Global Sourcing under Uncertainty

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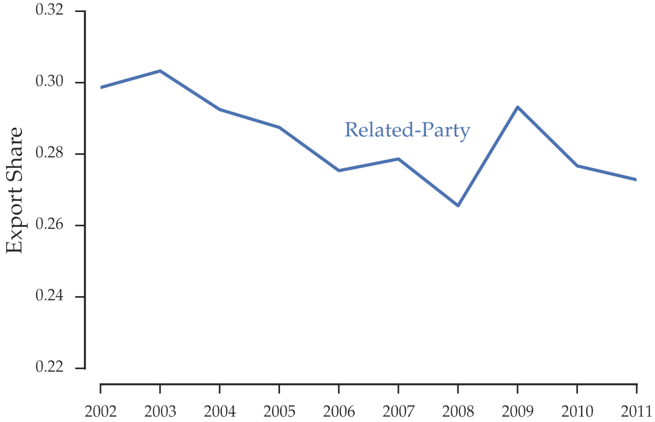
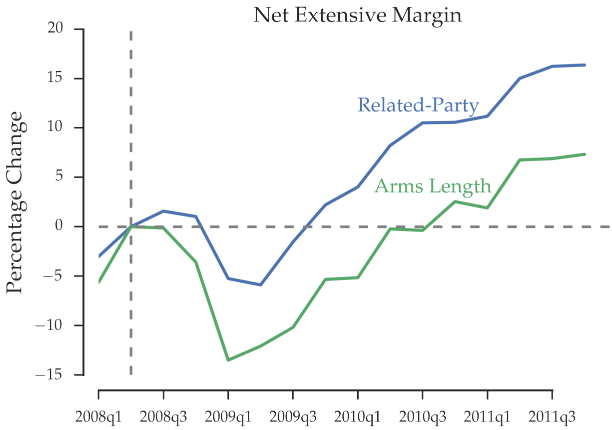
Motivation - Organizational Form Matters I

- Related parties trade represents around 47% of U.S. imports and **importantly** 30% of U.S. exports.
- This share increased during ’09.



Motivation - Organizational Form Matters II

- Heterogeneous responses during 2008-9 recession (GTC) of Related-Party relative to others

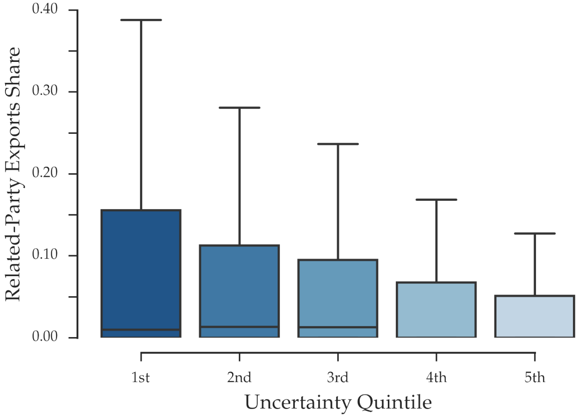


- Decomposition: stronger intensive margin & weaker extensive margin (2.25X smaller than non related parties). Dcp & Org. Form

Motivation - Uncertainty Matters

- Decisions to *Enter, Exit & Organizational form* in foreign markets
  - High sunk costs and forward looking decisions
  - Additional uncertainty: exchange rates, foreign market conditions, and foreign trade policies
- Trade provides an interesting setting to identify the effect of uncertainty
  - Detailed firm level information at high frequency
  - Cross-country variations in uncertainty
  - GTC as source of variation

Motivation - Uncertainty and Organizational Form



- Uncertainty is correlated with organizational form at aggregate level.

▸ Related Exports ▸ Distribution

This Paper - Questions

- How does uncertainty impact global sourcing decisions?
  - Firms integrate less with foreign counterparts in destinations with high uncertainty.
  - Uncertainty expands the differences in productivity cutoffs between organizational forms.
- How do firms with different organizational form do react to changes in demand conditions under uncertainty?
  - Related-party is more resilient to negative shocks
  - Uncertainty generates heterogeneous changes in the productivity cutoff in responses to demand changes across organizational forms in contrast with the deterministic setting.

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This Paper - Approach

1. Model endogenous entry, exit decisions & organizational form under demand uncertainty in the foreign destination.
2. Empirical test using U.S. firm level data for the period 2002-2011 focusing on the exit dynamics.
3. *Roughly* quantify the main mechanism of the model.

This Paper - Preview Results

- Exporting to related parties reduces the probability of exiting the foreign destination by at least 5 percentage points and up to 10.
- Uncertainty increases the probability of exiting by up to 23%.
  - >50% of firms have an increase in the prob. of exiting > 5 percent points due to uncertainty.
- Trading to related parties reduce
  - negative impact of uncertainty between 35%-55%.
  - negative effect of bad demand shocks between 26%-41%.
- Quantification: '09 Collapse would have been between
  - 10%-12% smaller if all firms were trading with related parties
  - 8% smaller if uncertainty fall to the 1st tercile.

Literature

- Sunk cost and the option value of waiting: Dixit (1989), Baldwin & Krugman (1989)
- Uncertainty and firm heterogeneity in trade:
  - Trade Policy: Handley & Limão (2015, 2017), Carballo, Handley & Limão (2018)
  - Demand Uncertainty and Horizontal FDI: Rob & Vettas (2003), Ramondo, Rappoport & Ruhl (2011), and Fillet & Garetto (2010)
  - Taglioni and Zavacka (2012)
  - Uncertainty: Bloom et al (2014)
- Multinationals and Intra-firm trade:
  - Markusen & Maskus (2001); Irrarazabal, Moxnes & Opromolla (2013); Keller & Yeaple (2014)
- Organizational Form:
  - Grossman & Helpman (2002), Antras (2003), Antras & Helpman (2004).

Structure of the Model

- The model has two layers:
  - (i) Static: organizational form
  - (ii) Dynamic: stochastic demand process.
- Timing is key in the model:
  - Pricing and production decisions are taken *after* realizations for the current period are known.
  - Firm face uncertainty about *future demand conditions*.
- Transitioning different status requires paying sunk costs.

Demand Structure - Foreign Country

- Preferences:
  - $U = x_o^{1-\mu} X^{\mu}$, where $0 < \mu < 1$
  - x_0 is the homogeneous good.
- Differentiated good:
  - $X = \left[\int x(i)^{\alpha} di\right]^{1/\alpha}$, where $0 < \alpha < 1$.
  - Quantity demanded: $x(i) = \mu Y \left[\frac{p(i)}{P^{\alpha}}\right]^{-\frac{1}{1-\alpha}}$.

Production

- Agents are separated geographically
  - entrepreneurs (exporter): provide a good
  - manufacturers (importer): provide assembly/distribution
- Final good
  - production: $x(i) = \theta_i \left[\frac{h(i)}{\eta}\right]^{\eta} \left[\frac{m(i)}{1-\eta}\right]^{1-\eta}$, $0 < \eta < 1$.
    - ★ θ_i := productivity
    - ★ $h(i)$:= headquarters input
    - ★ $m(i)$:= amount of assembly used
  - consumed in foreign destination
    - ★ Markusen & Maskus (2001), Antras & Yeaple (2014) and Ramondo, Rappoport & Ruhl (2015)

Organizational Form

- Organizational form: $k \in \{Outsourcing\,(O), Vertical\,Integration\,(V)\}$.
- Profit function:

$$\pi_k(\mathcal{A}, \eta, \theta) = \mathcal{A} \times \psi_k(\eta) \times \theta^{\frac{\alpha}{1-\alpha}}$$

  - $\mathcal{A} = \mu \times Y \times P^{\frac{\alpha}{1-\alpha}} \rightarrow$ Demand level.
  - $\psi_k(\eta) \rightarrow$ Organizational form.
  - $\theta^{\frac{\alpha}{1-\alpha}} \rightarrow$ Productivity.
- Incomplete contracts to model integration (Antras & Helpman, 2004)
- π_v and π_o cannot be ranked without imposing some structure.
  - η high enough $\pi_v > \pi_o$.

Uncertainty

- Firms face uncertainty about the $\mathcal{A}_s$ for $s > t$
  - $\{\mathcal{A}_t, t \geq 0\} \sim Poisson(\gamma \geq 0)$ and an underlying distribution function $G(.)$.
  - If shock arrives a new value $\mathcal{A}$ is drawn from the support.
- Why this approach?
  - Tractable and allows for closed for solution (cf. Handley & Limão [2015, 2017], Carballo, Handley & Limão [2018] in trade, Elsby & Michaels [2013] and Coles & Mortensen [2011, 2012] in labor).
    - ★ Persistence is consistent with income process.
    - ★ Impact of the arrival rate, FOSD and MPS shocks to the support.

Entry, Organizational Choice and Exit under Uncertainty

- Firms can be
  1. *Non-exporters* with value V_w,
  2. Exporters with *outsourcing* with value V_o,
  3. *Integrated* exporters with value V_v.

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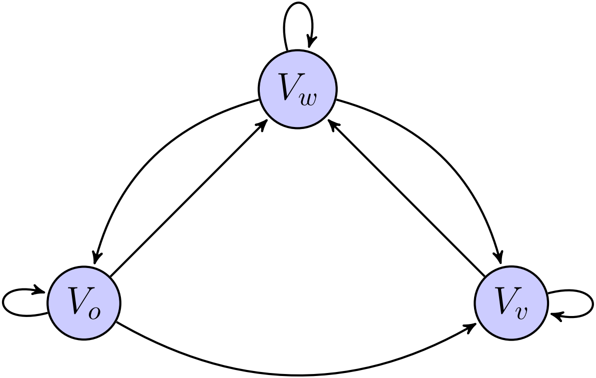
Value Functions and Transitions



Entry, Organizational Choice and Exit under Uncertainty

- Transitioning requires paying sunk cots
  - f_e:= sunk cost to *Enter*
  - f_v:= sunk cost to *Integrate*
  - f_x:= sunk cost to *Exit*
- f_p := Per-period fixed costs

Value Functions and Sunk Costs

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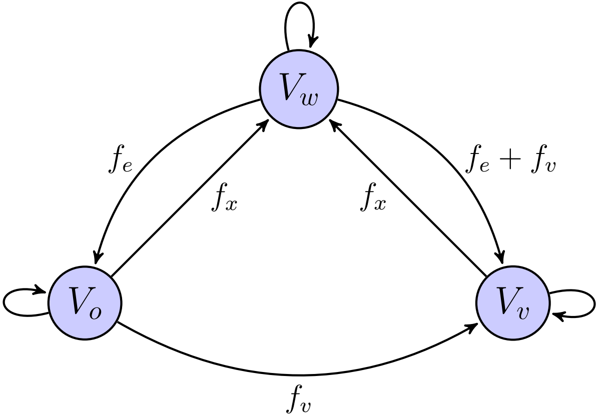

Entry, Organizational Choice and Exit under Uncertainty

- Optimal stopping problem with $\pi_k(\mathcal{A})$ continuous and increasing in $\mathcal{A}$.
- Decisions rules: $\left\{\mathcal{A} \in \{\mathcal{A}_o^e(\theta_i), \mathcal{A}_o^x(\theta_i), \mathcal{A}_v^e(\theta_i), \mathcal{A}_v^x(\theta_i)\}\right\}$

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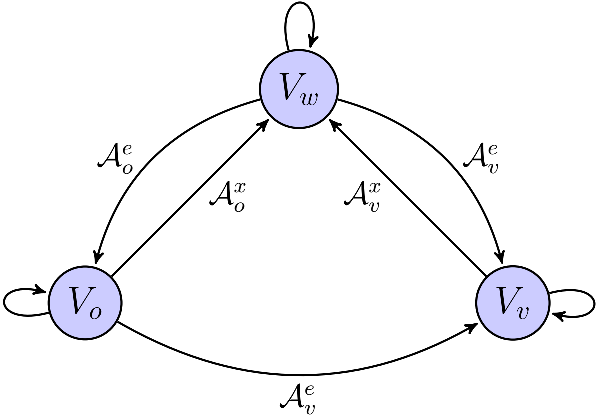
Value Functions and Demand Thresholds



Value Functions

- The system of equations allows to find implicit expressions for thresholds $\mathcal{A}_o^e$, $\mathcal{A}_o^x$, $\mathcal{A}_v^e$ and $\mathcal{A}_v^x$ conditional on a productivity level θ_i.
- Exit threshold for firms outsourcing:

$$f_x = -\underbrace{\frac{\pi_o(\mathcal{A}_o^x) - f_p}{1-\beta\tilde{\lambda}_o^{\bar{A}e}}}_{Current\,loss} - \underbrace{\frac{\beta\gamma}{1-\beta\tilde{\lambda}_o^{\bar{A}e}}\int_{A_o^x}^{\mathcal{A}_o^e}\frac{[\pi_o(\mathcal{A}) - \pi_o(\mathcal{A}_o^x)]dG}{1-\beta+\beta\gamma}}_{Expected\,loss\,inaction\,band}$$

$$-\underbrace{\frac{\beta\gamma[1-G(\mathcal{A}_o^e)]f_e}{1-\beta\tilde{\lambda}_o^{\bar{A}e}}}_{Sunk\,reentry\,cost}$$

▸ Integration ▸ Entry ▸ Exit V ▸ Value Functions

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Integration | Entry | Exit V | Value Functions

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Integration Entry Exit V Value Functions

Value Functions

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▸ Integration ▸ Entry ▸ Exit V ▸ Value Functions

Exit Condition and Organizational Form

- Productivity cutoffs for exit decisions are

$$\theta_o^x \equiv \Psi_o^x(\gamma, \mathbf{f}, \Delta_{\mathcal{A}}) \times \theta_o^{xD} < \theta_o^{xD} \text{ since } \Psi_o^x < 1$$
$$\theta_v^x \equiv \Psi_v^x(\gamma, \mathbf{f}, \Delta_{\mathcal{A}}) \times \theta_v^{xD} < \theta_v^{xD} \text{ since } \Psi_v^x < 1$$

  - $\mathbf{f} = \{f_e, f_x, f_v, f_p\}$
  - $\Delta_{\mathcal{A}} = \int_{\mathcal{A}'}^{\mathcal{A}_t}(\mathcal{A} - \mathcal{A}_t)dG/\mathcal{A}_t \Rightarrow$Uncertainty Measure.
- Exit depends on the organizational choice
  - Vertically integrated firms wait *longer* before exiting, $\theta_v^x < \theta_o^x$.
  - Uncertainty expands the difference across organizational forms,

$$[\theta_x^o - \theta_x^v] - [\theta_x^{oD} - \theta_x^{vD}] > 0$$

  - Results also hold conditionally on productivity.

Theory Results I: Productivity Cutoffs

- Delay $\left(\frac{d\ln(\theta_e^k)}{d\gamma} > 0, \frac{d\ln(\theta_x^k)}{d\gamma} < 0\right)$ & Caution effects $\left(\frac{d\ln\theta_i^k}{d\mathcal{A}} - \frac{d\ln\theta_{id}^k}{d\mathcal{A}} > 0\right)$
- Heterogeneity
  - Exit: $|\frac{d\ln\theta_o^x}{d\ln\mathcal{A}_t}(\gamma, \mathbf{f}, \Delta_{\mathcal{A}})| - |\frac{d\ln\theta_v^x}{d\ln\mathcal{A}_t}(\gamma, \mathbf{f}, \Delta_{\mathcal{A}})| > 0.$
  - Entry and Integration: $|\frac{d\ln\theta_o^e}{d\ln\mathcal{A}_t}(\gamma, \mathbf{f}, \Delta_{\mathcal{A}})| - |\frac{d\ln\theta_v^e}{d\ln\mathcal{A}_t}(\gamma, \mathbf{f}, \Delta_{\mathcal{A}})| > 0.$
  - Stark contrast with the deterministic model where all elasticities are equal to $(1-\alpha)/\alpha$.

Theory Results II: Future Economic Conditions

- FOSD: If $G(\mathcal{A})$ FOSD $\tilde{G}(\mathcal{A})$ then there is more exit and less integration and less entry.

- SOSD: assume that $\tilde{G}$ is a simple MPS of G (so they cross at $\tilde{\mathcal{A}}$)
  - Exit cutoff increases, $\theta_k^x < \tilde{\theta}_k^x$, for current realizations below $\tilde{\mathcal{A}}$ and reduces the exit cutoff, $\theta_k^x > \tilde{\theta}_k^x$, above this threshold.
  - Entry cutoff increases, $\theta_k^e > \tilde{\theta}_k^e$, for current realizations below $\tilde{\mathcal{A}}$ and decreases the entry cutoff, $\theta_k^e > \tilde{\theta}_k^e$, above this threshold.

Testable Predictions and Empirical Approach

- Focus on firms' **Exit Decision**
  - Straight forward measurement of both organizational form and uncertainty.
  - Key in the differences during the GTC.
  - Not well explore in trade models.
- Exit Decision Predictions
  - Trading with a related parties should reduce the probability of exiting .
  - Higher uncertainty should induce firms to exit using the theory-consistent measure.
  - Impact of uncertainty is smaller for Related Parties.
- Entry and Integration (*Preliminary*):
  - Identification of the effect at product-country level.

Testable Predictions and Empirical Approach

- Survival analysis.

$$h_{ipc}(t) = Prob[exit \in [t-1, t] | survive > t-1]$$

- Measuring Uncertainty
  - Construct a measure based on the GDP stochastic process
  - Following Bloom (2009) and Baker and Bloom (2013) use *stock market volatility* as proxies for uncertainty
  - Construct a *micro-measure of uncertainty* as in Bloom et al (2014)
- Measuring Organizational Form
  - Directly observable in the data

Data

- Firm exports data: Longitudinal Foreign Trade Transactions Database (LFTTD), Census Bureau.
  - Related Parties:

    > *"A transaction involving trade between a U.S. principal party in interest and an ultimate consignee where either party owns directly or indirectly 10 percent or more of the other party."*

- Firms characteristics: Longitudinal Business Database (LBD), Census Bureau.
- Country characteristics: International Financial Statistics, International Monetary Fund.
- Period: 2002-2011.

Uncertainty Measures

- Theory Based (165 countries) Details I Details II Details III
  - Firms do not know the value of $\mathcal{A}(t+1) = \mu \times Y(t+1) \times P(t+1)^{\frac{\alpha}{1-\alpha}}$
  - Asume $\Delta \ln gdp_c(t) \sim$AR(1)
  - Uncertainty measure

$$unc_c(t) = 1 - \frac{\exp(\ln gdp_c(t) + \hat{a}_c + \hat{\rho}\Delta \ln gdp_c(t) + \hat{\epsilon}_{c,0.05})}{gdp_c(t)}$$

- Micro-measure (184 countries) Details

$$\hat{\epsilon}_{ic}(t) = \Delta \ln x_c^i(t) - \hat{\theta}_c(t) - \hat{\varphi}_i(t)$$

  - $\sigma_c^{\hat{\epsilon}}(t)$ is the measure of uncertainty specific to destination s in time t .
- Stock Market Volatility (70 countries)

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Exit - Survival Approach

- Discrete time approach with hazard function:

$$h_{ipc}(t) = f\Big(\beta_{unc} unc_c(t) + \beta_R R_{ipc}(t) + X_{ipc}(t)\beta + j_t + \nu_{ipc}\Big)$$

  - $R_{ipc}(t)$: Related Party dummy
  - $unc_c(t)$: Uncertainty measure
  - $X_{ipc}(t)$: Additional controls: size, age and exports.
  - j_t: non-parametric baseline hazard.
  - $\nu_{ipc} \sim Normal \Rightarrow$ individual effect $\sim log - normal$.

Results - Exit and Related Parties

Depvar: Exit	**(1)**	**(2)**	**(3)**
Related Party (β_R)	0.791***	0.807***	0.946***
	(0.001)	(0.001)	(0.001)
GDP (log)		0.957***	0.963***
		(0.001)	(0.001)
Employees (log)			0.955***
			(0.001)
Age (log)			1.006***
			(0.001)
Exports (log)			0.747***
			(0.001)
Individual Effect	Yes	Yes	Yes
Observations (rounded)	17.6M	17.6M	17.6M

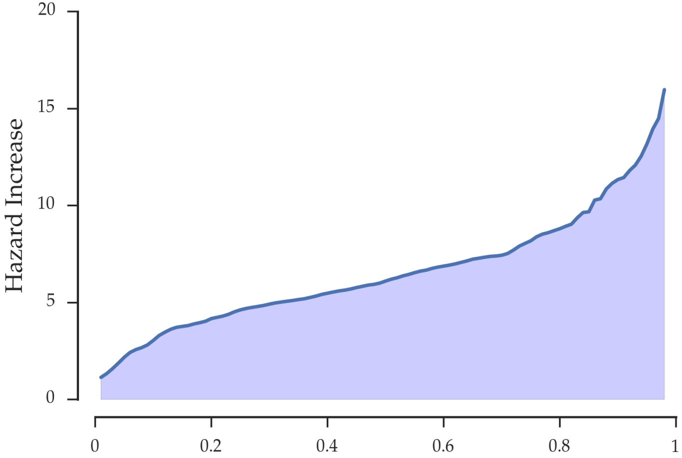
Clustered standard errors at firm-destination-product in parenthesis
Hazard function is non-parametric.
Coefficient are presented in their exponential form.
$***p < 0.01$, $**\ p < 0.05$

Results - Exit and Uncertainty

Depvar: Exit	**(1)**	**(2)**	**(3)**
Related Party (β_R)	0.804***	0.889***	0.917***
	(0.001)	(0.001)	(0.001)
Uncertainty AR(1) (β_{unc})	1.046***	1.080***	1.232***
	(0.004)	(0.005)	(0.004)
Crisis (2009)	1.082***	1.084***	1.099***
	(0.001)	(0.001)	(0.001)
GDP (log)		0.957***	0.968***
		(0.001)	(0.001)
Firms Characteristics	No	No	Yes
Individual Effect	Yes	Yes	Yes
Observations (rounded)	14.3M	14.3M	14.3M

Clustered standard errors at firm-destination-product in parenthesis
Hazard function is non-parametric.
Firms Characteristics: Size, Age and Exports.
Coefficient are presented in their exponential form.
$***p < 0.01$, $**\ p < 0.05$

Results - Exit and Uncertainty Distribution



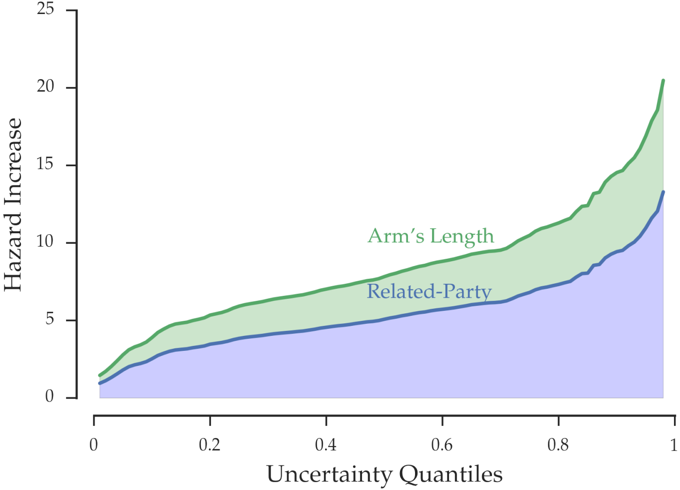
- Uncertainty increases the probability of exit the foreign destination by more than 5 percent points for the median firm.

Results - Heterogeneity I

Depvar: Exit	**(1)**	**(2)**
Related Party (β_R)	0.972***	0.976***
	(0.00876)	(0.0053)
Uncertainty AR(1) (β_{unc})	1.307***	1.152***
	(0.0305)	(0.0102)
RP x Uncertainty AR(1) (β^R_{unc})	0.910***	
	(0.0113)	
GDP (log) (β_{gdp})	0.956***	0.957***
	(0.007)	(0.007)
RP x GDP (log) (β^R_{gdp})		0.988***
		(0.00225)
Firms Characteristics	Yes	Yes
Individual Effect	Yes	Yes
Observations (rounded)	14.3M	14.3M

Clustered standard errors at firm-destination-product in parenthesis
Hazard function is non-parametric.
$***p < 0.01$, $**\ p < 0.05$

Results - Heterogeneity II



Robustness - Alternative Uncertainty Measures

Depvar: Exit	**(1)**	**(2)**	**(3)**	**(4)**
Related Party	0.805***	0.919***	0.799***	0.914***
	(0.001)	(0.001)	(0.001)	(0.001)
Crisis (2009)	1.018***	1.043***	1.079***	1.05***
	(0.002)	(0.002)	(0.002)	(0.002)
GDP (log)	0.96***	0.969***	0.974***	0.974***
	(0.001)	(0.001)	(0.001)	(0.001)
Std Xprts Growth	1.114***	1.292***		
	(0.004)	(0.004)		
Avg Xprts Growth	0.829***	0.847***		
	(0.004)	(0.004)		
Stock Market Volatility			1.027***	1.041***
			(0.003)	(0.001)
Stock Market Return			0.9539**	0.856***
			(0.021)	(0.009)
Firms Characteristics	No	Yes	No	Yes
Observations (rounded)	14.3M	14.3M	14.3M	14.3M

Clustered standard errors at firm-destination-product in parenthesis
Hazard function is non-parametric.
$***p < 0.01$, $**\ p < 0.05$

Robustness Exercises

- Unobserved firm's characteristics: add time varying TFP & domestic sales.
- Industry and Country unobserved characteristics: estimate industry and industry-country specific baseline hazard function.
- Multi-stage production process: drop Canada, Mexico and China.
- Estimator: Cox and LPM model.
- Frequency: half-yearly frequency.

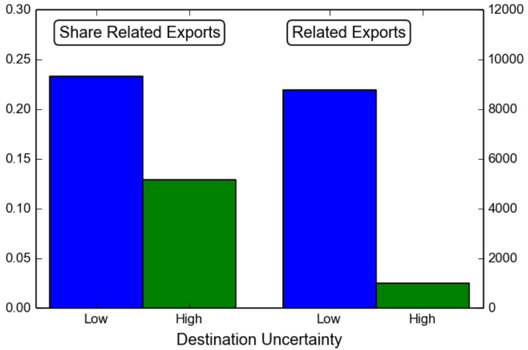
Results - Quantification

- Scenarios
  - Change in organizational form during 2009.
  - Reduction in uncertainty during 2009
- Recompute probability of exit.
- Compute counterfactual exports.
- Results: 2009 collapse would have been between
  - 10%-12% smaller if all firms were trading with related parties
  - 8% smaller if uncertainty fall to the 1st tercile.

Conclusion

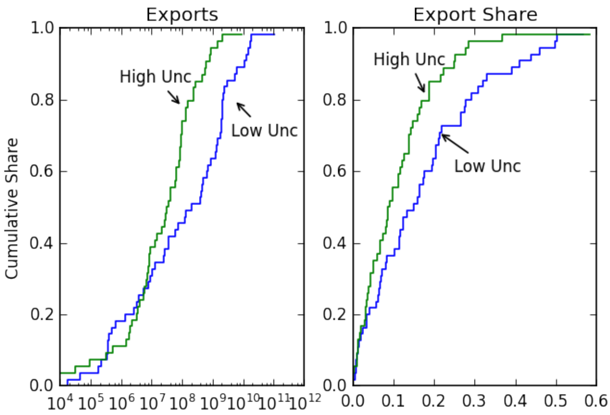
- Questions:
  1. How does uncertainty impact global sourcing decisions?
  2. How do firms with different organizational form do react to changes in demand conditions under uncertainty?
- The dynamic model developed
  - Uncertainty delays investment decisions.
  - Exit decision depends on the organizational form: integrated exporter are more resilient to negative shocks.
  - Uncertainty generates a heterogeneous impact on entry and exit decisions across organizational forms.
- Empirical results show
  - Uncertainty fosters firms exit and its impact is sizable.
  - Integrated firms are more resilient, in general, and also to increases in uncertainty.

Related Parties and Uncertainty



Return

Related Parties and Uncertainty



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Motivation - Uncertainty and Related Parties

Figure: Related-Party Exports

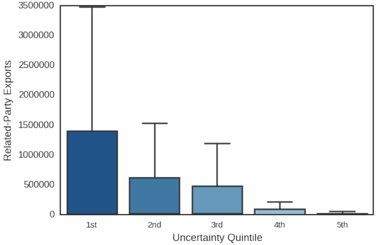
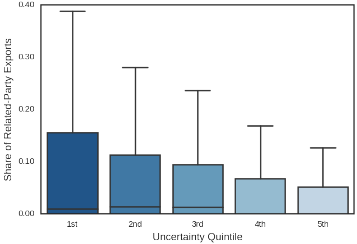
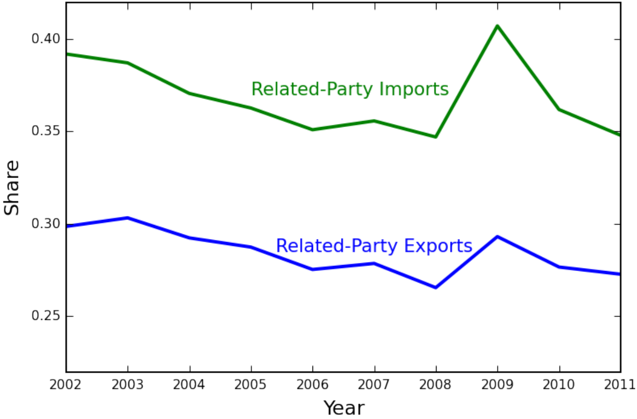


Figure: Related-Party Export Share



- U.S. related parties exports and its share are lower to countries with more uncertainty. ▸ Distribution

GTC and Organizational Form I



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GTC and Organizational Form II

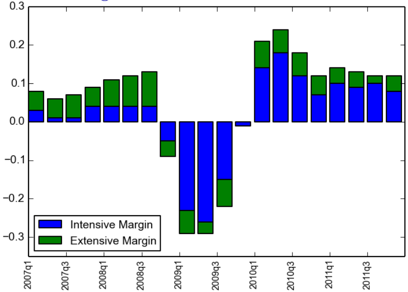


Figure: Related Parties

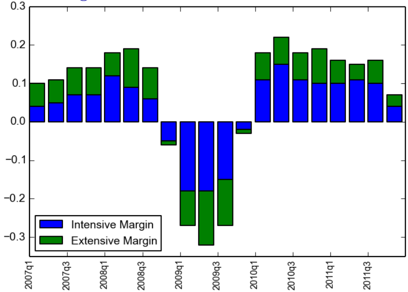


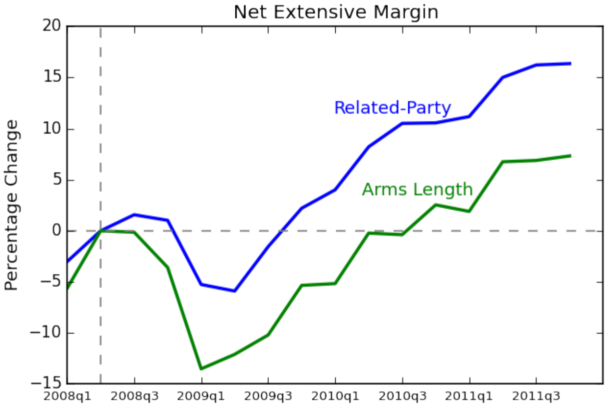
Figure: Non-related Parties

- The average drop in exports due to the extensive margin is 2.25 bigger for non-related parties than related parties.
- This *heterogeneity* in the adjustment is also evident in other dimensions such as exit rates and # of varieties exported.

Return

GTC and Organizational Form III

Figure: Firms Varieties and Organizational Form



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GTC and Organizational Form IV

- These differences between related parties trade and arm's length trade during the GTC also hold when considering the number of varieties traded.

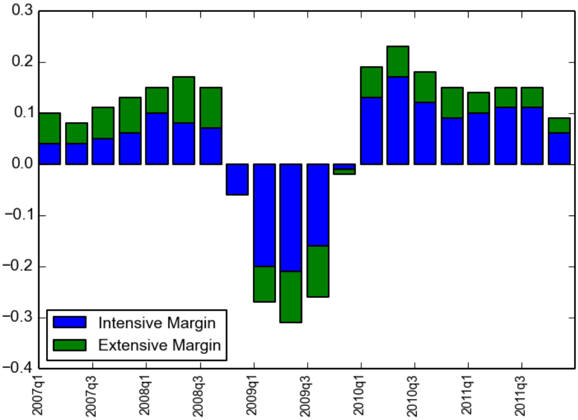
Arms Length Trade	Firm	Firm-cou	Firm-pro	Firm-cou-pro
Until Recovery	14	11	11	8
Highest Fall	-15.47	-13.54	-13.42	-13.10

Related Parties	Firm	Firm-cou	Firm-pro	Firm-cou-pro
Until Recovery	11	6	6	4
Highest Fall	-11.11	-8.97	-7.67	-7.57

Return

Motivation - Exit as an Adjustment Margin

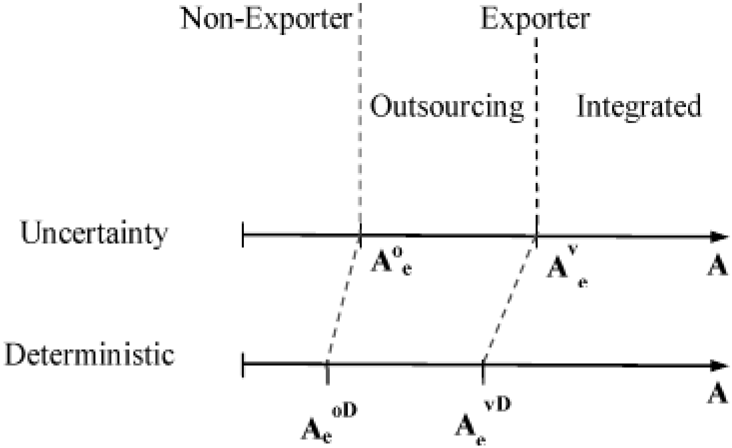
Figure: U.S. Exports Decomposition across Margins



- Trade focused on entry and *disregard* the exit decision which is at odds with exit margin role during the last recession.

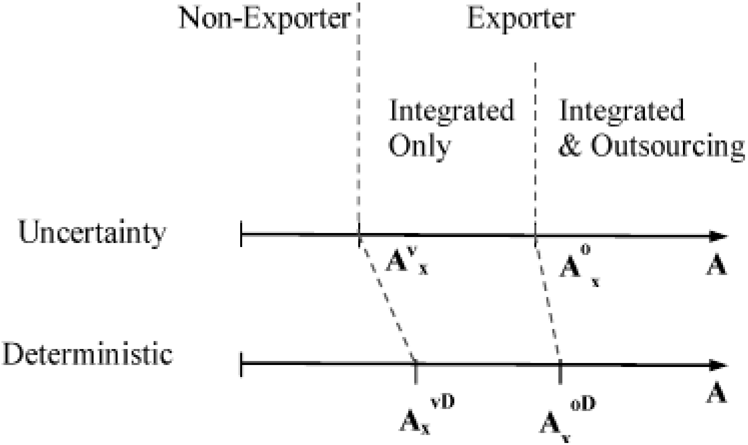
Uncertainty Impact

Figure: Demand Uncertainty Impact on Organizational Choice



Uncertainty Impact

Figure: Demand Uncertainty Impact on Organizational Choice



Quotes

- Olivierd Blanchard, chief economist at the IMF

  "[Uncertainty] is largely behind the dramatic collapse in demand. [...] Given the uncertainty, why build a new plant, or introduce a new product now? Better to pause until the smoke clears."

- John C. Williams, president of Federal Reserve Bank of San Francisco

  "There is pretty strong evidence that the rise in uncertainty is a significant factor holding back the pace of recovery now".

Incomplete Contracts

- Parties cannot write enforceable contracts contingent on outcomes.
- Entrepreneurs and manufacturing plant operators bargain over the surplus. Ex-post bargaining is model as a generalized Nash bargaining game in which the final-good producer obtains a fraction $\xi \in (0, 1)$ of the ex-post gains from the relationships.
- Ex-post bargaining takes place both under outsourcing and under integration.
- Outside options: for M is zero in all cases while for H its depends on the organizational form. In the case of outsourcing the outside option is zero while under vertical integration H can seize a share of the final good δ.
- The mode of ownership are chosen by H to maximize its profits.
- The contract includes an up-front fee (positive or negative) for participation in the relationship that has to be paid by M.

Incomplete Contracts

- The potential revenue is

$$R(i) = (\mu Y)^{1-\alpha} P^{\alpha} \theta^{\alpha} \left[\frac{h(i)}{\eta}\right]^{\alpha\eta} \left[\frac{m(i)}{1-\eta}\right]^{\alpha(1-\eta)}$$

- Under outsourcing H gets $\xi R(i)$ while M gets $(1-\xi)R(i)$ with agreement and zero without agreement.
- When parties failed to reach an agreement under vertical integration, H can sell an amount $\delta x(i)$ of output which yields the revenue $\delta^{\alpha} R(i)$. Hence in the bargaining, H receives its outside option and then its share of the ex-post gains $\delta^{\alpha} R(i) + \xi[1-\delta^{\alpha}]R(i)$. Thus, M receives $(1-\xi)[1-\delta^{\alpha}]R(i)$. Note

$$\xi_V = \delta^{\alpha} + \xi[1-\delta^{\alpha}] \geq \xi_0 = \xi$$

- H is able to appropriate higher fractions of revenue under integration than under outsourcing.

Incomplete Contracts

- Assumptions imply that H chooses the organizational form that maximizes $\pi_k(\theta, A, \eta)$. Operating profits are

$$\begin{aligned}\pi_{Hk} =& \xi_k R(i) + t - w^N h(i)\\ \pi_{Mk} =& (1-\xi_k)R(i) - t - w^S m(i)\end{aligned}$$

  Given that the outside option for M is zero, then t is set such that $\pi_{Mk} = 0$. Then in a subgame-perfect equilibrium $\pi_{Hk} = \pi_k(\theta, \mathcal{A}, \eta)$.

- Solving for the incomplete contract part of the model implies

$$\pi_k(\mathcal{A}, \eta, \theta) = \mathcal{A}\theta^{\frac{\alpha}{1-\alpha}}\psi_k(\eta) - w^N f_p$$

  Profit function is the product of a term capturing the demand level $(\mathcal{A} = (\mu Y)P^{\frac{\alpha}{1-\alpha}})$, the modified productivity of the firm $(\theta^{\frac{\alpha}{1-\alpha}})$, and a term capturing the impact of the incomplete contracts mechanism $\left(\psi_k(\eta) = \frac{(1-\alpha[\xi_k\eta+(1-\xi_k)(1-\eta)])}{\left(\frac{1}{\alpha}\left[\frac{w^N}{\xi_k}\right]^{\eta}\left[\frac{w^S}{(1-\xi_k)}\right]^{1-\eta}\right)^{\frac{\alpha}{1-\alpha}}}\right)$.

- The choice of ownership structure is the only instruments for affecting the division rule. The options are $\xi_k = \{\xi_V, \xi_0\}$. There is no free ex ante choice of the division rule of the surplus.

Incomplete Contracts

- $\xi_V > \xi_0$ is not enough to ranking unequivocally whether $\psi_v(\eta)$ is greater or lower than $\psi_o(\eta)$. The intensity of the headquarter services is key to determine which function $\psi_k(\eta)$ is larger.
- Incompleteness of contracts implies that neither of the parties appropriate of their full marginal return to its investments. Hence both the H and M underinvest and this underinvestment is ameliorated by the fraction of the surplus that they receive.
- Ex ante efficiency requires that the higher the intensity of headquarter services (i.e. high η) the higher the fraction of the surplus to H that should be allocated.

Incomplete Contracts

- The relationship between the optimal ξ and η combined with the assumption that ξ_k are fixed implies that for η sufficiently large higher values of ξ_k generate more profits. In contrast, for low enough η $\xi_v > \xi_o$ implies that $\psi_v(\eta) < \psi_o(\eta)$.
- Note that given that vertical integration requires an additional sunk cost, thus in cases where $\psi_v(\eta) < \psi_o(\eta)$ outsourcing is always the optimal choice. While in the cases that $\xi_v > \xi_o$ implies that $\psi_v(\eta) > \psi_o(\eta)$ combined with the additional sunk cost implies that both organizational choices arise as equilibrium outcomes as we will show latter.
- Hence focusing on high headquarters intensity sector where higher ξ_k imply higher $\psi_k(\eta)$ is without of loss of generality.

Value Functions

- The value of a *non-exporter*

$$V^w(\mathcal{A}_t) = \underbrace{\beta(1-\gamma)V^w(\mathcal{A}_t)}_{no\,shock} + \gamma\Bigg(\underbrace{\beta G(\mathcal{A}_e^o)V^w(\mathcal{A}_t)}_{shock\,below\,entry} + \underbrace{\beta[1-G(\mathcal{A}_e^v)][\mathbb{E}V^v(\mathcal{A} > \mathcal{A}_e^v) - f_e - f_v]}_{shock\,above\,v}\Bigg)$$
$$+\gamma\underbrace{\beta[G(\mathcal{A}_e^v) - G(\mathcal{A}_e^o)][\mathbb{E}V^o(\mathcal{A}_e^o < \mathcal{A} < \mathcal{A}_e^v) - f_e]}_{shock\,between\,o\,and\,v}$$

- The value of exporting with *outsourcing*

$$V^o(\mathcal{A}_t) = \pi_o(\mathcal{A}_t) - f_p + \underbrace{\beta(1-\gamma)V^o(\mathcal{A}_t)}_{no\,shock} + \gamma\underbrace{\beta G(\mathcal{A}_x^o)[\mathbb{E}V^w(\mathcal{A} < \mathcal{A}_x^o) - f_x]}_{shock\,below\,exit}$$
$$+\gamma\Bigg(\underbrace{\beta[G(\mathcal{A}_e^v) - G(\mathcal{A}_x^o)]\mathbb{E}V^o(\mathcal{A}_x^o < \mathcal{A} < \mathcal{A}_e^v)}_{shock\,between\,o\,and\,v} + \underbrace{\beta[1-G(\mathcal{A}_e^v)][\mathbb{E}V^v(\mathcal{A} > \mathcal{A}_e^v) - f_v]}_{shock\,above\,v}\Bigg)$$

- The value of *integrated* exporter

$$V^v(\mathcal{A}_t) = \pi_v(\mathcal{A}_t) - f_p + \underbrace{\beta(1-\gamma)V^v(\mathcal{A}_t)}_{no\,shock} + \gamma\underbrace{\beta G(\mathcal{A}_x^v)[\mathbb{E}V^w(\mathcal{A} < \mathcal{A}_x^v) - f_x]}_{shock\,below\,exit}$$
$$+\gamma\underbrace{\beta[1-G(\mathcal{A}_x^v)]\mathbb{E}V^v(\mathcal{A} > \mathcal{A}_x^v)}_{shock\,above\,exit}$$

Return

Entry Conditions

- The entry threshold for exporting with outsourcing is

$$f_e = \frac{\pi_o(\mathcal{A}_o^e) - f_p}{1 - \beta\tilde{\lambda}_o^{:x}} + \frac{\beta\gamma}{1 - \beta\tilde{\lambda}_o^{:x}} \int_{\mathcal{A}_o^x}^{\mathcal{A}_o^e} \frac{[\pi_o(\mathcal{A}) - \pi_o(\mathcal{A}_o^e)]dG}{1 - \beta + \beta\gamma} - \frac{\beta\gamma G(\mathcal{A}_o^x) f_x}{1 - \beta\tilde{\lambda}_o^{:x}}$$

▸ Return

Entry Conditions

- The entry threshold for exporting with integration is

$$f_v = \underbrace{\frac{\Delta_{vo}\pi(\mathcal{A}_v^e)}{\kappa_v\left(1-\beta\tilde{\lambda}_v^{:x}\right)}}_{\Delta Profits\,Integration} + \underbrace{\frac{\beta\gamma}{1-\beta\tilde{\lambda}_v^{:x}}\int_{\mathcal{A}_o^x}^{\mathcal{A}_v^e}\frac{\pi_v(\mathcal{A})-\pi_o(\mathcal{A})}{1-\beta+\beta\gamma}dG}_{\Delta Profits\,Entry}$$

$$+\underbrace{\frac{\beta\gamma}{1-\beta\tilde{\lambda}_v^{:x}}\int_{\mathcal{A}_v^x}^{\mathcal{A}_o^x}\frac{[\pi_v(\mathcal{A})-\pi_o(\mathcal{A}_o^x)]}{1-\beta+\beta\gamma}dG}_{\Delta Profits\,Exit}$$

- This condition is similar to the entry condition to exporting with outsourcing with the difference that it takes into account the optimal alternative is exporting with outsourcing.

Return

Exit Conditions

- Exit condition from exporting with outsourcing

$$f_x = -\frac{\pi_o(\mathcal{A}_o^x) - f_p}{1-\beta\tilde{\lambda}_o^{\bar{A}e}} - \frac{\beta\gamma}{1-\beta\tilde{\lambda}_o^{\bar{A}e}} \int_{A_o^x}^{\mathcal{A}_o^e} \frac{[\pi_o(\mathcal{A}) - \pi_o(\mathcal{A}_o^x)]dG}{1-\beta+\beta\gamma} - \frac{\beta\gamma[1-G(\mathcal{A}_o^e)]f_e}{1-\beta\tilde{\lambda}_o^{\bar{A}e}}$$

Exit Conditions

- Exit condition from exporting with integration

$$f_x = -\underbrace{\frac{\pi_v(\mathcal{A}_v^x) - f_p}{1 - \beta\tilde{\lambda}_v^{\bar{\mathcal{A}}e}}}_{Current\, Losses} - \underbrace{\frac{\beta\gamma}{1 - \beta\tilde{\lambda}_v^{\bar{\mathcal{A}}e}}\left[\int_{\mathcal{A}_v^x}^{\mathcal{A}_v^e} \frac{\pi_v(\mathcal{A})}{1-\beta+\beta\gamma} dG - \int_{\mathcal{A}_o^e}^{\mathcal{A}_v^e} \frac{\pi_o(\mathcal{A}) - \pi_o(\mathcal{A}_o^e)}{1-\beta+\beta\gamma} dG\right]}_{\Delta Profits\, Integration} - \underbrace{\frac{\beta\gamma[1 - G(\mathcal{A}_e^v)][f_v + f_e]}{1 - \beta\tilde{\lambda}_v^{\bar{\mathcal{A}}e}}}_{Sunk\, Cost\, Reentry}$$

- This exit condition has an extra term capturing the fact after exiting a firm may reenter as an exporter with outsourcing for the partition $[\mathcal{A}_e^o, \mathcal{A}_e^v]$.

Exit Conditions

- Exit with outsourcing

$$\begin{aligned}\pi_o(\mathcal{A}_x^o) - \pi_o(\mathcal{A}_{xd}^o) = & -\beta\gamma[G(\mathcal{A}_e^o) - G(\mathcal{A}_x^o)]\frac{\mathbb{E}\pi_o(\mathcal{A}_x^o < \mathcal{A} < \mathcal{A}_e^o) - \pi_o(\mathcal{A}_x^o)}{1-\beta+\beta\gamma} \\ & -\beta\gamma[G(\mathcal{A}_e^v) - G(\mathcal{A}_e^o)]f_e - \beta\gamma[1 - G(\mathcal{A}_e^o)]f_x < 0\end{aligned}$$

Hence $\mathcal{A}_x^o < \mathcal{A}_{xd}^o$.

- Exit and Organizational Choice

$$\begin{aligned}\pi_o(\mathcal{A}_x^o) - \pi_v(\mathcal{A}_x^v) = & \beta\gamma[G(\mathcal{A}_e^v) - G(\mathcal{A}_x^o)]\frac{\mathbb{E}\pi_v(\mathcal{A}_x^o < \mathcal{A} < \mathcal{A}_e^v) - \mathbb{E}\pi_o(\mathcal{A}_x^o < \mathcal{A} < \mathcal{A}_e^o)}{1-\beta+\beta\gamma} \\ & + \beta\gamma[G(\mathcal{A}_x^o) - G(\mathcal{A}_x^v)]\frac{\mathbb{E}\pi_v(\mathcal{A}_x^v < \mathcal{A} < \mathcal{A}_e^v) - \pi_v(\mathcal{A}_x^v)}{1-\beta+\beta\gamma} \\ & + \frac{\beta\gamma[G(\mathcal{A}_e^V) - G(\mathcal{A}_x^o)]}{1-\beta+\beta\gamma}\pi_o(\mathcal{A}_x^o) + \beta\gamma[1 - G(\mathcal{A}_e^v)][f_v + f_e]\end{aligned}$$

Hence $\mathcal{A}_x^v < \mathcal{A}_x^o$.

Productivity Cutoffs

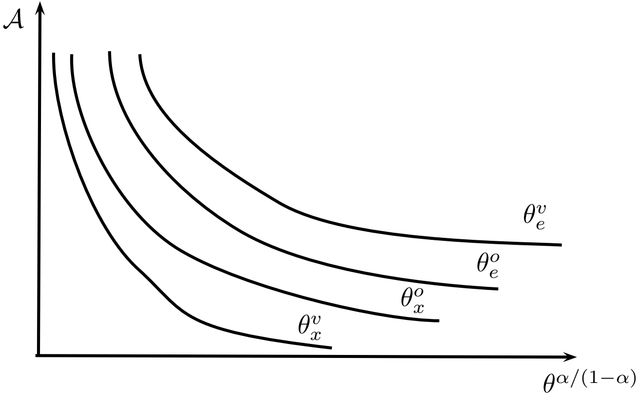
- Ψ_k^e is a ratio between the cost of exiting adjusted by its probability and the expected relative losses until exiting.
  - $\Psi_o^e = [1 + \underbrace{\frac{\beta\gamma G(\mathcal{A}_t\xi_o^x)f_e}{(1-\beta)f_e + f_p}}_{Exit\,cost}]^{\rho} \times [1 - \underbrace{\frac{\beta\gamma\Delta_{\mathcal{A}}(\mathcal{A}_t, \mathcal{A}_t\xi_o^x)}{1-\beta+\beta\gamma}}_{Rel.\,exp.\,gains\,entry}]^{-\rho}$
  - $\Psi_v^e = [1 + \underbrace{\frac{\beta\gamma G(\mathcal{A}_t\xi_v^x)}{1-\beta}}_{Exit\,cost}]^{\rho} \times [1 - \underbrace{\frac{\beta\gamma\Delta_{\mathcal{A}}(\mathcal{A}_t, \mathcal{A}_t\xi_o^x)}{1-\beta+\beta\gamma}}_{Rel.\,exp.\,gains\,int.} - \varphi_o \underbrace{\frac{\beta\gamma\Delta_{\mathcal{A}}(\mathcal{A}_t\xi_o^x, \mathcal{A}_t\xi_v^x)}{1-\beta+\beta\gamma}}_{Rel.\,exp.\,gain\,entry}]^{-\rho}$

  where $\Delta_{\mathcal{A}}(\mathcal{A}_i, \mathcal{A}_j) = \int_{\mathcal{A}_j}^{\mathcal{A}_i}(\mathcal{A}_i - \mathcal{A})dG/\mathcal{A}_i$

▸ Graphs Cutoffs Entry

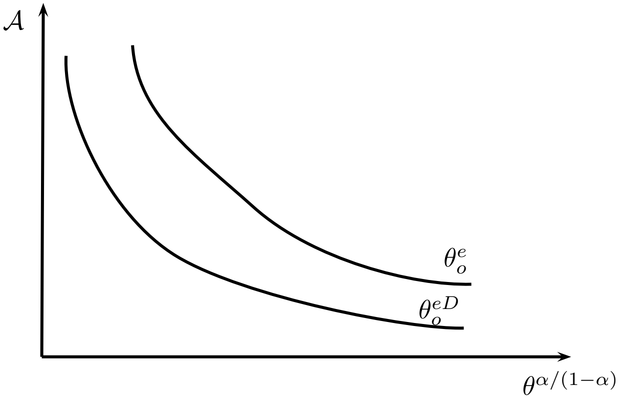
Productivity Cutoffs

Figure: Productivity Cutoff as a function of $\mathcal{A}$



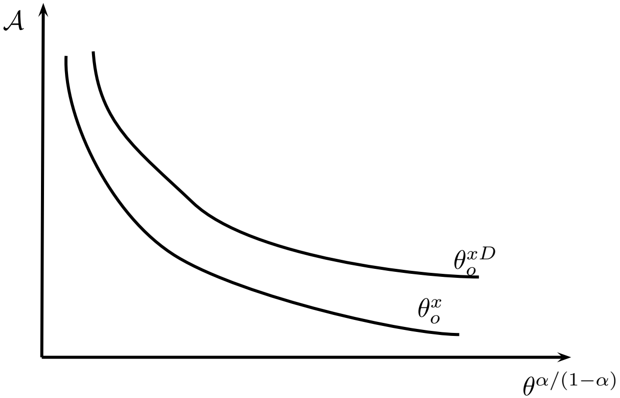
Productivity Cutoffs

Figure: Productivity Cutoff as a function of $\mathcal{A}$



Productivity Cutoffs

Figure: Productivity Cutoff as a function of $\mathcal{A}$



Uncertainty Measure I

- Firms do not know the value of $\mathcal{A}(t+1) = \mu \times Y(t+1) \times P(t+1)^{\frac{\alpha}{1-\alpha}}$
- Model GDP stochastic process to measure uncertainty.
- Asume $\ln gdp_c(t) \sim$AR(1)

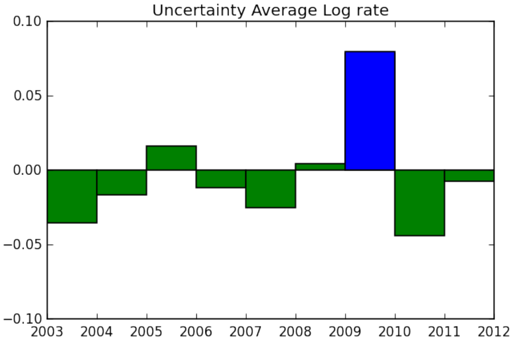
$$\Delta \ln gdp_c(t+1) = a_c + \rho_c \Delta \ln gdp_c(t) + \epsilon_c(t+1)$$

- Sample: 1988-2011 for 165 countries
- Uncertainty measure

$$unc_c(t) = 1 - \frac{\exp(\ln gdp_c(t) + \hat{a}_c + \hat{\rho} \Delta \ln gdp_c(t) + \hat{\epsilon}_{c,0.05})}{gdp_c(t)}$$

Return

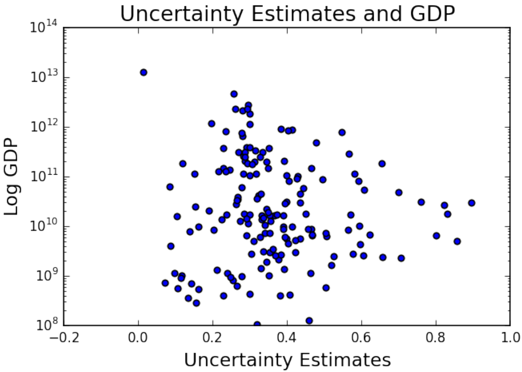
Uncertainty Measure III



- Uncertainty increased on average 8% in 2009.

Return

Uncertainty Measure II



Return

Micro-Uncertainty Measure

- Following Bloom et al (2014): I used the dispersion of log growth rate of sales in a given destination
- Set of U.S. permanent exporters to destination s for the period 2002-2011:

$$\begin{aligned} \ln x_c^i(t) =& \theta_c(t) + \varphi_i(t) + \lambda_{ic} + \epsilon_{ic}(t) \\ \Delta \ln x_c^i(t) =& \bar{\theta}_c(t) + \bar{\varphi}_i(t) + \bar{\epsilon}_{ic}(t) \\ \hat{\bar{\epsilon}}_{is}(t) =& \Delta \ln x_c^i(t) - \hat{\bar{\theta}}_c(t) - \hat{\bar{\varphi}}_i(t) \end{aligned}$$

- $\sigma_c^{\hat{\epsilon}}(t)$ is the measure of uncertainty specific to destination s in time t .
- Note that I am controlling for a firm-time fixed effect and this should control for changes in productivity.

Return

Productivity Cutoffs

- Productivity cutoffs for entry and integration at any given $\mathcal{A}$

$$\theta_o^e \equiv \Psi_o^e \times \theta_o^{eD} > \theta_o^{eD} \quad \text{since } \Psi_o^e > 1$$
$$\theta_v^e \equiv \Psi_v^e \times \theta_v^{eD} > \theta_v^{eD} \quad \text{since } \Psi_v^e > 1$$

- Ψ_k^e where $k \in \{O, V\}$ captures the impact of uncertainty and it is function of γ, sunk costs, and the difference in the expected gains among the possible status.
- Since $\theta_k^e > \theta_k^{eD} \Rightarrow$ Uncertainty delays entry and integration.

Graphs Cutoffs Entry | Intuition | Ψ_k^e

Productivity Cutoffs

- Ψ_k^x is a ratio between the cost of exiting adjusted by its probability and the expected relative losses until exiting.

$$\Psi_o^x = [1 - \frac{\beta\gamma\widetilde{G}(\mathcal{A}_t\xi_o^e)[f_e+f_x]}{f_p-[1-\beta]f_x}]^\rho \times [1 + \frac{\beta\gamma\Delta(\mathcal{A}_t\xi_o^e,\mathcal{A}_t)}{1-\beta+\beta\gamma}]^{-\rho}$$

$$\Psi_v^x = [1 - \frac{\beta\gamma\widetilde{G}(\mathcal{A}_t\xi_v^e)[f_v+f_e+f_x]}{f_p-[1-\beta]f_x}]^\rho \times [1 + \frac{\beta\gamma\Delta(\mathcal{A}_t\xi_v^e,\mathcal{A}_t)}{1-\beta+\beta\gamma} - \varphi\frac{\beta\gamma\Delta(\mathcal{A}_t\xi_v^e,\mathcal{A}_t\xi_o^e)}{1-\beta+\beta\gamma}]^{-\rho}$$

$$\Delta(\mathcal{A}_i,\mathcal{A}_j) = \frac{\int_{\mathcal{A}_j}^{\mathcal{A}_i}(\mathcal{A}_i-\mathcal{A})dG}{\mathcal{A}}$$

Graphs Cutoffs Entry