Trade Collapse and Policy Uncertainty in the Great Recession

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Main questions

- How do international trade policy uncertainty and economic uncertainty interact to affect firms' trading decisions?
- What was the role of this uncertainty during the Great Recession?
- Do international trade agreements provide insurance against this uncertainty for foreign firms?

Motivation: Great Trade Collapse (GTC) and Recovery

- In 2009 world trade fell 12%, largest since Depression (10%) but
  - **Income fell only 2.7%** vs. 20% for industrial output in depression (Eichengreen & O'rourke '09)
  - **New trade barriers affected only 1% trade (WTO '11) & accounted for $<$2% of collapse (Kee et al '13).** Barriers in Depression $>$ 35% for US, Germany, France & accounted for large fraction of decline (Madsen '01)

- Alternative explanations of GTC
  - (i) Demand composition (Eaton et al '13), (ii) Trade credit (Chor and Manova '11), (iii) Inventory (Alessandria et al '11) (iv) Input linkages (Bems et al '11) and (v) economic uncertainty (Novy and Taylor '13)
  - **Focus on trade collapse explanations but not the recovery**
  - **Omit role for policy uncertainty and trade agreements**

Motivation: Policy Uncertainty and Agreements in GTC

- Evidence of increase in trade policy uncertainty (TPU)
  - Prompted coordinate G-20 response: ”Falling demand is exacerbated by growing protectionist pressures [. . .] We will not repeat the historic mistakes of protectionism of previous eras.”
  - Jump in index of TPU –analogous to EPU a la Baker, Bloom, Davis
- No evidence during GTC of
  - substantial increases in trade barriers
  - negative correlation(income, protection), only pre-crisis: Bown & Crowley ‘13
- Previous work shows PTAs & WTO can reduce TPU
  - Handley and Limão (AEJ 2015): PTAs to reduce TPU
  - Handley (JIE 2014) and Handley and Limão (2013): WTO commitments reduce TPU

Hypotheses on role of uncertainty and agreements in GTC

- Uncertainty and Recovery
  - Downturn & economic uncertainty increased TPU thus lowering exports to high potential protection country-industries
  - Protection did not materialize, which reduced TPU and contributed to faster recovery
- What was different relative to 1930's? – Institutional commitments
  - WTO/GATT created to prevent recurrence of trade wars
  - Extensive network of strong preferential trade agreements (PTAs) insure against protectionism

Contributions

- **Model of interacting uncertainty shocks:** trade policy (cf. HL, 2015) and economic (cf. Bloom, 2009)
  - Economic and policy uncertainty reduce net entry
  - Derive conditions for TPU to magnify economic uncertainty resulting in lower entry and higher exit and how PTA can insure against these
- **Empirics: quantifying US export dynamics in GTC and recovery**
  - Sizable extensive margin contribution to GTC, particularly non-PTAs
  - Map income & policy uncertainty effects to estimation equation
  - Uncertainty reduced growth to non-PTA in varieties (2-8%) & exports …
  - Differentially smaller effects to PTAs and low market power industries
  - Differential effects reduced/eliminated after 2010Q4$\Rightarrow$ TPU reversal

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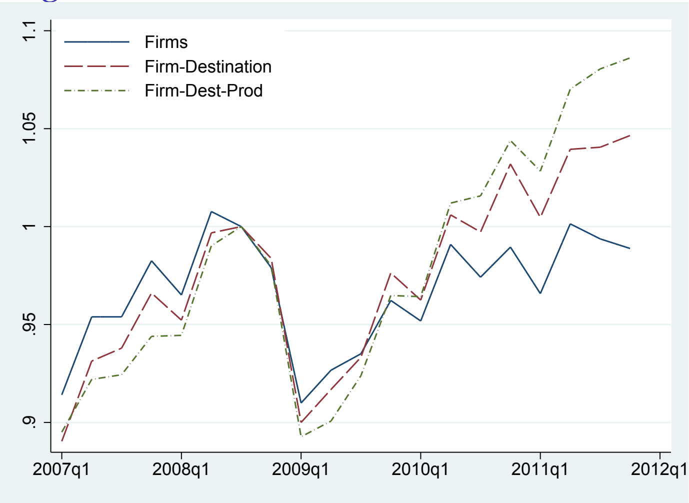
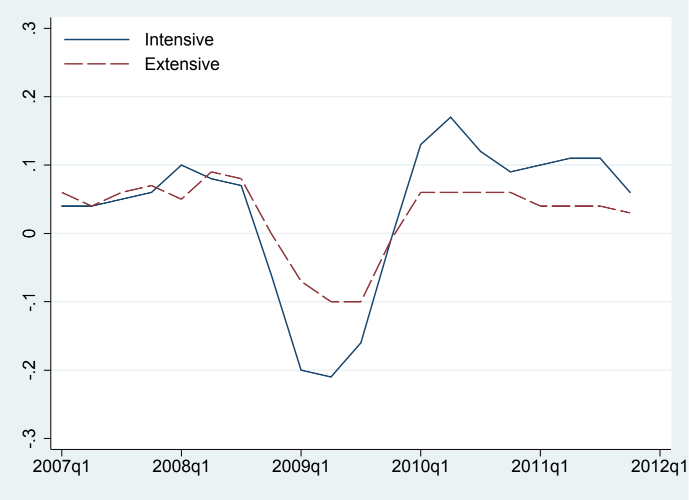
- **Trade agreements under uncertainty literature**
  Amador & Bagwell '13, Handley '14, Limao & Maggi '15, Handley & Limao '13...

US exporting firms and varieties in GTC (LFTTD)



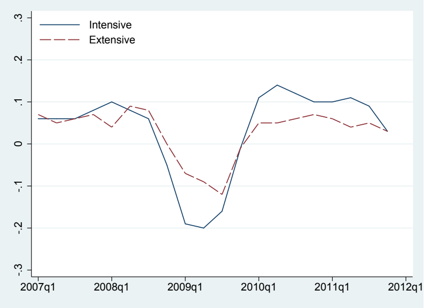
- Evolution of # firm-destination & firm-destination-product (varieties)
  - **Pre-crisis annual growth: 5%**with considerable churning
  - **Peak to trough: 10%** so larger than 2001 recession
  - **Recovery to pre-crisis #: 2 yrs** so true exit but faster than 2001

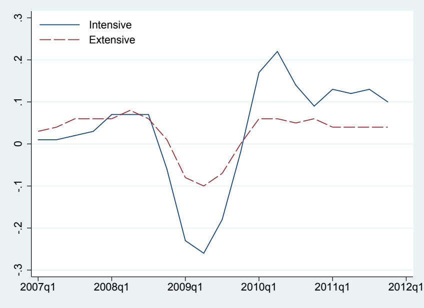
Export Growth Decomposition: Role of Extensive Margin



- Exp. growth = Extensive (Entry-Exit) + Intensive (Continuers)
- Extensive margin (variety) yearly growth
  - About 50% of pre-crisis growth, up to 38% of collapse (Q309).
  - Substantial churning even pre-crisis: gross entry 30% and exit -24%
  - GTC: Lower gross entry but exit even stronger (link)

Importance of Extensive Margin: non-PTA (left) vs. PTA





- Larger extensive margin drop and share in non-PTA than PTA in collapse
- Consistent differential increase in TPU for non-PTA in a model where uncertainty reduces entry.

Decline in US export share to PTAs reversed in GTC

- Trade share shift toward PTA. Even stronger in industries where exporter has high market power (link)

Model Setup

- Differentiated good firms; productivity $1/c_v$ & monop. competition
- Operating profits depend on demand, via income (Y_{it}) & tariffs τ

$$\pi_{ivt} = \underbrace{\left[\varepsilon_V Y_{it} \left(P_{it}\right)^{\sigma-1} \left(\tau_{iVt}\right)^{-\sigma}\right]}_{a_{iVT}} c_v^{1-\sigma} \tilde{\sigma}$$

- Underlying source of uncertainty: shocks to market conditions a_{iVt}
  - global economic conditions shocks arrive at rate γ
  - new a_{iVt} from joint distribution of income and policy $H(a_{iVt})$

- **Firms choose prices after observing a_{iVT} so uncertainty effects arise via irreversible market-entry investments**
- Focus on export entry so assume fixed set of domestic firms

Firm export investment decision

- Firm decisions: separable across markets so drop iV
- Entry: sunk investment, K, now or wait for improved conditions
- Optimal stopping problem: cutoff, c_t^U, s.t. indifferent between export investment or waiting

$$\Pi_e\left(a_t, c_t^U, r\right) - K = \Pi_w\left(c_t^U, r\right).$$

- Exit: no per period export cost so exogenous export survival $\beta = \ (1-\delta) * (1-d)$
  - Exogenous death rates: firm (δ) and export destination capital (d)
  - Predicts: persistence in exporting, exit in subset of markets
  - Re-entry possible after capital depreciation (similar to new entry). So measured gross exit rate increases if $c_T^U < c_t^U$

Equilibrium Entry

- Derive value functions (as in Handley and Limão, 2015), solve for c_t^U

$$c_t^U = \underbrace{\left[1 + \frac{\beta\gamma\left[\omega\left(a_t\right)\right]}{1-\beta\left(1-\gamma\right)}\right]^{\frac{1}{\sigma-1}}}_{=U_t \leq 1} \underbrace{\left[\frac{a_t\tilde{\sigma}}{(1-\beta)K}\right]^{\frac{1}{\sigma-1}}}_{=c_t^D}$$

- Deterministic demand ($\gamma = 0$) $\Rightarrow c_t^U = c_t^D$
- Uncertain demand$\Rightarrow c_t^U \leq c_t^D$since $U_t \leq 1$
- Expected proportional profit loss in a bad shock

$$\omega\left(a_t\right) = -H(a_t)\frac{a_t - \mathbb{E}(a' \leq a_t)}{a_t} \in (-1, 0]$$

- Demand regime $r' = \{\gamma', H'\}$ lowers entry if more uncertain than r:
  - Riskier: If H SSD $H' \Rightarrow \omega' < \omega$ for all a_t
  - More volatile: $\gamma' > \gamma$

Economic and Policy Sources of Demand Uncertainty

- Unbundle sources of demand shocks to guide estimation
- Derive cutoff allowing for independent & heterogeneous persistence
- Aggregate and industry sources of uncertainty: $a_{Vt} = \varepsilon_V \frac{y_t}{\varsigma_{Vt}}$
  - $y_t = Y_t / \tilde{P}_t$: aggregate real income effect where $\tilde{P}_t = \Pi \left(P_{Vt} \right)^{\varepsilon_V}$;
  - $\varsigma_{Vt} = \frac{P_{V_t}}{\tilde{P}_t} \left(\frac{\tau_{Vt}}{P_{Vt}} \right)^{\sigma}$ is the industry policy price effect
  - ε_V: constant expenditure share of V
- Shock Process. Any shock: $x_t = \{y_t, \varsigma_t\}$ with probability γ
  - Joint (j) income & policy shock: $x_j' = \{y', \varsigma'\}$ with prob= $\gamma \cdot \gamma^j$
  - Purely economic shock (y): $x_y' = \{y', \varsigma_t\}$ with prob $\gamma \cdot \gamma^y$
  - Rule out policy only shocks (more persistent): $\gamma^y = 1 - \gamma^j$
- CDFs for joint and income shock respectively: $H_j \left(a_t \right)$ and $H_y \left(a_t | \varsigma_t \right)$

Equilibrium Entry and Uncertainty Shocks

- Optimal stopping problem yields equilibrium entry c_t^U

$$c_t^U = \underbrace{\left[1 + \frac{\beta\gamma\bar{\omega}_t\left(a_t\right)}{1-\beta\left(1-\gamma\right)}\right]^{\frac{1}{\sigma-1}}}_{=U_t\leq 1}\underbrace{\left[\frac{a_t\tilde{\sigma}}{(1-\beta)K}\right]^{\frac{1}{\sigma-1}}}_{=c_t^D}$$

- Uncertain demand if shock prob. $\gamma > 0 \Rightarrow c_t^U \leq c_t^D$ since $U_t \leq 1$
- Expected profit loss if a_t falls as weighted average of risks

$$\bar{\omega}_t \equiv \gamma^j\phi_t\omega^j(a_t) + (1-\gamma^j\phi_t)\omega^y(a_t)$$

  - If $\gamma^j = 1$ then $\gamma^j\phi = 1$ and back to baseline model
  - If $\gamma^j = 0$ then only y shocks conditional on policy levels
  - Weights $\gamma^j\phi_t$ measure expected fraction of time spent in each

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- **Demand uncertainty shocks, $\gamma' > \gamma$, lower entry and this effect is magnified in riskier markets, i.e. when $\bar{\omega}_t' < \bar{\omega}_t$**

Economic and Policy Uncertainty: Predictions

- Uncertainty factor in $c_t^U = U_t c_t^D$ (1st order approx. around $\gamma = 0, a_0$)

$$\ln U_t = \frac{1}{\sigma - 1} \frac{\beta}{1-\beta} \left\{ \left[\omega^j(a_0) - \omega^y(a_0) \right] \gamma_t^j + \omega^y(a_0) \right\} \gamma_t + e_t$$

- **Which markets are riskier?** $\bar{\omega}_t' < \bar{\omega}_t$
  - $\omega'^y(a_0) < \omega^y(a_0) \equiv -H^y(a_0) \frac{a_0 - \mathbb{E}_y(a < a_0)}{a_0}$ iff H^y SSD H'^y
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  - Higher probability of riskier shocks, e.g. if $\gamma_t^j > \gamma_t^{j,PTA}$ and $\omega^j < \omega^y$

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  - Higher probability of riskier shocks, e.g. if $\gamma_t^j > \gamma_t^{j,PTA}$ and $\omega^j < \omega^y$
- **Key difficulty in testing: neither γ_t^j nor ω^j measurable, so model:**
  - PTA motive to generate predictions independent of $\omega^j < \omega^y$
  - Joint loss as a function of observable individual components

Sources and Interpretation of Risk Differential for PTAs

- $S = S(\bar{\omega}(a_t, m), a_t)$: export gov't objective reflects two motives
  - Market access so $dS/da > 0$
  - Export risk aversion so $S(\bar{\omega}^{PTA}, a_t) > S(\bar{\omega}, a_t)$ if $\bar{\omega}_t^{PTA} > \bar{\omega}_t$
- If PTA can affect policy (Δ_{ς}^{PTA}) & beliefs (Δ_{γ_j}) then exporter gains from
  - $\Delta_{\varsigma}^{PTA} < 0$: a protection reduction (increases market access)
  - $\bar{\omega}_t^{PTA}(\varsigma_t) > \bar{\omega}_t(\varsigma_t) \Leftrightarrow [\omega^j - \omega^y] \Delta_{\gamma_j}^{PTA} > 0$ (if H^y independent of ς_t)

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- **Risk differential of PTA vs. non-PTA** around $\gamma = 0$

$$\bar{\omega}_t^{PTA} - \bar{\omega}_t \approx \underbrace{\left[\omega^j - \omega^y\right]\Delta_{\gamma_j}^{PTA}}_{\text{Insurance (+)}} + \underbrace{\left[\gamma_j \frac{\partial \omega^j}{\partial \varsigma} + \left(1 - \gamma_j\right)\frac{\partial \omega^y}{\partial \varsigma}\right]\Delta_{\varsigma}^{PTA}}_{\text{Market Access Risk (-)}}$$

- Differential entry impacts of demand uncertainty shocks (γ) on PTAs
  - Mitigated: insurance effect (whether $\omega^j > \omega^y$ or v.v.)
  - Exacerbated: higher market access risk

Modelling policy and economic risk interdependence

- Let $h_y\left(y_t, s_y\right)$ w/ s_y indexing risk (e.g. $y \sim \ln N(-\left(s_y \Sigma\right)^2/2, s_y\Sigma))$
- If H^y independent of ς_t then it equals income CDF & s_y affects
  - Income loss: $\omega_t^y\left(s_y\right) \approx \left(\frac{\partial \omega_t^y\left(s_y\right)}{\partial s_y}|_{s_y=0}\right) s_y$
  - Joint loss: $\omega_t^j\left(s_y\right) \approx \left(\frac{\partial \omega_t^j\left(s_y\right)}{\partial s_y}|_{s_y=0}\right) s_y + \omega_t^j\left(s_y = 0, s_\varsigma\right)$

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- **Decomposition of risk differentials:** $\bar{\omega}_t^{PTA} - \bar{\omega}_t \approx$

$$\left(\frac{\partial \omega_t^j}{\partial \omega_t^y}|_{s_y=0} - 1\right) \Delta_{\gamma_j}^{PTA} \quad \omega_t^y + \left(\omega_t^j|_{s_y=0}\right) \Delta_{\gamma_j}^{PTA} + \left(H\left(a_t\right) \frac{\mathbb{E}\left(a < a_t\right)}{a_t}|_{s_y=0}\right.$$

Risk interdependence Insurance (+?) Policy Risk Insurance(+?) Market Access Risk (-)

Risk Differential Across Industries

- Focus on key difference in case of trade war: import market power
- If WTO does not fully internalize TOT incentives (cf. Broda et al '08, Ludema and Mayda, '13)
  - $\Delta_{\varsigma}^{HI} > 0$: higher current protection on average
  - $\Delta_{\gamma_j}^{HI} > 0$: higher probability of policy shock
- **Decomposition of risk differentials:** $\bar{\omega}_t^{HI} - \bar{\omega}_t^{LOW} \approx$

$$\underbrace{\left(\frac{\partial \omega_t^j}{\partial \omega_t^y}|_{s_y=0} - 1\right) \Delta_{\gamma_j}^{HI} \omega_t^y}_{\text{Risk complementarity (-?)}} + \underbrace{\left(\omega_t^j|_{s_y=0}\right) \Delta_{\gamma_j}^{HI}}_{\text{Policy Risk Insurance (-?)}} + \underbrace{\left(H\left(a_t\right) \frac{\mathbb{E}\left(a < a_t\right)}{a_t}|_{s_y=0}\right) \Delta_{\varsigma}^{HI}}_{\text{Market Access Risk (+)}}$$

- $\Delta_{\gamma_j}^{HI} > 0$ & less entry for HI implies Econ.-Policy risk complementarity

From theory to estimation: Goals and Approach

- **Goals:** Model impact of uncertainty shocks on exporting to
  - Test for economic and interdependent uncertainty shocks in GTC
  - Test for differential effects and PTA insurance against trade war
  - Quantify uncertainty and insurance effects
- **Basic approach:**
  - Interaction of time variation (uncertainty shocks) and cross-country economic risk
  - Differential for non-PTA vs. PTA (or non-PTA high vs. low MP) to capture interdependence
- **Outcomes:** focus on entry/exit of varieties and firms, also examine exports

Estimation Equation

- $N_{iVt} \geq N_{Vt} G(c^U_{iVt})$: Number of exporters to i in industry V, time t
  - $G(c) = (c/c_V)^k$: Productivity distribution
  - N_{Vt}: Number of US firms in V at t
- Export firm/variety yearly growth (around $\gamma = 0$, $\tilde{\beta} = \frac{k}{\sigma-1}\frac{\beta}{1-\beta}$)

$$\Delta \ln N_{iVt} = \tilde{\beta}\Delta\{\bar{\omega}_{iV0}\gamma_{it}\mathbb{1}_t\} + (k/(\sigma-1))\Delta \ln a_{iVt} + u_{iVt}$$

- Hysteresis and asymmetric effects:
  - Uncertainty reductions generate immediate entry: $\mathbb{1}_t = 1$
  - Uncertainty increases work through attrition so if it occurs at t-T it can still lower net entry at T (unless fully reversed): $\mathbb{1}_t = 1 - \beta^T$
  - Captured by time-varying coefficients on uncertainty

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- Change in uncertainty term: $\Delta\{\bar{\omega}_{iV0}\gamma_t\} = \omega^y_{i0}\Delta\gamma^y_T + \omega^j_{iV0}\Delta\gamma^j_{iVT}$
  - Weighted sum of income and joint risk at pre-crisis period 0
  - Regime switches at T allowed (estimate via period interactions)
  - $\Delta\gamma^y_T$ common across countries (common financial crisis)
  - $\Delta\gamma^j_{iVT}$ heterogeneous across countries (PTA) or industries (MP)

Economic and Policy Uncertainty: Measurement

- **Entry effect of income uncertainty shock: $\Delta\gamma_T^y$**

$$\Delta\gamma_T^y \left[\omega_{i0}^y\right] = -\Delta\gamma_T^y p_Y \times risk_{Y_i}$$

  - Expected profit reduction: $\omega_{i0}^y = -p_Y \times risk_{Y_i}$ Graph vs Exp.
  - Estimate AR(1) for each GDP (quarterly) & compute expected loss if 5th pctile (in 2001): $unc_{Yi} = 1 - \frac{\mathbb{E}[Y_{t+1}^{(.05)} | Y_{t+1} < Y_{2001}]}{Y_{2001}}$

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- **Entry effect of joint uncertainty shock: $\Delta\gamma_{iVT}^j$**

$$\Delta\gamma_{iVT}^j\left[\omega_{iV0}^j\right] = -\Delta\gamma_T^j w_{iV0} \times p_Y \times risk_{Y_i} + \Delta\gamma_T^j \times \alpha_{iV0}$$

  - $w_{iV0} = \bar{w} + \Delta\bar{w}^W W_{iV0}$: is average partial effect of ω_{i0}^y on ω_{iV0}^j
    - $\bar{w} \geq 0$ average non-PTA if $\frac{\partial\omega_t^j}{\partial\omega_t^y} > 0$
    - $\Delta\bar{w}^{PTA} \leq 0$ PTA differential if it insures interdependent risk
    - $\Delta\bar{w}^M \geq 0$ High MP industry if risk complementarity, $\frac{\partial\omega_t^j}{\partial\omega_t^y} > 1$
  - $\alpha_{iV0} = \bar{\alpha} + \Delta\bar{\alpha}^W W_{iV0}$: Policy risk and PTA or MP differential

Estimation equation and identification strategy, I

- **Entry yearly growth:** quarter t to $t-4$, industry V, country i

$$\Delta \ln N_{tVi} = \left(b + \sum b_T \times Q_T\right) \times risk_{Yi} + \left(b^W + \sum b_T^W \times Q_T\right) \times risk_{Yi} \times W_{iV0} + x_{tVi}$$

- Q_T: crisis dummies allow regime switches, $Q_{408} = 1$if $t \in [Q_{408}, Q_{309}]$
- Pre-crisis baseline period, $T = 0$: Q401-Q308
- **Sources of identifying variation:**
  - $risk_{Yi}$ fixed over time, varies by destination i
  - time-varying differentials through Q_T dummy interaction
  - industry*time differential when W_{iV0} is a high/low market power dummy interactions
  - country*time differential when W_i is a PTA dummy

Estimation equation and identification strategy, II

- **Entry yearly growth:** quarter t to $t-4$, industry V, country i

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- Q_T: crisis dummies allow regime switches, $Q_{408} = 1$if $t \in [Q_{408}, Q_{309}]$
- Pre-crisis baseline period, $T = 0$: Q401-Q308
- **Identifying uncertainty shocks vs. pre-crisis: e.g.** $\Delta_0 \gamma_T^y \equiv \Delta \gamma_T^y - \Delta \gamma_0^y$
  - $b_T = -\tilde{\beta} p_Y \left(\Delta_0 \gamma_T^y + \bar{w} \Delta_0 \gamma_T^j\right) \leq 0$: non-PTA econ & joint
  - $b_T^{PTA} = -\tilde{\beta} p_Y \left(\Delta \bar{w}^{PTA} \Delta_0 \gamma_T^j\right) \geq 0$: if PTA interdependent risk insurance

Estimation equation and identification strategy, III

- **Entry yearly growth:** quarter t to $t-4$, industry V, country i

$$\Delta \ln N_{tVi} = \left(b + \sum b_T \times Q_T\right) \times risk_{Yi} + \left(b^W + \sum b_T^W \times Q_T\right) \times risk_{Yi} \times W_{iV0} + x_{tVi}$$

- **Controls in x_{tVi}**
  - $\Delta \ln Y_{ti}$: changes in nominal income
  - $Q_T \times W_{iV0}$: captures policy effects $\Delta\gamma_T^j \times \alpha_{iV0}$
  - country, industry trends (prices, expenditure, protection, productivity): $\alpha_i + \alpha_V$
  - Quarter-year effects: α_t
  - Other PTA heterogeneity: interaction with $\Delta \ln Y_{ti}$ and Q_T

Data

- Yearly growth in number of firm-destinations or varieties (LFTTD):
  - $\Delta \ln N_{iVt}$: firms (or varieties) exporting to destination i in industry HS-2 V between quarter t and $t-4$ (2002-11).
  - Mid point growth: $\frac{N_{iVt}-N_{iV,t-4}}{(N_{iVt}+N_{iV,t-4})/2}$
- $ US, $\Delta \ln Y_{it}$: 4-quarter log change in GDP *Constrains PTA sample*. Source: IMF Financial Statistics
- PTA_{it}: Indicator if destination i has PTA in t: AUS(05), CAN(88), CHL(04), GTM(06), ISR(85), MEX(94), MAR(06). Source: USITC.
- M_{Vi}:Market Power Indicator for industries above first tercile of inverse foreign supply elasticity. Source: Broda, Limão and Weinstein, 2008

Summary statistics

Table 4: Summary Statistics for country-industry regressions

	Full Sample	Non-PTA	PTA
Uncertainty*	0.223	0.231	0.163
	[0.105]	[0.109]	[0.0240]
Market Power**	0.69	0.69	0.67
	[0.462]	[0.461]	[0.472]
Growth in Variety Net entry ***	0.0478	0.0473	0.0517
	[0.418]	[0.429]	[0.314]
Entry Contribution***	0.702	0.707	0.665
	[0.295]	[0.302]	[0.234]
Exit Contribution ***	0.654	0.66	0.614
	[0.287]	[0.294]	[0.221]
Growth in Firms Net entry***	0.0446	0.0444	0.0468
	[0.402]	[0.413]	[0.304]
Firm Entry Contribution***	0.632	0.638	0.586
	[0.299]	[0.305]	[0.238]
Firm Exit Contribution ***	0.588	0.594	0.539
	[0.291]	[0.298]	[0.227]
PTA	0.116	0	1
	[0.320]	-	
Growth in GDP (ln)	0.105	0.105	0.1
	[0.138]	[0.140]	[0.123]

Sample means and standard deviations (in brackets).

* Uncertainty estimates from AR(1) country-specific regressions. See details in main text.

** Market power constructed from Broda, Limao and Weinstein (2008)

*** Quarterly year-to-year midpoint growth rate where "Growth" denotes the total growth rate, "Entry" correspond to the new firms or varieties (firm*product) flows while "Exit" corresponds to those that disapear.

Uncertainty Estimates by PTA: Variety Growth

Table 5: Net entry of exported U.S. firm-country-product varieties (2003-2011)

	Net entry		Decomposition into:	
	$\Delta\ln$	midpoint growth	Entry	Exit
Uncertainty (no PTA)				
Uncertainty*Q408	-0.359***	-0.315***	-0.167***	-0.148***
	(0.080)	(0.080)	(0.050)	(0.040)
Uncertainty*Q409	-0.105*	-0.0937*	-0.0491*	-0.04
	(0.060)	(0.050)	(0.030)	(0.030)
Uncertainty*Q410	-0.191***	-0.177***	-0.100***	-0.0774***
	(0.050)	(0.040)	(0.030)	(0.020)
Uncertainty (PTA)				
PTA*Uncertainty*Q408	2.260***	2.148***	1.085***	1.064***
	(0.550)	(0.540)	(0.290)	(0.290)
PTA*Q408	-0.346***	-0.327***	-0.171***	-0.156***
	(0.080)	(0.080)	(0.040)	(0.040)
PTA*Uncertainty*Q409	1.342***	1.283***	0.931***	0.351***
	(0.250)	(0.240)	(0.210)	(0.120)
PTA*Q409	-0.223***	-0.214***	-0.168***	-0.0460*
	(0.040)	(0.040)	(0.040)	(0.020)
PTA*Uncertainty*Q410	-0.21	-0.21	-0.09	-0.12
	(0.190)	(0.180)	(0.170)	(0.170)
PTA*Q410	0.03	0.03	0	0.04
	(0.030)	(0.030)	(0.030)	(0.030)
PTA*Uncertainty	-1.593**	-1.490**	-0.58	-0.909**
	(0.780)	(0.730)	(0.360)	(0.430)
PTA	0.315**	0.293**	0.125*	0.168**
	(0.140)	(0.130)	(0.070)	(0.070)
Change in GDP	0.283***	0.267***	0.105***	0.162***
	(0.030)	(0.030)	(0.020)	(0.020)
PTA*Change in GDP	-0.05	-0.05	0.01	-0.06
	(0.090)	(0.080)	(0.040)	(0.050)
Observations	160,000	160000	160000	160000
R-squared	0.03	0.03	0.13	0.12
Quarter-Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Hs2 FE	Yes	Yes	Yes	Yes

Notes

Aggregation level: country-HS2. We use uncertainty estimates from AR(1) country-specific regressions. See details in text. Robust standard errors clustered at the destination country by time period level (pre-crisis

Uncertainty Estimates by PTA: Variety Growth

	Q408-Q309	Q409-Q310	Q410-Q311
Non-PTA: b_T	-0.359	-0.105	-0.191
	(0.080)	(0.060)	(0.050)
PTA differential: b_T^{PTA}	2.260	1.342	-0.21
	(0.550)	(0.250)	(0.190)

Table 5. Conditional on country, time, industry FEs, PTA interactions, income

- $b_T < 0$: consistent w/ demand uncertainty increase in each T (vs. 2001Q4-2008Q3) **reducing growth for non-PTA**
- $b_T^{PTA} > 0$: effect mitigated for PTAs: consistent w/ **risk interdep. insurance**
- $b_3^{PTA} \simeq 0$: risk interdep. insurance for PTAs is small, insignificant by Q410, consistent w/ **reduced probability of trade war w/non-PTA**
- Similar conclusions if we add back pre-crisis: so increase in absolute uncertainty in crisis, $\Delta\gamma_T > 0$, not just relative

Uncertainty Estimates by PTA: Firm Growth

	Q408-Q309	Q409-Q310	Q410-Q311
Non-PTA: b_T	-0.338	-0.0999	-0.191
	(0.080)	(0.050)	(0.040)
PTA differential: b_T^{PTA}	2.241	1.283	-0.17
	(0.520)	(0.250)	(0.200)

Table 6. Conditional on country, time,industry FEs,full PTA interactions, income

- **Identical effects to variety growth**: so similar dynamics at HS2-destination
- Similar if using midpoint growth, which allows for zeros and we decompose into gross margins

Uncertainty Estimates by PTA: Firm Gross Entry and Exit

		Q408-Q309	Q409-Q310	Q410-Q311
Non-PTA	Gross entry $b_{T,E}$	-0.164***	-0.0529*	-0.106***
	Gross exit $b_{T,X}$	-0.139***	-0.04	-0.0741***
PTA differential	Gross entry $b_{T,E}$	0.997***	0.834***	-0.07
	Gross exit $b_{T,X}$	1.133***	0.373***	-0.08

Table 6. Conditional on country, time, industry FEs,full PTA interactions, income

- Non-PTA: uncertainty reduces net entry via gross entry and exit by similar amount in given period
- PTA: Differential effects similar across gross margins and significant until Q410

Uncertainty Estimates by market power: Variety Growth

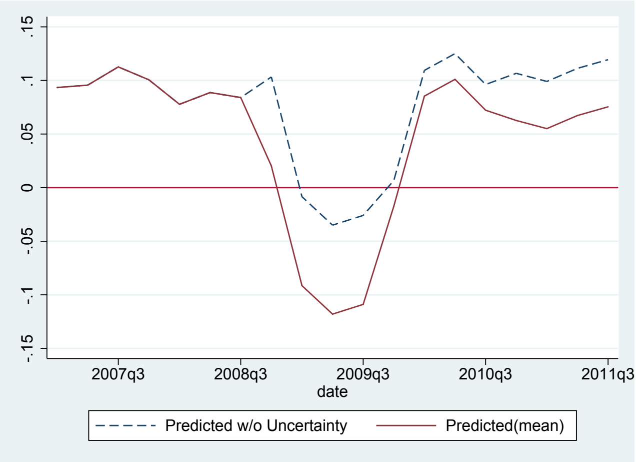
- Non-cooperative policies increasing in importer market power (Broda et al. '08)

	Q408-Q309	Q409-Q310	Q410-Q311
Low MP: b_T	-0.212 (0.097)	0.0165 (0.065)	-0.0979 (0.061)
High Differential: b_T^{HIGH}	-0.189 (0.050)	-0.158 (0.054)	-0.122 (0.046)

Table 8. Conditional on country, time, industry FEs,full PTA interactions, income

- $b_T \leq 0$: demand uncertainty increase **reduced growth in low MP if significant**
- $b_T^{HIGH} < 0$: magnified for high MP: consistent w/ **risk complementarity**
- Similar effects for firm growth: Table 9
- b_T^{HIGH}: Declining over time consistent w/ **reduced probability of trade war** (more so for firms and after controlling for MP*Qt)

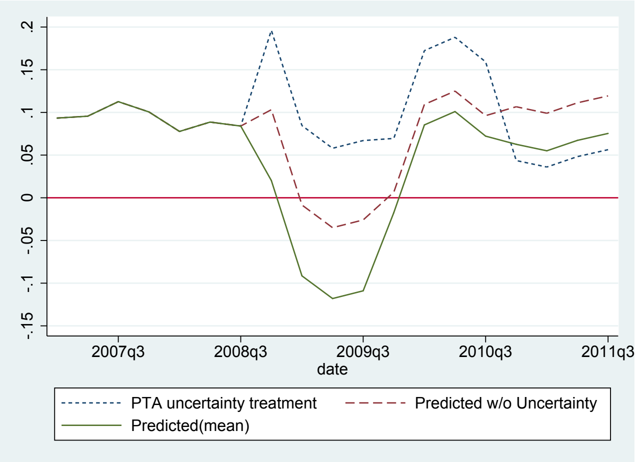
Variety Growth in non-PTA IF no income or interdep. risk



$$\mathbb{E}[\Delta \ln N_{Vi,T} | \omega^{y}_{i,T} = 0] = \mathbb{E}[\Delta \ln N_{Vi,T}] - b_T \overline{risk}_Y$$

- Growth: 2-8 lp higher on average

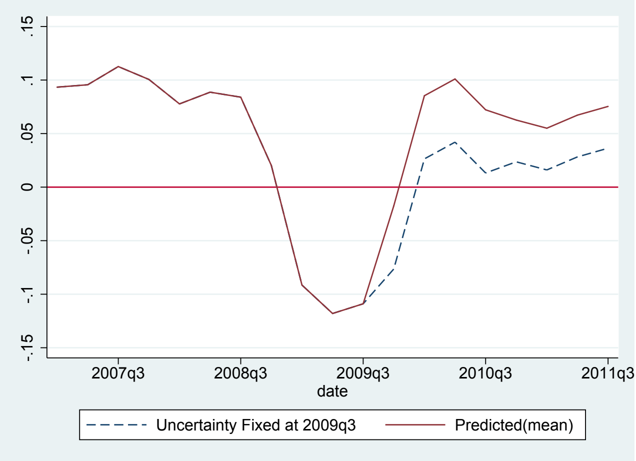
Variety Growth non-PTA IF treated as PTA



$$\mathbb{E}[\Delta \ln N_{Vi,T} | r_{PTA,T}] = \mathbb{E}[\Delta \ln N_{Vi,T}] + \left[a_T^{PTA} + b_T^{PTA} \times \overline{risk}_Y\right] \times PTA_i$$

- Growth if treated as PTA 9-17 lp higher for initial periods

Slower non-PTA recovery IF no uncertainty reversal



- Slower non-PTA variety recovery if uncertainty remained at Q408

Robustness I: Estimation and unobserved heterogeneity

- Unobserved heterogeneity in
  - country-industry average growth rates: control for α_{iV}
  - high market power growth in each T: control for $Q_t \times M_V$
- Sample and level of aggregation
  - Sample: Midpoint (includes 0's) vs. ln growth
  - Standard error clustering: baseline (countryxperiod) and also 2-way (countryxindustry, quarterxyear)
  - Dependent variable aggregation: Country vs. country-industry PTA results: so not simply driven by small industries

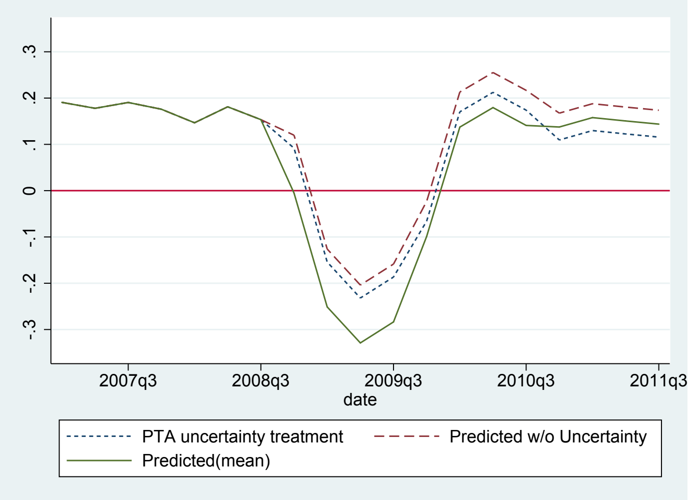
Robustness II: Alternative explanations and channels

- Variation in applied trade barriers across countries and industries
  - **Negligible variation in tariffs this period.** If τ_{iV} constant then differenced
  - **Robust to controls for variation in temporary trade barriers (TTBs):** $\Delta \ln TTB_{iVt}$ coverage ratios of HS6 lines w/in each HS-2 of destination (global safeguards, antidumping and countervailing duties)
  - If PTA coming into force: control for PTA differential for switchers
- Inventory adjustment
  - Plausible channel for adjustment to downturn and uncertainty
  - **Control for changes in US industry inventories: no change**
  - Re-estimate by industry: low or high inventory/shipments in 2001
  - PTA: Similar effects for low (bottom tercile) and high (rest)
  - Market power: differential effect still present in high inventory

Robustness III: Measurement

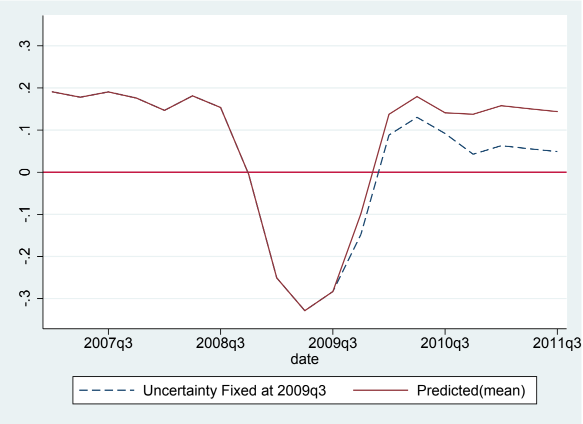
- **Timing of crisis: data rejects coefficient break pre-crisis (2007)**
- **Alternative measures of economic uncertainty:** baseline measure at 5th percentile, highly correlated w/ overall change, $1 - E[Y_i^{'} < Y_{i,0}|\varsigma]/Y_{i,0}$, and w/ other measures of uncertainty, e.g. Cor($risk_{Yi}, \sigma_{Yi}$) =0.62
- Alternative market power measures: allow variation by industry (MP) and country (relative size)

Smaller Export Collapse IF no uncertainty or PTA



	Q408-Q309	Q409-Q310	Q410-Q311
Counterf. PTA	$-23 + 9.7 = -13.3$	$8.9 + 3.3 = 12.2$	$15 - 2.8 = 12.2$
No uncertainty	$-23 + 12.5 = -10.5$	$8.9 + 7.6 = 16.5$	$15 + 3 = 18$

Slower Recovery of Exports IF no uncertainty reversal



- Slower recovery for non-PTA if uncertainty had remained at Q408

Conclusion

- Summary and main results
  - Extensive margin (both exit and entry) important in GTC for U.S.–more than other countries
  - Income uncertainty magnified by TPU contributed to GTC and recovery during Great Recession
- Broader implications
  - Potential WTO commitment role preventing trade war on high MP
  - Insurance value of new PTAs even if current barriers are low: TTIP
  - **Cost of Brexit and threats of Trexit (e.g. renegotiating NAFTA):**
    - Increased TPU and economic uncertainty
    - Erosion of credibility of PTA system worldwide