A Global View of Creative Destruction

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What we do and find

- Document 2 key facts about export turnover in U.S. manufacturing
- Analyze a 2-country Klette-Kortum model
- Calibrate the model and carry out counterfactuals
- Relative to autarky, current trade flows result in:
  - $\sim$ half a percentage point faster annual growth rate
  - $\sim$ 50% higher consumption-equivalent welfare

Some recent related papers

Evidence on dynamic benefits of trade

- Bloom, Draca and Van Reenen (2016)
- Aghion, Bergeaud, Lequien, and Melitz (2020)

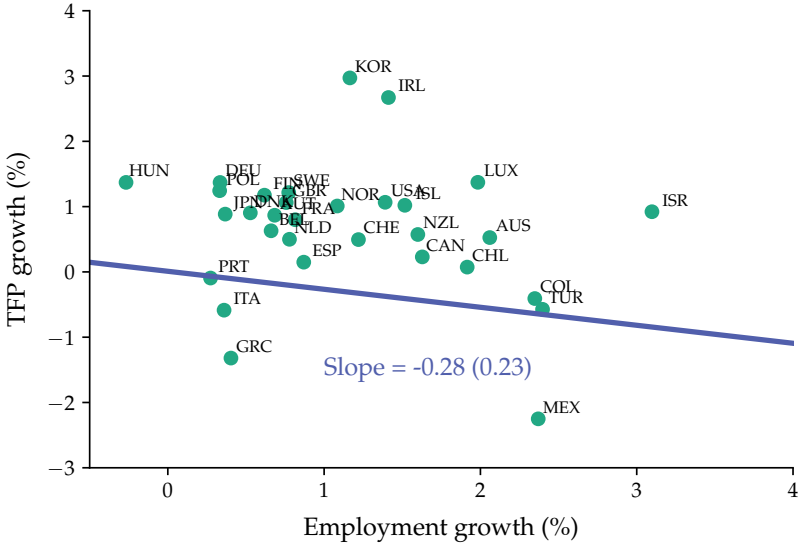
Models of trade and growth

- Sampson (2016)
- Buera and Oberfield (2020)
- Perla, Tonetti and Waugh (2021)
- Akcigit, Ates and Impullitti (2021)

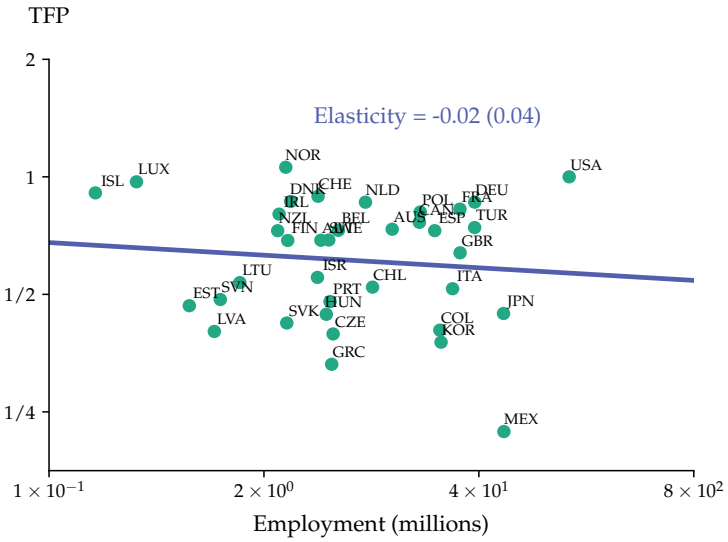
A *prima facie* case for knowledge flows across OECD countries

- OECD country growth rates are similar since 1980
  - Consistent with knowledge flows across OECD countries
- But also consistent with semi-endogenous growth and no knowledge flows
  - Presuming research effort grows at the same rate across OECD countries
- Employment growth rates since 1980 *do* differ across OECD countries
  - Is TFP growth faster in countries with faster employment growth?

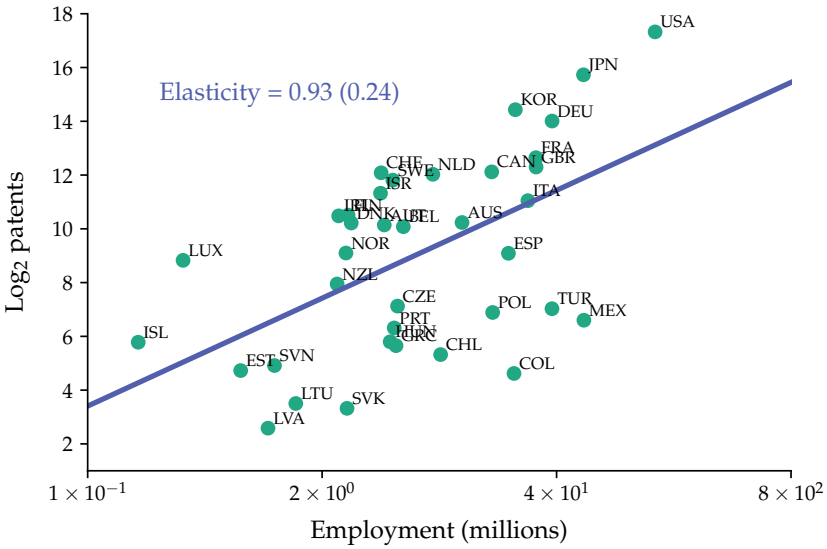
TFP growth and employment growth across OECD countries, 1980–2019



TFP and employment across OECD countries in 2019



Patents in the U.S. and employment in the country of origin 2019



Outline

1. **Facts about export reallocation**
2. Baseline model with learning from sellers
3. Alternative models with learning from producers
4. Dynamic gains from trade (or openness more generally)

Datasets

U.S. Census of Manufacturing

- All establishments with employees
- 300–375k establishments per Census year
- Use 1987, 1997, 2002, 2007, and 2012
- Domestic sales and exports for *firms*

U.N. Comtrade Database

- Bilateral country exports in HS-6 categories
- Use 2000, 2005, 2010, and 2015
- Focus on U.S. manufacturing exports

U.S. export reallocation across categories

Average of five-year changes across $\sim$ 4250 HS-6 categories

	U.S.	OECD
Excess export reallocation rate	18.2%	20.1%
Category entry and exit rates	1.2%	1.0%

Source: U.N. Comtrade Database

U.S. export reallocation across firms

1987–2012 five-year *arc* growth rates across firms

S.D. of export growth	1.72
S.D. of domestic sales growth for exporting firms	1.20
Variance ratio	2.05

Source: U.S. Census of Manufacturing

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Preferences

Representative consumer in each country

$$U = \int_0^1 \ln C_j \, dj$$

$$U^* = \int_0^1 \ln C_j^* \, dj$$

- Fixed set of varieties
- Each country consumes all varieties
- Home = U.S.
- Foreign = rest of OECD = *

Production technology

$$Y_j = A_j L_j$$

$$Y_j^* = A_j^* L_j^*$$

A_j and A_j^* are the best home and foreign blueprints

A_j' and $A_j^{*\prime}$ are the *second-best* home and foreign blueprints

Markups under Bertrand competition

$$\text{Home market} \begin{cases} \text{Exported or non-traded} & \text{Imported} \\ \dfrac{A_j}{\max\left[A_j',\ \frac{\omega A_j^*}{\tau}\right]} & \dfrac{A_j^*/\tau}{\max\left[\frac{A_j^{*\prime}}{\tau},\ \frac{A_j}{\omega}\right]} \end{cases}$$

$$\text{Foreign market} \begin{cases} \text{Imported} & \text{Non-traded or exported} \\ \dfrac{A_j/\tau}{\max\left[\frac{A_j'}{\tau},\ \omega A_j^*\right]} & \dfrac{A_j^*}{\max\left[A_j^{*\prime},\ \frac{A_j}{\omega\tau}\right]} \end{cases}$$

$\tau > 1$ is the symmetric tariff on all traded goods

ω is the relative wage (home relative to foreign)

Traded and non-traded goods

Ordering products so that A_j/A_j^* is decreasing in j

- $j \in [0, x]$ are traded and produced at home
- $j \in (x, x^*)$ are non-traded
- $j \in [x^*, 1]$ are traded and produced abroad

The cutoff products x and x^* are determined by

$$\frac{A_x}{\tau} = \omega A_x^*, \quad A_{x^*} = \frac{\omega A_{x^*}^*}{\tau}$$

When $\tau = 1$, $x = x^*$ and all products are traded

Labor market clearing

$$L = \int_0^1 L_j \, dj$$

$$L^* = \int_0^1 L_j^* \, dj$$

- $L_j = 0$ for an imported variety, $L_j^* = 0$ for an exported variety
- Exogenous innovation (does not use labor)

Balanced trade

The relative wage ω is pinned down by balanced trade:

$$I^* \cdot x \;=\; I \cdot (1 - x^*)$$

I and I^* denote nominal GDP at home and abroad

LHS = home country exports (x is the fraction of products exported)

RHS = home country imports ($1-x$ is the fraction of products imported)

Arrival rates of quality improvements

	Home	Foreign
Innovation by incumbents	λ	λ^*
Innovation by entrants	η	η^*

Pareto draws build on A of the current ***seller*** into the domestic market

The average improvement in quality (over the seller) is $\frac{1}{\theta-1}$

Expected growth rate for symmetric countries

Autarky $\left(\lambda + \widetilde{\eta}\right) \cdot \dfrac{1}{\theta - 1}$

Frictionless trade $2 \cdot \left(\lambda + \widetilde{\eta}\right) \cdot \dfrac{1}{\theta - 1}$

Reflecting barrier

The bottom ψ percent of qualities redraw from the top 1–ψ percent each year

- Maintains a stationary quality distribution
- Allows us to match the empirical trade elasticity

In the spirit of Perla, Tonetti and Waugh (2021)'s endogenous diffusion

Data moments used for calibration

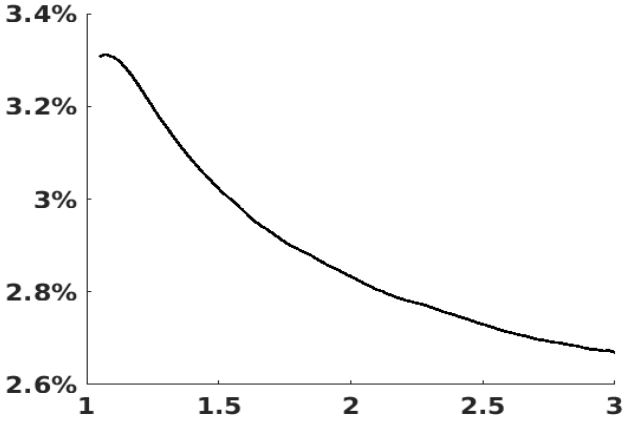
Export share of revenues (home)	U.S. mfg 2012	10.2%
Trade elasticity from halving τ	Head and Mayer (2014)	–5
Revenue per worker exp./non-exp.	U.S. mfg 2012	1.066
Employment share of entrants	U.S. mfg 2012	14.4%
Employment home/foreign	U.S./OECD mfg 1995–2008	0.389
Value added per worker home/foreign	U.S./OECD mfg 1995–2008	1.29
TFP growth rate	U.S. mfg 1995–2008	3.01%
Exports in 75th/25th HS-6	U.S. mfg 2000-2015	20
Number of HS-6 categories	U.S. mfg 2000-2015	4250

Sources: U.S. Census of Manufacturing
KLEMS for OECD countries
U.S. BLS Multifactor Productivity Database
UN Comtrade Database

Parameter estimates

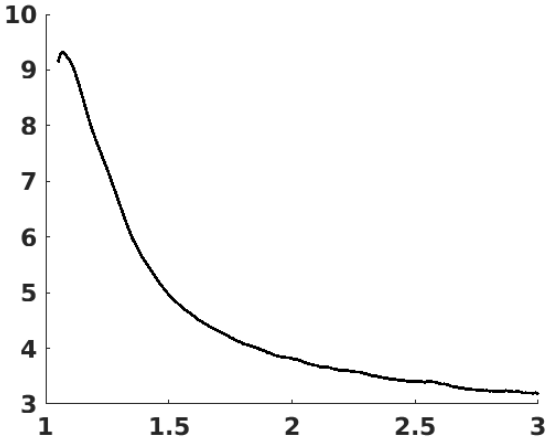
θ	Shape parameter of innovation draws	10.8
λ	Innovate rate, home incumbents	13.5%
$\widetilde{\eta}$	Innovation rate, home entrants	2.5%
$\widetilde{\mu}^*$	Innovation rate, foreign incumbents + entrants	12.2%
τ	Gross tariff rate	1.50
ψ	Reflecting barrier for product quality	1.0%

Growth vs. tariffs in the baseline model

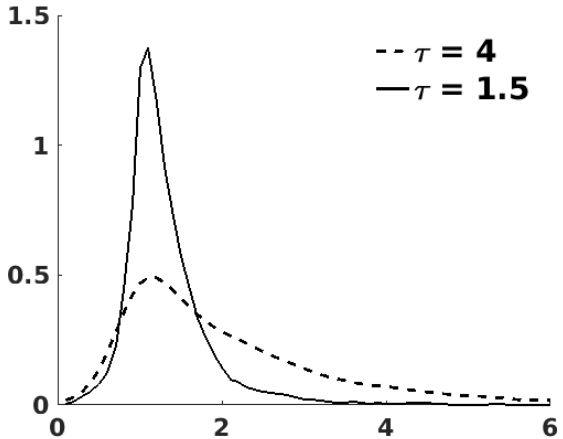


Relative wage vs. tariffs in the baseline model

Trade elasticity vs. tariffs in the baseline model



Quality dispersion in the baseline model



What if knowledge diffusion is *independent* of trade?

Suppose U.S. draws with probability

- z^* on its own best producers, $1 - z^*$ on the best OECD products

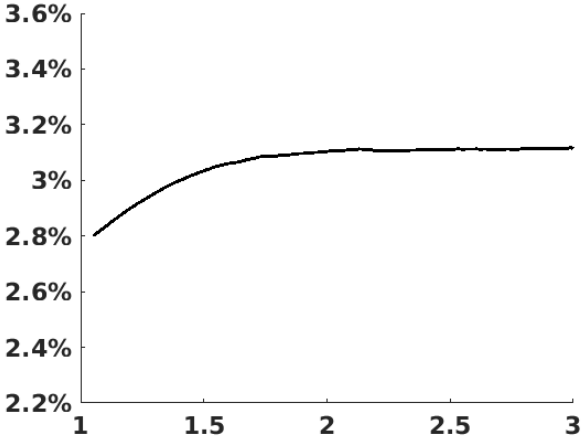
And the OECD draws with probability

- $1 - z$ on its own best producers, z on the best U.S. products

Such "disembodied" spillovers are isomorphic to baseline if $z = x$ and $z^* = x^*$

But dynamic gains from lower tariffs will differ if $\{z, z^*\}$ are fixed while $\{x, x^*\}$ move

Growth vs. tariffs with *disembodied* spillovers



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Alternative model assumptions

- Learning from *domestic producers*
  - When innovating on an imported variety:
    - 10% of draws on sellers
    - 90% of draws on dormant domestic producers
- Research specialization
  - 10% of draws on all products
  - 90% of draws on products a country currently produces

Alternative models and targeted moments

	Data	Global Learning	Domestic Learning	Research Specialization
TFP Growth	3.0%	3.0%	3.0%	3.0%
U.S./OECD wage premium	29.0%	29.0%	29.0%	29.0%
U.S. export share of revenues	10.2%	10.2%	10.2%	10.2%
Employment share of entrants	14.4%	14.4%	14.4%	14.4%
Trade elasticity	5.0	5.0	**1.4**	**0.0**
Exporter premium	6.6%	6.6%	**1.0%**	**-0.6%**

Alternative model implications for export reallocation

	Data	Global Learning	Domestic Learning	Research Specialization
Category-level export reallocation				
Export reallocation rate	18.2%	14.3%	**7.1%**	**1.4%**
Firm-level export volatility				
S.D. of exports vs. domestic sales	1.43	1.65	1.49	1.28

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Welfare gains from trade (in the baseline model)

	50% reduction in tariffs		Relative to autarky	
	U.S.	OECD	U.S.	OECD
Static gains	5.5%	3.5%	23.7%	21.5%
Dynamic gains	6.0%	14.3%	24.3%	100.9%
Static + dynamic gains	11.5%	17.8%	48.0%	122.4%

Annual growth rate boost from current trade vs. autarky

Global Learning	Domestic Learning	Research Specialization
0.47%	0.10%	0.45%

Conclusion

- Documented 2 key facts about export reallocation in U.S. manufacturing
  - $\sim$ 18% reallocation rate across HS-6 categories
  - firm-level export growth is twice as dispersed as domestic sales growth
- Analyzed a 2-country model of creative destruction and growth
- In our baseline model, current trade (relative to autarky):
  - raises the growth rate by $\sim$ 0.5% per year
  - lifts consumption-equivalent welfare by $\sim$ 50%