

# Innovation and Corporate Cash Holding in the Era of Globalization<sup>1</sup>

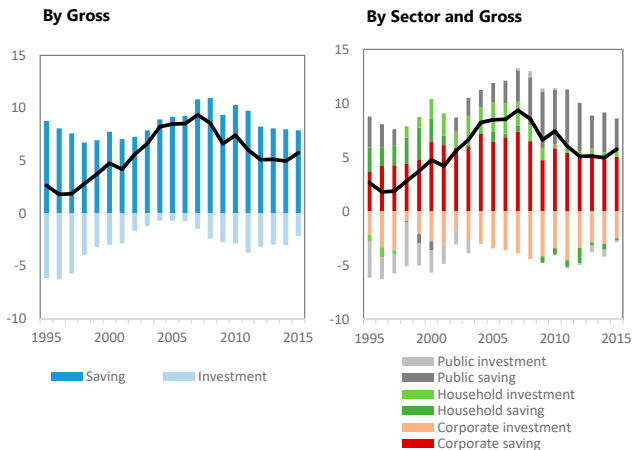
Konrad Adler (TSE), JaeBin Ahn (IMF), Mai Chi Dao (IMF)

July 6th, 2018  
Banque de France

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<sup>1</sup>The views expressed herein are those of the authors and do not necessarily represent views of the IMF.

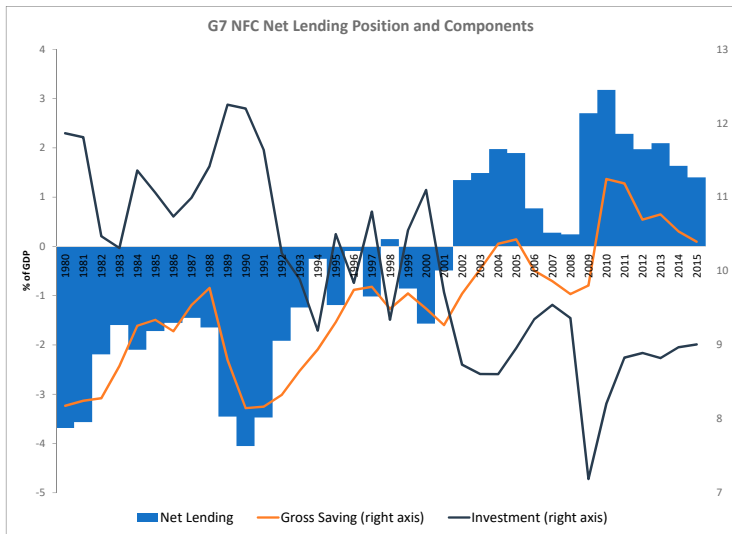
# Corporate saving accounts for largest share of CA differential between surplus and deficit AE's



Source: External Sector Report 2017.

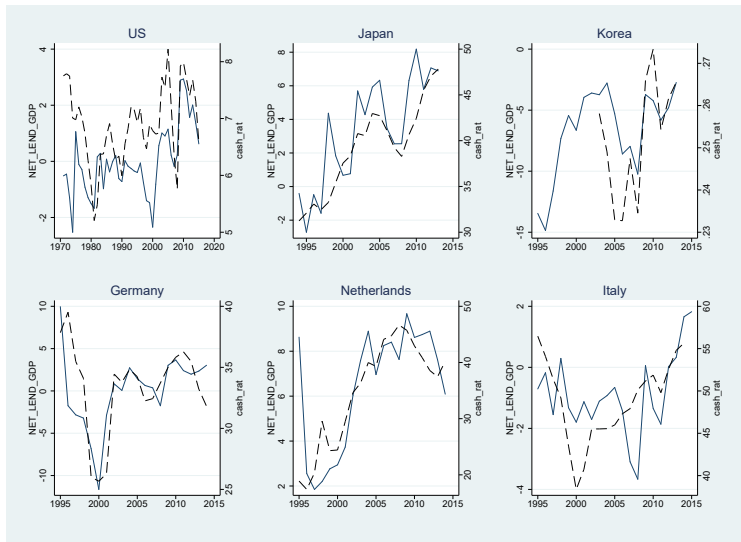
1/ Surplus (deficit) countries are those that ran surpluses (deficits) in 2008.

# Corporate sector became a net lender in major AEs...



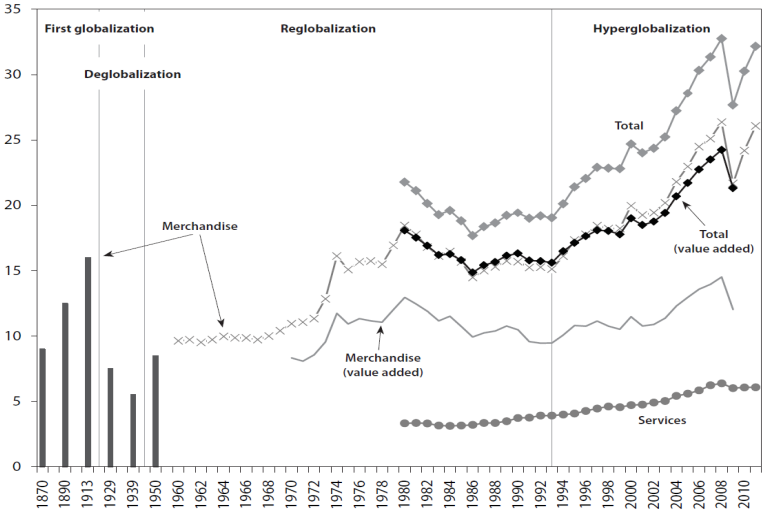
Source: OECD Sectoral National Accounts.

# Corp. saving used increasingly for the accumulation of cash



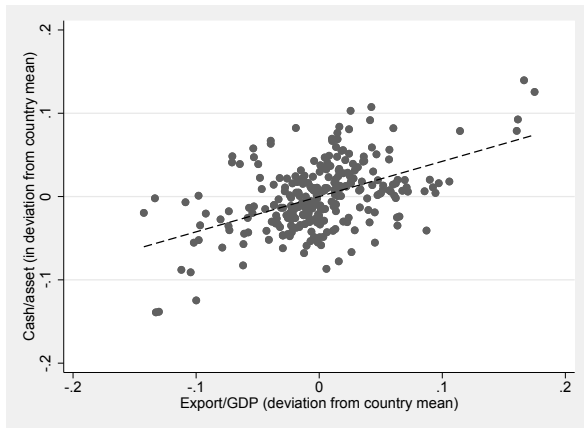
Source: Sectoral National Accounts from OECD and Eurostat.

# Globalization accelerated



Source: Subramanian and Kessler (2013). World exports, in% of GDP.

New aggregate stylized fact: cash holding higher with stronger export orientation.



Notes: Eurostat and OECD Sectoral Balance Sheet data. Each observation is a country-year, absorbing the country FE. Sample: G7+5 OECD countries, 1995-2014.

# Contribution

## Research question

*Why are firms saving/holding more liquid assets as globalization advances?*

- Offer a theoretical framework for linking rise in *globalization* with increased cash holding.
- Test empirical predictions using *international firm-level data*

- **Globalization and Innovation:** Autor et al. (2017), Bloom et al. (2017), Aghion et al. (2018), Gong and Xu (2017), Coelli et al. (2017)
- **R&D and cash holding:** Falato et al. (2013), Pinkovitz et al. (2016), Lyandres and Palazzo (2015), Ma et al. (2017)  
⇒ Our paper: connects the these 2 branches of literature.
- **Other drivers for rising cash holding/corporate saving:** Foley et al. (2007)/Armenter Hnatkovska (2016) for taxes, Azar et al. (2016) for cost of carry, Dittmar et al. (2003) for corporate governance, Fresard (2010) for strategic competition, Chen et al. (2017) for increased profitability/lower cost of capital.



# Theory

# Sketch of a Model

- We set up a heterogeneous firms trade model (Melitz, 2003) with investment in innovation (Holmström and Tirole, 1998).
  - ▶ Innovation helps improve productivity
  - ▶ Innovation activity involves liquidity risk (Aghion et al. 2010, Holmström and Tirole, 1998; Eisfeldt and Papanikolaou, 2013)
  - ▶ Firms cannot borrow when liquidity shock hits (Brown and Petersen, 2011) - later relaxed.

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- Firms hold cash to withstand liquidity shocks.
- More export opportunities → more returns to innovation → need for more cash to absorb larger liquidity shocks

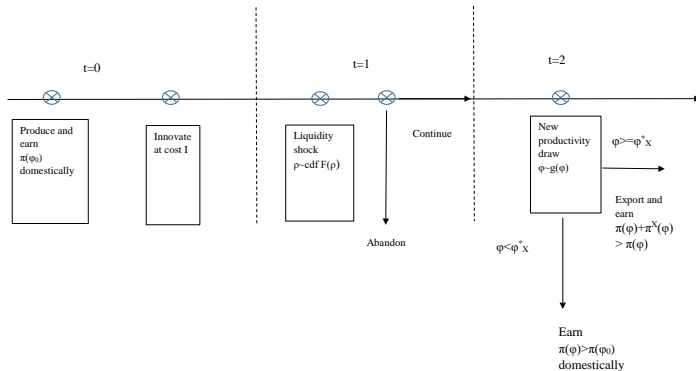
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- Firms hold cash to withstand liquidity shocks.
- More export opportunities → more returns to innovation → need for more cash to absorb larger liquidity shocks
  - ▶ More pronounced for firms with higher initial productivity (more likely to succeed in innovation and export).

# Timing of events



# Key ingredients of the model

- Returns from innovation depend positively on  $\phi_0$ :

$$E(R(\phi_0)) = E(\pi) - \pi_0 = \frac{M\xi}{\kappa - \xi} \phi_0^\xi + \frac{\kappa f_x}{\kappa - \xi} \phi_X^* (f_x, \tau, M^x)^{-\kappa} \phi_0^\kappa$$

- Optimal cash holding max. NPV of innovation:

$$\begin{aligned} \max_{\rho_1} NPV &= \max_{\rho_1} \int_0^{\rho_1} [E(R(\phi_0)) - \rho] f(\rho) d\rho - I \\ \rightarrow \rho_1 &= E(R(\phi_0)) \end{aligned}$$





## Formal set-up of full model (relax borrowing restr.)

The optimal contract, following Holmström and Tirole (1998):

$$\max_{\rho^*, \eta} \int_0^{\rho^*} E_G(R_f) f(\rho) d\rho \quad (1)$$

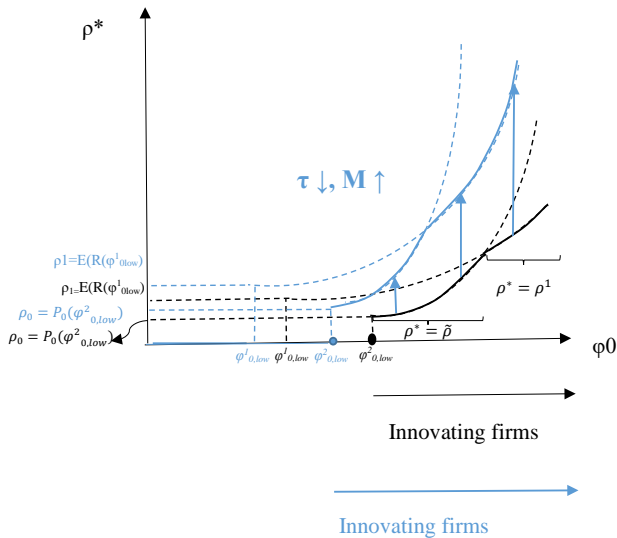
subject to:

$$\int_0^{\rho^*} [E_G(\pi) - E_G(R_f) - \rho] f(\rho) d\rho = I \quad (2)$$

$$E_G(R_f) = \eta E_G(\pi^D) \quad (3)$$

$$\eta \geq \eta_{min} \quad (4)$$

# Export opportunities increase cash holding...



# Model result

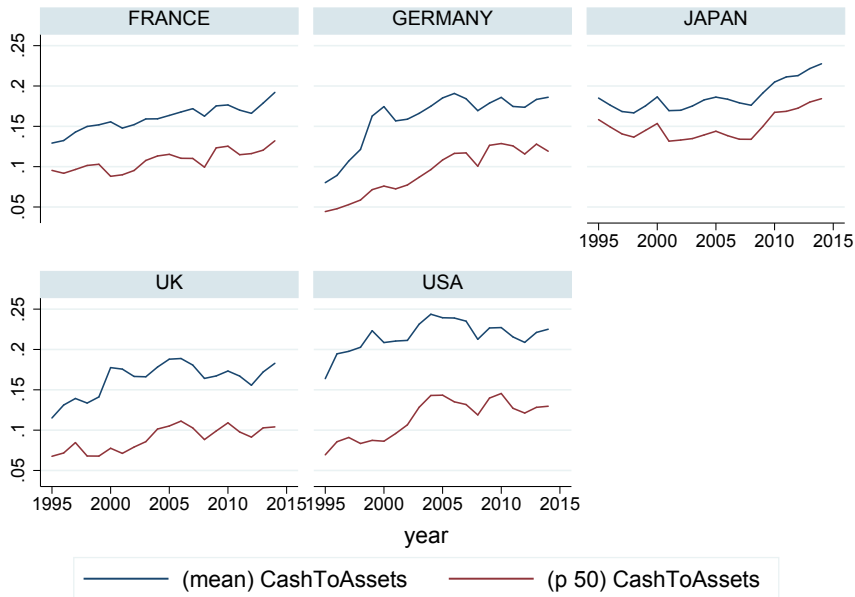
- **Result 1:** Only firms with sufficiently high productivity innovate and hold additional liquidity (to insure against innovation cost overrun).
- **Result 2:** Innovating firms with higher initial productivity hold more cash (to insure against larger liquidity overrun).
- **Result 3:** Globalization raises liquidity holding and spending on innovation, particularly for more productive firms.

# Empirics

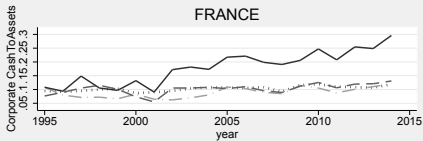
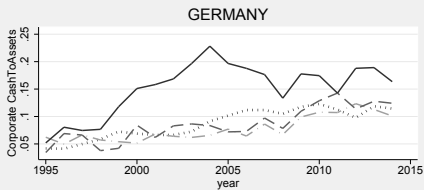
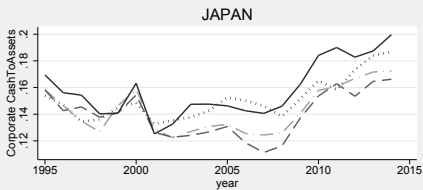
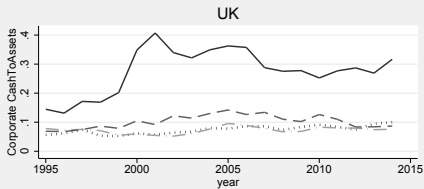
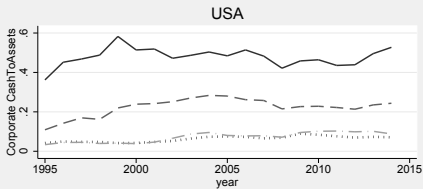
# Firm-level data

- Worldscope 1995-2014; mostly consolidated corporate balance sheet data for listed firms
- France, Germany, Japan, UK, US
- variables winsorized at 1%
- Cash & short-term investments
  - ▶ currency
  - ▶ checks
  - ▶ time deposits
  - ▶ letters of credit
  - ▶ commercial paper
  - ▶ treasury bills
  - ▶ stocks, bonds and other marketable securities
  - ▶ money market fund shares

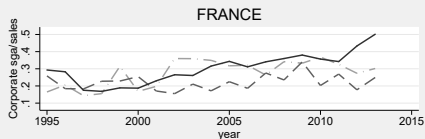
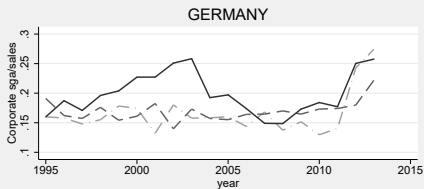
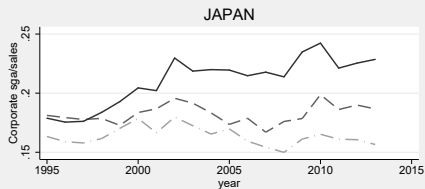
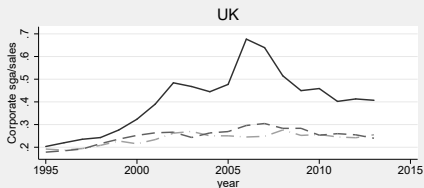
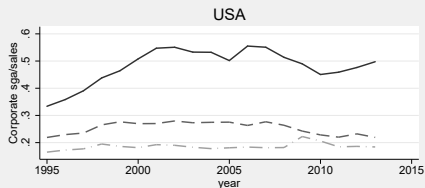
# A broad-based increase in cash holding



# ...and most pronounced for R&D intensive firms



# High cash ratio firms have higher (and rising) share of SG&A spending





# Trade data 1

- Trade data

- ▶ WIOD database
- ▶ Bilateral trade at ISIC-2 level
  - ★ import shock from China: imports from China in % of country-sector-level output (e.g., Autor et al. (2017); Bloom et al. (2017))

$$SHOCK_{jct}^{imp} = \left( \frac{\text{Total Imports from China}}{\text{Total Output}} \right)_{jct}.$$

- ★ export shock to China: exports to China in % of country-sector-level output (e.g., Mayer et al. (2017); Ahn and Duval (2017))

$$SHOCK_{jct}^{exp} = \left( \frac{\text{Total Exports to China}}{\text{Total Output}} \right)_{jct},$$

- Mapping: SIC code of the firm's largest line of business
- Instrumented by other countries' export/import shares

## Trade data 2

- Trade data
  - ▶ UN Comtrade database
  - ▶ Bilateral trade at HS6 product-level, aggregated to SIC-4 level
    - ★ import shock from China: share of imports from China in total imports
    - ★ export shock to China: share of exports to China in total exports
- Matching with firm data
  - ▶ SIC codes of the firm's two largest lines of business, weighted by sales

$$SHOCK_{ijct}^{exp} = \sum_j \omega_j^s (ChinaExport)_{jct},$$

$$SHOCK_{ijct}^{imp} = \sum_j \omega_j^s (ChinaImport)_{jct},$$

- Instrumented by other countries' data

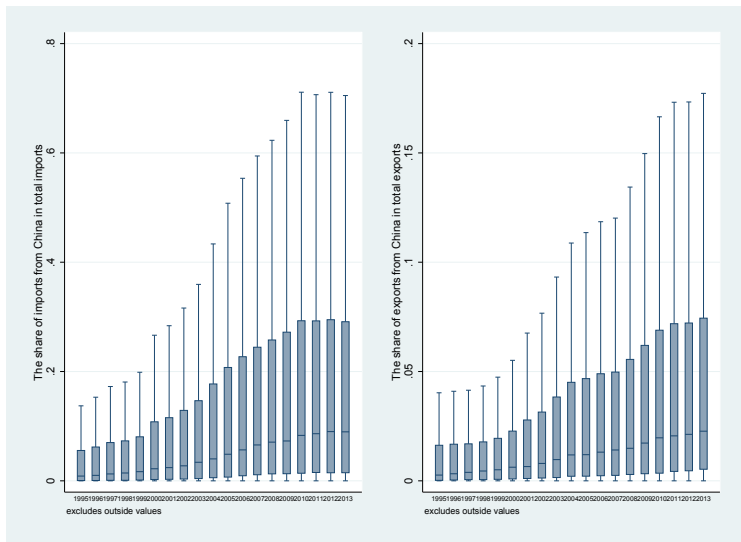
# Tariff data

- Tariff data
  - ▶ TRAINS database
  - ▶ MFN rate at HS6 product-level, aggregated to SIC-2 level
    - ★ import tariffs: domestic country's tariffs
    - ★ export tariffs: import tariffs domestic exporters face in destination countries, weighted by 1995 export trade flows
- Matching with firm data
  - ▶ SIC codes of the firm's two largest lines of business, weighted by sales

$$\tau_{ict}^{EXP} = \sum_s \omega_{ic}^s \tau_{cst}^{EXP},$$

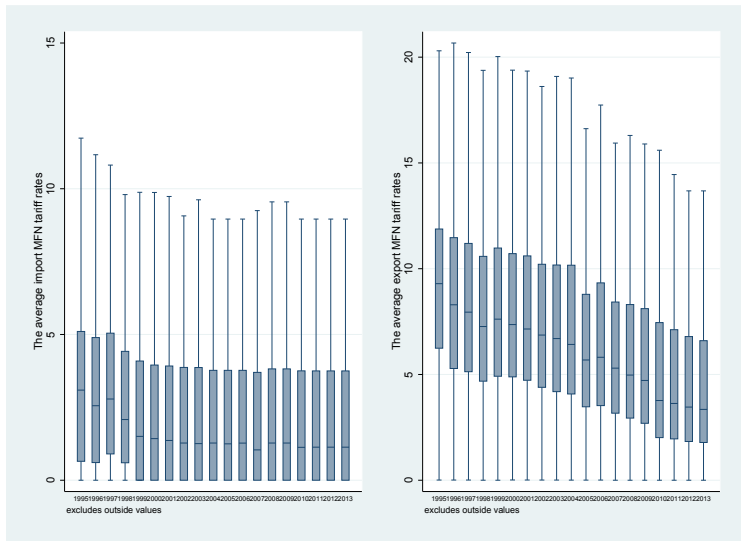
$$\tau_{ict}^{IMP} = \sum_s \omega_{ic}^s \tau_{cst}^{IMP},$$

# The evolving role of China in global trade



Sources: UN Comtrade and authors' calculations; Country-SIC 2digit level distribution.

# Global tariff liberalization



Sources: UN Comtrade, TRAINS, and authors' calculations; Country-SIC 2digit level distribution.

# Econometric specification

## firm-level regressions

$$Y_{ijct} = \beta^{exp} SHOCK_{(i)jct-1}^{exp} + \beta^{imp} SHOCK_{(i)jct-1}^{imp} + \Theta Z_{ict-1} + FE + \varepsilon_{ijct},$$

with

$Y$ : R&D-to-Sales or Cash-to-Asset ratio (in logs)

$Z$ : including other firm characteristics such as sales, operating cash flows, etc.

$FE$ : firm, country-year, sector-year fixed effects

### additional interactions with proxies for $\phi_0$ : initial productivity

Total Assets

Labor Productivity (Sales/Employee)

Likelihood to export (Percent of foreign sales)

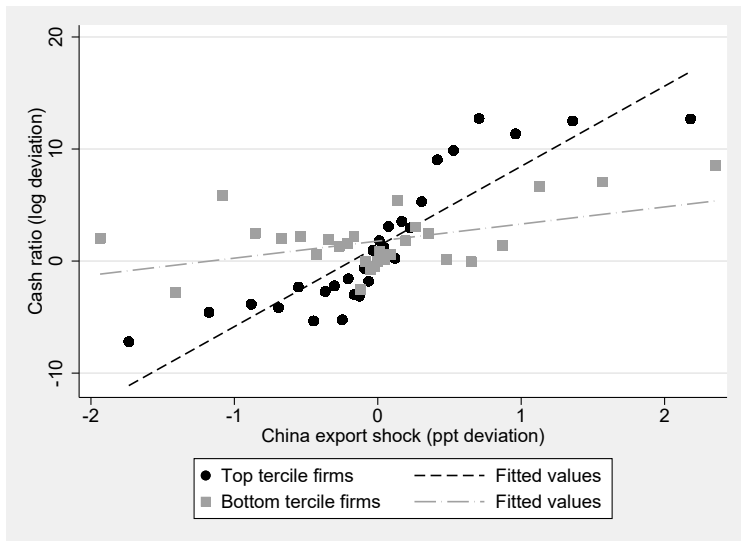
Profits (Net income/Employee)

Table : Globalization and Cash Holding: China Shocks; 2SLS

	(1)	(2)	(3)	(4)
	No interaction	X=SIZE	X=SIZE	X=SIZE
expSHOCK	8.209*** (0.758)	7.229*** (0.987)	-5.435*** (1.224)	-5.187*** (1.646)
expSHOCK_X2		-0.264 (1.280)	3.131** (1.342)	2.769 (1.967)
expSHOCK_X3		2.752* (1.483)	8.177*** (1.456)	8.042*** (2.098)
impSHOCK				-0.117 (0.193)
impSHOCK_X2				0.101 (0.244)
impSHOCK_X3				0.0212 (0.268)
First stage	<i>Dep. var: expSHOCK</i>			
<i>expSHOCK(IV)</i>	1.248*** [0.058]			
F-stat.	40.9			
Firm FE	Y	Y	Y	Y
Country-year FE	N	N	Y	Y
N	57172	57172	57172	57172

Notes: All columns control for total sales and operating cash flow. Tercile dummy variables based on total assets are also included in columns 2-4. Standard errors in parentheses are clustered at country-sector-year level. (\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ )

## Differential in reduced-form correlation - innovating firms only



Greater export shock is associated with higher cash holding, but only for top tercile firms.



Table : Globalization and Cash Holding: Tariff; OLS

	(1)	(2)	(3)	(4)
	No interaction	X=SIZE	X=SIZE	X=SIZE
expMFN	-3.106*** (0.602)	-1.753*** (0.541)	1.330*** (0.467)	1.008** (0.476)
expMFN_X2		-1.393** (0.531)	-1.320*** (0.476)	-0.837 (0.622)
expMFN_X3		-2.058*** (0.761)	-2.063*** (0.610)	-1.655** (0.675)
impMFN				0.636 (0.820)
impMFN_X2				-1.788* (0.965)
impMFN_X3				-1.735* (0.911)
Firm FE	Y	Y	Y	Y
Country-year FE	N	N	Y	Y
Sector-year FE	N	N	Y	Y
R2	0.713	0.713	0.731	0.730
N	45873	45873	45854	44162

Notes: All columns include total sales and operating cash flows. Tercile dummy variables based on total assets are also included but not reported in columns 2-4. Standard errors in parentheses are clustered at two levels (country-year and sector-year). (\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ )

**Table :** Channel of Globalization and Cash Holding 1: China Shocks; 2SLS

	(1) X=SIZE innovative firms	(2) X=SIZE non-innovative firms	(3) X=SIZE DV=R&D/sales	(4) X=SIZE DV=SG&A/sales
expSHOCK	-6.977*** (1.760)	3.537 (5.963)	-11.06*** (2.960)	-7.220*** (1.489)
expSHOCK_X2	2.957 (2.376)	8.067 (7.624)	11.74*** (3.519)	8.940*** (1.642)
expSHOCK_X3	8.747*** (2.164)	17.45 (10.80)	19.35*** (3.710)	11.56*** (1.839)
impSHOCK	-0.0276 (0.248)	-0.0784 (0.349)	1.409** (0.561)	0.494** (0.194)
impSHOCK_X2	-0.0926 (0.400)	0.0996 (0.428)	-0.843 (0.715)	-0.434* (0.223)
impSHOCK_X3	-0.230 (0.353)	0.0977 (0.505)	-2.056*** (0.751)	-0.630** (0.259)
Firm FE	Y	Y	Y	Y
Country-year FE	Y	Y	Y	Y
N	43782	13390	36782	51474

Notes: Standard errors in parentheses are clustered at country-sector-year level.

- Confirms the innovation channel through which globalization affects cash holding.

Table : Cash flow volatility and globalization shocks

	(1)	(2)	(3)	(4)
	All firms	SG&A < median	SG&A > median	SG&A > 75thpcile
exp_SHOCK	-3.696** (1.862)	-0.401** (0.172)	-7.409* (4.132)	-31.26* (17.53)
exp_SHOCK_X2	3.506** (1.785)	0.192 (0.210)	7.143* (3.942)	29.29* (16.99)
exp_SHOCK_X3	3.440* (1.883)	0.152 (0.193)	7.043* (4.218)	30.72* (17.62)
imp_SHOCK_X1	0.477* (0.282)	0.0361* (0.0197)	1.045 (0.671)	4.879* (2.941)
imp_SHOCK_X2	-0.498* (0.290)	0.00941 (0.0327)	-1.091 (0.694)	-4.616 (2.894)
imp_SHOCK_X3	-0.498* (0.297)	-0.0232 (0.0429)	-1.065 (0.688)	-5.069* (3.047)
Firm FE	Y	Y	Y	Y
Country-year FE	Y	Y	Y	Y
N	36430	16997	18901	10845

Notes: Dependent variable is standard deviation of cash flow/asset ratio over the subsequent 5 years.

- Confirms the liquidity risk channel through which globalization affects cash holding.

# Robustness checks

- Use other proxies for firms' initial productivity (Sales/Emp, Net income/Emp) and likelihood of exporting (Shr of foreign sales)
- Concern for remaining endogeneity in the “China shock”, correlation with simultaneous technological trend not completely captured by FE's.
  - ▶ tariff-based measure for trade (exp/imp) liberalization addresses this
  - ▶ Including country-sector-year FE in firm-spec. and tariff regressions
- Alternative explanations for main findings?
  - ▶ Tax incentive
    - ★ controlling for effective tax rates (e.g., Markle and Shackelford, 2012)
  - ▶ M&A motive (can observe)
  - ▶ share buybacks (control for change in shares outstanding)

# Sum-up

- We find consistent evidence that increased export opportunities provide motive for cash holding and innovation/intangible investment
- Economic magnitudes: Our mechanism can explain up to 33-40 percent of the increase in the median cash ratio among largest firms between 2001-2014.
- Policy implications:
  - ▶ structural increase in demand for liquidity may partly drive the increase in corporate saving
  - ▶ driver benign, BUT can lead to inefficient industrial concentration and subsequent lower competition/investment (secular stagnation)
  - ▶ implications for external imbalances

