

# Market Power under Heterogeneous Financial Frictions

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# Motivation

- Observed increase in market power in recent decades across advanced economies currently a hot topic: actual (De Loecker & Eeckhout, 2018) vs. measurement error (Gutierrez & Philippon, 2019); causes (Autor et al., 2017; Haskel & Westlake, 2017).
  - ▶ Agreement on two facts: 1. heterogeneous firms (markups, productivity, profits, ...); 2. estimated markups not necessarily related to actual profits (variable vs. fixed costs)
- Role of financial frictions:
  - ▶ Under imperfect financial markets, firms might raise prices (markups) in response to adverse demand shocks, in order to preserve internal liquidity and avoid accessing (costly) external finance (Gilchrist et al., 2017)
  - ▶ Firms' heterogeneity in the ability to access external finance within narrow industries, even after controlling for productivity (Irlacher and Unger, 2016)

# This Paper

1. Introduce financial frictions in a theoretical model of monopolistic competition with heterogeneous firms and endogenous markups, in a way consistent with stylized evidence
  - ▶ General demand with variable demand elasticity (Arkolakis, Morlacco, 2017)
  - ▶ Heterogeneous financial frictions
2. Use merged dataset of firm-level and balance-sheet information across EU countries over time (2002-2013) to match theoretical results on the relationship between firms' markups, productivity and access to finance
3. Counterfactual analysis: role of financial frictions in explaining cross-country differences in market power

# Motivating Evidence

# Data

1. Firm-level data from EFIGE:
  - ▶ harmonized and representative cross-country samples
  - ▶ ~ 15,000 manufacturing firms ( +10 employees)
  - ▶ 7 countries (Austria, France, Germany, Hungary, Italy, Spain, UK)
2. Firm-level balance sheet information (fixed assets, sales, number of employees, ...) merged from Amadeus for the period 2002 - 2013
3. Link with balance sheet data allows calculation of firm-level markups and TFP over time, covering the crisis years 2008-2010
4. Dataset provides information on relevant firms' characteristics (e.g. internazionalization, access to finance) observed once during the years 2008-2010

## Key Variables

1. Markups: estimated as in DeLoecker-Warzynski (2012) with Woolridge (2013) routine for production function (ACF, 2015 as robustness check)
2. TFP: estimated through Woolridge (2013), with labor productivity (value added per employee) as robustness check
3. Financial frictions: Ability to access external finance given shape of balance sheet (*Financial Capability*)

## Financial Capability

- Whited and Wu (2006) index of financial constraints (inverted and normalized) as structural combination of key balance sheet indicators: score from 0 (no financial capability) to 1 (maximum financial capability)

## Financial Capability

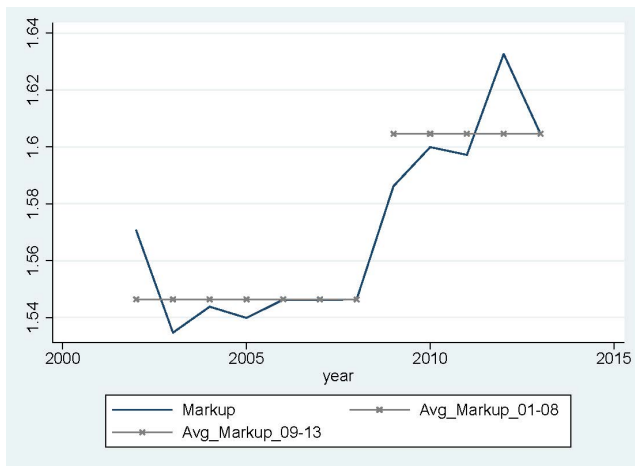
- Whited and Wu (2006) index of financial constraints (inverted and normalized) as structural combination of key balance sheet indicators: score from 0 (no financial capability) to 1 (maximum financial capability)
  - *Robustness*: ratio of interests on loans to the firm's operating revenues (higher values indicating less constrained access to external finance)
  - *Robustness*: normalized ASCL (Age, Size, Cash, Leverage) index of financial constraints (Mulier et al., 2016): score from 0 (constrained access to external finance) to 1 (unconstrained access)



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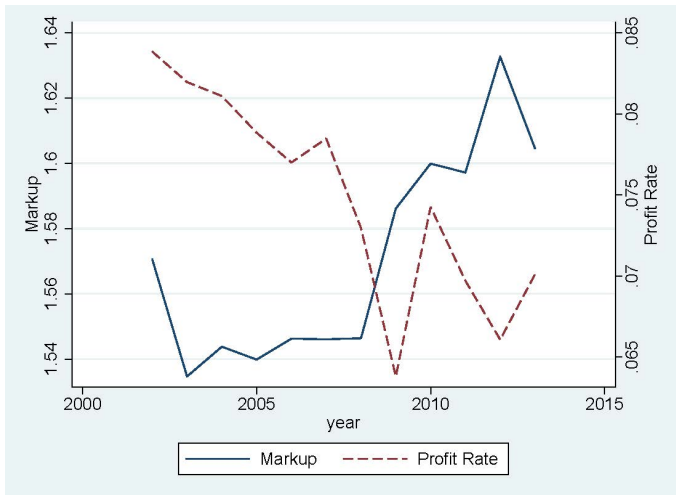
## SF 1 - Markups over time, average before/after 2008



Note: Weighted average of DLW(2012) markups with Woolridge(2013) TFP estimation. Difference before/after 2008 significant in firm-level regression of markups controlling for firm level TFP, Sector  $\times$  Country FE and clustering of s.e.

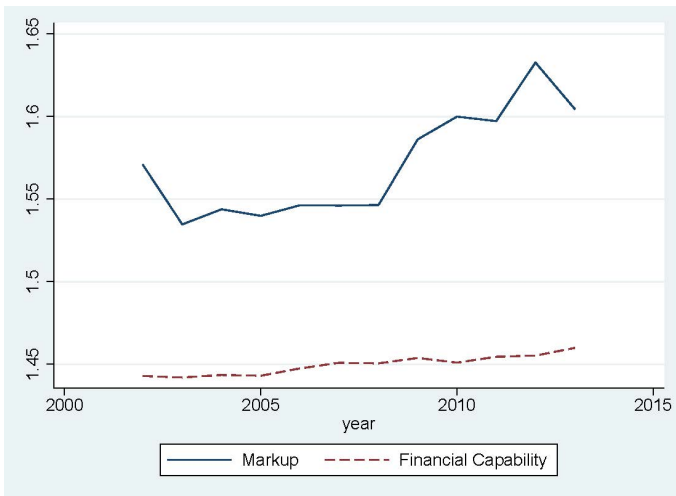
Overall trend and magnitude in line with De Loecker & Eeckhout (2018)

## SF 1 - Markups vs. profit rates over time



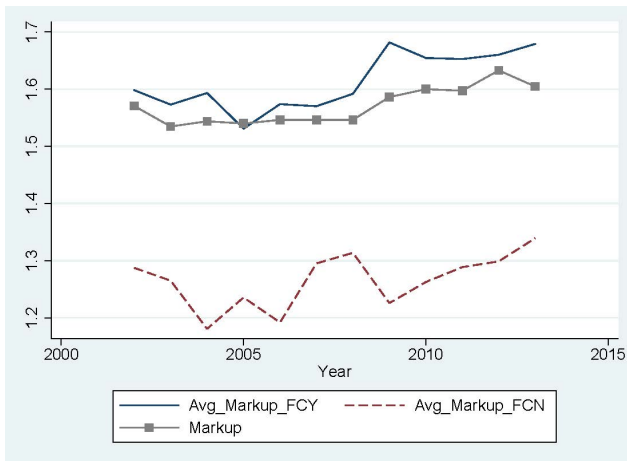
*Note:* Weighted average of DLW(2012) markups with Woolridge(2013) TFP estimation, and profit rates calculated as EBITDA/Revenues

## SF 1 - Markups vs. Financial Access over time



*Note:* Weighted average of DLW(2012) markups with Woolridge(2013) TFP estimation. Financial access is the (inverted) Whited and Wu (2006) index calculated on balance sheet data.

## SF 2 - Markups over time by access to finance



Note: DLW(2012) markups with Woolridge(2013) TFP estimation. Firms with access to finance above (FCY) or below (FCN) median. Financial access is the (inverted) Whited and Wu (2006) index calculated on balance sheet data.

## Theoretical Model: Overview

- Stylized facts point at a static “long-run” effect of financial factors on markup level
  - ▶ Consistent with a standard heterogeneous firms model with monopolistic competition and variable demand elasticity...
  - ▶ ...augmented with heterogeneous financial frictions affecting costs at the firm level, e.g. ability to finance high level of SGA expenditures (intangible capital), which typically cannot be pledged as collateral in loan contracts
  - ▶ Philippon et al. (2019) identify the increase of SGA expenditure relative to COGS as one of the reason for the increase of markups across countries
- SF also point at possible interplay of financial frictions with demand shocks in driving average markups  $\Rightarrow$  “dynamics” of the model, consistent with e.g. Gilchrist et al. 2017
  - ▶ Sticky customer base
  - ▶ Costly external finance

## Theoretical Model: Static Model

- Two exogenous sources of firm heterogeneity: (1) productivity ( $1/c$ ), and (2) financial capability ( $\tau$ ), ex-ante uncorrelated
  - ▶ Productivity  $1/c$ ,  $c \in (0, \infty)$ : the inverse of the marginal cost of output
  - ▶ Financial capability  $\tau \in (0, 1)$ : the firms' relative cost advantage in raising collateral
- **Financial Capability:**
  - ▶ Liquidity-constrained firms need to borrow from banks in order to finance a fixed share  $\rho \in [0, 1]$  of their production costs
  - ▶ In order to grant a loan, firms need to pledge costly collateral
- Let  $\tilde{c}(c, \tau)$  denote the (effective) marginal cost of the firm, inclusive of production ( $c$ ) and financing cost ( $\tau$ )
  - ▶ Note:  $\tilde{c}'_c > 0$  and  $\tilde{c}'_\tau < 0$  : marginal cost is decreasing in both productivity and financial capability

## Theoretical Model: Static Model

- **Demand:**

- ▶ Demand is as in Arkolakis and Morlacco (2018):

$$q_{\omega}(p_{\omega}, P, Q) = QD(p_{\omega}/P), \quad (1)$$

where  $\omega$  denotes a firm, or variety

- ▶ Note: general demand function with variable demand elasticity:

$$\varepsilon(\omega) \equiv -\frac{\partial \log q(\omega)}{\partial \log p(\omega)} = \varepsilon(p_{\omega}/P), \text{ s.t. } \varepsilon' > 0$$

- ▶ Implies that markups are variable across firms, and depend on relative price of firm

$$\mu(\omega) = \frac{\varepsilon(\omega)}{\varepsilon(\omega) - 1} = \mu(p_{\omega}/P)$$

- ▶ Note: firms that charge higher prices face higher demand elasticity and charge lower markups!



## Theoretical Model: Static Model

- Firm profit maximisation problem

$$\begin{aligned}\max_p \Pi(c, \tau) &= p(c, \tau)q(c, \tau) - \tilde{c}(c, \tau)q(c, \tau) \\ \text{s.t } p(c, \tau) &= D(p/P, Q)\end{aligned}$$

- Equilibrium price is given by:

$$p(c, \tau) = \frac{\varepsilon(x(c, \tau))}{\varepsilon(x(c, \tau)) - 1} \tilde{c}(c, \tau),$$

where  $x(c, \tau) = p(c, \tau)/p^{max}$ , and  $\tilde{c}(c, \tau) \equiv \frac{c}{c+\tau}$

- Both productivity and financial capability affect the effective marginal cost of firms, and so markups through their effect on prices!

## Theoretical Model: Comparative Statics

- The model yields in equilibrium two results:
  - Higher  $\tau$  firms charge higher markups:

$$\frac{d \log \mu(c, \tau)}{d \log \tau} = -\Gamma \frac{d \log p}{d \log \tau} = -\frac{1}{1 + \Gamma} \frac{\tilde{c}'_{\tau}(c, \tau)}{\tilde{c}(c, \tau)} > 0$$

- Effect of  $\tau$  is weaker for more productive firms (under conditions on  $\tilde{c}$ )

$$\frac{d^2 \log \mu(c, \tau)}{d \log \tau \cdot d \log c} = -\frac{1}{1 + \Gamma} \frac{\tilde{c}''_{\tau} \tilde{c}(c, \tau) - \tilde{c}'_c \tilde{c}'_{\tau}}{\tilde{c}(c, \tau)^2} > 0 \iff \tilde{c}''_{\tau} \tilde{c}(c, \tau) < \tilde{c}'_c \tilde{c}'_{\tau}$$

## SF 3 - Markups and Financial Capability

$$\ln \mu_{isct} = \alpha + \beta_0 \cdot \ln TFP_{isct} + \beta_1 \text{Fin capability}_{isct} + \gamma_i + \delta_{sct} + \varepsilon_{isct}$$

VARIABLES	(1)	(2)	(3)	(4)	(5)
	OLS Markup	OLS Markup	OLS Markup	OLS Markup	OLS Markup ACF
ln_TFP	1.555*** (0.00914)	1.650*** (0.00955)	1.591*** (0.00952)		1.518*** (0.00970)
Financial Capability	0.294*** (0.0113)			0.215*** (0.0160)	0.254*** (0.0115)
Interest paid / OR		1.198*** (0.197)			
ASCL			0.0604*** (0.00762)		
Labor Productivity				1.253*** (0.0137)	
Constant	-3.832*** (0.0216)	-3.922*** (0.0249)	-3.791*** (0.0231)	-5.236*** (0.0545)	-3.910*** (0.0228)
Observations	49,413	39,389	47,081	53,052	56,142
R-squared	0.964	0.967	0.961	0.937	0.956
FE	i, sct	i, sct	i, sct	i, sct	i, sct
SE	cluster mark	cluster mark	cluster mark	cluster mark	cluster mark
Time	2002-2013	2002-2013	2002-2013	2002-2013	2002-2013

*Note:* Weighted regressions with firm and Sector  $\times$  Country  $\times$  Year FE, clustered s.e. Financial capability is the (inverted, normalized) Whited and Wu (2006) index calculated on balance sheet data.

## Result 1 - Markups, Financial Capability & Ext. Finance

VARIABLES	(1)	(2)	(3)	(4)
	OLS Markup	OLS Markup	OLS Markup	OLS Markup
ln_TFP	1.555*** (0.00914)	1.616*** (0.0220)	1.596*** (0.0423)	1.641*** (0.0238)
Financial Capability	0.294*** (0.0113)	0.253*** (0.0193)	0.301*** (0.0330)	0.211*** (0.0246)
Constant	-3.832*** (0.0216)	-3.934*** (0.0504)	-3.901*** (0.0978)	-3.977*** (0.0533)
Observations	49,413	11,022	4,770	5,900
R-squared	0.964	0.984	0.984	0.984
FE	i, sct	i, sct	i, sct	i, sct
SE	cluster mark	cluster mark	cluster mark	cluster mark
Time	2002-2013	2008-2010	2008-2010	2008-2010
Sample	Pooled	Pooled	FN	FY

*Notes:* Weighted regressions with firm and *Sector x Country x Year* FE, clustered s.e. Financial capability is the (inverted, normalized) Whited and Wu (2006) index calculated on balance sheet data. Firms not using external finance (FN) in Col.(3) vs. firms using external finance (FY) in Col.(4).

## Result 1 - Markups, Financial Capability & Int. Activity

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Indep. Var.	Markup	Markup	Markup	Markup
In_TFP		1.486*** (0.0169)	1.446*** (0.0172)	1.450*** (0.0175)
Financial Capability			0.330*** (0.0427)	0.332*** (0.0429)
Int. Activity	0.141*** (0.0142)	0.0255** (0.0110)	0.000225 (0.00792)	-0.00261 (0.00800)
Use External Finance				0.0286*** (0.00631)
Constant	0.123*** (0.0110)	-3.514*** (0.0418)	-3.564*** (0.0422)	-3.587*** (0.0438)
Observations	15,367	14,203	12,823	12,480
R-squared	0.237	0.809	0.827	0.828
FE	sct	sct	sct	sct
SE	cluster sct	cluster sct	cluster sct	cluster sct
Time	2008-2010	2008-2010	2008-2010	2008-2010

*Notes:* Weighted regressions with *Sector*  $\times$  *Country*  $\times$  *Year* FE, clustered s.e. Financial capability is the (inverted, normalized) Whited and Wu (2006) index calculated on balance sheet data.

## Result 2 - Markups, Financial Capability & TFP

VARIABLES	(1) OLS Markup	(2) OLS Markup	(3) OLS Markup	(4) OLS Markup
In_TFP	1.482*** (0.00918)	1.506*** (0.0116)	1.491*** (0.0143)	1.587*** (0.0212)
Financial Capability	0.325*** (0.0130)	0.435*** (0.0413)	0.457*** (0.0501)	0.276*** (0.0799)
In_TFP x Financial Cap.		-0.0454*** (0.0151)	-0.0521*** (0.0184)	-0.0146 (0.0301)
Constant	-3.665*** (0.0218)	-3.723*** (0.0285)	-3.691*** (0.0354)	-3.854*** (0.0493)
Observations	49,530	49,530	36,547	11,042
R-squared	0.954	0.954	0.953	0.980
FE	i, CY	i, CY	i, CY	i, CY
SE	cluster mark	cluster mark	cluster mark	cluster mark
Time	2002-2013	2002-2013	No crisis	2008-2010

*Notes:* Weighted regressions with firm and *Country* x *Year* FE, clustered s.e. Financial capability is the (inverted, normalized) Whited and Wu (2006) index calculated on balance sheet data.

## Result 2 - Markups, Financial Capability & TFP

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
VARIABLES	$\Delta$ Markup	$\Delta$ Markup	$\Delta$ Markup	$\Delta$ Markup	$\Delta$ Markup
ln_TFP	0.660*** (0.0161)	0.648*** (0.0193)	1.191*** (0.0416)	1.113*** (0.0628)	1.251*** (0.0581)
Financial Capability	0.333*** (0.0207)	0.293*** (0.0253)	0.473*** (0.0461)	0.553*** (0.0756)	0.423*** (0.0588)
Constant	-1.829*** (0.0394)	-1.779*** (0.0475)	-3.222*** (0.0990)	-3.094*** (0.149)	-3.319*** (0.139)
Observations	36,163	25,553	8,926	3,883	4,801
R-squared	0.307	0.339	0.536	0.533	0.537
FE	i, CY	i, CY	i, CY	i, CY	i, CY
SE	cluster mark	cluster mark	cluster mark	cluster mark	cluster mark
Time	2002-2013	No crisis	2008-2010	2008-2010	2008-2010
Sample	Pooled	Pooled	Pooled	FN	FY

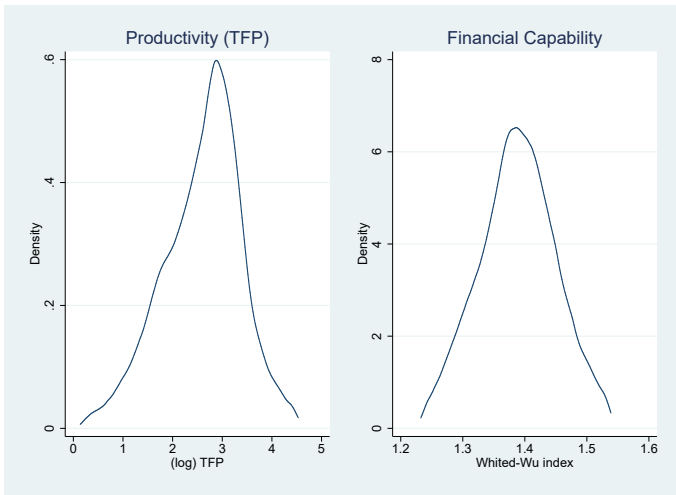
*Notes:* Weighted regressions with firm and *Country*  $\times$  *Year* FE, clustered s.e. Financial capability is the (inverted, normalized) Whited and Wu (2006) index calculated on balance sheet data. Firms not using external finance (FN) in Col.(4) vs. firms using external finance (FY) in Col.(5).

## Dynamic Model: Intuition

- Static model unable to generate countercyclical markups, as in the evidence we find during the crisis
  - ▶ Demand shock = negative cost shock  $\implies$  higher prices and **lower** markups
- To reconcile empirical evidence, embed demand system in a dynamic model à la Gilchrist et al. (2017) with:
  - ▶ Sticky customer base
  - ▶ Costly external finance
- Intuition:
  1. firms face a trade-off b/w current and future profits
    - ▶ lower price (markups) today = lower profits today BUT more customers and higher profits tomorrow
  2. After an adverse financial shock, firms find it less profitable to invest in customer base, raising prices (markups)
    - ▶ Effect is stronger for firms who access costly external finance



## Appendix - Financial Capability & TFP



Correlation TFP - FC = 0.171

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