Why Do Supply Disruptions Lead to Inflation?*

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Abstract

According to anecdotal accounts, firms tend to justify price increases as a need to cover cost increases. Standard pricing models imply that firms do not only adjust to cost increases, but also to changes in spending (such as pent-up demand). We present a model where this is not necessarily the case. Our framework relies on an asymmetry between firms and consumers, where firms have more precise information about aggregate shocks. This leads to a novel microfoundation for price stickiness. There is differential adjustment depending on the type of shock, with supply shocks triggering more adjustment than demand shocks. We discipline the model using a survey of firms during the post-pandemic reopening of the German economy in March 2021. Consistent with the model, firms report increasing prices as a reaction to higher costs resulting from strenuous hygiene and social distancing regulations. On the other hand, in an effort to avoid upsetting customers, firms report not reacting to pent-up demand (despite equilibrium rationing). In a calibrated version of the model, despite both large demand and supply shocks, supply shocks are responsible for most of the upward adjustment of prices.

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1 Introduction

The 2021-2022 global burst of inflation took macroeconomics by surprise. Inflation had been a non-story for decades, but the end of the pandemic brought back a familiar macroeconomic foe. As a result, a vigorous debate has emerged as to whether increased demand, or instead whether supply bottlenecks of various types, should be judged as the culprit. At a basic level, it should be obvious that both factors were at play, and most vigorously so, given the unprecedented economic impact of the pandemic, and the exceptional government efforts undertaken to combat it. Yet, as we will argue, a proper understanding of the post-Covid dynamics of inflation cannot be obtained by simply identifying the shocks that buffeted economies at their reopening.

The reason is that prices are set by firms, so inflation is ultimately determined by firms' decisions to adjust prices. Rather than simply cataloging the underlying shocks hitting the economy, it is crucial to focus on firms' *incentives* when adjusting prices, and whether these incentives justify an increase in prices, or not, *conditional* on a given shock. Indeed, a priori, it is not clear which shocks are likely to generate a price change. Some shocks might be more effective at triggering a price update than other shocks.

Our paper, therefore, answers the following questions: What incentives do firms have to change prices, and how do various shocks then determine aggregate inflation? We start by explicitly considering firms' incentives to adjust prices when firms have superior information about aggregate conditions. The main assumption of the model relies on an informational superiority of firms when it comes to assessing changes in aggregate demand and supply conditions. The model focuses on firms' incentives when setting prices and provides the novel insight that pricing strategies are not the same for all shocks.

Crucially, this single friction regarding information about the aggregate economy implies very different pricing behavior in response to changes in aggregate demand and supply, even when the information friction applies equally to both shocks. When firms' costs increase for supply-driven reasons—such as disruptions to production networks or increases in the prices of energy or intermediate goods—then firms' prices equal prices in the frictionless benchmark. There is no price rigidity. In contrast, when aggregate demand increases—implying both higher demand at a given price together with higher production costs for

endogenous reasons—firms are reluctant to change their prices and may not respond to changes in demand at all. In sum, firms' incentives based on asymmetric information about the state of the economy imply that supply shocks are much more likely to generate inflation than demand shocks.

This prediction based on firms' incentives is potentially useful and important to the extent that it is empirically realistic. Our next task is to provide empirical support for the implications of the incentives-based pricing model. To do this, we bring in microevidence based on a survey of German firms. The timing of the survey is crucial, delivered immediately after the post-Covid reopening of the economy in March 2021. In our survey, we target a particular industry (hairdressing businesses), in order to be able to go in depth into the reasons for price increases. Our firm-survey is unusually detailed, when compared to other firm surveys in the literature, thanks to our reliance on the head of industry guilds to distribute the survey. The nature of the survey allows us to have credible within-survey information, corroborated with outside information, about both shocks, sidestepping the need to structurally identify the shocks based on an estimated DSGE model or multivariate regression.

The survey provides strong micro-level evidence that firms change prices in response to exogenous cost increases but not in response to changes in demand. Two thirds of the firms in our survey increased their price for a male haircut from December 2020 to March 2021. Firms that increased their price did so overwhelmingly because of higher costs. 94% of firms that increased their price report that costs increased—exogenously caused by strict hygiene rules—and 68% of firms that attribute a big role to higher costs attribute no role to higher demand, even though demand also increased. We thus find a clear asymmetry between the roles of higher costs and of higher demand for price setting: most firms attribute their price increase to higher costs, while only a small fraction attribute it *additionally* to higher demand.

Furthermore, we find that firms are more likely to change their prices when customers are expected to understand the reasons behind the price change, an expectation which we elicit in the survey. We find that firms that expect a higher customer understanding were more likely (by 26pp) to increase their price. Remarkably, despite our survey being quite detailed

in terms of firm's perceptions and characteristics, no other survey answer predicts a price increase. In line with this, the main reason why firms did *not* increase their price—besides having already passed through the higher costs in the recent past—is that they feared to lose regular customers. The plausibility of the "customer understanding"-channel is confirmed by anecdotal evidence from a head of a hairdresser guild, who told us that customers usually ask for the reasons behind a price increase. These findings suggest the importance of information asymmetries between the firm and the consumers for the firm's price setting.

Having provided empirical evidence for the predictions of our model, we then calibrate our model to quantify how the underlying shocks hitting the economy translate into aggregate inflation. Our incentives-based model has very different implications for the decomposition of inflation compared to a standard (Calvo) pricing friction that treats demand and supply shocks symmetrically. In our calibrated model, nearly 94% of inflation during this time period can be attributed to supply-driven disturbances. To shed light on our quantitative results, we derive approximate closed-form formulas for the relative inflationary contributions of demand and supply. The formulas clarify that, in contrast to the standard Calvo model, in our model these relative contributions not only depend on the size of the demand and supply factors driving the economy, but also on the fraction of firms that adjust their prices *to demand* (since all firms adjust their prices to supply, frictionlessly). This implies that, even if demand-drivers are big (or bigger than supply drivers), if only a few firms adjust to them, their relative inflationary contribution will be small. This is consistent with our data, where only a small fraction of firms report attributing an important role to demand increases when raising their prices. This explains the sharp contrast of our quantitative results, when compared to other decompositions based, implicitly or explicitly, on standard models of price adjustment.

We thus answer the title question of our paper by saying, supply disruptions lead to inflation because firms have very strong incentives to change prices in response to supply-driven changes in costs.

Related Literature. There is a classic literature providing evidence that the firm-customer relation is what limits price adjustment, suggesting that nominal price-setting frictions are

determined by how consumers' demand reacts to price changes (Hall and Hitch 1939; Kahneman, Knetsch, and Thaler 1986; Greenwald and Stiglitz 1989; Blinder 1991). Blinder, Canetti, Lebow, and Rudd (1998) provide survey evidence that when asked to explain their reluctance to increase prices after an increase in costs, firms' managers usually answer that "price increases cause difficulties with customers." The survey evidence summarized in Fabiani, Druant, Hernando, Kwapil, Landau, Loupias, Martins, Mathä, Sabbatini, Stahl, and Stokman (2006) consistently finds that firms are more likely to increase prices in response to cost shocks than in response to demand shocks. In line with the predictions of our model, Bils and Chang (2000) provide evidence going back to the 1950s that firms are more likely to react to changes in cost factors than to changes in demand factors in their pricing. Our own survey results resonate with the results in this earlier literature: firms are more likely to adjust prices in response to costs *and* when customers can understand the justification for the price change.

A recent number of papers argues that fairness concerns and other behavioral features constitute bases for price rigidity in the survey evidence cited above (Rotemberg 2005; Rotemberg 2011; Eyster, Madarasz, and Michaillat 2021). Of those, only Rotemberg (2011) provides a theory for why prices are more sticky to demand shifts than to supply shifts. In contrast to this literature, our theoretical model imposes no behavioral preference for fairness, nor do we impose an inherent asymmetry in how consumers might feel about demand- versus supply-driven price changes for reasons outside of the model. In our model this is endogenous, and the difference is an equilibrium outcome of the information friction. Firms and consumers behave strategically. When setting prices, firms take into consideration how consumers may perceive a posted price. The key insight is that the degree of information among consumers may limit price adjustment, when firms may be tempted to stimulate demand. Other recent work that models the way firms set prices in line with survey evidence, which points towards strategic considerations, customer retention concerns, and coordination failures, among other channels, includes Nakamura and Steinsson (2011), Gilchrist, Schoenle, Sim, and Zakrajšek (2017), and Dupraz (2024).

In parallel, there is a significant body of evidence that for advanced economies the Phillips Curve (PC) is incredibly flat, with a slope that is small or close to zero. Hazell, Herreño,

Nakamura, and Steinsson (2022) use cross-sectional data to provide evidence of only a modest flattening of the PC since 1990. According to their findings, the PC has *always* been very flat. Del Negro, Lenza, Primiceri, and Tambalotti (2020) find overwhelming evidence in favor of a very flat PC, especially since 1990. This evidence means that firms prices are relatively unresponsive when facing changes in demand.

There is a recent literature started by Shapiro (2024) that decomposes inflation into supply- and demand-driven components based on the correlation of quantity and price changes. Using this decomposition, Shapiro (2024) ascribes roughly half of the post-Covid inflation to demand and supply pressures, though the earliest part of the post-Covid inflation is predominantly driven by supply. Within this literature, Firat and Hao (2023) estimate Phillips Curves separately for demand- and supply-driven inflation. They find that these Phillips Curves are not identical. The demand-driven PC is quite flat, with measures of output gaps having a negligible impact on demand-driven inflation, comparable to estimates for the aggregate PC. In contrast, measures of costs (such as energy) instead have a one-to-one impact on supply-driven inflation with almost no impact on demand-driven inflation. This is strong evidence in favor of what L'Huillier and Phelan (2024) call shock-dependent pricing, in which supply and demand shocks differentially pass-through to inflation. This insight is a central component of our current paper.

There is a robust literature that attempts to reconcile the New Keynesian framework with the data. The first major challenge is explaining (or reinterpreting) the so-called missing inflations during the Great Recession. It constitutes an anomaly within the standard paradigm. Several factors have been considered to explain (or reinterpret) these phenomena, such as inflation expectations (Jorgensen and Lansing 2019), online retail (Cavallo 2018), and globalization (Forbes 2019). See L'Huillier and Schoenle (2023) for related evidence of the link between the frequency of price adjustment and the inflation target.

2 The Model

We model the strategic interaction of a firm and a set of consumers. There are two shocks; one shock shifts consumer demand, the other shock shifts the firm's cost of production. The

goal of the model is to explain how incentives of the firm differ depending on the nature of the shock, with implications for the extent of price adjustment. Section 4 presents a quantitative analysis of the model.

The model is presented with an eye towards simplicity of the exposition (and hence sacrificing generality). We focus on the firm-consumer interaction, employing a partial equilibrium, 2-period environment, and binary exogenous states. It is straightforward to embed the model into a, full-blown, infinite horizon, general equilibrium model with more states (see L'Huillier (2020) for an example, using a similar environment, of how to proceed).

Preview. Consider the following problem. There is a monopolist selling a good to a set of consumers, a proportion of which are uninformed about the aggregate state of the economy. The aggregate state is given by the realization of two shocks: an aggregate demand and an aggregate supply shock. The monopolist is informed about the state. We motivate this assumption by the idea that firms are either sophisticated players that actively research variables allowing them to forecast revenues, or that firms typically observe more transactions than consumers. For instance, firms may observe the wage bill or the cost of inputs, gathering more information about the aggregate supply side of the economy than unsophisticated consumers. Similarly, firms may observe a time series of total sales in the last few weeks, providing them with information about the aggregate demand side of the economy. The goal is to derive cutoff rules for the optimal behavior of the monopolist in this environment of asymmetric information.

Time. There are two periods, the present and the future. We interpret the present as the "short run", and the future as the "long run". In the short run, trade is subject to pricing frictions. In the long run, trade is efficient in a Walrasian market.

Agents. There are three types of agents: consumers, firms, and a central bank.

Islands. The economy is subdivided into a unit mass of islands, each indexed by i, and a mainland. Each island is populated by a unit mass of consumers, and a firm. Trade within each island happens in the present (short run), and is decentralized; each island is served

by the island-specific firm, which sets a price. Trade between the islands and the mainland happens in the future (long run); it is centralized and Walrasian; the market is served by a competitive firm.

Consumers. Each consumer has the following utility function of consumption:

$$u(c) + \beta\vartheta C \tag{1}$$

where good c is consumed in the short-run, good C is consumed in the long-run, and $\beta < 1$ is the discount factor. The random variable ϑ is a discount factor shock, with $E[\vartheta] = 1$, used to model short-run shifts in aggregate demand. (In the long run, prices are flexible and hence real allocations are not impacted by ϑ.) For simplicity, $u(\cdot)$ is assumed to be quadratic: $u(c) = c - c^2/2$.[1]

The budget constraint is

$$pc + QC = d + QD$$

where p is the monopolist's price, and $Q \equiv 1/(1+i)$ is the nominal price of a bond, which is set by the monetary authority. C is a numeraire good. Consumers have a real endowment D in the future and receive firm profits d in the present.

Firms. Firms operate with a constant real marginal cost k, with $0 \leq k < 1$. This is a random variable. Exogenous changes to real marginal costs embody supply shocks, which could come from changes in productivity, changes to the price of inputs such as oil, or from changes to the labor supply schedule.[2] Nominal marginal costs vary proportionally to the price level (see the firm's problem below). Also, in general equilibrium, we can allow the marginal cost to adjust; this does not modify our conclusions.

[1] This assumption leads to analytical tractability when deriving the firms' cutoffs of adjustment. We can obtain similar theoretical results for any $u(\cdot)$ that is a strictly concave utility function.

[2] Different from the New Keynesian model, we do not need to recur to markup shocks to model cost-push shocks. The reason for this is that, as we show below, equilibrium prices move one-to-one with productivity (despite stickiness to demand shocks). Hence, productivity does not lead to output gaps, unless the monetary authority reacts with inefficient movements to the interest rate. Productivity shocks are, in fact, cost-push shocks in this model. (This would hold even if we obtained an isoelastic demand function in our firm problem.)

Exogenous Shocks. We model orthogonal binary states for both costs shock k and discount factor shock ϑ realizations. Denoting by $\{H, L\}$ (High, Low) the realizations of the supply shock, $k_H > k_L$, and by $\{H, L\}$ (High, Low) the realizations of the demand shock, $\vartheta_L > \vartheta_H$, then we have 4 possible realizations, each with equal probability. The notation for ϑ reflects the result that optimal short-run demand will be high when ϑ is low.

Monetary Policy. The central bank follows an interest rule that governs the reaction of the interest rate to inflation π and the output gap x in the decentralized market:

$$i = i_0 + \phi_\pi \pi + \phi_x x$$

where $\phi_\pi, \phi_x \geq 0$, and $i_0 = 1/\beta - 1$ is the benchmark rate.

Aggregate State. The aggregate state of the economy is determined by the state of aggregate supply and aggregate demand.

The state of aggregate supply is simply given by the exogenous shock k.

The state of aggregate demand, denoted ζ, is given by the exogenous shock to the discount factor ϑ and by the policy rate set by the central bank i. Specifically, the discount factor of consumers $\beta\vartheta$ defines the natural rate of interest ρ:

$$\rho \equiv \frac{1}{\beta\vartheta} - 1$$

and hence the shock ϑ can be equivalently thought as shocks to the natural rate ρ. *Aggregate demand* will be given by the total effect of the subjective discount rate ρ, and the market discount rate i, on short-run demand, written as

$$\zeta \equiv \frac{1+\rho}{1+i} \tag{2}$$

The state variable $s \equiv (s_\zeta, s_k)$, $s_\zeta, s_k \in \{L, H\}$, summarizes the aggregate state of the economy.

Information. There are two types of consumers: Insiders (informed consumers) and Outsiders (uninformed consumers). Insiders are perfectly informed about the aggregate state; Outsiders are uninformed about the aggregate state but know the probability distribution, and draw inferences from the price set by the firm with which they trade.

The fraction $\alpha \in [0, 1)$ of Insiders on a particular island varies across islands. We use this source of heterogeneity to allow for distinct patterns of price adjustment across islands. We assume that the distribution of α is given by a cdf F, where α_0, α_1 are the lower and upper limit, respectively, of the support of F, i.e. $\alpha_0 < \alpha_1$. Hence, α_0 is the fraction of Insiders on the least-informed island, and α_1 is the fraction of Insiders on the most-informed island.

By assumption, firms know the aggregate state. The assumption that Insiders and firms know the true state is just a convenient abstraction of the idea that they are better informed than Outsiders. One can microfound the assumption of informed firms by the existence of a 'time 0' where firms observe market transactions.

Demand Function. Faced with uncertainty, consumers maximize their utility (1) in expectation. Using the definition of aggregate demand (2), the first-order condition with respect to c can be written:[3]

$$u'(c) = pE_j \left[\frac{1}{\zeta}\right]$$

Informed consumers do not face uncertainty, and solve their problem under perfect information. With quadratic utility, we get the linear demand

$$c^* = 1 - \frac{p}{\zeta}$$

A high aggregate demand ζ increases the demand for the short-run good c.

Outsiders observe the price p offered by the firm, but do not observe the state of aggregate demand. There are no other informative signals in the economy. Their demand function is

[3]Note that ζ can also be interpreted as the inverse of the Lagrangian multiplier of the consumer's intertemporal budget constraint.

therefore written:

$$c^* = 1 - pE\left[\frac{1}{\zeta} \mid p\right] \tag{3}$$

We suggest two approaches to microfound consumer j's uncertainty about aggregate demand. A complete derivation would lead to a more involved, but more realistic, exposition. The first approach is introducing idiosyncratic discount factor shocks. In such formulation all consumers perfectly know their own discount factor, but do not know the aggregate discount factor. The second approach microfounds ϑ as a shock to future marginal utility. There, it can be derived as a shock to the future real endowment, which then affects the realization of future marginal utility (with concave long-run utility). In that case, one can interpret the shock as mimicking imperfect information about future real income, similar to the work by Lorenzoni (2009). These approaches lead to the same results. We follow the second approach when calibrating the aggregate demand shock in Section 4.

Total demand on a given island i is given by the sum of the demands of Insiders and Outsiders:

$$c_i(p) = \int c_{ij}^* \, dj = \alpha_i \left(1 - \frac{p}{\zeta}\right) + (1 - \alpha_i) \left(1 - pE\left[\frac{1}{\zeta} \mid p\right]\right) \tag{4}$$

Firm Problem. The firm maximizes profits given the demand function (4). We use a working capital assumption whereby nominal marginal costs are flexible and proportional to nominal aggregate demand.[4] Under this assumption, the firm's profit function is given by $(p - \zeta k)c(p)$.

When information is perfect ($\alpha = 1$), the firm's problem boils down to a standard price-setting monopolist problem. However, if information is not perfect and consumers and firms behave strategically, this is not necessarily an equilibrium; we must also ask whether the optimal monopoly price is consistent with equilibrium in the implicit game between the firm and the consumers. First, Outsiders must be behaving rationally, making consumption decisions based on utility maximization and beliefs about aggregate states upon observation of the price offered by the firm. This includes correctly understanding firm incentives. Second,

[4]Specifically, the assumption is that production costs (wages or intermediate goods) are paid at the end of the first period, and therefore the production cost is the discounted value of the price level in the future.

the firm must be exploiting all opportunities to increase profits, including opportunities to misrepresent the information the firm possesses.

Definition 1 (PBE) *A Perfect Bayesian Equilibrium (PBE) of the game between firms and consumers is given by a price, beliefs of Outsiders, and consumption decisions, such that*

1. *There is no profitable deviation from posting the price, given consumers' strategy,*
2. *Outsiders' beliefs, upon observation of the price, are formed using Bayes' rule on the equilibrium path,*
3. *Consumption decisions solve the consumer problem given consumers' beliefs.*

Aggregation. Aggregation of island equilibria is straightforward: recall that utility is quasilinear. Therefore, for each consumer j in island i, for a given choice c^*_{ij}, consumption of the long-run good is set to satisfy the budget constraint. Short-run aggregate allocations are obtained as follows. By market clearing, a given island i's output equals $c(\alpha_i) \equiv c_i(p(\alpha_i))$, and aggregate output y is obtained by integration over islands:

$$y = \int c(\alpha) dF(\alpha)$$

The natural level of output is computed as output under no information frictions: $y^n = (1-k)/2$. The output gap, x, is the percentage deviation of aggregate output from the natural level:

$$x = \frac{y - y^n}{y^n}$$

In order to compute inflation, we first compute the the benchmark, frictionless, price when $\zeta = 1/E[1/\zeta]$, which can be shown to be $p_0 = (1+k)/2$. (We normalize $E[1/\zeta] = 1$.) Inflation is given by the percentage deviation of the price level away from this benchmark:

$$\pi = \frac{\int p(\alpha) dF(\alpha) - p_0}{p_0}$$

2.1 Firm Incentives under Demand Shocks

For clarity, we analyze the effect of each type of shock on firm incentives separately. First, we consider pricing under aggregate demand shifts. Then, we tackle supply shocks. The quantitative Section 4 uses the evidence coming from our survey to calibrate the model when both shocks are active, and derives pricing implications in that context.

We focus on the demand shock by turning off supply shocks. With a slight abuse of notation, $s = s_\zeta \in \{L, H\}$ denotes the state of the demand shock, while cost is set to a fixed value k. There are two possible realizations of the discount factor shock ϑ_H and ϑ_L, with ϑ_H corresponding to high demand and ϑ_H corresponding to low demand ($\vartheta_L > \vartheta_H$), and $Pr(\vartheta_H) = Pr(\vartheta_L)$. The monetary authority reacts by partially dampening the shock ($0 < \phi_\pi, \phi_x < \infty$).

Consider the benchmark flexible prices under no information frictions:

$$p_s = \arg\max\ (p_s - \zeta_s k)\left(1 - \frac{p_s}{\zeta_s}\right)$$

It can be seen that these prices are proportional to the state of aggregate demand, ζ_s, and hence the state of nominal demand is neutral.

In order to construct an equilibrium, the question is whether adherence to the flexible prices p_s, $s = H, L$, is optimal for the firm. For example: would the firm prefer to charge p_L when aggregate demand is low, $\zeta = \zeta_L$, even if some consumers are Outsiders? In fact, it is possible that the firm will be tempted to raise its price to p_H to extract more rents, especially if many of the consumers are Outsiders, and these could be misled into spending more. But a PBE requires that Outsiders form beliefs rationally, and that the firm does not have profitable deviations given Outsiders' belief formation process. Proposition 1 below provides a sharp answer to this question.

Proposition 1 (Demand: Incentives to Misrepresent State) *Consider the flexible prices p_H and p_L. The firm truthfully reveals ζ_s iff the following IC constraint is satisfied:*

$$(p_L - \zeta_L k)\left(1 - \frac{p_L}{\zeta_L}\right) \geq \alpha(p_H - \zeta_L k)\left(1 - \frac{p_L}{\zeta_L}\right) + (1-\alpha)(p_H - \zeta_L k)\left(1 - \frac{p_H}{\zeta_H}\right) \quad (5)$$

Moreover, the constraint (5) is satisfied iff the proportion of Insiders α is high enough: there is a cutoff in the proportion of Insiders $\alpha^* < 1$, such that, for $\alpha \geq \alpha^*$, constraint (5) is satisfied.

The intuition for the observations stated by the proposition can be given as follows. Suppose that aggregate demand is low, and that many consumers are Outsiders (α is below the cutoff). If the firm were to lower prices, observing a lower price, Outsiders would conclude that it is 'a bad time to buy' or that 'there is a recession' (i.e. that $\zeta = \zeta_L$). This would shift their demand function to the left (since $1 - p/\zeta_L < 1 - pE[1/\zeta_s]$), reducing firm profits. Hence, the firm prefers not to post a low price to avoid this fall in profits. The firm prefers keeping the price unchanged, since then demand is higher and so are profits.

We can say more about the incentives of the firm. As a matter of fact, the firm prefers *raising* prices in hopes of convincing the Outsiders that it is a *good* time to buy, i.e. that $\zeta = \zeta_H$. The issue is that this cannot be a credible equilibrium strategy (it is not part of a PBE).

As the IC constraint (5) shows, a high enough proportion of Insiders α resolves the firm's incentive problem. With high enough α, posting a price that is not aligned with the state of demand is suboptimal. This leads to the following cutoff strategy.

Proposition 2 (Demand: Cutoff for Price Adjustment) *There is a cutoff in the proportion of Insiders $\alpha^* < 1$ such that:*

- *If $\alpha < \alpha^*$, the firm's price is sticky: $p = p_0$*
- *If $\alpha \geq \alpha^*$, the firm's price is flexible: $p = p_s$*

It is worthwhile mentioning that the sticky price p_0 is preferred when the proportion of Insiders is low. The reason is that the IC constraint (5) requires distortions for flexible prices when $\alpha < \alpha^*$, and these distortions lower profits away from maximum monopoly profits. At the extreme when $\alpha = 0$, it maximizes profits, since it corresponds to the monopoly price in the benchmark of no demand shocks.

2.2 Firm Incentives under Supply Shocks

We now turn to pricing under aggregate supply shocks. We focus on supply shocks by shutting down the demand shock. This is accomplished by shutting down exogenous variation in the discount factor (we set $\vartheta = 1$), and by shutting down the central bank's reaction ($\phi_\pi = \phi_x = 0$). With a slight abuse of notation, the aggregate state $s = s_k \in \{L, H\}$ denotes the two possible realizations of costs, k_H and k_L, with $k_H > k_L$ and $Pr(k_H) = Pr(k_L)$.

We ask the same question as before: Under asymmetric information ($\alpha < 1$), is adherence to flexible prices optimal for the firm? The answer is: Yes.

Proposition 3 (Supply: Truthful Incentives) *For any Outsider beliefs about the aggregate state s, the firm prefers posting the monopoly price:*

$$p_s = \arg\max\ (p - k_s)(1 - p) = \frac{1 + k_s}{2}$$

Thus, the firm's price truthfully reflects the aggregate supply shock k_s, for any α.

Thus, the proposition states that there are no incentives for the firm to deviate from the monopoly price. The intuition for the result can be given as follows, using a parallel reasoning to the case of variation in costs. Suppose that costs are indeed low. The firm is, in this case, supposed to lower its price. But in fact, the firm *prefers* lowering the price in this case (instead of raising it, or keeping it unchanged), since this increases profits. A lower price increases revenues, which together with low marginal costs, increases profits at the margin. On the other hand, consumers also prefer low prices since this raises utility. It can therefore be seen that firms and consumers incentives are, using informal language, "aligned."

The following proposition is a corollary of the previous discussion.

Proposition 4 (Supply: Flexible Prices) *For any α, the firm posts the benchmark frictionless price $p_s = (1 + k_s)/2$.*

It can thereby be established that there is no price stickiness to supply shocks. With aligned incentives, there is no strategic friction between the firm and the consumers, despite the information friction. The firm posts p_H and p_L, depending on the realization of the shock.

By Proposition 3, one can construct a PBE in which consumers infer the costs from the price; in this decentralized environment, consumers' inference would not have any impact on the demand schedule ($c(p) = 1 - p$). Consumers understand that, if the firm posts the high price, it must be because costs are high, but this does not impact their demand function.[5] Hence, one might say that the firm has the credibility to increase prices when it is based on costs (and therefore consumers believe that costs are indeed high when they see a high price), or, that, in this case, price increases are 'acceptable'.[6]

3 Micro Evidence on Firms' Motives for Increasing Prices

The previous section presented a model where firms' prices are more flexible to supply than demand shocks. In this section we present evidence that this prediction is realistic, based on a survey of German firms, launched during the reopening of the German economy after the Covid pandemic. We purposely target a particular industry: hairdressing businesses. This provides two advantages: First, our survey is detailed compared to other firm surveys available. Second, we have precise within-survey and external information about demand and supply factors at the time of the survey.

Data. We conducted our survey of German hairdressers on the online platform *SoSci Survey* from Monday, March 08, 2021, to Friday, April 16, 2021. The questionnaire consists of three main parts: First, we ask firm managers to submit the prices at which they offered a male haircut, at different times before and after the lockdown. Depending on whether or not they increased their price, we then present them with a list of reasons why they increased their price, or the reasons why they did not increase their price. We ask them to rate each reason on a Likert scale. Third, we ask them general questions about the characteristics of their firm and their assessment of their business during the pandemic. The complete

[5] When costs are high, the firm increases prices and demand falls (along the demand schedule), but this is necessary for profit optimization given high costs.

[6] Clearly, the same allocation obtains when consumers do not update their beliefs (say, if they have fixed beliefs by assumption). In this case, the firm problem boils down to a plain-vanilla monopoly maximization problem, where, obviously, the result that prices are flexible still holds.

questionnaire used is in Appendix C (both the original German version, and an English translation).

Everybody in possession of the link to the survey (URL) could participate. We recruited participants in two ways. First, on March 08, 2021, we contacted all local Chambers of Handicrafts (*Handwerkskammern*), since membership is mandatory for German hairdressing firms. However, the response rate was low. Thus, second, we contacted the heads (*Obermeister*) of all local hairdressing guilds (*Friseur-Innungen*)[7] in Germany on March 15, 2021, and asked them to participate and to forward our e-mail to the other members of their guild. On April 1, we sent a reminder to the heads of the local hairdressing guilds. After cleaning the data from incomplete or self-contradictory entries, we retained 208 responses.[8]

We complement our survey with micro data from the German Consumer Price Index, for the years 2020 and 2021. It allows us to observe prices for the specific service in the survey, male haircuts.[9] This corroborates that the frequency of price changes for the service in question was large during the pandemic in Germany, especially right after the lockdowns, and at the time of a temporary decrease in VAT in Germany in July of 2020 (see Figure 1).

The Covid-19 pandemic and the associated lockdowns hit German hairdressers with common aggregate shocks. Notably, the second lockdown in Germany, during which it was forbidden to offer close-contact services like haircuts, ended on February 28, 2021, right before we started our survey. In what follows, we present evidence of both increases in demand and increases in costs for the firms in our survey, caused by common circumstances.

3.1 Large Demand and Supply Shocks

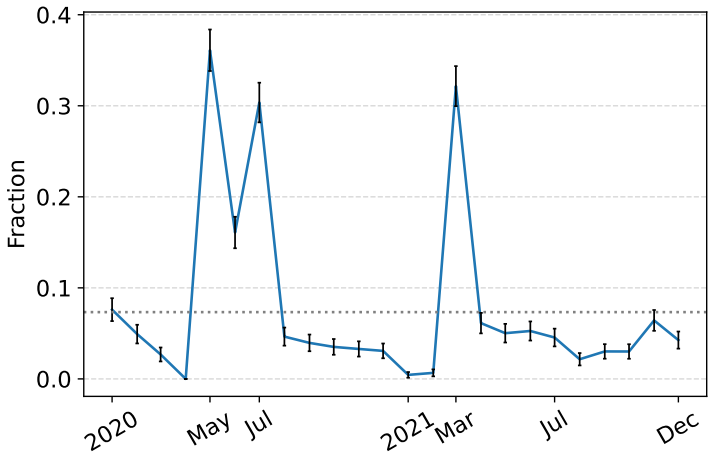
Aggregate Demand Shock. During the course of the Covid-19 pandemic, the German government imposed two lockdowns at the Federal level, during which the consumption of

[7]Guilds are lobby groups with voluntary membership. Local hairdressing guilds are organized on a county-level or slightly larger. As of 2022, there are 247 of them in total.

[8]For comparison, in 2020, 77,166 hairdressing firms were registered in Germany (Zentralverband des Deutschen Friseurhandwerks 2021, p. 12).

[9]We only consider entries that carry the attributes "haircut" (as opposed to shaving) and "wet cut" (hairwashing before cutting became mandatory after the first lockdown, so we delete dry cut-services for all months for consistency). We use the price series "PreisBearbeitet", since it is smoother and has less missing values. Our results are robust to using the series "PreisErhoben" instead. Results are available upon request. We delete sales prices and observations where the quality changed over time. For each month, between 445 and 465 observations remain.

Figure 1: Fraction of Price Changes



Notes: Ratio of hairdressers that changed their price for a man's haircut, monthly, from January 2020 to December 2021. Dotted horizontal line shows the average monthly price change frequency for the median firm, 7.3%. Whiskers depict 68%-confidence intervals. Source: German CPI micro-level data, N=445-465.

"close-contact services," like getting a professional haircut, was forbidden. The first lockdown lasted from March 22 to May 4, 2020, and the second lockdown lasted from December 13, 2020, to February 28, 2021.

Pent-up demand for a professional haircut after the second lockdown was very high. The German media reported on several hairdressers across Germany who auctioned off special appointments—some scheduled at midnight, one minute after the lockdown would be lifted—raising several hundreds of Euros per appointment for charity. *Treatwell*, an online booking platform for hair and beauty salons, reported a record high number of bookings in March 2021, which eclipsed the number of bookings after the first lockdown in May 2020, which had already been record high, by 36 percent. The average waiting time to get an appointment for a haircut on the platform was more than two weeks. The platform reported a slightly higher demand for male than for female haircuts.

Our survey of German hairdressers, which we conducted directly after the second lockdown, confirms that barbershops experienced higher demand than usual. 71% of hairdressers in our survey expanded their opening hours in response to the higher demand. When they had to ration their services, barbers report allocating appointments for the most part ac-

cording to the following rules: honor appointments that were scheduled before the lockdown (63%), prefer regular customers (59%), or apply the first-come-first-serve principle (51%). Only 3% of the respondents did none of the above.

While higher demand directly after the lockdown is evident, hairdressers might have expected a long-term decline in demand. Plausible counteracting forces that could have lowered the demand for close-contact services during the pandemic include the fear of infection or a long-lasting change in habits. We ask survey participants about their assessment of a long-term decline in demand due to people's fear of Covid. 71% of hairdressers we ask either think there will not be a permanent decline in demand or find the situation unclear. We also ask if they think that their customers' willingness to pay for a haircut would decline in the long-term as a result of the pandemic. Again, 76% of the respondents either disagree or are unsure. Hence, we find no evidence for hairdressers being particularly pessimistic about the demand for haircuts going forward.[10]

Aggregate Supply Shock. After the first lockdown in spring of 2020, in order to insure a safe conduct of close-contact services, German authorities introduced mandatory hygiene rules. For barbers, these included distancing rules: imposing a minimum distance of 1.5 meters between clients, effectively reducing the capacity of their hair salons, mandatory masking, and mandatory hair washing (i.e. no "dry cut" could be offered anymore). After the second lockdown, hygiene rules became even stricter: serving walk-in customers was prohibited, compulsory medical face mask wearing for hairdressers was imposed (with compulsory replacement after each customer), as well as a continuous stream of fresh air in the salon. In some regions with high infection rates, customers had to be tested negatively beforehand. In some states, the hairdresser was allowed to conduct the test. Many of the hygiene rules stayed in place until the end of 2021 and beyond.

In sum, these measures severely increased the costs of being in the hairdressing business. First, these firms lost months-worth of profits, paid bills from their savings, and some had to borrow funds to keep their business running. Second, distancing rules effectively increased

[10]Below, we show that the effect of these expectations on price-setting seems to be minor as well: while more pessimistic firms do appear to be less likely to increase their price, the effect is statistically insignificant, and comparatively small.

the average cost of a haircut, since salon space was now less useful, and more time had to be invested in cleaning after a client left. Third, hairdressers had to purchase hand sanitizers and masks. Some barbers further invested in prophylactic health measures by buying Covid-19 tests, or by installing an air purifying unit in their salon. Hairdressers expected these cost increases to be long-lasting at the time: 81% of hairdressers in our sample agree with the statement that the hygiene measures will last for years, while 16% are uncertain about it, and 3% disagree.

Other additional factors also increased the costs of a haircut in Germany in 2021. First, the value-added tax-rate was raised back to 19% (for most products and services, including haircuts) in 2021, after it had been temporarily lowered to 16% in July 2020. Second, the legal hourly minimum wage for hairdressers increased in several German states on January 1, 2021, by 15 Eurocent, and on July 1, 2021, by 10 Eurocent, either due to state-wide binding agreements, or due to the simultaneous increase in the federal minimum wage.[11] What is more, the higher uncertainty and more demanding working conditions had a negative effect on the labor supply of hairdressers (an effect that was generally observed in the service sector during the pandemic). For example, the Guild of Hairdressers in Bavaria reported a 25 percent decline in the number of trainees from 2020 to 2021. These forces further put upward supply-side pressure on the labor costs of a typical hair salon in Germany.

3.2 Firms' Reaction

Two thirds of firms in our survey increased their male haircut price from December 2020 to March 2021. Among price-increasing firms, the median reported price increase is 7.3%.[12]

Firms that increased their price did so overwhelmingly because of higher costs. 94% of firms that increased their price report that costs increased. The most important drivers of costs are the stricter hygiene measures (in particular, the cost of masks, disinfectants, and

[11] In some states, there are binding collective agreements determining the minimum wage in hairdressing. This is the case in Hesse, where the collectively agreed minimum wage increased on January 1, 2021. In some states, there are collective agreements, but employers decide themselves whether to opt in. In the remaining states, located mostly in Eastern Germany, there are no collective agreements on the minimum wage in hairdressing. The Federal minimum wage applies.

[12] This is roughly consistent with the CPI, where the median is at 5.5%. Differences might stem from sampling uncertainty.

more time per consumer).[13] In contrast, while 83% of firms report higher demand, only a small fraction of them say that it played a big role for their price increase.

To look at this pattern more closely, Figure 2 plots firms' responses to questions regarding the importance of demand or supply factors for their decision to increase prices. The question is: "You have indicated that at least one of your prices was larger in March 2021 than in December 2020. Which role did the following factors play in your increasing the prices?", with subquestions "Increased demand" or "Increased hygiene cost (masks, disinfection, time)" (among others). Firms are given a Likert scale with three options: "No Role", "A Small Role" or "A Big Role". As Figure 2 shows, firms are mostly looking at cost factors when adjusting prices, with 68% of firms attributing a big role to costs (versus 11% of firms attributing a big role to demand). A symmetric pattern is observed for no role, with 63% or firms attributing no role to demand (versus 4% attributing no role to costs). This is a remarkable finding given the prevailing presence of pent-up demand in our sample.

Looking at the correlation between the roles of costs and of demand, we find that 68% of firms that attribute a big role to higher costs attribute no role to higher demand. On the other hand, 83% of firms that attribute a big role to higher demand *also* attribute a big role to higher costs. We thus find a clear asymmetry between the roles of higher costs and of higher demand for price setting: most firms attribute their price increase to higher costs, while only a small fraction attribute it *additionally* to higher demand.[14]

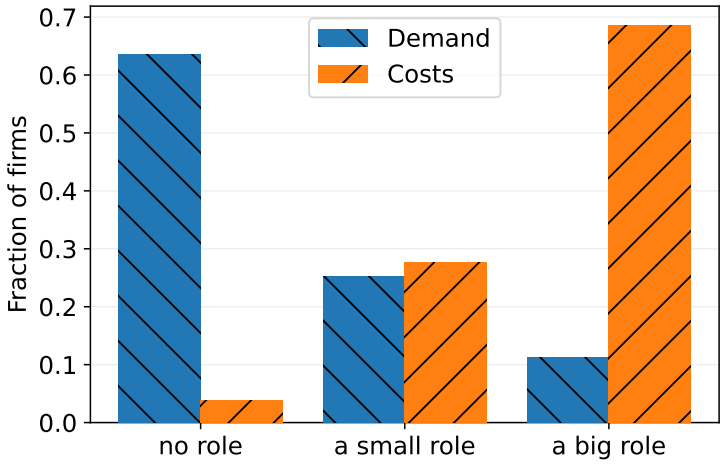
Firms that did not increase their price attribute this mainly to two reasons: that they already increased their price in 2020, after the pandemic started, and that they fear losing their regular customers with a price increase. About half of the firms in this group also state that costs did not increase, most of which say this played a role in their decision not to increase their prices. This suggests that some firms do not perceive the stricter hygiene rules that were imposed in 2021 as a significant increase in cost over the hygiene rules that were already in place before, and which they already adjusted to with a price increase.

The evidence of firms' rationing suggests that firms that did not increase their prices

[13] Lower shop capacity due to distancing rules also ranks highly as the reason to increase prices.

[14] The discrepancy between the roles for costs and for demand could come out even starker if survey participants did not have the tendency to select midpoint answers. We find this in our survey as well, as 38% of firm managers who pick the "small role"-answer for the role of higher costs, also pick it for the role of higher demand.

Figure 2: Reason for Increasing Prices: Roles Played by Higher Demand and Higher (Exogenous) Costs



Notes: Fraction of firms rating the role that higher demand, or higher costs, play for their price increase. The latter focuses on costs rising due to hygiene measures (masks, disinfectants, time per customer).

still experienced higher demand. Why did they not increase their price? Apparently, they feared that their customers would not find a price increase acceptable. To investigate this further, we also ask firm managers about whether they think that, in general, the reasons for price increases are understandable for their customers.[15] We find that firms with more understanding customers are more likely to increase their price after the second lockdown. The effect is economically significant: the average firm is 26pp more likely to increase its price if it is above the 40%-quantile of customer understanding. The customer understanding variable is the only firm characteristic that significantly predicts the firm's decision to increase their price (other firm characteristics include the size of the firm and the firm manager's business outlook). See Appendix B for the regression tables. These results suggest the importance of information asymmetries between the firm and the consumers for the firm's price setting. The more the firm's customers and the firm manager are "on the same page"—by the firm manager's account—the less sticky are the firm's prices.[16]

[15]We also ask two related questions—whether customers express understanding for the firm's prices, and whether some customers accused the firm manager of profiteering—and sum the Likert scale-answers to those questions up to a composite measure, which we call "customer understanding".

[16]A follow-up interview with the head of a hairdresser guild provides us with further, anecdotal evidence

4 Quantitative Exercise

The previous section presented firm survey evidence on the self-reported reasons for increasing prices when the German economy reopened. We find clear evidence that businesses are concerned about passing on cost increases to consumers that were caused by exogenous factors, such as hygiene costs and distancing rules. On the other hand, businesses were not concerned about increasing prices due to pent-up demand for their services, even in the presence of rationing or long queues.

In this section we calibrate the incentives-based pricing model developed in Section 2 based on these findings. We also calibrate the size of demand and supply shocks to answer the following question: What was the impact of these shocks on firm pricing decisions? Our main goal is to obtain aggregate implications for inflation, which will answer the question in the title of the paper. In order to transparently show the implications of the strategic pricing frictions, we benchmark the inflation contributions of the shocks implied by our pricing friction to those obtained under an exogenous pricing friction (Calvo). In that case, a random subset of firms in the economy are allowed to reoptimize their prices, and there is symmetric adjustment to the shocks since the model abstracts away from the effects that each type of shock has for firm incentives.

Calibration. We calibrate a version of the model that incorporates both demand and supply shocks (see Appendix A.1 for the theoretical results). Since there is no uncertainty about the supply side of the economy in equilibrium, $s_k = H$ is known. With a slight abuse of notation, we denote $s = s_\zeta$ as the aggregate state of the demand. Demand of consumer j, as given in equation (3), depends on (the expectation of) the demand shock. Equation (2) expresses the total demand shock ζ_s as the ratio of $1 + \rho_s$, one plus the subjective discount rate, and $1 + i_s$, one plus the market discount rate. The subjective discount rate is determined by consumption growth expectations of the consumer: higher consumption growth expectations imply a higher subjective discount rate. The market discount rate is set by the monetary authority. If monetary policy induces higher inflation expectations, the

for this: by the expert's account, customers typically ask hairdressers in the weeks after a price increase for reasons to justify it. The expert says that pointing to cost increases, which are evident also to clients (like an increase in energy costs that is also reported in the news), is most effective in justifying the price increase.

market discount rate falls. We measure these two components using long-run expectations data from surveys conducted at the time of the reopening of the economy. We use data about the distribution of these expectations to calibrate the two possible realizations of the demand shock that the consumer considers, ζ_L and ζ_H. The model predicts that, the higher the spread between the two possible levels of demand, $\Delta \equiv \zeta_H/\zeta_L$, the more likely it is for firms to set flexible prices. Intuitively, a higher spread between possible states of demand increases the loss firms make when not setting the price that is aligned with the true level of demand, which is understood both by firms and by consumers.[17]

The subjective discount rate is determined by the product of the inverses of the time discount factor β and the discount factor shock ϑ. In line with the first order condition of an optimal intertemporal consumption-savings choice, the discount factor is related to the expectation of future marginal utility of the consumer. Assuming complete markets and log-consumption preferences in the future, we can measure the discount factor shock as

$$\vartheta_s = E\left[\frac{1}{\Xi Y} \mid s\right]$$

where Y is long-run output, Ξ is the fraction of output that is consumed, which is constant across time and states of the world, and $E[\cdot \mid s]$ is the expectation operator conditional on state of the world, or information set, s. For example, $s = H$ stands for news that long-run output will be high, which raises expected future consumption, and thus increases demand. This captures the fact that, at the beginning of the year 2021, there was a large disagreement about the speed and size of the economic recovery, partly due to the uncertainty around the effectiveness of recently discovered vaccines against the Covid-19 virus. We measure the differences in long-run growth expectations for the Euro zone by taking data from the ECB's Survey of Professional Forecasters (SPF) from the first quarter of 2021. Looking at the cross-section of forecasters, we find that optimistic forecasters—the 75th percentile of forecasts—predicted output growth of 9.4% until the end of year 2022, while pessimistic forecasters—the 25th percentile—predicted 6.9% output growth. For longer-run

[17] Technically, the threshold of the share of Insiders above which firms set flexible prices, in the setting with both supply and demand shocks, is falling in Δ: firm i posts a flexible price iff $\alpha_i > \overline{\alpha}_H \equiv \frac{1-k_H}{\Delta(1+k_H)-2k_H}$. See Proposition 7 in Appendix A.1.

expectations, we assume that the difference of 2.5pp in expected output growth over two years measures a disagreement about a persistent component of productivity. Therefore, we assume that the optimistic year-on-year growth expectation for the years 2023 to 2025 is 2%, while the pessimistic year-on-year growth expectation for these years is 0.75%.[18]

The market discount rate is the inverse of the price of a future consumption unit in today's unit of account, Q_s. We measure this as the product of the price of a long-term bond denoted in Euro, P^b, with the expectation of the long-run price level, $P_s \equiv E[P \mid s]$. We measure disagreements over expected long-run inflation by combining short-run consumer inflation forecasts from the ECB Consumer Expectations Survey with long-run inflation forecasts from the ECB's SPF survey. In March of 2021, consumers in Germany expected annual inflation in 2021 to range between 2.4% (25th percentile) and 3.6% (75th percentile). While the interquartile range of longer-run consumer expectations is not available, professional forecasters predicted annual inflation in the year 2025 to lie between 1.5% and 1.8%. We estimate the percentiles for the years in between by linearly interpolating between these datapoints.[19]

We combine the estimates of the subjective discount rate and of the market discount rate into the spread Δ, by assuming that consumers expect a perfectly positive correlation between high output growth and high inflation:[20]

$$\begin{aligned}\Delta &= \frac{P^b P_H/(\beta\vartheta_H)}{P^b P_L/(\beta\vartheta_L)} = \frac{(P_H/p)(Y/Y_L)}{(P_L/p)(Y/Y_H)} \\ &= \frac{(1+\pi_H)(1+g_H)}{(1+\pi_L)(1+g_L)} \approx \frac{1+\pi_H+g_H}{1+\pi_L+g_L}\end{aligned}$$

where π_s and g_s are the net rates of long-run inflation and long-run output growth in state

[18] In the SPF, instead, differences across growth forecasts are more attenuated in the long run. We deviate from that, as we believe that long-run growth expectations of consumers, which we cannot measure in the cross-section due to data limitations, might have been more dispersed. Note that, by doing so, we estimate a higher Δ, and thus a larger demand component of inflation.

[19] In contrast to the output growth forecast, we do not impose that the gap between the high and the low short-run inflation forecast persists over time, but instead rely on the long-run forecast dispersion of the SPF. This appears to be more in line with long-run monetary neutrality, which is consistent with our model.

[20] This yields an upper bound on the spread between the high and low demand state, Δ. Dietrich, Kuester, Müller, and Schoenle (2022) find that households rather expected *lower* growth in conjunction with higher inflation at the onset of the pandemic. This is in line with the general finding in the literature that households expect high inflation in "bad times" (Stantcheva 2024). We instead take the upper bound in order to calibrate the largest possible demand shock in line with the data.

s, respectively. We calibrate $\Delta = 1.085$.

The share of flexible price firms is determined by the size of the demand shock, and, importantly, by the share of informed consumers—Insiders—at each firm. By assumption, firms are heterogeneous with respect to the share of Insiders, with cdf F. Firms with a share of Insiders above a threshold $\overline{\alpha}_H$ will set the flexible price, which reacts to the high demand. We utilize the survey of German hairdressers to directly measure the share of firms that set a higher price in response to the demand shock. Among firms that experience both higher costs and a higher demand (80% among firms that increased their price), only 11% state that the higher demand played a big role in their price increase. Hence, we calibrate that $1 - F(\overline{\alpha}_H) = 0.11$. Given our assumption that F is uniform, we choose the support $[\alpha_0, \alpha_1] \subset [0, 1]$ to be the largest that is consistent with the survey evidence.[21]

As outlined in section 2, all firms adjust their prices to higher costs, regardless of the information level of consumers. We assume that all firms were subject to the "high" cost shock, k_H. This is motivated by the stringent hygiene rules (as outlined above) that in effect increased the cost per client. We estimate the cost increase indirectly, using the stated price increase of firms in our survey that increased their prices due to higher costs, but not due to higher demand. Among this group, the median price increase is 7.2%.[22] We use the model to back out the cost shock, k_H, that rationalizes this observed price increase. To this end, we assume a markup of 12.5% over cost, denoted by $\mu = 1.125$, which is a standard value. The optimal cost pass-through of firms in the model then implies a cost shock level of

$$k_H = 1.072 \cdot \frac{2\mu}{2\mu - 1} - 1$$

4.1 Results

Contributions to the Rise in Inflation. Table 1 presents the results. We report the frequency of price adjustment, predicted inflation, and the relative contributions to inflation, all distinguished by demand and supply (and totals). The first column reports these figures

[21] If $\overline{\alpha}_H \geq F(\overline{\alpha}_H)$, we set $\alpha_1 = 1$ and $\alpha_0 = \frac{\overline{\alpha}_H - F(\overline{\alpha}_H)}{1 - F(\overline{\alpha}_H)}$. Otherwise, we set $\alpha_0 = 0$ and $\alpha_1 = \frac{\overline{\alpha}_H}{F(\overline{\alpha}_H)}$.

[22] Almost all firms in our survey attribute at least some of their price increase to higher costs. When broadening the sample to all price-increasing firms that state that the higher demand did not play a big role in their pricing, the median price increase is 6.8%. The median price increase of the complementary set of firms, who state that higher demand played a big role in their price increase, is 10.4%.

for the case of the Calvo model (exogenous friction). We calibrate this exogenous price-stickiness to the yearly price adjustment probability pre-pandemic of the relevant service sector, which we measure using the German CPI micro-data to a yearly price adjustment frequency of 59%. The second column reports these numbers for the strategic friction model presented in Section 2 (endogenous friction).

Table 1: Main Results: Inflation, Calvo Vs. Strategic Friction

	Friction: Exogenous (Calvo)	Friction: Endogenous (Incentive Based)
FRACTION OF ADJUSTERS (%)		
To Demand	59.0*	11.0*
To Supply	59.0*	100.0
To Both	59.0*	11.0
CONTRIBUTION TO INFLATION (%)		
Demand	37.0	6.1
Supply	63.0	93.9
Total	100.0	100.0
PREDICTED INFLATION (%)		
By Demand	2.5	0.5
By Supply	4.2	7.2
Total	6.9	7.7

Notes: * denotes calibrated values. We use exact formulas for inflation, and therefore factor-inflation figures do not necessarily add up to total inflation, due to a multiplicative term. We split the multiplicative term according to the relative sizes of demand and supply factors when calculating their relative contributions to inflation.

In the Calvo model, the fraction of adjusters to demand and supply is identical. This is because once a firm is allowed to adjust, it is optimal to adjust to all factors. The main novelty brought by the strategic (or incentive-based) friction in terms of price adjustment is that the fraction of adjusters differs by factor. All firms adjust to supply (and hence the total fraction of adjusters is 1). However, a small fraction of firms (11%) adjust to the demand shock.

Turning to the price level inflation predicted by the models, and the relative contribution of demand and supply factors, we notice that, according to the Calvo model, both factors had

an important contribution to inflation, with a demand-supply split of 37% vs. 63%. In the Calvo model, firms that update their price adjust to both shocks (which is in contradiction to the evidence we provided in Section 3). As we will explain below with the aid of formulas, the proportions are therefore simply given by the relative size of the shocks. According to our shock size calibration, this calibration points to a somewhat bigger supply than demand shock at the onset of the reopening of the economy.

The incentive-based, strategic, friction provides a different picture than the Calvo friction to the contributions of demand vs. supply to inflation. Looking at the fourth row, second column, of Table 1, notice that demand contributes only to 6.1% of the rise in inflation, whereas supply contributes the lion's share, to 93.9%. According to the calibrated model, almost all of the inflation was caused by the supply factor. The reason is that, consistent with our data set, only a small fraction of firms adjust prices taking the demand factor into consideration, and at the same time all firms pass on exogenous cost increases to the consumer.

Importantly, the different predictions in terms of relative contributions for the two models are not based on different predictions of the total rise in inflation. Both models predict roughly the same total price level inflation, of 7-8% post-covid. This is a remarkable finding given that total inflation was *not* targeted by our calibration.[23]

Predicted Output Gaps. Another point of comparison between the models is regarding their prediction for the output gap. Table 2 reports these gaps for the model that preserves the information friction among households, but uses a Calvo fairy to generate the nominal friction (instead of the strategic friction), and for the strategic friction model.

The output gap under Calvo is impressively large. The main reason for this large number is that, given our calibration of increase in costs, the natural level of output (output under flexible prices) deviates significantly from equilibrium output under exogenous stickiness. The strategic model with endogenous frictions predicts that firms adjust to the cost shock,

[23]This is inflation rate away from steady state. When asked whether they adjust prices to inflation, 65% of firms respond that this is not a major consideration in their general pricing decisions. Among firms that increase their price after the lockdown, only 31% report that the adjustment to the "general" ('allgemein', in German) price level played a big role, while the rest of the sample reports that general price level adjustment plays a minor or no role. We conclude that there is no strong evidence of indexation in our sample.

Table 2: Predicted Output Gap: Calvo Vs. Strategic Friction

	Friction: Exogenous (Calvo)	Friction: Endogenous (Incentive Based)
Calibration	82.7	14.9
No supply shock	2.5	17.4

Notes: Output gaps in percentages. For the second row, the supply shock is turned off, i.e. the marginal cost is $k_0 < k_H$. The demand shock and the parameterization of $F(\alpha)$ remain as in the baseline calibration.

leading to a smaller deviation of equilibrium output and natural output, and hence a more reasonable assessment of the output gap. To explore this point further, we can consider a counterfactual where there is only the demand shock. Now, the Calvo model predicts a smaller output gap than the strategic model, since, in that model, prices are more flexible. It is also remarkable that the predicted output gap in the strategic model is roughly similar to the one with supply shocks: the reason is that supply shocks do not lead to an output gap since prices are flexible to them.[24]

The result that predicted output gaps are unreasonably large in the Calvo model highlights the extreme nature of the stickiness assumption, and how it can lead to pathological outcomes. In our simulation, firms can't adjust prices despite a large deviation of current and natural output. This peculiar prediction under Calvo pricing connects our paper to several works that have encountered similar difficulties. A seminal paper on this direction is by Ascari (2004). Ascari and Sbordone (2014) explicitly derive feasible upper bounds on trend inflation for the NK model. In a related vein, Justiniano and Primiceri (2008), and more recently L'Huillier and Phelan (2024), explain that deviations between potential and natural output are estimated to be very large in DSGE models. More recently, Lago and Hashmat (2024) emphasize that NK models feature explosive equilibrium dynamics at high trend inflation. See also Andreasen and Kronborg (2022), Maršál, Rabitsch, and Kaszab (2023) and Holden (2024).

[24]The predicted gaps in the strategic model are not identical because the threshold for price adjustment increases with lower costs.

Inspecting the Mechanism. We provide an approximate analytical formula for the inflation contributions of the strategic model. We also provide the analog for the Calvo model. To do this, a few definitions are in order. First, denote the price of a sticky price firm as p_{00}, where the first subindex signifies no adjustment to demand, the second subindex signifies no adjustment to supply, and k_0 is the level of marginal costs before the supply shock ($k_0 = E[k] = .5k_H + .5k_L$). This price is obtained by maximizing monopoly profits in the absence of shocks. Given our baseline assumptions of linear demand and constant marginal costs, it equals

$$p_{00} = \frac{1 + k_0}{2}$$

Similarly, write the price of a flexible firm as the monopoly's optimal price taking into account both shocks, that is

$$p_{HH} \equiv \zeta_H \frac{1 + k_H}{2}$$

These are equilibrium prices in a model where firms fully adjust to both shocks, as in the a Calvo model. For the sake of the strategic model, we also need to define the price for a firm that adjusts to costs, but not to demand, which is

$$p_{0H} \equiv \frac{1 + k_H}{2}$$

since ζ_0 has been normalized to 1. Similarly, define a counterfactual price where a firm adjusts to demand, but not to supply:

$$p_{H0} \equiv \zeta_H \frac{1 + k_0}{2}$$

We obtain the following proposition, stating simple formulas for the inflation contribution of each factor. In our model, the demand inflation contribution depends not only on the demand and supply components, but also on the frequency of firms that adjust to demand.

Proposition 5 (Inflation Contributions) *Consider the inflation rate of a firm that adjusts its price to demand π_D, $\pi_D = p_{H0}/p_{00} - 1$, and the inflation rate of a firm that adjusts its price to supply π_S, $\pi_S = p_{0H}/p_{00} - 1$.*

- *In the Calvo model, the aggregate percent inflation contributions of each factor are given by:*

$$Cntr_D^{Calvo} = \frac{\pi_D}{\pi_D + \pi_S}, \quad Cntr_S^{Calvo} = \frac{\pi_S}{\pi_D + \pi_S}$$

- *In the strategic model, the aggregate percent inflation contributions of each factor are given by:*

$$Cntr_D = \frac{\lambda_D \pi_D}{\lambda_D \pi_D + \pi_S}, \quad Cntr_S = \frac{\pi_S}{\lambda_D \pi_D + \pi_S}$$

where λ_D is the fraction of adjusters to aggregate demand.

The full proof is given in the appendix, but the result follows immediately after obtaining that (up to first order) aggregate inflation in the Calvo model is:

$$\pi^{Calvo} = \lambda(\pi_D + \pi_S)$$

where λ is the frequency of price adjustment. Instead, in the strategic model, we get (up to a first order):

$$\pi^{Strategic} = \lambda_D \pi_D + \pi_S$$

where λ_D is the fraction of adjusters to aggregate demand. This last expression captures the role of differential adjustment: the fraction of adjusters to supply is 1.

Notice the crucial role of the frequency of adjusters in determining the demand-supply split. This is consistent with our calibration above, since even if the demand shock is large (and hence π_D is large), if the fraction of firms that adjust to demand λ_D is tiny, the proposition states that the total contribution of aggregate demand factors to total inflation can be small. Specifically, *large* demand shocks command two effects in our model. First, with large demand shocks, π_D is relatively larger than π_S, increasing $Cntr_D$ (and lowering $Cntr_S$). This is the same effect as in a Calvo model. Second, as the sensitivity analysis below explores in depth, in our microfounded model, λ_D is determined endogenously, and therefore, as the size of demand shocks increase, more firms adjust to it. However, if the primitives of the model are such that prices remain very sticky even for very large shocks, the demand inflation contribution can remain small or even zero (and the supply contribution is 1). At the extreme, this is stated formally as follows.

Proposition 6 (Large Demand Shocks) *Let $\Delta \longrightarrow \infty$. In the strategic model, there is a $\alpha_1(\Delta)$ such that the demand inflation contribution is zero:*

$$Cntr_D = 0, \quad Cntr_S = 1$$

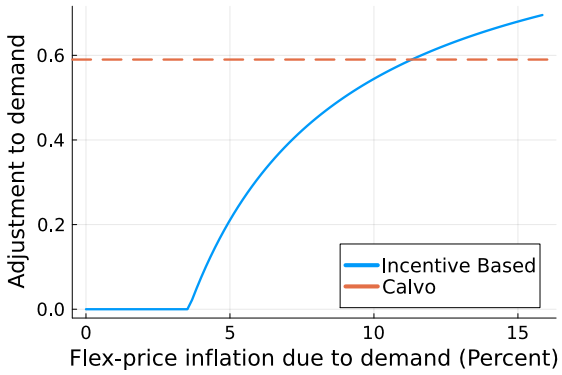
In contrast, in the Calvo model, very large shocks would always determine the answer the model provides to the determination of aggregation inflation, given the symmetric nature of price adjustment:

$$\lim_{\Delta \to \infty} \; Cntr_D^{Calvo} = 1, \quad \lim_{\Delta \to \infty} \; Cntr_S^{Calvo} = 0$$

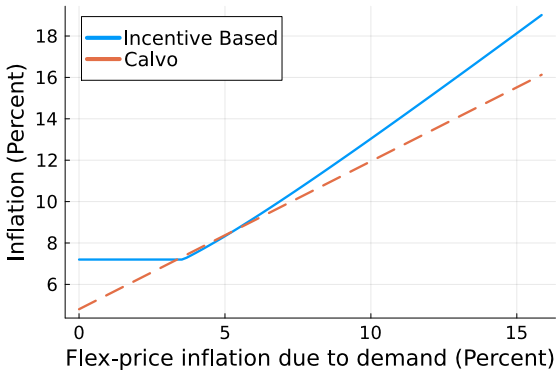
Sensitivity Analysis. We explore sensitivity in Figure 3. The left panel plots λ_D, the fraction of adjusters to demand, and the right panel plots total inflation, both as a function of the demand shock. The demand shock is measured as $(\Delta - 1)/2$, which is also equal to demand-driven inflation under flexible prices.

Figure 3: Sensitivity Analysis

(a) Fraction of Adjusters to Demand



(b) Total Inflation



Notes: Results for the baseline calibration for the distribution of Insiders, $F(\alpha)$, and supply shock k_H. Flexible price inflation due to demand is given by $(\Delta - 1)/2$.

The left panel shows that the fraction of adjusters increases (nonlinearly) in the size of the shock. This generates higher total inflation. For our calibration, the slope of the Phillips curve is nonlinear and increasing in the size of the shock, and it is flat even for fairly sizable shocks (of around 3%). The slope is constant in the Calvo model. This means that the model shares features of "state-dependence" with menu cost models, despite exhibiting

"shock-dependence" (since prices are flexible with respect to supply, but sticky with respect to demand). Finally, it is worthwhile highlighting that prices remain fairly sticky to demand, and stickier than in the calibrated Calvo benchmark, unless shocks are very big (roughly above 12%). Above a threshold, prices are more flexible than in the Calvo model calibration with respect to both demand and supply.

5 Conclusion

What incentives do firms have to change prices, and does the answer to this question matter for our views on what caused the post-Covid inflation? We provided an incentives-based model of firms' pricing in which firms have superior information regarding the state of the aggregate economy. Firms' incentives imply that firms are quick to change prices in response to supply-driven changes in costs but are reluctant to change prices in response to demand-driven changes in the economic environment, even when firms' costs change for demand-driven reasons. We provide micro-level survey evidence consistent with the predictions of our model (and inconsistent with standard pricing frictions): firms are much more likely to change prices in response to changes in costs, and they are much more likely to do so when they can justify these price changes to their customers.

A calibrated version of our model implies that the vast majority of the initial post-Covid inflation was driven by supply-driven disruptions, and that shock decompositions under exogenous stickiness provide a distorted picture of the drivers of inflation.

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Appendices

A Proofs

Proof of Proposition 1 . ONLY IF: To find the cutoff α^* we need to confirm that in the low state the firm would rather charge the low flexible price than the high flexible price (which would fool the uninformed agents). If the flexible price $\{p_s\}$ is consistent with some PBE, then if the true state is L the firm will not prefer to deviate and offer the price p_H rather than the price p_L. Note that if the true state is L and the firm offers p_H, Insiders will know that the true state is L but Outsiders will believe the true state is H. Hence the firm will not want to offer $p_H = \zeta_H(1+k)/2$ rather than $p_L = \zeta_L(1+k)/2$ if and only if:

$$\left(\frac{\zeta_L(1+k)}{2} - k\zeta_L\right)\left[1 - \frac{\zeta_L(1+k)}{2}\frac{1}{\zeta_L}\right] \geq \left(\frac{\zeta_H(1+k)}{2} - k\zeta_L\right)\left\{\alpha\left[1 - \frac{\zeta_H(1+k)}{2}\frac{1}{\zeta_L}\right] + (1-\alpha)\left[1 - \frac{\zeta_H(1+k)}{2}\frac{1}{\zeta_H}\right]\right\}$$

Simplifying:

$$\zeta_L\frac{(1-k)}{2}\left(\frac{1-k}{2}\right) \geq \left(\frac{\zeta_H(1+k) - 2\zeta_L k}{2}\right)\left(\alpha\left(\frac{2-(1+k)\zeta_H/\zeta_L}{2}\right) + (1-\alpha)\left(\frac{1-k}{2}\right)\right)$$

$$\zeta_L(1-k)\,(1-k) \geq (\zeta_H(1+k) - 2\zeta_L k)\,(\alpha\,(2-(1+k)\zeta_H/\zeta_L) + (1-\alpha)\,(1-k))$$

Letting $\delta \equiv \zeta_H/\zeta_L$ and dividing both sides by ζ_L

$$(1-k)\,(1-k) \geq (\delta(1+k) - 2k)\,(\alpha\,(2-(1+k)\delta) + (1-\alpha)\,(1-k))$$

$$(1-k)(1-k) \geq (\delta(1+k) - 2k)\,((1-k) + \alpha(1+k)(1-\delta))\,.$$

Note that $\delta(1+k) - 2k > 1-k$ and $\delta > 1$ so that $1-\delta < 0$. Then rearranging we have

$$\alpha(1+k)(\delta-1)(\delta(1+k)-2k) \geq (\delta(1+k)-2k)(1-k) - (1-k)(1-k)$$

$$\alpha \geq \frac{1-k}{\delta + \delta k - 2k} \equiv \alpha^*,$$

which is the desired result. Note that if $k = 0$, then we get $\alpha^* = 1/\delta$.

IF: Given that $\alpha \geq \alpha^*$, We must construct a PBE in which prices along the equilibrium path are p_L, p_H. Hence we must show that when the true state is s the firm will not wish to deviate to a price $p \neq p_s$. PBE implies that when the Outsiders see the price p_s, they believe the true state is s, as in (a), (c). However, we are free to assign arbitrary beliefs to Outsiders if they see a price p different from both p_L and p_H, as in (b), (d); in that event we assign to Outsiders the belief that the true state is L. We must rule out four kinds of potentially profitable deviations

(a) The true state is L and the firm offers p_H.

(b) The true state is L and the firm offers $p \neq p_L, p_H$.

(c) The true state is H and the firm offers $p = p_H$.

(b) The true state is H and the firm offers $p \neq p_L, p_H$.

When Outsiders see a price $p \neq p_L, p_H$ they believe the state is L and PBE guarantees that when Outsiders see the price p_L they believe the state is L, so we can subsume **(c), (d)** into

(e) The true state is L and the firm offers $p \neq p_H$.

We now verify **(a)** , **(b)** , and **(e)** in turn.

(a) This follows immediately by following the steps in the ONLY IF case above, but in reverse order, noting that each inequality is *equivalent* to the one above.

(b) We have posited that when Outsiders see a price $p \neq p_L, p_H$ they believe the state is L. Insiders know the true state so they also believe the state is L. Hence aggregate demand if the firm offers p will be $1 - p\frac{1}{\zeta_L}$ and firm profit will be $(p - k\zeta_L)[1 - p\frac{1}{\zeta_L}]$. By definition, this quantity is maximized when $p = 1/2\frac{(1+k)}{\zeta_L}$ and the maximum profit will be $1/4\frac{(1-k)^2}{\zeta_L}$. However this is the profit when the firm offers p_L so this cannot be a profitable deviation for any such p.

(e) We must show that when the true state is H the firm's profit if it offers p_H is at least as great as when it offers $p \neq p_H$; i.e. we must show

$$\begin{aligned}\frac{\zeta_H(1-k)^2}{4} &\geq (p - k\zeta_H)\Big(\alpha[1 - p\frac{1}{\zeta_H}] + (1-\alpha)[1 - p\frac{1}{\zeta_L}] \\ &= \alpha(p - k\zeta_H)[1 - p\frac{1}{\zeta_H}] + (1-\alpha)(p - k\zeta_H)[1 - p\frac{1}{\zeta_L}] \qquad (6)\end{aligned}$$

By definition, $(p - k\zeta_H)[1 - p\frac{1}{\zeta_H}]$ would be maximized by setting $p = p_H$ and $(p - k\zeta_H)[1 - p\frac{1}{\zeta_L}]$ would be maximized by setting $p = p_L$ so we must certainly have

$$\alpha(p - k\zeta_H)[1 - p\frac{1}{\zeta_H}] \leq \alpha\left(\frac{\zeta_H(1-k)^2}{4}\right) \tag{7}$$

$$(1-\alpha)(p - k\zeta_H)[1 - p\frac{1}{\zeta_L}] \leq (1-\alpha)\left(\frac{\zeta_L(1-k)^2}{4}\right) \tag{8}$$

The result follows by adding the inequalities (7) and (8) together with $\zeta_H > \zeta_L$ so we have verified **(e)** . Having verified **(a)** , **(b)** , and **(e)** , the proof is complete. ■

Proof of Proposition 2 . Assume the sticky price $p_0 = \zeta_0(1+k)/2$ is consistent with some PBE. Suppose that, in that PBE, the true state is L and the firm offers a price $p \neq p_0$. Because the Insiders know the true state, they will demand the quantity $1 - p\frac{1}{\zeta_L}$. PBE requires that the Outsiders form some belief about the true state and demand a quantity that is optimal with respect to that belief about the true state; hence the Outsiders will demand $1 - p_o\,[]$ where ${}_o\,[]$ is their expectation of the shock. The profit of the firm will be:

$$d_L(p) = (p - k\zeta_L)\Big(\alpha\big[1 - p\frac{1}{\zeta_L}\big] + (1-\alpha)\big[1 - p_o\,[]\,\big]\Big)$$

For every $p \neq p_0$, this expression will be minimized if the Outsiders assign probability 1 to the state L, in which case their expectation of the shock will be $E_o(\zeta_s i) = \frac{1}{\zeta_L}$. Hence if the firm offers $p \neq p_0$ we must have

$$d_L(p) \geq (p - k\zeta_L)[1 - p\frac{1}{\zeta_L}]$$

In a PBE the firm has no profitable deviation so it must be that $d_L(p_0) \geq d_L(p)$ for every p; in particular this inequality must hold when $p = p_L$. We conclude that

$$\left(\frac{\zeta_0(1+k)}{2} - k\zeta_L\right)\left(\alpha\left[1 - \frac{\zeta_0(1+k)}{2}\frac{1}{\zeta_L}\right] + (1-\alpha)\left[1 - \frac{\zeta_0(1+k)}{2}\,{}_o\,[]\right]\right) \geq \frac{\zeta_L(1-k)^2}{4}$$

Because ζ_0 is the harmonic mean of ζ_L, ζ_H, ${}_o\,[] = 1/\zeta_0$; substituting and simplifying yields

$$(\zeta_0(1+k) - 2k\zeta_L)\left(\alpha\left[2 - \frac{\zeta_0(1+k)}{\zeta_L}\right] + (1-\alpha)(1-k)\right) \geq \zeta_L(1-k)^2$$

The LHS is decreasing in α; we must set α sufficiently low. Note that if $\alpha = 0$ then the LHS equals $(\zeta_0(1+k) - 2k\zeta_L)(1-k)$ and $\zeta_0(1+k) - 2k\zeta_L = \zeta_0 + (\zeta_0 - \zeta_L)k - k\zeta_L > \zeta_L(1-k)$ since $\zeta_0 > \zeta_L$. Thus, there exists a threshold $\alpha_0^* > 0$ such that this inequality holds if $\alpha \leq \alpha_0^*$. Let $\equiv \frac{\zeta_0}{\zeta_L}$. Then

$$\begin{aligned}
((1+k) - 2k)(\alpha[2-(1+k)] + (1-\alpha)(1-k)) &\geq (1-k)^2 \\
((1+k) - 2k)(1-k+\alpha[2-(1+k)-(1-k)]) &\geq (1-k)^2 \\
(1-k) - \alpha(-1)(1+k) &\geq \frac{(1-k)^2}{(1+k)-2k}
\end{aligned}$$

Recall that > 1 since $\zeta_L < \zeta_0$, and therefore we have

$$\begin{aligned}
(1-k) - \frac{(1-k)^2}{(1+k)-2k} &\geq \alpha(-1)(1+k) \\
\frac{(1-k)(-1)(1+k)}{(1+k)-2k} &\geq \alpha(-1)(1+k)
\end{aligned}$$

And therefore we can simplify to $\alpha \leq \frac{1-k}{(1+k)-2k} \equiv \alpha_0^*$. Recall that

$$\alpha^* \equiv \frac{1-k}{\delta(1+k)-2k} < \frac{1-k}{(1+k)-2k}$$

since $\delta \equiv \zeta_H/\zeta_L >\equiv \zeta_0/\zeta_L$. Thus, if $\alpha < \alpha^*$, it follows that $\alpha < \alpha_0^*$ and therefore p_0 is a PBE.

To construct a PBE in which p_0 is offered in both states, we have to prescribe the behavior of Outsiders when a price $p \neq p_0$ is offered. As the argument above suggests, we posit that when when a price $p \neq p_0$ is offered, Outsiders believe the true state is L and hence demand $1 - p\frac{1}{\zeta_L}$. Insiders know the true state s and demand $1 - p\zeta_s i$ so the profit of the firm is

$$d_s(p) = (p - k\zeta_s)\left(\alpha[1 - p\zeta_s i] + (1-\alpha)[1 - p\frac{1}{\zeta_L}]\right) \tag{9}$$

If the firm offers the putative equilibrium price p_0, the Outsiders' expectation of the future

price will be $1/\zeta_0$, so the profit of the firm will be

$$d_s(p_0) = \left(\frac{\zeta_0(1+k)}{2} - k\zeta_s\right)\left(\alpha\left[1 - \frac{\zeta_0(1+k)}{2}\zeta_s i\right] + \frac{(1-\alpha)(1-k)}{2}\right)$$

The equilibrium condition is that

$$d_s(p_0) \geq d_s(p) \tag{10}$$

when $s = L$ and when $s = H$, under the assumption that $\alpha \leq \alpha^*$. That the inequality (10) is satisfied when the true state $s = L$ follows from the exercise we just did. To see that (10) is satisfied when the true state $s = H$ is more complicated. First note that simplifying the right side of (9) yields

$$d_H(p) = (p - k\zeta_H)\left(1 - p\left[\alpha\frac{1}{\zeta_H} + (1-\alpha)\frac{1}{\zeta_L}\right]\right)$$

Define $\equiv \left(\alpha\frac{1}{\zeta_H} + (1-\alpha)\frac{1}{\zeta_L}\right)^{-1}$ as the α-weighted harmonic mean of ζ_s. Since $< \zeta_H$,

$$d_H(p) < (p - k)\left(1 - p\left[\alpha\frac{1}{\zeta_H} + (1-\alpha)\frac{1}{\zeta_L}\right]\right)$$

and the RHS is maximized by setting $p = \frac{(1+k)}{2}$ and equals $\frac{(1-k)^2}{4}$. Thus, it suffices to show that for $\alpha \leq \alpha_0^*$

$$(p_0 - k\zeta_H)\left(1 - p_0\left[\alpha\frac{1}{\zeta_H} + (1-\alpha)\frac{1}{\zeta_0}\right]\right) \geq \frac{(1-k)^2}{4}.$$

Note first that this is satisfied for $\alpha = 0$ but not for $\alpha = 1$; in the first case there are no Informed agents, so setting $p = p_0$ is strictly dominant; in the second case there are only Informed agents so the flexible price is optimal. Rearranging we have

$$(p_0 - k\zeta_H)\left(1 - p_0\frac{1}{\zeta_0} + p_0\alpha\left(\frac{1}{\zeta_0} - \frac{1}{\zeta_H}\right)\right) \geq \frac{(1-k)^2}{4\left(\frac{1}{\zeta_L} - \alpha\left(\frac{1}{\zeta_L} - \frac{1}{\zeta_H}\right)\right)}.$$

Note that the LHS is increasing linearly in α since $\frac{1}{\zeta_0} - \frac{1}{\zeta_H} > 0$. The RHS is increasing with

α. Multiplying we have

$$\left(\frac{1}{\zeta_L}-\alpha\left(\frac{1}{\zeta_L}-\frac{1}{\zeta_H}\right)\right)(p_0-k\zeta_H)\left(1-p_0\frac{1}{\zeta_0}+p_0\alpha\left(\frac{1}{\zeta_0}-\frac{1}{\zeta_H}\right)\right)\geq\frac{(1-k)^2}{4},$$

which is a quadratic equation in α with a negative coefficient on α^2. Thus, if this holds at α_0^* it holds for all $\alpha\leq\alpha_0^*$. L'Huillier, Phelan, and Zame (2022) verify this condition holds for $k=0$. By continuity it holds for k sufficiently small. ■

Proof of Proposition 3. The proof is immediate. Note that conditional on the price p, Insiders and Outsiders have the same demand, $c=1-p\zeta_0$ with $\zeta_0=1$. Thus, profit maximization chooses p to maximize $(1-p)(p-k)$, which yields the desired result. ■

Proof of Proposition 5. To show for the strategic model: up to first order, overall inflation can be decomposed into a supply and a demand component:

$$\pi\approx\pi_S+\lambda_D\pi_D \tag{11}$$

To see this, note that the price of a firm reacting to both shocks is $p_{HH}=\zeta_H\frac{1+k_H}{2}$, while the price of a firm reacting to only the cost shock is $p_{0H}=\frac{1+k_H}{2}$, since ζ_0 is normalized to 1. Firms react to the demand shock iff their share of Insiders α is above the threshold $\overline{\alpha}_H$. The aggregate price level is thus given by

$$\overline{p}=\int_{\alpha_0}^{\overline{\alpha}_H}\frac{1+k_H}{2}dF(\alpha)+\int_{\overline{\alpha}_H}^{\alpha_1}\zeta_H\frac{1+k_H}{2}dF(\alpha) \tag{12}$$

$$=p_{0H}\left(1+\lambda_D(\zeta_H-1)\right) \tag{13}$$

where we used that $\lambda_D=1-F(\overline{\alpha}_H)$ is the share of firms that adjust to demand. To compute inflation π, we devide the aggregate price level by the price in the absence of shocks, $p_{00}=\frac{1+k_0}{2}$:

$$1+\pi=\frac{\overline{p}}{p_{00}}=\frac{p_{0H}}{p_{00}}\left(1+\lambda_D\left(\zeta_H\frac{p_{00}}{p_{00}}-1\right)\right) \tag{14}$$

$$=(1+\pi_S)(1+\lambda_D\pi_D) \tag{15}$$

where we used $p_{H0}=\zeta_H p_{00}$. The approximate formula follows when the multiplicative term

is small: $\pi_S \lambda_D \pi_D \approx 0$.

For the Calvo model, we show that inflation can be decomposed up to first order as

$$\pi^{\text{Calvo}} \approx \lambda(\pi_S + \pi_D) \tag{16}$$

To see this, notice that irrespective of the heterogeneity in the share of Insiders, firms set the optimal price p_{HH} with probability λ, and stay at the price p_{00} otherwise. Noting $p_{HH} = \frac{p_{H0}}{p_{00}} p_{0H}$, it follows that

$$1 + \pi^{\text{Calvo}} = \lambda \frac{p_{H0}}{p_{00}} \frac{p_{0H}}{p_{00}} + (1 - \lambda) = 1 + \lambda \left(\frac{p_{H0}}{p_{00}} \frac{p_{0H}}{p_{00}} - 1 \right) \tag{17}$$

$$= 1 + \lambda((1 + \pi_S)(1 + \pi_D) - 1) \tag{18}$$

The approximate formula follows when the multiplicative term is small: $\pi_S \pi_D \approx 0$. ■

Proof of Proposition 6.

The cutoff of price adjustment

$$\alpha_H^* = \frac{1 - k_H}{\Delta(1 + k_H) - 2k_H} > 0$$

since $0 \leq k_H < 1$. Hence, we can define $\alpha_0 = 0$ and $\alpha_1(\Delta) \equiv \alpha_H^*/2$. Then, no firm adjusts its price for any Δ. ■

A.1 Demand and Supply Shocks

We now introduce both demand and supply shocks. We denote the state of demand by $s = s_\zeta$ and the state of supply by $\varsigma = s_k$. The following result characterizes equilibrium prices. It characterizes the consequences of shock dependence when both shocks hit the economy.

Proposition 7 (Demand and Supply Shocks) *When the economy experiences both demand and supply shocks and $\alpha \leq \alpha_H^* \equiv \frac{1-k_H}{(\zeta_H/\zeta_L)(1+k_H)-2k_H}$, aggregate prices are flexible with respect to the supply shock but sticky with respect to the demand shock. Firms post $p_{0,\varsigma} = \frac{1+k_\varsigma}{2}$.*

In our shock-dependent model, equilibrium prices are sticky with respect to the demand shock (and therefore firms do *not* condition their prices on it), but equilibrium prices are

flexible with respect to the supply shock (and therefore firms condition their prices on it). Stickiness with respect to demand is evident in the lack of dependence of $p_{0,\varsigma}$ on ζ_s (recall the normalization of the state-state demand shocks term, $\zeta_0 = 1$). Flexibility with respect to supply is evident in the dependence of $p_{0,\varsigma}$ on the k_ς term. We have already noted that firms have no strategic incentive to misrepresent the realization of k_ς, and that remains true here. The firm can convey information about the shock k_ς without conveying information about the demand shock ζ.

Proof of Proposition 7. The proof follows quickly from earlier results. First, the firm can choose prices that communicates information about ζ_s, thus achieving full information. Let $p_{s,\varsigma}$ denote the price when demand is ζ_s and supply is k_ς. The full-information prices are given by

$$p_{H,H} = \frac{\zeta_H(1+k_H)}{2}, p_{L,H} = \frac{\zeta_L(1+k_H)}{2}, p_{H,L} = \frac{\zeta_H(1+k_L)}{2}, p_{L,L} = \frac{\zeta_L(1+k_L)}{2}.$$

Second, the firm can choose prices that do not communicate information about ζ_s. Since the demand shock is orthogonal to the shock to k_ς, it is easy to show that the following prices maximize profits without communicating information regarding ζ_s:

$$p_{0,H} = \frac{\zeta_0(1+k_H)}{2}, \quad p_{0,L} = \frac{\zeta_0(1+k_L)}{2}.$$

Except by coincidence, these six prices are all distinct. Hence, in the high cost state (k_H), the firm can choose a price that is sticky with respect to ζ_s by offering $p_{0,H} = \frac{\zeta_0(1+k_H)}{2}$, the firm can choose a price that is flexible with respect to ζ_s by offering $p_{s,H} = \frac{\zeta_s(1+k_H)}{2}$. The cutoff for choosing the sticky or flexible price is given by the threshold in Lemma **??** for a given k_ς. Recall that is decreasing in k_ς, so $_H <_L$ and therefore $\alpha <$ for both realizations of the supply shock.

In this way, the firm can choose a price that is flexible with respect to both shocks by offering $p_{s,\varsigma} = \frac{\zeta_s(1+k_\varsigma)}{2}$ or a price that is flexible with respect to the cost shock only by offering $p_{0,\varsigma} = \frac{\zeta_0(1+k_\varsigma)}{2}$, which is sticky with respect to demand. The remaining results follow immediately from earlier results.

Conditional on the price p, agents have the demand, $c = 1 - p\left[\frac{1}{\zeta_s}\right]$. Hence, any incentive

for firms to convey or hide information via p can only operate through the expectation on ζ_s. In the proposed equilibrium, Outsiders see a price $p_{0,\varsigma}$ and conclude it conveys information about the marginal cost alone ($p_{0,\varsigma} = \frac{1+k_\varsigma}{2}\zeta_0$); they do not learn the demand shock or update their demands. Given these beliefs, on islands with a small number of Insiders, the firms' problem is equivalent to determining the profit-maximizing price as if the demand shock is ζ_0, which provides the price above. By our assumption that $\delta < \underline{\delta}_H$, no island has a sufficiently high number of Insiders for the firm to want to set a price that responds to the demand shock. On each island, the fraction of Outsider is large enough so that firms choose the price $p_{0,\varsigma} = \frac{1+k_\varsigma}{2}\zeta_0$ taking as given that Outsiders will set their demand with $c_{0,\varsigma} = 1 - p_{0,\varsigma}\left[\frac{1}{\zeta_0}\right]$. Thus, no firm on any island adjusts prices in response to demand but every firm on every island adjusts prices in response to costs. ■

B Regression Tables

Regressors. To conduct the regression analysis of our survey results, we construct four variables as composites of the firm-level characteristics we query. The composites are sums of Likert-item scale answers to related questions and measure a common factor among these answers. By inverting some statements, answers from inattentive respondents cancel out, which increases the statistical power of the regression. We normalize the variables so that their values lie between 0 and 1. The composite variables are:

Customer understanding

Sign	Statement
+	The customers express understanding for my/our prices.
−	Some customers accuse me of profiteering.
+	The reasons for price increases are understandable for customers.

Table 3: Construction of a variable measuring the understanding of the hairdresser's customers for their prices. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by adding 3 and then dividing the whole sum by 12.

Satisfaction with pricing

Sign	Statement
+	I am satisfied with my pricing method.
+	My prices are optimal for the firm.
−	Actually, my prices should be higher.

Table 4: Construction of a variable measuring how satisfied the owners are with their own pricing. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by adding 3 and then dividing the whole sum by 12.

Hairwashing mandate

Sign	Statement
+	The mandatory hair washing is like a price increase.
+	I profit from the mandatory hair washing.

Table 5: Construction of a variable measuring how the owners view the mandatory hair washing. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by subtracting 2 and then dividing the whole sum by 8.

Sign	**Pessimism** Statement
+	There will be another lockdown this year.
−	We will be back to normal in one year.
+	The hygiene measures will stay for years.
+	Fear of infection will deter customers for a long time.
+	Customers' willingness to pay will lastingly decrease.
−	My personal financial situation will improve.

Table 6: Construction of a variable measuring the owners' expectations and professional uncertainty, expressed as pessimism. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by adding 6 and then dividing the whole sum by 24.

Table 7: Logit regression. The dependent variable is a dummy indicating whether or not the firm increased their price during the lockdown.

	(1)	(2)
const	-1.17**	-1.12
	(0.55)	(2.04)
Customer understanding	3.51***	3.93***
	(0.97)	(1.19)
Nr. Employees (linear part)		-0.05
		(0.13)
Many employees (dummy)		0.10
		(0.60)
More than one salon (dummy)		0.24
		(0.70)
Satisfaction with pricing		-0.88
		(1.04)
Hairwashing mandate		0.07
		(0.55)
Pessimism		-0.42
		(1.48)
Share of regular customers		0.59
		(1.53)
Observations	193	171
Pseudo R2	0.06	0.07

Standard errors in parentheses. * p<.1, ** p <.05, ***p <.01

Additionally, we include as regressors the number of employees, which we split into a continuous variable (zero to six employees, *Nr. Employees*) and a dummy variable (more than six employees, *Many employees*), the *share of regular customers*, and a dummy variable

indicating whether or not the firm manager owns *more than one salon*. For the sake of interpretation of the results, we also introduce a dummy variable that indicates whether or not the firm's customer understanding is above the 40% quantile (in our sample, we see two clusters below and above this quantile), which we call *High underst. clients*.

Table 8: Marginal effects at means of logit regression. The dependent variable is a dummy indicating whether or not the firm increased their price during the lockdown.

	(1)
High underst. clients (dummy)	0.2647***
	(0.0809)
Nr. Employees (linear part)	-0.0089
	(0.0275)
Many employees (dummy)	0.0563
	(0.1291)
More than one salon (dummy)	0.0338
	(0.1455)
Satisfaction with pricing	-0.0717
	(0.2047)
Hairwashing mandate	0.047
	(0.1158)
Pessimism	-0.0771
	(0.3122)
Share of regular customers	0.2363
	(0.3178)
Observations	171

Standard errors in parentheses. * p<.1, ** p <.05, ***p <.01

Results. Table 7 shows the result of a logistic regression on whether or not a firm increased its price over the lockdown. We find that only the customer understanding variable predicts this decision. The coefficient is positive and highly significantly different from zero. To understand the economic significance, we compute the marginal effects at means of the logistic regression. The result is in Table 8. We find that being in the upper 60% of customer understanding increases the probability of a firm to increase its price by 26pp. The effect is highly significantly different from zero.

C Survey Questions

The following is the translation of our survey into English. Below the translation is the German original.

English Translation of Our Questionnaire

Page 1

Dear Sir or Madam,

on March 1, you were finally allowed to open up again. For our dissertations in economics at the University of Bonn, we investigate how the pandemic and the lockdown in Germany affect the hairdressers and the prices for haircuts.

We kindly ask you to take 10 to 15 minutes to fill out our survey. If you have less time at your proposal, we would also be happy for partially filled out forms (all answers are optional). You can also save your progress and continue the survey later; to do so, please click on "save progress" on the bottom of the page.

The survey is anonymous. We do not ask for or save any personal data. Your answers will be treated confidentially and only used for scientific purposes.

Thank you very much for your support!

Thomas Kohler and Maximilian Weiß

Page 2

First, we would like to get to know you and your firm better.

1. What is your role in the firm?

() I am the owner.

() I am a franchisee.

() I am an employed manager.

() I am an employee.

() Other: [free text field]

() not applicable

2. Are you involved in the pricing in your firm?

() Yes, I set the prices.

() Yes, I suggest prices to my superior.

() Yes, I set the prices in accordance with my franchising contract.

() Yes, my associates and I set the prices together.

() No

() Other: [free text field]

3. How many branches does your firm have? (In case of franchises, please for the franchisee)

() no branch (mobile hairdresser)

() one branch

() two branches

() three to five branches

() more than five branches

() can't or won't say

4. How many employees does your firm have? (In case of franchises, please for the franchisee)

() none

() one to three

() three to six

() more than six

() can't or won't say

Comment: [free text field]

5. Which share of your customers are regulars?

() 0 % to 19 %

() 20 % to 39 %
() 40 % to 59 %
() 60 % to 79 %
() 80 % to 100 %
() can't or won't say

Page 3

On this page, we'll ask you some questions about the price of a man's haircut in your firm. If you do not offer this haircut, please indicate so (You will then receive questions about the price of a woman's haircut).

6. What is the price of the following man's haircut in your firm?
short back and sides, wash, cut, blow dry, 25 minutes

Please fill in the price including a possible hygiene surcharge.
Please fill in the base price if you charge other surcharges (e.g. for Mondays, late appointments, new customers, or other).

Before this lockdown (until December 16, 2020): [free text field] Euros
() can't or won't say

First week of March 2021: [free text field] Euros
() can't or won't say

[Planned] April 2021: [free text field] Euros
() can't or won't say

() I don't offer this kind of haircut (in this case, please indicate "can't or won't say" everywhere in this question, ignore the rest of the page, and click on "Continue").

7. Had you lowered your prices because of the VAT reduction in the second half-year of 2020?

() yes

() no

() can't or won't say

8. Pricing parts (begin of March 2021)

If the price you filled in (for begin of March 2021) contains a hygiene surcharge, please indicate what it is. If you charge different hygiene surcharges for different services, please indicate the hygiene surcharge for the haircut described above.

If new customers pay more than regular customers, please indicate the price difference.

If you charge a surcharge for late appointments, Monday appointments or weekend appointments, please indicate the surcharge.

hygiene surcharge: [free text field] Euros

new customer surcharge: [free text field] Euros

surcharge for late appointments: [free text field] Euros

surcharge for Monday appointments: [free text field] Euros

surcharge for weekend appointments: [free text field] Euros

() can't or won't say

9. Do you make more or less profit per customer with the haircut described above compared to before the pandemic (February 2020)?

() today less

() same

() today more

() can't or won't say

10. Do you make more or less profit per customer with the haircut described above compared

to before the last lockdown (December 2020)?

() today less

() same

() today more

() can't or won't say

Page 4 [only if indicated that the reference man's haircut is not offered]

On this page, we'll ask you some questions about the price of a woman's haircut in your firm.

11. What is the price of the following woman's haircut in your firm?
Length is to the shoulders; wash, cut, brush, blow dry. Total time around 45 minutes. No dying or highlights or similar.

Please fill in the price including a possible hygiene surcharge.
Please fill in the base price if you charge other surcharges (e.g. for Mondays, late appointments, new customers, or other).

Before this lockdown (until December 16, 2020): [free text field] Euros

() can't or won't say

First week of March 2021: [free text field] Euros

() can't or won't say

[Planned] April 2021: [free text field] Euros

() can't or won't say

12. Had you lowered your prices because of the VAT reduction in the second half-year of 2020?

() yes

() no

() can't or won't say

13. Pricing parts (begin of March 2021)

If the price you filled in (for begin of March 2021) contains a hygiene surcharge, please indicate what it is.

If you charge different hygiene surcharges for different services, please indicate the hygiene surcharge for the haircut described above.

If new customers pay more than regular customers, please indicate the price difference.

If you charge a surcharge for late appointments, Monday appointments or weekend appointments, please indicate the surcharge.

hygiene surcharge: [free text field] Euros

new customer surcharge: [free text field] Euros

surcharge for late appointments: [free text field] Euros

surcharge for Monday appointments: [free text field] Euros

surcharge for weekend appointments: [free text field] Euros

() can't or won't say

14. Do you make more or less profit per customer with the haircut described above compared to before the pandemic (February 2020)?

() today less

() same

() today more

() can't or won't say

15. Do you make more or less profit per customer with the haircut described above compared to before the last lockdown (December 2020)?

() today less

() same

() today more

() can't or won't say

Page 5 [only if the indicated price for March strictly larger than the price for December]

16. Why have you increased your prices since December?

You have indicated that at least one of your prices was larger in March 2021 than in December 2020. Which role did the following factors play in your increasing the prices?

Reduced capacity due to distancing rules

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Recoup lost revenue / reduced reserves due to lockdown

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Increased demand

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Increased financing cost (for example because of new loans)

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Adjustment to the general price level

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Increased wage cost

() no role

() a small role

() a big role

() does not apply

() can't or won't say

The price increase is only temporary

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Increased incidental cost

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Increased hygiene cost (masks, disinfection, time)

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Expectation that the customers understand the price increases

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Competitors have increased their prices

() no role

() a small role

() a big role

() does not apply

() can't or won't say

End of the VAT reduction

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Other important factors:

[free text field]

[free text field]

[free text field]

17. To what extent do you agree with these statements about your experiences with your customers?

The customers express understanding for my/our prices.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The customers complain to me about their own financial situation.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

Some customers accuse me of profiteering.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The customers tip more.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The customers tip less.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

page 6 [only if the indicated price for March is not larger than the price for December]

18. Why have you not increased your prices since last December?

You have indicated that at least one of your prices is not larger in March 2021 than in December 2020.

Which role did the following factors play in your decision to not increase the price?

The prices are contracted

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Within the firm, we could not agree on a price increase

() no role

() a small role

() a big role

() does not apply

() can't or won't say

I am not sure whether increased prices would be better for the firm

() no role

() a small role

() a big role

() does not apply

() can't or won't say

A price increase would seem larger than it actually is

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Increase the market share / gain new customers

() no role

() a small role

() a big role

() does not apply

() can't or won't say

The prices were already increased after the first lockdown (spring 2020)

() no role

() a small role

() a big role

() does not apply

() can't or won't say

The customers' budgets are smaller during the pandemic

() no role

() a small role

() a big role

() does not apply

() can't or won't say

VAT reduction was not passed on in the second half-year of 2020

() no role

() a small role

() a big role

() does not apply

() can't or won't say

The competitors have not increased their prices

() no role

() a small role

() a big role

() does not apply

() can't or won't say

The prices were not increased, so they don't have to be decreased again soon

() no role

() a small role

() a big role

() does not apply

() can't or won't say

The costs have not increased

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Retaining regular customers

() no role

() a small role

() a big role

() does not apply

() can't or won't say

Other important factors:

[free text field]

[free text field]

[free text field]

19. To what extent do you agree with these statements about your experiences with your customers?

The customers express understanding for my/our prices.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The customers complain to me about their own financial situation.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

Some customers accuse me of profiteering.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The customers tip more.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The customers tip less.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

Page 7

On this page we ask you questions about how your company is dealing with the political measures and how you assess future developments.

20. If you received more requests for appointments for the beginning of March than you could satisfy: how did you deal with it?

Multiple answers are possible.

[ ] preferential treatment of new customers

[ ] hire more employees to offer more appointments

[ ] preferential treatment of customers that had appointments canceled in the past months

[ ] preferential treatment of regular customers

[ ] first come, first served

[ ] extend the opening hours to offer more appointments

[ ] charge a surcharge for new customers

() does not apply

() can't or won't say

21. To what extent do you agree with these statements about the mandate to wash the customers' hair?

I feel safer when I wash the customers' hair before the treatment.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The mandatory hair washing is like a price increase.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The customers find the mandatory hair washing acceptable.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

I profit from the mandatory hair washing.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

22. How accurate do you think the following predictions are?

We will be back to normal in one year.

() not at all

() rather not

() unclear

() rather

() very

() can't or won't say

The hygiene measures will stay for years.

() not at all

() rather not

() unclear

() rather

() very

() can't or won't say

Fear will deter customers for a long time.

() not at all

() rather not

() unclear

() rather

() very

() can't or won't say

My personal financial situation will improve (compared to today).

() not at all

() rather not

() unclear

() rather

() very

() can't or won't say

Due to (fighting) the pandemic, the customers' willingness to pay will lastingly decrease.

() not at all

() rather not

() unclear

() rather

() very

() can't or won't say

There will be another lockdown this year.

() not at all

() rather not

() unclear

() rather

() very

() can't or won't say

23. How unsure are you about your own professional future?

() not at all

() barely

() somewhat

() a lot

() can't or won't say

Page 8

On this page, we ask general questions about pricing in your firm.

24. In general, what do you pay most attention to when setting prices?

Multiple answers are possible.

[ ] Costs

[ ] The competitors' prices

[ ] The quality of my offer

[ ] Customer satisfaction

[ ] Adjustment to the general price level

[ ] Something else: [free text field]

() can't or won't say

25. To what extent do you agree with these statements about your pricing?

I am satisfied with my pricing method.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

My prices are optimal for the firm.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

Actually, my prices should be higher.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

The reasons for price increases are understandable for customers.

() totally disagree

() somewhat disagree

() undecided

() somewhat agree

() totally agree

() can't or won't say

Page 9

Thank you very much for participating in our study!

26. If you want to tell us anything, you can do so anonymously here (note: this answer will be saved together with the other answers, but without any personal information).

If you have a question that you would like an answer to, please feel free to email us.

[free text field]

Last page

Thank you again for participating!

Your answers have been saved, you may close the browser window now.

oeffnung_der_friseure → base 19.04.2021, 11:38

Seite 01

Startseite

Sehr geehrte Damen und Herren,

am 01. März durften Sie endlich wieder öffnen. Im Rahmen unserer Doktorarbeiten in VWL an der Universität Bonn untersuchen wir, wie sich die Pandemie und der Lockdown in Deutschland auf die Friseur/innen und die Preise für Haarschnitte auswirken.

Wir bitten Sie, sich 10 bis 15 Minuten Zeit zu nehmen, um unseren Fragebogen auszufüllen. Sollten Sie weniger Zeit zur Verfügung haben, würden wir uns auch über teilweise ausgefüllte Bögen freuen (alle Antworten sind optional). Sie können auch Ihren zwischenzeitlichen Fortschritt abspeichern und die Befragung zu einem späteren Zeitpunkt an der Stelle fortsetzen; dazu klicken Sie bitte auf "Fortschritt speichern" am unteren Rand der Seite.

Die Befragung ist anonym. Es werden keinerlei personenbezogene Daten erhoben oder gespeichert. Ihre Angaben werden vertraulich behandelt und nur für wissenschaftliche Zwecke verwendet.

Herzlichen Dank für Ihre Unterstützung!
Thomas Kohler und Maximilian Weiß

PHP-Code

```
$pageNr = 1;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
option('progress.last','KO');
```

Seite 02

PHP-Code

```
$pageNr = 2;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 1 Allgemein

Zunächst möchten wir etwas über Sie und Ihr Unternehmen erfahren.

AI03

1. Was ist Ihre Rolle in Ihrem Unternehmen?

- ○ Ich bin der/die Besitzer/in
- ○ Ich bin Franchise- oder Lizenznehmer/in
- ○ Ich bin angestelle/r Betriebsleiter/in
- ○ Ich bin Angestellte/r
- ○ Anderes:

- ○ Nicht zutreffend

AI02

2. Sind Sie an der Preissetzung in Ihrem Unternehmen beteiligt?

- ○ Ja, ich bestimme die Preise selbst
- ○ Ja, ich schlage meiner/m Vorgesetzten Preise vor
- ○ Ja, ich wähle die Preise im Rahmen meines Franchise-Vertrags
- ○ Ja, mein/e Geschäftspartner/in und ich wählen die Preise gemeinsam
- ○ Nein
- ○ Anderes:

AI04

3. Wie viele Filialen hat Ihr Unternehmen? (Bei Franchises bitte für das Franchise-nehmende Unternehmen)

- ○ keine Filiale (mobiler Friseur)
- ○ eine Filiale
- ○ zwei Filialen
- ○ drei bis fünf Filialen
- ○ mehr als fünf Filialen

- ○ Kann / Möchte ich nicht sagen

AI05

4. Wie viele Angestellte hat Ihr Unternehmen? (Bei Franchises bitte für das Franchise-nehmende Unternehmen)

- ○ keine
- ○ eine/n bis drei
- ○ drei bis sechs
- ○ mehr als sechs

- ○ Kann / Möchte ich nicht sagen

AI08

Anmerkung:

5. Welcher Anteil Ihrer Kunden sind Stammkunden?

AI01

- ○ 0 % bis 19 %
- ○ 20 % bis 39 %
- ○ 40 % bis 59 %
- ○ 60 % bis 79 %
- ○ 80 % bis 100 %

- ○ Kann / Möchte ich nicht sagen

Seite 03

PHP-Code

```
$pageNr = 3;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 2 Preise Haarschnitt 1

Auf dieser Seite stellen wir Ihnen einige Fragen zum Preis eines Herren-Haarschnitts in Ihrem Unternehmen. Falls Sie diesen Haarschnitt nicht anbieten, markieren Sie dies bitte (Sie erhalten dann Fragen zum Preis eines Damen-Haarschnitts).

PL01

6. Wie viel kostet der folgende Herren-Haarschnitt in Ihrem Unternehmen?

Klassischer Fassonschnitt. Waschen, Schneiden, Föhnen. Gesamtdauer etwa 25 Minuten.

Bitte geben Sie den Preis inklusive einer eventuellen Hygienepauschale an.

Bitte geben Sie den Grundpreis an, falls Sie andere Zuschläge (z.B. montags, späte Termine, für Neukunden oder ähnliches) erheben.

Vor diesem Lockdown (bis zum 16. Dezember 2020)		Euro	☐ Kann / Möchte ich nicht sagen
Erste Märzwoche 2021		Euro	☐ Kann / Möchte ich nicht sagen
April 2021		Euro	☐ Kann / Möchte ich nicht sagen

PL14

☐ Ich biete diese Art Haarschnitt nicht an (Bitte kreuzen Sie in diesem Fall bei dieser Frage überall „Kann ich nicht sagen“ an und ignorieren Sie bitte den Rest dieser Seite und klicken auf „Weiter“.)

PL16

7. Hatten Sie aufgrund der Mehrwertsteuersenkung im zweiten Halbjahr 2020 Ihre Preise gesenkt?

○ ja	○ nein	○ Kann / Möchte ich nicht sagen

PL05

8. Preisbestandteile (Anfang März 2021)

Falls der angegebene Preis (Anfang März 2021) eine Hygienepauschale beinhaltet, geben Sie bitte an, wie hoch diese ist. Falls Sie eine unterschiedlich hohe Hygienezuschläge für unterschiedliche Dienstleistungen erheben, geben Sie bitte den Hygienezuschlag für den oben beschriebenen Haarschnitt an.

Falls Neukunden mehr zahlen als Stammkunden, geben Sie bitte den Preisunterschied an.

Falls Sie einen Zuschlag für späte Termine, für Termine am Montag oder für Termine am Wochenende erheben, geben Sie bitte die Höhe des Zuschlags an.

☐ Hygienepauschale: Euro

☐ Neukunden-Zuschlag: Euro

☐ Zuschlag für späte Termine: Euro

☐ Zuschlag für Termine am Montag: Euro

☐ Zuschlag für Termine am Wochenende: Euro

☐ Kann / Möchte ich nicht sagen

9. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor der Pandemie (Februar 2020)?

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

10. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor dem letzten Lockdown (Dezember 2020)? PL10

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

Seite 04

PHP-Code

```
if (value('PL14_01')==1){
goToPage('PH');
}
$pageNr = 3;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 2 Preise Haarschnitt 2

Auf dieser Seite stellen wir Ihnen einige Fragen zum Preis eines Damen-Haarschnitts in Ihrem Unternehmen.

PL02

11. Wie viel kostet der folgende Damen-Haarschnitt in Ihrem Unternehmen?

Haarlänge: etwa schulterlang

Waschen, Schneiden, Kämmen, Föhnen. Gesamtdauer etwa 45 Minuten.

Keine Farbe, Strähnchen oder ähnliches.

Bitte geben Sie den Preis inklusive einer eventuellen Hygienepauschale an.

Bitte geben Sie den Grundpreis an, falls Sie andere Zuschläge (z.B. montags, späte Termine, für Neukunden oder ähnliches) erheben.

Vor diesem Lockdown (bis zum 16. Dezember 2020)		Euro	☐ Kann / Möchte ich nicht sagen
Erste Märzwoche 2021		Euro	☐ Kann / Möchte ich nicht sagen
April 2021		Euro	☐ Kann / Möchte ich nicht sagen

PL17

12. Hatten Sie aufgrund der Mehrwertsteuersenkung im zweiten Halbjahr 2020 Ihre Preise gesenkt?

○ ja	○ nein	○ Kann / Möchte ich nicht sagen

PL13

13. Preisbestandteile (Anfang März 2021)

Falls der angegebene Preis (Anfang März 2021) eine Hygienepauschale beinhaltet, geben Sie bitte an, wie hoch diese ist. Falls Sie eine unterschiedlich hohe Hygienezuschläge für unterschiedliche Dienstleistungen erheben, geben Sie bitte den Hygienezuschlag für für den oben beschriebenen Haarschnitt an.

Falls Neukunden mehr zahlen als Stammkunden, geben Sie bitte den Preisunterschied an.

Falls Sie einen Zuschlag für späte Termine, für Termine am Montag oder für Termine am Wochenende erheben, geben Sie bitte die Höhe des Zuschlags an.

☐ Hygienepauschale: Euro

☐ Neukunden-Zuschlag: Euro

☐ Zuschlag für späte Termine: Euro

☐ Zuschlag für Termine am Montag: Euro

☐ Zuschlag für Termine am Wochenende: Euro

☐ Kann / Möchte ich nicht sagen

14. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor der Pandemie (Februar 2020)?

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

15. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor dem letzten Lockdown (Dezember 2020)? PL12

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

Seite 05
PH

PHP-Code

```
if (
(
(value('PL14_01') == 1) and (value('PL01_02') <= value('PL01_01'))
)
or
(
(value('PL14_01') == 2) and (value('PL02_02') <= value('PL02_01'))
)
){
goToPage('PG');
}
$pageNr = 4;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

PL03

16. Weshalb haben sich Ihre Preise seit letztem Dezember erhöht?

Sie haben angegeben, dass mindestens einer Ihrer Preise im März 2021 höher ist als er im Dezember 2020 war. Welche Rolle haben die folgenden Faktoren bei der Preiserhöhung gespielt?

	Keine Rolle	Eine kleine Rolle	Eine große Rolle	Trifft nicht zu	Kann / Möchte ich nicht sagen
verringerte Kapazität durch Abstandsregelungen	○	○	○	○	○
Ausgleich des entgangenen Umsatzes / des Rücklagenabbaus durch den Lockdown	○	○	○	○	○
höhere Nachfrage	○	○	○	○	○
gestiegene Finanzierungskosten (zum Beispiel wegen Kreditaufnahme)	○	○	○	○	○
Anpassung an das allgemeine Preisniveau	○	○	○	○	○
gestiegene Lohnkosten	○	○	○	○	○
Die Preiserhöhung ist nur kurzfristig.	○	○	○	○	○
gestiegene Nebenkosten	○	○	○	○	○
gestiegener Hygieneaufwand (Masken, Desinfektionsmittel und Zeit)	○	○	○	○	○
Erwartung, dass Kunden für Preiserhöhung Verständnis haben	○	○	○	○	○
gestiegene Preise der Konkurrenz	○	○	○	○	○
Ende der Mehrwertsteuersenkung	○	○	○	○	○

PL07

Sonstige wichtige Faktoren:

17. Inwiefern stimmen Sie diesen Aussagen über Ihre Erfahrungen mit Ihren Kunden zu? PL15

	stimme gar nicht zu	stimme eher nicht zu	unent-schieden	stimme eher zu	stimme voll zu	Kann / Möchte ich nicht sagen
Die Kunden äußern Verständnis für meine/unsere Preise.	○	○	○	○	○	○
Die Kunden beklagen sich aufgrund ihrer eigenen finanziellen Situation über die Preise.	○	○	○	○	○	○
Einzelne Kunden haben mir vorgeworfen von der Krise profitieren zu wollen.	○	○	○	○	○	○
Die Kunden geben mehr Trinkgeld.	○	○	○	○	○	○
Die Kunden geben weniger Trinkgeld.	○	○	○	○	○	○

Seite 06
PG

PHP-Code

```
if ((value('PL01_02') > value('PL01_01')) or (value('PL02_02') > value('PL02_01'))) {
goToPage('RA');
}
$pageNr = 4;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

PL04

18. Weshalb haben sich Ihre Preise seit letztem Dezember nicht erhöht?

Sie haben angegeben, dass mindestens einer Ihrer Preise im März 2021 nicht höher ist als er im Dezember 2020 war. Welche Rolle haben die folgenden Faktoren bei der Entscheidung, den Preis nicht zu erhöhen, für Sie gespielt?

	keine Rolle	eine kleine Rolle	eine große Rolle	Trifft nicht zu	Kann / Möchte ich nicht sagen
Die Preise sind vertraglich festgelegt.	○	○	○	○	○
Innerhalb des Unternehmens konnten wir uns nicht auf Preissteigerungen einigen.	○	○	○	○	○
Ich weiß nicht, ob höhere Preise besser für das Unternehmen wären.	○	○	○	○	○
Eine Preiserhöhung würde größer scheinen als sie wirklich ist.	○	○	○	○	○
Erhöhung des Marktanteils / neue Kunden gewinnen	○	○	○	○	○
Die Preise wurden bereits nach dem 1. Lockdown (Frühjahr 2020) erhöht.	○	○	○	○	○
Zahlungskraft der Kunden ist in der Pandemie geringer	○	○	○	○	○
Mehrwertsteuersenkung im zweiten Halbjahr 2020 wurde nicht weitergegeben	○	○	○	○	○
Die Konkurrenz hat ihre Preise nicht erhöht.	○	○	○	○	○
Die Preise wurden nicht erhöht, um sie nicht in absehbarer Zeit wieder senken zu müssen.	○	○	○	○	○
Die Kosten sind nicht gestiegen.	○	○	○	○	○
Erhalt der Stammkunden	○	○	○	○	○

PL08

Sonstige wichtige Faktoren:

19. Inwiefern stimmen Sie diesen Aussagen über Ihre Erfahrungen mit Ihren Kunden zu? PL15

	stimme gar nicht zu	stimme eher nicht zu	unent-schieden	stimme eher zu	stimme voll zu	Kann / Möchte ich nicht sagen
Die Kunden äußern Verständnis für meine/unsere Preise.	○	○	○	○	○	○
Die Kunden beklagen sich aufgrund ihrer eigenen finanziellen Situation über die Preise.	○	○	○	○	○	○
Einzelne Kunden haben mir vorgeworfen von der Krise profitieren zu wollen.	○	○	○	○	○	○
Die Kunden geben mehr Trinkgeld.	○	○	○	○	○	○
Die Kunden geben weniger Trinkgeld.	○	○	○	○	○	○

Seite 07
RA

PHP-Code

```
$pageNr = 5;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 3 Zustand nach Lockdown

Auf dieser Seite stellen wir Ihnen Fragen dazu, wie Ihr Unternehmen mit den politischen Maßnahmen umgeht, und wie Sie die zukünftige Entwicklung einschätzen.

LO04

20. Falls Sie für Anfang März mehr Terminanfragen erhalten haben, als Sie Termine zu vergeben hatten: wie sind Sie damit umgegangen?

Mehrfachantworten sind möglich

- ☐ Bevorzugung von Neukunden
- ☐ Anstellung von Mitarbeitern, um mehr Termine anbieten zu können
- ☐ Bevorzugung von Kunden, deren Termine in den letzten Monaten abgesagt werden mussten
- ☐ Bevorzugung von Stammkunden
- ☐ Wer zuerst angefragt hat, hat Termine bekommen
- ☐ Ausweitung der Öffnungszeiten, um mehr Termine anbieten zu können
- ☐ Erhebung eines Zuschlags für Neukunden

- ☐ Trifft nicht zu
- ☐ Kann / Möchte ich nicht sagen

LO01

21. Inwiefern stimmen Sie diesen Aussagen über die Pflicht zum Haarewaschen zu?

	Stimme gar nicht zu	Stimme eher nicht zu	Unent-schieden	Stimme eher zu	Stimme voll zu	Kann / Möchte ich nicht sagen
Ich fühle mich sicherer, wenn die Haare der Kunden vor der Behandlung gewaschen werden.	○	○	○	○	○	○
Die Pflicht zum Haarewaschen ist wie eine Preiserhöhung.	○	○	○	○	○	○
Die Kunden finden die Pflicht zum Haarewaschen akzeptabel.	○	○	○	○	○	○
Ich profitiere finanziell von der Pflicht zum Haarewaschen.	○	○	○	○	○	○

LO07

22. Für wie zutreffend halten Sie die folgenden Vorhersagen?

	gar nicht	eher nicht	unklar	eher ja	sehr	Kann / Möchte ich nicht sagen
In einem Jahr werden wir wieder den Zustand von vor der Pandemie haben.	○	○	○	○	○	○
Infektionsschutzmaßnahmen werden noch für Jahre vorgeschrieben bleiben.	○	○	○	○	○	○
Die Angst vor dem Virus wird manche Menschen noch lange Zeit von einem Friseurbesuch abhalten.	○	○	○	○	○	○
Meine persönliche finanzielle Situation wird sich längerfristig verbessern (verglichen zu heute).	○	○	○	○	○	○
Infolge der Pandemie(bekämpfung) wird die Zahlungsbereitschaft meiner/unserer Kunden nachhaltig sinken.	○	○	○	○	○	○
Es wird dieses Jahr einen weiteren Lockdown geben, in dem Friseurläden wieder schließen müssen.	○	○	○	○	○	○

LO08

23. Wie unsicher sind Sie sich über Ihre berufliche Zukunft?

gar nicht	kaum	etwas	sehr	Kann / Möchte ich nicht sagen
○	○	○	○	○

Seite 08

PHP-Code

```
$pageNr = 6;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 4 Preissetzung allgemein

Auf dieser Seite stellen wir Ihnen allgemeine Fragen zur Preissetzung in Ihrem Unternehmen.

PA01

24. Im Allgemeinen, worauf achten Sie am meisten bei der Preissetzung?

Mehrfachantworten sind möglich

- ☐ Kosten
- ☐ Preise der Konkurrenz
- ☐ Qualität meines Angebots
- ☐ Kundenzufriedenheit
- ☐ Anpassung an das allgemeine Preislevel
- ☐ Anderes:

- ☐ Kann / Möchte ich nicht sagen

PA02

25. Inwiefern stimmen Sie diesen Aussagen über Ihre Preissetzung zu?

	stimme gar nicht zu	stimme eher nicht zu	unent-schieden	stimme eher zu	stimme voll zu	Kann / Möchte ich nicht sagen
Ich bin zufrieden mit der Art wie ich/wir Preise setze/n.	○	○	○	○	○	○
Die Preise sind optimal für das Unternehmen gewählt.	○	○	○	○	○	○
Eigentlich sollten die Preise höher sein.	○	○	○	○	○	○
Die Gründe für Preiserhöhungen sind für die Kunden nachvollziehbar.	○	○	○	○	○	○

Seite 09
KO

PHP-Code

```
$pageNr = 7;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Danke

Vielen Dank für Ihre Teilnahme an unserer Studie!

S001

26. Wenn Sie uns etwas mitteilen möchten, können Sie dies hier anonym tun

Anmerkung: Diese Antwort wird zusammen mit Ihren anderen Antworten, aber ohne personenbezogene Informationen gespeichert.

Sollten Sie eine Frage haben, auf die Sie eine Antwort wünschen, können Sie uns gerne eine E-Mail schreiben.

Letzte Seite

Nochmals vielen Dank für Ihre Teilnahme!

Ihre Antworten wurden gespeichert, Sie können das Browser-Fenster nun schließen.

Thomas Kohler und Maximilian Weiß, Bonn Graduate School of Economics

Rheinische Friedrich-Wilhelms Universität Bonn – 2021

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