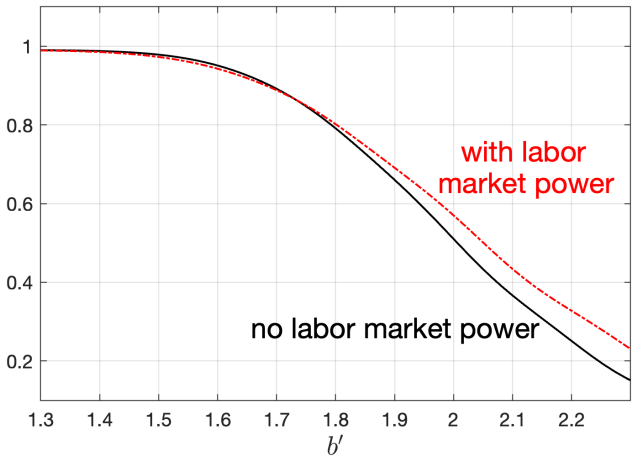
(20) is slack, and employment is independent of cash on hand. As cash on hand falls, the constraint binds, and the firm relies more heavily on borrowing to meet its obligations. Increased borrowing raises default risk, making employment riskier, so the firm shrinks its workforce.

The policy functions also illustrate how firms respond to an unexpected disinflation shock. A decline in π raises the real value of outstanding debt, b/π, and reduces the firm's cash on hand. Higher ex-ante debt implies a larger decline in cash on hand. It also means a lower initial level of cash on hand, which leads to a larger employment decline because the employment policy is concave. Thus, an unexpected disinflation is more contractionary for firms with higher ex-ante leverage, consistent with our empirical findings.

The dash-dot red lines represent the decision rules under labor market power. The middle panel shows that firms optimally choose lower employment *levels*. This is the standard monopsony result: hiring additional workers requires raising wages for existing workers. The marginal cost of labor therefore exceeds the wage rate, leading firms to restrict employment.

Our focus, however, is on the *slope* of the employment policy. With labor market power, employment declines less in response to a given decrease in cash on hand. This mitigated response reflects an additional margin of adjustment: wages. As shown in the rightmost panel, firms without labor market power pay the same wage regardless of cash on hand. In contrast, firms with monopsony power face an upward-sloping labor supply curve, so reducing employment also lowers wages for remaining workers. This wage adjustment effectively allows firms to obtain financing from workers, enhancing their resilience to financial distress.

Figure 8: Bond Price Schedules



Note: This figure plots the bond price schedules $Q(z, n', b')$ as a function of next-period debt b' for a firm with average productivity. Next-period employment n' is held fixed. The red dash-dot line represents the benchmark model with labor market power; the black solid line represents the reference model without labor market power.

4.2.2 Bond Price Schedules

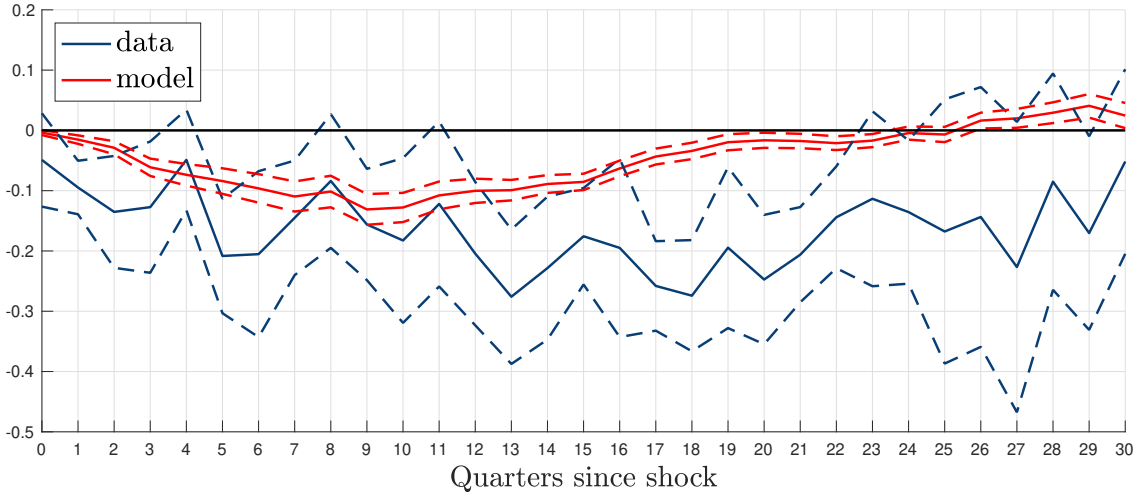
Figure 8 plots the bond price schedules $Q(z, n', b')$, defined in equation (23), as a function of next-period debt b' for a firm with average productivity. The bond price $Q(z, n', b')$ is the amount a firm can borrow today per dollar of promised repayment next period. In both models, bond prices decline when debt increases, as the probability of default increases. Lenders compensate for this elevated risk by requiring a higher return, which translates into a lower bond price.

The two curves intersect at a low level of b'. This reflects the recalibration of the model without labor market power to match the same credit-spread targets. To the right of the intersection, the bond price schedule in the model with labor market power is higher and flatter, implying lower marginal borrowing costs. It reflects lenders' anticipation that firms with monopsony power can reduce wages during downturns, mitigating default risk. This channel operates alongside the direct financing-from-workers mechanism and provides an additional financing advantage associated with firms' labor market power.

4.3 Model Validation: Heterogeneous Wage Responses

To validate the model, we estimate local projections using model-simulated data to assess whether the benchmark model reproduces the heterogeneous wage responses documented in Figure 2. We focus on the benchmark model because, in the reference model without labor market power, all firms pay the same equilibrium wage. The reference model therefore generates no cross-firm variation in wage responses, and the corresponding regression coefficients are always zero.

Figure 9: Heterogeneous Responses of Worker Earnings: Model versus Data



Note: This figure compares our baseline empirical estimates (blue lines) from Figure 2 with the model-simulated estimates (red lines). Solid lines show the estimated coefficients (β_h) from equation (10), and dashed lines report the 90% confidence intervals. The coefficients capture the heterogeneous responses of workers' earnings growth to unexpected disinflation shocks.

Our empirical sample covers 24 states. Accordingly, we simulate 24 independent economies, each experiencing a one-time, unexpected inflation shock in period $t = 5$. The shocks are drawn from a normal distribution whose parameters are estimated from the historical distribution shown in Figure 1. Each simulation begins with 1,000 firms drawn from the stationary equilibrium distribution. For now, the simulated paths are computed by holding the price schedules and the stochastic discount factor fixed.[7]

We pool data from all 24 simulated economies and estimate one local projection regression using the specification (10). Recall that leverage is defined as the debt-to-asset ratio in the data. We use the same definition in the model, with assets (i.e., capital) normalized to one for all firms. Since all employees within a firm receive the same wage, we use firm-level wage growth as the dependent variable and drop worker fixed effects.[8] Additionally, our model is not subject to seasonal fluctuations, so we can directly use shorter-lagged variables (w_{jt-1} and lev_{jt-2}) rather than the longer lags (w_{jt-4} and lev_{jt-5}) required in the empirical estimation.

Figure 9 compares these model-simulated results (red lines) with our baseline empirical estimates (blue lines) from Figure 2. The model successfully reproduces the key empirical pattern: following unexpected disinflation, workers' earnings growth is lower at more highly leveraged firms. These firms experience a larger increase in their real debt burden and face a

[7] The simulations therefore do not capture feedback from aggregate wage and SDF adjustments. Solving a separate general-equilibrium transition path for each of the 24 simulated economies remains work in progress; Section 4.4 solves the general-equilibrium transition for a single economy.

[8] Note that the model does not explicitly incorporate hours worked, so the wage rate is the relevant measure of workers' earnings.

tighter non-negative dividend (NND) constraint. Their marginal cost of labor rises more, and they reduce employment more sharply. Moving along the upward-sloping labor supply curve, they can reduce wages, resulting in a larger decline in the remaining workers' earnings.

4.4 Aggregate Impacts: Mitigation from Labor Market Power

To quantify the role of financing from workers in mitigating financial distress, we compare the aggregate responses of the benchmark model and the reference model without labor market power. Both economies begin in their respective stationary equilibria and face the same one-time, unexpected disinflation shock. We solve their perfect foresight transition paths.

We choose the shock size so that aggregate output falls by 1% in the reference model under partial equilibrium. The resulting shock is $\Delta \log \pi_t = -0.071$, close to the 5th percentile of state-level unexpected inflation shocks in 1982Q3 and 2009Q3 (Figure 1). We present the partial-equilibrium results first and then the general-equilibrium results.

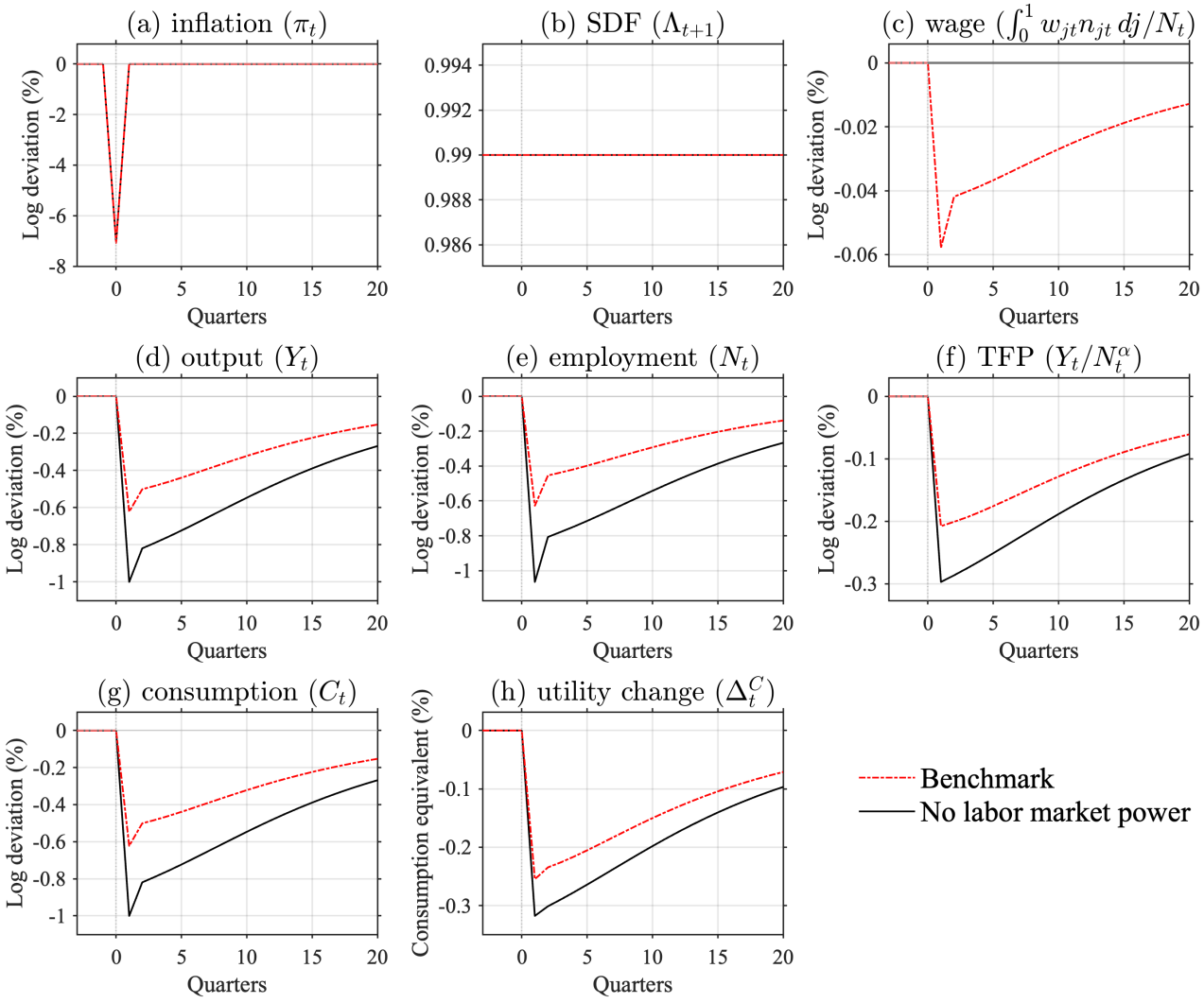
4.4.1 Partial Equilibrium

Figure 10 shows the partial-equilibrium impulse responses, with the stochastic discount factor held constant. In the reference model without labor market power, the competitive wage rate remains fixed at its pre-shock level. In the benchmark model, firm j pays $w_t(n_{jt}) = (n_{jt}/N_t)^{1/\eta}\bar{W}_t$. We hold $N_t^{-1/\eta}\bar{W}_t$ fixed to shut down aggregate wage adjustment and isolate firm-specific wage adjustment.

In response to the unexpected disinflation, firms' real debt burdens rise, tightening their financial constraints. They reduce employment for the next period, leading to declines in aggregate employment, output, and consumption. Aggregate TFP, defined as Y/N^{α}, also falls. This is because some productive but financially constrained firms exit after the shock, while new entrants tend to be less productive. We also report the consumption-equivalent change in period utility, Δ_t^C, in panel (h). It is defined by $u\big((1+\Delta_t^C)C_0, N_0\big) = u(C_t, N_t)$, where C_0 and N_0 are each model's steady-state consumption and employment. Thus, Δ_t^C is the proportional change in steady-state consumption that delivers the same period utility as the post-shock allocation. Panel (h) shows that period utility falls, as the loss from lower consumption outweighs the gain from working less.

Although both models exhibit these declines, the recession is milder in the model with labor market power. Under partial equilibrium, this mitigation reflects a shift in adjustment from employment (quantities) to wages (prices). As shown in panel (c), the competitive wage in the reference model without labor market power is fixed under partial equilibrium. Financially constrained firms can therefore reduce labor costs only by cutting employment, with no ability

Figure 10: Impulse Responses to an Unexpected Disinflation Shock (Partial Equilibrium)

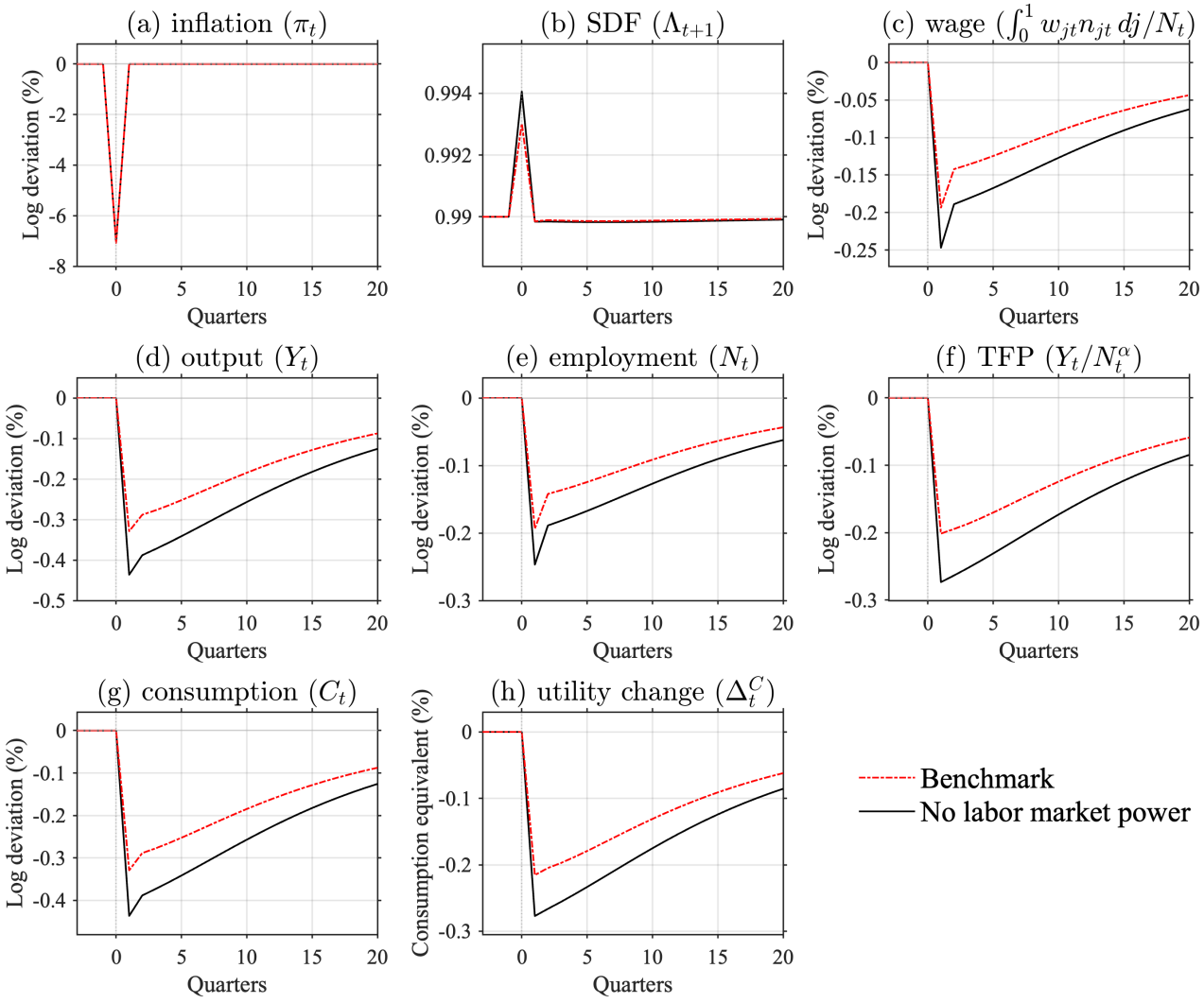


Note: This figure shows the partial-equilibrium responses to a one-time, unexpected disinflation shock. The shock size is chosen so that aggregate output falls by 1% in the reference model (no labor market power) under partial equilibrium. Red dash-dot lines represent the benchmark model; black solid lines represent the reference model without labor market power.

to lower wages.

In contrast, average wages ($\int_0^1 w_{jt} n_{jt}\, dj/N_t$) fall in the benchmark model even though aggregate wage adjustment is shut down. Individual firms face upward-sloping labor supply curves, so financially constrained firms can pay lower wages to the remaining workers when they cut employment. This wage adjustment helps cushion the impact of disinflation on firms' balance sheets. Lenders also recognize that wage adjustment reduces default risk and offer more favorable bond prices. Together, these two channels help firms maintain more stable employment and output after the shock.

Figure 11: Impulse Responses to an Unexpected Disinflation Shock (General Equilibrium)



Note: This figure shows the general-equilibrium responses to a one-time, unexpected disinflation shock. The shock size is chosen so that aggregate output falls by 1% in the reference model (no labor market power) under partial equilibrium. Red dash-dot lines represent the benchmark model; black solid lines represent the reference model without labor market power.

4.4.2 General Equilibrium

Under partial equilibrium, labor market power mitigates the downturn by shifting adjustment from employment to wages. In general equilibrium, however, competitive wages can fall too: weaker labor demand lowers wages and eases firms' financial constraints even without labor market power. What additional role, then, can labor market power play?

Figure 11 presents the general-equilibrium responses. In both models, the stochastic discount factor rises and the average wage falls endogenously, easing firms' financing constraints and partially offsetting the downturn. Even with these adjustments, labor market power provides

additional mitigation: one quarter after the shock, output falls by 0.44% in the reference model without labor market power, but by only 0.33% in the benchmark model, indicating a 24.6% smaller decline. The declines in employment, consumption, and period utility are also mitigated by 21.7%, 24.6%, and 22.3%, respectively. We also compute the consumption-equivalent lifetime welfare change, Δ^C, that satisfies

$$\frac{u\big((1+\Delta^C)C_0, N_0\big)}{1-\beta} = \sum_{t=t_0}^{\infty} \beta^{t-t_0} u(C_t, N_t), \tag{37}$$

where t_0 denotes the shock date. The resulting lifetime welfare loss is 0.040% of steady-state consumption in the reference model and 0.030% in the benchmark model, a mitigation of 25.1%.

A striking difference between partial and general equilibrium is the behavior of the average wage. Although labor market power allows firms to lower wages, the average wage falls less in the benchmark model. This contrast highlights how financing from workers operates differently at the *micro* and *macro* levels. At the firm level, it shifts adjustment from employment to wages: firms pay less so that they do not need to reduce employment as much. At the aggregate level, however, labor market power helps stabilize both employment and average wages.

The key is *firm heterogeneity*. To see why it matters, consider an economy with homogeneous firms. In a symmetric equilibrium,

$$w_{jt} = \frac{-\mathbb{E}_{t-1}[u_{Nt}]}{\mathbb{E}_{t-1}[u_{Ct}/\pi_t]} \left(\frac{n_{jt}}{N_t}\right)^{1/\eta} \underset{\substack{\uparrow \\ \text{homogeneous firms} \\ n_{jt}=N_t}}{=} \frac{-\mathbb{E}_{t-1}[u_{Nt}]}{\mathbb{E}_{t-1}[u_{Ct}/\pi_t]}. \tag{38}$$

The wage expression is the same across all firms, independent of job substitutability η, and collapses to the expression under a competitive labor market. In other words, the wage adjustment enabled by labor market power is already available through the upward-sloping aggregate labor supply curve in a competitive labor market. Labor market power therefore provides no additional wage-adjustment margin.

With heterogeneous firms, however, financial frictions generate firm-specific distortions. A uniform decline in wages cannot fully offset these distortions. In contrast, the upward-sloping labor supply curve facing each firm, given by (16), allows for firm-specific wage adjustment: more distressed firms can reduce wages by more than less distressed firms. It limits employment cuts, especially at productive but financially constrained firms, alleviating misallocation and stabilizing the economy more effectively. Consistent with this mechanism, panel (f) shows that labor market power mitigates the aggregate TFP decline by 26.4%. The smaller contraction in aggregate labor demand, in turn, reduces the decline in average wages.

5 Conclusion

It is well established that either financial frictions or labor market power alone depresses economic activity. In this paper, we show that through its interaction with financial frictions, labor market power stabilizes the economy during financial distress.

Using Census employer-employee data, we find that workers in high-leverage firms experience significantly slower earnings growth following an unexpected disinflation shock that increases the real burden of firms' nominal debt. This response is stronger among firms with greater labor market power. These findings suggest that firms with labor market power can obtain financing from workers through reduced compensation. To explore this mechanism, we develop a heterogeneous-firm model incorporating labor market power and endogenous default risk, calibrated to U.S. firm financing patterns and labor supply elasticities. The model shows that firm-specific wage adjustment preserves employment at productive but financially constrained firms, alleviating misallocation and reducing the aggregate costs of financial distress.

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Appendix to "Financing from Workers: Can Labor Market Power Mitigate Financial Frictions?"

by Yan Bai and Yajie Wang

A Proofs

Proof of Proposition 1 When the labor market is perfectly competitive and financial frictions are absent, a firm solves the following problem:

$$\max_n \mathbb{E}\left(zn^\alpha - \bar{w}n - \zeta\right).$$

The first-order condition with respect to n is

$$\alpha\,\mathbb{E}(z)(n^*)^{\alpha-1} = \bar{w}.$$

Proof of Proposition 2 With only financial frictions, a firm solves the following problem

$$\max_n \mathbb{E}\left(zn^\alpha - \bar{w}n - \zeta\right), \text{ s.t. } zn^\alpha - \bar{w}n - \zeta \geq 0, \ \forall z,$$

which is equivalent to solving

$$\max_n \mathbb{E}\left(zn^\alpha - \bar{w}n - \zeta\right), \text{ s.t. } \underline{z}n^\alpha - \bar{w}n - \zeta \geq 0.$$

Let γ be the multiplier on the NND condition. The first-order condition with respect to n is given by

$$\alpha\,\mathbb{E}\,zn^{\alpha-1} - \bar{w} + \gamma(\underline{z}\alpha n^{\alpha-1} - \bar{w}) = 0.$$

After combining terms, we obtain

$$\alpha\,\mathbb{E}\,zn^{\alpha-1} = \frac{1+\gamma}{1+(\underline{z}/\mathbb{E}\,z)\gamma}\bar{w}.$$

We now prove that labor falls with a larger financial shock ζ.

When the NND condition is not binding, $\gamma = 0$, and the labor $n = n^*$ is efficient and solves $\alpha\,\mathbb{E}\,zn^{\alpha-1} = \bar{w}$. When ζ is large enough, the NND condition under $\underline{z}$ binds at n^*. In this case, labor has to fall to satisfy the NND condition. Now labor and multiplier (n, γ) solve

$$\underline{z}n^\alpha - \bar{w}n - \zeta = 0,$$

$$\alpha\,\mathbb{E}\,zn^{\alpha-1} = \frac{1+\gamma}{1+(\underline{z}/\mathbb{E}\,z)\gamma}\bar{w}.$$

Differentiating the binding NND condition with respect to ζ, we obtain

$$\frac{dn}{d\zeta} = \frac{1}{\alpha \underline{z} n^{\alpha-1} - \bar{w}} < 0.$$

The inequality follows from the first-order condition:

$$\begin{aligned}
\alpha \underline{z} n^{\alpha-1} - \bar{w} &= \alpha \underline{z} n^{\alpha-1} - \frac{\alpha(\mathbb{E}[z] + \gamma \underline{z}) n^{\alpha-1}}{1+\gamma} \\
&= \frac{\alpha n^{\alpha-1} \left[(1+\gamma)\underline{z} - \mathbb{E}[z] - \gamma \underline{z} \right]}{1+\gamma} \\
&= -\frac{\alpha(\mathbb{E}[z] - \underline{z}) n^{\alpha-1}}{1+\gamma} < 0.
\end{aligned}$$

Thus, employment falls with an adverse financial shock when the NND condition binds.

Proof of Proposition 3 With both financial frictions and labor market power, the firm solves

$$\max_n \mathbb{E}\left(z n^\alpha - w(n) n - \zeta\right), \text{ s.t. } \underline{z} n^\alpha - w(n) n - \zeta \geq 0.$$

The first-order condition with respect to labor is given by

$$\alpha \, \mathbb{E}\, z n^{\alpha-1} = \frac{1+\gamma}{1 + (\underline{z}/\mathbb{E}\, z)\gamma} \frac{1+\eta}{\eta} w(n).$$

We now prove that labor market power locally mitigates the adverse impact of a financial shock on labor. To make this case comparable with that with only financial frictions, we assume the two cases start at the same initial employment level n_0 and wage w_0, with the NND condition binding in both cases. Without labor market power, the wage is fixed at w_0; with labor market power, $w(n) = w_0 (n/n_0)^{1/\eta}$.

When the NND condition binds, optimal labor satisfies

$$\underline{z} n^\alpha - w(n) n - \zeta = 0.$$

Let $\hat{x}$ denote the percentage deviation of variable x from its initial level x_0: $\hat{x} = (x - x_0)/x_0$. Let $\zeta_0 = \underline{z} n_0^\alpha - w_0 n_0 > 0$. For a sufficiently small increase in ζ above ζ_0, firms have to reduce labor. Using the binding NND condition,

$$\zeta = \underline{z} n^\alpha - w(n) n,$$

we obtain the first-order approximation

$$\hat{n}^L \approx -\frac{\zeta_0}{\frac{\eta+1}{\eta} w_0 n_0 - \alpha \underline{z} n_0^{\alpha}} \hat{\zeta}.$$

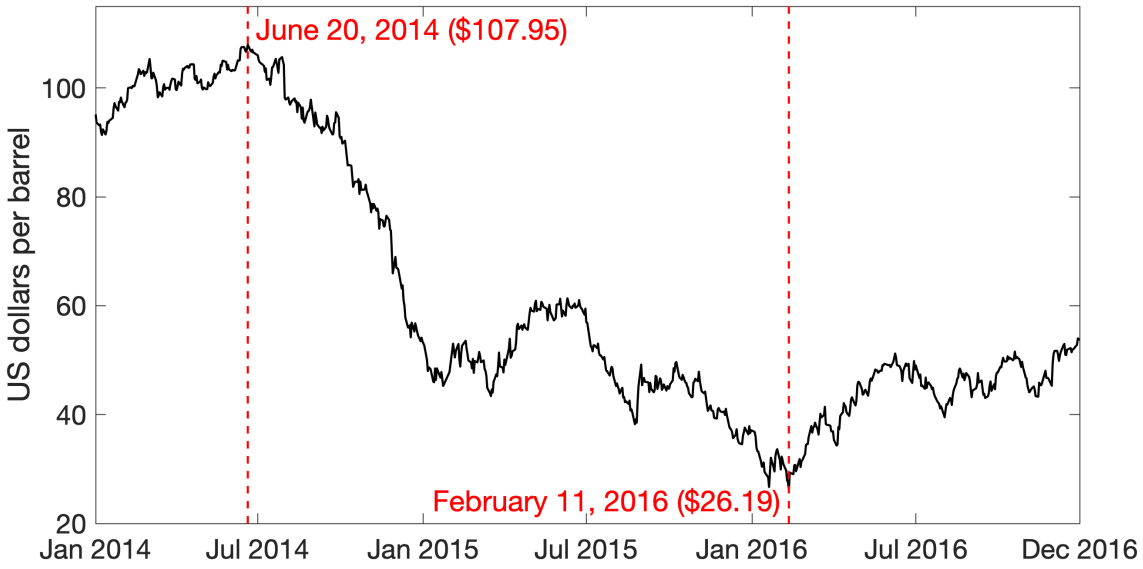
For comparison, in the case without labor market power:

$$\hat{n}^{noL} \approx -\frac{\zeta_0}{w_0 n_0 - \alpha \underline{z} n_0^{\alpha}} \hat{\zeta}.$$

When the labor supply curve is upward sloping, the inverse markdown factor $(\eta + 1)/\eta$ makes the denominator larger, which mitigates the response of labor to a financial shock. Thus, $\hat{n}^{noL} < \hat{n}^L < 0$.

B Case Study: The 2014–2016 Oil Bust

Figure B.1: WTI Crude Oil Prices



Note: The figure shows the daily West Texas Intermediate (WTI) crude oil spot price in U.S. dollars per barrel. The red dashed lines mark the highest and lowest prices during 2014–2016. Source: U.S. Energy Information Administration (series DCOILWTICO), retrieved from FRED.

Oil prices fell by more than 70% between 2014 and 2016. Figure B.1 shows that the West Texas Intermediate (WTI) crude oil spot price fell from a peak of $107.95 per barrel on June 20, 2014, to a low of $26.19 per barrel on February 11, 2016. According to Stocker et al. (2018), two supply-side factors contributed to the initial drop in oil prices from mid-2014 to early 2015: concerns about supply disruptions in the Middle East eased, and in November 2014 OPEC chose to protect its market share rather than cut output to support prices. From mid-2015 to early 2016, slower global growth weakened oil demand and pushed prices down further.

The oil bust was a large, unexpected price shock for U.S. oil producers, who are generally price takers in the global crude oil market.[1] Lower oil prices sharply increased oil producers' debt burden relative to sales. We use Denbury Resources and ExxonMobil as contrasting examples to show how oil producers responded to the shock. Table B.1 summarizes their differences.

Denbury entered the downturn with much higher leverage than ExxonMobil. At the end of 2013, Denbury had $3.30 billion in debt and $11.79 billion in total assets, so its leverage was 28.0% (Denbury Resources Inc., 2014). As oil prices fell, Denbury reduced its workforce from 1,523 in 2014 to 1,356 in 2015 and 1,058 in 2016, a 30.5% decline over two years. Denbury said it cut jobs to "reduce overhead and operating costs in response to the significant decline

[1] In our model, disinflation lowers both output and input prices. During the oil bust, oil producers' output prices fell while their input prices did not. This changed their relative price and made the shock more severe for them than the economy-wide disinflation.

Table B.1: Denbury Resources and ExxonMobil During the 2014–2016 Oil Bust

	Denbury Resources	ExxonMobil
Balance sheet at year-end 2013		
Debt (US$ billions)	3.30	22.70
Total assets (US$ billions)	11.79	346.81
⇒ Leverage	28.0%	6.5%
Year-end employment		
2014	1,523	83,700
2015	1,356	75,600
2016	1,058	72,700
⇒ Change, 2014–2016	−30.5%	−13.1%
Compensation and credit ratings		
Compensation, 2015–2016	Froze base salaries and cut performance-based bonuses in 2016.	No company-wide wage cut found.
S&P rating, October 2015	Lowered from BB to BB−	Maintained at AAA

Note: This table compares Denbury Resources and ExxonMobil. It shows their leverage before the oil bust and their employment, compensation, and credit ratings during the bust.

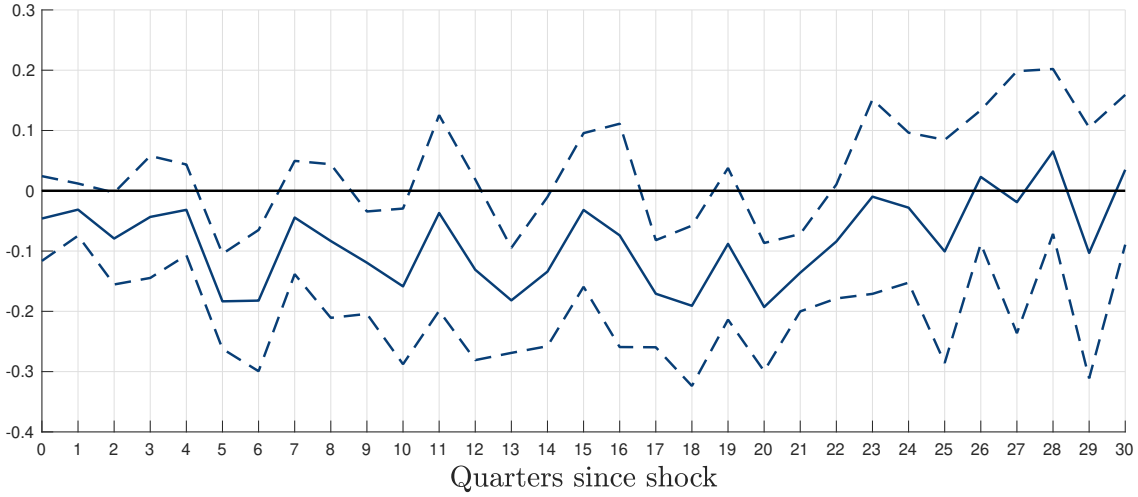
in oil prices" (Denbury Resources Inc., 2017b). In 2016, Denbury froze base salaries and cut performance-based annual bonuses by 20% for all employees, including senior management (Denbury Resources Inc., 2017a). On October 2, 2015, S&P lowered Denbury's corporate credit rating from BB to BB− "to reflect the company's increased leverage due to our lower oil and natural gas price deck assumptions" (Standard & Poor's Ratings Services, 2015).

ExxonMobil entered the downturn with lower leverage. At the end of 2013, it had $22.70 billion in debt and $346.81 billion in total assets, so its leverage was 6.5% (Exxon Mobil Corporation, 2014). Its employee count fell from 83,700 in 2014 to 72,700 in 2016, a 13.1% decline compared with Denbury's 30.5%. The headcount includes employees at company-operated retail sites. ExxonMobil attributed the decline in retail-site employment to its shift toward a branded-wholesaler model (Exxon Mobil Corporation, 2017). We found no reports from 2015–2016 of a company-wide wage cut at ExxonMobil. In October 2015, S&P maintained ExxonMobil's AAA corporate credit rating (Standard & Poor's Ratings Services, 2015).

As summarized in Table B.1, the two firms' responses are consistent with our hypothesis: after unexpected disinflation, employment and wages grow more slowly or even fall at firms with higher ex-ante leverage. Additionally, we did not find any public reports that either firm cut individual workers' working hours in response to the oil price decline.

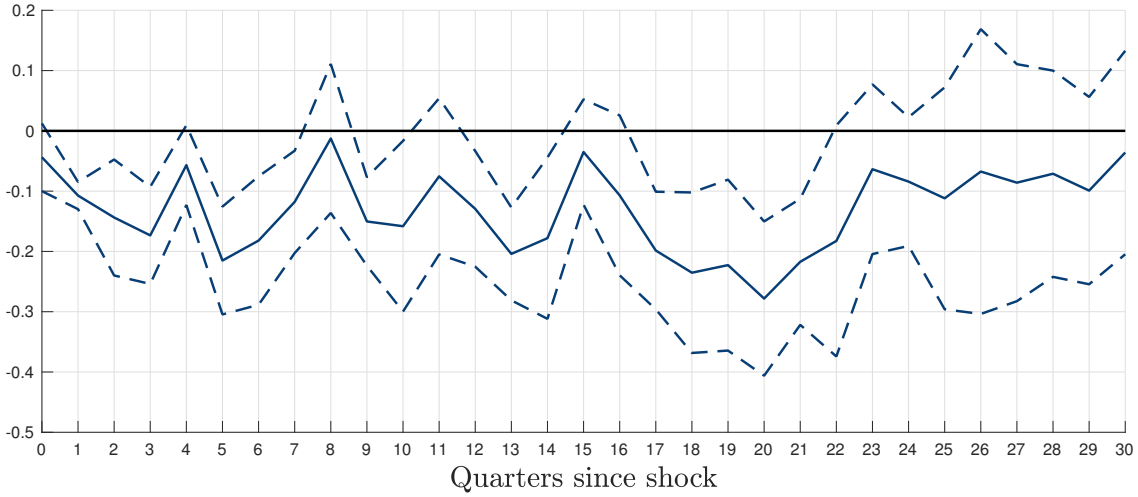
C Empirical Robustness

Figure C.1: Heterogeneous Responses of Worker Earnings to Aggregate Disinflation



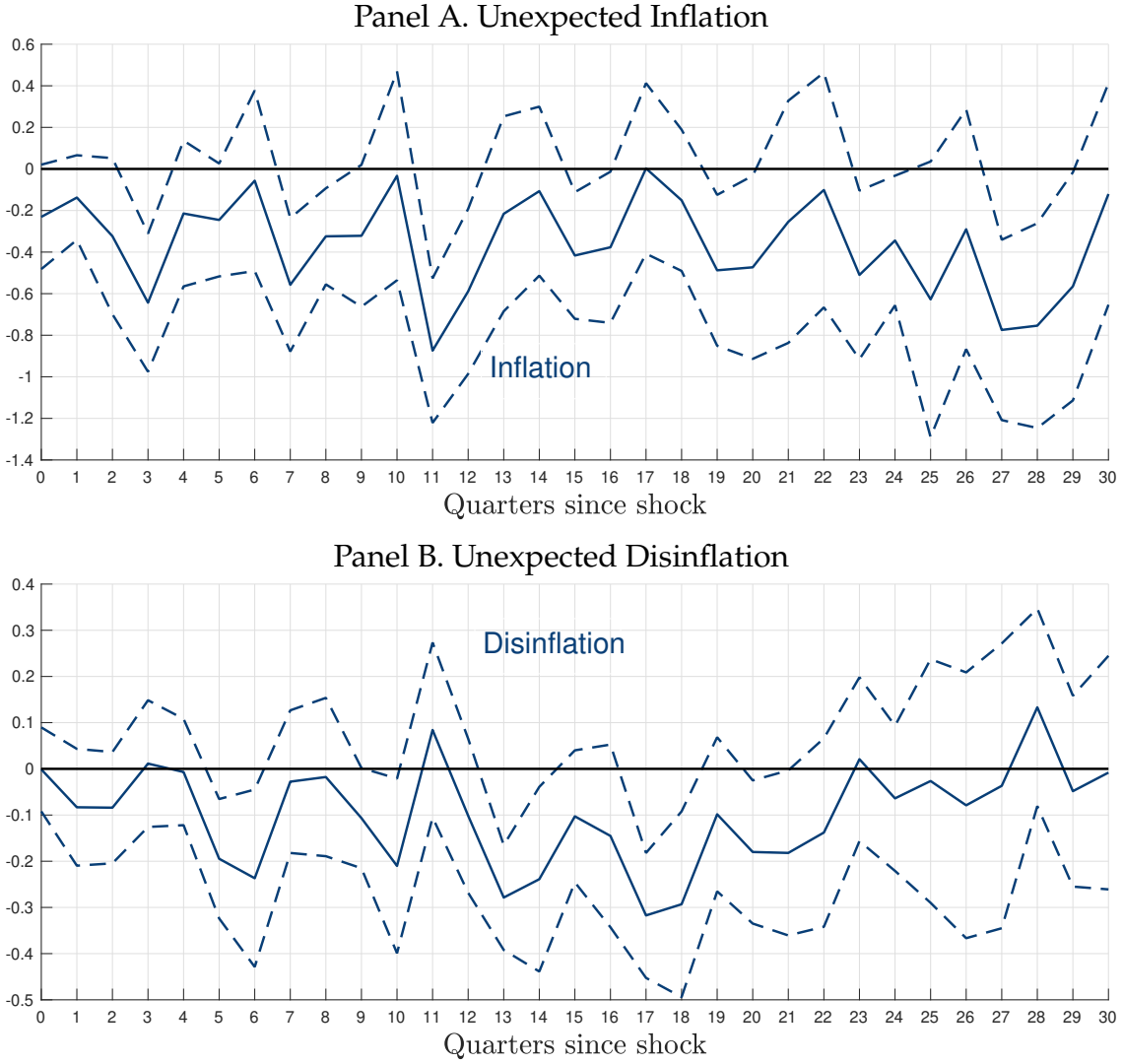
Note: The figure plots the estimated coefficients (β_h) with their corresponding 90% confidence intervals from equation (10), using nationwide CPI-based unexpected disinflation. It illustrates the heterogeneous responses of workers' earnings growth to aggregate disinflation shocks, conditional on firm leverage.

Figure C.2: Heterogeneous Responses of Worker Earnings Growth to Firm-Headquarters State Disinflation



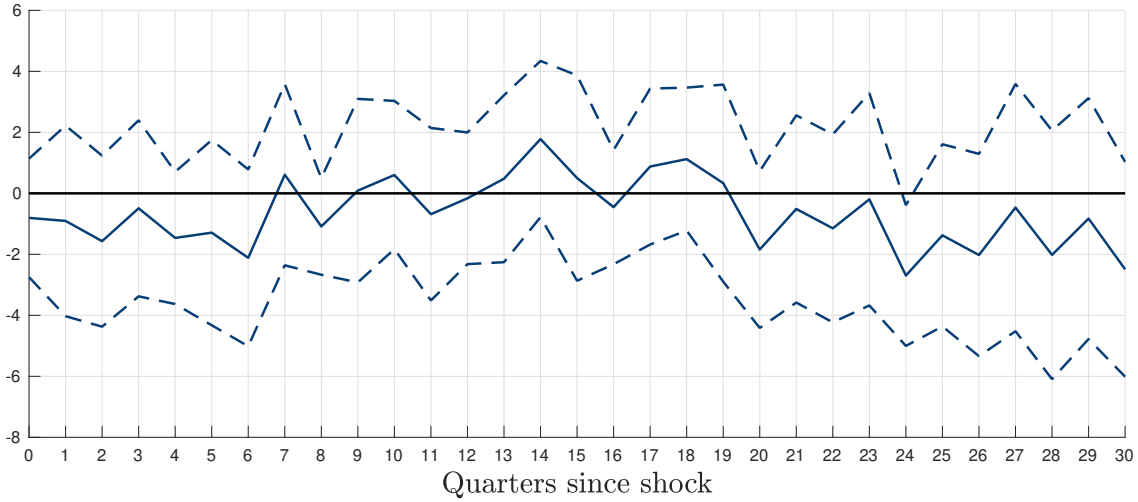
Note: The figure plots the estimated coefficients (β_h) with their corresponding 90% confidence intervals from equation (10), showing the heterogeneous responses of workers' earnings growth to unexpected state-level disinflation shocks in firms' headquarters states, conditional on firm leverage.

Figure C.3: Heterogeneous Responses of Worker Earnings to Inflation and Disinflation



Note: The figure plots the estimated coefficients with their corresponding 90% confidence intervals from equation (10), allowing asymmetric responses to unexpected inflation and disinflation shocks: $(lev_{jt-5} - \mathbb{E}_j[lev_{jt}]) \cdot (-\epsilon^{\pi}_{jt-1}) \cdot (\beta^1_h \mathbb{1}\{\epsilon^{\pi}_{jt-1} \geq 0\} + \beta^2_h \mathbb{1}\{\epsilon^{\pi}_{jt-1} < 0\})$. Panel A shows the heterogeneous responses of workers' earnings growth to unexpected inflation shocks (β^1_h), and Panel B shows the responses to disinflation shocks (β^2_h), conditional on firm leverage.

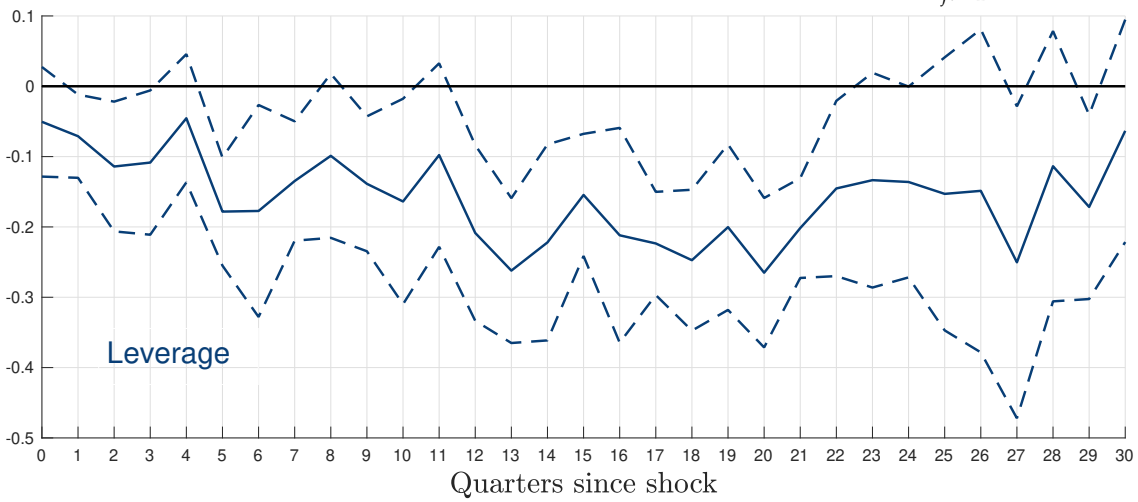
Figure C.4: Heterogeneous Responses of Worker Earnings to Monetary Policy Shocks



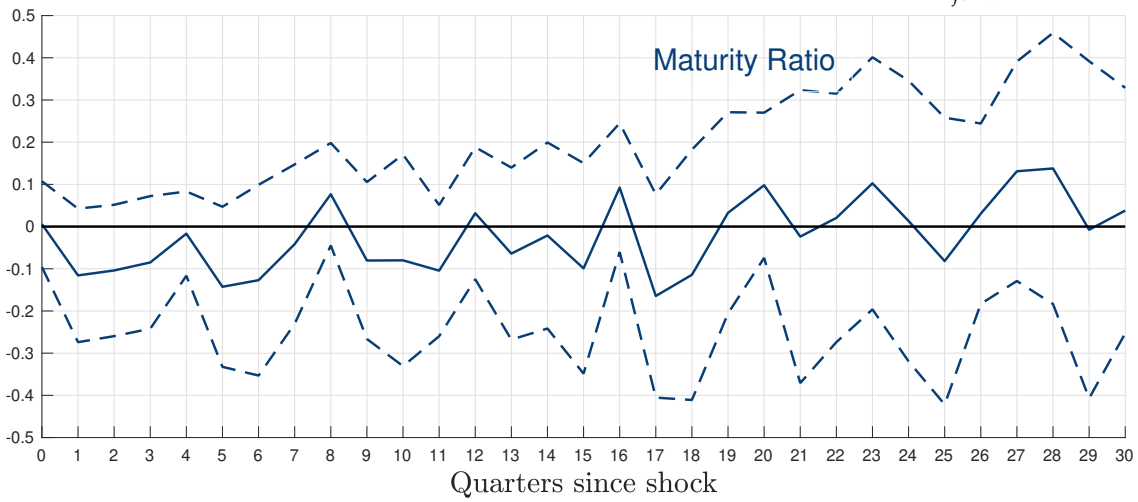
Note: The figure plots the estimated coefficients and 90% confidence intervals of the interaction between lagged leverage and lagged monetary policy shocks from equation (10), showing the heterogeneous responses of workers' earnings growth to monetary policy shocks, conditional on firm leverage.

Figure C.5: Heterogeneous Responses of Worker Earnings to Unexpected Disinflation Conditional on Debt Maturity

Panel A. Estimated Coefficients of $(lev_{jt-5} - \mathbb{E}_j[lev_{jt}])(-\epsilon^{\pi}_{jt-1})$

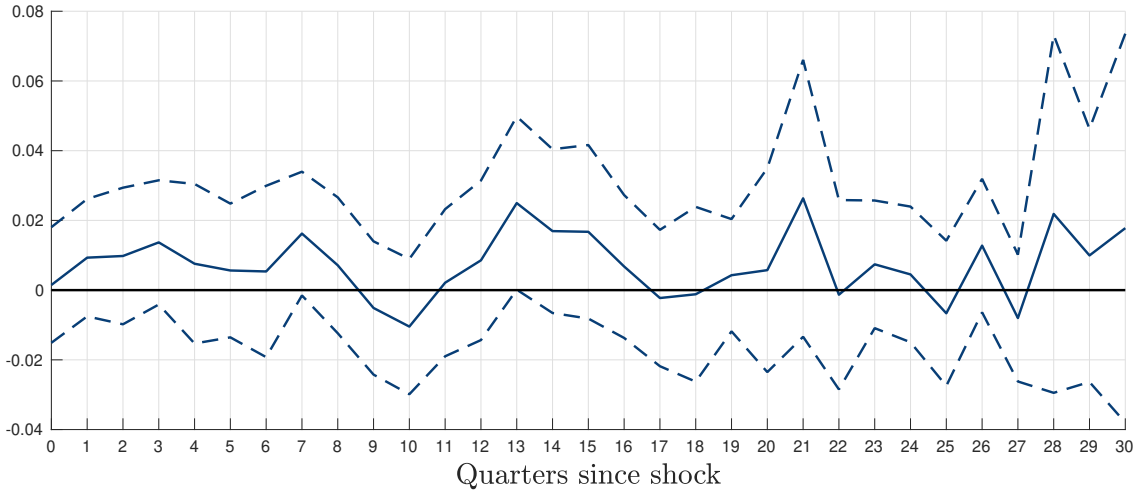


Panel B. Estimated Coefficients of $(mty_{jt-5} - \mathbb{E}_j[mty_{jt}])(-\epsilon^{\pi}_{jt-1})$



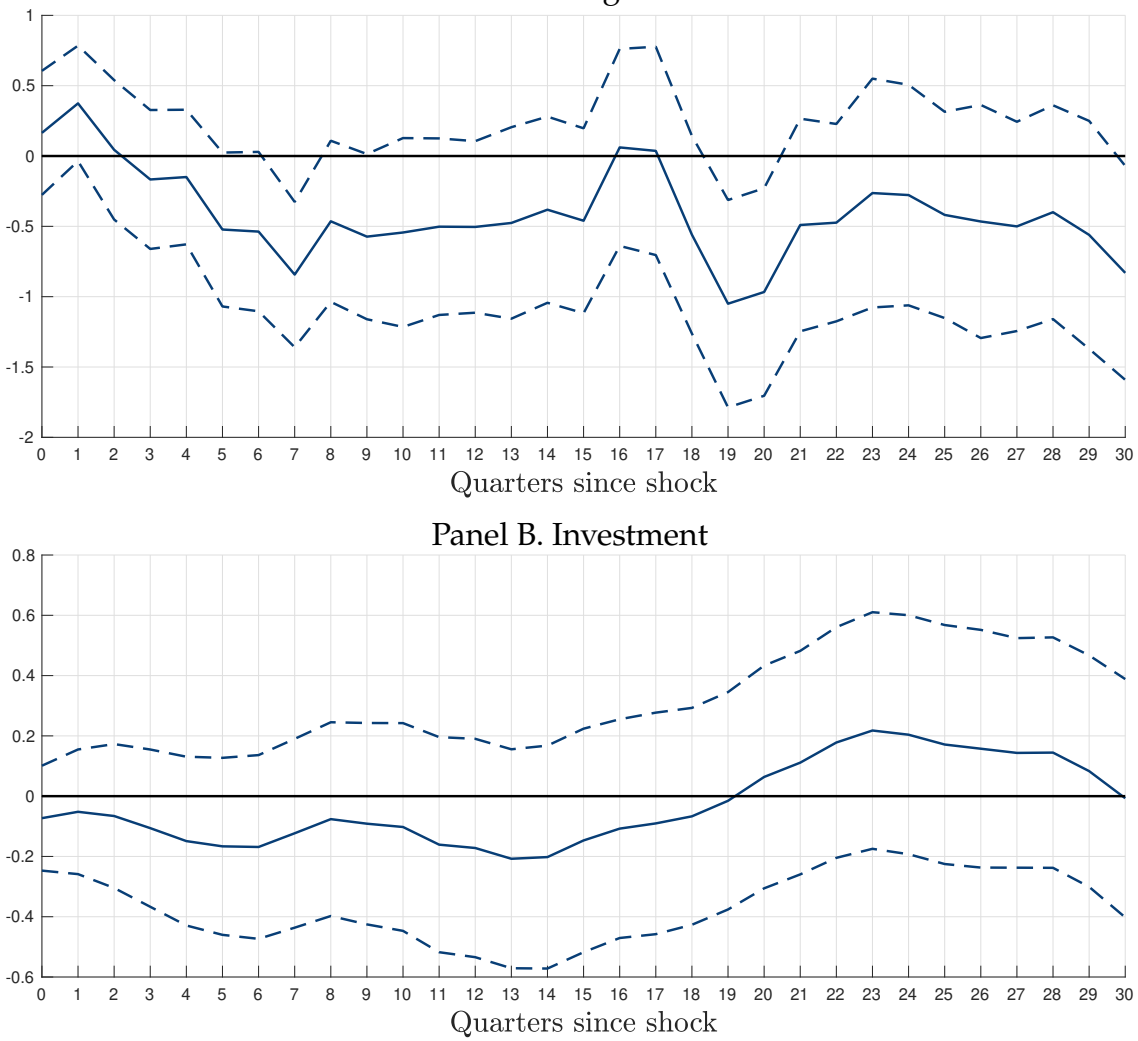
Note: The blue lines plot the estimated coefficients (β_h) and their corresponding 90% confidence intervals from equation (10), illustrating the heterogeneous responses of workers' earnings growth to unexpected disinflation shocks, conditional on firm leverage and debt maturity. Panel A reports the estimated coefficients for the interaction between lagged, demeaned leverage and unexpected disinflation shocks. Panel B reports the estimated coefficients for the interaction between the lagged, demeaned maturity ratio and unexpected disinflation shocks. The maturity ratio, mty, is defined as long-term debt ($dlttq$) divided by total debt ($dlcq + dlttq$).

Figure C.6: Heterogeneous Responses of Worker Layoffs



Note: The figure plots the estimated coefficients (β_h) with their corresponding 90% confidence intervals from equation (10), replacing the dependent variable with the layoff indicator $\mathbb{1}^{\text{lay}}_{ijt+h}$. It shows the heterogeneous responses of workers' layoff probability to unexpected disinflation shocks, conditional on firm leverage.

Figure C.7: Heterogeneous Responses of Firms to Unexpected Disinflation



Note: The figure plots the estimated coefficients (β_h) with their corresponding 90% confidence intervals from equation (11), using hiring growth as the dependent variable in Panel A and capital growth in Panel B. Panel A shows the heterogeneous responses of firms' hiring growth to unexpected disinflation shocks, conditional on firm leverage. Panel B shows the heterogeneous responses of firms' investment.

D Computational Algorithm

D.1 Benchmark Model

We first rewrite the firm's problem in terms of cash on hand to reduce the dimension of its state space. We then describe the algorithms for computing the stationary equilibrium and the transition path.

D.1.1 Firm's Problem in Cash-on-Hand Form

The firm's individual state is (z, κ, n, b). Conditional on productivity z, the remaining state variables (κ, n, b) affect the firm's problem only through cash on hand,

$$x = zn^{\alpha} - \frac{w_t(n)}{\pi_t} n - \frac{b}{\pi_t} - \kappa. \tag{39}$$

The firm's problem can therefore be written using the reduced state (z, x):

$$\begin{aligned} V_t(z, x) = \max_{n', b'} \; & x + Q_t(z, n', b')b' \\ & + (1-\delta)\mathbb{E}_t \left[\Lambda_{t+1} \sum_{z'} \pi_z(z' \mid z) \int_{-\infty}^{\kappa^*_{t+1}(z', n', b')} V_{t+1}(z', x')\phi(\kappa')\, d\kappa' \right], \end{aligned} \tag{40}$$

$$\text{s.t.} \quad x + Q_t(z, n', b')b' \geq 0, \qquad b' \geq 0, \tag{41}$$

$$x' = z'(n')^{\alpha} - \frac{w_{t+1}(n')}{\pi_{t+1}} n' - \frac{b'}{\pi_{t+1}} - \kappa', \tag{42}$$

$$w_{t+1}(n') = (n')^{\frac{1}{\eta}} \tilde{W}_{t+1}. \tag{43}$$

$$M_t(z) = \max_{n', b' \geq 0} Q_t(z, n', b')b'. \tag{44}$$

$$\kappa^*_{t+1}(z', n', b') = z'(n')^{\alpha} - \frac{w_{t+1}(n')}{\pi_{t+1}} n' - \frac{b'}{\pi_{t+1}} + M_{t+1}(z'), \tag{45}$$

$$Q_t(z, n', b') = \mathbb{E}_t \left[\frac{\Lambda_{t+1}}{\pi_{t+1}} \sum_{z'} \pi_z(z' \mid z) \Phi\big(\kappa^*_{t+1}(z', n', b')\big) \right]. \tag{46}$$

Here $\tilde{W}_{t+1} \equiv N_{t+1}^{-\frac{1}{\eta}} \bar{W}_{t+1}$ is an auxiliary variable. Firms take $\tilde{W}_{t+1}$ and the aggregate stochastic discount factor Λ_{t+1} as given when solving their optimization problem.

Let $\gamma_t(z, x)$ and $\lambda_t(z, x)$ denote the non-negative multipliers on the non-negative dividend

constraint $x + Q_t(z, n', b')b' \geq 0$ and the borrowing constraint $Q_t(z, n', b')b' \geq 0$, respectively. Define the undiscounted continuation value as

$$G_t(z, n', b') \equiv \sum_{z'} \pi_z(z' \mid z) \int_{-\infty}^{\kappa^*_{t+1}(z', n', b')} V_{t+1}(z', x')\phi(\kappa')\, d\kappa'. \tag{47}$$

The first-order conditions are

$$[1 + \gamma_t(z, x) + \lambda_t(z, x)]\frac{\partial[Q_t(z, n', b')b']}{\partial n'} + (1 - \delta)\mathbb{E}_t\left[\Lambda_{t+1}\frac{\partial G_t(z, n', b')}{\partial n'}\right] = 0, \tag{48}$$

$$[1 + \gamma_t(z, x) + \lambda_t(z, x)]\frac{\partial[Q_t(z, n', b')b']}{\partial b'} + (1 - \delta)\mathbb{E}_t\left[\Lambda_{t+1}\frac{\partial G_t(z, n', b')}{\partial b'}\right] = 0, \tag{49}$$

with complementary slackness conditions

$$\gamma_t(z, x)\,[x + Q_t(z, n', b')b'] = 0, \qquad \lambda_t(z, x)\, Q_t(z, n', b')b' = 0. \tag{50}$$

The derivatives entering these first-order conditions are

$$\frac{\partial[Q_t(z, n', b')b']}{\partial n'} = b'\mathbb{E}_t\left[\frac{\Lambda_{t+1}}{\pi_{t+1}}\sum_{z'} \pi_z(z' \mid z)\phi(\kappa^*_{t+1}) \times \left(\alpha z'(n')^{\alpha-1} - \frac{\eta + 1}{\eta}\frac{w_{t+1}(n')}{\pi_{t+1}}\right)\right], \tag{51}$$

$$\frac{\partial[Q_t(z, n', b')b']}{\partial b'} = Q_t(z, n', b') - b'\mathbb{E}_t\left[\frac{\Lambda_{t+1}}{\pi^2_{t+1}}\sum_{z'} \pi_z(z' \mid z)\phi(\kappa^*_{t+1})\right], \tag{52}$$

$$\begin{aligned}\frac{\partial G_t(z, n', b')}{\partial n'} = &\sum_{z'} \pi_z(z' \mid z)\left(\alpha z'(n')^{\alpha-1} - \frac{\eta + 1}{\eta}\frac{w_{t+1}(n')}{\pi_{t+1}}\right) \\ &\times \left[\int_{-\infty}^{\kappa^*_{t+1}} [1 + \gamma_{t+1}(z', x')]\phi(\kappa')\, d\kappa' + V_{t+1}(z', -M_{t+1}(z'))\phi(\kappa^*_{t+1})\right],\end{aligned} \tag{53}$$

$$\begin{aligned}\frac{\partial G_t(z, n', b')}{\partial b'} = &-\frac{1}{\pi_{t+1}}\sum_{z'} \pi_z(z' \mid z) \\ &\times \left[\int_{-\infty}^{\kappa^*_{t+1}} [1 + \gamma_{t+1}(z', x')]\phi(\kappa')\, d\kappa' + V_{t+1}(z', -M_{t+1}(z'))\phi(\kappa^*_{t+1})\right].\end{aligned} \tag{54}$$

Here κ^*_{t+1} abbreviates $\kappa^*_{t+1}(z', n', b')$. These expressions use the envelope condition $\partial V_{t+1}(z', x')/\partial x' = 1 + \gamma_{t+1}(z', x')$ and the fact that $x' = -M_{t+1}(z')$ at the default threshold.

D.1.2 Stationary Equilibrium

In the stationary equilibrium, gross inflation is $\pi_{t+1} = \pi = 1$, and the stochastic discount factor is $\Lambda = \beta$. We suppress time subscripts below. For computational convenience, we choose and fix the wage index $\tilde{W}$ so that firm-level employment lies between 0 and 30. Given the wage schedule $w(n) = n^{\frac{1}{\eta}}\tilde{W}$, we solve for firms' decision rules and the stationary distribution. We then recover the labor-disutility parameter χ from the labor-market clearing condition.

The computational algorithm proceeds as follows:

1. Discretize productivity z using Tauchen's method and obtain the transition probabilities $\pi_z(z' \mid z)$. Construct grids for employment n' and debt b'.

2. Iterate to find the borrowing limit and bond price schedule.

   (a) Make an initial guess of the maximum borrowing $M^{\{0\}}(z)$.

   (b) Update the bond-price schedule as

   $$Q^{\{\ell\}}(z, n', b') = \beta \sum_{z'} \pi_z(z'|z)\Phi(\kappa'^*)\frac{1}{\pi'}, \tag{55}$$

   where $\kappa'^* = z'n'^{\alpha} - \frac{w(n')}{\pi'}n' - \frac{b'}{\pi'} + M^{\{\ell\}}(z')$.

   (c) Update maximum borrowing as

   $$M^{\{\ell+1\}}(z) = \max_{n', b'} Q^{\{\ell\}}(z, n', b')b'$$

   (d) Repeat steps (b)–(c) until maximum borrowing and the bond-price schedule converge. Denote the converged objects by Q and M and hold them fixed in the following value-function iteration.

3. Construct initial cash-on-hand grids and initialize the multiplier on the non-negative dividend constraint $\gamma^{\{0\}}(z, x)$, and the value function $V^{\{0\}}(z, x)$. In the following steps, $G^{\{\ell\}}$ is the undiscounted continuation value computed using $V^{\{\ell\}}$.

4. Solve the relaxed problem without the two inequality constraints:

   $$\hat{V}(z) = \max_{n', b'} Q(z, n', b')b' + \beta(1-\delta)G^{\{\ell\}}(z, n', b').$$

   Obtain the policies $\{\hat{n}'(z), \hat{b}'(z)\}$ for the relaxed problem by solving the following system of first-order conditions:

   $$\frac{\partial[Q(z, n', b')b']}{\partial n'} + \beta(1-\delta)\frac{\partial G^{\{\ell\}}(z, n', b')}{\partial n'} = 0. \tag{56}$$

$$\frac{\partial[Q(z,n',b')b']}{\partial b'} + \beta(1-\delta)\frac{\partial G^{\{\ell\}}(z,n',b')}{\partial b'} = 0. \tag{57}$$

5. If $\hat{b}'(z)$ does not satisfy the borrowing constraint, set $\hat{b}'(z) = 0$ and solve for $\hat{n}'(z)$ using:

$$\frac{\partial[Q(z,n',b')b']}{\partial n'}\frac{\partial G^{\{\ell\}}(z,n',b')}{\partial b'} - \frac{\partial[Q(z,n',b')b']}{\partial b'}\frac{\partial G^{\{\ell\}}(z,n',b')}{\partial n'} = 0, \tag{58}$$

   where $b' = 0$.

6. Update the cash-on-hand grids $x \in [x_{min}^{\{\ell+1\}}(z), x_{max}^{\{\ell+1\}}(z)]$:

$$\begin{aligned} x_{min}^{\{\ell+1\}}(z) &= -M(z), \\ x_{max}^{\{\ell+1\}}(z) &= \hat{x}(z) \equiv -Q(z,\hat{n}'(z),\hat{b}'(z))\hat{b}'(z). \end{aligned}$$

   When $x \leq \hat{x}(z)$, the non-negative dividend constraint (NND) binds. Since $\hat{x}(z) \leq 0$, this implies $Q(z,n',b')b' = -x \geq 0$, so the borrowing constraint is automatically satisfied. When $x > \hat{x}(z)$, the NND constraint is slack, and the optimal policies $\hat{n}'(z)$ and $\hat{b}'(z)$ are independent of x.

7. Solve the constrained problem and update the multiplier and value function for $x \in [x_{min}^{\{\ell+1\}}(z), x_{max}^{\{\ell+1\}}(z)]$. First, obtain the policies $n'(z,x)$ and $b'(z,x)$ by solving

$$x + Q(z,n',b')b' = 0,$$

$$\frac{\partial[Q(z,n',b')b']}{\partial n'}\frac{\partial G^{\{\ell\}}(z,n',b')}{\partial b'} - \frac{\partial[Q(z,n',b')b']}{\partial b'}\frac{\partial G^{\{\ell\}}(z,n',b')}{\partial n'} = 0.$$

   Use these policies to update the multiplier:

$$\gamma^{\{\ell+1\}}(z,x) = -\beta(1-\delta)\frac{\partial G^{\{\ell\}}(z,n',b')/\partial b'}{\partial[Q(z,n',b')b']/\partial b'} - 1. \tag{59}$$

   For $x > x_{max}^{\{\ell+1\}}(z)$, the NND constraint is slack, so $\gamma^{\{\ell+1\}}(z,x) = 0$.

   Update the value function as

$$\begin{aligned} V^{\{\ell+1\}}(z,x) = {} & x + Q(z,n',b')b' \\ & + \beta(1-\delta)\sum_{z'}\pi_z(z' \mid z)\int_{-\infty}^{\kappa'^*(z',n',b')} V^{\{\ell\}}(z',x')\phi(\kappa')\,d\kappa'. \end{aligned} \tag{60}$$

   When evaluating the continuation value for $x' > x_{max}^{\{\ell\}}(z')$, use the following property

$$V^{\{\ell\}}(z',x') = V^{\{\ell\}}\left(z', x_{max}^{\{\ell\}}(z')\right) + x' - x_{max}^{\{\ell\}}(z'). \tag{61}$$

8. Repeat steps 4–7 until γ and V converge.

9. Given the converged policies, iterate the firm distribution until it converges to the stationary distribution $\Upsilon(z, x)$. Compute aggregate employment as

$$N = \left[\int [n'(z, x)]^{\frac{\eta+1}{\eta}} \, d\Upsilon(z, x) \right]^{\frac{\eta}{\eta+1}}.$$

To recover χ, recall that $\tilde{W}_{t+1} \equiv N_{t+1}^{-\frac{1}{\eta}} \bar{W}_{t+1}$, where $\bar{W}_t \equiv \frac{-\mathbb{E}_{t-1}[u_{Nt}]}{\mathbb{E}_{t-1}[u_{Ct}/\pi_t]}$. In the stationary equilibrium, $\pi = 1$, and the household's preferences imply $-u_N/u_C = \chi N^{\frac{1}{\nu}}$. Hence,

$$\tilde{W} = \chi N^{\frac{1}{\nu} - \frac{1}{\eta}}.$$

We therefore recover $\chi = 0.02$ as

$$\chi = \tilde{W} N^{-\frac{1}{\nu} + \frac{1}{\eta}}.$$

D.1.3 Transition Path

We consider a one-time unexpected decrease in gross inflation in period t_0, with $\pi_{t_0} < 1$ and $\pi_t = 1$ in all other periods. The economy is initially in its stationary equilibrium. This shock permanently lowers the price level to $P_t = \pi_{t_0} P_{t_0 - 1}$ for $t \geq t_0$. Because the shock is unexpected, $\mathbb{E}_{t_0 - 1}[\pi_{t_0}] = 1$. The inherited employment, debt, and wage commitments $(n_{t_0}, b_{t_0}, w_{t_0})$ are predetermined and unaffected by the realized π_{t_0}.

From t_0 onward, the aggregate path is perfectly foreseen. We truncate the transition at period $T = 120$ and verify that this is large enough for the economy to return to its stationary equilibrium. We start with guesses for the paths of aggregate prices. Given them, we solve firms' decision problems backward and then solve for the distribution forward. We update the guessed paths and repeat until convergence. The transition path is computed as follows:

1. Use $V_T = V^{SS}$, $\gamma_T = \gamma^{SS}$, and $M_T = M^{SS}$ as terminal conditions for the backward solution, where the superscript SS denotes the stationary-equilibrium solution.

2. Define consumption net of labor disutility as

$$H_t \equiv C_t - \chi \frac{N_t^{1+1/\nu}}{1 + 1/\nu}.$$

Initialize the wage-index path $\{\tilde{W}_t^{\{0\}}\}_{t=t_0+1}^{T}$ and the path $\{H_t^{\{0\}}\}_{t=t_0+1}^{T}$ at their steady-state values $\tilde{W}^{SS}$ and H^{SS}, respectively. We verify that $H^{SS} > 0$.

3. At iteration ℓ, first compute the SDFs from the guessed H path:

$$\Lambda_{t+1}^{\{\ell\}} = \beta \frac{H_t^{\{\ell\}}}{H_{t+1}^{\{\ell\}}}, \qquad t = t_0, \ldots, T - 1,$$

where $H_{t_0}^{\{\ell\}} = H^{SS}$ for every ℓ. Given the inflation path $\{\pi_t\}_{t=t_0}^{T}$, the guessed wage-index path $\{\tilde{W}_t^{\{\ell\}}\}_{t=t_0+1}^{T}$, and these computed SDFs, solve backward for the decision rules and bond pricing schedules for $t = T-1, T-2, \ldots, t_0$. For each t:

(a) Solve the borrowing limit, bond price schedule, and the derivatives of $Q_t^{\{\ell+1\}}$:

i. Compute the bond pricing schedule

$$Q_t^{\{\ell+1\}}(z, n', b') = \Lambda_{t+1}^{\{\ell\}} \sum_{z'} \pi_z(z'|z)\Phi(\kappa'^*)\frac{1}{\pi_{t+1}}, \tag{62}$$

where $\kappa'^* = z'n'^{\alpha} - \frac{w_{t+1}^{\{\ell\}}(n')}{\pi_{t+1}}n' - \frac{b'}{\pi_{t+1}} + M_{t+1}^{\{\ell+1\}}(z')$.

ii. Update the maximum borrowing for t:

$$M_t^{\{\ell+1\}}(z) = \max_{n', b'} Q_t^{\{\ell+1\}}(z, n', b')b'$$

(b) Given the continuation values at $t+1$, solve for the optimal decisions, Lagrangian multipliers, and value functions at t:

i. The undiscounted continuation value is

$$G_t^{\{\ell+1\}}(z, n', b') \equiv \sum_{z'} \pi_z(z'|z) \int_{-\infty}^{\kappa'^*} V_{t+1}^{\{\ell+1\}}(z', x')\phi(\kappa')d\kappa'.$$

Solve the relaxed problem without the two inequality constraints:

$$\hat{V}_t^{\{\ell+1\}}(z) = \max_{n', b'} Q_t^{\{\ell+1\}}(z, n', b')b' + \Lambda_{t+1}^{\{\ell\}}(1-\delta)G_t^{\{\ell+1\}}(z, n', b').$$

We solve the following first-order conditions to obtain the optimal policies $\{\hat{n}_t'(z), \hat{b}_t'(z)\}$ for the relaxed problem:

$$\frac{\partial[Q_t^{\{\ell+1\}}(z, n', b')b']}{\partial n'} + \Lambda_{t+1}^{\{\ell\}}(1-\delta)\frac{\partial G_t^{\{\ell+1\}}(z, n', b')}{\partial n'} = 0. \tag{63}$$

$$\frac{\partial[Q_t^{\{\ell+1\}}(z, n', b')b']}{\partial b'} + \Lambda_{t+1}^{\{\ell\}}(1-\delta)\frac{\partial G_t^{\{\ell+1\}}(z, n', b')}{\partial b'} = 0. \tag{64}$$

ii. If $\hat{b}_t'(z)$ does not satisfy the borrowing constraint, set $\hat{b}_t'(z) = 0$ and solve for $\hat{n}_t'(z)$ using the following condition:

$$\frac{\partial[Q_t^{\{\ell+1\}}(z, n', b')b']}{\partial n'}\frac{\partial G_t^{\{\ell+1\}}(z, n', b')}{\partial b'} - \frac{\partial[Q_t^{\{\ell+1\}}(z, n', b')b']}{\partial b'}\frac{\partial G_t^{\{\ell+1\}}(z, n', b')}{\partial n'} = 0, \tag{65}$$

where $b' = 0$.

iii. Update cash-on-hand grids $x \in [x_{min,t}^{\{\ell+1\}}(z), x_{max,t}^{\{\ell+1\}}(z)]$:

$$x_{min,t}^{\{\ell+1\}}(z) = -M_t^{\{\ell+1\}}(z),$$
$$x_{max,t}^{\{\ell+1\}}(z) = \hat{x}_t^{\{\ell+1\}}(z) \equiv -Q_t^{\{\ell+1\}}(z, \hat{n}_t'(z), \hat{b}_t'(z))\hat{b}_t'(z).$$

When $x \leq \hat{x}_t^{\{\ell+1\}}(z)$, the non-negative dividend condition binds, and the borrowing constraint automatically holds. For any $x \geq \hat{x}_t^{\{\ell+1\}}(z)$, the optimal policies are $\hat{n}_t'(z)$ and $\hat{b}_t'(z)$, independent of x.

iv. Solve the constrained problem and update the multiplier and value function for $x \in [x_{min,t}^{\{\ell+1\}}(z), x_{max,t}^{\{\ell+1\}}(z)]$. First, obtain the policies $n_t'(z,x)$ and $b_t'(z,x)$ by solving

$$x + Q_t^{\{\ell+1\}}(z, n', b')b' = 0,$$

$$\frac{\partial[Q_t^{\{\ell+1\}}(z,n',b')b']}{\partial n'}\frac{\partial G_t^{\{\ell+1\}}(z,n',b')}{\partial b'} - \frac{\partial[Q_t^{\{\ell+1\}}(z,n',b')b']}{\partial b'}\frac{\partial G_t^{\{\ell+1\}}(z,n',b')}{\partial n'} = 0.$$

Use these policies to update the multiplier:

$$\gamma_t^{\{\ell+1\}}(z,x) = -\Lambda_{t+1}^{\{\ell\}}(1-\delta)\frac{\partial G_t^{\{\ell+1\}}(z,n',b')/\partial b'}{\partial[Q_t^{\{\ell+1\}}(z,n',b')b']/\partial b'} - 1. \tag{66}$$

For $x > x_{max,t}^{\{\ell+1\}}(z)$, the NND constraint is slack, so $\gamma_t^{\{\ell+1\}}(z,x) = 0$.
Update the value function as

$$\begin{aligned} V_t^{\{\ell+1\}}(z,x) = {} & x + Q_t^{\{\ell+1\}}(z,n',b')b' \\ & + \Lambda_{t+1}^{\{\ell\}}(1-\delta)\sum_{z'}\pi_z(z'|z)\int_{-\infty}^{\kappa'^*(z',n',b')} V_{t+1}^{\{\ell+1\}}(z',x')\phi(\kappa')d\kappa'. \end{aligned} \tag{67}$$

When evaluating the continuation value for $x' > x_{max,t+1}^{\{\ell+1\}}(z')$, use the following property:

$$V_{t+1}^{\{\ell+1\}}(z',x') = V_{t+1}^{\{\ell+1\}}\left(z', x_{max,t+1}^{\{\ell+1\}}(z')\right) + x' - x_{max,t+1}^{\{\ell+1\}}(z'). \tag{68}$$

4. Given the optimal policies and the initial stationary distribution, solve the distribution forward. For $t = t_0 - 1, \ldots, T-1$,

$$\begin{aligned} \Upsilon_{t+1}^{\{\ell+1\}}(z',x') = {} & \int\int \mathbf{1}\left\{x' = z'\left(n_t'\right)^{\alpha} - \frac{w_{t+1}^{\{\ell\}}\left(n_t'\right)n_t' + b_t'}{\pi_{t+1}} - \kappa'\right\} \\ & \times \mathbf{1}\left\{\kappa' \leq \kappa_{t+1}^{*,\{\ell+1\}}\left(z', n_t', b_t'\right)\right\} \times \pi_z(z'|z)\, d\Phi(\kappa')\, d\Upsilon_t^{\{\ell+1\}}(z,x) \\ & + m_{e,t+1}^{\{\ell+1\}} \int \mathbf{1}\{z' = z_e,\ x' = -b_e/\pi_{t+1}\}\mathbf{1}\{b_e \leq b_{e,t+1}^{*,\{\ell+1\}}\}\, d\Phi_e(b_e). \end{aligned} \tag{69}$$

Here, n'_t and b'_t denote the optimal policies evaluated at the current state (z, x). $\Upsilon_{t_0-1}^{\{\ell+1\}}$ is the initial stationary distribution. The mass of potential entrants is determined by

$$m_{e,t+1}^{\{\ell+1\}} = \frac{\int \sum_{z'} \int \mathbf{1}\left\{\kappa' > \kappa_{t+1}^{*,\{\ell+1\}}\left(z', n'_t, b'_t\right)\right\} \pi_z(z'|z)\, d\Phi(\kappa')\, d\Upsilon_t^{\{\ell+1\}}(z, x)}{\int \mathbf{1}\{b_e \leq b_{e,t+1}^{*,\{\ell+1\}}\}\, d\Phi_e(b_e)}. \tag{70}$$

5. Calculate aggregate variables and obtain the implied $\tilde{W}$ and H paths. Given the solved distribution and decision rules, compute for $t = t_0, \ldots, T$:

$$\begin{aligned}
N_t^{\{\ell+1\}} &= \left[\int \left(n'_{t-1}\right)^{(\eta+1)/\eta} d\Upsilon_{t-1}^{\{\ell+1\}}(z, x)\right]^{\eta/(\eta+1)}, \\
Y_t^{\{\ell+1\}} &= \int \sum_{z'} \pi_z(z'|z)\, z' \left(n'_{t-1}\right)^{\alpha} d\Upsilon_{t-1}^{\{\ell+1\}}(z, x), \\
C_t^{\{\ell+1\}} &= Y_t^{\{\ell+1\}} - \bar{\kappa}.
\end{aligned}$$

Here, n'_{t-1} denotes the employment policy evaluated at state (z, x) in period $t-1$.

For $t = t_0 + 1, \ldots, T$, calculate

$$\begin{aligned}
\tilde{W}_t^{\text{new}} &= \pi_t \chi (N_t^{\{\ell+1\}})^{1/\nu - 1/\eta} = \chi (N_t^{\{\ell+1\}})^{1/\nu - 1/\eta}, \\
H_t^{\text{new}} &= C_t^{\{\ell+1\}} - \chi \frac{(N_t^{\{\ell+1\}})^{1+1/\nu}}{1 + 1/\nu}.
\end{aligned}$$

We verify that $H_t^{\text{new}} > 0$ for all t at every iteration.

6. Check convergence and update the $\tilde{W}$ and H paths jointly using Broyden's method. Define the joint vectors of the current and newly computed log paths as

$$\mathbf{x}^{\{\ell\}} \equiv \begin{pmatrix} \{\log \tilde{W}_t^{\{\ell\}}\}_{t=t_0+1}^T \\ \{\log H_t^{\{\ell\}}\}_{t=t_0+1}^T \end{pmatrix}, \qquad g(\mathbf{x}^{\{\ell\}}) \equiv \begin{pmatrix} \{\log \tilde{W}_t^{\text{new}}\}_{t=t_0+1}^T \\ \{\log H_t^{\text{new}}\}_{t=t_0+1}^T \end{pmatrix},$$

where $\tilde{W}_t^{\text{new}}$ and H_t^{new} are obtained in the preceding step. The equilibrium paths satisfy $\mathbf{x} = g(\mathbf{x})$. Define the residual as

$$f(\mathbf{x}) \equiv \mathbf{x} - g(\mathbf{x}).$$

At each iteration, check whether

$$\|f(\mathbf{x}^{\{\ell\}})\|_\infty \leq 10^{-6}.$$

If this criterion holds, retain $\mathbf{x}^{\{\ell\}}$ and stop. Otherwise, update the paths using a joint inverse-Jacobian approximation $\mathbf{B}$. Specifically, at the initial evaluation, set $\mathbf{B}^{\{0\}} = 0.005I$.

For $\ell \geq 1$, define

$$\begin{aligned}\mathbf{s}^{\{\ell\}} &= \mathbf{x}^{\{\ell\}} - \mathbf{x}^{\{\ell-1\}},\\ \mathbf{y}^{\{\ell\}} &= f(\mathbf{x}^{\{\ell\}}) - f(\mathbf{x}^{\{\ell-1\}}),\\ \mathbf{u}^{\{\ell\}} &= \mathbf{B}^{\{\ell-1\}}\mathbf{y}^{\{\ell\}},\end{aligned}$$

and update the inverse-Jacobian approximation as

$$\mathbf{B}^{\{\ell\}} = \mathbf{B}^{\{\ell-1\}} + \frac{(\mathbf{s}^{\{\ell\}} - \mathbf{u}^{\{\ell\}})(\mathbf{s}^{\{\ell\}})^T\mathbf{B}^{\{\ell-1\}}}{(\mathbf{s}^{\{\ell\}})^T\mathbf{u}^{\{\ell\}}}. \tag{71}$$

Then update the joint log paths:

$$\mathbf{x}^{\{\ell+1\}} = \mathbf{x}^{\{\ell\}} - \mathbf{B}^{\{\ell\}} f(\mathbf{x}^{\{\ell\}}). \tag{72}$$

Exponentiate $\mathbf{x}^{\{\ell+1\}}$ to obtain $\tilde{W}_t^{\{\ell+1\}}$ and $H_t^{\{\ell+1\}}$ for $t = t_0 + 1, \ldots, T$. Return to Step 3 and repeat.

D.2 Model without Labor Market Power

Without labor market power, firms take the common wage w_{t+1} as given. The firm's problem is

$$\begin{aligned}V_t(z, x) = \max_{n', b'}\ & x + Q_t(z, n', b')b' \\ & + (1-\delta)\mathbb{E}_t\left[\Lambda_{t+1}\sum_{z'}\pi_z(z' \mid z)\int_{-\infty}^{\kappa^*_{t+1}(z', n', b')} V_{t+1}(z', x')\phi(\kappa')\,d\kappa'\right],\end{aligned} \tag{73}$$

$$\text{s.t.} \quad x + Q_t(z, n', b')b' \geq 0, \qquad b' \geq 0, \tag{74}$$

$$x' = z'(n')^\alpha - \frac{w_{t+1}}{\pi_{t+1}}n' - \frac{b'}{\pi_{t+1}} - \kappa'. \tag{75}$$

$$M_t(z) = \max_{n', b' \geq 0} Q_t(z, n', b')b'. \tag{76}$$

$$\kappa^*_{t+1}(z', n', b') = z'(n')^\alpha - \frac{w_{t+1}}{\pi_{t+1}}n' - \frac{b'}{\pi_{t+1}} + M_{t+1}(z'), \tag{77}$$

$$Q_t(z, n', b') = \mathbb{E}_t\left[\frac{\Lambda_{t+1}}{\pi_{t+1}}\sum_{z'}\pi_z(z' \mid z)\Phi\big(\kappa^*_{t+1}(z', n', b')\big)\right]. \tag{78}$$

The computational algorithm follows Section D.1, with three changes. First, the common wage replaces the firm-specific wage schedule in the firm's problem. Second, aggregate labor

is the sum of firm-level employment:

$$N_t = \int n'_{t-1}(z, x)\, d\Upsilon_{t-1}(z, x).$$

Third, the household's labor-supply condition becomes

$$w_t = \frac{-\mathbb{E}_{t-1}[u_{Nt}]}{\mathbb{E}_{t-1}[u_{Ct}/\pi_t]} = \chi N_t^{1/\nu},$$

where the last equality holds under perfect foresight with $\pi_t = 1$ for $t > t_0$. At $t = t_0$, wages w_t, consumption C_t, and employment N_t remain at their initial stationary values.

For the stationary equilibrium, we hold χ fixed at its benchmark value and iterate on the equilibrium wage rate w. Given a candidate wage, we solve the firm's problem and the stationary distribution, compute aggregate labor, and update the wage based on the labor-market clearing condition $w = \chi N^{1/\nu}$ until convergence.

For the transition path, we jointly update the log wage and The implied wage path is

$$w_t^{\text{new}} = \chi \left(N_t^{\{\ell+1\}}\right)^{1/\nu}, \qquad t = t_0 + 1, \ldots, T.$$

The remaining steps follow the benchmark algorithm.

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