Surveying Price Stickiness with Large Shocks

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Why do firms not adjust prices?

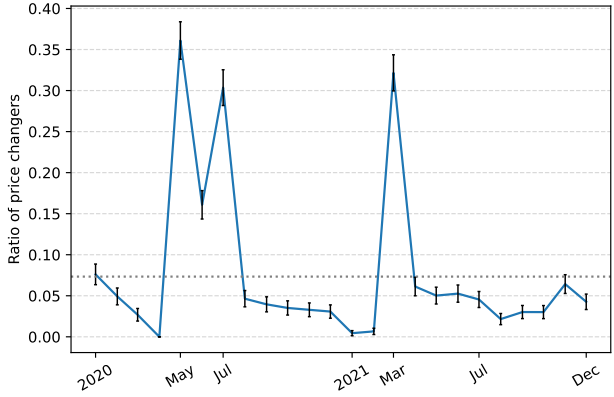
Literature on asking firm managers (Blinder et al., 1998) finds hierarchy of reasons:

1. Customer markets: retain regular customers
2. Cost-based pricing: costs did not change
3. Coordination failure: multiple equilibra due to strategic complementarity among firms

Special characteristics of our survey:

- Managers of *specific industry*: German hairdressers, members of local hairdresser guilds, in counties all over Germany
- In *times of large shocks*: during Covid-19 pandemic, with lockdowns, hygiene rules

Covid-19 as a natural experiment



Dates of lockdowns: March-**April** 2020, December 2020-**February** 2021
Date of our survey: March to April 2021

Preview: empirical findings

Extensive margin

- Main state-dependent reason not to increase: retain regular customers
- Main reasons to increase: higher hygiene costs
- Main explanatory variable for choice to increase: *customer understanding* of own prices

Intensive margin

We calculate relative price of male haircut within county.
Find:

- Low customer understanding is *real* price rigidity: lower cost pass-through
- Rigidity most prevalent in the middle of the price distribution

Preview: theoretical contribution

Rationalize findings within search model with uncertainty on *customer* side (asymmetric information, L'Huillier (2020))

Uncertainty about supply shock generates

- heterogeneous cost pass-through (Hobijn et al., 2021)
- lower markups (Born and Pfeifer, 2021)
- fluctuating relative prices (Klenow and Willis, 2016, Mongey, 2021)

No recourse to fair pricing/behavioral types (Rotemberg, 2011, Eyster et al., 2021)

Related literature

- Asking firm managers about price-setting: Blinder et al. (1998), 26 replication studies
- Price-dynamics in response to shocks: Hobijn et al. (2021), Born and Pfeifer (2021), Benzarti et al. (2020), Gilchrist et al. (2017)
- Realistic monetary non-neutrality (micro-macro puzzle): Klenow and Willis (2016), Karadi and Reiff (2019), Mongey (2021)
- Learning from prices: Bénabou and Gertner (1993), Fishman (1996), L'Huillier (2020), Nakamura and Steinsson (2011), Janssen and Shelegia (2019)

Survey: empirical findings

Survey design and realization

Design

- Query prices of specific service — male haircut — before and after lockdown
- Query rankings of hypotheses/reasons for price-setting, dependent on whether increased or not
- Controls: firm size, share of regular customers, pricing satisfaction, pessimism, customer understanding

Realization

- Sample hairdresser guilds in Germany (county-level)
- Online survey e-mailed to head of guild, asked to share among colleagues
- Time: March-April 2021 (after second lockdown)
- $N = 281$ usable responses, 21 counties with ≥ 6 firms

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Comparison with German CPI micro-level data

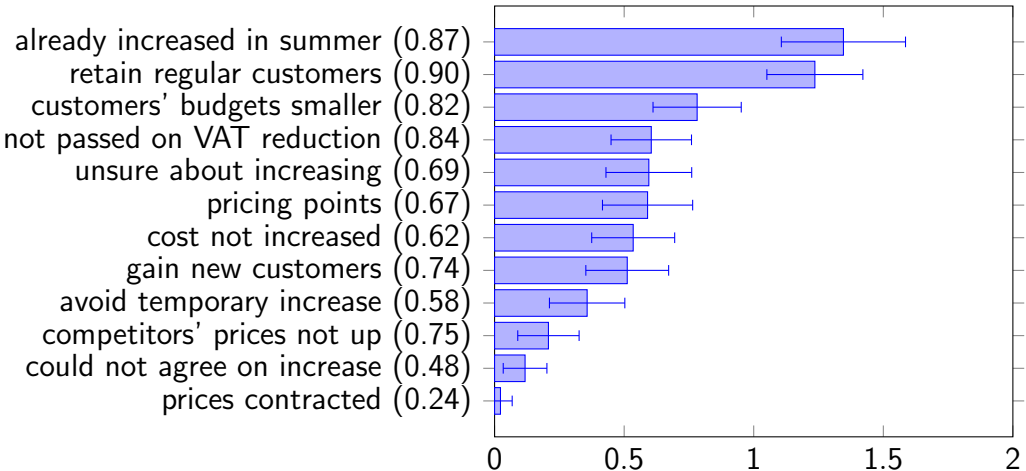
Evident sample-bias:

- 64% (survey) vs 30% (CPI) increased prices in March 2021
- Conditional price increase: 12.6% (survey) vs 7.1% (CPI)
- Standard deviation within county: 17.7% (survey) vs 23.6% (CPI)

Explanations:

- Selection bias: only participate if price-increase is planned
- Guilds are special: larger (duty to hire trainees), possibly easier coordination
  evidence
- Conjecture: We are missing firms with very sticky prices

Ranking of reasons for not adjusting



Blinder-comparison

Ranking of reasons for price-increase

The role of customer understanding

Definition Sum of Likert-scale answers to

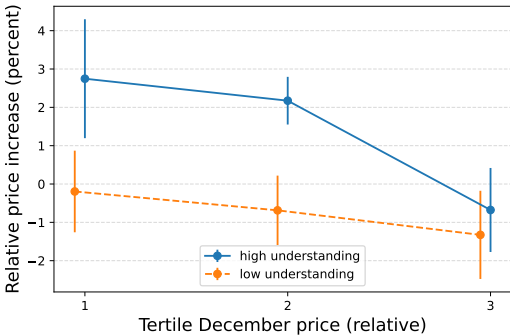
Sign	Statement
$+$	The customers express understanding for my/our prices.
$-$	Some customers accuse me of profiteering.
$+$	The reasons for price increases are understandable for customers.

Find: customer understanding significant for

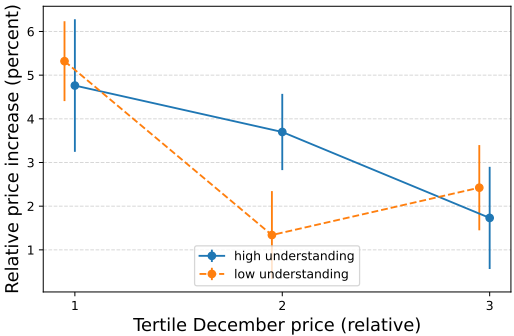
- $(+)$ extensive margin regression
- $(+)$ intensive margin (nominal and real) regression
- $(-)$ importance of "retaining customers"-reason regression
- $(+)$ profit margins, price satisfaction, optimism

Heterogeneous effect over relative price distribution

(a) All firms



(b) Only increasers



- Understanding-rigidity only for firms in center of price distribution
- Price increase falls in initial price

Search model

Overview

Follow Fishman (1996): temporary uncertainty about average costs

Main assumption: understanding customers are more informed about idiosyncratic production cost of firm

- Each firm has regular customer, prefers to stay at firm due to search cost
- Common cost shock (hygiene rules) makes firms want to increase price
- Customers attempt to learn about industry-wide condition using conservative rule
- Low productive firms with low understanding customers are most restricted in their pricing

Customers and firms

Customers:

- Customer j starts search at firm $i(j)$ (regular customer)
- Linear utility $\xi_t^i q_{it} - p_{it}$
  quality q, (real) price p, preference shock $\xi \sim Unif[0,1]$
- Customer understanding type $u \in \{0,1\}$

Firms:

- firm's common marginal cost $c_{it} \in \{\underline{c}_t, \overline{c}_t\}$
- firm's idiosyncratic marginal cost $\zeta_i \sim Unif[\underline{\zeta}, \overline{\zeta}]$
- good's quality $q_i \in \{\underline{q}, \overline{q}\}$
- assumption: $\mathcal{P}[\underline{c}, \overline{q}, u] = 0$ for all $u \in \{0,1\}$

The customer's problem I

Stage 2

- Decided on firm i
- Learns about ξ_t^i and p_{it} if $i \neq i(j)$

$\rightarrow$ demand $d_{jt}(i) = 1 \Leftrightarrow \xi_{jt}^i \geq p_{it}/q_{it}$, o.w. $d_{jt}(i) = 0$

Expected surplus of consuming at firm i:

$$V_{it}^u = \frac{(q_{it} - p_{it}^u)^2}{2q_{it}}, p_{it}^u < q_{it} \tag{1}$$

$\rightarrow$ price-elastic expected demand curve

The customer's problem II

Stage 1

Assumptions about search process:

1. Search for at most for one other firm
2. Undirected random search
3. No return to firm $i(j)$

With search cost s, customer j searches iff

$$V_{i(j)t} < \underbrace{\sum_{c,q,u} \mathcal{P}[c,q,u] \int_{\zeta} V^{u(j)}_{c,q,u,\zeta,t} d\mathcal{P}(\zeta)}_{=:\mathbb{E}\, V^{u}_{t}} - s \tag{2}$$

Firm's problem I

Taking customer's expected outside option $\mathbb{E}\, V_t^u - s$ *as given*:

$$\max_{p_{it}} \mathbb{E}^u[d_{jt}(i)](p_{it} - C_{it}) - F_{it}, \tag{3}$$

where

- $\mathbb{E}^u[d]$ = random demand $\mathcal{D}_t$ + regular's demand
- marginal cost $C_{it} = c_{it} + \zeta_i$
- fixed cost $F_{it} = F(C_{it}, q_i)$
- understanding of regular customer u

Assumption: F_{it} such that firm always wants to retain regular customer

Firm's problem II

- firm's monopoly price $p_{it}^m = (C_{it} + q_i)/2$ yields surplus V_{it}^m
- can offer higher surplus to retain customer, until V_{it}^* (zero profits)

$\rightarrow$ firm offers

$$V_{it} = \max\{\mathbb{E}\, V_t^u - s, V_{it}^m\} \quad \text{if } q_i \geq C_{it} \text{ and } \mathbb{E}\, V_t^u - s \leq V_{it}^* \tag{4}$$

$\rightarrow$ yields p_{it}

Otherwise, exit market in t

Learning from prices: conservative rule

- in *uncertainty period*, customers learn about $\underline{c}$ (baseline cost) by observing price $p_{i(j)}$
- *Knightian uncertainty*: customers *never underestimate* outside option
- critical assumption: $p_{it} \leq p_{it}^m$ (justification: dynamic problem)

Customers with understanding $u \in \{0, 1\}$ learn

$$\underline{c}_{it}^u = \underline{c}_{t-1} + \gamma_i^u(\underline{c}_t - \underline{c}_{t-1}) \tag{5}$$

Only understanding customers observe idiosyncratic ζ_i
$\rightarrow \gamma_i^0 \leq \gamma_i^1$

Model experiment: uncertainty about cost increase

- periods $t = 0$ and $t = 2$: all customers perfectly informed about $\underline{c}_t$
- baseline costs increase in $t = 1$ by fixed amount κ

Choose equilibrium where only low-productivity firms $(\overline{c}, \underline{q})$ are constrained:

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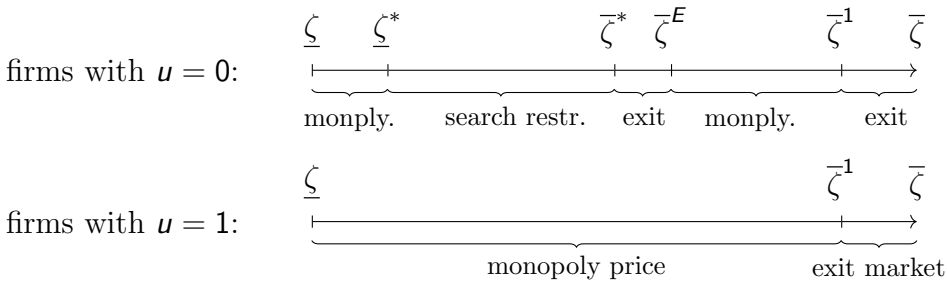


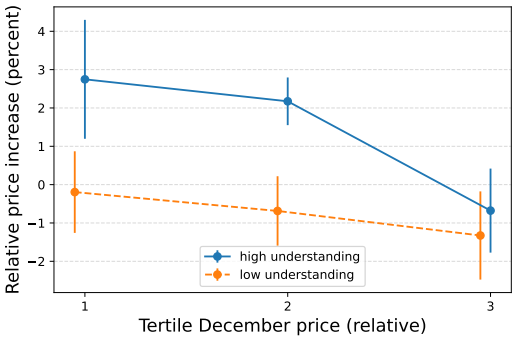
Model calibration

- Data source: firms in counties with ≥ 6 firms $\rightarrow$ relative price distribution
- Fundamentals-based ranking over $(q_i + C_i)/2$ (monopoly-price)
- Matched moments: relative price dispersion December, heterogeneous relative price changes
- Matched share of firms with low understanding customers: $\alpha = 45\%$.

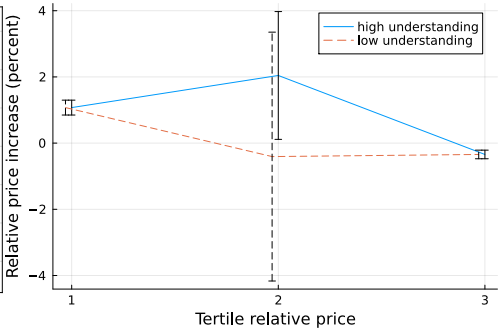
parameters

Real rigidity of customer understanding

(a) Survey data



(b) Model



Real and nominal rigidities: data and model

Source	α	$\sigma(\Delta_1 p)$
Model	0.0	0.8%
Model	0.45	1.1%
Model	0.9	2.9%
CPI (con.)	-	7.5%

- SD of relative price changes *conditional* on adjustment (Klenow and Willis, 2016), $\sigma(\Delta p)$:
  increases with α as median price fluctuates more
- Only 1.8% of firms in the model do not adjust

Conclusion

Conclusion

Surveying price stickiness

- Adaptation of survey-method for times of large shocks
- Customer markets important for price setting of hairdressers, consistent with literature
- Low customer understanding is nominal and real rigidity

Search model with uncertainty on customer side

- Customer understanding matters w/o recourse to behavioral bias/fair pricing
- Real rigidity for uncertain cost-shock: falling markups, heterogeneous pass-through, relative price fluctuation

Outlook: dynamic model extension

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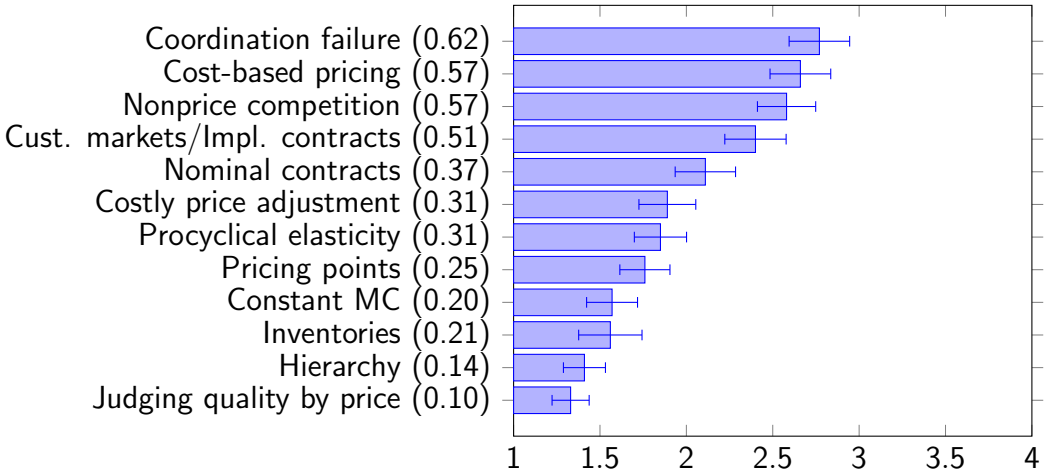
Appendix

Blinder ranking



back

More likely to increase prices back I

	(1)	(2)	(3)
Price increased during the lockdown?			
Cust. understand prices	2.593***	3.553***	3.566**
	(0.710)	(1.205)	(1.562)
Employees (linear part)		0.0790	0.0953
		(0.113)	(0.139)
Dummy for many employees=1		0.443	0.207
		(0.446)	(0.590)
More than one salon=1		-0.560	-0.400
		(0.492)	(0.617)
Satisfaction with pricing		-1.504*	-1.589*
		(0.813)	(0.959)
Hairwashing		0.201	0.0528
		(0.537)	(0.671)
Pessimism		-0.101	-0.739
		(1.557)	(2.046)
Share of regular customers		0.0280	0.150
		(0.234)	(0.277)
Rel. price December			-1.411*
			(0.765)
Constant	-1.485**	-1.697	-0.189
	(0.580)	(1.411)	(1.934)
Observations	237	207	137
Pseudo R2	0.0343	0.0521	0.0836

More likely to increase prices back II

	(1)
Employees (linear part)	0.0212
	(0.0308)
Dummy for many employees=1	0.0875
	(0.120)
More than one salon=1	-0.126
	(0.161)
High understanding customers=1	0.237***
	(0.0888)
Satisfaction with pricing	-0.201
	(0.173)
Hairwashing	0.0397
	(0.146)
Pessimism	-0.205
	(0.437)
Rel. price December	-0.312*
	(0.164)
Share of regular customers	0.0590
	(0.0661)
N	138

Increase prices by more back I

	(1)	(2)	(3)
Cust. understand prices	6.757***	8.909**	9.748**
	(2.074)	(3.450)	(4.198)
Employees (linear part)		-0.183	-0.290
		(0.328)	(0.402)
Dummy for many employees=1		0.393	-1.307
		(1.475)	(1.439)
More than one salon=1		-1.964	-1.102
		(1.384)	(1.610)
Satisfaction with pricing		-3.502*	-4.373**
		(1.931)	(1.973)
Hairwashing		0.532	-0.336
		(1.459)	(1.267)
Pessimism		2.098	3.504
		(4.642)	(5.564)
Share of regular customers		-0.491	-0.430
		(0.630)	(0.704)
Rel. price December			-4.460***
			(1.259)
Constant	0.179	1.978	6.262
	(1.628)	(4.628)	(6.166)
Observations	237	207	137
R2	0.0361	0.0576	0.146

Increase prices by more back II

	(1)	(2)	(3)
Cust. understand prices	6.946***	8.862**	8.917**
	(2.049)	(3.533)	(3.558)
Employees (linear part)		0.00928	0.198
		(0.312)	(0.304)
Dummy for many employees=1		-0.396	0.500
		(1.004)	(1.167)
More than one salon=1		-2.272	-1.891
		(2.227)	(1.805)
Satisfaction with pricing		-4.442*	-4.784**
		(2.256)	(2.050)
Hairwashing		0.517	0.740
		(1.665)	(1.729)
Pessimism		-1.865	-1.582
		(3.649)	(3.505)
Share of regular customers		-0.463	-0.337
		(0.720)	(0.729)
Rel. price December			-6.039***
			(1.225)
Constant	-4.888**	-0.473	4.429
	(1.759)	(4.879)	(5.591)
Observations	157	137	137
R2	0.0523	0.0927	0.169

Increase prices by more back III

	(1)	(2)	(3)
High understanding customers=1	1.997***	2.469**	2.714**
	(0.703)	(0.971)	(1.159)
Employees (linear part)		-0.149	-0.293
		(0.320)	(0.387)
Dummy for many employees=1		0.707	-0.849
		(1.454)	(1.417)
More than one salon=1		-1.982	-1.383
		(1.382)	(1.560)
Satisfaction with pricing		-1.786	-2.515
		(1.713)	(1.514)
Hairwashing		0.786	0.00207
		(1.426)	(1.227)
Pessimism		1.692	2.814
		(4.660)	(5.640)
Share of regular customers		-0.263	-0.156
		(0.640)	(0.785)
Rel. price December			-4.512***
			(1.317)
Constant	4.325***	5.485	10.17
	(0.557)	(4.165)	(6.090)
Observations	281	209	138
R2	0.0234	0.0438	0.122

Increase prices by more back IV

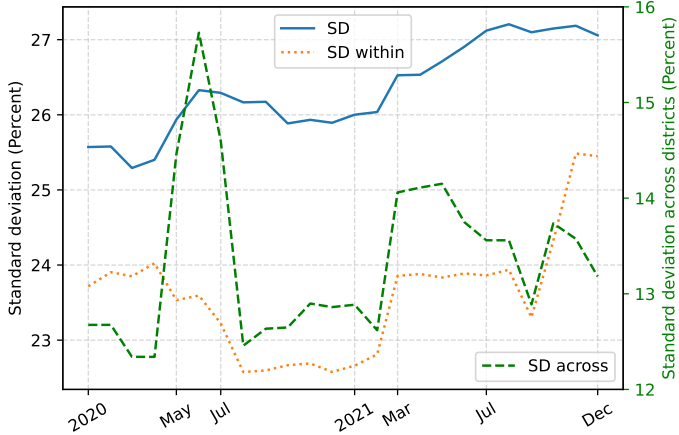
	(1)	(2)	(3)
High understanding customers=1	1.671**	1.897**	1.911*
	(0.620)	(0.896)	(0.935)
Employees (linear part)		-0.0303	0.157
		(0.307)	(0.302)
Dummy for many employees=1		-0.154	0.738
		(0.955)	(1.123)
More than one salon=1		-2.550	-2.175
		(2.244)	(1.892)
Satisfaction with pricing		-2.325	-2.673
		(1.908)	(1.703)
Hairwashing		0.796	1.020
		(1.637)	(1.725)
Pessimism		-2.872	-2.545
		(3.867)	(3.640)
Share of regular customers		-0.221	-0.100
		(0.759)	(0.743)
Rel. price December			-6.090***
			(1.337)
Constant	-0.477	3.480	8.482
	(0.748)	(5.068)	(5.664)
Observations	186	138	138
R2	0.0204	0.0573	0.134

Retaining regular customers less important

	(1)	(2)	(3)
Dummy for retain regulars applies			
Cust. understand prices	-7.956**	-20.82*	-20.61*
	(4.035)	(12.43)	(10.77)
Employees (linear part)		-7.377***	-9.426***
		(0.823)	(1.030)
Dummy for many employees=1		-32.12***	-40.27***
		(3.141)	(3.220)
Satisfaction with pricing		2.814**	
		(1.309)	
Hairwashing		-0.934	
		(1.054)	
Pessimism		-4.867	
		(3.837)	
Share of regular customers		-0.431	
		(0.831)	
Rel. price December			-3.753***
			(1.432)
Constant	8.848**	55.51***	64.37***
	(3.575)	(17.74)	(12.00)
Observations	81	74	52
Pseudo R2	0.134	0.585	0.543

back

Price dispersion over time, across counties



Men's haircuts: relative price standard deviation

back

Calibrated parameters

Parameter	Value	Matched data moment
$\underline{c}$	1	- (normalization)
$\overline{c}$	1.55	relative price dispersion December
$\underline{q}$	1.99	relative price dispersion December
$\overline{q}$	2.53	relative price dispersion December
κ	0.18	relative price increases March
$\overline{\zeta}$	0.21	relative price gap March
α	0.45	survey evidence
s	2.88%	choice of equilibrium

Calibration of model parameters.

back