

# Global Engagement and Returns Volatility

INFER Workshop on Modelling Economic Resilience to External Shocks

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# Motivation

- There is a strong perception among policy-makers and the general public that globalization increases economic uncertainty
- Greater trade openness could help to reduce volatility through diversification of country-wide shocks

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- There is a strong perception among policy-makers and the general public that globalization increases economic uncertainty
- Greater trade openness could help to reduce volatility through diversification of country-wide shocks
- A similar trade-off exists at the firm-level
- Whether greater international exposure increases or decreases firm-level volatility is ultimately an empirical question

## Research questions

1. Does a firm's reliance on **foreign sales** affect the volatility of its stock returns?
2. Is this relationship mediated by the margins of global engagement that a firm uses to reach foreign customers?
3. Does the volatility of globally-engaged firms spill over to domestic firms in the same industry? in upstream industries?

We answer these questions using high-frequency firm-level data for publicly-listed Japanese manufacturing firms for 2000-2010

Why should we care?

## Why should we care?

- Higher volatility has important effects on the timing and scale of firm-level investment and employment decisions:
  - ▶ it makes firms behave more cautiously and become less responsive to policy stimuli (Leahy & Whited 1996; Bloom et al. 2009; Bloom 2009)
  - ▶ it can weaken firms' ability to raise external finance (Froot et al. 1993; Rountre et al. 2008)
  - ▶ it can increase risk premia and the likelihood of default (Adrian & Rosenberg 2008; Arellano et al. 2011)

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- There is a vast literature relating firms' extent of global engagement with the **first moment** of various performance measures, e.g. size, capital/skill/R&D-intensity, TFP
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- However, we know much less about whether exposure to international markets makes firms more or less volatile
- By focusing on firms' stock returns we investigate if global engagement actually matters to firms' investors



## Preview of our findings

1. A greater intensity of global engagement increases firm-level volatility — an exogenous increase in a firm's share of foreign sales increases the conditional volatility of its stock returns
2. Both the intensive margin of exports and sales through foreign affiliates increase volatility, with the latter producing a larger effect on returns volatility
3. The positive effect of exporting on volatility is stronger for firms that are more dependent on external sources of finance
4. We find evidence of substantial horizontal and upstream volatility spillovers originating from globally-engaged firms towards domestically-oriented ones

# Outline of the talk

- 1 Related Literature
- 2 Data and Empirical Specification
- 3 Results
  - Baseline specification
  - IV
  - Volatility spillovers
- 4 Conclusions

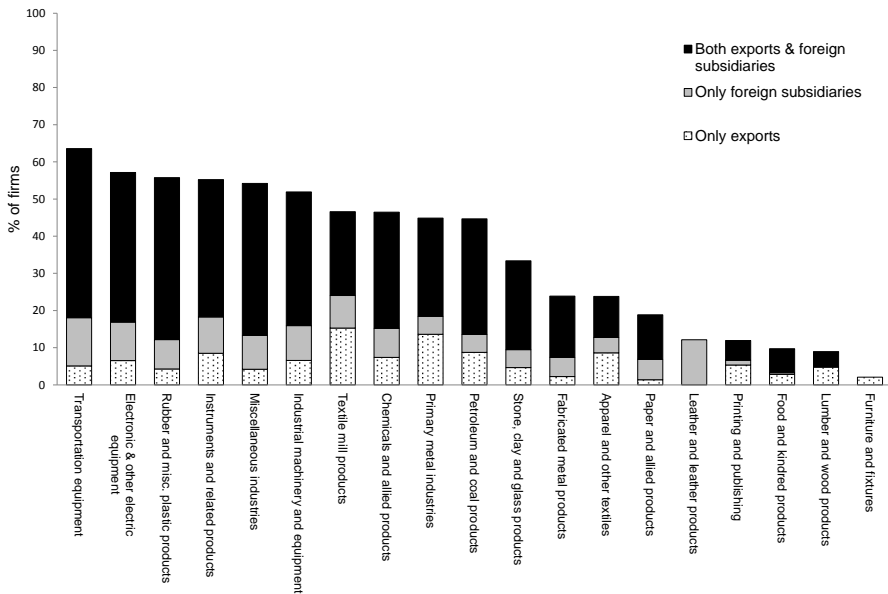
## Related literature

- Previous work: does exporting affect the unconditional volatility of sales at the firm level?
- Vanoorenberghe (2012):
  - ▶ short-run sales substitution across markets
  - ▶ export intensity increases the volatility of total sales for continuing exporters
- Riaño (2011):
  - ▶ risk-averse entrepreneurs value lower volatility of sales
  - ▶ exporting allows diversification of demand shocks but is characterized by large sunk entry costs
  - ▶ hysteresis dominates sales diversification effect

# Contribution

1. we investigate the link between two margins of global engagement, exports and sales through foreign subsidiaries, and firm-level volatility
2. stock returns vs sales
3. high-frequency conditional volatility vs low-frequency unconditional volatility

# Global engagement across sectors



## Exports vs sales through foreign subsidiaries

- Proximity-concentration trade-off can also have implications for firm-level volatility:
- Opening a subsidiary requires higher sunk costs than exporting:
  - ▶ Helpman, Melitz & Yeaple (2004)
  - ▶ Fillat & Garetto (2012)
- Export transactions take longer to complete than local sales by foreign affiliates:
  - ▶ financial frictions: Amiti & Weinstein (2011); Arellano et al. (2011)
  - ▶ lumpier inventory costs for exporting: Alessandria et al (2010)

# Why is Japan interesting?

- Large swings in aggregate and firm-level volatility



- Significant changes in firms' external exposure are taking place at the same time

# Data

- Sample: 1,474 Japanese listed mfg. companies over the period 2000:1-2010:12 (132 months)  $\Rightarrow$  181,600 firm-month obs.
- **Conditional volatility** of a firm's monthly excess stock return (rel. to 2-digit value-weighted industry return) is estimated from a GARCH(1,1) model fitted for each individual firm
- **Export sales and export intensity** (Datastream and Bloomberg) can be broken down into 4 aggregate destinations: {Asia, Europe, N. America and others}
- **Foreign affiliates' sales intensity** (Datastream, Bloomberg and Orbis): sales generated from operations in foreign countries excluding export sales



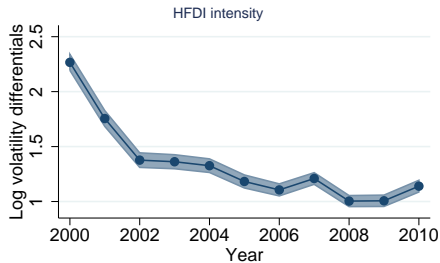
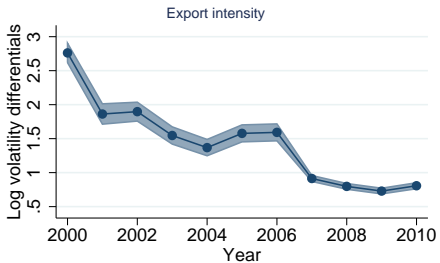
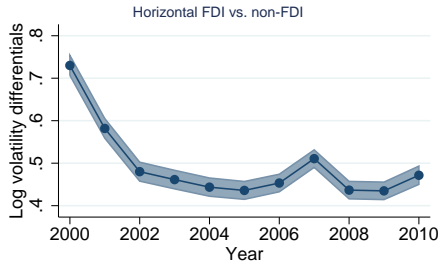
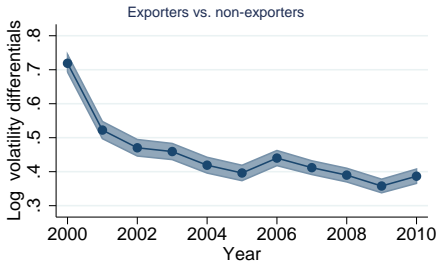
## Summary statistics

	Mean	Std. dev.	Proportion of within variance	Proportion explained by firm and time effects	Coefficient on export dummy	Coefficient on HFDI dummy
Excess stock Returns	-0.000	0.103	0.993	0.000	0.001 <sup>***</sup>	0.003 <sup>***</sup>
Conditional volatility	-2.495	0.838	0.196	0.047	0.530 <sup>***</sup>	0.596 <sup>***</sup>
Export intensity	0.257	0.215	0.522	0.348		
HFDI intensity	0.287	0.188	0.146	0.018		
Size	17.549	1.538	0.017	0.000	1.352 <sup>***</sup>	1.892 <sup>***</sup>
Leverage	0.219	0.181	0.185	0.025	-0.004	-0.000
Returns on assets	1.725	7.086	0.554	0.031	0.712 <sup>***</sup>	1.334 <sup>***</sup>
Age	3.755	0.832	0.037	0.004	0.183	0.205 <sup>***</sup>
Market value	9.779	1.770	0.072	0.022	1.592 <sup>***</sup>	2.243 <sup>***</sup>
External finance dependence dummy	0.498	0.500	0.753	0.000	0.033 <sup>***</sup>	0.027 <sup>**</sup>
Exchange rate conditional volatility	-3.737	0.1244				
Firm-year-month observations: 180,122						

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

# The impact of global engagement on returns volatility:

Differentials across time with 95% confidence intervals



## Econometric model

- We estimate the following benchmark specification:

$$\ln \sigma_{it}^2 = \text{GLOB}'_{it-12} \boldsymbol{\alpha} + X'_{it-12} \boldsymbol{\beta} + f_i + f_t + \epsilon_{it}.$$

- $\text{GLOB}_{it-12}$ : export and foreign affiliate sales' intensity (1-yr lagged)
- $X_{it-12}$ : conditional volatility of US\$/¥ exchange rate, total assets, age, leverage, ROA (1-yr lagged)
- Plus firm ( $f_i$ ) and month-year ( $f_t$ ) fixed effects
- Standard errors are adjusted for cross-sectional dependence and within-firm serial correlation using the Driscoll & Kraay (1998) covariance matrix estimator

## Baseline specification (OLS)

	Global Engagement (1)	Exports only (2)	Exports and HFDI (3)	Weighted regression (4)	Without outliers (5)
<b>Foreign sales intensity</b>	0.088*** (0.032)				
<b>Exporting intensity</b>		0.078** (0.034)	0.068** (0.033)	0.077*** (0.002)	0.055* (0.033)
<b>HFDI intensity</b>			0.151** (0.071)	0.162*** (0.005)	0.149** (0.071)
Size	0.077*** (0.019)	0.081*** (0.019)	0.076*** (0.019)	0.081*** (0.001)	0.068*** (0.020)
Leverage	-0.169*** (0.054)	-0.169*** (0.054)	-0.171*** (0.054)	-0.195*** (0.004)	-0.174*** (0.055)
Return on assets	0.007*** (0.001)	0.007*** (0.001)	0.007*** (0.001)	0.008*** (0.000)	0.007*** (0.001)
Age	-0.073*** (0.025)	-0.075*** (0.025)	-0.073*** (0.025)	-0.073*** (0.002)	-0.072*** (0.025)
Exchange rate volatility	0.450*** (0.113)	0.450*** (0.113)	0.450*** (0.113)	0.457*** (0.003)	0.448*** (0.113)
Firm fixed effects	Y	Y	Y	Y	Y
Month-year fixed effects	Y	Y	Y	Y	Y
Observations	163,823	163,823	163,823	163,823	160,487

## Instrumental variables

- There might be concerns about reverse causality of export and foreign subsidiary sales' intensity
- A firm can choose to adjust its mix of exports and sales through subsidiaries in response to the perceived riskiness of foreign markets:
  - ▶ Goldberg & Kolstad (1995); Ramondo & Rappoport (2010); Conconi et al (2013); Sala & Yalcin (2014)

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- **Instruments:**

- ▶ firm-specific exchange rate shocks:

$$Z_{it}^k \equiv \sum_{d \in \mathcal{D}} \bar{\mu}_{id}^k \Delta e_{dt-12}, \quad k \in \{\text{EXP}, \text{HFDI}\}.$$

- ▶ Foreign affiliates' investment rate:

$$Z_{it}^I \equiv \sum_{d \in \mathcal{D}} (I/K)_{idt-12}.$$

- $\bar{\mu}_{id}^k$  is firm  $i$ 's 3-year moving average of sales in destination  $d$  using margin  $k$  of global engagement

## IV first stage (Tobit) estimates

	Exporting intensity	HFDI intensity
<b>Lagged Exports-weighted exchange rate shock</b>	3.999 <sup>***</sup> (0.082)	1.224 <sup>***</sup> (0.064)
<b>Lagged HFDI-weighted exchange rate shock</b>	0.210 <sup>***</sup> (0.013)	0.072 <sup>***</sup> (0.010)
<b>Lagged foreign subsidiaries' investment rate</b>	0.001 (0.004)	0.011 <sup>**</sup> (0.005)
Size	0.035 <sup>***</sup> (0.001)	0.052 <sup>***</sup> (0.001)
Leverage	0.021 <sup>***</sup> (0.005)	-0.038 <sup>***</sup> (0.003)
Return on assets	0.001 <sup>***</sup> (0.000)	0.002 <sup>***</sup> (0.000)
Age	0.012 <sup>***</sup> (0.001)	0.019 <sup>***</sup> (0.001)
Exchange rate volatility	-0.004 (0.009)	-0.005 (0.008)
Observations	147,413	147,413

Statistic	p-value
Kleibergen-Paap rk LM statistic	0.000 ( $\chi^2(2)$ )
Cragg-Donald Wald F-statistic	0.000
Kleibergen-Paap rk Wald F-statistic	0.000
Over-identifying restrictions test	0.712 ( $\chi^2(1)$ )

## IV estimates

	Exports only (1)	Exports and HFDI (2)	Weighted regression (3)	Without Outliers (4)
<b>Exporting intensity</b>	0.090 <sup>***</sup> (0.022)	0.110 <sup>***</sup> (0.028)	0.133 <sup>***</sup> (0.009)	0.076 <sup>***</sup> (0.029)
<b>HFDI intensity</b>		0.684 <sup>**</sup> (0.285)	0.671 <sup>***</sup> (0.082)	0.930 <sup>***</sup> (0.283)
Size	0.036 <sup>***</sup> (0.006)	0.007 (0.007)	-0.000 (0.002)	0.001 (0.007)
Leverage	-0.146 <sup>***</sup> (0.018)	-0.174 <sup>***</sup> (0.018)	-0.191 <sup>***</sup> (0.006)	-0.177 <sup>***</sup> (0.019)
Return on assets	0.005 <sup>***</sup> (0.000)	0.004 <sup>***</sup> (0.000)	0.005 <sup>***</sup> (0.000)	0.005 <sup>***</sup> (0.000)
Age	-0.077 <sup>***</sup> (0.009)	-0.082 <sup>***</sup> (0.009)	-0.083 <sup>***</sup> (0.003)	-0.079 <sup>***</sup> (0.009)
Exchange rate volatility	0.510 <sup>**</sup> (0.012)	0.534 <sup>***</sup> (0.012)	0.544 <sup>**</sup> (0.004)	0.536 <sup>**</sup> (0.012)
Correction term 1	0.727 <sup>***</sup> (0.266)	-1.959 <sup>***</sup> (0.555)	-2.147 <sup>***</sup> (0.170)	-1.853 <sup>***</sup> (0.560)
Correction term 2		21.982 <sup>***</sup> (1.959)	23.871 <sup>***</sup> (2.147)	20.662 <sup>***</sup> (1.853)
Firm fixed effects	Y	Y	Y	Y
Month-year fixed effects	Y	Y	Y	Y
Observations	147,413	147,413	147,413	144,413



## Further extensions

	Excluding recessions	Interaction with external finance dependence sectoral dummy		Controlling for covariance with foreign markets
	(1)	(2)	(3)	(4)
<b>Exporting intensity</b>	0.108 <sup>***</sup> (0.029)	0.017 (0.046)	0.111 <sup>***</sup> (0.028)	0.119 <sup>***</sup> (0.028)
<b>Foreign sales intensity</b>	0.946 <sup>***</sup> (0.237)	0.737 <sup>**</sup> (0.287)	1.001 <sup>***</sup> (0.268)	1.112 <sup>***</sup> (0.361)
<b>Export-weighted covariance with foreign markets</b>				0.008 <sup>***</sup> (0.002)
<b>HFDI-weighted covariance with foreign markets</b>				-0.028 <sup>***</sup> (0.006)
<b>Exporting * High EFD</b>		0.120 <sup>***</sup> (0.038)		
<b>HFDI * High EFD</b>			-0.527 <sup>**</sup> (0.222)	
Size	0.007 (0.008)	0.005 (0.007)	0.007 (0.007)	0.002 (0.008)
Leverage	-0.176 <sup>***</sup> (0.020)	-0.172 <sup>***</sup> (0.018)	-0.164 <sup>***</sup> (0.018)	-0.168 <sup>***</sup> (0.018)
Return on assets	0.005 <sup>***</sup> (0.000)	0.004 <sup>***</sup> (0.000)	0.004 <sup>***</sup> (0.000)	0.004 <sup>***</sup> (0.000)
Age	-0.073 <sup>***</sup> (0.010)	-0.078 <sup>***</sup> (0.009)	-0.080 <sup>***</sup> (0.009)	-0.075 <sup>***</sup> (0.010)
Exchange rate volatility	0.598 <sup>***</sup> (0.015)	0.534 <sup>***</sup> (0.012)	0.534 <sup>***</sup> (0.012)	0.531 <sup>***</sup> (0.012)
Firm fixed effects	Y	Y	Y	Y
Month-year fixed effects	Y	Y	Y	Y
Observations	147,413	147,413	111,059	111,059

## Volatility spillovers

- Does the positive volatility premium that we have identified for globally-engaged firms affect the volatility of domestically-oriented firms?

## Volatility spillovers

- Does the positive volatility premium that we have identified for globally-engaged firms affect the volatility of domestically-oriented firms?
- Parallel to the literature investigating the existence of knowledge/productivity spillovers from foreign-owned to domestic firms (Javorcik 2004; Girma 2005; Keller & Yeaple, 2011), we define the following two variables:

$$\text{HOR}_{jt} \equiv \sum_{i \in j} \text{GLOB}_i \sigma_{it}^2,$$
$$\text{DOWN}_{jt} \equiv \sum_{k \neq j} \omega_{jk} \text{HOR}_{jt}.$$

for each 2-digit industry  $j$

- $\text{GLOB}_i = 1$  if firm  $i$  sold some of its output abroad at some point during the sample period
- $\omega_{jk}$  is the share of sector  $j$ 's sales to sector  $k$  from the 2000 IO table

## Econometric model

- To test for the existence of volatility spillovers, we estimate the following model:

$$\ln \sigma_{it}^2 = \theta_0 \text{HOR}_{jt} + \theta_1 \text{DOWN}_{jt} + X'_{it-12} \beta + f_i + f_t + \epsilon_{it}.$$

for the subset of **domestically-oriented firms**

- Our vector of control variables  $X_{it-12}$  is the same as in previous regressions
- We instrument  $\text{HOR}_{jt}$  and  $\text{DOWN}_{jt}$  with lagged industry exporting and horizontal FDI intensities

## Volatility spillovers

	OLS	IV
Horizontal spillover	0.450 <sup>***</sup> (0.035)	0.255 <sup>***</sup> (0.097)
Downstream spillover	0.385 <sup>***</sup> (0.045)	0.496 <sup>***</sup> (0.069)
Exchange rate volatility	-0.021 (0.061)	0.034 (0.074)
Size	0.050 <sup>**</sup> (0.023)	0.049 <sup>**</sup> (0.023)
Leverage	-0.089 <sup>*</sup> (0.047)	-0.101 <sup>**</sup> (0.048)
Return on assets	0.004 <sup>***</sup> (0.001)	0.005 <sup>***</sup> (0.001)
Age	-0.071 <sup>***</sup> (0.026)	-0.072 <sup>***</sup> (0.026)
Observations	87,538	86,804
Number of firms	933	933
Hansen J statistic of over-identification test: chi(3); p-value		4.501 0.212
Kleibergen-Paap rk Wald F statistic: p-value		15.175 0.000

# Conclusions

- We find a robust positive causal link of greater global engagement, understood as a greater foreign market sales intensity, and the volatility of a firm's stock returns
- The two margins of global engagement that we study, exports and sales by foreign affiliates have a positive and significant effect on volatility
- The intensity of sales by foreign affiliates has the greatest effect on firm-level volatility
- The intensive margin of exports only appears to be important for firms that are highly dependent on external finance
- We also find evidence of significantly positive volatility spillovers from globally-engaged to domestic firms in the same industry and in upstream industries