Who is in the Driver's Seat?

Markups, Markdowns & Firm Relationships in the Car Industry

Nadine Hahn

KU Leuven, ZEW Mannheim & MaCCI

August 30, 2023

Motivation

Markups along Value Chains

- Increasing interest in empirical literature for markup estimation

Motivation

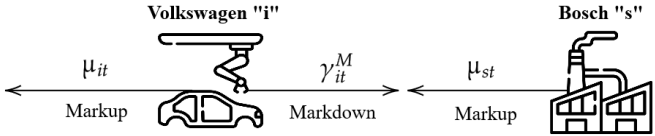
Markups along Value Chains

- Increasing interest in empirical literature for markup estimation
  - Goal: Analysing presence and implications of market power

Motivation

Markups along Value Chains

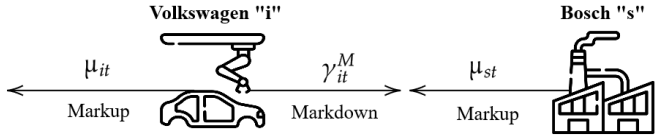
- Increasing interest in empirical literature for markup estimation
  - Goal: Analysing presence and implications of market power
- Firms can exert market power towards consumers *and* suppliers :



Motivation

Markups along Value Chains

- Increasing interest in empirical literature for markup estimation
  - Goal: Analysing presence and implications of market power
- Firms can exert market power towards consumers *and* suppliers :

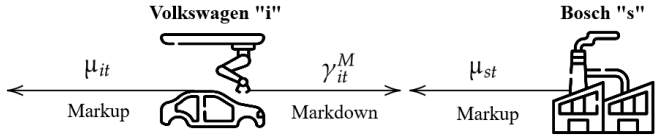


- Standard assumption: $\mu_{st} = 1$ and/or $\gamma_{it}^{M} = 1$

Motivation

Markups along Value Chains

- Increasing interest in empirical literature for markup estimation
  - Goal: Analysing presence and implications of market power
- Firms can exert market power towards consumers *and* suppliers :



- Standard assumption: $\mu_{st} = 1$ and/or $\gamma_{it}^{M} = 1$
  - If violated: markup estimate = total margin (markup+markdown)

Research Questions/Contributions

- Research Questions:
  - How are margins split along the value chain of the car industry?

Research Questions/Contributions

- Research Questions:
  - How are margins split along the value chain of the car industry?
  - Which firm-level characteristics drive the split of the margins?

- Contributions:

Research Questions/Contributions

- Research Questions:
  - How are margins split along the value chain of the car industry?
  - Which firm-level characteristics drive the split of the margins?

- Contributions:
  - 1) Markup estimation with profit sharing in input markets

Research Questions/Contributions

- Research Questions:
  - How are margins split along the value chain of the car industry?
  - Which firm-level characteristics drive the split of the margins?

- Contributions:
  - 1) Markup estimation with profit sharing in input markets
  - 2) Backing out relative bargaining weights from the supply side

Research Questions/Contributions

- Research Questions:
  - How are margins split along the value chain of the car industry?
  - Which firm-level characteristics drive the split of the margins?

- Contributions:
  - 1) Markup estimation with profit sharing in input markets
  - 2) Backing out relative bargaining weights from the supply side
  - 3) Production function estimation controlling for product characteristics & prices

Regarding Contribution 3):

- Production function estimation requires comparable output and input measures
  - Car models are not necessarily comparable:

Regarding Contribution 3):

- Production function estimation requires comparable output and input measures
  - Car models are not necessarily comparable:

Regarding Contribution 3):

- Production function estimation requires comparable output and input measures
  - Car models are not necessarily comparable:

- Proposed solution: including car characteristics to the estimation procedure

Structure of the Presentation

Structure of the Presentation

Structure of the Presentation

Structure of the Presentation

Structure of the Presentation

Structure of the Presentation

Measures for Markdowns and Markups

- Markdown Manufacturer i:
  - Profit maximizing
  - Input price P_{it}^M
  - Marginal revenue product of material input MRP_{it}^M

$$\gamma_{it}^M = \frac{MRP_{it}^M}{P_{it}^M} \tag{1}$$

Measures for Markdowns and Markups

- Markdown Manufacturer i:
  - Profit maximizing
  - Input price P_{it}^M
  - Marginal revenue product of material input MRP_{it}^M

$$\gamma_{it}^M = \frac{MRP_{it}^M}{P_{it}^M} \tag{1}$$

- Markups Supplier s:
  - Cost minimizing
  - $P_{st} = P_{it}^M$
  - Supplier's marginal cost MC_{st}

$$\mu_{st} = \frac{P_{it}^M}{MC_{st}} \tag{2}$$

Measures for Markdowns and Markups

Graphical Illustration

- (1)=(2) results in the markdown equation:

$$\gamma_{it}^{M} = \frac{1}{\mu_{st}} \frac{MRP_{it}^{M}}{MC_{st}} \tag{3}$$

Measures for Markdowns and Markups

Graphical Illustration

- (1)=(2) results in the markdown equation:

$$\gamma_{it}^{M} = \frac{1}{\mu_{st}} \frac{MRP_{it}^{M}}{MC_{st}} \tag{3}$$

- Consists of two parts:
  - Inverse supplier markups
  - Shared margin

Measures for Markdowns and Markups

Graphical Illustration

- (1)=(2) results in the markdown equation:

$$\gamma_{it}^{M} = \frac{1}{\mu_{st}} \frac{MRP_{it}^{M}}{MC_{st}} \tag{3}$$

- Consists of two parts:
  - Inverse supplier markups
  - Shared margin
- Manufacturers' markups with input distortions:
  - $\rightarrow$ e.g. Rubens (2023) in Leontief setting

$$\mu_{it} = \frac{P_{it}}{MC_{it}} = \frac{1}{\frac{\alpha_{it}^{L}}{\theta_{it}^{L}} + \alpha_{it}^{M} \gamma_{it}^{M}} \tag{4}$$

Profit Sharing - Industry Background

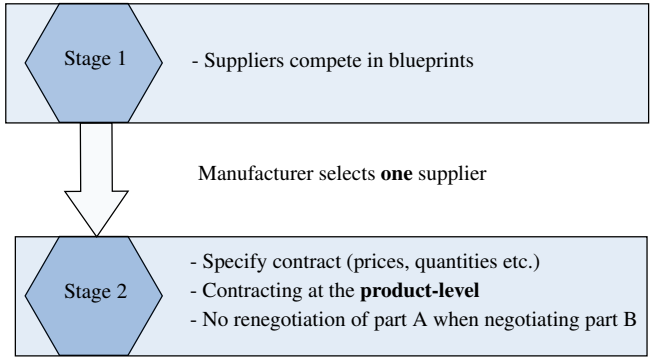
Calzolari et al. (2022)

- Car production period: 6-7 years with annual/biannual facelifts

Profit Sharing - Industry Background

Calzolari et al. (2022)

- Car production period: 6-7 years with annual/biannual facelifts
- Two-stage procurement process:



Intuition - Markups, Markdowns & Profit Sharing

Theoretical Background

- Firms alternate offers for linear P_{it}^{M} of M_{it}^{*}

Intuition - Markups, Markdowns & Profit Sharing

Theoretical Background

- Firms alternate offers for linear P_{it}^{M} of M_{it}^{*}
- Shared margin: $(MRP_{it}^{M} - MC_{st})M_{it}^{*}$

Intuition - Markups, Markdowns & Profit Sharing

Theoretical Background

- Firms alternate offers for linear P_{it}^{M} of M_{it}^{*}
- Shared margin: $(MRP_{it}^{M} - MC_{st})M_{it}^{*}$
- Nash-Bargaining product

Intuition - Markups, Markdowns & Profit Sharing

Theoretical Background

- Firms alternate offers for linear P_{it}^M of M_{it}^*
- Shared margin: $(MRP_{it}^M - MC_{st})M_{it}^*$
- Nash-Bargaining product
- FOC relates bargaining weights, Lerner-type markdown and Lerner markup: Illustration

$$\frac{\frac{MRP_{it}^M - P_{it}^M}{P_{it}^M}}{\frac{P_{it}^M - MC_{st}}{P_{it}^M}} = \frac{b}{(1-b)} \tag{5}$$

Intuition - Markups, Markdowns & Profit Sharing

Theoretical Background

- Firms alternate offers for linear P_{it}^M of M_{it}^*
- Shared margin: $(MRP_{it}^M - MC_{st})M_{it}^*$
- Nash-Bargaining product
- FOC relates bargaining weights, Lerner-type markdown and Lerner markup: Illustration

$$\frac{\frac{MRP_{it}^M - P_{it}^M}{P_{it}^M}}{\frac{P_{it}^M - MC_{st}}{P_{it}^M}} = \frac{b}{(1-b)} \tag{5}$$

- Inserting γ_{it}^M and μ_{st}:

$$\frac{\gamma_{it}^M - 1}{1 - \mu_{st}^{-1}} = \frac{b}{(1-b)} \tag{6}$$

Equations That I Take to the Data:

- Markdowns Manufacturer i:
  - α_{st}^{z}: revenue shares of supplier s with $z = (L, M)$
  - θ_{st}^{L}: output elasticity of L supplier s

$$\gamma_{it}^{M} = \mu_{st}^{-1} \frac{MRP_{it}^{M}}{MC_{st}} \propto \mu_{st}^{-1} = \frac{\alpha_{st}^{L}}{\theta_{st}^{L}} + \alpha_{st}^{M} \tag{7}$$

Green $\rightarrow$ From Data

Blue $\rightarrow$ Estimates

Equations That I Take to the Data:

- Markdowns Manufacturer i:
  - α_{st}^{z}: revenue shares of supplier s with $z = (L, M)$
  - θ_{st}^{L}: output elasticity of L supplier s

$$\gamma_{it}^{M} = \mu_{st}^{-1} \frac{MRP_{it}^{M}}{MC_{st}} \propto \mu_{st}^{-1} = \frac{\alpha_{st}^{L}}{\theta_{st}^{L}} + \alpha_{st}^{M} \tag{7}$$

- Total Margin Manufacturer ψ_{it}:

$$\psi_{it} = \frac{1}{\frac{\alpha_{it}^{L}}{\theta_{it}^{L}} + \alpha_{it}^{M}} \tag{8}$$

Green $\rightarrow$ From Data

Blue $\rightarrow$ Estimates

Dataset

- Balance sheet information (sales, wagebill, number of employees etc.) ▸▸ Stat1 ▸▸ Stat2

Dataset

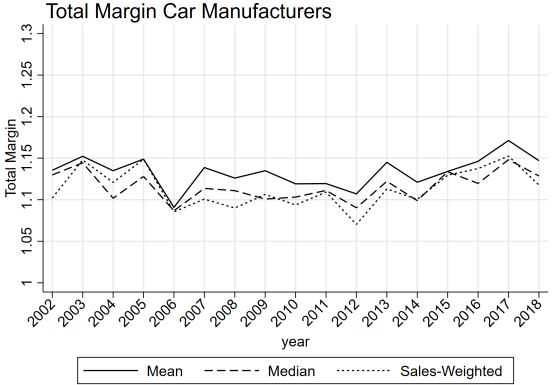
- Balance sheet information (sales, wagebill, number of employees etc.) Stat1 Stat2
- Contracting data between manufacturers and suppliers
  - Level of: supplier/part/model/manufacturer-location Stat3

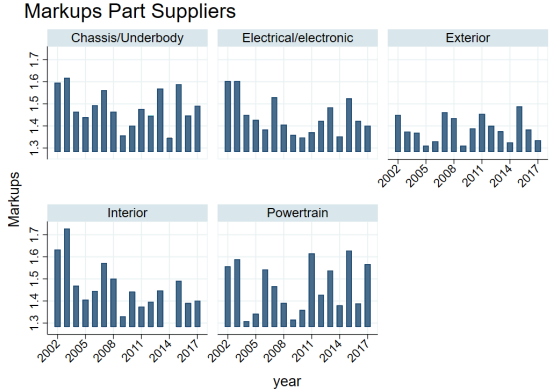
Dataset

- Balance sheet information (sales, wagebill, number of employees etc.) Stat1 Stat2
- Contracting data between manufacturers and suppliers
  - Level of: supplier/part/model/manufacturer-location Stat3
- Sales-weighted plant-level prices and characteristics of manufacturers Stats4 Stat5

Results I:

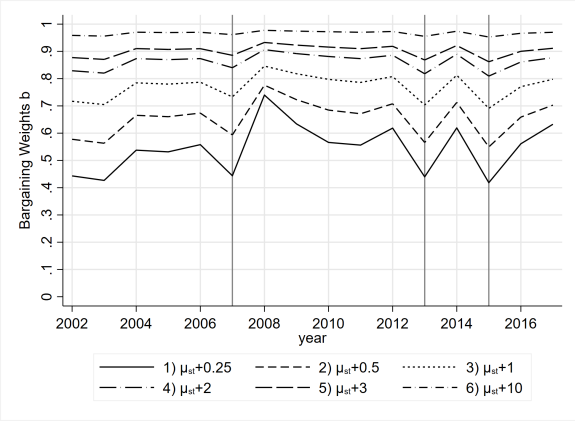
Stable Car Manufacturers' Margin/Volatile Suppliers' Markups

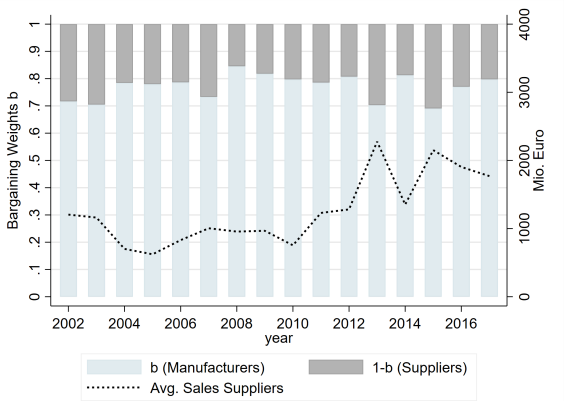




Results II:

Fluctuating Bargaining Weights of Manufacturers





Results III:

Firm-Level Analysis of Markups and Markdowns

Car Manufacturers' Markdowns:

- Highly dispersed **within** car manufacturing groups
- Significantly higher for Mini producers

Results III:

Firm-Level Analysis of Markups and Markdowns

Car Manufacturers' Markdowns:

- Highly dispersed **within** car manufacturing groups
- Significantly higher for Mini producers

Part Suppliers' Markups:

- Highly correlated with:
- Relationship intensity (positively) and
- Size of product portfolio (negatively).

Conclusions

Relating to the Bigger Picture

- Distribution of margins along the value chain varies within and between firms:

Conclusions

Relating to the Bigger Picture

- Distribution of margins along the value chain varies within and between firms:
  - Car manufacturers' total margin stayed constant

Conclusions

Relating to the Bigger Picture

- Distribution of margins along the value chain varies within and between firms:
  - Car manufacturers' total margin stayed constant

    $\rightarrow$ cost shocks from suppliers' markups are not passed on

Conclusions

Relating to the Bigger Picture

- Distribution of margins along the value chain varies within and between firms:
  - Car manufacturers' total margin stayed constant

    $\rightarrow$ cost shocks from suppliers' markups are not passed on
  - Dispersed markdowns within car manufacturer groups

Conclusions

Relating to the Bigger Picture

- Distribution of margins along the value chain varies within and between firms:
  - Car manufacturers' total margin stayed constant

    $\rightarrow$ cost shocks from suppliers' markups are not passed on
  - Dispersed markdowns within car manufacturer groups

    $\rightarrow$ bargaining weights vary with major crises
  - Suppliers' markups correlate with product portfolio and relationship intensity

Conclusions

Relating to the Bigger Picture

- Distribution of margins along the value chain varies within and between firms:
  - Car manufacturers' total margin stayed constant

    $\rightarrow$ cost shocks from suppliers' markups are not passed on
  - Dispersed markdowns within car manufacturer groups

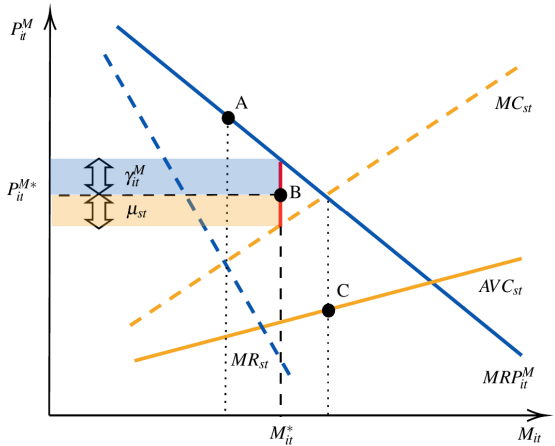
    $\rightarrow$ bargaining weights vary with major crises
  - Suppliers' markups correlate with product portfolio and relationship intensity

- Margin distribution along value chain could paint a different picture of market power than markups only

Thank You

Intuition - Graphical Illustration

$$\gamma_{it}^{M} = \frac{1}{\mu_{st}} \frac{MRP_{it}^{M}}{MC_{st}} \tag{9}$$



Balance Sheet Data

Revenue & Expenditure Shares

Back

	rev_M	exp_M	rev_L	exp_L
2002	0.776	0.866	0.073	0.084
2003	0.760	0.862	0.071	0.076
2004	0.773	0.886	0.061	0.070
2005	0.783	0.881	0.069	0.075
2006	0.804	0.891	0.069	0.073
2007	0.806	0.901	0.064	0.071
2008	0.804	0.899	0.064	0.071
2009	0.765	0.882	0.073	0.077
2010	0.801	0.886	0.070	0.075
2011	0.814	0.904	0.061	0.066
2012	0.801	0.896	0.069	0.074
2013	0.796	0.886	0.070	0.076
2014	0.814	0.902	0.067	0.073
2015	0.834	0.914	0.061	0.066
2016	0.827	0.914	0.062	0.067
2017	0.816	0.920	0.058	0.064
2018	0.843	0.922	0.054	0.058
2019	0.835	0.927	0.051	0.054

Manufacturers

	rev_M	exp_M	rev_L	exp_L
2002	0.868	0.557	0.059	0.036
2003	0.862	0.563	0.067	0.036
2004	0.788	0.582	0.094	0.066
2005	0.853	0.592	0.061	0.043
2006	0.879	0.590	0.051	0.033
2007	0.863	0.601	0.068	0.045
2008	0.807	0.613	0.084	0.061
2009	0.829	0.593	0.091	0.053
2010	0.809	0.600	0.106	0.069
2011	0.878	0.619	0.066	0.040
2012	0.856	0.615	0.073	0.059
2013	0.902	0.608	0.055	0.032
2014	0.778	0.612	0.143	0.072
2015	0.869	0.602	0.083	0.050
2016	0.885	0.602	0.045	0.034
2017	0.820	0.603	0.101	0.045
2018	0.800	0.624	0.072	0.045

Suppliers

Balance Sheet Data

Summary Statistics

Intro

	Capital	Revenue	Materials	Wages	Employees
2002	10490	38341	23140	1231	270
2003	10090	46477	24531	1379	260
2004	10856	23098	14156	1314	294
2005	10028	16196	8317	1384	264
2006	9021	22461	13348	1257	253
2007	8404	30526	21038	1236	264
2008	8374	27445	18996	1516	270
2009	7951	24137	16481	2453	225
2010	8176	26431	17903	1929	250
2011	8762	38655	30152	1960	254
2012	9600	29158	20234	2322	250
2013	9754	54782	36810	2588	272
2014	10153	40159	27818	3134	275
2015	11145	67476	45095	3016	281
2016	10848	49691	31973	2496	279
2017	11326	51563	33760	2387	320
2018	9152	47780	39134	2563	319

Monetary Values in Thousands

Manufacturers

	Capital	Revenue	Materials	Wages	Employees
2002	10490	38341	23140	1231	270
2003	10090	46477	24531	1379	260
2004	10856	23098	14156	1314	294
2005	10028	16196	8317	1384	264
2006	9021	22461	13348	1257	253
2007	8404	30526	21038	1236	264
2008	8374	27445	18996	1516	270
2009	7951	24137	16481	2453	225
2010	8176	26431	17903	1929	250
2011	8762	38655	30152	1960	254
2012	9600	29158	20234	2322	250
2013	9754	54782	36810	2588	272
2014	10153	40159	27818	3134	275
2015	11145	67476	45095	3016	281
2016	10848	49691	31973	2496	279
2017	11326	51563	33760	2387	320
2018	9152	47780	39134	2563	319

Monetary Values in Thousands

Suppliers

Contracting Data

Back

	mean	p25	p50	p75	N
Observations per Supplier - Overall:					
Contracts	462.89	102	284	638	18160
Manufacturer Plants	65.76	33	77	95	18160
Car Models	105.09	44	115	159	18160
Products (wide categories)	3.82	3	4	5	18160
Products (narrow categories)	13.90	5	12	21	18160
Observations Manufacturers - Overall:					
Contracts	360.44	223	294	532	7091
Supplier Groups	97.80	72	86	138	7091
Car Models	2.79	2	3	4	7091
Contracts Suppliers - Manufacturers from Dataset:					
Contracts	155.12	34	115	210	5077
Manufacturer Plants	21.22	13	25	30	5077
Car Models	34.11	20	39	49	5077
Products (wide categories)	3.51	2	4	5	5077
Products (narrow categories)	10.87	5	10	16	5077
Contracts Manufacturers - Suppliers from Dataset:					
Contracts	258.05	145	223	359	5077
Supplier Groups	58.06	41	54	77	5077
Car Models	2.78	2	3	4	5077

Data - Characteristics and Prices

Summary Statistics

Back

	mean	p25	p50	p75	count
Horsepower	82.97	61.14	85.36	98.39	480
Cylinder	1618.80	1332.45	1604.11	1823.17	480
Length	423.86	398.06	426.18	449.59	480
Width	175.28	169.69	176.35	181.06	480
Height	150.52	145.33	148.55	152.97	480
Liter	5.41	4.69	5.33	6.03	480
Price	22244.11	14245.66	21394.96	28754.42	480

Characteristics and Prices

Correlations

Back