Markup Polarization and Missing Inflation: A Tale of Two Firms

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Abstract

This paper explores the contribution of polarization in price-cost markups (see Diez, Fan, Villegas-Sanchez, 2021) to the slowdown of inflation/disinflation responses. I extend a basic New Keynesian model to have two types of firms: high- and low-markup firms. In this environment, I show that the polarization on price-cost markups has a jamming effect on the responses of the aggregate price level, and thus, the inflation responses are subdued.

Keywords: Markup, Polarization, Inflation, New Keynesian model

JEL classification: E31, E32, E58

Declarations of interest: None

1 Introduction

How would the rising market power of firms affect inflation? The literature has documented the changes in price-cost markups to shed light on the changes in market competition (see Basu 2019, Díez, Fan and Villegas-Sánchez 2021, among many others). This paper focuses on the ramification of such changes in markups on inflation. I incorporate polarization of steady-state

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price-cost markups into a basic New Keynesian model. The markup polarization has a jamming effect on the price aggregator, and thus, inflation responses are subdued. Considering such an economic environment, the monetary policy to control inflation may need to be aggressive.

This paper shares the spirit of Kimball (1995) and Eichenbaum and Fisher (2007) to relax the assumption of the constant elasticity of substitution in the production function. However, the specific construction is differentiated. Kimball (1995) constructs the elasticity as a function of a firm's market share. In Eichenbaum and Fisher (2007) when price rises, elasticity increases, and demand falls. The construction of elasticity in this paper allows a small niche market business to be able to charge a high-markup, earning consumers' loyalty and enjoying a low elasticity of substitution.

Andrés, Arce and Burriel (2021) discuss the effect of superstar firms on the slowdown of inflation: If the firms with large market shares try raising their prices, their market shares shrink so that inflationary pressure dissipates. In this paper, in contrast, inflation responses are subdued because low-markup firms have little room to adjust their prices.

2 The Model

I extend a basic New Keynesian model resembling Galí (2015, Chap. 3) to have two types of firms. All notations are standard unless otherwise noted. The representative household provides both sectors with labor, denoted by $\widehat{N}_t^h$ and $\widehat{N}_t^l$, respectively. Since labor is provided to two types of firms, a representative household is assumed to have two labor disutility components, Z_t^h and Z_t^l:

$$\begin{aligned} &\max_{C_t, B_t \widehat{N}_t^l, \widehat{N}_t^h} E_0 \sum_0^{\infty} \beta^t \left[\log C_t - Z_t^l \cdot \frac{(\widehat{N}_t^l)^{1+\varphi}}{1+\varphi} - Z_t^h \cdot \frac{(\widehat{N}_t^h)^{1+\varphi}}{1+\varphi} \right] \\ &\text{s.t. } \mathbb{P}_t \cdot C_t + Q_t \cdot B_t \leq W_t^l \cdot \widehat{N}_t^l + W_t^h \cdot \widehat{N}_t^h + D_t^l + D_t^h + B_{t-1}. \end{aligned} \tag{1}$$

The production function of firm i in a sector k is given by $y_t(i_k) = A_t^k N_t(i_k)^{1-\alpha}$ where $k \in \{h, l\}$. Firm i in a sector k can reset its price at time t to optimizes

$$\max_{P_t^{k\#}(i_k)} \mathbb{E}_t \sum_{s=0}^{\infty} (\beta\phi)^s \frac{C_{t+s}^{-\sigma}}{C_t^{-\sigma}} \left[\frac{P_t^{k\#}(i_k)}{P_{t+s}^k} y_{t+s}(i_k) - \frac{W_{t+s}^k}{\mathbb{P}_{t+s}} N_{t+s}(i_k) \right], \tag{2}$$

where $P_t^{h\#}$ denotes the reset price and ϕ is the probability of price stickiness. Note that firm i_k is a price-taker for the relative wage $W_{t+s}^k / \mathbb{P}_{t+s}$ in the labor market. I assume that consumers substitute their consumption within-sector: For example, those who purchase high-markup products consider only other high-markup products as substitutes. Then, when a high-markup firm has an opportunity to reset its price, the relative price is given with respect to the overall price of high-markup goods, i.e., $P_t^{h\#}(i_h)/P_{t+s}^h$.

For simplicity, this paper uses a standard Taylor rule,

$$R_t = \quad \exp(v_t) \cdot \frac{1}{\beta} \cdot \left(\frac{\Pi_t}{\Pi}\right)^{\phi_\pi} \cdot \left(\frac{Y_t}{Y}\right)^{\phi_y}. \tag{3}$$

Two Virtual Economies Define the virtual output of high-markup sector only as $Y_t^h \equiv \left(\int_0^1 y_t(i_h)^{(\epsilon_h-1)/\epsilon_h} di_h\right)^{\epsilon_h/(\epsilon_h-1)}$ Similarly, the virtual output of low-markup sector only $Y_t^l \equiv \left(\int_0^1 y_t(i_l)^{(\epsilon_l-1)/\epsilon_l} di_l\right)^{\epsilon_l/(\epsilon_l-1)}$. In each of the virtual models isolating high(low)-markup firms only, the price dispersion can be constructed as in a basic New Keynesian model.

Denote the virtual high-markup-sector-only consumption by $C_t^h \equiv \left(\int_0^1 C_t(i_h)^{(\epsilon_h-1)/\epsilon_h} di_h\right)^{\epsilon_h/(\epsilon_h-1)}$. Similarly, the virtual low-markup-sector-only consumption is given as $C_t^l \equiv \left(\int_0^1 C_t(i_l)^{(\epsilon_l-1)/\epsilon_l} di_l\right)^{\epsilon_l/(\epsilon_l-1)}$. Thanks to the simple formulation of elasticities, the quantity C_t of the aggregate consumption at time t is given as an implicit function by

$$1 = \int_0^\theta \left(\frac{C_t(i_h)}{C_t}\right)^{\frac{\epsilon_h-1}{\epsilon_h}} di_h + \int_\theta^1 \left(\frac{C_t(i_l)}{C_t}\right)^{\frac{\epsilon_l-1}{\epsilon_l}} di_l \;=\; \theta\left(\frac{C_t^h}{C_t}\right)^{\frac{\epsilon_h-1}{\epsilon_h}} + (1-\theta)\left(\frac{C_t^l}{C_t}\right)^{\frac{\epsilon_l-1}{\epsilon_l}}, \tag{4}$$

where the consumption of a high-markup good i is denoted by $C_t(i_h)$ and that of a low markup good i as $C_t(i_l)$. The measure θ reflect the number of high-markup firms when the total number of firms is normalized to 1, and it is exogenously given.

The aggregate price level $\mathbb{P}_t$ is given by an implicit function $1 = \left[\theta \cdot \left(P_t^h/\mathbb{P}_t\right)^{1-\epsilon_h} + (1-\theta) \cdot \left(P_t^l/\mathbb{P}_t\right)^{1-\epsilon_l}\right]$ where the virtual price level of high-markup-sector-only economy $\left(P_t^h\right)^{1-\epsilon_h} = \int_0^1 (P_t(i_h))^{1-\epsilon_h}\, di_h$ and symmetrically the virtual price level of low-markup-sector-only economy $\left(P_t^l\right)^{1-\epsilon_l} = \int_0^1 (P_t(i_l))^{1-\epsilon_l}\, di_l$.

Parameters and Steady-State Values Parameter values follow Galí (2015, Chap. 3, p. 52) unless otherwise specified. The benchmark measure of high-markup firms θ is set as 10% to match the construction of "high-markup sector" in Díez, Fan and Villegas-Sánchez (2021). The elasticity parameters of ϵ_h and ϵ_l are set to match the latest markups in Díez, Fan and Villegas-Sánchez (2021), that are 2.8 and 1.1.[1] With 10% firms of the markup value 2.8, the aggregate markup matches 1.29. Then, the elasticity for high-markup goods is 1.55, and the one for low-markup goods is 9.19. The aggregate elasticity is given by 4.45, which I plug into a basic New Keynesian model to compare the results.

3 Impulse-Response Comparison

I simulate the shocks that lead to inflation in the economy: a rise in labor disutility, a fall in productivity, and an expansionary monetary shock. Although the model allows for experimenting with isolated shocks that hit only one sector, I focus on the cases where both sectors are hit by the same shock in order to compare the results with a basic New Keynesian model.

3.1 Expansionary Monetary Policy Shock

An expansionary monetary policy shock (100 b.p. cut in the annualized nominal interest rate) induces subdued inflation response in the polarized markup model (see the blue line in Figure 1) compared with the conventional basic New Keynesian model (the black dashed line). The initial response in inflation is reduced by 34% in the polarized markup model. The initial response in output is boosted by 29%. These changes help the nominal interest rate become lower in the polarized markup model after the expansionary monetary policy shock.

[1] For example, in the steady state, $\epsilon_h/(\epsilon_h - 1) = 2.8$.

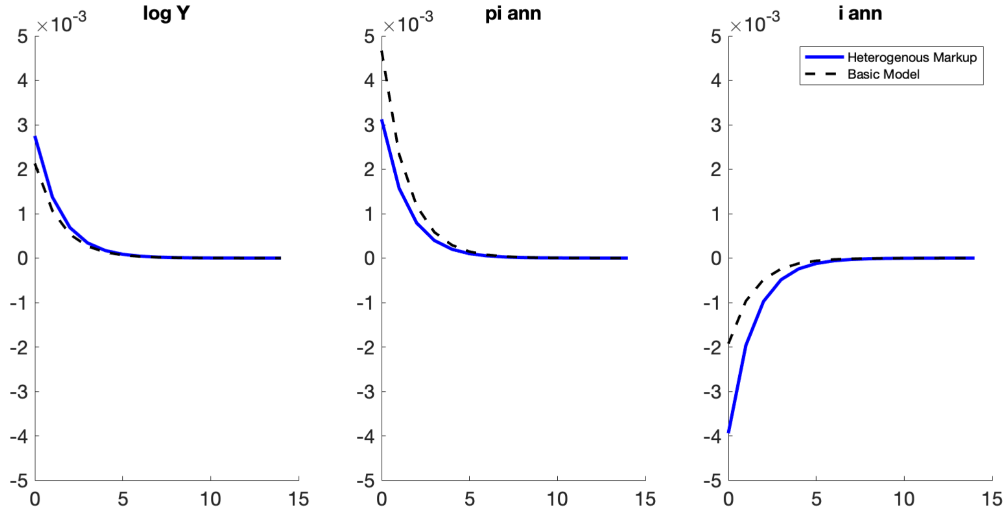

Figure 1: Effects on Output, Inflation, and Nominal Interest Rate after an Expansionary Monetary Shock

3.2 Adverse Technology Shock

In order to consider the productivity shock that affect both high- and low-markup production concurrently, in this experiment, I modify the production functions for high- and low- markup to share the same productivity A_t, i.e., $Y_t^k = A_t(N_t^k)^{1-\alpha}$ where $k \in \{h,l\}$. Figure 2 shows the comparison after 1%p fall in TFP. The initial output response is reduced less than that of the basic New Keynesian model by 11%. Also, there is an 11% reduction in the initial inflation response. The response of the nominal interest rate is also subdued as the output and inflation responses are relatively contained.

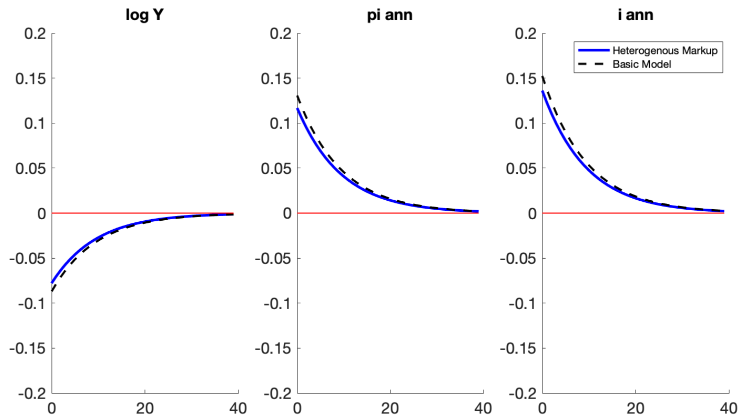

Figure 2: Effects on Output, Inflation, and Nominal Interest Rate after an Adverse Tech Shock in the Heterogeneous Markup Model

3.3 Labor Disutility Shock

Consider the periodic utility function of the representative household is given by $\log C_t - Z_t \cdot (\widehat{N}_t^l)^{1+\varphi}/(1+\varphi) - Z_t \cdot (\widehat{N}_t^h)^{1+\varphi}/(1+\varphi)$: That is, workers of the high- and low- markup firms share the same level z_t of the labor disutility. Figure 3 shows 40% reduction in the initial response in inflation when there is an 1%p rise in z_t. Output decreases 40% less in the initial response. Hence, the nominal interest rate also responds 40% less than it is in a basic New Keynesian model.

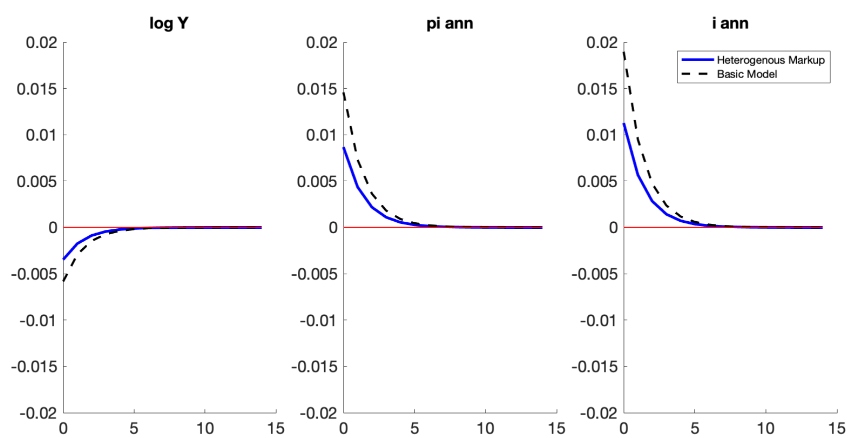

Figure 3: Effects on Output, Inflation, and Nominal Interest Rate after an Adverse Labor Disutility Shock in the Heterogeneous Markup Model

4 Conclusion

In this paper, I extend a basic New Keynesian model to have two production sectors featuring polarized price-cost markups as in Díez, Fan and Villegas-Sánchez (2021). I observe the effect of such polarized markups on inflation. Compared with a basic New Keynesian model (Galí 2015, Chap. 3), inflation responses are always subdued when the economy is hit by an expansionary monetary policy shock, an adverse TFP shock common to both sectors, or a labor disutility shock common to both sectors. Output responses are also subdued after an adverse TFP shock or a labor disutility shock. However, after an expansionary monetary policy shock, the output response is more boosted. With a contractionary monetary policy shock, the disinflationary effect is subdued while output reduction is exacerbated. That is, in an economy with such polarized markups, the conventional monetary policy tool of adjusting the nominal interest rate to control inflation may not be as powerful as in a basic New Keynesian model. Given the empirical finding of Díez, Fan and Villegas-Sánchez (2021), a central bank might want to move aggressively or expand the set of policy tools to control inflation.

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