International Trade and Macro: Firm-level data

Firm-level data and facts

▶ Follows section 2 of Alessandria et al. (2021)

▶ Focus on Colombia

▶ Dynamic linked panel that is easy to access and widely used. Information on total sales and custom data by destination.

▶ Regression tables
  ▶ We suppress standard errors here, but they are in the paper
  ▶ The usual notation: $^*p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$

▶ Goals
  ▶ Get familiar with data
  ▶ Layout some facts

Which facts?

- ► There are lots of facts out there

- ► Which ones should we care about?
  - ► Not many firms export: I care
  - ► Some trade comes in ships, some in planes: I care
  - ► Some trade comes in red boxes, some blue: I don't care

- ► The facts should be informative about something we care about
  - ► The first two facts help identify trade costs
  - ► Trade costs decrease the gains from trade

Decomposing aggregate trade

- ▶ Firms $i = 1 \ldots n$ export. Firms $i = n+1 \ldots N$ do not.

- ▶ Decompose aggregate export-sales ratio into three margins
    1. Extensive margin (first term on rhs)
    2. Intensive margin (second term on rhs)
    3. Exporter size premium (third term on rhs)

$$
\frac{\sum\limits_{i=1}^{n} exports_i}{\sum\limits_{i=1}^{N} sales_i} = \frac{n}{N} \times \frac{n^{-1} \sum\limits_{i=1}^{n} sales_i \times exs_i}{n^{-1} \sum\limits_{i=1}^{n} sales_i} \times \frac{n^{-1} \sum\limits_{i=1}^{n} sales_i}{N^{-1} \sum\limits_{i=1}^{N} sales_i}
$$

- ▶ Use this framework to organize our empirical study
- ▶ First, take exports to the world, later exports by destination country

Decomposing aggregate trade

	All values are expressed as percentages							
	United States			Colombia		Colombia 100+		
Panel A	1987	2007	log diff.	1983	2013	1983	2013	log diff.
Export/sales	6.3	11.6	61.1	5.2	14.6	5.2	13.9	97.7
Extensive	43.2	63.0	37.7	10.8	24.6	36.5	59.8	49.5
Intensive	9.9	15.5	44.9	12.8	23.5	10.8	20.3	62.8
Premium	148.0	119.5	−21.4	374.9	252.4	132.1	114.2	−14.6
Panel B								
Starter rate	10	−		2.0	5.5	6.9	13.8	
Stopper rate	17	−		16.5	16.1	11.9	10.1	

► Trade barriers fall → trade grows

► Extensive and intensive margins grow

► Newer, smaller exporters → size premium falls

The extensive margin

▶ Large literature on drivers of entry and exit

▶ Laws-of-motion for exporters and total firms

$$n_{t+1} = \gamma_{t+1}^{\text{starter}} \left[\delta_{nt}(N_t - n_t) + N_{E,t+1} \right] + \left(1 - \gamma_{t+1}^{\text{stopper}} \right) \left[\delta_{xt} n_t \right]$$

$$N_{t+1} = \delta_{nt}(N_t - n_t) + \delta_{xt} n_t + N_{E,t+1},$$

▶ δ are the survival rates; N_E mass of newly created firms

▶ $\gamma^{\text{starter}}, \gamma^{\text{stopper}}$ are the export starter and stopper rates

  ▶ increasing starter rate, flat stopper rate $\rightarrow$ increasing extensive margin (previous table)

Fact #1. Past export participation is the main predictor of current export participation.

	Export status$_t$			
	(1)	(2)	(3)	(4)
log sales$_t$	0.129***	0.053***	0.053***	0.043***
exporter$_{t-1}$		0.640***	0.593***	0.636***
exs$_{t-1}$			0.217***	0.220***
N	76,662	76,662	76,662	76,662
adj. R^2	0.330	0.618	0.622	0.610

Columns 1–3 include industry and year fixed effects. Column 4 includes year fixed effects.

▶ Linear probability model
▶ Size (measured by sales) matters less when controlling for history
▶ Coefficient on exporter$_{t-1}$ < 1

Fact #2. Exporter exit rates fall with past export intensity and time in the export market.

	Stopper$_t$	
	(1)	(2)
log sales$_{t-1}$	0.003	
log exports$_{t-1}$	-0.032^{***}	-0.022^{***}
starter$_{t-1}$	0.244^{***}	0.207^{***}
starter$_{t-2}$	0.119^{***}	0.084^{***}
log destinations$_{t-1}$		-0.075^{***}
log months$_{t-1}$		-0.100^{***}
Market	World	Country
N	15,631	324,297
adj. R^2	0.157	0.319

Column 1 includes industry and year fixed effects. Column 2 includes destination-year fixed effects.

- ► Linear probability model
  - ► Col 1: Total exports
  - ► Col 2: Exports by country
  - ► months = # months with positive shipments
  - ► destinations = # countries served
- ► Export volume, **not overall size**, decreases exit prob.
- ► Newer exporters more likely to exit

Fact #3. The exporter entry rate is low but is increasing in size and past export activity.

	Starter$_t$		
	(1)	(2)	(3)
log sales$_{t-1}$	0.027***	0.028***	
log destinations$_{t-1}$			0.004***
exporter$_{t-2}$	0.214***	0.185***	0.158***
exs$_{t-2}$		0.211***	
Market	World	World	Country
N	47,289	47,289	20,598,517
adj. R^2	0.109	0.111	0.036

Columns 1&2 includes industry and year fixed effects. Column 2 includes destination-year fixed effects.

► Linear probability model
  ► Col 1&2: Total exports
  ► Col 3: Exports by country
  ► destinations = # countries served
► Entry rates are low
► Size matters but previous experience is more important
► Previous export experience raises the probability of *reentry* by 20 percentage points

The intensive margin

▶ Facts #1–#3 about the extensive margin: Does the firm export at all?

▶ Now we turn to the intensive margin: Conditional on exporting, how much does the firm export?

▶ Measure it as the exports-to-total-sales ratio

$$exs_{it} = \frac{\text{exports}_{it}}{\text{sales}_{it}}$$

▶ Regress this on lagged exs, and time since entry or until exit

$$
\begin{aligned}
exs_{it} = {} & \alpha + \sum_{k=0}^{K} \rho_{-k}\, exs_{i,t-k} \\
& + \beta_1 d_{it}^{\text{starter}} + \beta_2 d_{it}^{\text{exporter}} + \sum_{k=0}^{K} \theta_k d_{i,k}^{\text{stopper}} + \mu d_{it}^{\text{start,stop}} + \varepsilon_{it}
\end{aligned}
$$

The intensive margin

	Export-total-sales ratio$_t$			
	(1)	(2)	(3)	(4)
exporter$_t$	0.216***	0.242***	0.073***	0.240***
starter$_t$		−0.093***	0.070***	−0.078***
stopper$_{t+1}$		−0.087***	−0.028***	−0.097***
starter$_t$,stopper$_{t+1}$		0.063***	0.012	0.045***
exs$_{t-1}$			0.543***	
exs$_{t-2}$			0.190***	
stopper$_{t+2}$				−0.040***
stopper$_{t+3}$				−0.028***
N	60,668	60,668	60,668	37,072
Adj. R^2	0.358	0.378	0.692	0.381

Fact #4. Export intensity rises with time in the export market.

► Average intensity of 20 percent. Home bias at the firm level.

► New and soon-to-exit exporters sell less

► Export intensity is persistent

► Overall life cycle pattern is one of entry, growth, shrinkage, exit
  ► Use coefficients to trace out pattern

Exporter life cycle

Export to total-sales ratio

	1	2	3	4	5	6	7	Long run
Starter	14.3	15.1	18.2	20.1	21.7	22.9	23.9	27.4
	–7	–6	–5	–4	–3	–2	–1	
Stopper	22.1	23.2	21.8	19.5	18.8	19.1	16.9	

- ▶ Long-run ratio is $exs_{LR} = \alpha/(1 - \sum_{k=0}^{K} \rho_{-k})$
- ▶ A new exporter grows by 50 percent in its first five years
- ▶ An exiting firm shrinks by about 30 percent in its last five years

Further decomposing the intensive margin

► We have been considering a firm's total exports to the world

► With transactions-level data, we can learn more about how a firm's total exports grow/shrink

  ► By adding or subtracting markets (countries, e.g. Arkolakis 2016)

  ► By shipping more or less frequently (e.g. Alessandria, Kaboski, Midrigan 2010)

► This takes some of the intensive margin growth and turns it into extensive margin growth

► This data let us think more about how the exporting technology works.

Destinations

- ▶ Previous facts largely unchanged at the destination level

- ▶ Fact #2: Stopper rates
    - ▶ Similar role for history
    - ▶ Stopper rates falling in number of months a firm ships
    - ▶ Stopper rates falling in number of markets served

- ▶ Fact #3: Starter rates
    - ▶ Past exporting good predictor of entry into a country
    - ▶ Starter rates rising in number of markets served

- ▶ Export costs may depend on access to other markets...

Destinations

► Fact #4: Intensive margin growth (exports, not exports-sales ratio)

    ► New exporters in a market grow fast for only one year: $starter_{t-2}$ insignificant or negative

Export growth by destination

	Δ_t log export			
	(1)	(2)	(3)	(4)
starter$_{t-1}$	0.245***	0.039**	0.410***	0.068**
stopper$_{t+1}$	-0.948^{***}	-0.280^{***}	-1.042^{***}	-0.251^{***}
starter$_{t-2}$	-0.011	-0.021^{*}		
log exports$_{t-1}$	-0.184^{***}	-0.147^{***}		
log destinations$_{t-1}$	-0.077^{***}	-0.071^{***}	0.070**	
log months$_{t-1}$	0.033***		0.071***	
log total exports$_{t-1}$	0.105***	0.077***	-0.135^{***}	-0.089^{***}
Δ_t log months		1.034***		0.988***
Δ_t log destinations				0.146***
Market	Country	Country	World	World
N	131,282	131,282	50,192	50,192
adj. R^2	0.116	0.445	0.128	0.474

Columns 1 and 2 include country-year fixed effects. Columns 3 and 4 include year fixed effects.

Shipment frequency

Fact #5: Most firms import or export a few times per year. Shipment size increases, and frequency decreases, in distance. Trade grows through more frequent and larger shipments.

► A role for inventories

► Suggests that exporters face fixed per-shipment costs

Micro data: Summary

1. Past export participation is the main predictor of current export participation.

2. Exporter exit rates fall with past export intensity and time in the export market.

3. The exporter entry rate is low but is increasing in size and past export activity.

4. Export intensity rises with time in the export market.

5. Most firms import or export a few times per year. Shipment size increases, and frequency decreases, in distance. Trade grows through more frequent and larger shipments.

Aggregate effects of firm-dynamics

▶ Firm-level dynamics are slow: The small size, high exit rate, and slow growth of new exporters means that exports are reallocated away from existing exporters over time.

▶ Next table: What is the cumulative impact of new exporters?
  ▶ After 12 months, 20 percent of exporters are new
  ▶ After 60 months, 36 percent of exporters are new

  ▶ After 12 months, entrants account for 11 percent of exports
 ▶ After 60 months, entrants account for 21 percent of exports

Window (months)	continuation rate				entrants' share		
	1	6	12	36	12	36	60
Panel A: Number							
Firm			80	76	20	30	36
Firm, balanced			85	83	15	21	24
Firm*	64	65	59	41	41	54	63
Firm-destination*	54	63	60	46	40	54	62
Panel B: Export value							
Firm			89	91	11	18	21
Firm, balanced			94	98	6	8	7
Firm*	95	98	98	96	2	7	11
Firm-destination*	85	95	94	92	6	13	19

Panel A: *Continuation rate* is the share of exporters that remain exporters across two windows, e.g., 80 percent of firms who exported in a 12-month window export in the next 12-month window. *Entrant's share* is the share of total exporters accounted for by entrants, e.g., 30 percent of exporters are firms that did not export 36 months prior. Panel B: The columns are defined analogously but for export volumes, rather than firm counts. * From the customs transaction-level data.
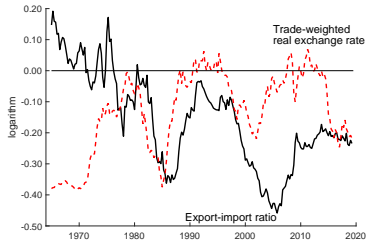
Aggregate data

► Aggregate trade tends to respond slowly to changes in trade barriers or business-cycle conditions

Aggregate trade in the United States
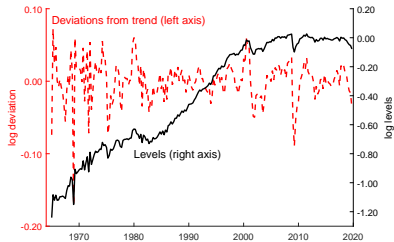
U.S. trade (exports plus imports)

U.S. net trade and real exchange rate

► Levels respond slowly to liberalization (left panel, solid line)

  ► GATT/WTO rounds in 1967, 1979, 1994

► Levels respond with a lag to relative prices (right panel)

Aggregate data

▶ Aggregate trade tends to respond slowly to changes in trade barriers or business-cycle conditions

Fact #7: The long-run response of aggregate trade volumes to changes in trade policy is larger than the short-run response.

Aggregate data

► Aggregate trade tends to respond slowly to changes in trade barriers or business-cycle conditions
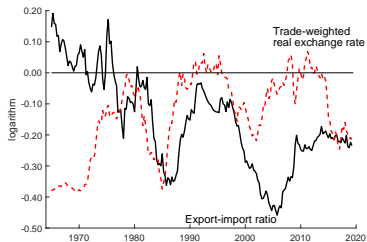
   Fact #7: The long-run response of aggregate trade volumes to changes in trade policy is larger than the short-run response.

► . . . but not always. The 2008 recession featured a sharp fall in trade.

Aggregate trade in the United States
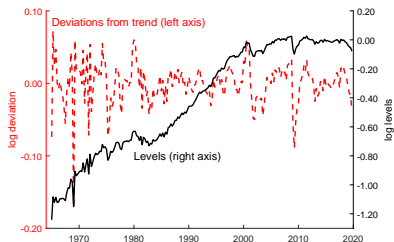
U.S. trade (exports plus imports) U.S. net trade and real exchange rate

- ► Levels respond slowly to liberalization (left panel, solid line)
  - ► GATT/WTO rounds in 1967, 1979, 1994
- ► Levels respond with a lag to relative prices (right panel)
- ► At business-cycle frequencies, trade can fall sharply (left panel, dashed)
  - ► 2008 recession, coronavirus response

Understanding aggregate dynamics

► Time-varying slow and fast responses of trade to shocks are enormous challenges for static models

► Interpreted through a "gravity" model, these dynamics load onto the error term and we learn nothing about them. The dynamics are interpreted as shocks to trade barriers.

► Explicitly dynamic models allow us to learn more about the nature of these "shocks" and the structure of export costs/technologies

References

Alessandria, George, Costas Arkolakis, and Kim J. Ruhl (2021). "Firm Dynamics and Trade." *Annual Review of Economics* 13 (1), pp. 253–280.