EMORY

GOIZUETA BUSINESS SCHOOL

The Lost Decade for the U.S. Manufacturing Jobs: A Story of Cost and Risk

Nikolay Osadchiy (Emory), Sridhar Seshadri (UIUC)

Presentation at the University of Hong Kong

July 5, 2019

Supply Chain/Networks Research

- "Sales Forecasting with Financial Indicators and Experts' Input", with V. Gaur and S. Seshadri. *Production and Operations Management*, Vol. 22, No. 5, September-October 2013, pp. 1056-1076.
- "Systematic Risk in Supply Chain Networks", with V. Gaur and S. Seshadri. *Management Science*, Vol.62, No. 6, June 2016, pp. 1755-1777.
- "Sourcing Strategies for Online Retail Marketplaces", with V.Gaur, S.Seshadri, and M.Subrahmanyam, 2018, under review.
- "The Bullwhip Effect in Supply Networks", with W.Schmidt and J.Wu, 2018, under review.
- "Fragmentation of Supply Networks" with V.Gaur and M.Udenio, *in progress*.
- "The Lost Decade for the U.S. Manufacturing Jobs: A Story of Cost and Risk" with S.Seshadri, *in progress*.

Story of This Paper

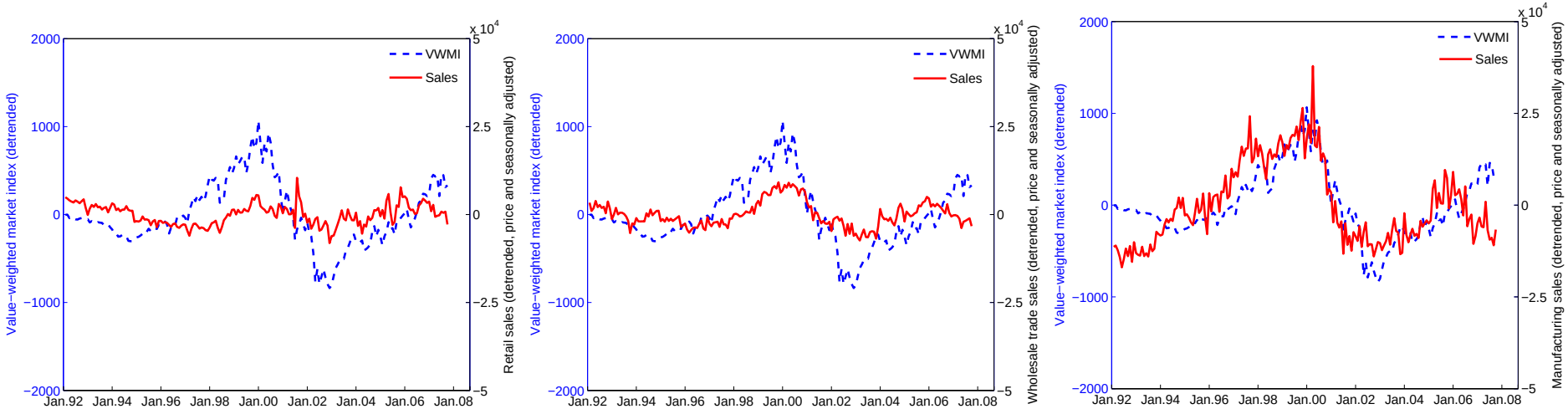
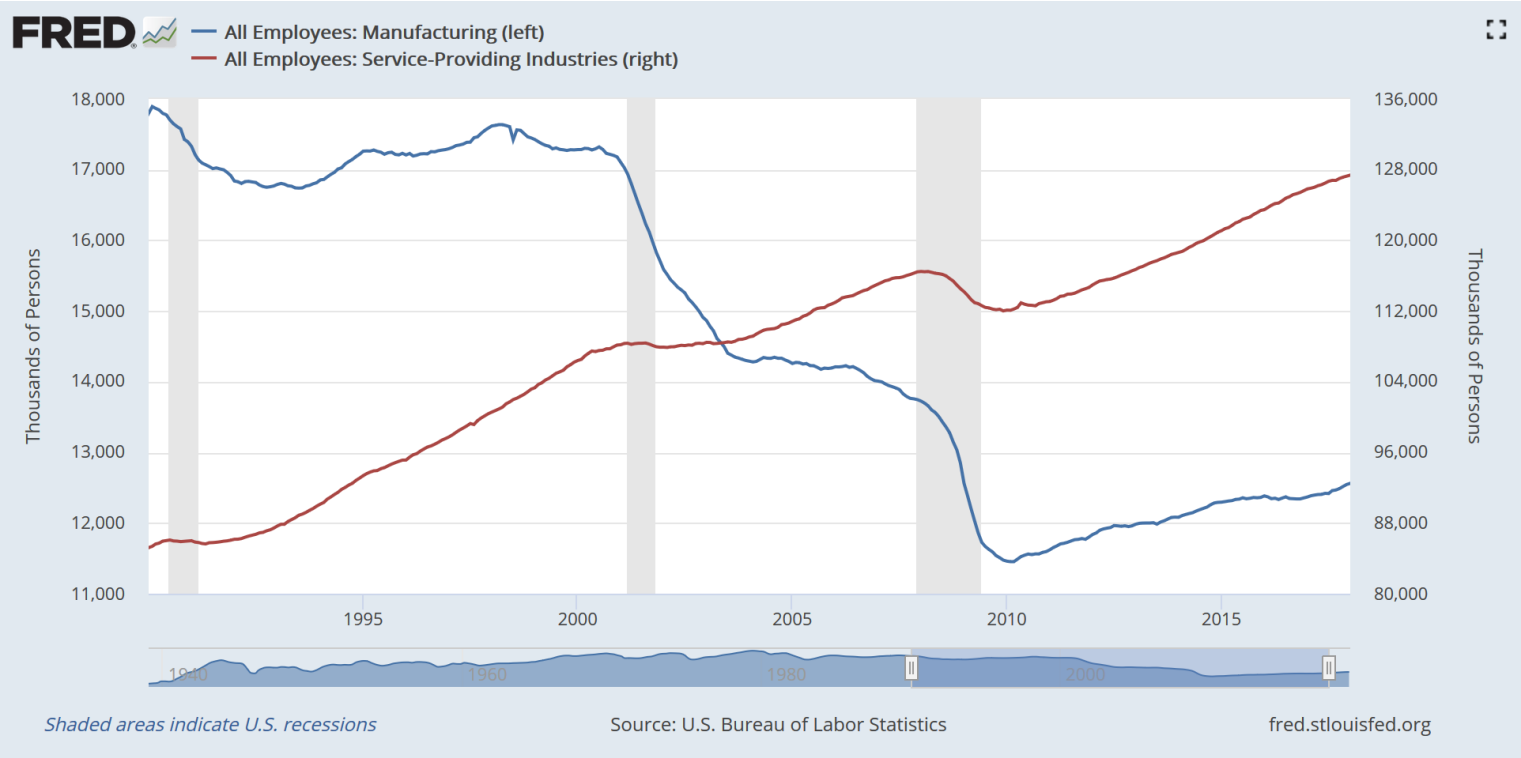
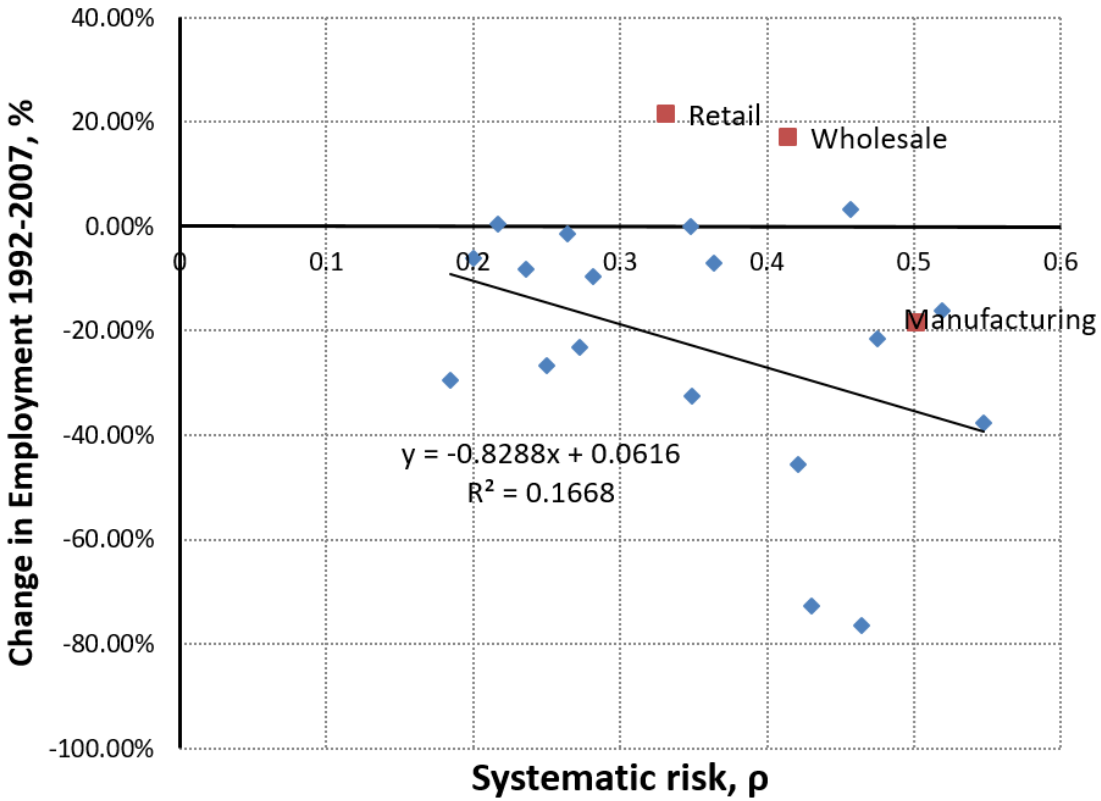


Figure: Retail, wholesale, and manufacturing sales and the VWMI market index time series, with trends removed. Systematic risk estimates are 0.33, 0.42, 0.50, respectively (Osadchiy et al. 2016)

U.S. Manufacturing Employment (1990-2018)



Our "hunch"


40.00%
20.00%
0.00%
-20.00%
-40.00%
-60.00%
-80.00%
-100.00%
0
0.1
0.2
0.3
0.4
0.5
0.6
Change in Employment 1992-2007, %
Systematic risk, ρ
Retail
Wholesale
Manufacturing
y = -0.8288x + 0.0616
R² = 0.1668

What is known?

American Economic Review 2016, 106(7): 1632–1662
http://dx.doi.org/10.1257/aer.20131578

The Surprisingly Swift Decline of US Manufacturing Employment†

By Justin R. Pierce and Peter K. Schott*

This paper links the sharp drop in US manufacturing employment after 2000 to a change in US trade policy that eliminated potential tariff increases on Chinese imports. Industries more exposed to the change experience greater employment loss, increased imports from China, and higher entry by US importers and foreign-owned Chinese exporters. At the plant level, shifts toward less labor-intensive production and exposure to the policy via input-output linkages also contribute to the decline in employment. Results are robust to other potential explanations of employment loss, and there is no similar reaction in the European Union, where policy did not change. (*JEL* D72, E24, F13, F16, L24, L60, P33)

What is known?

American Economic Review 2016, 106(7): 1632–1662
http://dx.doi.org/10.1257/aer.20131578

The Surprisingly Swift Decline of US Manufacturing Employment†

By Justin R. Pierce and Peter K. Schott*

This paper links the sharp drop in US manufacturing employment after 2000 to a change in US trade policy that eliminated potential tariff increases on Chinese imports. Industries more exposed to the change experience greater employment loss, increased imports from China, and higher entry by US importers and foreign-owned Chinese exporters. At the plant level, shifts toward less labor-intensive production and exposure to the policy via input-output linkages also contribute to the decline in employment. Results are robust to other potential explanations of employment loss, and there is no similar reaction in the European Union, where policy did not change. (*JEL* D72, E24, F13, F16, L24, L60, P33)

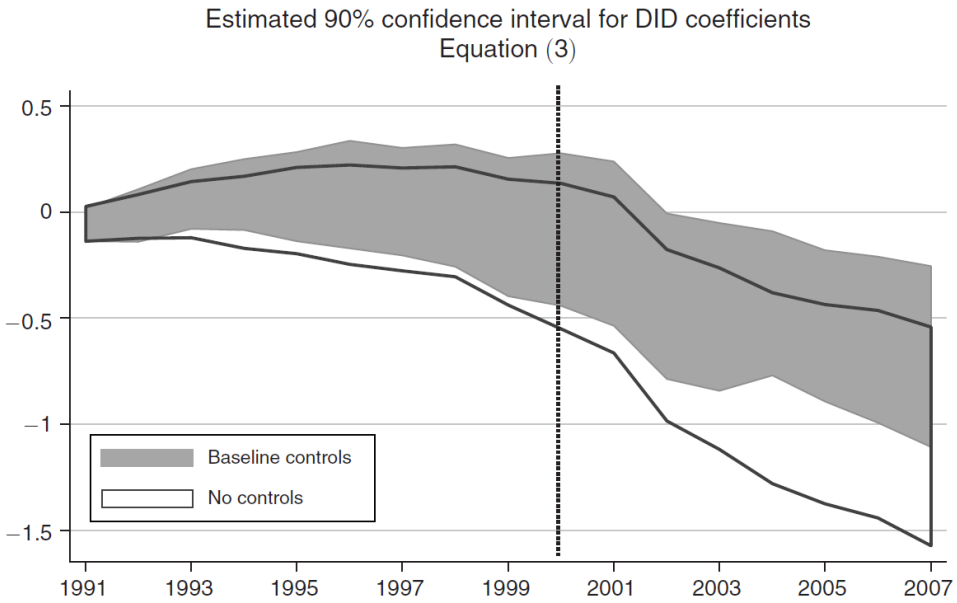


Figure 4. Estimated Timing of the PNTR Effect (*LBD*)

Mechanisms

- Encouraging US firms to start sourcing inputs or final goods from Chinese rather than domestic suppliers;
- Persuading Chinese firms to expand into the US market;
- Motivating US manufacturers either to invest in labor-saving production techniques or to produce more skill- and capital-intensive products that are more in line with US comparative advantage;
- Inducing US firms to shift all or part of their operations offshore, perhaps in conjunction with other firms in their supply chains;

- *Can we add to these? Operational mechanisms?*

Mechanisms

- Encouraging US firms to start sourcing inputs or final goods from Chinese rather than domestic suppliers;
- Persuading Chinese firms to expand into the US market;
- Motivating US manufacturers either to invest in labor-saving production techniques or to produce more skill- and capital-intensive products that are more in line with US comparative advantage;
- Inducing US firms to shift all or part of their operations offshore, perhaps in conjunction with other firms in their supply chains;

- *Can we add to these? Operational mechanisms?*

Literature

- Factors affecting trade:
  - Resource availability, e.g., labor, natural resources, etc. (Heckscher-Olin model, Krugman et al. 2015)
  - Autor et al. (2016) China's WTO entry, privatization, removal of requirements to trade through state intermediaries.
- Outsourcing decisions:
  - Agglomeration (Ellison et al. 2007), co-location gains (Baldwin and Venables, 2013)
  - Trade policy (Pierce and Schott, 2016)
- Labor economics and employment:
  - Greater reliance on contract workers (Faberman, 2008)
  - Outsourcing vs. immigration (Ottaviano, 2013)
  - Import penetration (Acemoglu et al. 2016)
- Operations management:
  - Real options under exchange rate uncertainty (Kogut and Kulatilaka, 1994)
  - Plant location decisions (Kouvelis et al 2008)
  - Cost is not a primary driver of offshoring, reshoring does not happen broadly (Cohen et al. 2018)

The Current State of Affairs

- The U.S. Constitution empowers Congress to set tariffs:
  - ‘‘to lay and collect taxes, duties, Imposts and Excises, to pay the Debts and provide for the common Defence and general Welfare of the United States’’
- Congress has partially delegated this authority to the President:
  - Through the Trading With the Enemy Act of 1917, the president can impose a tariff during a time of war;
  - The Trade Act of 1974 allows the president to implement a 15 percent tariff for 150 days if there is an adverse impact on national security from imports. After 150 days, the trade policy would need congressional approval;
  - The International Emergency Economic Powers Act of 1977 allows the president to implement tariffs during a national emergency;
  - Current: the Trade Expansion Act of 1962 gives the secretary of commerce the authority to investigate and determine the impacts of any import on the national security of the United States and the president the power to adjust tariffs accordingly.

The Current State of Affairs

- The U.S. Constitution empowers Congress to set tariffs:
  - ‘‘to lay and collect taxes, duties, Imposts and Excises, to pay the Debts and provide for the common Defence and general Welfare of the United States’’
- Congress has partially delegated this authority to the President:
  - Through the Trading With the Enemy Act of 1917, the president can impose a tariff during a time of war;
  - The Trade Act of 1974 allows the president to implement a 15 percent tariff for 150 days if there is an adverse impact on national security from imports. After 150 days, the trade policy would need congressional approval;
  - The International Emergency Economic Powers Act of 1977 allows the president to implement tariffs during a national emergency;
  - Current: the Trade Expansion Act of 1962 gives the secretary of commerce the authority to investigate and determine the impacts of any import on the national security of the United States and the president the power to adjust tariffs accordingly.

The Current State of Affairs

- The U.S. Constitution empowers Congress to set tariffs:
  - ‘‘to lay and collect taxes, duties, Imposts and Excises, to pay the Debts and provide for the common Defence and general Welfare of the United States’’
- Congress has partially delegated this authority to the President:
  - Through the Trading With the Enemy Act of 1917, the president can impose a tariff during a time of war;
  - The Trade Act of 1974 allows the president to implement a 15 percent tariff for 150 days if there is an adverse impact on national security from imports. After 150 days, the trade policy would need congressional approval;
  - The International Emergency Economic Powers Act of 1977 allows the president to implement tariffs during a national emergency;
  - Current: the Trade Expansion Act of 1962 gives the secretary of commerce the authority to investigate and determine the impacts of any import on the national security of the United States and the president the power to adjust tariffs accordingly.

The Current State of Affairs

- The U.S. Constitution empowers Congress to set tariffs:
  - ‘‘to lay and collect taxes, duties, Imposts and Excises, to pay the Debts and provide for the common Defence and general Welfare of the United States’’
- Congress has partially delegated this authority to the President:
  - Through the Trading With the Enemy Act of 1917, the president can impose a tariff during a time of war;
  - The Trade Act of 1974 allows the president to implement a 15 percent tariff for 150 days if there is an adverse impact on national security from imports. After 150 days, the trade policy would need congressional approval;
  - The International Emergency Economic Powers Act of 1977 allows the president to implement tariffs during a national emergency;
  - Current: the Trade Expansion Act of 1962 gives the secretary of commerce the authority to investigate and determine the impacts of any import on the national security of the United States and the president the power to adjust tariffs accordingly.

Research Questions

- Does the supply-demand mismatch risk matter for production location decisions?
  - Overall demand volatility
  - Systematic risk
- Does the impact of supply-demand mismatch risk change with the expected tariff rate?
- What is the effect of production (volume) flexibility on mitigating demand risk?

Research Questions

- Does the supply-demand mismatch risk matter for production location decisions?
  - Overall demand volatility
  - Systematic risk
- Does the impact of supply-demand mismatch risk change with the expected tariff rate?
- What is the effect of production (volume) flexibility on mitigating demand risk?

Research Questions

- Does the supply-demand mismatch risk matter for production location decisions?
  - Overall demand volatility
  - Systematic risk
- Does the impact of supply-demand mismatch risk change with the expected tariff rate?
- What is the effect of production (volume) flexibility on mitigating demand risk?

China: Production Scale Flexibility

- ‘‘Famously, Hon Hai (Foxconn), a Chinese electronics contract manufacturing company, employs hundreds of thousands of workers, many of them live in dormitories inside its manufacturing complexes. This arrangement creates a rapidly scalable access to the labor force. According to an Apple executive, Hon Hai could hire 3,000 workers overnight." (NY Times, Jan 22, 2012)
- Specialization and concentration of global demand.
- Demand pooling allows the firm to accommodate a local volatility of demand while keeping its capacity utilization relatively steady.

Summary of Results

- Supply-demand mismatch factors matter
  - But only when the risk of tariffs is low
  - Results remarkably different before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Systematic risk matters more when it is high
- Our effects are complementary to known factors: PNTR, supply chain agglomeration, final demand in China, productivity growth, etc.
- Approximately 408,000 manufacturing jobs could have been saved with flexibility

Summary of Results

- Supply-demand mismatch factors matter
  - But only when the risk of tariffs is low
  - Results remarkably different before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Systematic risk matters more when it is high
- Our effects are complementary to known factors: PNTR, supply chain agglomeration, final demand in China, productivity growth, etc.
- Approximately 408,000 manufacturing jobs could have been saved with flexibility

Summary of Results

- Supply-demand mismatch factors matter
  - But only when the risk of tariffs is low
  - Results remarkably different before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Systematic risk matters more when it is high
- Our effects are complementary to known factors: PNTR, supply chain agglomeration, final demand in China, productivity growth, etc.
- Approximately 408,000 manufacturing jobs could have been saved with flexibility

Summary of Results

- Supply-demand mismatch factors matter
  - But only when the risk of tariffs is low
  - Results remarkably different before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Systematic risk matters more when it is high
- Our effects are complementary to known factors: PNTR, supply chain agglomeration, final demand in China, productivity growth, etc.
- Approximately 408,000 manufacturing jobs could have been saved with flexibility

Summary of Results

- Supply-demand mismatch factors matter
  - But only when the risk of tariffs is low
  - Results remarkably different before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Systematic risk matters more when it is high
- Our effects are complementary to known factors: PNTR, supply chain agglomeration, final demand in China, productivity growth, etc.
- Approximately 408,000 manufacturing jobs could have been saved with flexibility

Summary of Results

- Supply-demand mismatch factors matter
  - But only when the risk of tariffs is low
  - Results remarkably different before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Systematic risk matters more when it is high
- Our effects are complementary to known factors: PNTR, supply chain agglomeration, final demand in China, productivity growth, etc.
- Approximately 408,000 manufacturing jobs could have been saved with flexibility

Summary of Results

- Supply-demand mismatch factors matter
  - But only when the risk of tariffs is low
  - Results remarkably different before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Systematic risk matters more when it is high
- Our effects are complementary to known factors: PNTR, supply chain agglomeration, final demand in China, productivity growth, etc.
- Approximately 408,000 manufacturing jobs could have been saved with flexibility

Model

- Single period model.
- An all-equity firm; serves domestic demand; can choose to produce domestically or overseas.
- Maximize the expected cash flow discounted at a risk adjusted weighted cost of capital.
- The present value of the future free cash flow FCF (Copeland and Antikarov 2001, Ch.3) :

$$PV = \frac{E(FCF)}{1 + R_f + (E(R_m) - R_f)\beta}, \tag{1}$$

- β is the financial beta of the firm, R_m is the return on the market portfolio, and R_f is the risk-free rate.
- Demand $\sim Normal(1, \beta^2\sigma)$
- σ - volatility (scalar)

Produce Domestically or Overseas?

- Domestic:
  - Maintains k units of costly production capacity, at a rate c per unit.
  - Sells $min(k, D)$ units, at unit margin p_d.
  - k chosen according to the newsvendor model.

$$E(FCF_d) = (p_d - c) - p_d \sigma \beta^2 \phi(z^*), \tag{2}$$

  - $z^* = \Phi^{-1}\left(\frac{p_d - c}{p_d}\right)$.
- Overseas:
  - Labor intensive process, perfect volume flexibility, unit margin p_o.

$$E(FCF_o) = p_o. \tag{3}$$

- *Domestic risk exposure is due to rigid, inflexible, and costly capacity*

Produce Domestically or Overseas?

- Domestic:
  - Maintains k units of costly production capacity, at a rate c per unit.
  - Sells $min(k, D)$ units, at unit margin p_d.
  - k chosen according to the newsvendor model.

$$E(FCF_d) = (p_d - c) - p_d \sigma \beta^2 \phi(z^*), \tag{2}$$

  - $z^* = \Phi^{-1}\left(\frac{p_d - c}{p_d}\right)$.
- Overseas:
  - Labor intensive process, perfect volume flexibility, unit margin p_o.

$$E(FCF_o) = p_o. \tag{3}$$

- *Domestic risk exposure is due to rigid, inflexible, and costly capacity*

Switching Decision

- Switching cost S
- PV producing domestically

$$PV_d = \frac{p_d - c - p_d \sigma \beta^2 \phi(z^*)}{1 + R_f + (E(R_m) - R_f)\beta},$$

- PV producing overseas

$$PV_o = \frac{p_o}{1 + R_f + (E(R_m) - R_f)\beta} - S.$$

- Produce domestically if

$$\Delta PV = PV_d - PV_o = \frac{p_d - p_o - c - p_d \sigma \beta^2 \phi(z^*)}{1 + R_f + (E(R_m) - R_f)\beta} + S \geq 0. \quad (4)$$

The Effect of Key Model Primitives: σ, β, S, $p_o - p_d$

$\frac{\partial(\Delta PV)}{\partial \sigma} \leq 0$: Hypothesis 1

The domestic manufacturing employment growth is negatively associated with the overall demand volatility.

$\frac{\partial(\Delta PV)}{\partial \beta} \leq 0$ iff $\sigma\phi(z^*)\beta^2 + \frac{2\sigma\phi(z^*)(1+R_f)}{E(R_m)-R_f}\beta - \left(\frac{c+p_0}{p_d} - 1\right) \geq 0.$

Hypothesis 2a

The domestic manufacturing employment growth is negatively associated with the financial beta.

Hypothesis 2b

The domestic manufacturing employment growth is negatively associated with the financial beta when beta is high.

Hypothesis 2c

The domestic manufacturing employment growth is positively associated with the financial beta when beta is low.

The Effect of Key Model Primitives: σ, β, S, $p_o - p_d$, contd.

$\frac{\partial(\Delta PV)}{\partial S} \geq 0$: Hypothesis 3

The domestic manufacturing employment growth is positively associated with the switching cost.

$\frac{\partial(\Delta PV)}{(p_o - p_d)} \leq 0$: Hypothesis 4

The domestic manufacturing employment growth is negatively associated with the reduction of overseas variable production costs.

Data Sources: Employment

- Annual Survey of Manufacturers
  - Industry level data, 6 digit NAICS level, $>$ 450 manufacturing industries
- 1990-2011 period
  - Change from SIC to NAICS in 1997, redefinitions of NAICS in 2002, 2007
  - At this level of detail, concordances matter
- NBER-CES database, Becker et al. (2013)
  - Time-consistent series for employment, compensation, value added, etc. for 1959-2011
  - Production workers (up to line supervisor)
  - Total employment (Production workers + Professional, Executive, Support functions)
  - 473 manufacturing industries, very clean data

Demand Volatility and Systematic Risk

- Value-weighted market index including dividends and distributions (VWRETD, NYSE/AMEX/NASDAQ)
- Betas using daily returns on VWRETD for 184 portfolios defined by 5-digit NAICS codes
  - Firms' NAICS segments re-checked and updated annually
  - Ensures data availability for majority of industy-year pairs
  - For less than 7% observations, use NAICS3 betas
  - Robust if NAICS6 portfolios are used, loses 35% of the sample
- Robustness: implied volatility (VIX) and implied cost of capital beta (Beta ICC)

Switching Cost

- Cost of scaling down domestic operations (selling assets, PPE)
  - Asset specificity: transaction cost economics (Williamson, 1988)
  - Market thickness Shleifer and Vishny 1992
- Redeployability index Kim and Kung (2016)
  - Combines asset specificity and market thickness
  - Derived from the BEA capital flow table
  - Distinct estimates for 53 manufacturing industries (NAICS3-4), for 1990-2011

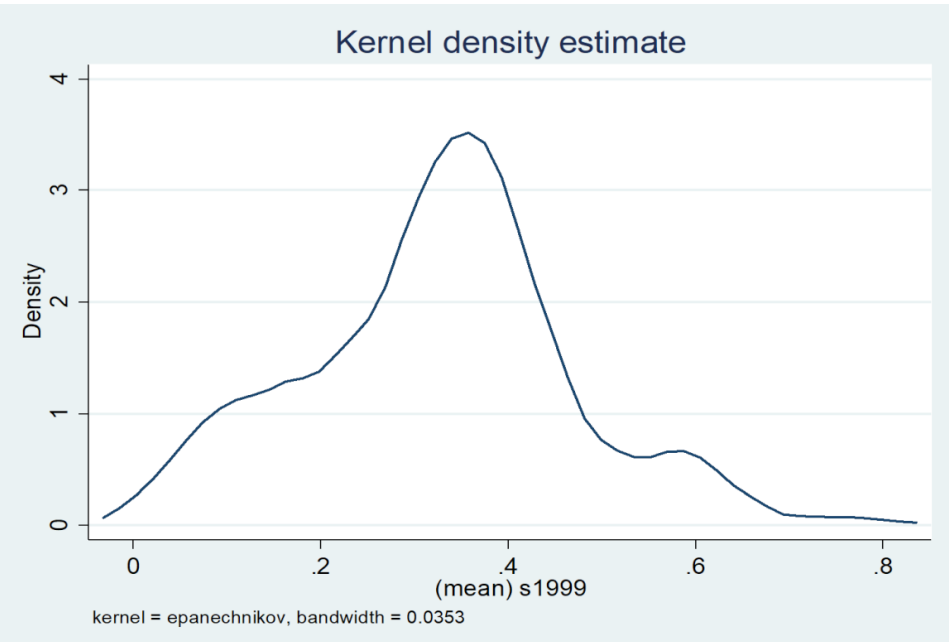
Variable Production Cost

- Producer price index (PPI) for industrial products by sector provided in Statistical Yearbooks by the National Bureau of Statistic of China (NBSC)
- 33 manufacturing industries, years 1990-2011
- Use industry descriptions to map to NAICS3-4 codes
- Landed cost includes tariffs
  - Tariffs remained set at the NTR level during the period.

NTR Gaps, Pierce and Schott (2016)

$$NTR - Gap = NonNTRRate(1930) - NTRRate(1999)$$

- Rates set by the Harmonized Tariff Schedule
- NonNTR rates set by the Smoot-Hawley Act of 1930; slight temporal variation in the NTR rates
- Example: the NonNTR duty for toys is 70% (free for NTR)
- Include NTR gaps for upstream and downstream industries
- Compute predicted job losses due to PNTR



Final Demand in China

$$Cons_{it}^{Chn}/(Cons_{it}^{Chn} + Cons_{it}^{US})$$

- Growing final demand in China could be a rationale to relocate production
- World Input-Output Database, National input-output tables for the period 2000-2014
- Data for 17 manufacturing industries (NAICS3), in the U.S. and China for years 2001-2011

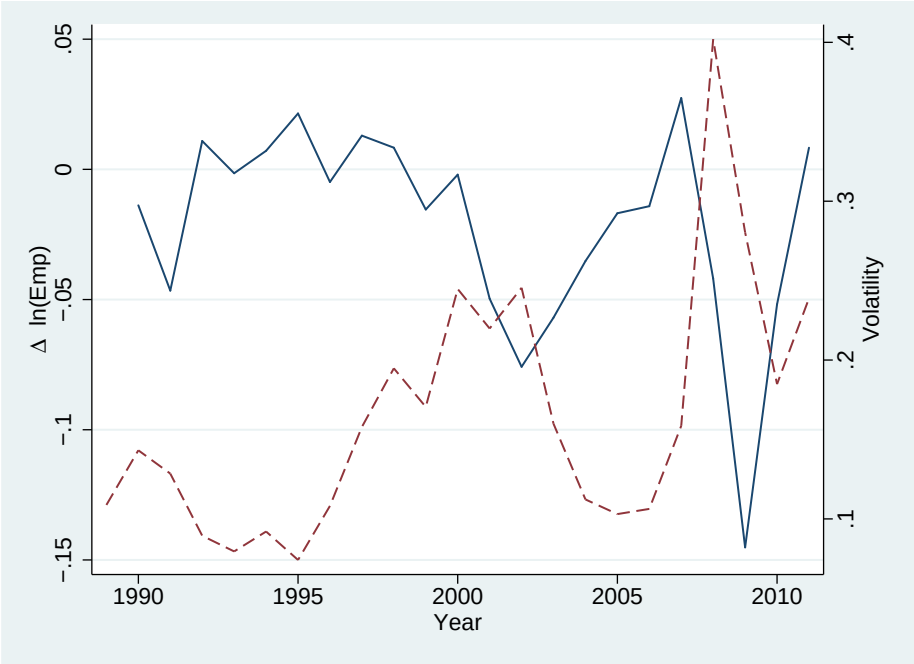
Import of Intermediate Inputs and Other Controls

- The level of imports may affect further outsourcing
  - Imported intermediate inputs and total volume of intermediate inputs (BEA)
  - Annual IO matrices at the summary level (NAICS3), 1997-2011
- Additional controls (NAICS6 level, all years, NBER-CES)
  - Labor cost
  - Labor intensity
  - Skill intensity
  - Gross margin
  - Productivity growth

Roster of Variables

Variable	Definition	Source
log-Employment	$\ln(Emp_{it})$	ASM
log-Production hours	$\ln(ProdH_{it})$	ASM
Volatility	St.Dev. of daily VWRETD in a year	CRSP
VIX	VIX mean over trading days in a year	CBOE
Beta	Regression of daily portfolio returns on the VWRETD in a year	CRSP
Beta(ICC)	Implied cost of capital-based beta	CRSP, IBES
R-index	Redeployability index	Kim and Kung (2016)
PPI	Annual measure	NBS China
China FX reserves, YoY change	$1 - FXR_{t-1}/FXR_t$	PB China
Labor cost	$(Annual\ Pay)_{it}/EMP_{it}$	ASM
Labor intensity	$(Annual\ Pay)_{it}/(Value\ of\ Shipments)_{it}$	ASM
Skill intensity	$\ln(1 - (Production\ Workers)_{it}/EMP_{it})$	ASM
Gross margin	$(Value\ Added_{it} - Annual\ Pay_{it})/(Value\ of\ Shipments)_{it}$	ASM
Share of imported intermediate inputs (siii)	$(Value\ of\ imported\ intermediate\ inputs_{it})/(Total\ value\ of\ inputs_{it})$	BEA
China's share of final demand	$Cons_{it}^{Chn}/(Cons_{it}^{Chn} + Cons_{it}^{US})$	WIOD
Predicted pNTR losses	Year-by-year regression of centered rec on NTR gaps for years 2001-2007	Pierce and Schott (2016)
TFP5-growth	$TFP5_{it} - TFP5_{i,t-1}$	NBER-CES

Preliminary Evidence



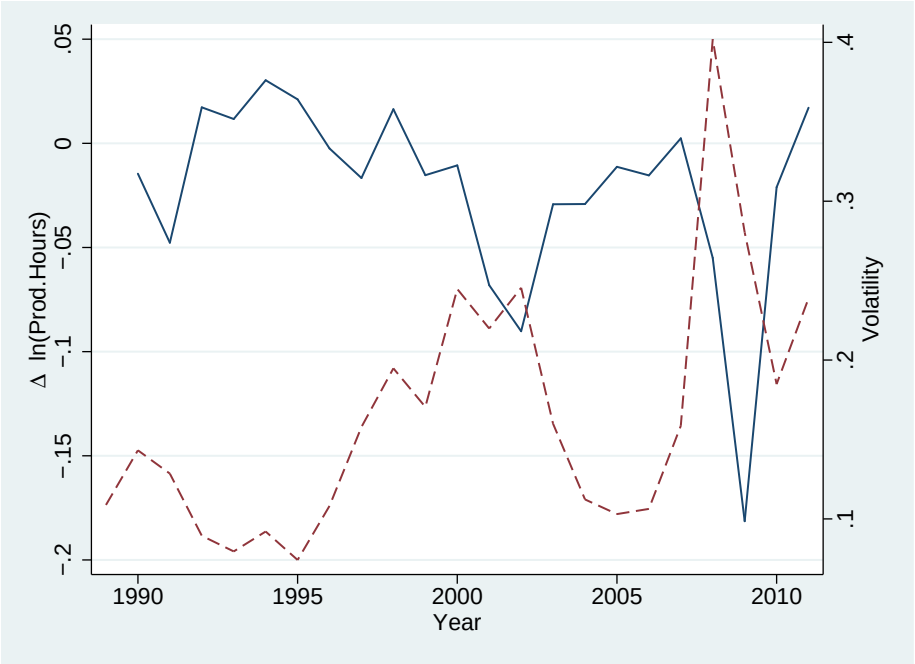


Figure: Manufacturing difference in logarithm employment and production hours overlayed with financial market volatility (red dashed line, right axis) for years 1990-2011.

Summary Statistics

Table: Summary statistics, full sample (1990-2011).

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
ln(Emp)	10,847	2.889	1.087	-1.609	6.319
ln(Hours)	10,847	3.242	1.089	-1.204	6.769
Volatility	10,879	0.165	0.0772	0.0742	0.402
VIX	10,406	20.57	5.996	12.39	32.69
Beta	10,879	0.907	0.455	-2.795	3.267
BetaICC	10,406	1.017	0.354	0.183	2.234
PPI	10,406	104.0	9.285	83.40	168.3
R-index	10,406	0.381	0.0614	0.178	0.550
FX YoY Change, %	10,879	38.35	34.36	-10.45	143.5
Margin	10,847	0.324	0.103	-0.0818	0.891
Labor cost	10,847	36.81	12.85	9.394	106.4
Labor int.	10,847	0.177	0.0765	0.00831	0.694
Skill int.	10,847	-1.328	0.388	-3.060	-0.201
Imp.Int.Input	7,095	14.06	5.954	6.204	60.66
Loss_PNTR	10,879	-0.000169	0.0166	-0.133	0.106
China demand	5,676	20.19	12.43	1.303	56.50
TFP5-growth	10,843	0.00211	0.0752	-0.642	1.387

Estimation Framework

Dynamic panel data specification

$$\begin{aligned}\ln Emp_{it} &= \alpha \ln Emp_{i,t-1} + \beta_1 Volatilty_t + \beta_2 Beta_{it} \\ &\quad + \beta_3 R\text{-}index_{it} + \beta_4 PPI_{it} + C_{it}\lambda + \mu_i + \epsilon_{it},\end{aligned}$$

$$\begin{aligned}\ln Emp_{it} &= \alpha \ln Emp_{i,t-1} + \beta_1 Volatilty_t + \beta_2 Beta_{it} + \gamma_2 H_{it} + \delta_2 Beta_{it} * H_{it} \\ &\quad + \beta_3 R\text{-}index_{it} + \beta_4 PPI_{it} + C_{it}\lambda + \mu_i + \epsilon_{it}.\end{aligned}$$

- Large N (473 industries), small T (11 or 22 years) panel
- FE estimator is biased, due to the incidental parameters problem
- Arellano-Bover/Blundell-Bond system GMM
  - More efficient, suitable when the ratio of the variance of the panel-level effect to the variance of idiosyncratic error is large

Endogeneity Concerns

- PPI could be affected by the volume of global trade, which simultaneously would affect Employment
- Instrument PPI with a YoY change in China's FX reserves (Peoples Bank of China, 2019)
  - Instrument is relevant, also for the real exchange rate (Blanchard et al., 2015)
  - Unlikely to directly affect employment in the U.S.

Pooled Sample: 1990-2011

VARIABLES	(1) ln(Emp)	(2) ln(Emp)	(3) ln(Emp)	(4) ln(Emp)
Volatility	-0.2512***	-0.1190***	-0.1226***	
	(0.0150)	(0.0209)	(0.0210)	
Beta	-0.0305***	-0.0275***	0.0001	
	(0.0044)	(0.0049)	(0.0080)	
1(betahigh)			0.0272**	
			(0.0108)	
Beta*1(betahigh)			-0.0394***	
			(0.0114)	
PPI	0.0009***	0.0010***	0.0010***	
	(0.0001)	(0.0001)	(0.0001)	
R-index	-0.2132***	0.0517	0.0231	
	(0.0669)	(0.0998)	(0.1033)	
Margin		-0.3776***	-0.3838***	-0.2737***
		(0.0792)	(0.0793)	(0.0820)
Labor cost		-0.0004	-0.0003	-0.0014***
		(0.0003)	(0.0003)	(0.0003)
Labor int.		0.0007	-0.0043	0.1850
		(0.1417)	(0.1423)	(0.1145)
Skill int.		0.0183	0.0194	-0.0005
		(0.0124)	(0.0126)	(0.0132)
Loss_PNTR		0.8332***	0.8543***	0.7906***
		(0.1692)	(0.1665)	(0.1671)
TFP5-growth		0.4794***	0.4785***	0.5162***
		(0.0529)	(0.0528)	(0.0533)
ln(Emp) = L,	0.9955***	1.0029***	1.0030***	1.0101***
	(0.0067)	(0.0068)	(0.0069)	(0.0064)
Observations	10,374	10,374	10,374	10,374
Number of iid	473	473	473	473

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Pooled Sample: 1990-2011

- Coefficients show associations of predictor variables with relative employment change
- Strong support for H1, H2a, H2b, and H4. Mixed/weak support for H3, H2c
  - Greater demand volatility and systematic risk are associated with employment losses
  - The effect is stronger for high systematic risk industries
  - Increase in volatility by 0.1 is associated with 1.9% employment losses per year; an increase in beta by 1 unit is associated with 2.75% annual employment losses.
- Effect of PPI is strong
  - Higher costs in China have a positive association with the employment in the U.S.
  - A 1 point increase in PPI is associated with approximately 0.1% annual gain.
- The effect of switching cost is in the expected direction and significant for the basic specification only
  - Possible collinearity with controls?
- The lagged employment is close to unity (as expected)
- PNTR losses load significantly, coefficient close to unity (as expected)
- Margin loads negative (pursuit of higher margins?), productivity loads positive (Nordhaus 2005), labor costs does not seem to be a deciding factor (Cohen et al. 2018)

Post-PNTR: 2001-2011

VARIABLES	(1) ln(Emp)	(2) ln(Emp)	(3) ln(Emp)	(4) ln(Emp)	(5) ln(Emp)
Volatility	-0.1505***	-0.1079***	-0.0444*	-0.0491**	
	(0.0198)	(0.0224)	(0.0238)	(0.0235)	
Beta	-0.0374***	-0.0432***	-0.0450***	-0.0197	
	(0.0074)	(0.0072)	(0.0071)	(0.0126)	
1(betahigh)				0.0019	
				(0.0182)	
Beta*1(betahigh)				-0.0201	
				(0.0162)	
PPI	0.0032***	0.0035***	0.0016***	0.0016***	
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	
R-index	-0.6313***	0.1272	-0.0445	-0.1085	
	(0.1246)	(0.2455)	(0.2506)	(0.2560)	
Margin		-0.3921***	-0.4066***	-0.4120***	-0.3422***
		(0.1146)	(0.1175)	(0.1176)	(0.1104)
Labor cost		-0.0011	-0.0018**	-0.0017*	-0.0028***
		(0.0007)	(0.0009)	(0.0009)	(0.0008)
Labor int.		-0.4252**	-0.1530	-0.1636	0.0400
		(0.1686)	(0.1796)	(0.1802)	(0.1355)
Skill int.		0.0871***	0.0879***	0.0883***	0.0773***
		(0.0165)	(0.0172)	(0.0174)	(0.0174)
Imp.Int.Input			0.0150***	0.0151***	0.0182***
			(0.0018)	(0.0018)	(0.0018)
Loss_PNTR		0.6793***	0.7453***	0.7669***	0.6884***
		(0.1653)	(0.1652)	(0.1641)	(0.1653)
China demand			-0.0003	-0.0001	-0.0004
			(0.0006)	(0.0006)	(0.0006)
TFP5-growth		0.4242***	0.4395***	0.4388***	0.4586***
		(0.0613)	(0.0647)	(0.0641)	(0.0630)
ln(Emp) = L,	0.9531***	0.9741***	0.9810***	0.9833***	0.9882***
	(0.0091)	(0.0098)	(0.0111)	(0.0115)	(0.0099)
Observations	5,203	5,203	5,203	5,203	5,203
Number of iid	473	473	473	473	473

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Post-PNTR: 2001-2011

- Largely consistent with the pooled sample estimates
- The effect of systematic risk is **stronger**
- Skill intensity has a positive association with the US employment
- China demand has no significant effect
- Agglomeration has a positive effect (perhaps outsorcing goes only to a certain point)

- *Risk considerations, hence flexibility in the U.S. manufacturing processes, matter*

Post-PNTR: 2001-2011

- Largely consistent with the pooled sample estimates
- The effect of systematic risk is **stronger**
- Skill intensity has a positive association with the US employment
- China demand has no significant effect
- Agglomeration has a positive effect (perhaps outsorcing goes only to a certain point)

- *Risk considerations, hence flexibility in the U.S. manufacturing processes, matter*

Pre-PNTR: 1990-2000

VARIABLES	(1) ln(Emp)	(2) ln(Emp)	(3) ln(Emp)	(4) ln(Emp)
Volatility	-0.1342***	-0.0330	-0.0330	
	(0.0358)	(0.0411)	(0.0412)	
Beta	0.0233***	0.0181***	0.0270**	
	(0.0074)	(0.0068)	(0.0113)	
1(betahigh)			-0.0005	
			(0.0129)	
Beta*1(betahigh)			-0.0070	
			(0.0163)	
PPI	0.0005***	0.0005***	0.0005***	
	(0.0002)	(0.0002)	(0.0002)	
R-index	-0.6004***	-1.0295***	-1.0297***	
	(0.1213)	(0.1804)	(0.1803)	
Margin		-0.3324***	-0.3303***	-0.5042***
		(0.1239)	(0.1237)	(0.1039)
Labor cost		0.0001	-0.0000	0.0008
		(0.0009)	(0.0009)	(0.0007)
Labor int.		0.9221***	0.9286***	0.2526
		(0.2014)	(0.2019)	(0.1895)
Skill int.		-0.0355	-0.0352	0.0052
		(0.0305)	(0.0306)	(0.0251)
TFP5-growth		0.5563***	0.5561***	0.5544***
		(0.0807)	(0.0805)	(0.0789)
ln(Emp) = L,	1.0552***	1.0521***	1.0517***	1.0195***
	(0.0189)	(0.0236)	(0.0237)	(0.0169)
Observations	5,171	5,171	5,171	5,171
Number of iid	473	473	473	473

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Pre-PNTR: 2001-2011

- No association with volatility
- Weak (in magnitude) and reversed (in direction) association with Beta
- Association with PPI remains strong
- Lower switching costs (high R-index) associated with employment losses
- *Opportunistic, cost-driven switching*

Pre-PNTR: 2001-2011

- No association with volatility
- Weak (in magnitude) and reversed (in direction) association with Beta
- Association with PPI remains strong
- Lower switching costs (high R-index) associated with employment losses
- *Opportunistic, cost-driven switching*

Implied Volatility and Cost of Capital, VIX and ICC Beta, 2001-2011

VARIABLES	(1) ln(Emp)	(2) ln(Emp)	(3) ln(Emp)	(4) ln(Emp)
VIX	-0.0039***	-0.0026***	-0.0027***	
	(0.0003)	(0.0004)	(0.0004)	
BetaICC	-0.0807***	-0.0891***	-0.0754***	
	(0.0101)	(0.0089)	(0.0087)	
1(betahigh)			-0.0047	
			(0.0158)	
Beta*1(betahigh)			-0.0111	
			(0.0115)	
PPI	0.0018***	0.0011***	0.0010***	
	(0.0004)	(0.0004)	(0.0004)	
R-index	0.1748	0.5021**	0.4646*	
	(0.1365)	(0.2508)	(0.2563)	
Margin		-0.4578***	-0.4605***	-0.3422***
		(0.1139)	(0.1141)	(0.1104)
Labor cost		-0.0017**	-0.0013	-0.0028***
		(0.0009)	(0.0009)	(0.0008)
Labor int.		-0.1859	-0.2026	0.0400
		(0.1745)	(0.1723)	(0.1355)
Skill int.		0.0806***	0.0810***	0.0773***
		(0.0166)	(0.0169)	(0.0174)
Imp.Int.Input		0.0124***	0.0124***	0.0182***
		(0.0017)	(0.0017)	(0.0018)
Loss_PNTR		0.8836***	0.8955***	0.6884***
		(0.1613)	(0.1610)	(0.1653)
China demand		0.0006	0.0008	-0.0004
		(0.0007)	(0.0007)	(0.0006)
TFP5-growth		0.3922***	0.3914***	0.4586***
		(0.0604)	(0.0601)	(0.0630)
ln(Emp) = L,	0.9371***	0.9757***	0.9767***	0.9882***
	(0.0087)	(0.0106)	(0.0108)	(0.0099)
Observations	5,203	5,203	5,203	5,203
Number of iid	473	473	473	473

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Alternative Measure of Employment, ln(*Prod.Hours*), 2001-2011

VARIABLES	(1) ln(Hours)	(2) ln(Hours)	(3) ln(Hours)	(4) ln(Hours)
Volatility	-0.2347***	-0.0817***	-0.0852***	
	(0.0241)	(0.0307)	(0.0306)	
Beta	-0.0357***	-0.0407***	-0.0181	
	(0.0080)	(0.0076)	(0.0133)	
1(betahigh)			0.0236	
			(0.0193)	
Beta*1(betahigh)			-0.0307*	
			(0.0167)	
PPI	0.0043***	0.0017***	0.0017***	
	(0.0005)	(0.0005)	(0.0005)	
R-index	-0.6974***	-1.4129***	-1.4761***	
	(0.1532)	(0.2810)	(0.2899)	
Margin		-0.3301***	-0.3376***	-0.4188***
		(0.1255)	(0.1257)	(0.1239)
Labor cost		0.0007	0.0007	-0.0025***
		(0.0009)	(0.0009)	(0.0008)
Labor int.		0.1991	0.1859	-0.0867
		(0.2062)	(0.2074)	(0.1594)
Skill int.		-0.1899***	-0.1904***	-0.1647***
		(0.0266)	(0.0267)	(0.0266)
Imp.Int.Input		0.0162***	0.0163***	0.0157***
		(0.0018)	(0.0018)	(0.0018)
Loss_PNTR		1.0331***	1.0484***	0.9335***
		(0.1848)	(0.1835)	(0.1805)
China demand		-0.0009	-0.0008	-0.0021***
		(0.0006)	(0.0006)	(0.0006)
TFP5-growth		0.5380***	0.5385***	0.5806***
		(0.0723)	(0.0722)	(0.0730)
ln(Hours) = L,	0.9330***	0.9600***	0.9636***	0.9131***
	(0.0099)	(0.0142)	(0.0146)	(0.0132)
Observations	5,203	5,203	5,203	5,203
Number of iid	473	473	473	473

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Counterfactual experiment: reduce systematic risk

NAICS3	Name	Emp(2001) (thousand)	Emp(2011)-Emp(2001) (thousand)	Losses due to syst. risk %	Losses due to syst. risk (thousand)
331	Primary metals	531.8	-161.8	25.4%	41.1
321	Wood products	556.5	-233.2	15.3%	35.8
327	Nonmetallic mineral products	506.9	-172.1	14.8%	25.4
335	Electrical equipment and appliance mfg.	553.4	-226.1	12.0%	27.1
333	Machinery	1317.2	-353.7	11.9%	42.1
336	Transportation equipment	1713.6	-474.8	10.2%	48.4
332	Fabricated metal products	1722.0	-446.2	8.3%	36.9
314	Textile product mills	208.9	-102.6	7.7%	7.9
325	Chemicals	874.4	-187.7	7.6%	14.2
337	Furniture and related products	608.1	-286.6	7.5%	21.4
334	Computer and electronic products	1580.6	-773.2	6.8%	52.9
313	Textile mills	296.0	-194.2	5.8%	11.2
323	Printing and related support activities	798.6	-342.9	4.3%	14.9
322	Paper	530.2	-183.7	4.3%	7.9
326	Plastics and rubber products	1028.2	-351.5	2.7%	9.4
324	Petroleum and coal products	101.9	-2.8	2.5%	0.1
315	Apparel	454.5	-360.8	2.4%	8.6
339	Miscellaneous manufacturing	727.5	-170.8	1.7%	2.9
316	Leather and allied products	61.3	-34.1	0.6%	0.2
311	Food	1496.5	-150.3	0.0%	0.0
312	Beverage and tobacco products	177.5	-38.2	0.0%	0.0
31-33	**All manufacturing**	**15845.6**	**-5247.3**	**7.8%**	**408.2**

Table: Employment in year 2001, actual employment changes from 2001 to 2011, total and attributable to high demand volatility and systematic risk.
Scenario: High betas are reduced to the median beta.

Conclusion

- Propose and validate a plausible mechanism for production switching decisions
- Jointly capture cost-arbitrage and risk management motives in outsourcing decisions
- Empirics shows stark difference in behavior before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Underscore importance of manufacturing flexibility for the preservation of manufacturing jobs in the U.S.

Conclusion

- Propose and validate a plausible mechanism for production switching decisions
- Jointly capture cost-arbitrage and risk management motives in outsourcing decisions
- Empirics shows stark difference in behavior before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Underscore importance of manufacturing flexibility for the preservation of manufacturing jobs in the U.S.

Conclusion

- Propose and validate a plausible mechanism for production switching decisions
- Jointly capture cost-arbitrage and risk management motives in outsourcing decisions
- Empirics shows stark difference in behavior before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Underscore importance of manufacturing flexibility for the preservation of manufacturing jobs in the U.S.

Conclusion

- Propose and validate a plausible mechanism for production switching decisions
- Jointly capture cost-arbitrage and risk management motives in outsourcing decisions
- Empirics shows stark difference in behavior before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Underscore importance of manufacturing flexibility for the preservation of manufacturing jobs in the U.S.

Conclusion

- Propose and validate a plausible mechanism for production switching decisions
- Jointly capture cost-arbitrage and risk management motives in outsourcing decisions
- Empirics shows stark difference in behavior before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Underscore importance of manufacturing flexibility for the preservation of manufacturing jobs in the U.S.

Conclusion

- Propose and validate a plausible mechanism for production switching decisions
- Jointly capture cost-arbitrage and risk management motives in outsourcing decisions
- Empirics shows stark difference in behavior before and after PNTR (year 2001)
  - Before PNTR: opportunistic switching (costs matter)
  - After PNTR: managing supply demand mismatch (risk matters)
- Underscore importance of manufacturing flexibility for the preservation of manufacturing jobs in the U.S.

Thank You!

- Paper: https://ssrn.com/abstract=3317604
- Your feedback (now or later) is greatly appreciated!
- nikolay.osadchiy@emory.edu