De Loecker Eeckhout Unger

- Challenges of estimating production functions

  Last class.

Data Strategy

- 10K filings of U.S. corporations as collected by compustat
- Accounting statements
  - sales
  - cost of goods sold (COGS)
  - Selling General and Administrative expenses (SG&A)
  - measures of capital
  - sometimes labor, but not always, so putting that in COGS
- This revision adds US Census

Table A.1: Summary Statistics (1955-2016)

		Sample A			Sample B		
	Acronym, var.	Mean	Median	Nr Obs	Mean	Median	Nr Obs
Sales	*SALE, PQ*	1,922,074	147,806	247,644	5,894,779	578,912	28,116
Cost of Good Sold	*COGS, V*	1,016,550	55,384	247,644	2,970,693	195,087	28,116
Capital Stock	*PPEGT, K*	1,454,210	57,532	247,644	5,193,319	345,592	28,116
SG&A	*XSG&A, X*	342,805	29,682	247,644	926,542	78,487	28,116
Wage Bill	*XLR, WL*	1,093,406	130,486	28,116	1,093,406	130,486	28,116
Employment	*EMP, L*	8,363	863	221,121	24,861	4,522	25,527

Notes: Million USD deflated using the GDP Deflator with base year 2010. For each variable we list: the Compustat acronym, the associated notation (in levels) used throughout the manuscript.

Traditional Production Function with Fixed Costs

- Variable cost V and fixed K, plus F is overhead

- Estimate

$$\mu_{it} = \phi_{st}^{V} \frac{P_{it} Q_{it}}{P_{it}^{V} V_{it}}$$

  Then

$$\mu_t = \sum_i m_{it} \mu_{it}$$

  where m_{it} is market share

Appendix 4 A Selection of Firms' Individual Markups

	Markup μ_i					Empl. L_i thousands	Sales S_i millions (2010 $)
	1980	1990	2000	2010	2016	2016	2016
1-800-FLOWERS.COM	.	.	1.41	1.43	1.61	4	1,053
ALKERMES PLC	.	.	.	3.37	6.66	2	669
ALPHABET INC	.	.	.	2.50	2.23	72	81,025
AMAZON.COM INC	.	.	1.19	1.13	1.50	341	122,058
AMERICAN AIRLINES GROUP INC	.	.	.	0.98	1.31	122	36,064
ANHEUSER-BUSCH COS INC	1.21	1.46	1.60	.	.	.	.
ANHEUSER-BUSCH INBEV	.	.	.	2.43	2.83	207	40,855
APPLE INC	1.51	1.90	1.18	1.39	1.50	116	193,059
AT&T INC	.	2.31	.	1.83	1.53	269	146,989
BRIGHT SCHOLAR EDU-ADR	.	.	.	.	1.36	6	140
CAMPBELL SOUP CO	1.21	1.37	2.01	1.63	1.45	16	7,146
CAVIUM INC	.	.	.	2.65	3.39	2	542
COCA-COLA CO	1.58	2.32	3.17	2.86	2.54	100	37,575
COSTCO WHOLESALE CORP	.	.	0.99	0.99	1.05	218	106,559
DISNEY (WALT) CO	.	.	.	.	1.33	195	49,934
DR PEPPER SNAPPLE GROUP INC	.	.	.	2.35	2.32	20	5,780
GENERAL ELECTRIC CO	1.27	1.51	.	2.39	1.35	295	107,428
GOODYEAR TIRE & RUBBER CO	1.15	1.17	1.12	1.00	1.31	66	13,605
HARLEY-DAVIDSON INC	.	1.15	1.40	1.61	1.58	6	5,382
HEWLETT PACKARD ENTERPRISE	.	.	.	.	1.31	195	44,989
INTEL CORP	2.08	1.97	3.04	3.53	3.29	106	53,304
JOHNSON & JOHNSON	1.85	2.76	3.38	3.05	3.55	126	64,526
KELLOGG CO	1.45	1.88	2.03	1.68	1.54	37	11,653
KRAFT HEINZ CO	1.41	1.55	1.60	1.50	1.60	41	23,774
LEVI STRAUSS & CO	1.44	1.50	1.60	1.92	1.92	13	4,086

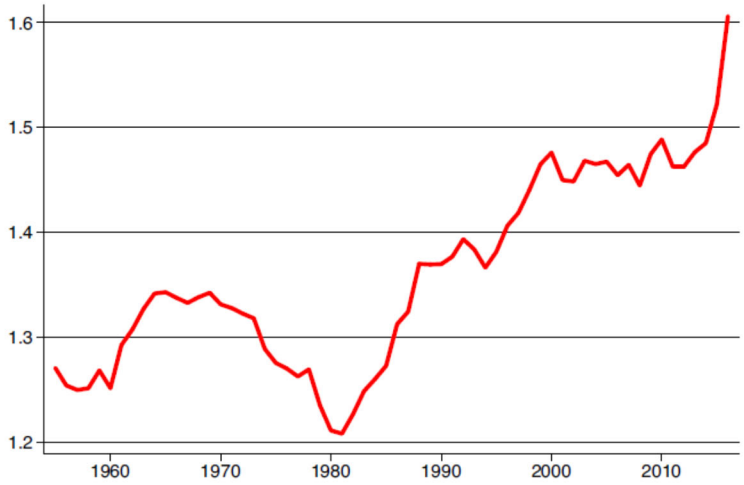


FIGURE I

Average Markups

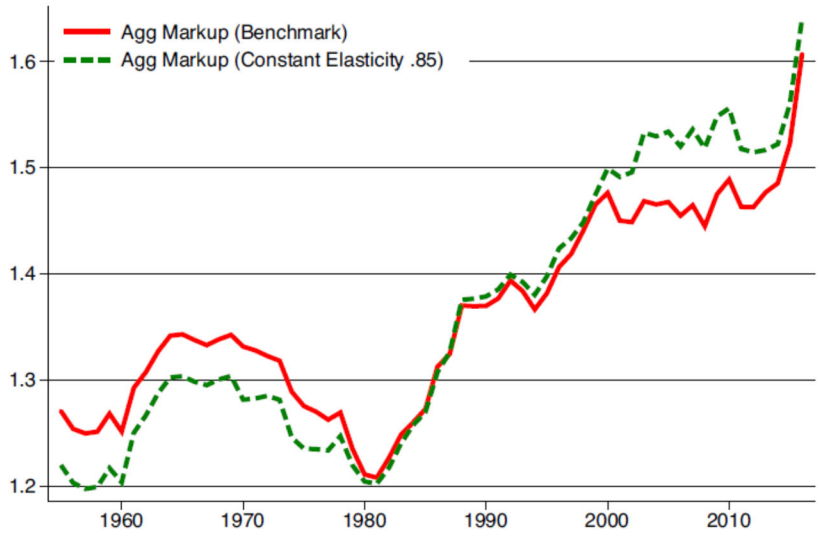
Output elasticities θ_{st} from the estimated production function are time-varying and sector-specific (two-digit). The average is revenue weighted. The figure illustrates the evolution of the average markup from 1955 to 2016.

III.A. Aggregate Markups

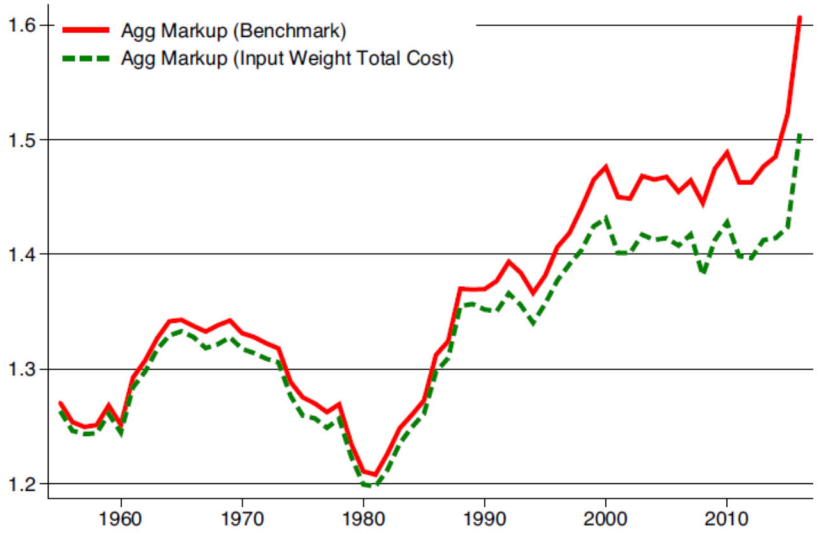
The measure of markups in equation (7) is the product of the output elasticity θ and the inverse of the variable input's revenue share $\frac{PQ}{P^V V}$. The latter is directly measured in the firm's income statement, and we estimate the former. Our estimated output elasticities are sector- and time-specific and thus capture technological differences across sectors and time.

We calculate the average markup as follows:

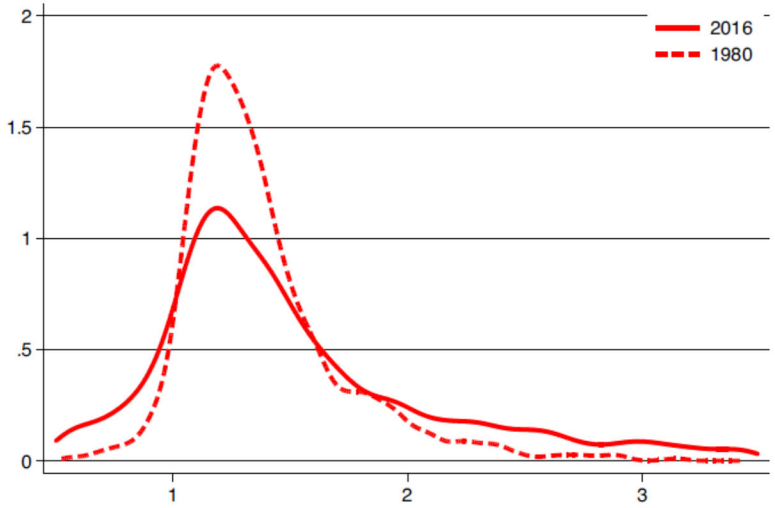
$$\mu_t = \sum_i m_{it} \mu_{it}, \tag{8}$$



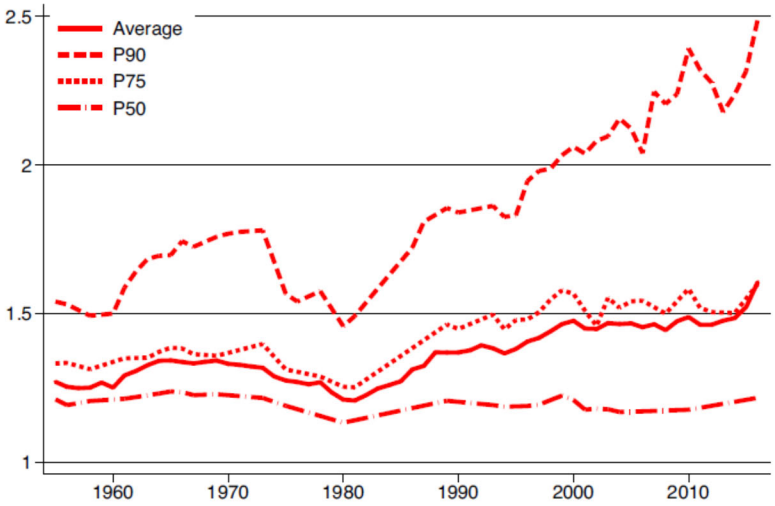
(A) Constant elasticity



(B) Input weighted (total cost)



(A) Kernel density (unweighted)



(B) Percentiles markup distribution (revenue weight)

FIGURE III

The Distribution of Markups μ_{it}

follows:

$$\Delta\mu_t = \underbrace{\sum_i m_{i,t-1}\Delta\mu_{it}}_{\Delta\text{within}} + \underbrace{\underbrace{\sum_i \tilde{\mu}_{i,t-1}\Delta m_{i,t}}_{\Delta\text{market share}} + \underbrace{\sum_i \Delta\mu_{i,t}\Delta m_{i,t}}_{\Delta\text{cross term}}}_{\Delta\text{reallocation}}$$

$$(9) \qquad + \underbrace{\sum_{i\in\text{Entry}} \tilde{\mu}_{i,t}m_{i,t} - \sum_{i\in\text{Exit}} \tilde{\mu}_{i,t-1}m_{i,t-1}}_{\text{net entry}},$$

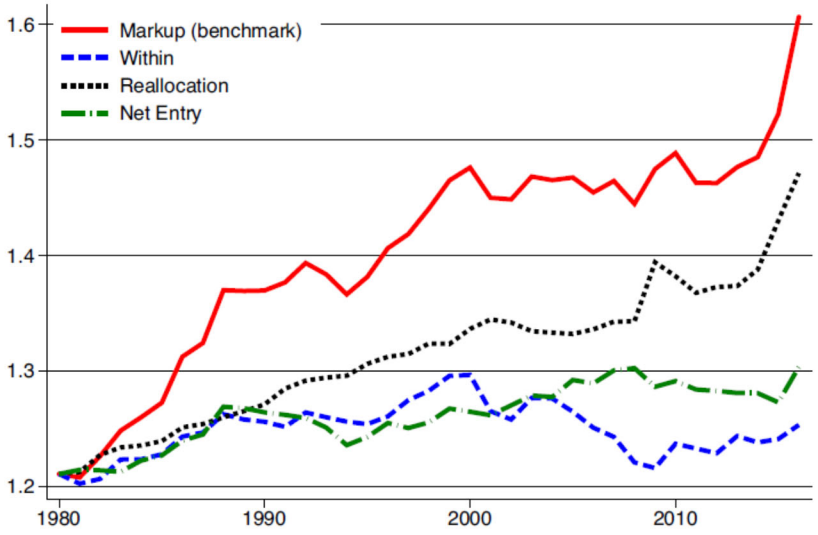


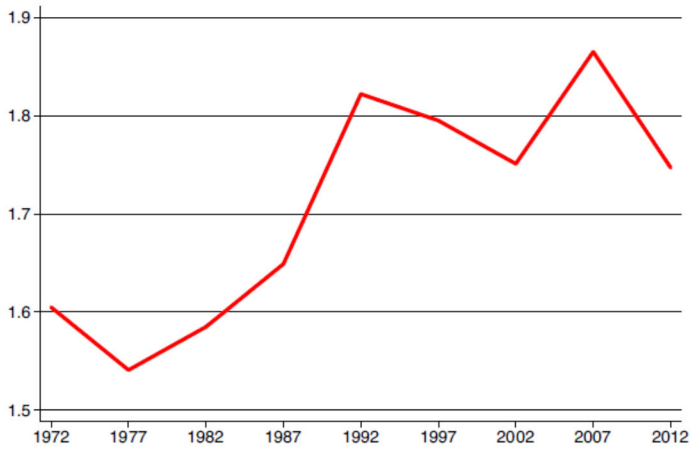
FIGURE IV

Decomposition of Markup Growth at the Firm Level

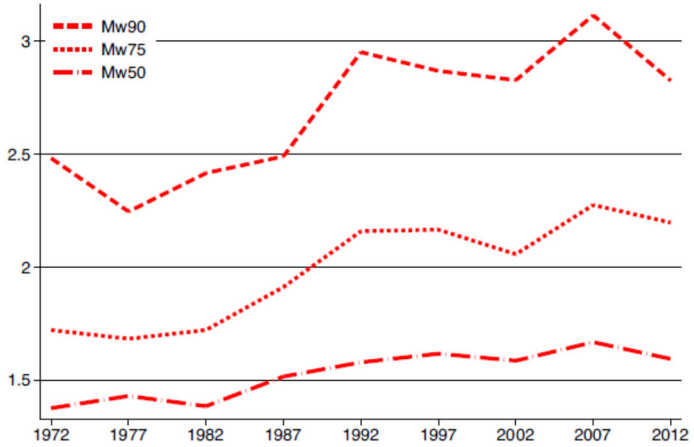
that we estimated from the publicly traded firms.

In the Census of Manufacturing, we use the cost shares to construct the output elasticity of any variable input (labor and materials) at the four-digit NAICS industry level (denoted by n) by census year.[29] This leads to the standard recovery of the output elasticity for the variable input:

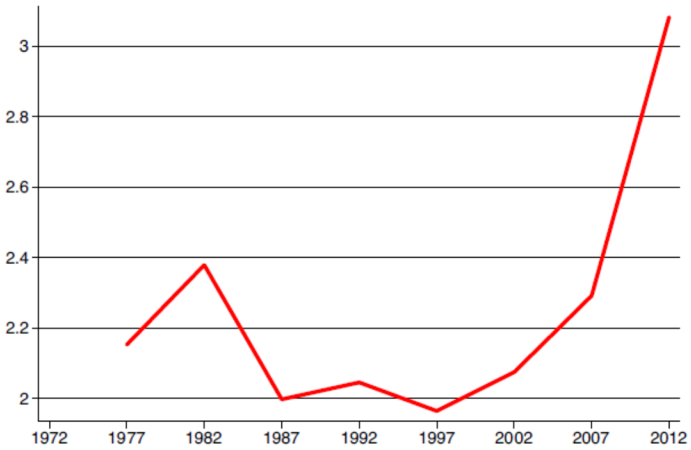
$$\theta_{nt}^{V} = N_{nt}^{-1} \sum_{j \in n} \frac{P_{jt}^{V} V_{jt}}{P_{jt}^{V} V_{jt} + r_{nt} K_{jt}}, \tag{12}$$



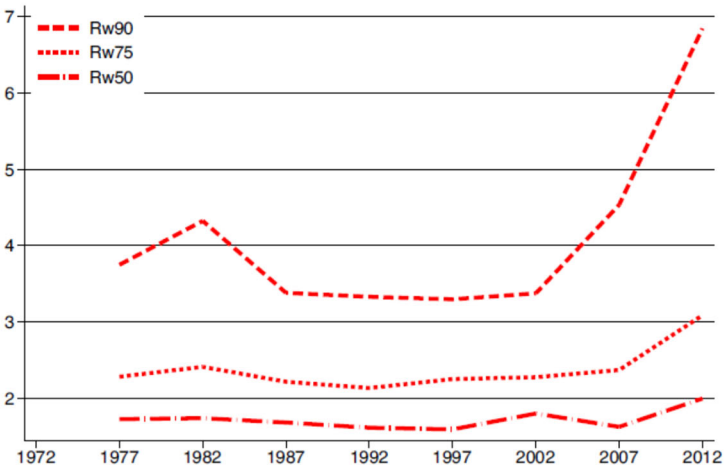
(A) Manufacturing: average



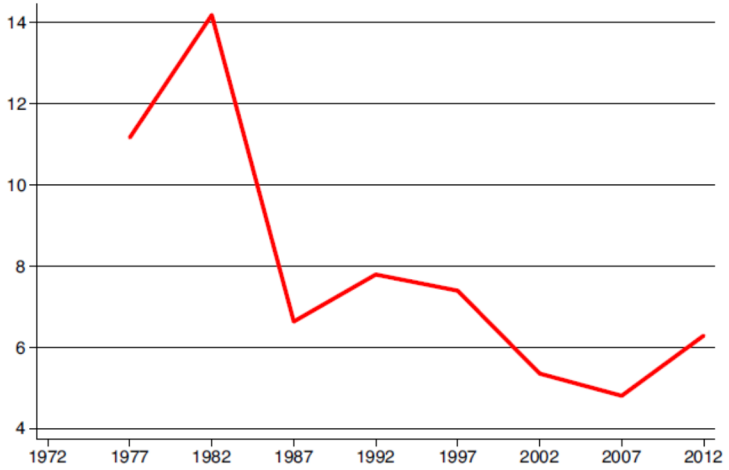
(B) Manufacturing: percentiles



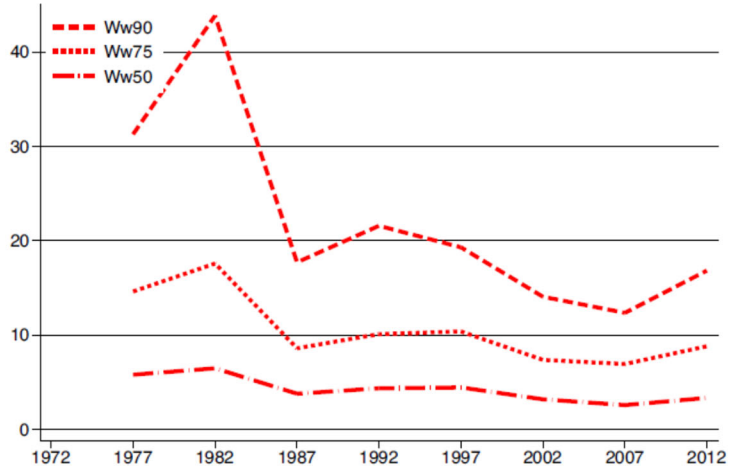
(C) Retail: average



(D) Retail: percentiles



(E) Wholesale: average



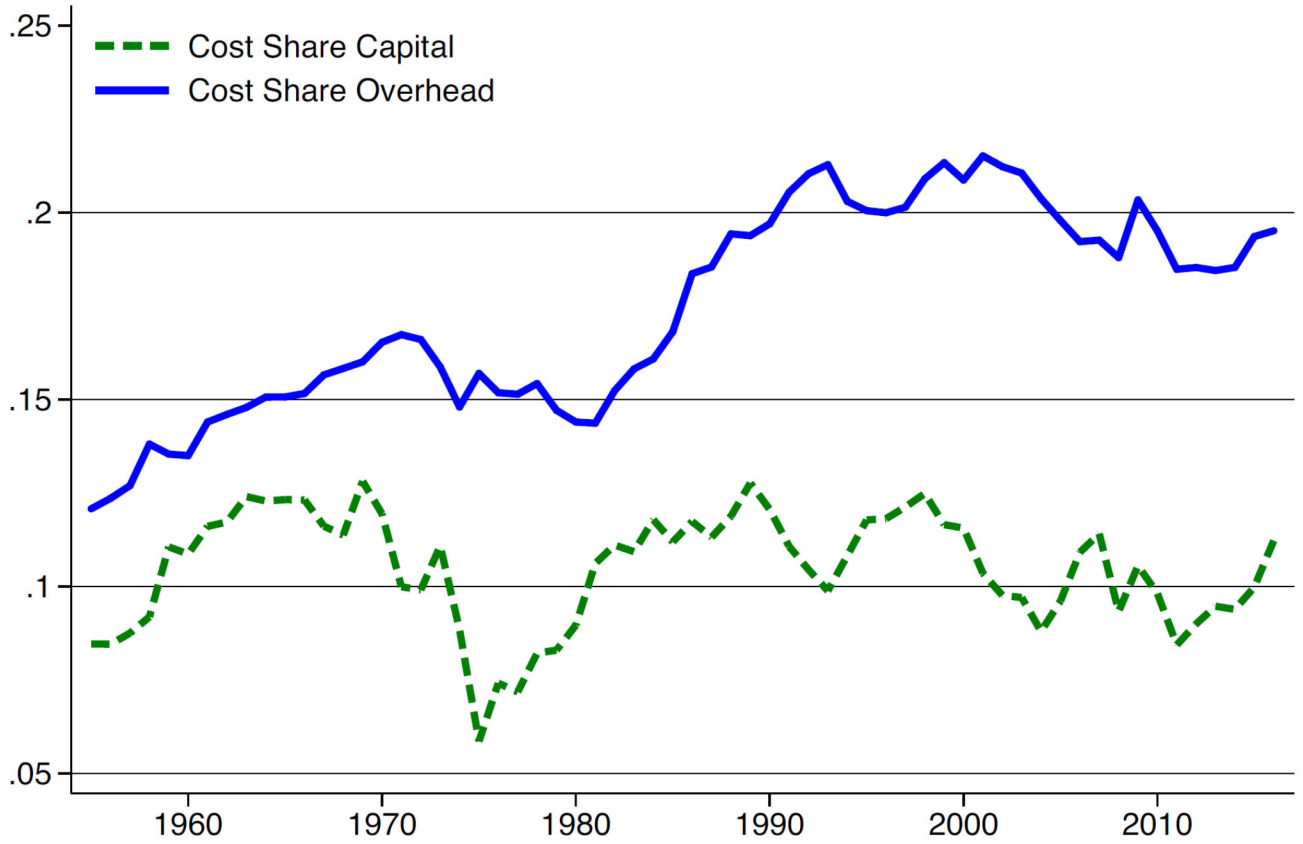
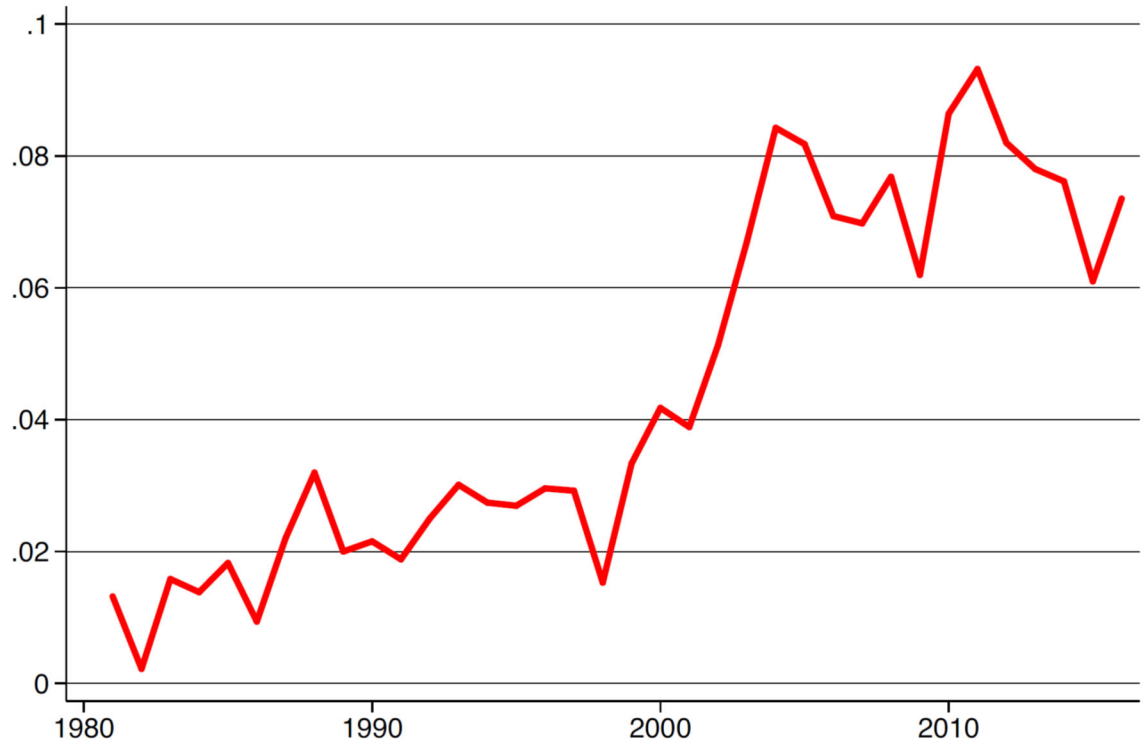


FIGURE VII

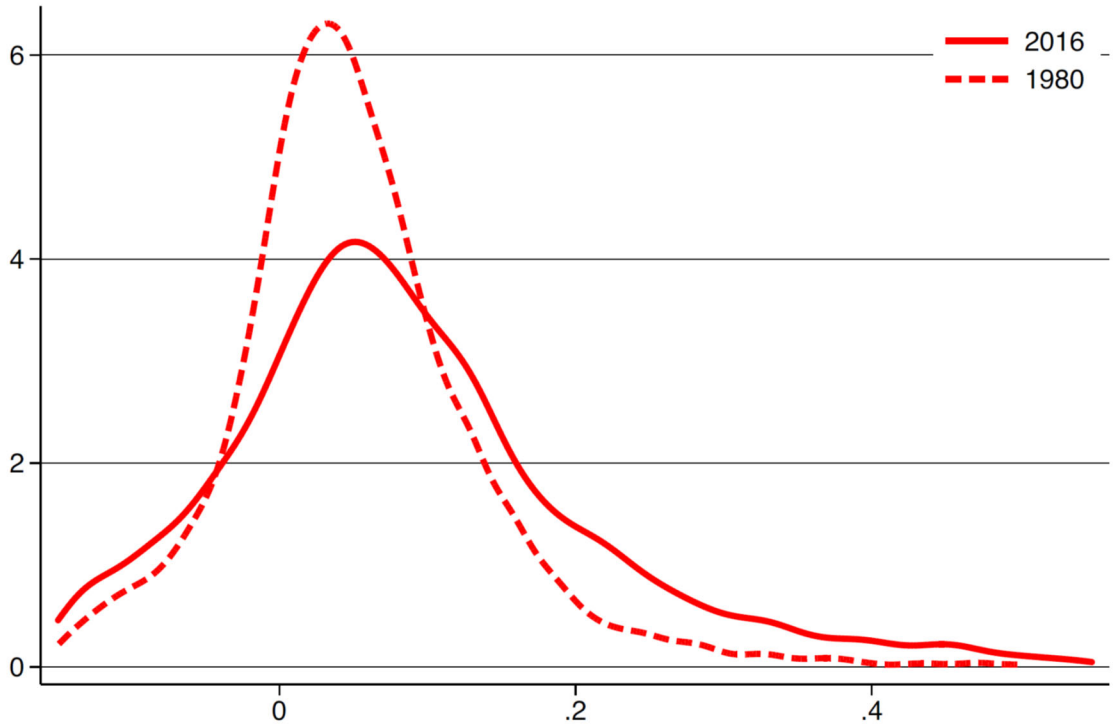
Aggregate Overhead and Capital Cost Shares of Total Cost

Let $\Pi_i = S_{it} - P_t^V V_{it} - r_t K_{it} - P_t^X X_{it}$ denote net profits, where $P_t^X X_{it} = F_{it}$ denotes expenditure on overhead as measured by SG&A and is equal to the fixed cost.[36] Then the net profit rate $\pi_{it} = \frac{\Pi_{it}}{S_{it}}$ can be written as:

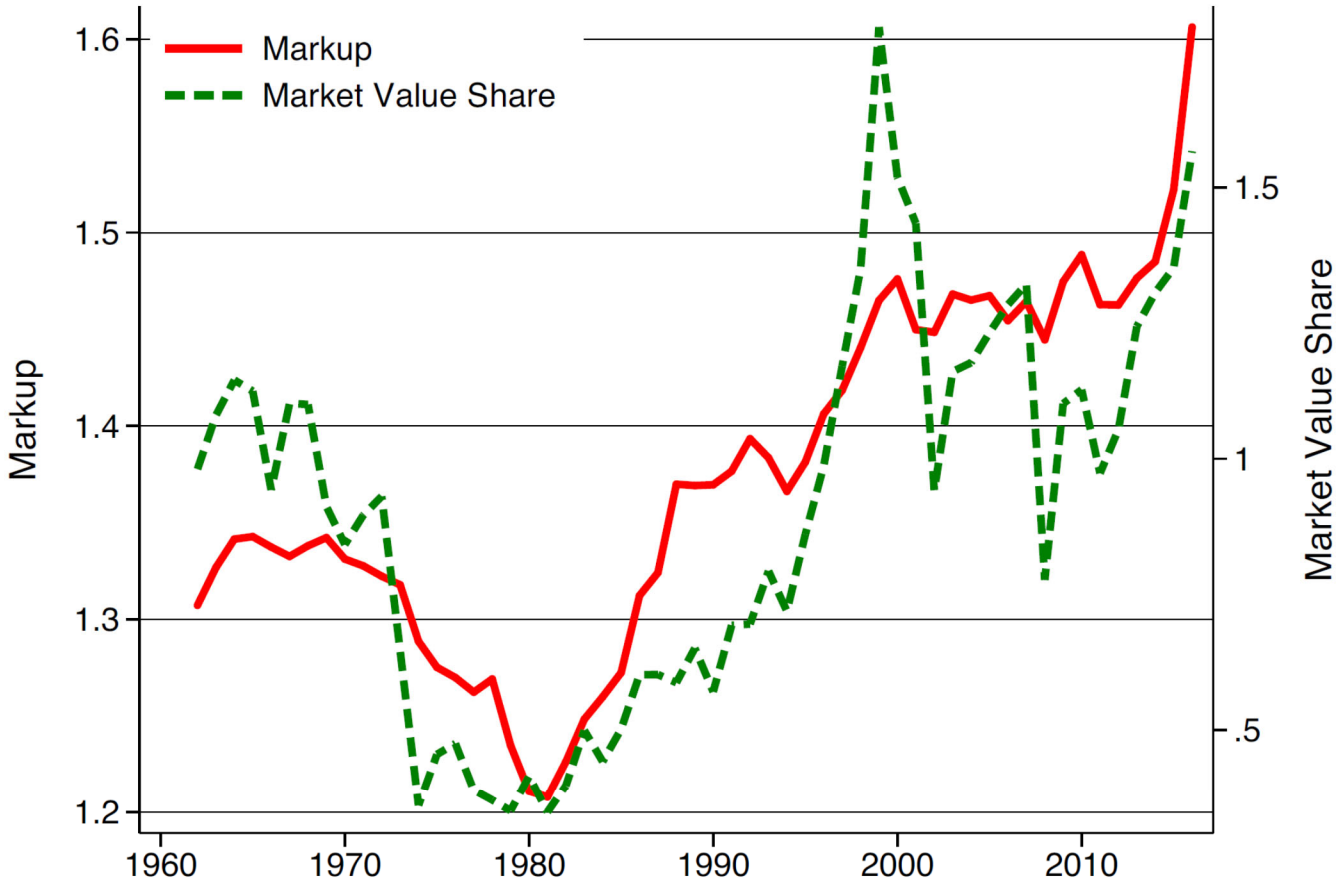
$$\pi_{it} = 1 - \frac{\theta_{st}}{\mu_{it}} - \frac{r_t K_{it}}{S_{it}} - \frac{P_t^X X_{it}}{S_{it}}, \tag{13}$$



(A) Average profit rate (revenue weighted)



(B) Kernel density profit rate (unweighted)



(A) Average market value (share of sales), markup

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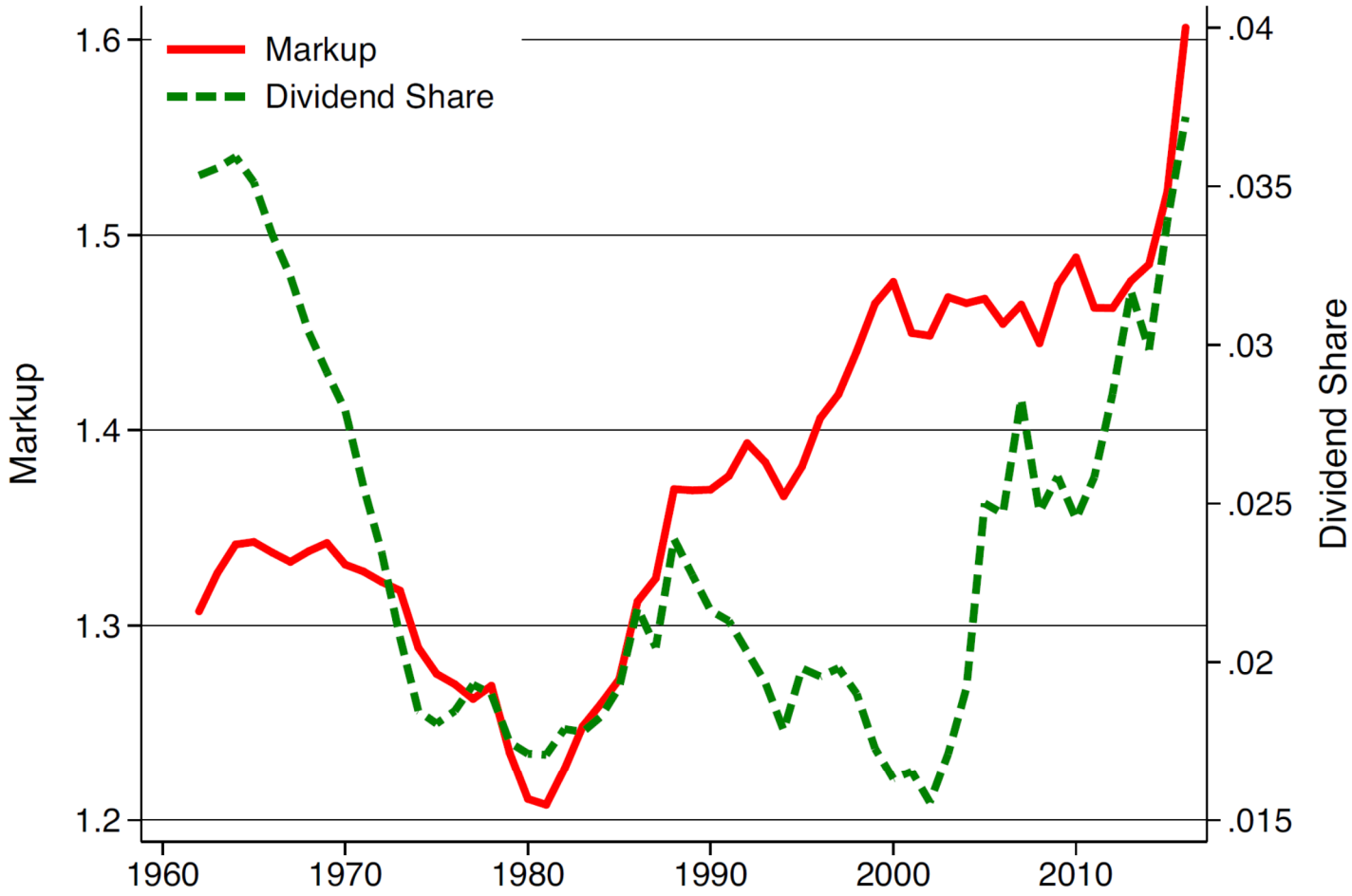

(B) Average dividends (share of sales), markup

TABLE II

FIRM-LEVEL REGRESSIONS: MARKET VALUES AND DIVIDENDS ON MARKUPS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\ln\left(\frac{\text{market value}}{\text{sales}}\right)$				ln(market value)			
ln(markup)	0.71	0.64	0.56	0.17	0.71	0.65	0.58	0.27
	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
ln(sales)					0.81	0.81	0.83	0.68
					(0.00)	(0.00)	(0.00)	(0.01)
Year fixed effects		Y	Y	Y		Y	Y	Y
Sector fixed effects			Y				Y	
Firm fixed effects				Y				Y
R^2	0.05	0.13	0.21	0.68	0.68	0.71	0.73	0.89
	$\ln\left(\frac{\text{dividends}}{\text{sales}}\right)$				ln(dividends)			
ln(markup)	1.05	0.97	0.80	0.26	1.03	0.93	0.78	0.26
	(0.04)	(0.03)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)
ln(sales)					0.94	0.92	0.93	0.76
					(0.01)	(0.01)	(0.01)	(0.02)
Year fixed effects		Y	Y	Y		Y	Y	Y
Sector fixed effects			Y				Y	
Firm fixed effects				Y				Y
R^2	0.06	0.11	0.17	0.70	0.66	0.68	0.70	0.89

Note: Standard errors clustered by firm are in brackets.