Counter-Cyclical Macroeconomic Policy, Product Market Competition and Growth: Firm-level Evidence from the Global Financial Crisis

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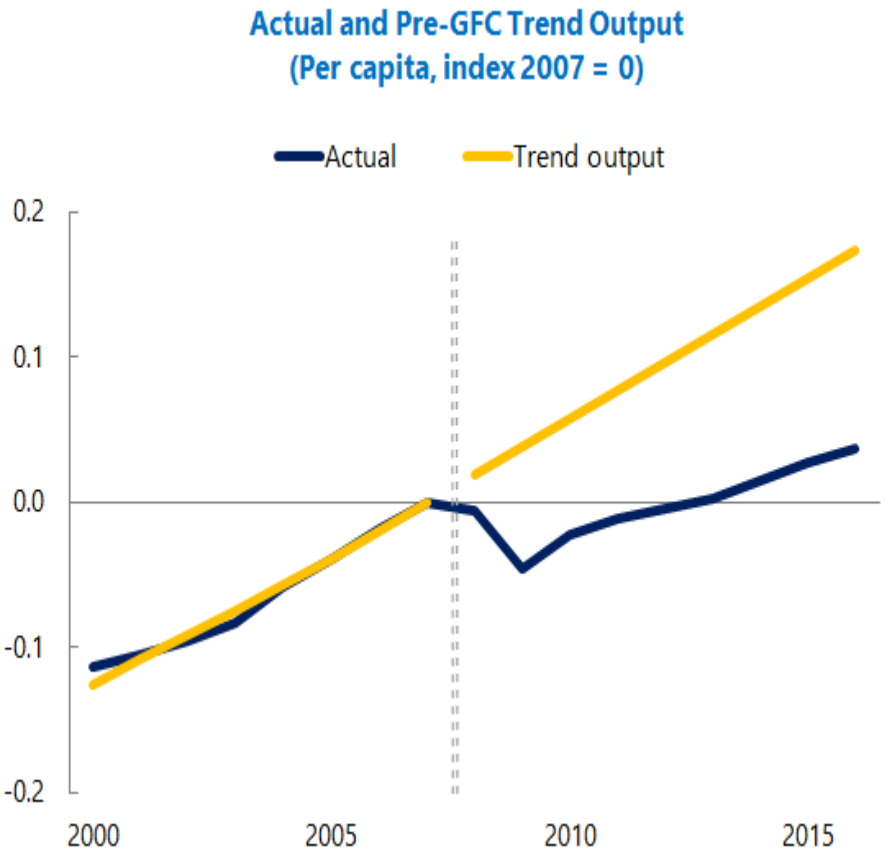
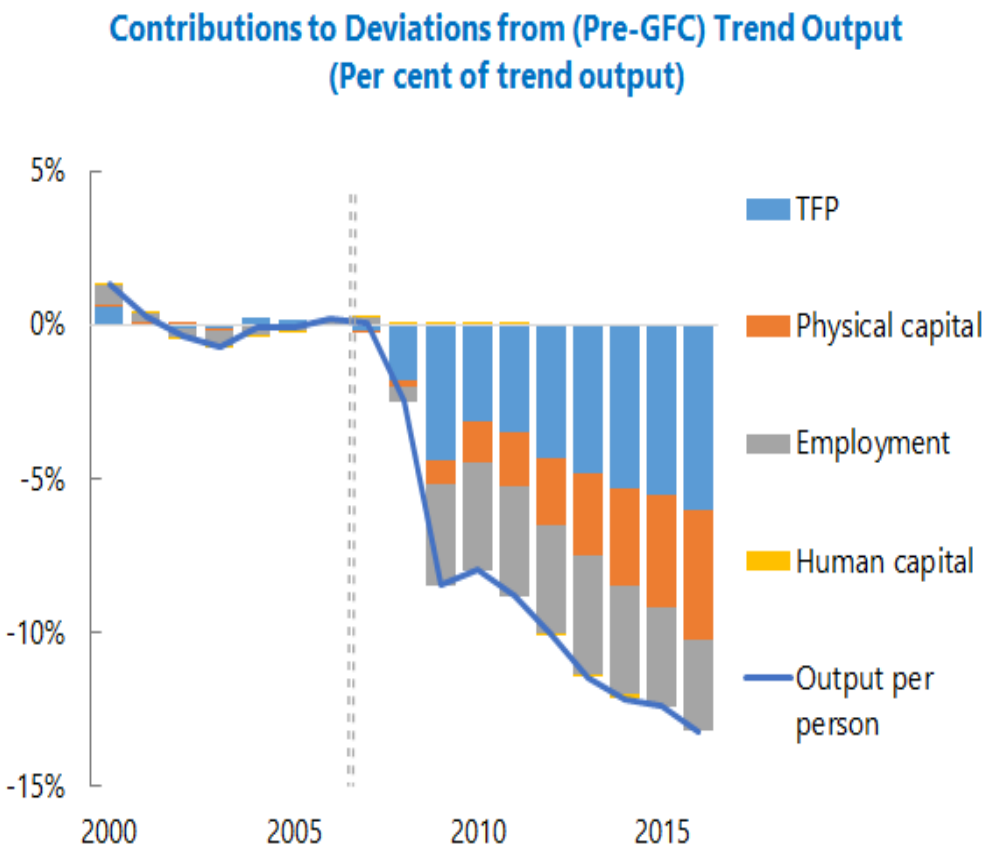
Banque de France – College de France Conference on Productivity Dynamics after the Crisis

Paris, June 18, 2018

Large and persistent output and TFP losses from the 2008-2009 GFC…





Sources: Penn World Table 9.0; IMF, *World Economic Outlook*; Adler et al. (2017).
Note: GFC = global financial crisis, TFP = total factor productivity. Purchasing-power-parity-GDP-weighted average of largest 20 advanced economies is reported. Trend output = projection based on the Hodrick–Prescott filter trend in years preceding the GFC.

…have renewed a broader theoretical and macro policy debate about hysteresis

- Large and persistent output losses from recessions associated with financial crises—although magnitude still debated:
  e.g., Cerra and Saxena, 2008; IMF, 2009; Jorda, Schularick and Taylor, 2013; Reinhart and Rogoff, 2009; Romer and Romer, 2017…

- Even more puzzling, persistent output losses from recessions in general?
  e.g., Blanchard, Cerutti and Summers, 2015…

- …pointing to possible role for counter-cyclical macro policy to affect growth

- Channel(s)? Investment in innovation may be one:
  e.g., Aghion et al., 2010; Aghion, Hemous and Kharroubi, 2014; Aghion, Farhi and Kharroubi, 2012, 2017; Benigno and Fornaro, forthcoming

➔ Role of intangibles

What is special about intangible assets?

- Growing emphasis on intangibles as potential source of TFP growth:
  e.g., Corrado et al., 2009; van Ark et al., 2009; Aw et al., 2011; Doraszelski and Jaumandreu, 2013

- But investment in intangibles is also vulnerable—key issues include:

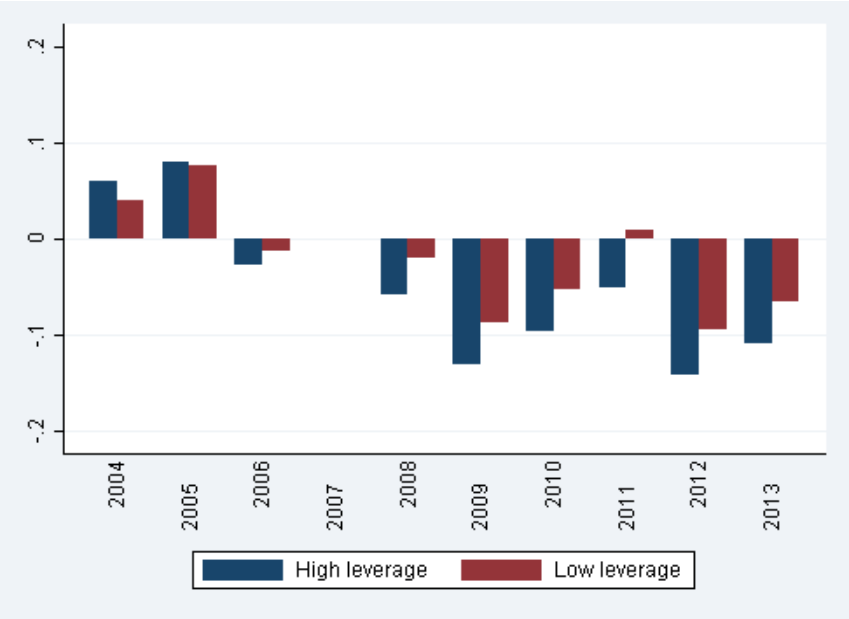
  - Long duration projects with high adjustment costs (sunk human capital investment, lost with layoffs) → even a temporary disruption can permanently affect project returns

  - Intrinsic uncertainty + asymmetric information/moral hazard + limited pledgeability → particularly sensitive to external financing conditions
    e.g., Aghion et al., 2010, 2012; Almeida et al., 2007; Duval, Hong and Timmer, 2017; Hall and Lerner, 2010; Garcia-Macia, 2017

Post-GFC drop in intangible investment was larger for more leveraged firms

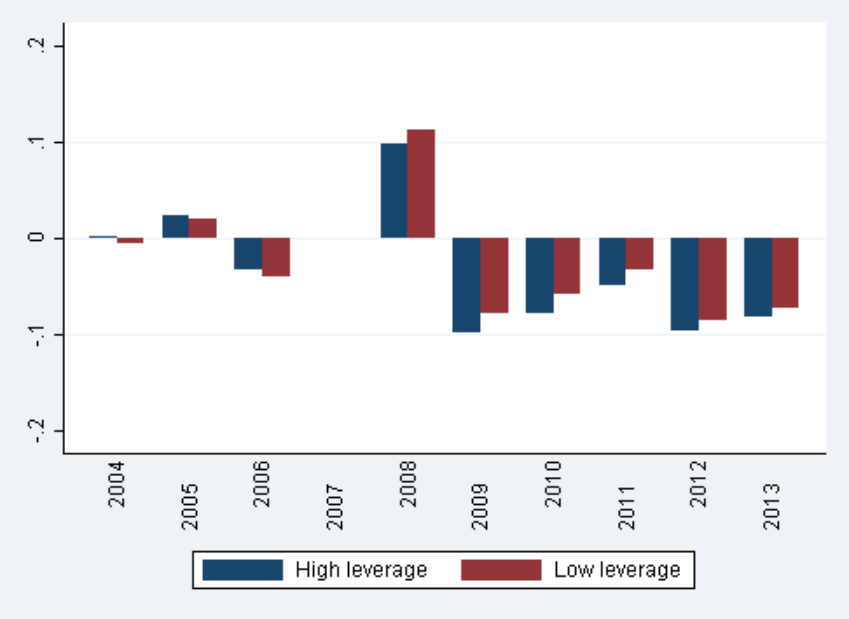
Intangible investment

(firms with high vs low leverage before the GFC)



Tangible investment

(firms with high vs low leverage before the GFC)



- *Within* a given country-sector (i.e., controlling for country-sector fixed effects), the decline in intangible investment was as big/persistent as that in tangible investment…(# Corrado et al., 2018)

- Leverage seems to matter more for intangible investment

The role of counter-cyclical macro policy and product market competition

- Counter-cyclical macro policy makes credit constraints less binding…
  - Indirectly by boosting output—monetary and fiscal policies
  - Directly by affecting the cost and availability of external finance—monetary policy

  e.g. Aghion et al. (2010, 2012)

- …unlike product market competition…
  - Competition ➔ lower rents ➔ lower internal funds for investment

- …implying potential complementarity between product market deregulation and counter-cyclical macro policy in raising intangible investment and growth

- Aghion, Farhi and Kharroubi (2017) support this complementarity in theoretical model of growth-enhancing (but non-pledgeable) investment choice under macro and liquidity shocks.

What we do in this paper

- Using cross-country firm-level data, and focusing on the Lehman shock and policy responses in its aftermath, this paper addresses 2 key questions:

(i) Does counter-cyclical macroeconomic policy help mitigate the adverse impact of financial frictions on intangible investment?
➔ Implication 1: relevance of macro policy for longer-term growth

(ii) Is it complementary to product market deregulation?
➔ Implication 2: increased relevance of macro policy as competition is strengthened through deregulation

- Two main contributions relative to Aghion, Farhi and Kharroubi (2017):

(i) Firm-level data and identification
(ii) Strict focus on competition measures and broader range of policies

Empirical strategy (1)

$$\Delta Intangible\ Inv_{isc} = \alpha_{sc} + \beta_1 Vulnerability_i^{pre} + \gamma' \mathrm{X}_i + \varepsilon_{isc}$$

- DID framework: more vs. less vulnerable firms over post- vs. pre-crisis (2008-12 vs 2003-07), in spirit of Giroud and Mueller, 2017; Duval et al., 2017; Kalemli-Ozcan et al., 2018
- $\Delta Intangible\ Inv_{isc}$: Change in net intangible investment rate $\Delta\ \frac{I^{int}}{K^{tot}}$ (2008-12 vs 2003-07)
- α_{sc}: 4-digit FEs to control for unobserved country-sector heterogeneity (e.g. demand)
- X_i: firm-level controls (age, size, cash-flow, etc.)
- *Vulnerability*: average pre-crisis leverage; interest coverage ratio (robustness check)
- $\beta_1 < 0$: Financially vulnerable firms cut investment in intangible assets more

Empirical strategy (2)

$$\Delta Intangible\ Inv_{isc} = \alpha_{sc} + \beta_1 Vulnerability_i^{pre} + \beta_2 Vulnerability_i^{pre} * Expansionary\ monetary\ conditions_c^{post} + \gamma' \mathrm{X}_i + \varepsilon_{isc}$$

- *Expansionary monetary conditions*: measure of extent to which monetary policy response to crisis was more expansionary than expected:
  - OECD forecast errors for 10yr govt bond yields (Aghion et al., 2017)
  - Deviation from basic Taylor-rule policy rates (Nechio, 2011; Dell'Ariccia et al., 2017)
  - Consensus forecast errors for short-term rates (Duval and Furceri, 2018)
  - Extension to fiscal policy: OECD forecast errors for G (Auerbach and Gorodnichenko, 2012)

- $\beta_2 > 0$:
  - Expansionary policy alleviates adverse effects of financial frictions on investment in intangible assets

Empirical strategy (3)

$$\Delta Intangible\ Inv_{isc} = \alpha_{sc} + \beta_1 Vulnerability_i^{pre} +$$
$$\beta_2 Vulnerability_i^{pre} * Expansionary\ monetary\ conditions_c^{post} +$$
$$\beta_3 Vulnerability_i^{pre} * Weak\ competition_{sc}^{pre} +$$
$$\beta_4 Vulnerability_i^{pre} * Expansionary\ monetary\ conditions_c^{post}$$
$$* Weak\ competition_{sc}^{pre} + \gamma' \mathrm{X}_i + \varepsilon_{isc}$$

- *Weak competition*:
  - Lerner index (pre-crisis median in each country-industry, a la Aghion et al., 2005)
  - Markups (pre-crisis median in each country-industry: Diez et al., forthcoming, based on De Loecker and Warzynski , 2012)
  - OECD Product Market Regulation (PMR) indicators

- $\beta_3 > 0$: The adverse effects of financial frictions on investment in intangible assets are larger where competition is stronger
- $\beta_4 < 0$: Monetary policy is more effective where competition is stronger

Data

- **ORBIS cross-country firm-level data**
  - 17 OECD countries, annual data

    (Austria, Belgium, Czech Republic, Germany, Finland, France, Greece, Hungary, Ireland, Italy, Korea, Norway, Poland, Portugal, Slovakia, Spain, UK)
  - Constructed by combining different vintages of ORBIS

    (Diez et al., forthcoming, following Gopinath et al., 2017)
  - Industry category: 4 digit NACE
  - Balance sheet and income statements; non-listed (99%) and listed (1%); non-financial corporations including service sectors

- **Intangible investment data**
  - Net intangible investment = change in real intangible capital stock
  - Issues: typically does not fully capture intangible assets, notably internally-generated ones (e.g. R&D); M&As (on our agenda)
  - Should generate measurement error and attenuation bias

Baseline results

	(1)	(2)	(3)	(4)
(Vulnerability)$_i$	-0.005***	-0.006***	-0.008***	-0.009***
	(0.000)	(0.000)	(0.001)	(0.001)
(Vulnerability)$_i$ X (Expansionary monetary conditions)$_c$		0.006***		0.009***
		(0.001)		(0.001)
(Vulnerability)$_i$ X (Weak competition)$_{cs}$			0.059***	0.068***
			(0.012)	(0.013)
(Vulnerability)$_i$ X (Expansionary monetary conditions)$_c$ X (Weak competition)$_{cs}$				-0.066***
				(0.019)
Observations	664,086	664,086	664,086	664,086
R-squared	0.061	0.061	0.061	0.062
Country-Sector FE	YES	YES	YES	YES

Note: The dependent variable is the difference in the average net investment in intangible assets (as a ratio of total assets) between post- and pre-crisis periods. Firm-level *Vulnerability* is measured as the average debt-to-assets ratio in the pre-crisis period. *Expansionary monetary conditions* is the average OECD forecast error for long term (10-year government bond) interest rate in the post-crisis period as a measure of more-than-expected policy loosening. Weak *competition* is measured as the median pre-crisis Lerner index value in each country-sector, reflecting the degree of profitablity. The post-crisis period starts in 2008. Firm-specific controls include firm age, total assets, and cash-flow/assets ratio. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

- **Adverse effects of financial frictions on intangible assets investment…**
- **…mitigated by expansionary policy**
- **…especially where firms face stronger competition**

Tangible vs Intangible assets investment

	(1) *baseline*	(2) *intangible-total assets ratio*	(3) *investment in tangible assets*
(Vulnerability)$_i$	-0.009***	-0.056***	-0.017***
	(0.001)	(0.008)	(0.003)
(Vulnerability)$_i$ X (Expansionary monetary conditions)$_c$	0.009***	0.099***	0.004
	(0.001)	(0.012)	(0.005)
(Vulnerability)$_i$ X (Weak competition)$_{cs}$	0.068***	0.588***	-0.021
	(0.013)	(0.120)	(0.047)
(Vulnerability)$_i$ X (Expansionary monetary conditions)$_c$	-0.066***	-0.977***	0.079
X (Weak competition)$_{cs}$	(0.019)	(0.172)	(0.073)
Observations	664,086	662,923	674,266
R-squared	0.062	0.145	0.033
Country-Sector FE	YES	YES	YES

$$\Delta \frac{I^{int}}{K^{tot}} = \Delta \frac{I^{int}}{K^{int}} \frac{K^{int}}{K^{tot}}$$

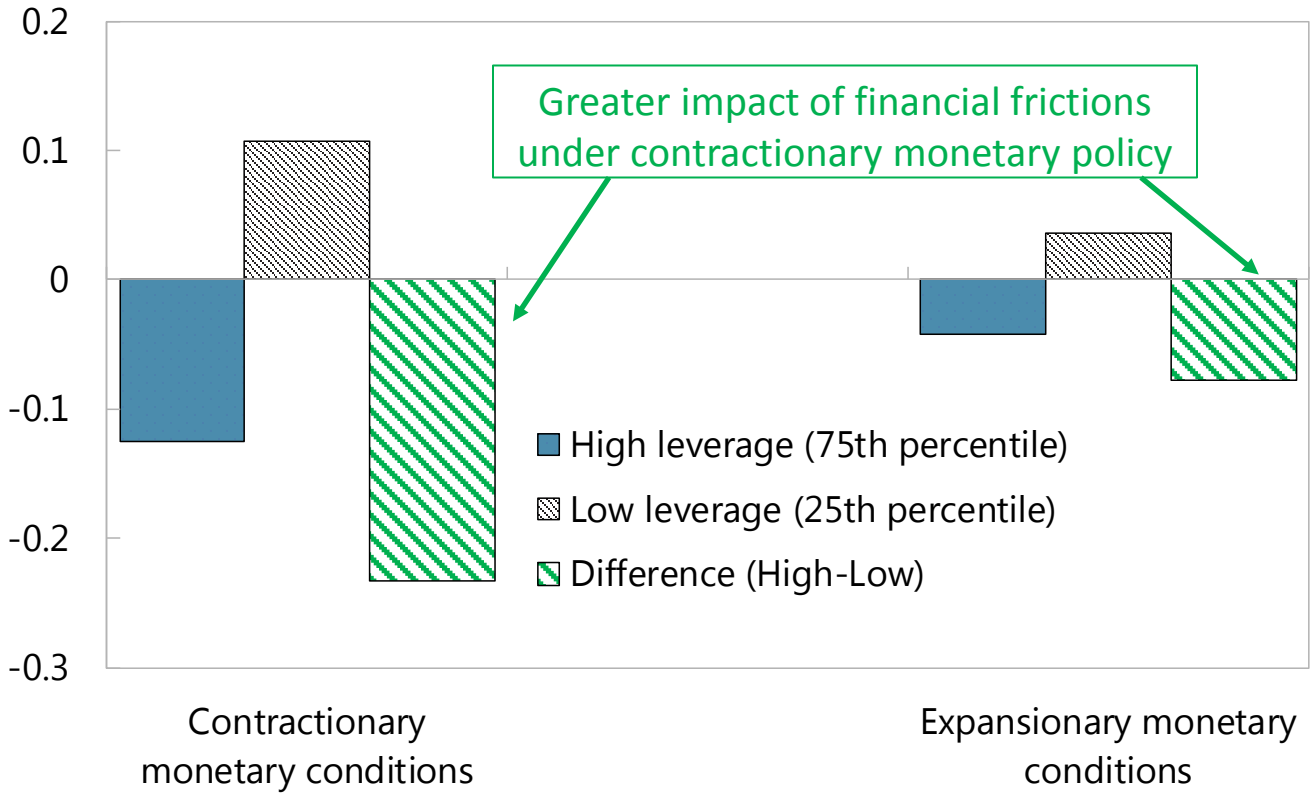
Note: The dependent variable is the difference in the average net investment in intangible assets (as a ratio of total assets) between post- and pre-crisis periods in column (1); the difference in the average ratio of intangible assets to total assets between post- and pre-crisis periods in column (2); the difference in the average net investment in tangible assets (as a ratio of total assets) between post- and pre-crisis periods in column (3). Firm-level *Vulnerability* is measured as the average debt-to-assets ratio in the pre-crisis period. *Expansionary monetary conditions* is the average OECD forecast error for long term (10-year government bond) interest rate in the post-crisis period as a measure of more-than-expected policy loosening. Weak *competition* is measured as the median pre-crisis Lerner index value in each country-sector, reflecting the degree of profitablity. The post-crisis period starts in 2008. Firm-specific controls include firm age, total assets, and cash-flow/assets ratio. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

- **These effects are largely specific to intangible (as opposed to tangible) investment ➔ consistent with theory**

Illustrative example: counter-cyclical policy

Estimated Decline in Intangible Assets Investment

(in percent of total assets)

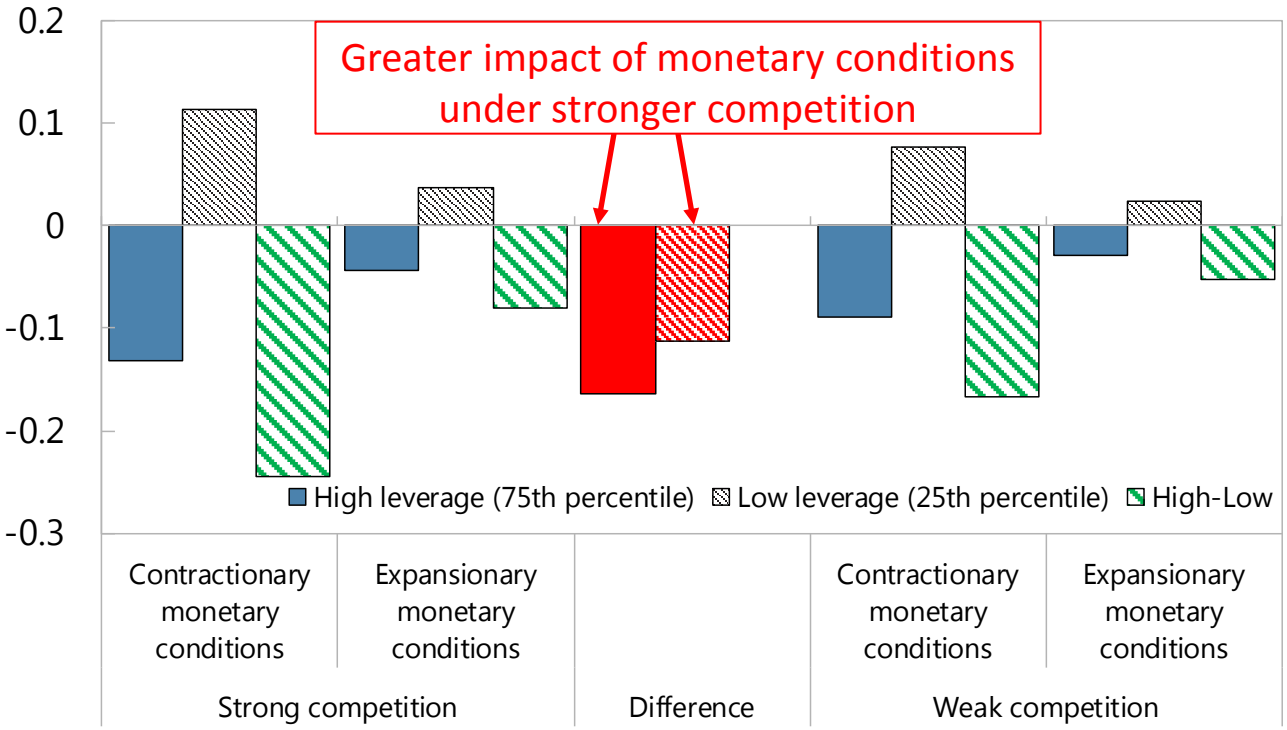


Note: High (low) leverage corresponds to the 75th (25th) percentile of the cross-firm distribution of pre-crisis average leverage ratio. The red bars indicate the difference in estimated effects for high and low leverage firms, separately for contractionary and expansionary monetary conditions. Estimated coefficients are from column (2) in the baseline results table. Expansionary/contractionary monetary conditions are defined as forecast errors in 10-year gov't bond yields by ±50 bps.

Illustrative example: policy complementarity

Estimated Deline in Intangible Assets Investment

(in percent of total assets)



Note: High (low) leverage corresponds to the 75th (25th) percentile of the cross-firm distribution of pre-crisis average leverage ratios. The green striped bars indicate the difference in estimated effects for high and low leverage firms in contractionary and expansionary monetary conditions, respectively, while the red bars measure the difference between them, separately for strong and weak competition environments. Estimated coefficients are from column (4) in the baseline results table. Expansionary/contractionary monetary conditions are defined as forecast errors in 10-year gov't bond yields by ±50 bps. Weak (strong) competition corresponds to the 75th percentile of the country-sector distribution of pre-crisis average Lerner index values.

Robustness checks: alternative policy shock measures

Expansionary policy is:	(1) *Deviation from Taylor rule*	(2) *Forecast errors in short-term policy rate*	(3) *Forecast errors in gov't consumption*
$(Vulnerability)_i$	-0.005***	-0.012***	-0.015***
	(0.001)	(0.001)	(0.001)
$(Vulnerability)_i$ X (Expansionary monetary conditions)$_c$	0.004***	0.010***	0.015***
	(0.000)	(0.002)	(0.001)
$(Vulnerability)_i$ X (Weak competition)$_{cs}$	0.028***	0.079***	0.111***
	(0.010)	(0.016)	(0.015)
$(Vulnerability)_i$ X (Expansionary monetary conditions)$_c$ X (Weak competition)$_{cs}$	-0.013**	-0.057	-0.117***
	(0.006)	(0.039)	(0.017)
Observations	664,086	571,482	647,836
R-squared	0.063	0.062	0.062
Country-Sector FE	YES	YES	YES

Note: The dependent variable is the difference in the average net investment in intangible assets (as a ratio of total assets) between post- and pre-crisis periods. Firm-level Vulnerability is measured as the average debt-to-assets ratio in the pre-crisis period. *Expansionary monetary conditions* as a measure of more-than-expected policy loosening is the average deviation of policy rates from the Taylor-rule implied one in the post-crisis period in column 1; the forecast error in monetary policy rates from Duval and Furceri (2018) in column 2; the forecast error of government consumption expenditure to GDP from Duval and Furceri (2018) in column 3. *Weak competition i*s measured as the median pre-crisis Lerner index value in each country-sector, reflecting the degree of profitablity. Firm-specific controls include firm age, total assets, and cash-flow/assets ratio. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

Robustness checks: alternative competition measures

Competition measure is:	(1) *median markup (country-sector)*	(2) *product market regulation*	(3) *regulatory protection of incumbents*	(4) *administrative burdens for startups*
$(Vulnerability)_i$	-0.009***	-0.018***	-0.043***	-0.031***
	(0.001)	(0.002)	(0.004)	(0.003)
$(Vulnerability)_i$ X (Expansionary monetary conditions)$_c$	0.011***	0.043***	0.069***	0.052***
	(0.002)	(0.003)	(0.005)	(0.005)
$(Vulnerability)_i$ X (Weak competition)$_{cs}$	0.002***	0.007***	0.031***	0.010***
	(0.001)	(0.001)	(0.003)	(0.001)
$(Vulnerability)_i$ X (Expansionary monetary conditions)$_c$ X (Weak competition)$_{cs}$	-0.003***	-0.021***	-0.049***	-0.017***
	(0.001)	(0.002)	(0.004)	(0.002)
Observations	664,086	664,086	664,086	664,086
R-squared	0.062	0.062	0.062	0.062
Country-Sector FE	YES	YES	YES	YES

Note: The dependent variable is the difference in the average net investment in intangible assets (as a ratio of total assets) between post- and pre-crisis periods. Firm-level *Vulnerability* is measured as the average debt-to-assets ratio in the pre-crisis period. *Expansionary monetary conditions* is the average OECD forecast error for long term (10-year government bond) interest rate in the post-crisis period as a measure of more-than-expected policy loosening. *Weak competition* is measured as the median markup estimate in each country-sector, reflecting the degree of profitablity in column 1; the OECD indicator of Product Market Regulation (PMR) in 2008 in column 2; the OECD indicator of Regulatory Protection of Incumbents (RPI) in 2008; the OECD indicator of Administrative Burdens for Start-ups (ABS) in 2008 in column 4. The post-crisis period starts in 2008. Firm-specific controls include firm age, total assets, and cash-flow/assets ratio. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

Additional robustness checks

	(1) *Shorter window (2005-2010)*	(2) *Binary choice model (Linear probability)*	(3) *Alternative vulnerability (Interest coverage)*	(4) *Excluding zeros (no intangible assets)*
$(Vulnerability)_i$	-0.013***	-0.172***	-0.006***	-0.011***
	(0.001)	(0.013)	(0.001)	(0.001)
$(Vulnerability)_i$ X (Expansionary monetary conditions)$_c$	0.011***	0.081***	0.015***	0.012***
	(0.002)	(0.023)	(0.002)	(0.002)
$(Vulnerability)_i$ X (Weak competition)$_{cs}$	0.103***	0.804***	0.003***	0.082***
	(0.015)	(0.206)	(0.001)	(0.016)
$(Vulnerability)_i$ X (Expansionary monetary conditions)$_c$	-0.095***	-0.564*	-0.007***	-0.089***
X (Weak competition)$_{cs}$	(0.023)	(0.316)	(0.001)	(0.023)
Observations	615,143	664,086	664,453	518,048
R-squared	0.074	0.087	0.060	0.072
Country-Sector FE	YES	YES	YES	YES

Note: The dependent variable is the difference in the average net investment in intangible assets (as a ratio of total assets) between post- and pre-crisis periods. Firm-level *Vulnerability* is measured as the average debt-to-assets ratio in the pre-crisis period except for in column 3 where it is measured as the interest coverage ratio (the average ratio of interest payments to earnings (EBITDA)) in the pre-crissi period. *Expansionary monetary conditions* is the average OECD forecast error for long term (10-year government bond) interest rate in the post-crisis period as a measure of more-than-expected policy loosening. *Weak competition* is measured as the median pre-crisis Lerner index value in each country-sector, reflecting the degree of profitablity. Column 1 considers a shorter window between 2005 and 2010; column 2 corresponds to linear probability model by replacing the non-negative dependent variable with 1 (and 0 otherwise). Column 4 excludes obersvations without intangible assets in both periods, and hence, no change in intangible investement during the periods. The post-crisis period starts in 2008. Firm-specific controls include firm age, total assets, and cash-flow/assets ratio. Standard errors are clustered at the country-sector level. *: significant at 10% level; **: significant at 5% level; ***: significant at 1% level.

Conclusion

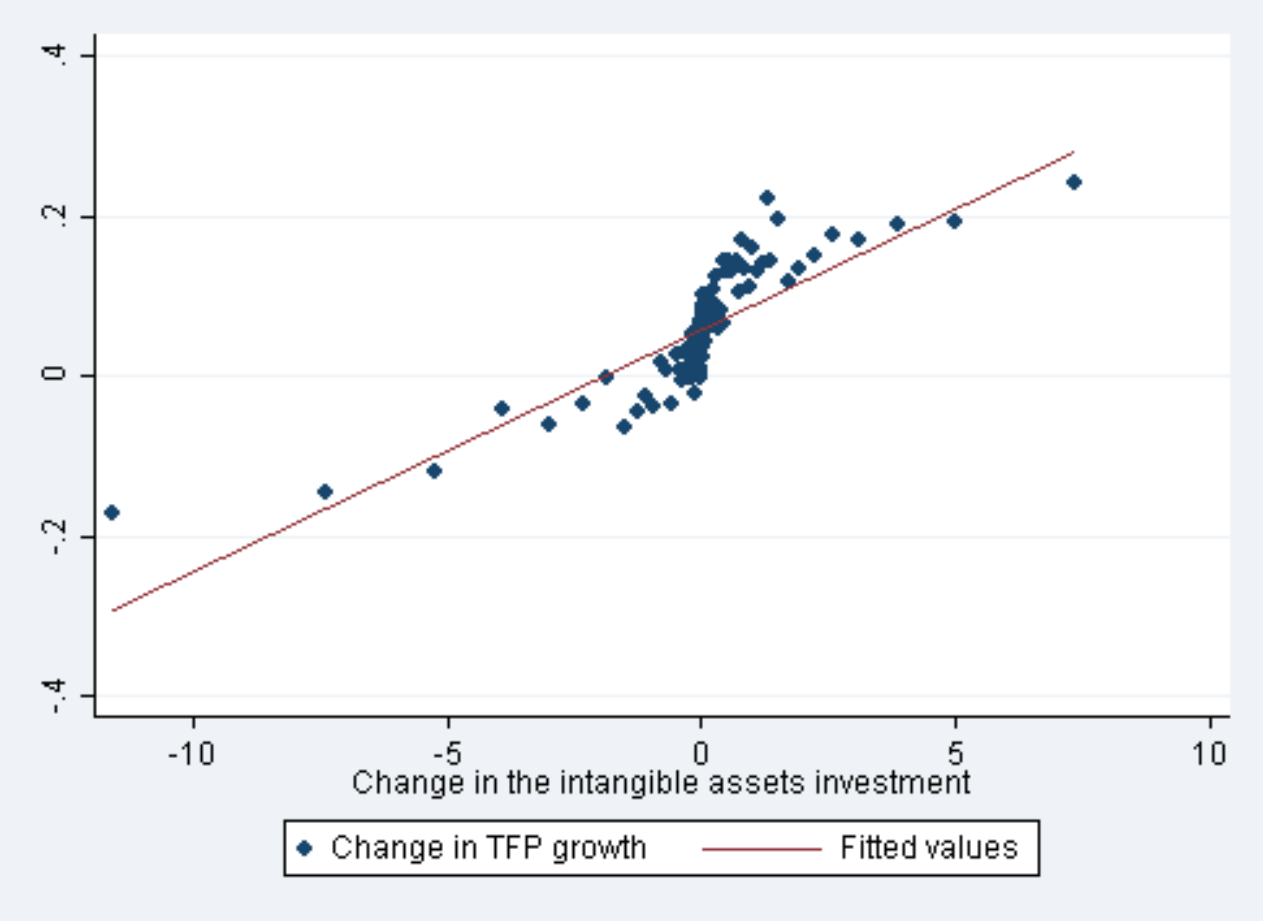
- Countercyclical macro policy helped financially vulnerable firms keep on investing in intangibles after GFC, especially where competition was stronger

- Points to role of counter-cyclical macro policy for longer-term growth, and to complementarity with product market deregulation:
  - Product market competition increases efficiency, and possibly innovation
    e.g. Griffith, Harrison, and Simpson, 2010; Aghion et al., 2005, 2009
  - But it can backfire when credit constraints bite in downturns, so needs to be supported by strong countercyclical macro policies

- Lesson for European debate on macro vs structural policies: need for both

Extra slides

Post-GFC drop in intangible investment correlates with drop in TFP growth at the firm level



Note: Each dot represents the quantile-median of the *residual* of the change in the average TFP growth between the post- and the pre-crisis periods on *country-sector fixed effect* (y-axis) against the quantile-median of the *residual* of the change in the average investment in intangible assets between the post-and the pre-crisis periods on *country-sector fixed effect* (x-axis), where the latter is broken down into 100 quantiles. The post- and pre-crisis periods includes five years after and before the 2008 crisis, respectively.

Measuring expansionary monetary conditions

$$Forecast\ Error_{ct}^{X} = Forecast_{ct}^{X} - Actual_{ct}^{X}$$

- OECD forecast errors for long-term (10yr) gov't yields
- Consensus forecast errors for short-term policy rates
  - Take residuals from the regression of short-term policy rate forecast errors on inflation and output growth forecast errors
  - Exogenous monetary policy shocks that are orthogonal to unexpected changes in output growth and inflation
- Forecast as of October of the previous year

$$i_{ct}^{Taylor} = (R + \pi) + a * (output\ gap_{ct}) + b * (\pi - \pi_{ct}^{target})$$

- Deviation from the most basic Taylor-rule implied policy rates: $i_{ct}^{Taylor} - i_{ct}^{Actual}$
  - Common parameter values for all the sample countries
  - $a = 1; b = .5; R = 2; \pi_{ct}^{target} = 2$

- Extension: fiscal policy
  - OECD forecast errors for gov't consumption expenditure to GDP (multiplied by -1)

Measuring the degree of competition

$$Lerner\ index_{ict} = \frac{P - MC}{P} \simeq \frac{(EBITDA - Depreciation\ and\ Amortization)_{ict}}{(Operating\ Revenue)_{ict}}$$

a la Nickell (1996); Aghion et al. (2005)

$$Markup_{ict} = \frac{P}{MC} = \frac{P_{ict}Q_{ict}}{P^v_{ict}X^v_{ict}} \cdot \frac{\partial Q_{ict}}{\partial X^v_{ict}} \frac{X^v_{ict}}{Q_{ict}}$$

$\left(\frac{P_{ict}Q_{ict}}{P^v_{ict}X^v_{ict}}\right)^{-1}$: variable input share;

$\left(\frac{\partial Q_{ict}}{\partial X^v_{ict}} \frac{X^v_{ict}}{Q_{ict}}\right)$: output elasticity of variable input of production

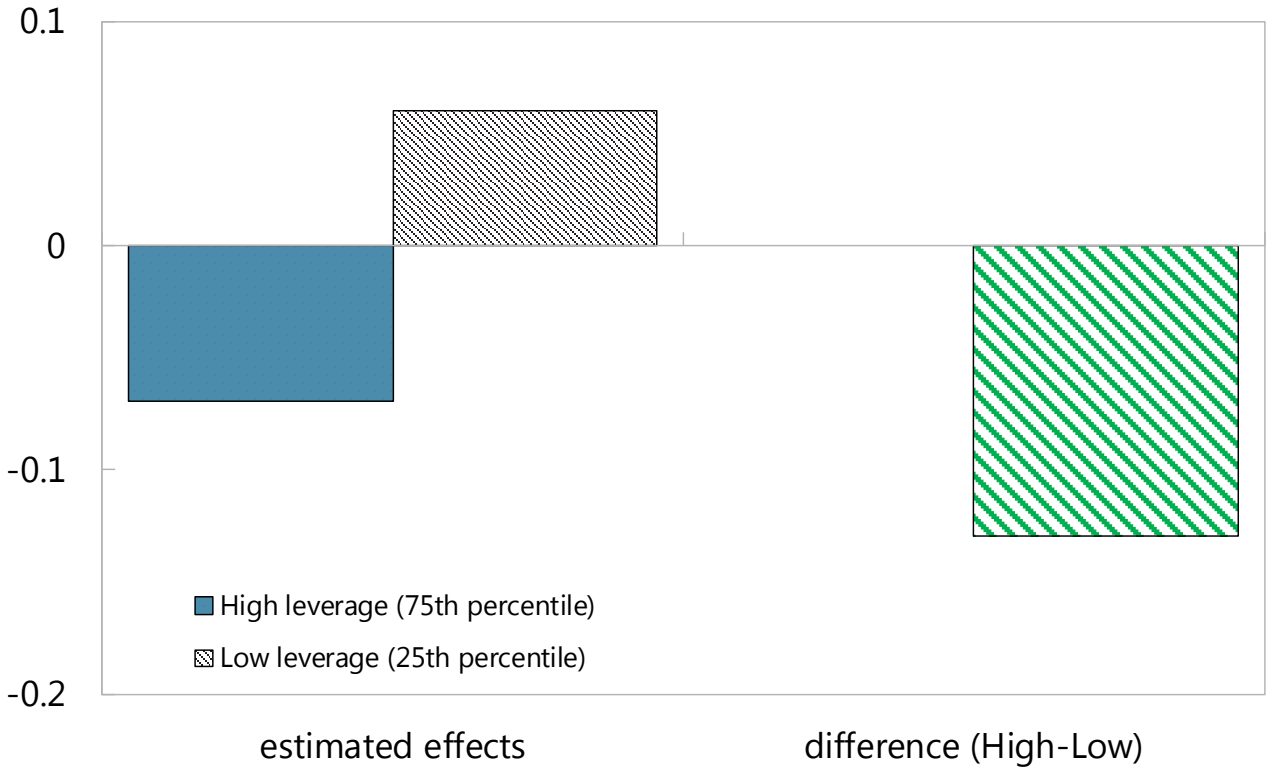
a la De Loecker and Warzynski (2012)

- Take the median value in each country-sector in the pre-crisis period

Illustrative example: financial vulnerability

Estimated Decline in Intangible Assets Investment

(in percent of total assets)



Note: High (low) leverage corresponds to the 75th (25th) percentile of the cross-firm distribution of pre-crisis average leverage ratio. The red bar indicates the difference in estimated effects for high and low leverage firms. Estimated coefficients are from column (1) in the baseline results table.

- **The decline in intangible assets investment was more pronounced for highly leveraged firms**