Bargaining Power and the Neutrality–Non-Neutrality of Money *

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Abstract

This paper studies how buyer–seller bargaining power shapes monetary non-neutrality. When sellers have stronger bargaining power, the economy operates in an excess-supply regime and the Phillips curve is upward-sloping. When buyers have stronger bargaining power, the economy operates in an excess-demand regime and the Phillips curve is downward-sloping. Bargaining power smoothly parameterises the transition between the two regimes. In the knife-edge case, when the two powers cancel out, the Phillips curve becomes vertical and the economy approximates the flexible-price outcome. In this case, inflation is no longer costly. By allowing bargaining power to vary, the model places the insights of the general disequilibrium literature on an equilibrium footing.

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1 Introduction

What is the source of monetary non-neutrality? Much of the literature has focused on price stickiness. Yet another crucial ingredient in the canonical New Keynesian model is a particular assumption about market power, namely monopolistic competition.

Motivated by evidence of non-monopolistic conduct in a wide range of markets (Crawford and Yurukoglu, 2012; Grennan, 2013), this paper uncouples the tight link between market power and price stickiness implicit in standard models.

In this paper, I propose a model featuring nominal rigidities and bargaining between buyers and sellers in the firm sector. The slope of the Phillips curve[1] depends on the bargaining power: *upward-sloping* when sellers have stronger bargaining power, as in the standard case, *downward-sloping* when buyers have stronger bargaining power, or even fully *vertical* at the knife-edge—all conditional on the same degree of price stickiness.

Furthermore, this result has normative implications. Around the knife-edge, price dispersion induced by inflation is not particularly costly, as the economy approximates the flexible-price outcome. Moving away from the knife-edge, however, inflation increasingly distorts production and becomes more costly.

These results are driven by contrasting output-determination mechanisms, a theme emphasised in the general disequilibrium literature of the 1970s. At one extreme, when sellers possess full bargaining power[2], the economy becomes isomorphic to the canonical New Keynesian model. The economy operates in a general excess-supply regime, and output is determined by buyer conditions (Barro, 2025). At the opposite extreme, when buyers possess full bargaining power[3], the model becomes isomorphic to a New Keynesian model with monopsony.[4] In this case the economy operates in a general excess-demand regime, and output is determined by supplier conditions (Barro, 2025). Intermediate allocations of bargaining power smoothly connect the two regimes.

The model therefore provides a synthesis of these regimes. The seminal contribution of Barro and Grossman (1971) pursued a similar objective within the disequilibrium paradigm, but generated sharp discontinuities between regimes. By introducing bargaining power as a key primitive, this paper responds to Barro (2025)'s call to reincorporate these insights into a general-equilibrium framework and allows for a smooth transition between regimes.

I close this section with a remark on the interpretation of the results. The aim of the paper is *not* to claim that the Phillips curve is downward-sloping in the aggregate economy. Rather,

[1] Here, I am considering the inflation-real marginal cost Phillips curve.
[2] I also require buyers to be perfectly substitutable from the standpoint of sellers.
[3] I also require sellers to be perfectly substitutable from the standpoint of buyers.
[4] See Appendix A for the full model.

the paper studies markets with non-monopolistic competition in isolation and examines how bargaining power interacts with price stickiness in such markets.

2 Literature

This paper builds on the Old Keynesian general disequilibrium literature of the 1970s (e.g., Barro and Grossman, 1971, 1974). That literature emphasised that output is determined by the short side of the market: demand in the excess-supply regime and vice versa. While the canonical New Keynesian model only features the excess-supply regime (Barro, 2025), my model extends beyond this regime.

This paper shares its objective with the seminal contribution of Michaillat and Saez (2015), which integrates the disequilibrium literature into a general-equilibrium framework. More recently, Bianchi et al. (2024) applied their framework to housing inflation in the post-pandemic period. Relative to this line of research, which emphasises search and matching frictions, the contribution of this paper is to introduce bargaining power as an alternative bridge between the excess-supply and excess-demand regimes. Moreover, in contrast to their framewor requiring equilibrium selection, my model delivers a unique equilibrium.

Considering market structure beyond monopoly is of independent interest given accumulating evidence of monopsony power in both labour and product markets (Grennan, 2013; Prager and Schmitt, 2021; Ren and Zhang, 2025). A closely related paper by Dennery (2020) studies the interaction between wage rigidity and labour-market monopsony. This paper develops a more general theory of nominal rigidity and bargaining power encompassing both monopoly and monopsony, highlighting the crucial role that bargaining power plays in generating monetary non-neutrality.

Finally, this paper contributes to the literature on the determinants of monetary non-neutrality. Much of the literature studies the sources of price stickiness (Golosov and Lucas Jr, 2007; Woodford, 2003a). This paper instead approaches the question from a different angle: altering the market structure while taking price stickiness as given.

3 Setup

This section presents a static version of the model to illustrate the key mechanism. This setup is a limiting case of the infinite-horizon model in Appendix B. Consequently, the results presented for the static model carry over to the more general case verbatim.

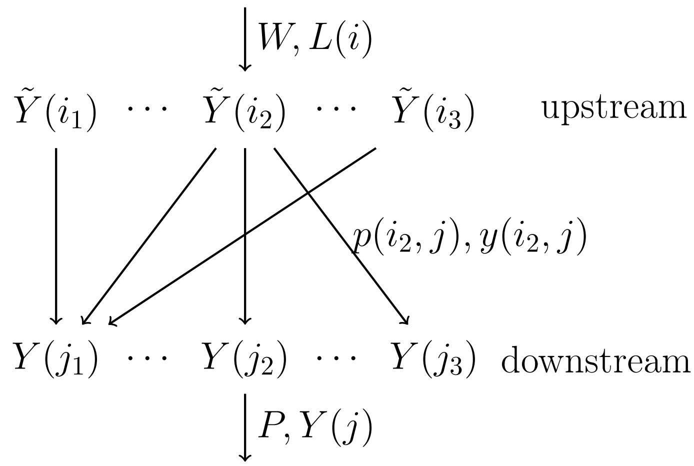

Figure 1: Schematic representation of the firm block: arrows represent the flow of goods

3.1 Firms

There are two tiers in the production structure: upstream intermediate producer and downstream aggregator, with each tier populated by a continuum of firms of measure one. Throughout the paper, I index upstream sellers by $i \in [0,1]$ and downstream buyers by $j \in [0,1]$. Each upstream seller sells to all downstream buyers, and each downstream buyer buys from all upstream sellers. For downstream buyers, the upstream sellers are imperfect substitutes. For upstream sellers, the downstream buyers are imperfect substitutes. Figure 1 presents the schematic representation of the firm block.

Upstream

Each upstream seller i purchases labour $L(i)$ from the competitive labour market at the nominal wage $W(i)$ and produces a composite good $\tilde{Y}(i)$ according to the production function

$$\tilde{Y}(i) = ZL(i), \tag{1}$$

where Z denotes the aggregate productivity shock.[5]

The composite good $\tilde{Y}(i)$ is sold to each downstream buyer j at the nominal price $p(i,j)$. The amount of goods sold to each buyer $\{y(i,j)\}_{j\in[0,1]}$ satisfies

$$\tilde{Y}(i) = \left(\int_0^1 y(i,j)^{1+\theta}\, dj \right)^{\frac{1}{1+\theta}}, \tag{2}$$

[5] As in the canonical New Keynesian model, the productivity shock is assumed to affect upstream sellers.

where $\theta > 0$ governs the elasticity of substitution across buyers. Buyers exploit their imperfect substitutability as a source of monopsonistic power.[6]

The profit of an upstream seller i is given by

$$\tilde{D}(i) = \int_0^1 p(i,j)y(i,j)\,dj - W(i)L(i). \tag{3}$$

Downstream

Each downstream buyer j purchases intermediate goods $y(i,j)$ from upstream sellers $i \in [0,1]$ and produces the final good $Y(j)$ according to the aggregation function

$$Y(j) = \left(\int_0^1 y(i,j)^{\frac{1}{1-\epsilon}}\,di\right)^{1-\epsilon}, \tag{4}$$

where $\epsilon > 0$ governs the elasticity of substitution across upstream sellers. As in canonical New Keynesian models, this imperfect substitutability gives rise to market power for sellers.

The final good $Y(j)$ is sold to the representative household. From the household's perspective, final goods produced by different downstream buyers are perfect substitutes. Hence, downstream firms j sell their product at the common price P to the representative household.

The profit of a downstream buyer j is given by

$$D(j) = PY(j) - \int_0^1 p(i,j)y(i,j)\,di. \tag{5}$$

Bargaining

Buyers and sellers conduct Nash bargaining over the price and quantity of the transaction following the realization of demand and supply shocks. This requires specifying the gains from trade for both parties. I adopt the Nash-in-Nash approach to define the gains from trade for each buyer–seller pair: each pair takes the negotiation outcomes of all other pairs as given (Horn and Wolinsky, 1988).

The gains from trade for the upstream seller i and downstream buyer j[7] are given by

$$\tilde{\phi}^u(i,j) = p(i,j)y(i,j) - \frac{\theta}{\theta+1} y(i,j)^{1+\frac{1}{\theta}} \tilde{Y}(i)^{-\frac{1}{\theta}} \frac{W}{Z}, \tag{6}$$

$$\phi^d(j,i) = \frac{\epsilon}{\epsilon-1} P\, y(i,j)^{1-\frac{1}{\epsilon}} Y(j)^{\frac{1}{\epsilon}} - p(i,j)y(i,j). \tag{7}$$

[6] This modelling choice is common in the labour monopsony literature (Azar and Marinescu, 2024). Because buyers are imperfect substitutes, each buyer faces an upward-sloping residual supply curve that can be exploited.

[7] Derivations are provided in Appendix ??.

Nominal rigidity is introduced in the tradition of Calvo (1983). With probability $\delta \in (0,1)$, a buyer–seller pair is selected to bargain over both price and quantity. The transaction price and quantity solve

$$\max_{p(i,j),y(i,j)} \left(\tilde{\phi}^u(i,j)\right)^{\eta_u} \left(\phi^d(j,i)\right)^{\eta_d}. \tag{8}$$

The remaining buyer–seller pairs can only renegotiate the transaction quantity. In that case, the transaction quantity solves

$$\max_{y(i,j)} \left(\tilde{\phi}^u(i,j)\right)^{\eta_u} \left(\phi^d(j,i)\right)^{\eta_d}, \tag{9}$$

while holding the transaction price fixed at the previous period's level. Here $\eta_u, \eta_d \in (0,1)$ denote the bargaining weights of the upstream seller and downstream buyer, respectively.[8]

Connection to monopolistic and monopsonistic competition models

In what follows, I consider two benchmarks. I refer to the case of full seller bargaining power $\eta_u \to 1^-$ and perfectly substitutable buyers $\theta \to \infty$ as the *monopoly/excess-supply* benchmark. This benchmark shares key features with the monopolistic competition model: buyers are perfectly substitutable and sellers set prices. However, unlike in monopolistic competition—where quantities are pinned down by buyers' residual demand—quantities in this benchmark are determined by sellers through a take-it-or-leave-it offer.

Nonetheless, even under our benchmark, quantity is driven by the seller's condition, hence in the excess-supply manner, and monopoly/excess-supply benchmark turns out to be isomorphic to the monopolistic competition model. These points will be clarified in the next section and in Appendix A. Moreover, it is not *a priori* evident that one modelling approach is superior to the other. While monopolistic competition may appear natural in the context of retailer–consumer interactions, the bargaining framework presented here may be more appropriate in firm-to-firm transactionts.

Conversely, the case of full buyer bargaining power $\eta_d \to 1^-$ and perfectly substitutable sellers $\epsilon \to \infty$ defines the *monopsony/excess-demand* benchmark. This turns out to be isomorphic to the monopsonistic counterpart.

[8] I impose $\eta_u + \eta_d = 1$.

3.2 Households

The economy is populated by a representative household that supplies labour and consumes the final good. The household's problem is given by

$$\max_{C,N,M} \log(C) - \frac{1}{1+\chi_n} N^{1+\chi_n} + \varphi \log\left(\frac{M}{P}\right) \tag{10}$$

$$\text{s.t.} \quad PC + M \leq WN + D. \tag{11}$$

The household derives utility from consumption C and real money balances M/P, while incurring disutility from labour N. Households face the nominal price of the final good P and the nominal wage W, and D denotes firm dividends. Nominal money supply serves to pin down aggregate demand in the static model.[9]

3.3 Monetary authority

The monetary authority sets the nominal money supply M exogenously. Changes in the money supply serve as the aggregate demand shock.

3.4 Equilibrium

Given productivity Z and the nominal money supply M, the equilibrium is defined as the aggregate price level P, the nominal wage W, and the transaction prices and quantities $\{p(i,j), y(i,j)\}_{i,j\in[0,1]^2}$ such that the following conditions hold:

1. **Household optimisation:** Given the price level P and nominal wage W, the household chooses consumption C and labour supply N to maximize utility subject to its budget constraint.

2. **Firm optimisation:** The transaction price and quantity for each buyer–seller pair $\{p(i,j), y(i,j)\}$ solve the Nash bargaining problems given in (8) and (9).

3. **Market clearing:** The labour market and the final good market clear.[10]

4 Positive analysis

For the rest of the paper, I work with the log-linearised version of the model around the deterministic steady state with flexible prices and consider small MIT shocks around the

[9] Following Woodford (2003b), I take the cashless limit $\varphi \to 0^+$ when conducting welfare analysis.
[10] Money market clearing is imposed implicitly.

steady state. I denote log deviations from the steady state by hats.

4.1 Pairwise quantity determination

Proposition 1. *For all seller-buyer pairs, the transaction price $p(i,j)$ and quantity $y(i,j)$ satisfy*

$$\left(\frac{\tilde{\eta}_d}{\theta} + \frac{\tilde{\eta}_u}{\epsilon}\right)(\hat{Y} - \hat{y}(i,j)) + p(i,j)\,(\tilde{\eta}_d - \tilde{\eta}_u) - \tilde{\eta}_d \hat{\Psi} + \tilde{\eta}_u \hat{P} = 0 \tag{12}$$

where $\tilde{\eta}_d := \eta_d/(\theta+1)$ and $\tilde{\eta}_u := \eta_u/(\epsilon-1)$ are the effective bargaining power [11] *of the downstream buyer and upstream seller, and $\Psi = W/Z$ is the nominal marginal cost. I will refer to $\hat{y}(i,j)$ implicitly defined in* (12) *as the residual quantity curve.*

Proof. The proof is relegated to Appendix B.2. □

To interpret the result, it is constructive to consider the two benchmarks.

Monopoly/excess-supply benchmark

Under this benchmark, the transacted output and price satisfy

$$\hat{y}(i,j) = \hat{Y} - \epsilon(\hat{p}(i,j) - \hat{P}). \tag{13}$$

Transaction quantity depends negatively on the transaction price, with price elasticity given by ϵ. Intuitively, when the upstream seller has full bargaining power, the seller chooses the transaction quantity such that the buyer enjoys zero surplus. As a result, a higher transaction price reduces the buyer's surplus and therefore lowers the transacted quantity.

This situation corresponds to the excess-supply regime. Although sellers ultimately present the price-quantity menu in a take-it-or-leave-it manner, the output is still pinned by buyer's zero-surplus condition. Moreover, (13) coincides with the residual demand curve under monopolistic competition,[12] giving rise to an isomorphic price-quantity schedule.

Monopsony/excess-demand benchmark

At the other extreme , (12) reduces to

$$\hat{y}(i,j) = \hat{Y} + \theta(\hat{p}(i,j) - \hat{\Psi}) \tag{14}$$

[11] Recall that sellers' market power derives from the impefect substitutability of intermediate inputs as captured by low ϵ. The variable $\tilde{\eta}_u$ captures this effect since $\tilde{\eta}_u$ is decreasing in ϵ. The same argument applies to $\tilde{\eta}_d$.

[12] In principle, the residual quantity curve (12) and the residual demand curve are distinct objects. See Appendix A for further details.

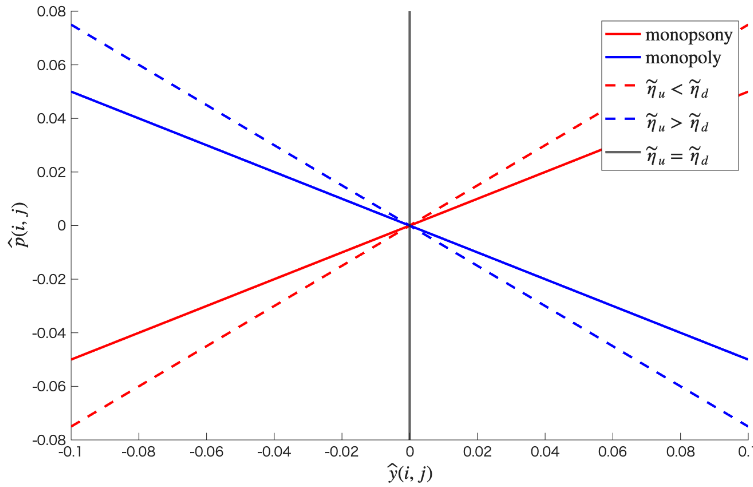

Figure 2: Residual quantity curve for different bargaining power allocations

Note: Here I am setting $\hat{Y} = \hat{P} = \hat{\Psi} = 0$ and $\theta - \epsilon = 2$. The red solid line represents the monopoly/excess-supply benchmark, while the blue solid line represents the monopsony/excess-demand benchmark.

Output now depends *positively* on the transaction price, with price elasticity given by θ. When the downstream buyer has full bargaining power, the buyer chooses the transaction quantity such that the upstream seller enjoys zero surplus $\tilde{\psi}^u(i,j)$. A higher price therefore increases the buyer's surplus and leads to a larger transaction quantity.

By an argument symmetric to that of the monopoly / excess-supply benchmark, this situation corresponds to the excess-demand regime, and (14) characterises the residual supply curve under monopsonistic competition.[13]

Intermediate case

In between the two extremes, the residual quantity may increase or decrease with the transaction price. When $\tilde{\eta}_u > \tilde{\eta}_d$, quantity decreases with the price and the economy approaches the monopoly / excess-supply benchmark; the opposite holds when $\tilde{\eta}_d > \tilde{\eta}_u$. The knife-edge case arises when $\tilde{\eta}_u = \tilde{\eta}_d$, where the two forces cancel and quantity becomes independent of the transaction price. This threshold recurs throughout the model, marking the point at which bargaining powers balance. These situations are illustrated in figure 2.

4.2 Pairwise price determination

The residual quantity curve specified the relationship between transaction price and quantity for each buyer-seller pair. How then are the transaction prices set?

[13] The derivation is provided in Appendix A.

Proposition 2. *For all price-setting pairs, the transaction price $p(i,j)$ satisfies*

$$\hat{p}(i,j) = \frac{\epsilon}{\theta+\epsilon}\hat{P} + \frac{\theta}{\theta+\epsilon}\hat{\Psi} \tag{15}$$

Proof. See Appendix B.2. ☐

For price-resetting pairs, the transaction price is a weighted average of the final good price and the nominal marginal cost in terms of log deviations. As before, I consider the two benchmarks to interpret the result. Under the monopoly/excess-supply benchmark, the transaction price is given by

$$\hat{p}(i,j) = \hat{\Psi}. \tag{16}$$

This is ismorphic to the markup rule in monopolistic competition.[14]

By the same token, under the monopsony/excess-demand benchmark, the transaction price is given by

$$\hat{p}(i,j) = \hat{P}. \tag{17}$$

This is isomorphic to the markdown rule in monopsonistic competiton.

4.3 Phillips curve

Having characterised pairwise prices and quantities, I now turn to the relationship between the aggregate price level and nominal marginal cost—that is, the Phillips curve.

Proposition 3. *The equilibrium price level $\hat{P}$ and nominal marginal cost $\hat{\Psi}$ satisfy*

$$\hat{P} = \underbrace{\frac{\tilde{\eta}_d - \delta(\tilde{\eta}_d - \tilde{\eta}_u)\frac{\theta}{\theta+\epsilon}}{\tilde{\eta}_u + \delta(\tilde{\eta}_d - \tilde{\eta}_u)\frac{\epsilon}{\theta+\epsilon}}}_{\tilde{\delta}}\hat{\Psi} \tag{18}$$

Equivalently, the Phillips curve is given by

$$\pi = \hat{P} = \frac{\tilde{\delta}}{1-\tilde{\delta}}\hat{\psi} \tag{19}$$

where $\psi := \Psi/P$ is the real marginal cost.

[14] Recall that (16) is in log deviations.

The Phillips curve is upward sloping and $\tilde{\tilde{\delta}} < 1$ *iff* $\tilde{\eta}_u > \tilde{\eta}_d$ *and* downward *sloping and* $\tilde{\tilde{\delta}} > 1$ *iff* $\tilde{\eta}_u < \tilde{\eta}_d$. *The Phillips curve is vertical iff* $\tilde{\tilde{\delta}} = 1$.

Proof. Proof is relegated to Appendix B.2. □

Before discussing the result, it is worth pointing out that the flexible price model is nested here with $\delta = \tilde{\tilde{\delta}} = 1$.

Monopoly/excess-supply benchmark

Under this benchmark, (18) reduces to

$$\hat{P} = \delta \hat{\Psi} \iff \tilde{\tilde{\delta}} = \delta < 1. \tag{20}$$

There is incomplete pass-through from marginal cost to the aggregate price level. The intuition closely mirrors that of the canonical New Keynesian model. Only a fraction δ of buyer–seller pairs can reset their price to $\hat{\Psi}$, and thus only a fraction δ of the marginal cost shock is passed through to the aggregate price level. All these responses are the same as the canonical New Keynesian model.

Monopsony/excess-demand benchmark

Under the monopsony / excess-demand benchmark, (18) reduces to

$$\hat{P} = \frac{1}{\delta}\hat{\Psi} \iff \hat{\Psi} = \delta \hat{P} \iff \tilde{\tilde{\delta}} = \frac{1}{\delta} > 1. \tag{21}$$

There is a more-than-one-to-one pass-through from marginal cost to the aggregate price level. A more natural and equivalent interpretation is that there is incomplete pass-through from the aggregate price level to marginal cost. Moving to the Phillips curve representation, the arguments imply a *negative* slope of the Phillips curve with respect to real marginal cost. An inflationary pressure is only partially passed on to the nominal marginal compensation of the seller, leading to a fall in real marginal cost.

Another interpretation clarifies the role of the excess-demand regime in generating this result and elucidates how the residual quantity curve is encoded in (18). Suppose a shock reduces the nominal marginal cost Ψ (e.g. a positive supply shock). For sellers in the measure $1 - \delta$ of the non–price-resetting pairs, this is a boon since they now enjoy a markup over marginal cost and thus increase production. On the margin, buyers are willing to accept as much as sellers produce since they are charging a markdown. Thus, the supply of the good increases as predicted by the residual quantity curve (14). This puts downward pressure on the price level and continues until (21) is satisfied. In the limit when $\delta \to 0^+$, sellers enjoy a markup for almost all pairs and flood the market with goods to the point that the price level falls to zero. This is consistent with $\tilde{\delta} \to \infty$ as $\delta \to 0^+$.

Intermediate case

The analysis opens up the tight link between price stickiness and the pass-through of nominal marginal cost implicit in canonical New Keynesian models. Even for the same degree of price stickiness δ, $\tilde{\delta}$ can be below or above one depending on whether $\tilde{\eta}_u \gtrless \tilde{\eta}_d$. When $\tilde{\eta}_u > \tilde{\eta}_d$, sellers have relatively stronger bargaining power and the economy behaves closer to the monopoly / excess-supply benchmark. The opposite is true when $\tilde{\eta}_u < \tilde{\eta}_d$, which corresponds more closely to the monopsony / excess-demand benchmark.

The knife-edge case occurs when $\tilde{\eta}_u = \tilde{\eta}_d$. The two forces cancel out and, up to first order, the impulse response coincides with that of the flexible-price economy.

4.4 General equilibrium

I close this section with a brief analysis of the general-equilibrium properties. I keep this section short, since most of the results are driven by the positive or negative slope of the Phillips curve.

Proposition 4. *Output satisfies*

$$\hat{Y} = \frac{1}{1+\tilde{\delta}\chi_c}\left[(1-\tilde{\delta})\hat{\psi} + \tilde{\delta}(\chi_c+1)\hat{Z}\right]. \tag{22}$$

Output responses to aggregate demand and supply shocks depend critically on $\tilde{\delta}$. An increase in aggregate demand raises nominal marginal cost through the wealth effect.[15] When $\tilde{\delta} < 1$, the increase is only partially passed through to the price level, generating a positive output response.[16] Meanwhile, when $\tilde{\delta} > 1$, the price level rises by more than the increase in aggregate demand, leading to a contraction in output. Although based on different microfoundations, the idea that an increase in aggregate demand can be contractionary in the excess-demand regime has precedents in Barro and Grossman (1974) and Michaillat and Saez (2015).

The analysis for a supply shock closely mirrors that for a demand shock. Depending on whether $\tilde{\delta} < 1$ or $\tilde{\delta} > 1$, the productivity shock may be under- or over-passed through to

[15] In this case, nominal marginal cost increases one-for-one.
[16] Recall that household preferences imply $\hat{Y} = \hat{\psi} - \hat{P}$.

the price level and, consequently, to output. This result is also reminiscent of the supply-multiplier logic of Barro and Grossman (1974).

Finally, when $\tilde{\delta} = 1$, the economy responds as in the flexible-price equilibrium, and aggregate demand shocks have no effect on output.

5 Normative analysis

Proposition 5. *The flexible-price equilibrium is efficient.*

Proof. See section B.2. □

Unlike its New Keynesian counterpart, which requires a production subsidy to offset the monopolistic-competition wedge, the steady state in this model is efficient. With flexible prices, the transfer between sellers and buyers given by $p(i,j)y(i,j)$ acts as a tariff between the two parties. As a result, the two parties exhaust all mutually beneficial trade, yielding efficiency.

The analysis thus far has revealed that, even with price stickiness, when $\tilde{\eta}_u = \tilde{\eta}_d$, aggregate output replicates the flexible-price outcome, which is efficient Proposition **??**. What, then, happens to intra-sectoral inefficiency from inflation?

Proposition 6. *The second-order log approximation of the household utility function yields (up to a scale and a constant)*

$$-\frac{1}{2}\left[(\chi_n+1)\hat{Y}^2 + \left(\frac{1}{\theta}+\frac{1}{\epsilon}\right)^{-1}\delta(1-\delta)\left(\frac{\tilde{\eta}_d-\tilde{\eta}_u}{\tilde{\eta}_d-\delta(\tilde{\eta}_d-\tilde{\eta}_u)\frac{\theta}{\theta+\epsilon}}\right)^2\pi^2\right] \tag{23}$$

Proof. See Appendix B.2. □

This expression again reveals the symmetry of the model around the $\tilde{\eta}_u = \tilde{\eta}_d$ threshold. As argued in section 4.1, at the knife-edge case, residual quantity is invariant to the transaction price. Consequently, inflation causes no inefficient dispersions and hence not costly. Away from the knife-edge case, eitherway you go, there is inefficiency from inflation.

6 Conclusion

Standard macroeconomic models generate monetary non-neutrality by coupling price stickiness with monopolistic competition. This paper teased apart this tight link and highlights the crucial role played of bargaining power. Price stickiness alone is insufficient to generate monetary non-neutrality. Even with the same degree of price stickiness, the response of inflation to marginal cost depends on the distribution of bargaining power between buyers and sellers.

I then investigated normative implications of bargaining power. When buyer and seller power balance out, inflation may even generate no allocative inefficiency. These findings call for serious considerations of bargaining power for business-cycle analysis.

I presented these results in the context of a model that allows for a smooth transition between excess-supply and excess-demand regimes. By incorporating bargaining power as a primitive, the model successfully integrated the insights of the general disequilibrium literature into a general-equilibrium framework.

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A Monopolistic and monopsonistic competition models

Model of monopolistic competition with sticky prices

Set $\theta \to \infty$ so that buyers are perfect substitute for sellers. In place of bargaining, quantity and prices are determined as follows.

Downstream buyers solve

$$\max_{Y(i,j)} \quad PY(j) - \int_0^1 P(i,j)Y(i,j)di \tag{24}$$

subject to the CES aggregator (4). This gives rise to the residual demand curve

$$Y(i,j) = Y(j)\left(\frac{P(i,j)}{P}\right)^{-\epsilon} \tag{25}$$

and the zero-profit condition yields [17]

$$P = \left(\int_0^1 P(i,j)^{1-\epsilon}dj\right)^{\frac{1}{1-\epsilon}} \tag{26}$$

With probability δ, buyer-seller pairs are able to revise their pairwise price $P(i,j)$ to solve

$$\max_{P(i,j)}(P(i,j) - \Psi)Y(i,j) \tag{27}$$

subject to the demand curve (25). This yields $\hat{P} = \delta\hat{\Psi}$.

Model of monopsonistic competition with sticky prices

Set $\epsilon \to \infty$ so that sellers are perfect substitute for buyers. In place of bargaining, quantity and prices are determined as follows.

Upstream sellers solve

$$\max_{Y(i,j)} \quad \int_0^1 P(i,j)Y(i,j)dj - \Psi\tilde{Y}(i) \tag{28}$$

[17] Since the right-hand side varies across $i \in [0,1]$ only by an asymptotically negligible amount, taking the infimum over $i \in [0,1]$ is equivalent in the limit to evaluating it at the common limiting value.

subject to the CES disaggregator (2). This gives rise to the residual demand curve

$$Y(i,j) = \tilde{Y}(j) \left(\frac{P(i,j)}{P} \right)^{\theta} \tag{29}$$

and the zero-profit condition yields [18]

$$\Psi = \left(\int_0^1 P(i,j)^{1+\theta} dj \right)^{\frac{1}{1+\theta}} \tag{30}$$

With probability δ, buyer-seller pairs are able to revise their pairwise price $P(i,j)$ to solve

$$\max_{P(i,j)} (P - P(i,j)) Y(i,j) \tag{31}$$

subject to the supply curve (29). This yields the optimal markdown rule for reoptimising pairs,

$$P(i,j) = \frac{\theta}{\theta+1} P. \tag{32}$$

This yields $\hat{\Psi} = \delta \hat{P}$.

B The infinite-horizon model

B.1 Setup

The household sector may or may not hold bonds and the monetary policy can control the nominal interest rate instead of money supply.

The key setup is in the firm sector, which I will detail here. I assume the following two-stage bargaining protocol.

Stage 1

Every period, fraction δ of buyer-seller pairs are randomly chosen to negotiate over the transaction price. If the negotiation breaks down, the pair cannot negotiate until next

[18] Since the right-hand side varies across $j \in [0,1]$ only by an asymptotically negligible amount, taking the infimum over $i \in [0,1]$ is equivalent in the limit to evaluating it at the common limiting value.

chosen to negotiate over their price. Thus, the transaction price $p(i,j)$ solves

$$\max_{p(i,j)} \left(\sum_{s=0}^{\infty} [\beta(1-\delta)]^s \tilde{\phi}_s^u(i) \right)^{\eta_u} \left(\sum_{s=0}^{\infty} [\beta(1-\delta)]^s \phi^d(j) \right)^{\eta_d} \tag{33}$$

The rest of the buyer-seller transaction prices are stuck at the previous-period level.

Stage 2

Both parties negotiate over the price given the price determined in stage 1. If this negotiation breaks down, there is no transaction only for this period. Consequently, the transaction quantity $y(i,j)$ solves

$$\max_{y(i,j)} [\tilde{\phi}^u]^{\eta_u} [\phi^d]^{\eta_d} \tag{34}$$

Comment

The model reduces to the static version of the model discussed in the main text under myopia by setting $\beta \to 0^+$ and adopting the convetion that $0^0 = 1$.

B.2 Results

Proposition 7. *Proposition 1 under infinite-horizon The residual quantity curve is given by* (12).

Proof. First, note that the residual quantity still solves the same problem (34). Taking the first-order condition of (8) with respect to $Y(i,j)$, In non-linear terms

$$\eta_u \frac{p - \Psi \tilde{Y}(i)^{-\frac{1}{\theta}} y(i,j)^{\frac{1}{\theta}}}{p - \frac{\theta}{\theta+1} \Psi \tilde{Y}(i)^{-\frac{1}{\theta}} y(i,j)^{\frac{1}{\theta}}} + \eta_d \frac{PY(j)^{\frac{1}{\epsilon}} y(i,j)^{-\frac{1}{\epsilon}} - p}{\frac{\epsilon}{\epsilon-1} PY(j)^{\frac{1}{\epsilon}} y(i,j)^{-\frac{1}{\epsilon}} - p} = 0 \tag{35}$$

Log-linearising the equation and using $\hat{Y}(j) = \hat{\tilde{Y}}(i)$ a.s. yields (12). □

To state subsequent results, it is instructive to define $\tilde{\beta} := \beta(1-\delta)$ as the effective discount rate when making pricing decisions.

Proposition 8. *Proposition 2 under infinite-horizon The renegotiated price $\hat{p}_t^o$ satisfies*

$$\hat{p}_t^o = (1-\tilde{\beta}) \left[\frac{\epsilon}{\theta+\epsilon} \hat{P}_t + \frac{\theta}{\theta+\epsilon} \hat{\Psi}_t \right] + \tilde{\beta} \hat{p}_{t+1}^o \tag{36}$$

Proof. Take the first-order condition of (34) with respect to the renegotiated $p(i,j)$. Omitting i,j indecies, the first-order condition is given by

$$\eta_u \frac{\sum \tilde{\beta}^s \left[\left(p - \Psi \tilde{Y}^{-\frac{1}{\theta}} y^{\frac{1}{\theta}}\right) \frac{\partial y_s}{\partial p} + y_s\right]}{\sum_{s=0}^{\infty} \tilde{\beta}^s \left(py - \Psi \frac{\theta}{\theta+1} \tilde{Y}^{-\frac{1}{\theta}} y^{1+\frac{1}{\theta}}\right)} + \eta_d \frac{\sum \tilde{\beta}^s \left[\left(P_s Y_s^{\frac{1}{\epsilon}} y_s^{-\frac{1}{\epsilon}} - p\right) \frac{\partial y_s}{\partial p} - y_s\right]}{\sum_{s=0}^{\infty} \tilde{\beta}^s \left(\frac{\epsilon}{\epsilon-1} P Y^{\frac{1}{\epsilon}} y^{1-\frac{1}{\epsilon}} - py\right)} = 0 \tag{37}$$

where $\partial := \partial y_s / \partial p$ is the partial derivative of the residual quantity curve with respect to the transaction price. I log-linearising the above expression. I make use of the facts that 1. the coefficient on the log-deviation of ∂ is zero due to the envelope condition on transaction quantity, and 2. that (12) holds for all dates in the future. This yields

$$\sum \tilde{\beta}^s [\epsilon \tilde{\eta}_u \hat{P} + \theta \tilde{\eta}_d \hat{\Psi} + (\tilde{\eta}_u - \tilde{\eta}_d)(\hat{Y} - \hat{y})] - \frac{\epsilon \tilde{\eta}_u + \theta \tilde{\eta}_d}{1 - \tilde{\beta}} \hat{p}^o = 0 \tag{38}$$

Combining this with (12) yields

$$\hat{p}_t^o = (1 - \tilde{\beta}) \sum_{s=0}^{\infty} \left[\hat{P}_{t+s} + \frac{\theta}{\theta + \epsilon} \hat{\psi}_{t+s}\right] \tag{39}$$

$$= (1 - \tilde{\beta}) \left[\hat{P}_t + \frac{\theta}{\theta + \epsilon} \hat{\psi}_t\right] + \tilde{\beta} \hat{p}_{t+1}^o \tag{40}$$

$$= (1 - \tilde{\beta}) \left[\frac{\epsilon}{\theta + \epsilon} \hat{P}_t + \frac{\theta}{\theta + \epsilon} \hat{\Psi}_t\right] + \tilde{\beta} \hat{p}_{t+1}^o. \tag{41}$$

□

Proposition 9. *Proposition 3 under infinite-horizon The Phillips curve is given by*

$$\pi_t - \frac{\tilde{\eta}_d}{\tilde{\eta}_u - \tilde{\eta}_d} \Delta \hat{\psi}_t = \frac{\delta}{1 - \delta} (1 - \tilde{\beta}) \left[\frac{\theta}{\theta + \epsilon} + \frac{\tilde{\eta}_d}{\tilde{\eta}_u - \tilde{\eta}_d}\right] \hat{\psi}_t + \beta \left[\pi_{t+1} - \frac{\tilde{\eta}_d}{\tilde{\eta}_u - \tilde{\eta}_d} \Delta \hat{\psi}_{t+1}\right] \tag{42}$$

Proof. Define the aggregate transacted price by

$$\hat{\mathcal{P}}_t = \int_{i,j} \hat{p}(i,j) didj) \tag{43}$$

$$= \delta \hat{p}_t^o + (1 - \delta) \hat{\mathcal{P}}_{t-1} \tag{44}$$

Integrating (12) across all (i, j) pairs,

$$\hat{P}_t = \frac{\tilde{\eta}_d}{\tilde{\eta}_u - \tilde{\eta}_d}\hat{\psi}_t + \hat{\mathcal{P}}_t \tag{45}$$

$$\pi_t = \frac{\tilde{\eta}_d}{\tilde{\eta}_u - \tilde{\eta}_d}\Delta\hat{\psi}_t + \Delta\hat{\mathcal{P}}_t \tag{46}$$

Now, let

$$\hat{p}_t^o - \hat{\mathcal{P}}_t = (1-\tilde{\beta})\left[\hat{P}_t - \hat{\mathcal{P}}_t + \frac{\theta}{\theta+\epsilon}\hat{\psi}_t\right] + \tilde{\beta}[p_{t+1}^o - \hat{\mathcal{P}}_{t+1} + \Delta\hat{\mathcal{P}}_{t+1}] \tag{47}$$

$$= (1-\tilde{\beta})\left[\frac{\tilde{\eta}_d}{\tilde{\eta}_u - \tilde{\eta}_d} + \frac{\theta}{\theta+\epsilon}\right]\hat{\psi}_t + \tilde{\beta}[p_{t+1}^o - \hat{\mathcal{P}}_{t+1} + \Delta\hat{\mathcal{P}}_{t+1}] \tag{48}$$

Noting that

$$\hat{\mathcal{P}}_{t-1} = \frac{1}{1-\delta}(\hat{\mathcal{P}}_t - \hat{p}_t^o), \tag{49}$$

$$\Delta\hat{\mathcal{P}}_t = \frac{\delta}{1-\delta}(\hat{p}_t^o - \hat{\mathcal{P}}_t) \tag{50}$$

$$\Delta\hat{\mathcal{P}}_t = (1-\tilde{\beta})\frac{\delta}{1-\delta}\left[\frac{\tilde{\eta}_d}{\tilde{\eta}_u - \tilde{\eta}_d} + \frac{\theta}{\theta+\epsilon}\right]\hat{\psi}_t + \beta\Delta\hat{\mathcal{P}}_{t+1} \tag{51}$$

We obtain the following relationship between nominal price and margianl cost inflation

$$\begin{aligned}\frac{1}{\tilde{\eta}_u - \tilde{\eta}_d}\left[\tilde{\eta}_u\Delta\hat{P}_t - \tilde{\eta}_d\Delta\hat{\Psi}_t\right] =& \frac{\delta}{1-\delta}(1-\tilde{\beta})\left[\frac{\epsilon}{\theta+\epsilon}(\hat{P}_t - \hat{\mathcal{P}}_t) + \frac{\theta}{\theta+\epsilon}(\hat{\Psi}_t - \hat{\mathcal{P}}_t)\right] \\ &+ \frac{\beta}{\tilde{\eta}_u - \tilde{\eta}_d}\left[\tilde{\eta}_u\Delta\hat{P}_{t+1} - \tilde{\eta}_d\Delta\hat{\Psi}_{t+1}\right]\end{aligned} \tag{52}$$

Rearranging (45)

$$\hat{\mathcal{P}}_t = \frac{1}{\tilde{\eta}_u - \tilde{\eta}_d}[\tilde{\eta}_u\hat{P}_t - \tilde{\eta}_d\hat{\Psi}_t] \tag{53}$$

Equations (52) and (53) define the equilibrium. Alternative representations

$$\begin{aligned}\frac{1}{\tilde{\eta}_u-\tilde{\eta}_d}\left[\tilde{\eta}_u\Delta\hat{P}_t-\tilde{\eta}_d\Delta\hat{\Psi}_t\right] =&\frac{\delta}{1-\delta}(1-\tilde{\beta})\left[\left(\frac{\epsilon}{\theta+\epsilon}-\frac{\tilde{\eta}_u}{\tilde{\eta}_u-\tilde{\eta}_d}\right)\hat{P}_t+\left(\frac{\theta}{\theta+\epsilon}+\frac{\tilde{\eta}_d}{\tilde{\eta}_u-\tilde{\eta}_d}\right)\hat{\Psi}_t\right]\\ &+\frac{\beta}{\tilde{\eta}_u-\tilde{\eta}_d}\left[\tilde{\eta}_u\Delta\hat{P}_{t+1}-\tilde{\eta}_d\Delta\hat{\Psi}_{t+1}\right] \qquad (54)\\ =&\frac{\delta}{1-\delta}(1-\tilde{\beta})\left[\frac{\theta}{\theta+\epsilon}+\frac{\tilde{\eta}_d}{\tilde{\eta}_u-\tilde{\eta}_d}\right]\hat{\psi}_t\\ &+\frac{\beta}{\tilde{\eta}_u-\tilde{\eta}_d}\left[\tilde{\eta}_u\Delta\hat{P}_{t+1}-\tilde{\eta}_d\Delta\hat{\Psi}_{t+1}\right] \qquad (55)\end{aligned}$$

$$\begin{aligned}\pi_t-\frac{\tilde{\eta}_d}{\tilde{\eta}_u-\tilde{\eta}_d}\Delta\hat{\psi}_t =&\frac{\delta}{1-\delta}(1-\tilde{\beta})\left[\frac{\theta}{\theta+\epsilon}+\frac{\tilde{\eta}_d}{\tilde{\eta}_u-\tilde{\eta}_d}\right]\hat{\psi}_t\\ &+\beta\left[\pi_{t+1}-\frac{\tilde{\eta}_d}{\tilde{\eta}_u-\tilde{\eta}_d}\Delta\hat{\psi}_{t+1}\right] \qquad (56)\end{aligned}$$

□

Proposition 10. *Proposition 5 under infnite-horizon The fleixble-price steady state is efficient.*

Proof. Under flexible prices, $p(i,j)y(i,j)$ acts as a tariff between buyers and sellers. Hence, Nash-bargaining maximises

$$\tilde{\psi}^u(i)+\psi^d(j) \qquad (57)$$

The first-order condition with respect to $y(i,j)$ gives $P=\Psi$. Thus, the economy is efficient.

□

Proposition 11. *Proposition 6 under infinite-horizon The second-order log-approximation of the household utility function gives (up to a scale and a constant)*

$$-\frac{1}{2}\sum_{s=0}^{\infty}\beta^s\left[(\chi_n+1)\hat{Y}_s^2+\left(\frac{1}{\theta}+\frac{1}{\epsilon}\right)(\tilde{\eta}_u-\tilde{\eta}_d)^2\left(\frac{\tilde{\eta}_u}{\epsilon}+\frac{\tilde{\eta}_d}{\theta}\right)^{-2}\frac{1-\delta}{\delta(1-\tilde{\beta})}\left(\pi_t-\frac{\tilde{\eta}_d}{\tilde{\eta}_u-\tilde{\eta}_d}\Delta\hat{\psi}_t\right)^2\right] \qquad (58)$$

Proof. The first term is standard. For the second term, note that

$$N_t = \left(\int y^{1+\frac{1}{\theta}} \right)^{\frac{\theta}{\theta+1}} \tag{59}$$

$$C_t = \left(\int y^{1-\frac{1}{\epsilon}} \right)^{\frac{\epsilon}{\epsilon-1}} \tag{60}$$

I obtain

$$\hat{c}_t - \hat{n}_t = -\frac{1}{2} \left(\frac{1}{\theta} + \frac{1}{\epsilon} \right) var(y_{i,t}) \tag{61}$$

$$= -\frac{1}{2} \left(\frac{1}{\theta} + \frac{1}{\epsilon} \right) (\tilde{\eta}_u - \tilde{\eta}_d)^2 \left(\frac{\tilde{\eta}_u}{\epsilon} + \frac{\tilde{\eta}_d}{\theta} \right)^{-2} var(p_{i,t}) \tag{62}$$

Finally, following Woodford (2003b)

$$\sum \beta^s var(p_{i,s}) = \frac{1-\delta}{\delta(1-\tilde{\beta})} \sum_s \beta^s (\Delta \hat{\mathcal{P}}_s)^2 \tag{63}$$

$$= \frac{1-\delta}{\delta(1-\tilde{\beta})} \sum_s \beta^s \left\{ \frac{1}{\tilde{\eta}_u - \tilde{\eta}_d} \left[\tilde{\eta}_u \Delta \hat{P}_s - \tilde{\eta}_d \Delta \hat{\mathcal{M}}_s \right] \right\}^2 \tag{64}$$

□