Declining Competition and Investment in the U.S.

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Agenda

Goal of the Paper

Propose and test two hypothesis

1. Rise in concentration in most industries reflects declining domestic competition (henceforth DDC) and not EFS

2. Decline in competition is (partly) responsible for the decline in investment, after controlling for INTAN and GLOBAL

Abbreviation

- DDC - decreasing domestic competition
- EFS - increases in the efficient scale of operation
- INTAN - intangible investment
- GLOBAL - globalization

Two Stylized Fact

High Concentration and Profitability

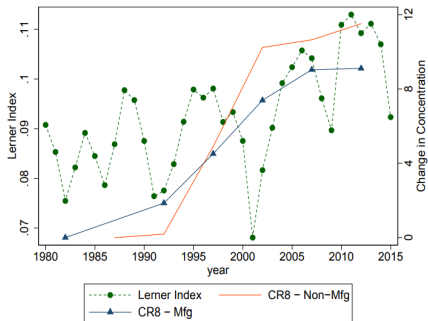1. Concentration and profitability have increased across most U.S. industries (Grullon et al. (2016))

Figure 1: Concentration and Mark-ups

Two Stylized Fact

Low Investment

② Business investment has been weak relative to measures of profitability,
funding costs, and market values since the early 2000s
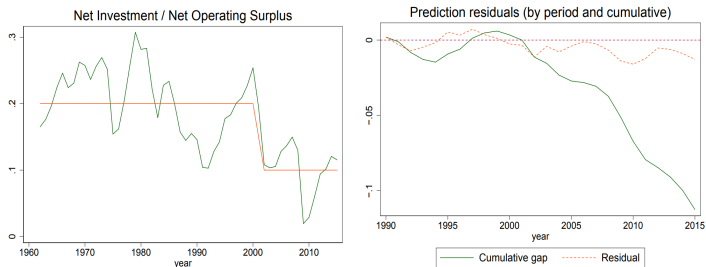

Figure 2: Net Investment, Profits and Q-Residuals

Two Stylized Fact

Four Explanations

1. DDC - decreasing domestic competition
   Concentration suggests "economic rents and barriers to competition"
   (Furman (2015) and CEA (2016))

2. EFS - increases in the efficient scale of operation
   Concentration reflects an efficient increase in the scale of operation (Autor et al. (2017a))

Two Stylized Fact

Four Explanations

3 INTAN - intangible investment
Increase in the (intangible) capital share together with a downward bias
in our traditional measures of intangible investment could lead, even in
competitive markets, to an increase in profits (competitive payments for
intangible services) and a decrease in (measured) investment (Alexander
and Eberly (2016))

4 GLOBAL - globalization
Foreign competition can lead to an increase in measured (domestic)
concentration (e.g. textile industry), and a decoupling of firm value from
the localization of investment (Feenstra and Weinstein, 2017)

Data

1. Intangible Assets
2. Adjusted Herfindahls

Data type	Key Data fields	Source	Region	Granularity
Aggregate/sector-level	I, K, OS, and Q	Flow of Funds	US	Country and Sector (NFCB, NFNCB)
Industry-level data	I, K and OS	BEA	US	ˉNAICS L3
		OECD STAN	EU	ISIC Rev 4
Concentration Measures	Herfindahls and Concentration Ratios	Economic Census	US	NAICS L3-L6
		Compustat	US	BEA segments
		CompNET	EU	ISIC Rev 4
		BvD Amadeus	EU	ISIC Rev 4
Firm Financials	I, K, OS,Q and other controls	Compustat NA	US	Firm
		Compustat Global	EU	Firm
China	Import Exposure	UN Comtrade	Global	HS code
	NTR Gap and import value	Peter Schott's website	US	NAICS L6
Productivity & controls	TFP & Mfg Industry Controls	NBER-CES Database	US	NAICS L6
	TFP	BLS KLEMS	US	BEA segments
Other	Analyst Forecasts	I/B/E/S	US	Firm
	Intangible Capital	Peters & Taylor	US	Firm

Summary of Key Data Sources

Data

1. Intangible Assets
   - Aggregate and Industry-level data - U.S. and European National Accounts

     - I and K - Since 2013, these accounts capitalize 'identifiable' intangible assets such as software, RD, and entertainment, literary, and artistic originals.

     - Q - ratio of market value to the replacement cost of capital including intangibles (Gutierrez and Philippon, 2017b)

   - Firm-level data - Compustat

     - I and K - Use PT's estimates of I and K and report results separately for tangible, intangible and total capital where appropriate (Peters and Taylor (2016))

     - Q - market-to-book ratio, in line with Gutierrez and Philippon (2017b)
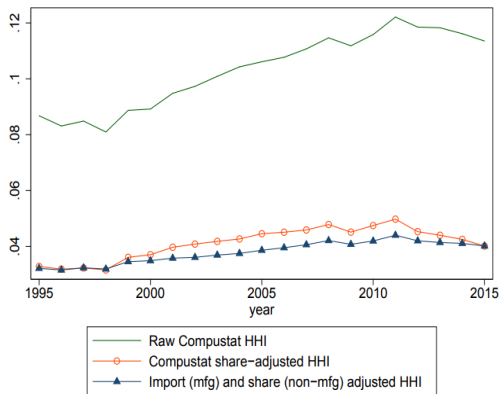
Data

- ❷ Adjusted Herfindahls

Figure 3: Weighted Average Herfindahls

Data

1. Intangible Assets
2. Adjusted Herfindahls - Our ideal competition measure should cover the whole economy and take into account foreign competition (i.e., imports)

   - Manufacturing - Feenstra and Weinstein (2017) (FW for short) construct such a measure. We extend the series to cover 1990 to 2015 by regressing FW Herfindahls on Compustat Herfindahls and share of sales.

   - non-Manufacturing - use Compustat since neither Census nor foreign Herfindahls are available.
     "Compustat share-adjusted" Herfindahl HHI_{kt}^{CPadj}

$$HHI_{kt}^{CPadj} = \frac{1}{N} = HHI_{kt}^{CP} \times s_{kt}^{CP} \tag{1}$$

s_{kt}^{CP} - the share of Compustat sales in US output plus imports

For service sectors, import data is not available but these are typically small, so we set them to zero.

Rising Concentration Reflects Decreasing Domestic Competition

We present three pieces of evidence that are inconsistent with EFS but consistent with DDC.

1. US vs. Europe
   Industry-level concentration, profitability and investment trends in Europe differ from those in the US, despite the use of similar technologies across the regions.

2. Concentration and TFP
   The relationship between concentration and industry productivity has been zero or negative in the 2000s.

3. Investment by Leaders
   Leaders invest less in physical and intangible assets in concentrated industries.

US vs. Europe

▸ Present only key comparisons of industries with significant increases in concentration in the U.S. (such as Telecom)
i.e., top 5 concentrating industries in the US - Information Telecom, Arts and Recreation, Wholesale and Retail trade, Other Services and Information Publishing (which includes software).

▸ Exclude the Manufacturing - Textiles industry even though it exhibits a rise in domestic concentration because the increase is primarily due to foreign competition
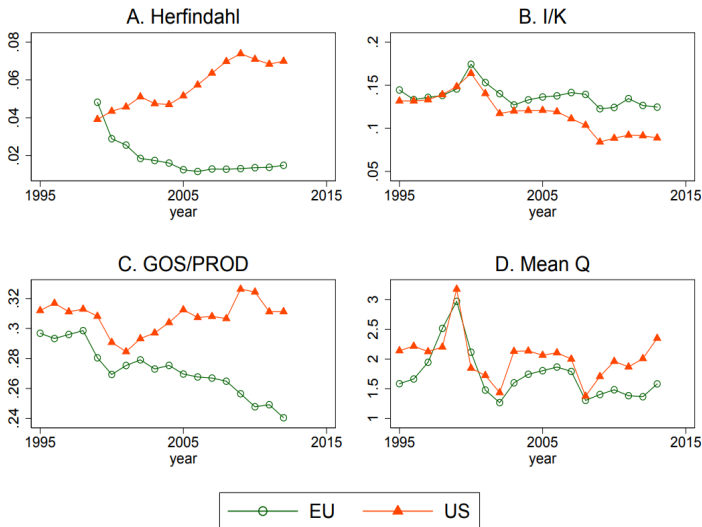
US vs. Europe

Figure 4: Comparison with EU for Top 5 Concentrating Industries in US

US vs. Europe

Two pieces of evidence

▸ These industries in Europe use the same technology and are exposed to the same foreign competition

▸ Antitrust enforcement in Telecom and Airlines has indeed become more aggressive in Europe than in the US in recent years (see Faccio and Zingales (2017) for Telecoms, Economist (2017) for Airlines, and Gutierrez and Philippon (2017a) for all industries)

Concentration and TFP

Study the relationship between changes in concentration and changes in industry TFP at two levels of granularity.

1. Study the more granular NAICS Level 6 manufacturing industries using productivity measures from the 2017 release of the NBER-CES database (which contains data up to 2011).

2. Next, we broaden the sample to all US industries by using KLEMS, at the expense of considering more aggregated NAICS Level 3 industries.

Concentration and TFP

Study the relationship between changes in concentration and changes in industry TFP at two levels of granularity.

Results - We find some evidence in favor of EFS in the 1990s, but evidence against it in the 2000s.

	(1)	(2)	(3)	(4)	(5)
	$\Delta\text{TFP}(t, t-5)$			$\Delta\text{TFP}(t, t-5)$	
	97-02	02-07	07-12†	90-00	00-14†
ΔCensus CR8$(t, t-5)$	**1.456****	0.237	-1.35		
	[0.312]	[0.652]	[0.871]		
ΔCP CR8$(t, t-5)$				**0.461***	**-0.208+**
				[0.198]	**[0.115]**
Sectors	Mfg			All	
Granularity	NAICS-6			KLEMS	
Observations	469	469	299	86	129
R^2	0.045	0	0.008	0.061	0.025

Industry regressions: Concentration vs. TFP

Investment by Leaders

According to the EFS hypothesis, leaders should increase investment in concentrating industries, reflecting their increasing relative productivity.

We test this at the firm-level, by performing the following regression for firm i that belongs to BEA segment k:

$$
\begin{aligned}
\Delta \log\left(K_{it}\right) =& \beta_1 Q_{it-1} + \beta_2 HHI_{t-1}^k \times \text{Leader}_{it-1}^k + \beta_3 HHI_{t-1}^k \\
& + \beta_4 \, \text{Leader}_{it-1}^k + \beta_5 \log\left(Age_{it-1}\right) + \eta_t + \mu_i + \varepsilon_{it}
\end{aligned} \tag{2}
$$

- K_{it} - firm capital (PPE, Intangibles, or Total)
- HHI_t^k - import-adjusted Herfindahl
- $Leader_{it}^k$ - indicator for a firm

having a market value in the top quantile of segment k

- $\eta_t \, \mu_i$ - firm and year fixed effects

Investment by Leaders

Result: Leaders decrease investment with concentration, rather than increase it.

	(1) $\Delta log(PPE)^a$ ≥ 2000	(2) $\Delta log(Int_{PT})^b$ ≥ 2000	(3) $\Delta log(K_{PT})^{a+b}$ ≥ 2000
Q_{it-1}	6.84**	3.38**	4.01**
	[0.24]	[0.13]	[0.13]
HHI_{t-1}^k	15.82	11.25	21.32*
	[14.43]	[9.40]	[9.44]
$Leader_{it-1}^k$	0.91	0.37	0.22
	[1.16]	[0.96]	[0.85]
$HHI_{t-1}^k \times Leader_{it-1}^k$	**-34.41***	**-24.43+**	**-29.28***
	[13.92]	**[12.89]**	**[11.20]**
$log(Age_{it-1})$	-6.10**	-14.02**	-12.52**
	[1.38]	[0.89]	[0.87]
Observations	59361	56472	56704
R^2	0.06	0.08	0.09
Year FE	YES	YES	YES
Firm FE	YES	YES	YES

Investment by Leaders

Competition Encourages Investment

Three different identification strategies: correlated with concentration (*X*), uncorrelated with anticipated demand/productivity (ϵ)

1. Chinese Competition
2. Noisy Entry
3. Realization of MA

Findings

- Leaders react to exogenous increases in competition by increasing investment – and, inversely, that leaders decrease investment when competition decreases.
- Controlling for smooth industry trends, investment decreases sharply following bursts of MA activity.

Competition Encourages Investment

Chinese Competition as IV

- ▸ Uncorrelated with anticipated demand/productivity - China entered the WTO on December 2001, after which a number of US industries began to be exposed to Chinese competition
- ▸ Correlated with concentration - See figures below

Figure 5: Number of firms by Chinese exposure (1991 = 1)

Competition Encourages Investment

Chinese Competition as IV

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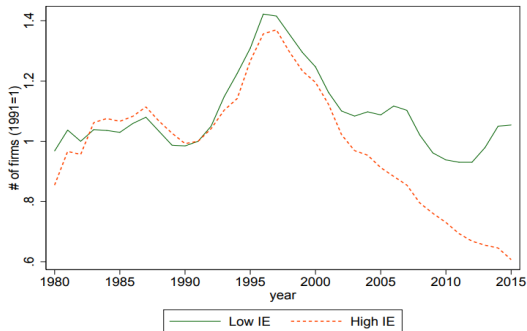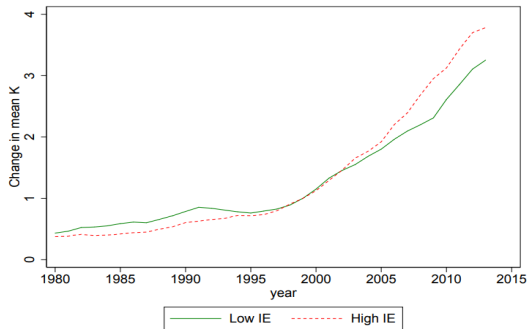- Correlated with concentration - See figures below

Figure 6: Change in average firm K^{PT} by Chinese Exposure (1999 = 1)

Competition Encourages Investment

Chinese Competition as IV

Model

$$NTRGap_j = NonNTRRate_j - NTRRate_j \tag{3}$$

$$\begin{aligned}
\log(K_{i,j,t}) = {} & \beta_1 \text{Post} - 2001 \times NTRGap_j \times \overline{\Delta IP_t^{US}} \\
& + \beta_2 \text{Post} - 2001 \times NTRGap_j \times \Delta IP_t^{US} \times \text{Leader}_{i,j,0} \\
& + \text{Post} - 2001 \times X'_{j,91}\gamma + \eta_t + \mu_i + \varepsilon_{it}
\end{aligned} \tag{4}$$

Competition Encourages Investment

Chinese Competition as IV

Results - Leaders increase investment in response to exogenous changes in foreign competition.

	(1)	(2)	(3)	(4)	(5)	(6)
	$log(PPE_t)^a$	$log(Int_t^{PT})^b$	$log(k_t^{PT})^{a+b}$	$log(PPE_t)^a$	$log(Int_t^{PT})^b$	$log(k_t^{PT})^{a+b}$
$Post01 \times NTRGap$	-7.136**	-1.096	-1.223	-6.901*	-2.236	-2.075
	[2.56]	[1.99]	[1.61]	[2.75]	[1.87]	[1.56]
$Post01 \times NTRGap \times Lead_{99}$	**7.251****	**6.143****	**5.795****	**5.848***	**7.097****	**6.469****
	[2.22]	**[1.31]**	**[1.33]**	**[2.31]**	**[1.58]**	**[1.55]**
Observations	29854	29980	29982	13988	14009	14021
R^2	0.088	0.508	0.46	0.131	0.541	0.496
Industry controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Sample	All firms			Continuing firms		

Chinese Competition: $log(K_t)$ results based on $NTRGap_j \times \overline{\Delta IP_{j,t}^{US}}$

Competition Encourages Investment

Noisy Entry as IV

▸ Uncorrelated with anticipated demand/productivity - See figures below

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta log(Sale)_{99-04}$		$\Delta log(V.Add)_{99-04}$		ΔTFP_{99-04}	
$\Delta log(\# firms)_{94-99}$	0.019		**0.493****		**0.244****	
	[0.15]		**[0.15]**		**[0.07]**	
$Noisy\ Entry_{90-99}(i)$		-0.315		-0.26		-0.045
		[0.22]		[0.26]		[0.12]
Observations	43	42	43	42	43	42
R^2	0	0.05	0.208	0.025	0.256	0.004

Figure 7: Noisy Entry vs. Sales and Productivity: Regression Results

▸ Correlated with concentration - See figures below

Competition Encourages Investment

Noisy Entry as IV

‣ Uncorrelated with anticipated demand/productivity - See figures below

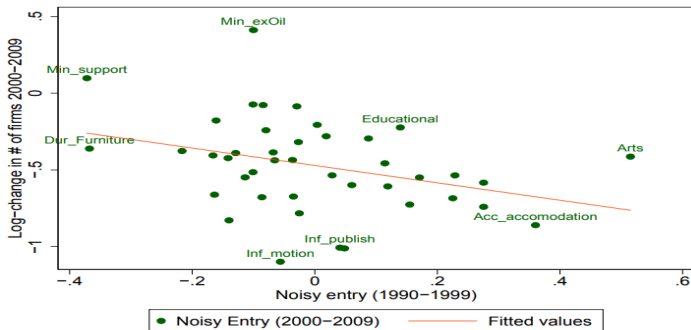‣ Correlated with concentration - See figures below

Figure 8: Change in of firms post-2000 vs. Noisy entry pre-2000

Competition Encourages Investment
Noisy Entry as IV

Model

$$HHI_{j,t-1} = \theta_0 + \theta_1 NoisyEntry_{j,90-99} + \theta_2 MeanQ_{j,t-1} + \theta_3 ExcessInv_{j,90-99} + \epsilon_{1,jt} \tag{5}$$

$$\frac{NI_{jt}}{K_{jt-1}} = \beta_0 + \beta_1 \widehat{HHI_{j,t-1}} + \beta_2 M ean\, Q_{j,t-1} + \beta_3 Ex cess\, Inv_{j,90-99} + \varepsilon_{2,jt} \tag{6}$$

Competition Encourages Investment

Noisy Entry as IV

Results - Industries with more noisy entry are more sensitive to aggregate concentration trends, which in turn lead to a larger reduction in investment.

	(1) 1st St. $HHI_{j,t}$	(2) 2nd St. Net I/K	(3) 1st St. $HHI_{j,t}$	(4) 2nd St. Net I/K
	01-05		01-15	
Mean Q (t-1)	0.02	0.025**	0.01	0.027+
	[.018]	[0.01]	[.01]	[0.01]
$Excess\,Inv_{90-99}$	-0.55	0.057		
	[1.03]	[0.45]		
$Excess\,Inv_{90-99}(i) \times NIK_{t-1}^{US}$			12.02	49.696**
			[14.33]	[16.73]
$Noisy\,Entry_{j,90-99}(i)$	-0.15**			
	[.046]			
$Noisy\,Entry_{90-99}(i) \times Wtm\,HHI_t$			4.41+	
			[2.28]	
$HHI_{i,t}$		-0.243*		-1.278**
		[0.10]		[0.45]
Year FE	No		Yes	
Industry FE	No		Yes	
Observations	210		630	
RMSE	0.038		0.031	
F-stat	10.652		3.752	

Noisy Entry: *NI*/*K* Regression Results

Competition Encourages Investment

Realized MA as IV

▸ Uncorrelated with anticipated demand/productivity - The actual realization of large MA transactions is (partly) random. MA typically occurs in waves, that cluster through time and across industries (Andrade et al., 2001).

▸ Correlated with concentration - MA waves result in sharp changes to the Herfindahl, which can identify the effect of concentration on investment without being affected by relatively slow changes in demand and technology.

Competition Encourages Investment

Realized MA as IV

- ▸ Uncorrelated with anticipated demand/productivity
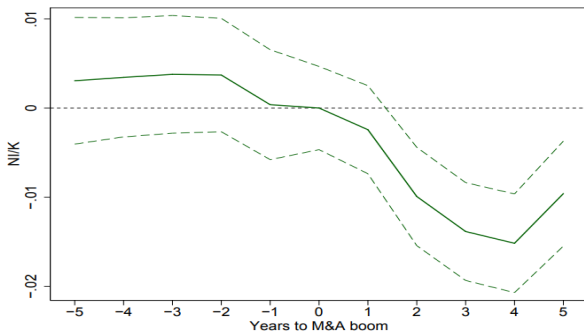- ▸ Correlated with concentration - See figure below

Figure 9: Investment Following Large MA

Competition Encourages Investment

Realized MA as IV

Results

	(1) $Herf_j^{CP}$(t) $\geq$1980	(2) Net I/K (All) $\geq$1980	(3) $\geq$1980	(4) $\geq$2000
$Mean\,Q_j$(t-1)		2.462**	2.468**	2.017**
		[0.66]	[0.66]	[0.48]
$Herf_j^{CP}$(t-4)	0.752**	-1.63	-1.493	
	[0.09]	[1.06]	[1.06]	
$Herf_j$(t-4)				5.707
				[4.28]
$\Delta log(Output)_j$(t-4)		5.886**	5.834**	2.709**
		[0.97]	[0.96]	[0.91]
M&A boom(t-3)	0.025**	-0.546+		
	[0.01]	[0.32]		
Post-M&A indicator			-0.594*	-0.669+
			[0.25]	[0.33]
Age controls	Yes		Yes	
Year FE	Yes		Yes	
Industry FE	Yes		Yes	
Observations	1530	1529	1529	688
Within R^2	0.543	0.279	0.281	0.284

MA and NI/K

Competition Encourages Investment

Realized MA as IV

Results

1. Column 1 shows that MA booms lead to increased (domestic) concentration.

2. Columns 2 and 3 show that, conditional on measures of (domestic) concentration as well as expected sales growth at the time of MA, large mergers result in lower investment.

3. Column 4 shows that results are robust over the more recent period, while controlling for import adjusted Herfindahls.

Conclusion

1. Rise in concentration in most industries reflects declining domestic competition (henceforth DDC) and not EFS

2. Competition – actual or via the threat of entry – has a positive causal impact on investment, in particular by industry leaders.