Financial Frictions and the Great Productivity Slowdown

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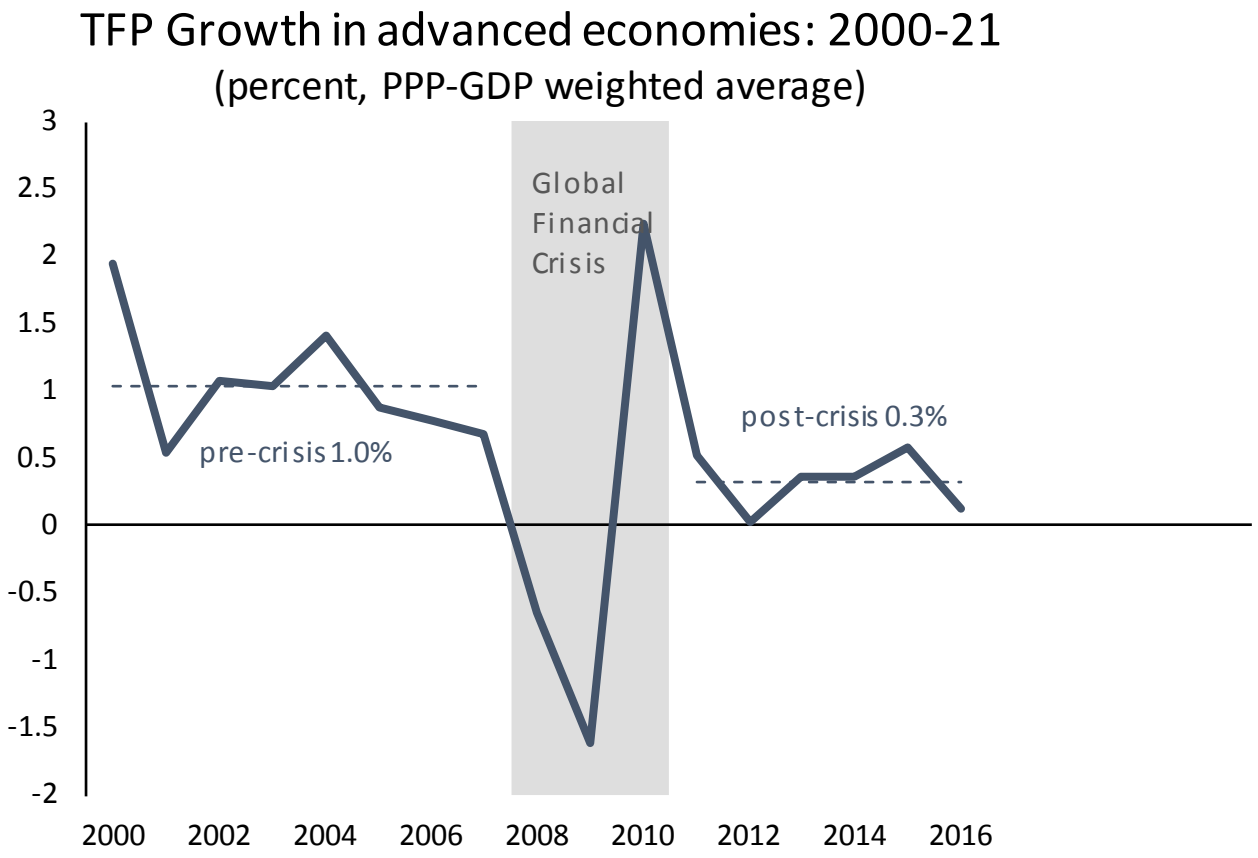
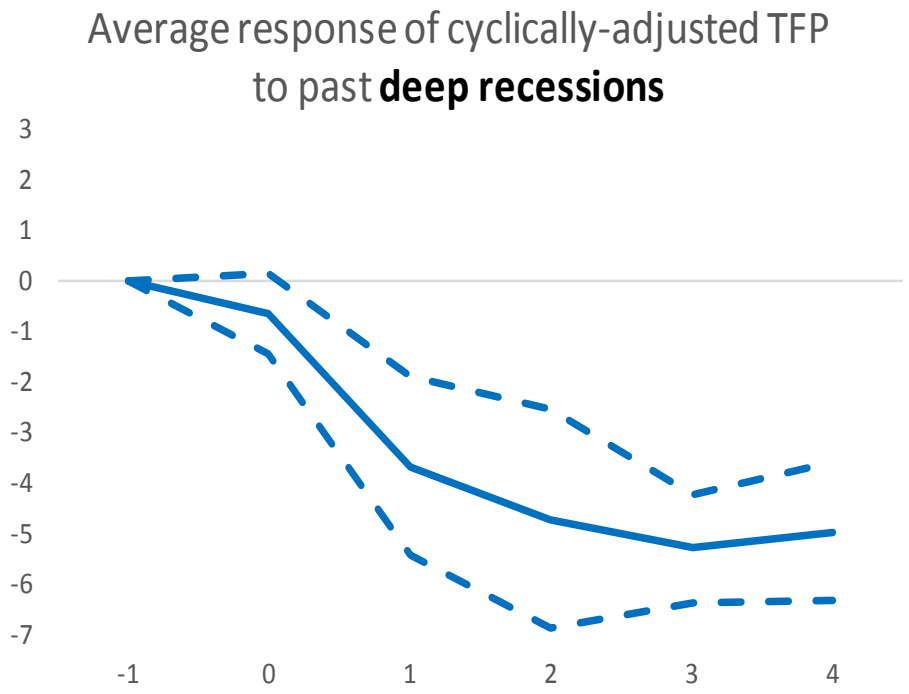
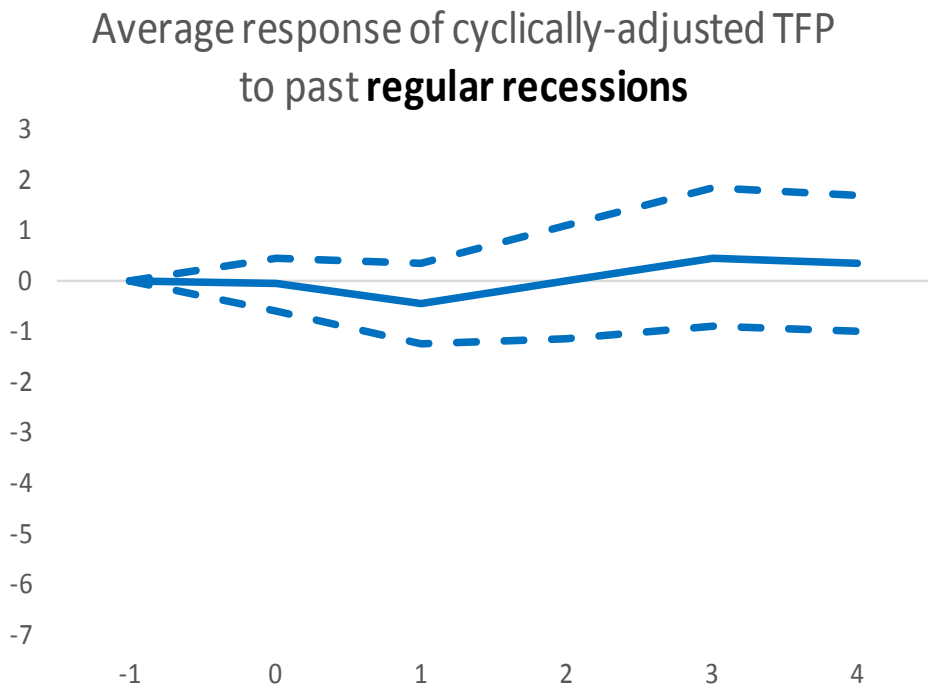
Sharp and persistent productivity slowdown since the GFC, casting doubt on dominant view that it is just a structural issue…



Sources: Penn World Table 9.0; World Economic Outlook, and IMF staff
Note: Weighted averages (using PPP-GDP as weights) are reported for a 20 largest advanced economies.

…and indeed major past recessions also seem to have entailed "TFP hysteresis", just like the GFC…





Sources: KLEMS; Blanchard, Cerutti, Summers (2015); IMF staff calculations.

Note: The cyclically-adjusted measure of TFP based on Basu, Fernald and Kimball (2006) is used. Major recessions are the biggest 10% falls in GDP in the first two years of a recession episode across 17 advanced economies over 1970-2007. The response of cyclically-adjusted TFP to major past recessions is estimated using a local projections method (Jorda 2005), 90 percent confidence intervals are shown. See Adler, Duval, Furc Koloskova and Poplawski-Ribeiro (2017) for details.

What could account for the magnitude and persistence of post-GFC TFP slowdown?

- ***Not*** Secular headwinds:

Waning ICT boom and innovation, slowing technology diffusion, possible roles of global trade slowdown, slowdown in human capital, ageing, etc.

➔ Already at play prior to the GFC

- But possibly crisis-related setbacks:

Balance sheet vulnerabilities, tight credit conditions, weak aggregate demand, elevated policy uncertainty

➔ Could affect investment in a broad sense—in tangibles and intangibles—with adverse effects on TFP

This paper: focus on role of balance sheet vulnerabilities and credit conditions

Unresolved ongoing policy debate on role of credit conditions for productivity

- Contradictory views regarding impact on misallocation of capital *across firms*:
  - Easy credit conditions can *reduce* misallocation of capital by easing the impact of financial frictions, e.g. collateral constraints (Midrigan and Xu, 2013) …
  - …but easy credit conditions may *increase* misallocation of capital if financial intermediation is poor (Gopinath et al., 2015)…
  - …and lead to busts with further misallocation post-bust (Borio et al., 2015; ongoing OECD work on zombie firms?)
- Impact on *within-firm* productivity growth virtually unknown:
  - Tight credit conditions may lead financially vulnerable firms to cut R&D spending (Holmstrom and Tirole 1997; Aghion et al., 2010, 2012)

This paper: focus on role of balance sheet vulnerabilities and credit conditions for *within-firm* productivity growth

Key Question(s)

Q: What is the role of financial frictions in explaining *firm-level* TFP slowdown since the financial crisis?

Q1. Can firm-specific pre-crisis financial vulnerabilities account for some of the post-crisis TFP growth slowdown? **Short answer: YES**

Q2. Did tighter credit conditions also play a role? If so, did they interact with corporate balance sheet vulnerabilities? **Short answer: YES**

Q3. If answer to Q1 and/or Q2 is yes, what are the channels?

Impact of financial frictions on intangible asset investment in distressed firms is one

Data

- **ORBIS cross-country firm-level data (15 OECD countries)**
  - Provided by Bureau van Dijk (BvD)
  - Balance sheet and income statements
  - Both small and large firms, listed and non-listed
  - Industry Category: 2 digit NACE
  - Time: 1998-2013 (annual frequency) ➔ Unique, constructed by combining different vintages of ORBIS (2005, 2010, 2015) (Gal and Hijzen, 2016)

- **TFP estimation**
  - Residual from estimation of firm-level production function (using 2-digit sectoral deflators)
  - One-step GMM approach by Woolridge (2009). Uses intermediate inputs to proxy for unobserved productivity for production function estimation to deal with simultaneity problem (builds on Levinsohn and Petrin 2003; Olley and Pakes 1996).

Q1. Empirical Approach

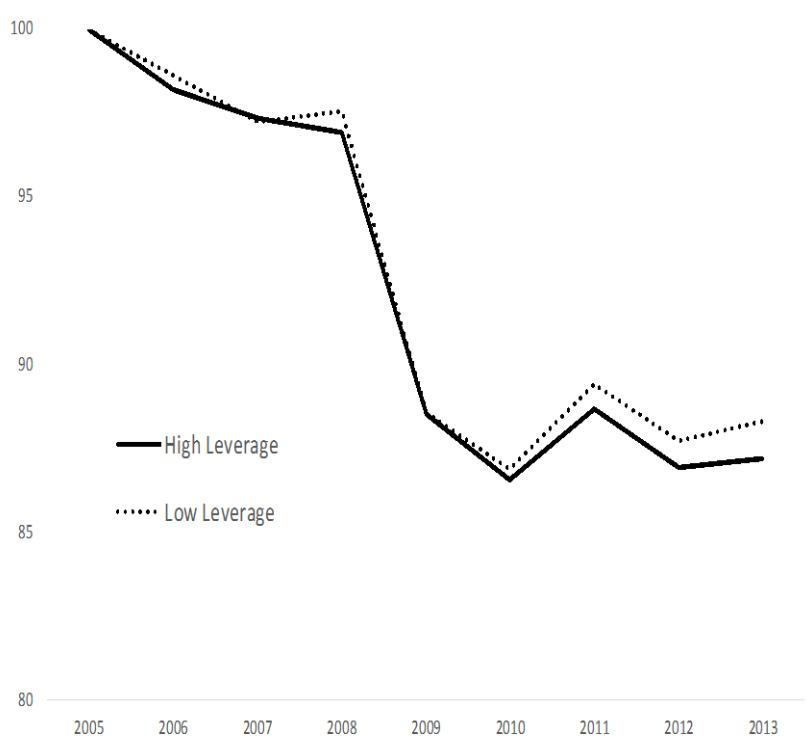
$$\Delta TFP_{isc}^{growth} = \alpha_{sc} + \beta_1 Vulnerabilities_i^{pre} + \gamma' \mathrm{X}_i + \varepsilon_{isc}$$

- DID framework: comparison between more and less vulnerable firms post- vs. pre-Crisis (6 years after vs. 6 years before), in spirit of Giroud and Mueller (QJE 2017)
- $\Delta TFP_{isc}^{growth}$:
  - Difference in average TFP growth post- vs. pre-Crisis (6 years after vs. 6 years before)
  - Implicit firm fixed effects
- Vulnerability:
  - (1) Average pre-crisis leverage (Debt/Total Assets) = debt overhang
  - (2) Debt maturing in 2008 (Current liabilities in 2007) = rollover risk
- α_{sc}: Country* Sector Fixed Effect
  - Absorbs time-variant unobserved heterogeneity at country-sector level
  - Implies *within* country-sector comparison
- X: Age, Size and EBITDA, Employment

Q1. Stylized facts

Post GFC TFP Level path for firms with different pre-GFC vulnerabilities

(Index 100 = 2005; high (low) vulnerability = 75th (25th) percentile of distribution)



Q1. Regression results

Table: Baseline

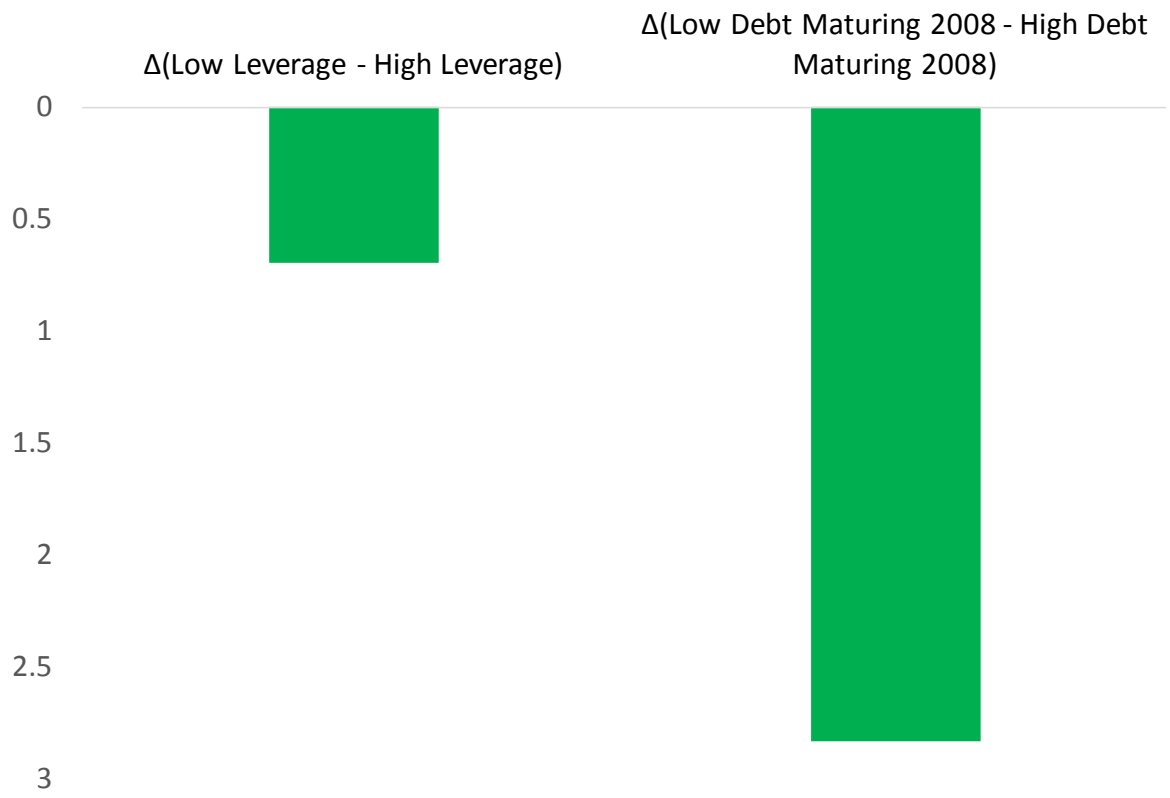
	(1)	(2)	(3)
		ΔTFP Growth	
Leverage Pre-Crisis	-0.0323***		-0.0211***
	(0.007)		(0.006)
Debt Maturing 2008		-0.0834***	-0.0819***
		(0.010)	(0.010)
R-squared	0.148	0.151	0.151
N	163163	163163	163163
Country*Sector FE	Yes	Yes	Yes

*Note: The dependent variable `ΔTFP Growth' is the difference in the TFP growth rate post vs. pre-crisis. `Leverage Pre-Crisis' is the average pre-crisis debt over assets ratio. `Debt Maturing 2008' is the amount of debt maturing in 2008 divided by average total sales pre-crisis. Post-crisis starts in 2008. Standard errors in parentheses. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.*

Q1. Quantitative implications: large

Implied impact of pre-GFC firm vulnerabilities on post-GFC slowdown

$$(\Delta TFP^{growth}_{low\ vulnerability} - \Delta TFP^{growth}_{high\ vulnerability}, percent)$$



Note: high (low) vulnerability = 75th (25th) percentile of distribution.

Q2. Exploring country heterogeneity: extended empirical Approach

$$\Delta TFP_{isc}^{growth} = \beta_1 Vulnerability_i^{pre} + \beta_2 Vulnerability_i^{pre} * \Delta CDS_c$$

$$+\gamma' \mathrm{X}_i + \alpha_{sc} + \varepsilon_{isc}$$

Where:

- ΔCDS_c: Change in average bank CDS spread in country c around collapse of Lehman Brothers, i.e. 2008H1 and 2008H2 (similar results with tighter window: W1 and W2)

- Hypothesis: banking systems that were more exposed to Lehman shock tightened credit conditions more, amplifying the adverse TFP impact of firm vulnerabilities

Q2. Regression results

Table: Banks' Lehman Exposure

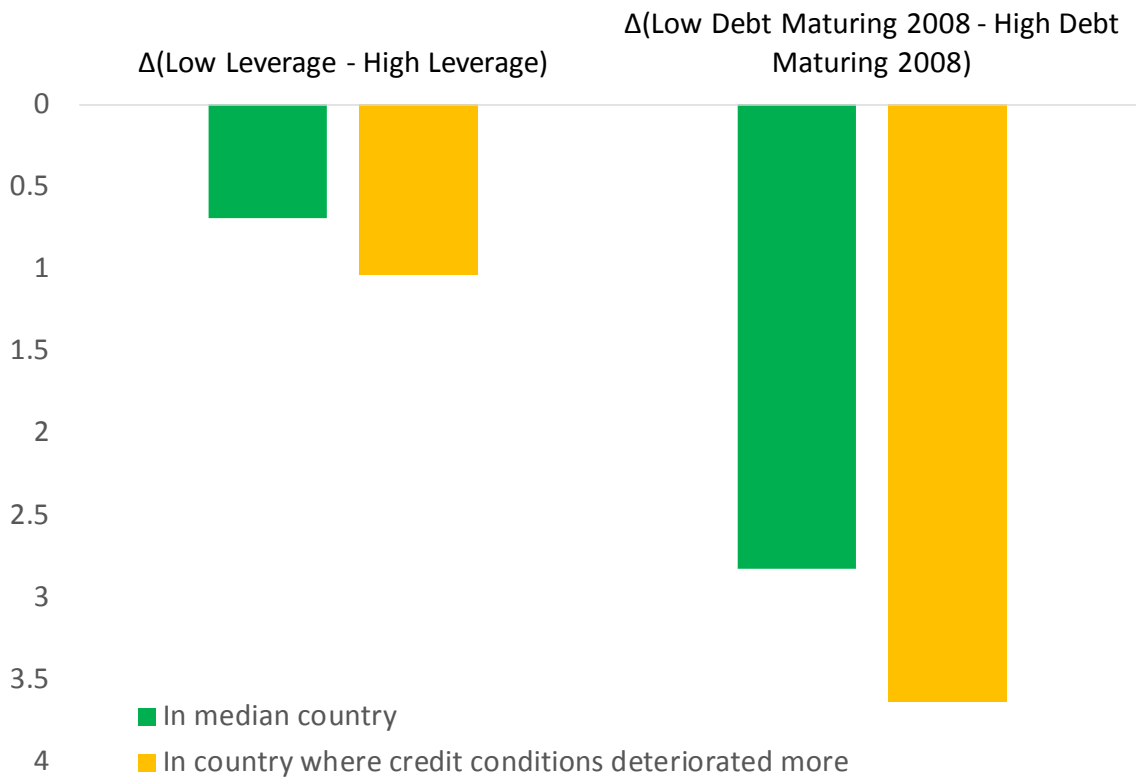
	(1)	(2)	(3)
	ΔTFP Growth		
Leverage Pre-Crisis	-0.0451***		-0.0317***
	(0.007)		(0.007)
Leverage Pre-Crisis * ΔCDS	-0.0760***		-0.0584***
	(0.020)		(0.020)
Debt Maturing 2008		-0.110***	-0.108***
		(0.009)	(0.009)
Debt Maturing 2008 * ΔCDS		-0.119***	-0.115***
		(0.018)	(0.018)
R-squared	0.169	0.174	0.174
N	129049	129049	129049
Country*Sector FE	Yes	Yes	Yes

*Note: The dependent variable `ΔTFP Growth' is the difference in the TFP growth rate post vs. pre-crisis. `Leverage Pre-Crisis' is the average pre-crisis debt over assets ratio. `Debt Maturing 2008' is the amount of debt maturing in 2008 divided by average total sales pre-crisis. Post-crisis starts in 2008. `ΔCDS' is the difference in the average CDS spread of banks in each country two quarters before and two quarters after the Lehman bankruptcy. Standard errors in parentheses. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.*

Q2. Quantitative implications

Implied impact of pre-GFC firm vulnerabilities on post-GFC slowdown: the role of country-wide credit conditions

$(\Delta TFP^{growth}_{low\ vulnerability} - \Delta TFP^{growth}_{high\ vulnerability}$, *percent)*



Note: high (low) vulnerability = 75th (25th) percentile of distribution. "Median country" = median of distribution of change in bank CDS spreads. "Country where credit conditions deteriorated more" = 75th percentile of distribution of change in bank CDS spreads

Q2. Further refinement: using banks' CDS changes matched to firms

"BANKER" variable from AMADEUS (i.e. Gianneti and Ongena (2012))

ΔCDS_firm: change in the average CDS spread of the firm's main creditor bank(s) (up to five of them) matched to a firm around the collapse of the Lehman Brothers (one week before and after)

Extended Specification: Accounting for Firm-Level Heterogeneity in Exposure to the Collapse of Lehman Brothers

	(1)	(2)	(3)	(4)
	ΔTFP growth			
Debt Maturing 2008	-0.112***	-0.112***	-0.114***	-0.163***
	(0.014)	(0.015)	(0.015)	(0.015)
ΔCDS_firm	-0.140	-0.179	-0.176	-0.293
	(0.214)	(0.219)	(0.217)	(0.214)
Debt Maturing 2008*ΔCDS_firm	-0.023**	-0.024**	-0.024**	-0.024**
	(0.010)	(0.010)	(0.010)	(0.011)
R-squared	0.0640	0.0719	0.0793	0.109
N	20798	20798	20798	20798
Country*Sector FE	No	No	Yes	Yes
Sector FE	No	Yes	-	-
Country FE	Yes	Yes	-	-
Controls	No	No	No	Yes

Note: The dependent variable `ΔTFP Growth' is the difference in the average TFP growth rate between post- and pre-crisis periods. `Debt Maturing in 2008' is the amount of debt maturing in 2008 divided by average total sales pre-crisis. The post-crisis period starts in 2008. 'ΔCDS_firm' refers to the change in the average CDS spread of the firm's main creditor bank(s) (up to five of them, drawn from the 'BANKER' variable in AMADEUS) between the weeks before and after the collapse of Lehman Brothers. Firm-specific controls include firm age, size of assets and earnings (EBITDA). Standard errors in parentheses. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

Putting our analysis of Q1 and Q2 together…

- Firms with higher debt-to-assets (leverage) ratios pre-crisis experienced larger drop in productivity growth than less leveraged counterparts (Debt Overhang)
- Firms with more debt maturing in 2008 experienced larger drop in productivity growth than firms with less debt maturing in 2008 (Rollover Risk)
- Both relationships stronger in countries where credit conditions tightened more in immediate aftermath of Lehman
- No systematic difference pre-crisis, and placebo test for the 2000-01 recession (which was *not* a banking crisis) are suggestive of causal relationship…

Was the GFC different from past recessions? Placebo Test: Was 2000 different from 2008?

Table: Placebo

	(1)	(2)	(3)
		ΔTFP Growth	
Leverage Pre-Crisis	-0.00383		0.00620
	(0.015)		(0.017)
Debt Maturing 2000		-0.0657	-0.0690
		(0.046)	(0.050)
R-squared	0.157	0.157	0.157
N	53200	53200	53200
Country*Sector FE	Yes	Yes	Yes

*Note: The placebo post-crisis covers 2000 until 2005. The dependent variable `ΔTFP Growth' is the difference in the TFP growth rate post vs. pre-crisis. `Leverage Pre-Crisis' is the average pre-crisis debt over assets ratio. `Debt Maturing 2000' is the amount of debt maturing in 2008 divided by average total sales pre-crisis. Standard errors in parentheses. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.*

Q3. What are the channels? Cut in productivity-enhancing investment in intangibles is one

Table 5: Investment in Intangible Assets

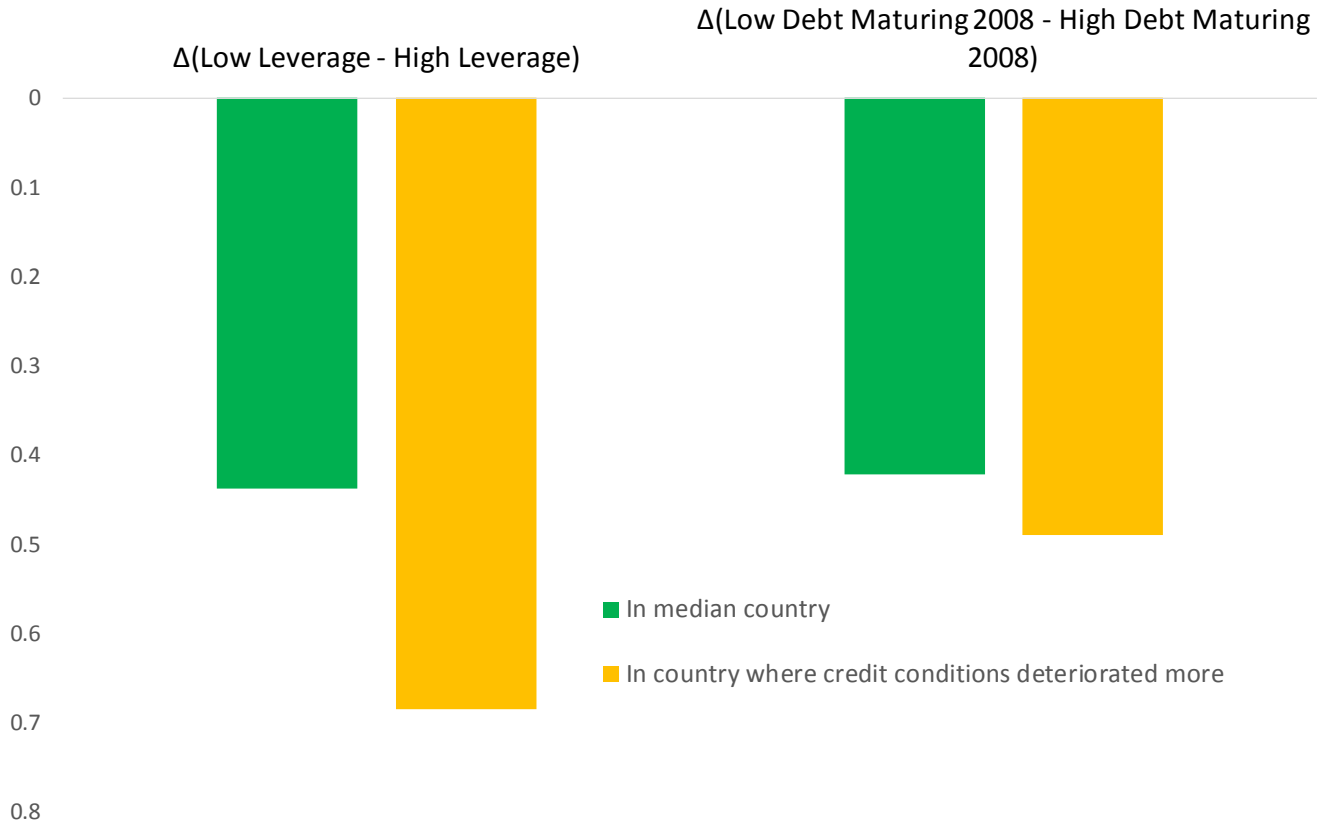
	(1)	(2)	(3)
	Δ Investment in Intangible Assets		
Leverage Pre-Crisis	-0.0218***		-0.0200***
	(0.003)		(0.003)
Leverage Pre-Crisis * ΔCDS	-0.0363***		-0.0353***
	(0.007)		(0.007)
Debt Maturing 2008		-0.0173***	-0.0161***
		(0.001)	(0.001)
Debt Maturing 2008* ΔCDS		-0.0123***	-0.00965***
		(0.003)	(0.003)
R-squared	0.169	0.174	0.174
N	129049	129049	129049
Country*Sector FE	Yes	Yes	Yes

*Note: The dependent variable `Δ Investment in Intangible Assets' is the difference in the investment in intangible assets as a ratio of value added post vs. pre-crisis. `Leverage Pre-Crisis' is the average pre-crisis debt over assets ratio. `Debt Maturing 2008' is the amount of debt maturing in 2008 divided by average total sales pre-crisis. Post-crisis starts in 2008. `ΔCDS' is the difference in the average CDS spread of banks in each country two quarters before and two quarters after the Lehman bankruptcy. Standard errors in parentheses. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.*

Q3. Quantitative implications

Implied impact of pre-GFC firm vulnerabilities on post-GFC decline in intangible investment

$(\Delta I/Y^{intangibles}_{low\ vulnerability} - \Delta I/Y^{intangibles}_{high\ vulnerability}$, percentage points of value added)



Note: high (low) vulnerability = 75th (25th) percentile of distribution. "Median country" = median of distribution of change in bank CDS spreads. "Country where credit conditions deteriorated more" = 75th percentile of distribution of change in bank CDS spreads

Conclusion

- Financial frictions do matter for productivity growth, and not just through capital (mis)allocation across firms
- More vulnerable firms experienced larger drop in TFP growth post-GFC
- Weaker intangible investment was one channel—its drop was frontloaded and short-lived, while TFP growth decline was more gradual (dynamic analysis)
- Stronger relationships in countries where banking sector was hit harder by GFC
- Results are *not* driven by more vulnerable firms being low-productivity (level or growth) firms, or differing from less vulnerable firms along other dimensions
- Effects seem economically large: taken at face value, coefficients imply that up to a third of productivity slowdown in this sample of firms can be explained