

Trading Plants and Volatility

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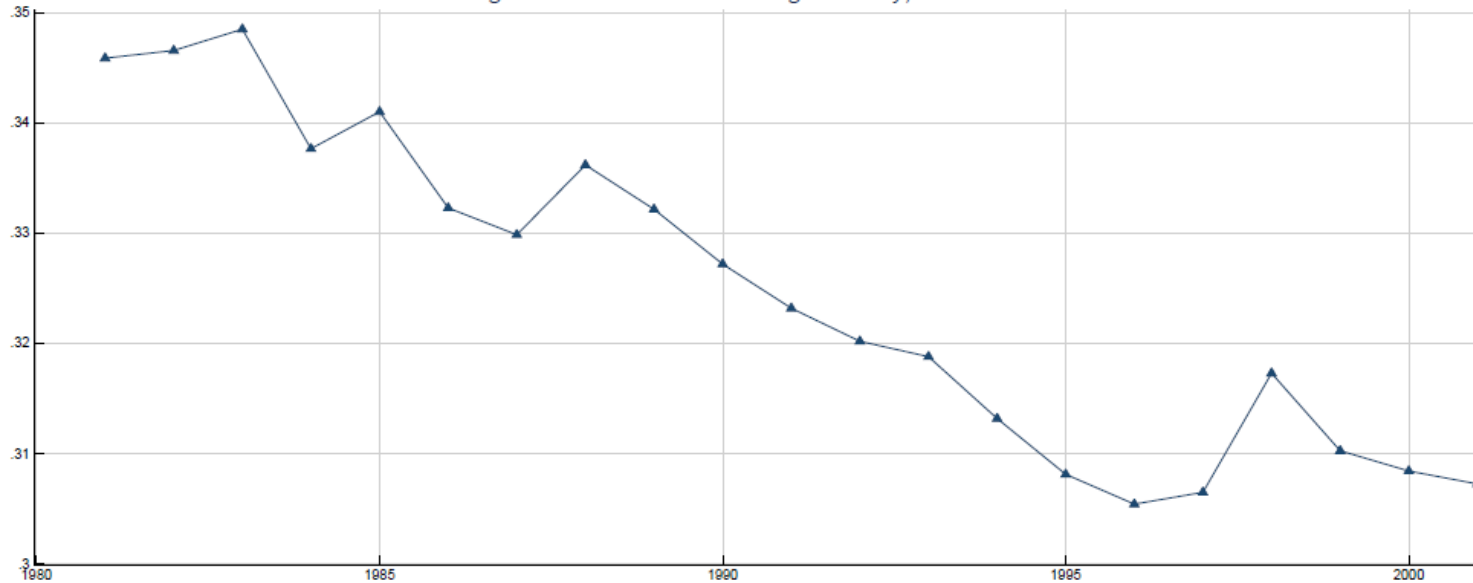
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Volatility has Declined

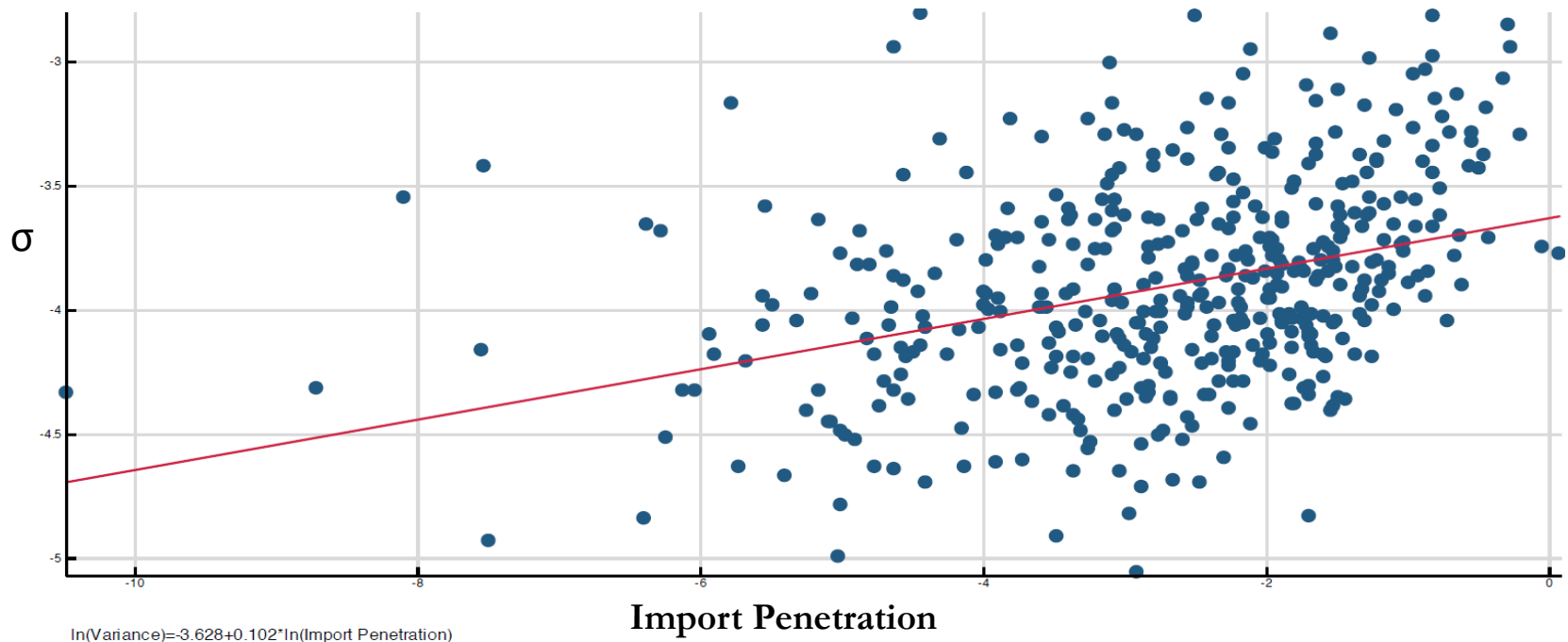
Figure 1: Total Manufacturing Volatility, 1976–2005



Source: Longitudinal Business Database (Census)

- Overall volatility has trended down
- There has been a recent moderation in the decline
- Volatility in the manufacturing sector

Volatility and Trade



- International aspects of volatility
- Industry Level: Di Giovanni and Levchenko (2009)
- The relationship between employment variation and trade exposure at the micro-level is ambiguous.

Volatility of Importing Plants

- Offshore volatility (-)
 - Bergin, Feenstra and Hanson (2009, 2011)
 - Domestic demand shocks are transmitted across borders
- Complex production process (-)
 - Koren and Tenreyro (2007) and Krishna and Levchenko (2009)
 - Expanded input variety correlated with lower output volatility
- Labor demand elasticities (+)
 - Rodrik (1997), Slaughter (2001), and Senses (2009)
 - input/import competition lowers input demand elasticity
 - More elastic input demand increases input response to supply/demand shocks
- Transmission of input shocks (+)
 - Kose and Yi (2001), Burnstein, et al (2008), and Huang and Liu (2007)
 - Shocks can be transmitted through intermediate input demand
 - di Giovanni and Levchenko (2009) find evidence of this at the industry level

Volatility of Exporting Plants

- Diversify Demand Shocks (-)
 - Caselli, Koren, Lisicky, and Tenreyro (2011)
 - Country specific shocks can be diversified away through a larger number of trading partners
 - Assumes country specific shocks dominate
- Convex marginal costs (+/-)
 - Vannoorenberghe (2011) and Nguyen and Schaur (2011)
 - Firms substitute away from a domestic market as export opportunities increase
 - Export sales are negatively correlated with domestic sales
 - Positive effect of exporting openness on output volatility
 - Output volatility is higher (lower) for marginal (permanent) exporters
 - For employment, the results are similar.
- Positive relationship between foreign and domestic sales
 - Berman, Berthou, and Hericourt (2011)

Overview

- How does trade exposure relate to volatility at the micro level?
 - For 14 and 7 year windows
 - For measures of exports, imports, and both relative to non-traders
 - Results are similar for both firms and plants
- Do the correlations between employment volatility and trade hold at the industry level?
- How does volatility vary with the amount of time trading, the countries traded with, and the products traded for organizations?
- Findings
 - Export status and volatility (-)
 - Import status (+)
 - At industry level (Imports (+), Exports (-), Both (-))
 - Percent Export (-), Percent Import (+)
 - Countries imported (+), Countries exported (-)

Data

- Longitudinal Business database (LBD):
 - Plant-level data covering the 1976-2005 period
 - Plant and firm identifiers, industry, employment , payroll, and multi-unit status, age
 - Covers all sectors of the economy
- Census of Manufactures (CMF):
 - Skill share and product count
- Linked/Longitudinal Firm Trade Transaction Database (LFTTD)
 - Firm-level data covering the 1992-2005 period
 - Links individual U.S. trade transactions to U.S. firms
 - For each export and import transaction
 - Product Code
 - Value and Quantity
 - Source/Destination country
- Industry-level data:
 - NBER productivity database
 - Schott (2010) for import penetration and export share
- Windows for analysis (“balanced” and “unbalanced”):
 - 1976-2005, 1992-1998, and 1999-2005

Table 1**Summary Statistics**

Year	Plant Count	Import Value	Export Value
1992	407,727	249.0	275.0
1993	439,785	244.6	276.9
1994	443,718	273.2	324.3
1995	446,591	416.5	397.2
1996	453,338	461.1	446.9
1997	455,994	356.5	401.6
1998	455,572	346.4	412.2
1999	455,142	410.3	460.9
2000	455,037	600.0	584.6
2001	457,718	479.1	502.3
2002	448,823	460.2	466.5
2003	432,953	448.1	453.5
2004	420,146	528.8	471.8
2005	390,416	614.2	450.0
Total	6,162,960		
1992-2005 averages			
		mean	count
employment		44.75	5,617,397
multit-unit plants		0.20	6,162,960
fraction trading		0.45	6,172,812

Note: Plant count for plants from the LBD with positive employment in the manufacturing sector merged to the LFTTD. Export and import value in billions of current dollars.

Table 2

Summary Statistics for Variables of Interest for Plants for 14 years

Variable	Mean	Std Dev
Employment	42.14	136.73
Skill Share	0.25	0.17
Age	9.40	5.00
Multi-Unit Status	0.21	0.40
Number of Products	2.89	2.19
Fraction Trading	0.50	0.50
Export Country	4.26	12.06
Import Country	1.74	5.27
Export Product	12.16	45.62
Import Product	7.54	30.68
Percent Export	0.30	0.40
Percent Import	0.20	0.35

Note: The 14 year period is 1992-2005. The summary statistics are calculated for N=344,446.

Measures of Trading Status

- Trade is measured at the firm level for time t in $\{14,7\}$ year windows
- Measure of trading status(Omitted category: firms that never engaged in trade):
 - $Exp_{f,t} = 1$ if the firm exported for at least one year and never imported
 - $IMP_{f,t} = 1$ if the firm imported for at least one year and never exported
 - $Both_{f,t} = 1$ if the firm both exported and imported for at least one year

	Plants			Firms		
	14 years	7 years		14 years	7 years	
Non Trader	50%	55%	52%	58%	65%	60%
Exporter	18%	17%	18%	20%	18%	20%
Importer	3%	3%	3%	3%	3%	3%
Both	29%	25%	27%	19%	14%	17%

Note: The 14 year period is 1992-2005 and the two 7 year periods are 1992-1998 and 1999-2005. The number of observations is 344,446.

- In addition, we have the percent traded, countries traded with, and products traded variables.

Measuring the Volatility of Employment Growth

- Volatility of plant-level employment growth rates
 - Available for consecutive years in the LBD
 - Unlike nominal variables no need for deflation or mark-up adjustments
 - Employment volatility exhibits trends similar to other measure
- Baseline: Plant-level volatility is the standard deviation of employment growth rates (γ_{it}) calculated over a 7 or 14 year window:

$$\sigma_{it} = \left[\frac{1}{w} \sum_{\tau=0}^w (\gamma_{it+\tau} - \bar{\gamma}_{it})^2 \right]^{1/2}$$

- Growth rate calculated by:
 - Log differences: $\gamma_{it} = \log(E_{it}) - \log(E_{it-1})$
 - Davis, Haltiwanger, Schuh (1996) methodology
- Alternative measure of volatility (Residual)
 - Estimate residuals from a fixed effect regression:
 - $\ln(Y_{it}) - \ln(Y_{it-1}) = \phi_i + \gamma_t + v_{it}$
 - Where employment volatility is measured as: $Vol(y_i) = \sqrt{\sum v_{it}^2}$

Table 5

Employment Volatility by Time Period and Trading Status

Plants	14-years (1992-2005)			7-years (1992-1998)			7-years (1999-2005)		
	Mean	Std Dev	N	Mean	Std Dev	N	Mean	Std Dev	N
Full Sample	0.37	0.27	344,446	0.31	0.28	254,610	0.31	0.27	242,777
Only Exporter	0.35	0.27	61,675	0.29	0.27	43,861	0.29	0.26	44,473
Only Importer	0.41	0.29	9,945	0.35	0.30	6,501	0.34	0.29	6,739
Both Exp. and Imp.	0.32	0.28	100,511	0.26	0.28	63,085	0.27	0.27	66,207
Non-Trading	0.41	0.26	172,315	0.34	0.28	141,163	0.34	0.27	125,358
Firms									
Full Sample	0.38	0.27	298,679	0.32	0.29	216,736	0.31	0.27	206,706
Only Exporter	0.35	0.27	59,483	0.29	0.27	39,939	0.29	0.26	41,037
Only Importer	0.41	0.29	9,653	0.35	0.30	6,064	0.34	0.29	6,368
Both Exp. and Imp.	0.34	0.30	56,764	0.28	0.30	30,165	0.28	0.27	35,074
Non-Trading	0.41	0.26	172,779	0.34	0.27	140,568	0.34	0.27	124,227

Note: Volatility is defined as the standard deviation of the growth rate of employment, calculated by log differences.

Volatility and Trading Status: Micro Level

- Do trading plants differ in terms of employment volatility?

$$\ln \sigma_{iff,w} = \alpha_o + \alpha_E Exp_{f,w} + \alpha_I Im p_{f,w} + \alpha_B Both_{f,w} + \beta_1 X_{i,w} + \beta_2 X_{j,w} + \alpha_j + t_w + \varepsilon_{iff}$$

- $X_{i,w}$: Multi-unit status, size, age, skill share, number of products
- α_j : Industry fixed effects
- $X_{j,w}$: Industry controls: export share, import penetration, skill share, size.

- Volatility calculated over multiple samples
 - For each of the three measures of volatility
 - 14 year “unbalanced”, 14year balanced
 - 7 year sample and 7 year fixed effects
 - The 7 year samples allow us to control for:
 - Industry fixed effects: control for industry-specific constants
 - Time varying industry characteristics
 - Plant fixed effects: Controls for plant-specific factors constant over both periods

Table 7									
Plant-Level Volatility and Trade Status for Log-Differences									
	(1)	(2)	(3)	(4)	(5)				
	14 yr Unbalanced		14 yr Balanced		7 year		7yr Fixed Effects		
Both	0.00	0.029 ***	0.048 ***	0.002	-0.002				
	(0.004)	(0.004)	(0.006)	(0.005)	(0.009)				
Exporter	-0.03 ***	-0.013 ***	0.003	-0.031 ***	0.004				
	(0.003)	(0.003)	(0.005)	(0.003)	(0.006)				
Importer	0.03 ***	0.062 ***	0.057 ***	0.029 ***	0.019 *				
	(0.006)	(0.007)	(0.011)	(0.007)	(0.012)				
Import Penetration		0.027 ***	0.051 ***	-0.022 ***	-0.013 ***				
		(0.002)	(0.004)	(0.004)	(0.005)				
Export Share		-0.034 ***	-0.065 ***	0.035 ***	0.019 ***				
		(0.002)	(0.004)	(0.004)	(0.005)				
Industry Size		-0.002 *	0.006 ***	0.033 ***	-0.034 ***				
		(0.001)	(0.002)	(0.008)	(0.01)				
Plant skillshare	-0.10 ***	-0.165 ***	-0.189 ***	-0.147 ***	-0.028 **				
	(0.002)	(0.008)	(0.015)	(0.007)	(0.012)				
Industry Skillshare		-0.012	0.147	-0.059	-0.100				
		(0.015)	(0.026)	(0.062)	(0.075)				
Plant Employment	0.04 ***	-0.131 ***	-0.154 ***	-0.202 ***	-0.228 ***				
	(0.004)	(0.001)	(0.002)	(0.001)	(0.005)				
Multi-unit status	-0.16 ***	0.016 ***	0.088 ***	0.095 ***	0.143 ***				
	(0.008)	(0.006)	(0.008)	(0.005)	(0.017)				
Age	-0.109 ***	-0.118 ***	-0.099 ***	-0.108 ***	-0.171 ***				
	(0.001)	(0.001)	(0.002)	(0.001)	(0.006)				
Number of products	-0.14 ***	-0.131 ***	-0.111 ***	-0.088 ***	-0.032 ***				
	(0.001)	(0.003)	(0.004)	(0.002)	(0.004)				
Time				0.015 ***	0.099 ***				
				(0.003)	(0.004)				
N	344,446	344,446	124,141	478,569	478,569				
R ²	0.21	0.18	0.18	0.24	0.20				

Volatility and Trading Status: Micro Level Categorical Results

- Do trading plants differ in terms of employment volatility (log-differences)?
 - Sole Exporters are less volatile
 - Sole Importers are more volatile
 - Firms and plants that do both are more volatile in the 2 of the 14 yr specifications
- Controls
 - Skill workers, size, number of products and age are negatively correlated volatility
 - Multi-unit status appears to be positively correlated with plant volatility
 - The industry controls tend to vary with specification
 - Import penetration positive in 14 year and negative in 7 year
 - Export share negative in 14 year and positive in 7 year
- Results on DHS and “residual” specifications
 - Results are broadly similar for exporters and importers but negative for plants that do both
- Fixed Effects Specifications
 - Importers continue to be more volatile than non-traders, while exporters and “both” are now insignificant
 - Fixed effects coefficients identified off of transitions (in the second 7 year period relative to the first)
 - 81 percent of nontraders remained nontraders
 - 86 percent of firms that both import and export continue to do both
 - 60 percent exporters continue to solely export in the second period.

Volatility and Trading Status: Industry Level

- A primary drawback of the micro-level volatility analysis is sample selection
 - About 85 percent of plants do not exist for entire 14 year period
- Aggregate data by trade status and calculate volatility by industry
- Do trading plants differ in terms of employment volatility at the industry level?

$$\ln \sigma_{j,w} = \alpha_o + \alpha_E Exp_{j,w} + \alpha_I Im p_{j,w} + \alpha_B Both_{j,w} + \beta_1 X_{j,w} + \alpha_j + t_w + \varepsilon_j$$

- α_j : Industry fixed effects
- $X_{j,w}$: Industry controls: export share, import penetration, skill share, size.
- t_w : Time fixed effect

- Volatility calculated over 14 and 7 year periods
 - The results are consistent with our findings at the plant level
 - Exporters are less volatile
 - Importers are more volatile
 - Plants that do both are less volatile than nontrading plants

Table 9								
Industry Employment Volatility and Combined Trade Status								
	(1)		(2)		(3)		(4)	
	14 year				7 year			
	$\sigma(\text{Indiffemp})$		$\sigma(\text{Indiffemp})$		$\sigma(\text{Indiffemp})$		$\sigma(\text{Indiffemp})$	
Constant	-1.41 ***		-1.10 ***		-1.63 ***		-0.19	
	(0.026)		(0.147)		(0.025)		(0.760)	
Trade Status								
Import	0.45 ***		0.31 ***		0.48 ***		0.48 ***	
	(0.041)		(0.051)		(0.034)		(0.034)	
Export	-0.22 ***		-0.29 ***		-0.22 ***		-0.22 ***	
	(0.036)		(0.053)		(0.030)		(0.030)	
Both	-0.88 ***		-0.94 ***		-0.98 ***		-0.98 ***	
	(0.042)		(0.054)		(0.033)		(0.033)	
Import Penetration			0.03				0.08	
			(0.022)				(0.051)	
Export Share			0.15 ***				0.03	
			(0.025)				(0.054)	
Shipments			0.02				-0.13 *	
			(0.017)				(0.079)	
Skill Share			-0.14				-0.39	
			(0.189)				(0.726)	
Time					0.059		0.04	
					(0.023)		(0.031)	
N	2103		2071		4050		4004	
R ²	0.59		0.27		0.61		0.61	

Sources of Volatility in Plants and Firms

- Investigate the relationship between volatility and:
 - Duration of time imported and exported
 - Product and country count imported to and exported from
 - Products imported and products exported

Variable	Mean	Std Dev
Fraction Trading	0.50	0.50
Export Country	4.26	12.06
Import Country	1.74	5.27
Export Product	12.16	45.62
Import Product	7.54	30.68
Percent Export	0.30	0.40
Percent Import	0.20	0.35

Table 10

Plant-Level Volatility and Trade Status for log differences

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	14 yr Unbalanced			Traders only	14yr Balanced	7 yr	7 yr FE
Percent Importer			0.089 ***	0.079 ***	0.068 ***	0.053 ***	-0.064 ***
			(0.009)	(0.009)	(0.012)	(0.008)	(0.013)
Percent Exporter			-0.070 ***	-0.128 ***	-0.048 ***	-0.075 ***	-0.036 ***
			(0.006)	(0.007)	(0.008)	(0.005)	(0.010)
Number of Countries							
Exported	-0.007 ***		-0.006 ***	-0.007 ***	-0.006 ***	-0.005 ***	-0.003 ***
	(0.001)		(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Imported	0.010 ***		0.006 ***	0.006 ***	0.005 **	0.006 ***	0.007 **
	(0.001)		(0.002)	(0.002)	(0.002)	(0.001)	(0.003)
Number of Products							
Exported		-0.001 ***	0.000	0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Imported		0.001 ***	0.000	0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	344,446	344,446	344,446	172,131	124,141	478,569	478,569
R-squared	0.19	0.18	0.19	0.17	0.18	0.24	0.20

Conclusion (preliminary)

- Sole exporters are less volatile
- Sole importers are more volatile
- Plants that both import and export (results are ambiguous)
- At industry level (Imports (+), Exports (-), Both (-))
- For percentage of time trading
 - import (+) and export (-)
- For Countries
 - import (+) and export (-)