

Does Import Competition Induce R&D Reallocation? Evidence from the U.S.¹

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Motivation: Trade Shocks and Innovation

The China shock: large effects on U.S. labor markets, firms, and households.

- ▶ However, along with heterogeneity and reallocation (e.g., [Gu et al. 2024](#); [Autor et al., 2025](#))

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Does import competition reallocate innovative resources toward more productive uses?

▶ Examples of High-tech Chinese Import Competition

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Why this matters now:

- ▶ Supply-chain resilience, reshoring, and friend-shoring
- ▶ The CHIPS Act and industrial policy
- ▶ AI and digital services
- ▶ Technological leadership amid trade tensions

This Paper

The paper asks three related questions.

1. **Average effect:** Does Chinese import competition reduce firm-level R&D spending?
2. **Within-industry reallocation:** Are R&D resources reallocated toward certain firms within the same industry?
3. **Across-industry reallocation:** Do researchers move from exposed manufacturing industries toward service industries?

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▶ Conceptual Framework

Data and Empirical Strategy

- ▶ Data: U.S. public firms from Compustat
 - ▶ Combined with industry-level Chinese import exposure
 - ▶ Supplemented by U.S. Census and ACS worker data

▶ Data Sources ▶ Summary Statistics

- ▶ Empirical Strategy
 - ▶ IV strategy following [Autor et al. \(2020\)](#)

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Preview of Findings

The answer is: **yes, yes, and yes** — more nuanced than a simple decline in innovation.

- ▶ Firm-level average effect is negative, but industry-level R&D fall a little
- ▶ R&D is reallocated towards high-productivity and high-markup firms
- ▶ Accompanied by researcher reallocation from manufacturing to services

Related Literature

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3. Competition and innovation incentives

Aghion et al. (2005), Bloom, Schankerman, and Van Reenen (2010)

Data and Empirical Strategy

Measuring Chinese Import Competition

Import competition at the SIC industry-year level:

$$\text{Import Competition}_{i,t}^{US} = \frac{\text{Trade Flow}_{i,t}^{China \rightarrow US}}{\text{Consumption}_{i,t}^{US}}$$

- ▶ i denotes 3-digit industry, t denotes year
- ▶ $\text{Consumption}_{i,t}^{US} = \text{Production}_{i,t}^{US} + \text{Imports}_{i,t}^{US} - \text{Exports}_{i,t}^{US}$
- ▶ Alternative: using value-added output as denominator

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Instrument using imports from China in other high-income countries:

$$\text{Import Competition}_{i,t}^{Other} = \frac{\sum_{c=1}^8 \text{Trade Flow}_{i,t}^{China \rightarrow c}}{\text{Consumption}_{i,1995}^{US}}$$

- ▶ $c \in \{\text{Denmark, Finland, Germany, Japan, New Zealand, Spain, Switzerland}\}$
- ▶ Assumption: Chinese export growth to other high-income countries captures China-side supply shocks, not U.S.-specific industry shocks.

Empirical Specification: Average Firm-Level Effect

Baseline specification: long-difference (five years)

$$\begin{aligned}\Delta \log(R\&D)_{j,t} = \beta_1 \cdot \Delta \text{Import Competition}_{i,t}^{U.S.} + \delta_i + \omega_t \\ + \beta_2 \cdot \text{Controls}_{j,t-5} + \epsilon_{j,t}\end{aligned}$$

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- ▶ j denotes firm; i denotes industry; t denotes year
- ▶ δ_i : industry fixed effects; ω_t : year fixed effects
- ▶ Controls include lagged firm characteristics:
 - ▶ log assets
 - ▶ market-to-book ratio
 - ▶ book leverage

Empirical Specification: Reallocation Within Industry

However, the average effect can be misleading due to firm heterogeneity

Core hypothesis

Import competition reallocates R&D within industries toward firms better positioned to innovate.

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Reallocation specification: interact import competition with firm characteristics measured relative to the industry mean

$$\begin{aligned}\Delta \log(R\&D)_{j,t} = & \beta_1 \cdot \Delta \text{Import Competition}_{i,t}^{U.S.} + \beta_3 \cdot X_{j,t-5} \\ & + \beta_4 \cdot \Delta \text{Import Competition}_{i,t}^{U.S.} \times X_{j,t-5} \\ & + \beta_2 \cdot \text{Controls}_{j,t-5} + \delta_i + \omega_t + \epsilon_{j,t}\end{aligned}$$

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- ▶ $X_{j,t-5}$: standardized within each industry-year cohort (deviations from the industry mean)
 - ▶ Productivity: TFP and labor productivity
 - ▶ Market power: Lerner index

Main Findings

Finding 1: Average Firm-Level Effect Is Negative

Firms in industries more exposed to Chinese import competition reduce R&D spending on average.

	OLS		2SLS			
	(1) All	(2) All	(3) All	(4) All	(5) High-tech	(6) Balanced Panel
Δ Imp. Comp.1,US	-0.590** (0.229)	-0.590*** (0.196)	-0.618** (0.245)	-0.640*** (0.238)	-0.730*** (0.267)	-0.734*** (0.236)
L5.Log asset		0.009 (0.008)		0.009 (0.008)	0.008 (0.007)	0.004 (0.009)
L5.Market-to-book ratio		0.010* (0.006)		0.010* (0.006)	0.010 (0.006)	0.009* (0.005)
L5.KZ index		-0.020*** (0.005)		-0.020*** (0.005)	-0.021*** (0.005)	-0.018*** (0.006)
First-stage F statistic			17.634	16.337	16.254	15.101
N	13209	11230	13209	11230	9135	9163

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable is the five-year change in log(R&D) in all columns. The sample includes U.S. manufacturing firms in Compustat from 1995 to 2009. Industry- and year- fixed effects are controlled, and standard errors are clustered by industry. The first-stage F statistics of the 2SLS are reported.

Finding 2: Reallocation Toward More Productive Firms

High-TFP firms are less negatively affected by Chinese import competition.

	(1)	(2)	(3)
	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$
$\Delta \text{ Imp. Comp.1,US}$	-0.640*** (0.238)	-0.499*** (0.188)	-0.584*** (0.197)
L5.TFP (Olley-Pakes)		0.126*** (0.035)	0.105*** (0.033)
$\Delta \text{ Imp. Comp} \times \text{L5.TFP}$			0.683** (0.270)
First-stage F statistic	16.337	14.911	7.609
N	11230	8146	8146

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: We control for the same firm-level variables as in the previous table, including lagged log assets, market-to-book ratio and KZ index (dependence on external financing). Industry fixed effects and year effects are controlled, and standard errors are clustered by industry.

Finding 2: Reallocation Toward More Productive Firms

More productive firms are less negatively affected by Chinese import competition.

	(1)	(2)	(3)
	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$
$\Delta \text{ Imp. Comp.1,US}$	-0.640*** (0.238)	-0.479** (0.191)	-0.556*** (0.198)
L5.labor productivity		0.109*** (0.041)	0.075* (0.038)
$\Delta \text{ Imp. Comp} \times \text{L5.labor productivity}$			1.116** (0.483)
First-stage F statistic	16.337	14.918	7.663
N	11230	8146	8146

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: We control for the same firm-level variables as in the previous table, including lagged log assets, market-to-book ratio and book leverage. Industry fixed effects and year effects are controlled, and standard errors are clustered by industry.

Finding 3: Reallocation Toward Firms with Higher Market Power

Firms with higher initial profit margins are less harmed by import competition and increase R&D.

	(1)	(2)	(3)
	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$
$\Delta \text{ Imp. Comp.1,US}$	-0.640*** (0.238)	-0.613*** (0.210)	-0.672*** (0.222)
L5.profit margin		0.238*** (0.028)	0.215*** (0.029)
$\Delta \text{ Imp. Comp} \times \text{L5.profit margin}$			0.656*** (0.227)
First-stage F statistic	16.337	15.937	7.936
N	11230	9628	9628

Standard errors in parentheses

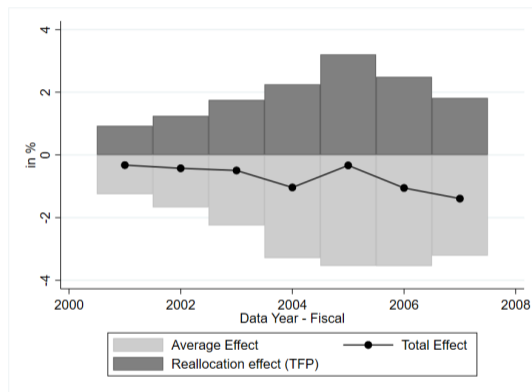
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▶ Alternative Measure of Import Competition ▶ Non-overlapping Differences ▶ Alternative Controls ▶ Six Year Differences

Finding 4: Reallocation Mitigates Aggregate Effect

Reallocation can offset 57% (in 2007) to 90% (in 2005) of the average effect.



Note: Total effect of Chinese import competition on R&D expenditures in public manufacturing companies is calculated as the sum of the average effect and the reallocation effect.

► Decomposition Method ► Industry-level Regressions

Extensions

Finding 5: Increased Demand for Researchers

We employ the following specification based on U.S. Population Census (2000, 2006-2012):

$$Y_{i,t} = \text{Imp. Comp.}_{i,t-3}^{US} + \delta_i + \gamma_t + \epsilon_{i,t}$$

- ▶ $Y_{i,t}$: share of researchers and average wage of researchers

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- ▶ $Y_{i,t}$: share of researchers and average wage of researchers

Import competition increases overall demand for researchers.

	Researcher%		Log wage	
	(1)	(2)	(3)	(4)
L3.Imp Comp.1,US	0.082*** (0.021)	0.098*** (0.032)	0.379*** (0.080)	0.680*** (0.123)
F statistic (K-P)		360.926		360.926
N	552	552	552	552

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Industry fixed effect and year effect are controlled. We merge U.S. population censuses (2000, 2006–2012) with industry-level import competition measures (1997, 2003–2009), respectively. Researchers are defined as college graduates working in S&E occupations.

Finding 6: Researchers Reallocated to Services

We construct occupational level import competition:

$$\text{Import Competition}_{o,t}^{China \rightarrow US} = \sum_i s_{j,o,t} \cdot \text{Import Competition}_{i,t}^{China \rightarrow US}$$

$$\text{Import Competition}_{o,t}^{China \rightarrow Other} = \sum_i s_{j,o,t} \cdot \text{Import Competition}_{i,t}^{China \rightarrow Other}$$

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More exposed researchers are reallocated to: business and repair, financial, and personal services

	(1)	(2)	(3)
	finance	business and repair	personal
L3.Imp Comp.1(Occ)	0.072* (0.036)	0.115** (0.047)	0.111* (0.057)
F statistic (K-P)	1324.621	1324.621	1324.621
N	341	341	341

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Occupation fixed effect and year effect are controlled. Only significant service industry results are presented. Researchers in service industries overall and other service industries not listed here are not affected.

Concluding Remarks

Conclusion

This paper revisits a central question in trade and innovation: does import competition undermine domestic innovative capacity?

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Main Take-away

Chinese import competition reduced R&D at the average public firm, but it also reallocated innovative resources within and across industries.

1. Firm-level averages hide reallocation towards more competitive firms.
2. Industry-level R&D does not significantly decline.
3. Researchers move toward expanding, skill-intensive services.

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Further question: does import competition improve innovation efficiency?

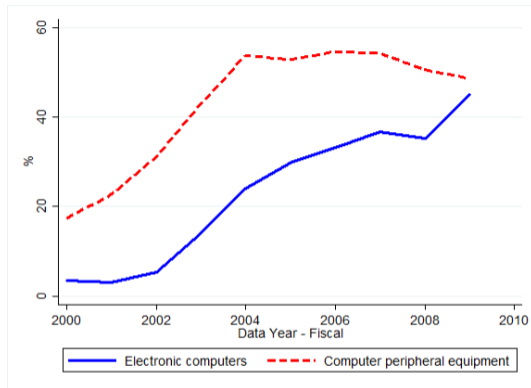
▶ TFP and Innovation Efficiency

Thank you!

Questions and comments welcome

Appendix

Examples of High-tech Chinese Import Competition



▶ Back

Conceptual Framework

Import competition can affect innovation through two opposing channels (Aghion et al., 2005).

Market-size effect

- ▶ Import competition reduces market size
- ▶ Lower expected profits reduce returns to R&D investment
- ▶ Firms cut innovation input

Escape-competition effect

- ▶ Firms innovate to differentiate products
- ▶ Innovation helps firms “escape” low-cost foreign competition
- ▶ Productive firms respond more strongly

Implication

The average effect can be negative even if resources are reallocated toward stronger innovators.

▶ Back

Data Sources

Data	Use	Level
Compustat North America	Firm R&D, assets, leverage, sales	Firm-year
Comtrade	Bilateral trade flows	Industry-year
NBER Manufacturing CES	U.S. production and consumption	Industry-year
U.S. Census and ACS	Researcher employment and wages	Worker / industry-year

▶ Back

Summary Statistics

Table: Summary Statistics of Key Variables

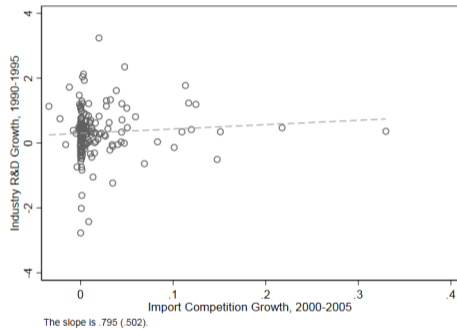
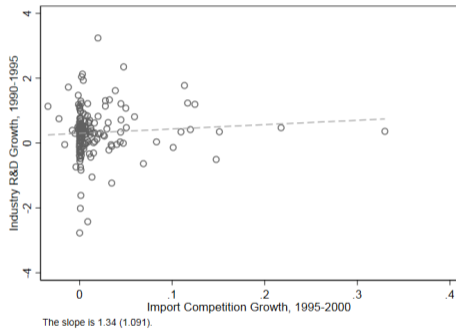
Variable	Obs	Mean	Std. Dev.	P50
Total assets in mil. USD	28799	1744.954	11626.4	87.469
Sales (net) in mil. USD	28800	1547.598	9442.648	69.263
R&D expense in mil. USD	28800	72.714	413.28	6.611
R&D expense/sales	27452	2.512	15.698	.081
Employment (thousands)	28800	4.867	19.6	.332
Market-to-book ratio	24549	3.634	7.009	1.856
Kaplan-Zingales index	24176	.922	3.144	.565
Imp. Comp.1, US	1503	.078	.145	.02
Five-year change in Imp. Comp.1, US	710	.031	.087	.011

Note: Firm-level variables are based on U.S. manufacturing firms in Compustat from 1995 to 2009. Import competition is computed at industry level from 1995-2009.

► Back

Placebo Test

Change in R&D Expenditure vs. Import Competition



▶ Back

Alternative Measure of Import Competition

	(1)	(2)	(3)	(4)
	$\Delta \log R\&D$	$\Delta \log R\&D$	$\Delta \log R\&D$	$\Delta \log R\&D$
$\Delta \text{ Imp. Comp.2,US}$	-1.129 (0.744)	-0.818** (0.371)	-0.822** (0.383)	-0.966*** (0.388)
$\Delta \text{ Imp. Comp} \times \text{L5.TFP}$		0.452* (0.269)		
L5.TFP (Olley-Pakes)		0.117*** (0.035)		
$\Delta \text{ Imp. Comp} \times \text{L5.Labor productivity}$			0.796* (0.423)	
L5.Labor productivity			0.093** (0.040)	
$\Delta \text{ Imp. Comp} \times \text{L5.Profit margin}$				0.621** (0.297)
L5.Profit margin				0.222*** (0.030)
First-stage F statistic	18.784	11.738	11.708	12.395
N	11222	8146	8146	9622

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes U.S. manufacturing firms in Compustat from 1995 to 2009. Firm- and year-fixed effects are controlled, and standard errors are clustered by industry. Dependent variables are winsorized at the top 1 percent.

► Back

Non-overlapping Differences

	(1)	(2)	(3)	(4)
	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$
$\Delta \text{ Imp. Comp.1,US}$	-0.626** (0.270)	-1.069*** (0.342)	-0.948** (0.367)	-0.896** (0.392)
$\Delta \text{ Imp. Comp} \times \text{L5.TFP}$		1.526** (0.592)		
L5.TFP (Olley-Pakes)		0.074* (0.042)		
$\Delta \text{ Imp. Comp} \times \text{L5.Labor productivity}$			2.035*** (0.654)	
L5.Labor productivity			-0.003 (0.049)	
$\Delta \text{ Imp. Comp} \times \text{L5.Profit margin}$				0.761 (0.523)
L5.Profit margin				0.211*** (0.045)
First-stage F statistic	52.486	9.262	7.352	22.063
N	2283	1811	1811	1941

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes U.S. manufacturing firms in Compustat in 1997, 2002 and 2007. Firm- and year-fixed effects are controlled, and standard errors are clustered by industry. Dependent variables are winsorized at the top 1 percent.

► Back

Alternative Controls

	(1)	(2)	(3)	(4)
	$\Delta \log R\&D$	$\Delta \log R\&D$	$\Delta \log R\&D$	$\Delta \log R\&D$
$\Delta \text{ Imp. Comp. 1, US}$	-0.595** (0.241)	-0.536** (0.212)	-0.512** (0.214)	-0.653*** (0.222)
$\Delta \text{ in Share of Foreign Sales}$	0.236** (0.117)	0.233 (0.142)	0.239* (0.142)	0.245* (0.132)
$\Delta \text{ Imp. Comp} \times \text{L5.TFP}$		0.637** (0.261)		
L5.TFP (Olley-Pakes)		0.083*** (0.030)		
$\Delta \text{ Imp. Comp} \times \text{L5.Labor productivity}$			1.078** (0.487)	
L5.Labor productivity			0.043 (0.039)	
$\Delta \text{ Imp. Comp} \times \text{L5.Profit margin}$				0.631*** (0.225)
L5.Profit margin				0.236*** (0.027)
First-stage F statistic	16.330	7.603	7.655	7.928
N	11230	8146	8146	9628

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes U.S. manufacturing firms in Compustat from 1995 to 2009 after cleaning. Firm- and year-fixed effects are controlled, and standard errors are clustered by industry. Dependent variables are winsorized at the top 1 percent.

Six-year Differences

	(1)	(2)	(3)	(4)
	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$	$\Delta \log \text{R\&D}$
$\Delta \text{ Imp. Comp. 1, US}$	-0.602*	-0.467	-0.425	-0.766***
	(0.323)	(0.299)	(0.312)	(0.332)
$\Delta \text{ Imp. Comp} \times \text{L6.TFP}$		0.699**		
		(0.303)		
L6.TFP (Olley-Pakes)		0.098**		
		(0.038)		
$\Delta \text{ Imp. Comp} \times \text{L6.Labor productivity}$			1.023*	
			(0.519)	
L6.Labor productivity			0.062	
			(0.051)	
$\Delta \text{ Imp. Comp} \times \text{L6.Profit margin}$				0.952***
				(0.273)
L6.Profit margin				0.216***
				(0.034)
First-stage F statistic	17.306	8.140	8.409	8.369
N	9489	6805	6805	8126

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The sample includes U.S. manufacturing firms in Compustat from 1995 to 2009 after cleaning. Firm- and year-fixed effects are controlled, and standard errors are clustered by industry. Dependent variables are winsorized at the top 1 percent.

► Back

Decomposition Method

$$\begin{aligned} \% \Delta \text{ in R\&D} &= \frac{1}{N} \sum_{j=1}^N \beta_{1,avg} \cdot \Delta \text{Imp Comp}_{i,t} \\ &+ \frac{1}{N} \sum_{j=1}^N (\beta_{1,TFP} \cdot + \beta_{4,TFP} \cdot TFP_{j,t-5}) \cdot \Delta \text{Imp Comp}_{i,t} \cdot \frac{(R\&D_{j,t-5} - \overline{R\&D}_{t-5})}{\overline{R\&D}_{t-5}} \end{aligned}$$

- ▶ j denotes each firm and i denotes each industry
- ▶ N : number of firms
- ▶ TFP_j : standard deviations from industry mean
- ▶ Based on previous regression estimates
 - ▶ $\beta_{1,avg} = -0.640$
 - ▶ $\beta_{1,TFP} = -0.584$ and $\beta_{4,TFP} = 0.683$

▶ Back

Industry-level Regressions

	OLS		2SLS		2SLS (SIC3 FE)	
Δ Imp. Comp.1	-0.068 (0.230)	-0.176 (0.233)	0.179 (0.399)	-0.088 (0.412)	0.105 (0.427)	0.031 (0.427)
L5.Log(total assets)		-0.044*** (0.009)		-0.044*** (0.009)		-0.052*** (0.013)
L5.Median market to book ratio		0.058*** (0.017)		0.058*** (0.017)		0.031* (0.018)
L5.Median book leverage		-0.284** (0.123)		-0.276** (0.126)		-0.449** (0.185)
First-stage F statistic			674.377	623.438	654.948	642.348
N	1363	1329	1363	1329	1361	1327

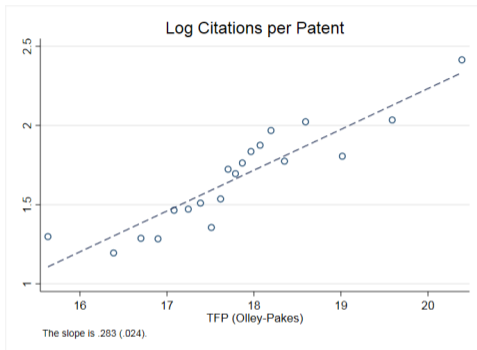
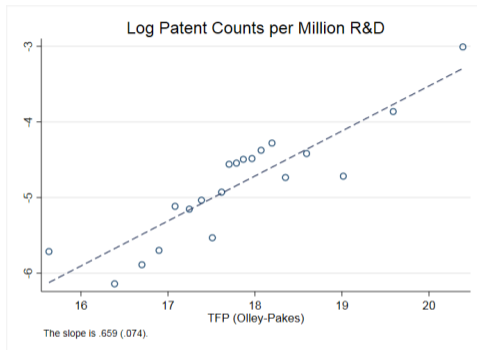
Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: We aggregate R&D spending and other controls using a balanced panel of Compustat firms from 1997–2009. Year fixed effects are controlled in all columns. SIC three-digit industry fixed effects are added in the last two columns

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TFP and Innovation Efficiency



Note: the two charts show the cross-sectional correlation between three-year lagged TFP and 1) log citation weighted patent counts per million R&D spending, and 2) log citations per patent, respectively. The firms are grouped into twenty bins based on their TFP level, so that each bin has the same number of firms. Industry by year fixed effects are controlled in both charts.

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