STATISTICS

The Rise of AI Pricing:
Trends, Driving Forces, and Implications for Firm Performance

NOVEMBER 21, 2024

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Motivation: General

- Recent advances in artificial intelligence (AI) have spurred many studies aiming to understand the macroeconomic impact of the new technologies and the related policy implications.
  - Topics: labor market, economic growth, income inequality, firm growth, market concentration
  - A lesser-known area is the rise of AI-powered algorithmic pricing (or AI pricing hereafter).
- Unlike traditional price-setting technologies, AI pricing can
  - Incorporate a wide range of information for firms’ pricing decisions
  - Respond to real-time changes in demand and supply conditions
- Recent studies have focused on the impact of AI pricing on market competitiveness or collusion outcomes in specific industries: online retailing, housing rental, gasoline, and pharmaceuticals
- How is the economic-wide adoption? And will there be aggregate implications?

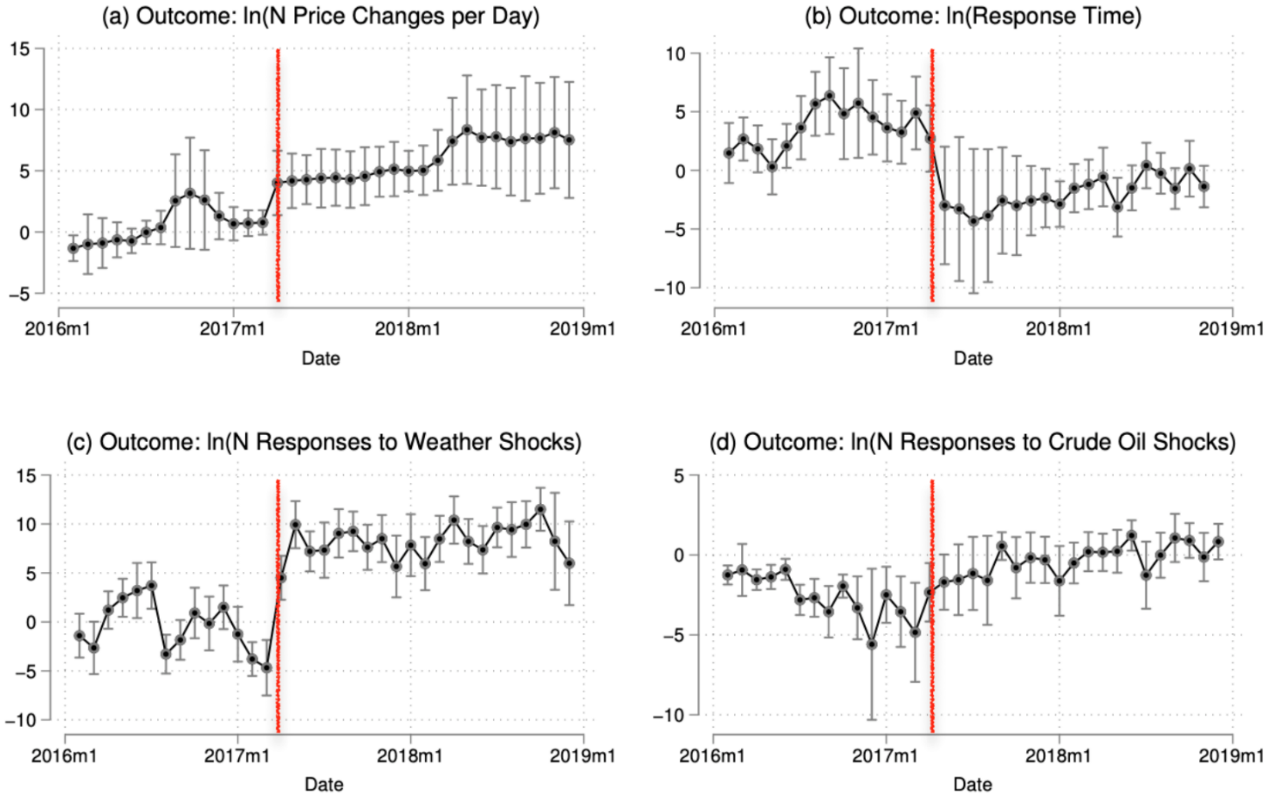
Motivation: An Example

Example from the German Gasoline Market: Assada-Clarkb-Ershovc-Xu'24 (JPE)

Figure 2: % Difference Between Adopters and Non-Adopters

more frequent changes

shorter response time to rival's price change



quicker response to shocks

quicker response to shocks

This Paper

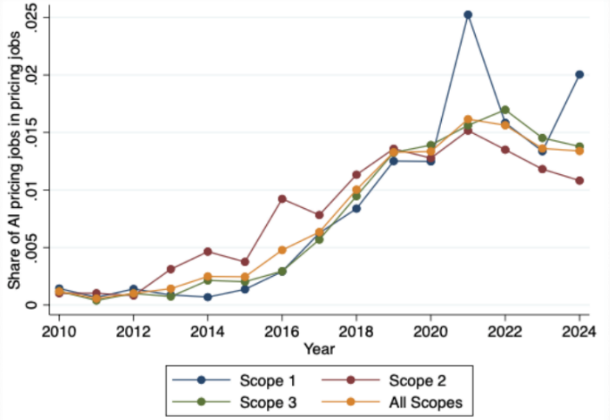
- Today: Document economic-wide AI pricing adoptions
  - The aggregate trend over time and variations across industries
  - The determinant factors of adopting at firm-level
  - The correlation between firm performances with adoption
- Today: Provide some causal evidence on AI pricing adoption and monetary transmission

Data and Measure

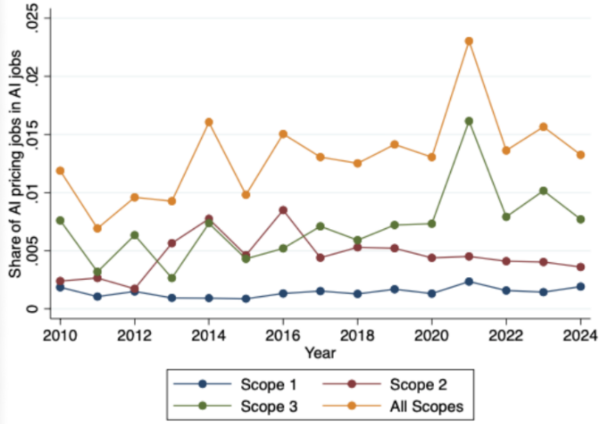
- We rely on Lightcast job posting data (2010-2024Q1) to identify (AI) pricing job posts
  - AI-related skills as the standard approach in Acemoglu et al. (2022b) and Babina et al. (2024)
  - Keyword "pricing" in job title (Scope 1), skill requirements (Scope 2), description (Scope 3)
  - Sum all scopes (non-overlapping) as the total AI pricing posts
- Merge to Compustat when documenting determinant factors and firm performances
- Merge to CRSP and Bauer and Swanson (2023) monetary shocks when documenting causal evidence
- Summaries omitted for today (to save time)

[The Rise of AI Pricing]

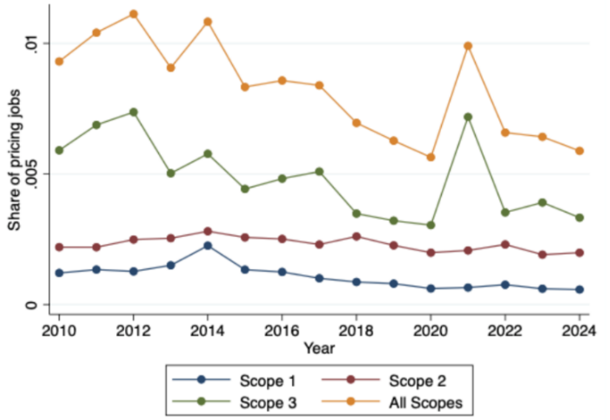
Aggregate Time Trends of AI Pricing, Pricing, and AI Jobs



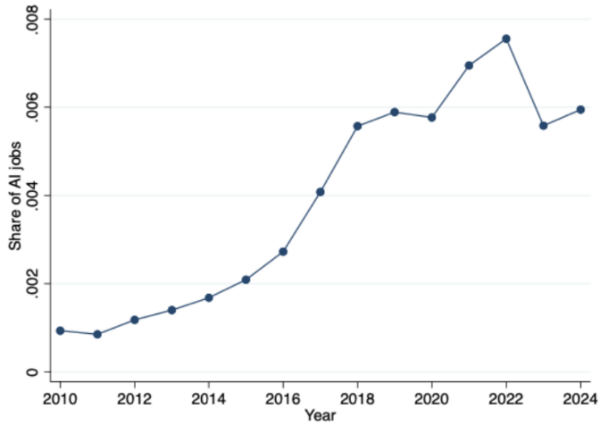
(a) Share of AI Pricing in Pricing Jobs



(b) Share of AI Pricing in AI Jobs



(c) Share of Pricing Jobs in All Jobs



(d) Share of AI Jobs in All Jobs

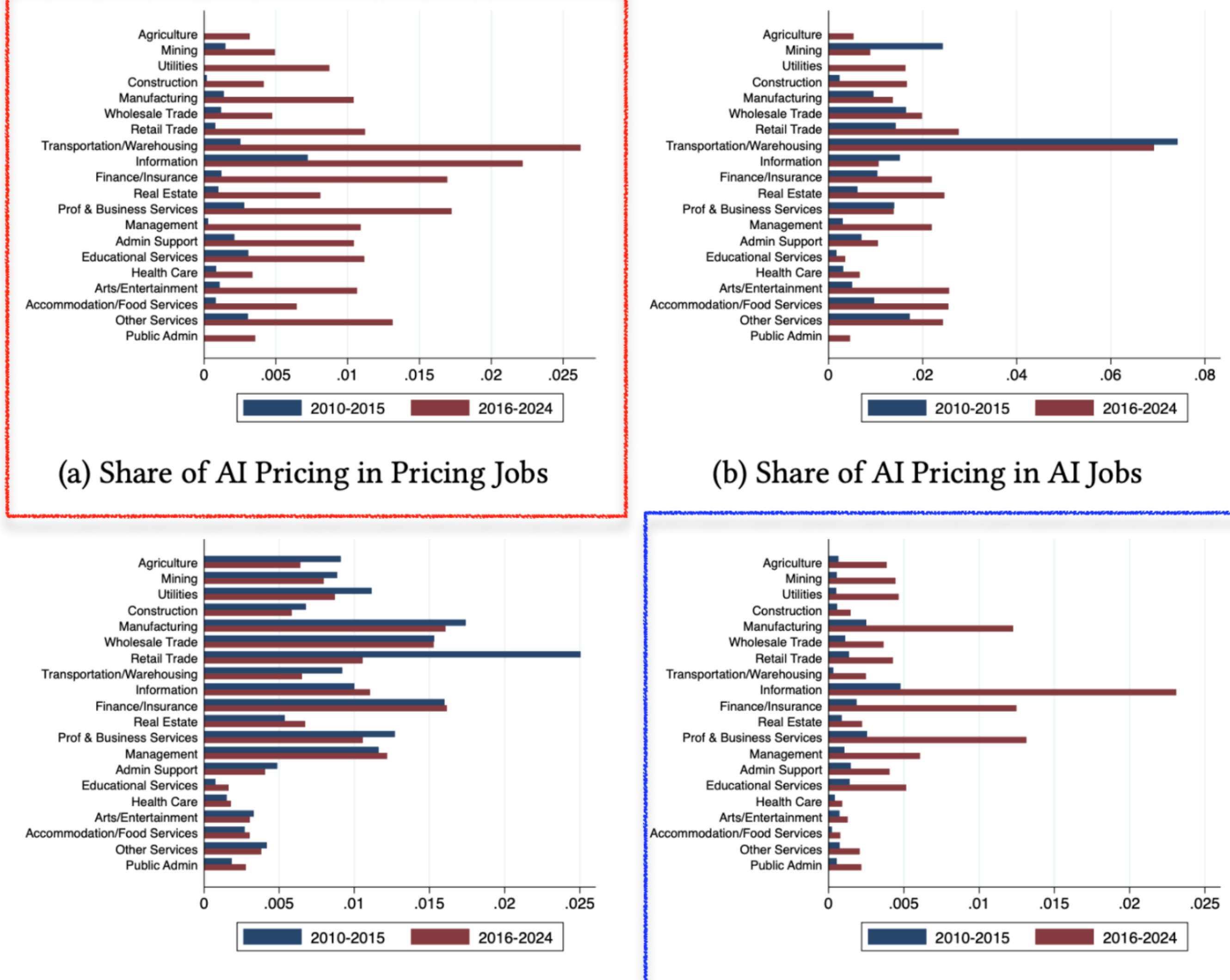
Leading Firms in AI Pricing Job Postings

Firm	No. of AI Pricing Jobs	AI Pricing/AI Jobs	AI Pricing/Pricing Jobs
Deloitte	1672	6.9%	2.4%
Amazon	1198	1.7%	15.0%
Uber	664	21.1%	46.8%
Johnson & Johnson	611	8.5%	7.2%
Accenture	427	2.8%	2.0%
The RealReal	388	7.9%	43.6%
JPMorgan Chase	344	2.7%	2.8%
CyberCoders	337	0.9%	2.8%
USAA	281	7.7%	5.8%
Capital One	273	1.1%	8.1%
Wells Fargo	251	2.2%	3.3%
Wayfair	246	18.3%	25.7%
IBM	200	1.0%	2.8%
General Motors	195	2.5%	6.0%
PricewaterhouseCoopers	186	2.5%	0.6%
Verizon Communications	147	1.7%	3.1%
UnitedHealth Group	143	2.6%	0.6%
Kforce	142	1.7%	1.2%
The Judge Group	133	3.7%	3.0%
CarMax	132	37.0%	13.9%
Target	131	10.5%	3.8%

Variations Across Industries

AI Pricing:

Transpotation
IT
Finance
Business Services
Retail
Education
Manufacuring
Entertainment



(a) Share of AI Pricing in Pricing Jobs

(b) Share of AI Pricing in AI Jobs

(c) Share of Pricing Jobs in All Jobs

(d) Share of AI Jobs in All Jobs

AI:

IT
Business Services
Finance
Manufacuring

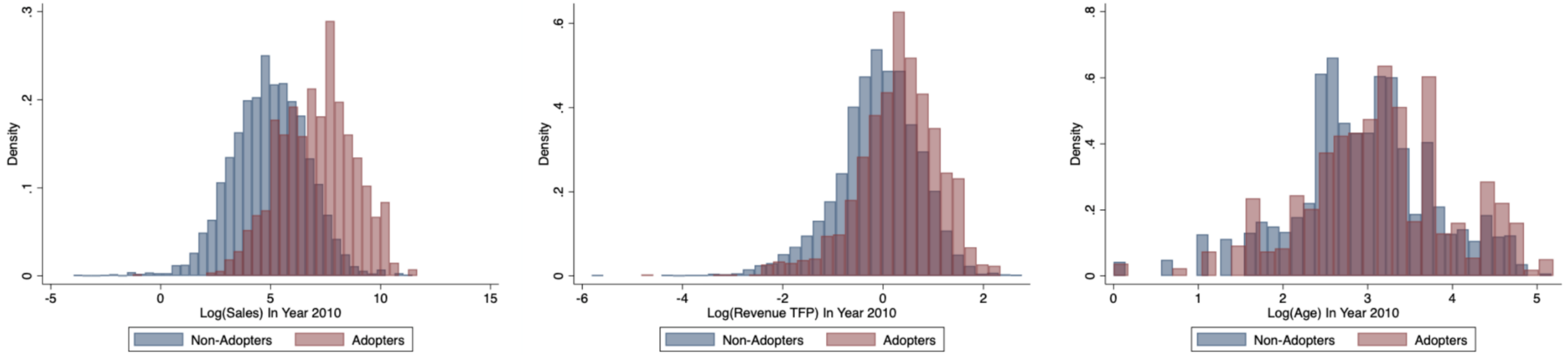
Takeaways

- A sharp rise of AI pricing jobs as a share of pricing jobs (0.12% to 1.34%)
- A (slow) decline of pricing jobs as a share of all jobs (0.93% to 0.59%)
  - Back of envelope calculation: AI pricing jobs $\uparrow$ by 1 $\Rightarrow$ Pricing jobs $\downarrow$ by 50
- Firms who deal with more real-time pricing tasks tend to adopt more
- AI pricing jobs grew more rapidly and spread to broader industries
  - Including transportation, IT, business services, finance, and retail
  - While AI jobs are dominantly concentrated in IT

[Firm-level Determinants of Adoption]

Distributions of Adopters and Non-Adopters

Figure 3: Distributions of AI Pricing Adopters and Non-Adopters In the Year 2010



(a) Size Distribution (b) TFP Distribution (c) Age Distribution

Notes: An adopter ($\mathbb{1}^{AP}_{j,2024Q1} = 1$) is a firm j that posted at least one AI pricing job since the beginning of our data sample until 2024Q1; Non-Adopter ($\mathbb{1}^{AP}_{j,2024Q1} = 0$) is a firm j that never posted AI pricing job since the beginning of our data sample until 2024Q1. We provide a comparison to AI adoption in Figure B4.

Firm-level Determinants of AI Pricing Adoption

Table 4: Firm-level Determinants of AI Pricing Adoption

	AI Pricing Adopter Dummy Indicator, 2010-2024Q1 ($\mathbb{1}^{AP}_{j,2024Q1} = 1$)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log Sales 2010	0.089***									0.109***
	(0.002)									(0.004)
Log TFP 2010		0.103***								0.024**
		(0.006)								(0.012)
Log Age 2010			0.032***							0.007
			(0.005)							(0.008)
Tobin's Q 2010				0.011***						0.006
				(0.003)						(0.004)
Log Markup					0.016**					0.009
					(0.007)					(0.016)
R&D/Sales 2010						-0.000				0.351***
						(0.000)				(0.065)
ROA 2010							-0.225***			0.130
							(0.081)			(0.136)
Cash/Assets 2010								-0.104***		0.020
								(0.023)		(0.042)
Debt/Assets 2010									0.071***	-0.013
									(0.020)	(0.037)
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	7768	7060	7304	7785	7748	3790	7776	7787	7299	3021
adj. R^2	0.205	0.060	0.022	0.018	0.017	0.021	0.017	0.004	0.002	0.239

Takeaways

- Larger, more productive, and more R&D intensive firms are more likely to adopt and adopt more
- Age, financial conditions, and operation conditions do not matter much

[AI Pricing and Firm Performance]

Long-differences Results

Table 7: AI Pricing and Firm Performance: Long-differences

	Δ Log Sales		Δ Log Employment		Δ Log Assets		Δ Log Markup	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta APS_{j,[2010,2023]}$	1.193***	0.857***	0.996***	0.559**	1.134***	0.806***	0.259	0.282**
	(0.332)	(0.291)	(0.286)	(0.252)	(0.343)	(0.309)	(0.166)	(0.121)
Share of AI		-0.029		-0.332		-0.237		-0.634**
		(0.663)		(0.570)		(0.706)		(0.277)
Share of Pricing		0.252		0.712***		0.321		-0.035
		(0.188)		(0.243)		(0.201)		(0.079)
Log Sales		-0.088***		-0.098***		-0.107***		0.005
		(0.009)		(0.008)		(0.009)		(0.004)
Log TFP		-0.014		0.118***		-0.013		-0.085***
		(0.020)		(0.018)		(0.021)		(0.008)
Log Age		-0.117***		-0.114***		-0.110***		0.003
		(0.016)		(0.014)		(0.017)		(0.007)
Tobin's Q		0.436***		0.360***		0.684***		-0.032**
		(0.035)		(0.032)		(0.038)		(0.015)
Cash/Assets		0.003		0.173*		-0.291***		0.184***
		(0.103)		(0.095)		(0.110)		(0.043)
Controls	N	Y	N	Y	N	Y	N	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y	Y	Y
N	4014	3583	3677	3293	4025	3587	4014	3583
adj. R^2	0.064	0.184	0.086	0.228	0.049	0.201	0.018	0.054

Long-differences Results

Table 8: AI Pricing and Heterogeneous Firm Performance: Long-differences

	Δ Log Sales		Δ Log Employment		Δ Log Assets	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta APS_{j,[2010,2023]} \times$ Size Small	0.606	0.235	0.606	0.235	0.606	0.235
	(0.516)	(0.479)	(0.516)	(0.479)	(0.516)	(0.479)
$\Delta APS_{j,[2010,2023]} \times$ Size Medium	2.008***	1.676***	2.008***	1.676***	2.008***	1.676***
	(0.605)	(0.534)	(0.605)	(0.534)	(0.605)	(0.534)
$\Delta APS_{j,[2010,2023]} \times$ Size Large	2.919***	2.305***	2.919***	2.305***	2.919***	2.305***
	(0.875)	(0.787)	(0.875)	(0.787)	(0.875)	(0.787)
Controls	N	Y	N	Y	N	Y
Industry×Szie Group FE	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y
N	4005	3583	4005	3583	4005	3583
adj. R^2	0.135	0.221	0.135	0.221	0.135	0.221

Evidence from High-frequency Monetary Shocks

$$R_{j,e} = \beta_0 + \beta_1 MP_e + \beta_2 MP_e \times X_{j,t-1} + \beta_3 X_{j,t-1} + \beta_4 Z_{j,t-1} + \beta_5 MP_e \times Z_{j,t-1} + \gamma_j + \gamma_e + \epsilon_{je},$$

- $R_{j,e}$ denotes the daily stock return of firm j in the event date e
- MP_e is our monetary shocks (sign-flipped, divided by 25 bps)
- $X_{j,t-1}$ denote the variables of interest (demeaned if are continuous), including
  - firm-level lagged AI pricing adoption dummy $1^{AP}_{j,t-1}$
  - firm-level lagged AI pricing adoption share $APS_{j,t-1}$
  - industry-level frequency of price adjustment FPA_s (standardized)

Evidence from High-frequency Monetary Shocks

Table 11: Response of Stock Return to Monetary Shocks: AI Pricing Share Baseline

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MP_e	2.394***	2.432***	2.488***		2.805***	2.898***	2.942***	
	(0.067)	(0.070)	(0.070)		(0.148)	(0.152)	(0.152)	
$MP_e \times APS_{j,t-1}$	3.930***	3.656***	3.546**	4.231***	6.680**	6.252**	5.810*	5.743**
	(1.360)	(1.398)	(1.410)	(1.275)	(2.990)	(2.948)	(3.021)	(2.744)
$APS_{j,t-1}$	0.084	-0.010	0.055	0.223	0.271	0.404	0.577	0.517
	(0.164)	(0.173)	(0.440)	(0.397)	(0.331)	(0.341)	(0.692)	(0.629)
$MP_e \times FPA_s$					0.494***	0.497***	0.510***	0.564***
					(0.127)	(0.129)	(0.129)	(0.117)
FPA_s					0.029*	0.025		
					(0.015)	(0.019)		
Controls	N	Y	Y	Y	N	Y	Y	Y
Firm FE	N	N	Y	Y	N	N	Y	Y
Event FE	N	N	N	Y	N	N	N	Y
N	112844	104855	104855	104855	28779	26790	26790	26790
adj. R^2	0.011	0.012	-0.008	0.176	0.013	0.015	-0.006	0.170

Evidence from High-frequency Monetary Shocks

Table 12: Response of Stock Return to Monetary Shocks: Interaction with Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$MP_e \times APS_{j,t-1}$	4.881*	5.354**	5.391**	5.377**	5.794**	5.362**	5.725**	5.460**	5.200*
	(2.704)	(2.694)	(2.695)	(2.695)	(2.695)	(2.694)	(2.699)	(2.694)	(2.715)
$MP_e \times FPA_s$	0.486***	0.470***	0.491***	0.469***	0.426***	0.430***	0.443***	0.406***	0.409***
	(0.116)	(0.116)	(0.122)	(0.116)	(0.117)	(0.118)	(0.118)	(0.120)	(0.127)
MP_e × Share of AI	10.855**								13.588***
	(4.608)								(4.702)
MP_e × Share of Pricing		-2.934							-2.762
		(2.108)							(2.113)
MP_e × Log Sales			-0.040						0.039
			(0.083)						(0.107)
MP_e × Log Age				-0.133					-0.159
				(0.170)					(0.182)
MP_e × Log TFP					-0.628***				-0.690***
					(0.164)				(0.251)
MP_e × Log Tobin's Q						-0.598**			-0.239
						(0.253)			(0.311)
MP_e × Cash/Asset							-1.351*		-0.889
							(0.775)		(1.016)
MP_e × Log Markup								-0.556**	0.262
								(0.235)	(0.345)
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Event FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	24432	24432	24432	24432	24432	24432	24432	24432	24432
adj. R^2	0.175	0.175	0.175	0.175	0.176	0.175	0.175	0.175	0.176

Increase APS
from 0 to 10%
is similar to
increase FPA by 1 std

Takeaways

- Firms with more AI pricing are associated with higher growth and markup
- Firms with more AI pricing have larger stock returns upon monetary expansion
  - Just as if the firm is in an industry with more flexible prices
- Magnitude: from non-AI-pricing to Amazon (16%), responses increase by 33%
- Equivalent to an increase in the frequency of price adjustment by two standard deviations!

Remarks and In-progress

- AI pricing is rising rapidly and is widely adopted in broad industries
- Preliminary results show that it may act as reducing price stickiness in the aggregate
- In-progress: A sticky information model + AI pricing and BLS micro-pricing patterns