ECO364H1S: International Trade Theory

Lecture 11[1]

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[1] Revised slides by Scott Orr

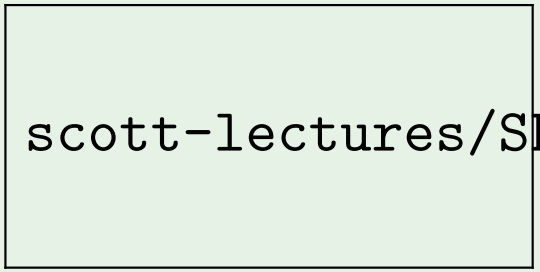
Outline for Today

- Allow for increasing returns in heterogeneous firm models.
  - Motivation: Why are exporters more productive?
  - Heterogeneous Firms with Fixed Costs
  - Heterogeneous Firms with Exporting Costs
- Some empirics.
  - Impact of trade liberalization on productivity
- External economies of scale.
  - Introduction
  - Model
  - "Infant Industry" argument.

Motivation: Exporters and Productivity

- Exporters tend to be "better" in a number of dimensions, compared to non-exporters. (Bernard and Jensen 1999)
  - Relative to plants that only produce for the domestic market, exporters are:
    - More capital intensive.
    - More technology intensive.
    - Pay higher wages.
    - Are more productive.
- Why is this?

Labour Productivity Of Canadian Manufacturers



Source: Melitz and Trefler (2012)

Exporting, Productivity, and Selection

- Popular explanation: Highly productive exporters may be due to *selection*
  - Since exporting is costly, it may be that only the most productive firms can afford to enter export markets
- Note: causality may run in the other direction!
  - Exporters may "learn" to be more productive through exporting.

Exporting, Productivity, and Selection: Theory

- Whether the exporter "productivity premium" is due to selection or learning is an empirical question.
- We are going to first focus on the theory underlying positive selection of exporters
  - How does this export market "selection effect" interact with the market entry selection effects we discussed last class?
  - To do this, we need to add fixed costs to the heterogeneous firm model.

Monopolistic competition with heterogeneous firms

Quick recap of heterogeneous firm model:

- Each firm j faces the same symmetric demand function

$$q_j(p_j) = S\left[\frac{1}{n} - b\left(p_j - \bar{p}\right)\right]$$

- Different firms have different marginal costs c_j

$$TC_j = c_j q_j$$

- We showed last class that:
  - In equilibrium there is a cutoff marginal cost, c^*, such that any firm with $c_j > c^*$ exits the market
  - Trade integration increases c^*, forcing the least productive firms out the market.
- Let's now add increasing returns to scale to the model:

$$TC_j = c_j q_j + F$$

- F is not sunk (i.e. rent)!

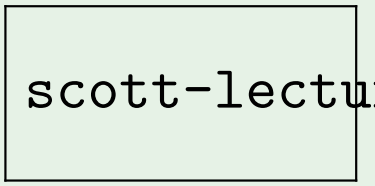
Heterogeneous Firms and Fixed Costs

- Each firm still prices according to the first-order condition:
  - $MR_j = MC_j$
- Note that by definition fixed costs do not affect marginal costs.
- Pricing rules for firms is exactly the same.

$$p_j^* = p^*(c_j) = \frac{1}{2}\left(\frac{1}{bn} + \bar{p} + c_j\right)$$

- The addition of fixed costs makes the cutoff marginal cost, c^*, lower.
  - No longer equal to the "choke price"

Pricing, Quantity, and Profits by Costs



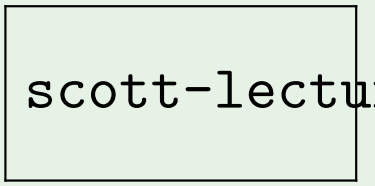
Costs, productivity, and profits

- Since pricing rule has not changed, operating profits simply given by:

$$\pi(c_j) = \frac{Sb}{4}\left(\frac{1}{bn} + \bar{p} - c_j\right)^2 - F$$

  - Lower cost firms still earn higher profits.
  - $\pi(c^*) = 0$ defines the cutoff cost.
    - Can use the above expression for c^* algebraically (as a function of $\bar{p}, n, S$, and F)
    - Practice this on your own
- Firms with $c_j > c^*$ exit.

Profits for different costs



Export market selection

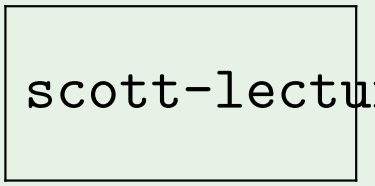
Now suppose that home (h) firms can choose to export to an identical foreign country.

- Key assumption: Exporting is costly (E.g. Setting up a shipping route)
  - Suppose each firm must pay F_x per period to access export market.
    - In *addition* to the operating fixed costs F.
    - This guarantees that if a firm exports, they will also serve the domestic market.
  - We will just consider fixed costs to exporting.
    - We could add variable shipping costs to the model as well, but the qualitative results would not change.

Who exports?

- Key trade-off:
  - Larger market: $\pi \uparrow$
  - But have to pay F_x: $\pi \downarrow$
- Only larger, productive firms benefit from increased market size enough to justify paying the export costs:

Export Versus Dometisc Profits



Export Versus Dometisc Profits

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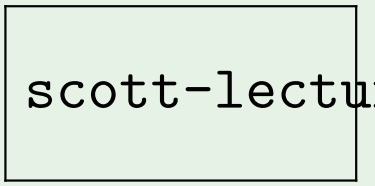
Export Versus Dometisc Profits



Export market selection

With costly export markets:

- Only highly productive (low cost) firms earn higher profits by exporting $\rightarrow$ positive selection into export markets.
  - Firms with $c \leq c_X^*$
- Medium productivity firms only serve the domestic market
  - Firms with $c_X^* < c \leq c^*$
- Low productivity firms exit.
  - Firms with $c^* < c$

Trade liberalization with export costs

What does trade liberalization do?

- Convenient to think of this as a fall in F_x
  - We shall assume that F_x falls both for the foreign country *and* home country.
- Could also think of this as a fall in variable trade costs, but qualitative results are about the same.

We shall consider falling trade costs in two steps:

1. Direct effect: Increased access to foreign markets.
2. Indirect effect: Increased competition.

Direct effect of falling export costs

- If it becomes cheaper to enter export markets, we should see more export market entry.
  - c_X^* will *fall*.
  - More firms enter export markets, but these firms are marginally less productive.

Falling Export Costs: Direct Effect

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Indirect effect of falling export costs: Increased competition

Recall that we are assuming that F_x is falling in both the home and foreign market.

- Since more home firms enter the export (foreign) market, more foreign firms should enter the home market as well.
- Number of firms has to rise ($\uparrow n$)
- Extra competition drives down the profits that be earned domestically and by exporting

Falling Export Costs: Competition Effect

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Falling Export Costs: Overall Effect

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Falling Export Costs: Initial Cost Cutoffs

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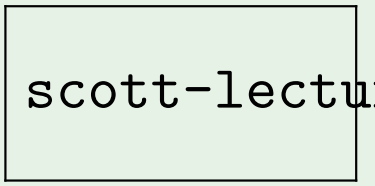
Falling Export Costs: Change in Cost Cutoffs



Falling Export Costs: Entry and Exit

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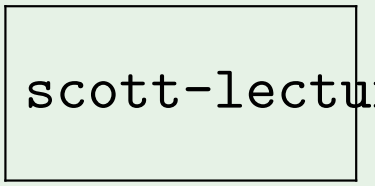
Falling Export Costs: Final Cost Cutoffs



Trade liberalization with heterogeneous firms and fixed export costs: Conclusion

- Highest cost firms are forced out of the market.
- More firms select into exporting.
  - At the margin, these are less productive (higher cost) firms.
- Consumers still enjoy variety gains ($n \uparrow$)
- Allocative gains from trade due to exit of highest cost firms.

Trefler (2004): Effect of Canada U.S. FTA on productivity

- While NAFTA went into force in 1993, the Canadian-American Free Trade Agreement (FTA) was enacted in 1989.
- Involved tariff concessions by both Canada and the United States.
- Prior to this one in four Canadian industries were protected by average stated tariffs of at least 10%.
- Canadian firms were protected by average tariffs of 8.1% with an average effective tariff of 16.1%.

We have talked a lot about gains- what about loses?

- Canadian manufacturing fell by 5% (100,000 jobs!) following implementation of the FTA.
  - What is the counterfactual? Unclear.
- Short-run labour adjustment costs due to trade liberalization
  - However, within ten years, employment rates had recovered.
    - Gains are generally a long-run phenomenon.

Main findings of Trefler (2004):

- The least productive firms in the contracted/suffered in Canadian sectors that benefited from tariff cuts.
  - Explicitly predicted by the above model as the most productive firms enhance their productive scale.
- In formerly sheltered industries, labour productivity (value added per worker) grew by 15%.
  - Approximately half came from reallocation across firms and the remainder from *within* firm improvements.
  - Firm heterogeneity model explains the first half.
    - What explains within-firm improvements?
- Tradeoff: Employment fell in these industries by 12%.
  - Do the long-run productivity benefits outweigh the short-run costs?

Lileeva and Trefler (2010)

Further examination of the "within-firm" productivity improvements surrounding the FTA.

- "Improved Access to Foreign Markets Raises Plant Level Productivity... For Some Plants."
- Examines whether access to foreign markets encourages firms to *invest* in productivity improvements.
  - Use plants specific tariff cuts to disentangle this effect.

Lileeva and Trefler (2010): Main Findings

- Magnitude of different productivity gains in manufacturing:
  - Exit of least productive plants increased average productivity by 4.3 %
  - Increased market share of exporters raised average productivity by 4.1%
  - Within-firm productivity improvements increased average productivity by 4.8-5.6%

Lileeva and Trefler (2010): Evidence on Mechanisms

Provide further evidence on the within-firm productivity improvements.

- Theory:
  - If productivity improvements driven by incentives to invest, lower productivity firms that begin exporting for the first time will have the highest incentives to invest in productivity improvements.
  - Roughly, these firms need to "catch up" the most if they want to compete in world markets!
- We see the largest productivity gains for the least productive firms that entered the export market.
- Using survey data, also find that least productive, new exporters, were the most likely to adopt new technologies.

Motivation: Industrial Clusters

Many industries tend to concentrate in a single location:

- Some well-known examples:
  - Silicon Valley
  - Hollywood
  - Investment banking in New York
- Why does this happen?

External Economies of Scale

Alfred Marshall argued that industrial clusters tend to occur in industries characterized by *external* economies of scale.

- **External economies of scale**: Average costs fall as the output of the industry increases.
  - Basic Idea: If being located near other firms generates "positive spillovers," average cost may fall as more and more firms enter the same area.
  - Key difference relative to internal economies of scale:
    - Each firm takes industry scale (or industry average costs) as *exogenous*.

Sources of Extrernal Economies of Scale

What generates external economies of scale?

1. Specialized suppliers
2. Labour market pooling
3. Knowledge spillovers

Let's consider each of these in turn.

Specialized Suppliers

- Many industries require require inputs that are highly specialized inputs.
  - E.g. semiconducters and computer chips.
- Problem: Firms may not wish to specialize in producing highly specialized inputs if market size is too small.
  - Could always produce inputs internally, but loss in efficiency
- Solution: If many "downstream" firms locate in the same area, generates a large enough market size for independent input suppliers to be viable (the "upstream" firms).
  - Note gains due to specialized suppliers will tend to generate "path dependence."
    - Once some input suppliers start to locate in the same area (which could be anywhere!), very little incentive for downstream firms to locate anywhere else!

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Specialized Suppliers

"...engineers left established semiconductor companies to start firms that manufactured capitals goods such as diffusion ovens, step-and-repeat cameras, and testers, and materials and components such as photomasks, testing jigs, and specialized chemicals.... This independent equipment sector promoted the continuing formation of semiconductor firms by freeing individual producers from the expense of developing capital equipment internally and by spreading the costs of development. It also reinforced the tendency towards industrial localization, as most the specialized inputs were not available elsewhere in the country. "

(On specialized suppliers in Silicon Valley, quoted in KOM Ch. 7)

Labor Market Pooling

Similar to specialized suppliers, except applied to a particular factor, *labour*.

- Some jobs require highly specialized skills.
  - Film animation or special effects production.
- Workers with highly specialized skills are going to want to locate in regions with lots of potential employers.
  - Easier to find/change jobs.
- Firms also want to locate in regions with lots of potential employees
  - Less likely to have to deal with labour shortages.
- These gains are very important when demand is highly uncertain.

Labor Market Pooling: Example

Consider a world with two film studios and 200 animators.

- Both studios face *idiosyncratic* demand uncertainty:
  - If studio-level demand is high, will want hire 150 workers.
  - If demand is low, will only want to hire 50 workers.
- Let's consider what happens if the studios locate in different cities, and when they locate in the same city

Labour Market Pooling: Example

Suppose both studios locate in different cities.

- Suppose 100 animators go to each city.
- If demand is high for either firm, there is a labour shortage!
- If demand is low for either firm, some animators are unemployed!

At least one side of the market is hurt no matter what!

Labour Market Pooling: Example

Suppose both studios locate in the same cities.

- All animators are now located in the same place as well.
- There will only be labour shortage if demand is high for *both* firms!
- Similarly, there will only be unemployment if demand if low for both firms.
- Whenever one firm has high demand, and the other has low demand, the market clears.

This environment is much less risky.

Labour Market Pooling: Silicon Valley

"...it wasn't a big catastrophe if you quit your job on Friday and have another job on Monday... You didn't necessarily have to tell your wife. You just drove off in another direction on Monday morning." (Silicon Valley engineer)

Knowledge Spillovers

To remain competitive highly innovative industries, it is crucial that one remain near the "technology frontier."

- People like to talk about what they do.
  - Informal exchange of ideas by employees after-hours may help keep one's firm up to date.

"Every year there was some place, the Wagon Wheel, Chez Yvonne, Rickey's, the Roundhouse, where members of this esoteric fraternity, the young men and women of the semiconductor industry, would head after work to have a drink and gossip and trade war stories about phase-jitters, phantom circuits, bubble memories, pulse trains, bounceless contracts, burst modes, leapfrog tests, p-n junctions, sleeping sickness modes, slow-death episodes, RAMs, NAKs, MOSes, PCMs, PROM blowers, PROM blasters, and teramagnitudes..." (Tom Wolfe on early Silicon Valley)

External Economies of Scale: Model

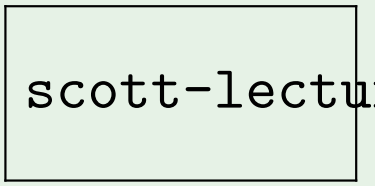
We are going to consider a perfectly competitive model of external economies of scale.

- Partly for historical reasons
  - External economies were first developed in this context
- Partly for simplicity
  - One "type" of good, one price $\rightarrow$ much easier to solve

Basic environment:

- Large number of perfectly competitive and identical firms, each of whom supplies a negligible portion of industry output.
  - Each firm takes industry output as given.
- Average costs fall with industry output.
- The economy is in a long-run equilibrium, so $P = AC$.

External Economies of Scale Equilibrium

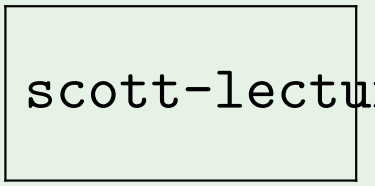


Trade and External Economies of Scale

What happens in an environment with external economies and trade?

- Suppose Japan (JPN) and the United States (US) have the *exact same* inverse demand function for microchips, but different average cost curves.
  - Let's suppose JPN has a cost advantage in microchip production ($AC_{JPN} < AC_{US}$)
- External returns to scale are "local" in the sense that average costs fall with industry output *within a country.*
  - Higher output in Japan does not help the US, and *vice versa*.

Autarky Equilibria



Opening up to trade with external economies of scale

- Since ($P^A_{JPN} < P^A_{US}$), we should expect Japan to export microchips with free trade.
  - With external economies, Japan takes over the whole market.
  - Moreover, the new world price will lie *below* both Japan and the US autarky price!
    - Different prediction from standard comparative advantage models developed at the beginning of the course, where we would expect $P^A_{JPN} < P^T_{world} < P^A_{US}$

Free Trade Equilibrium

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Gains from trade with external economies

- Efficiency gains,
  - Increased Market Size $\rightarrow$ Cost savings due to (industry level) economies of scale.
- Consumer gains
  - Price of microchips has fallen in both countries!

Gains from trade look pretty good here!

Gains from trade with external economies

...However

- Models with external economies of scale *do not* always imply that the right country will take over the industry!
  - Due to the possibility of technological "lock-in", a non-comparative advantage country could take over the entire market!
  - To see this, suppose that the US had a much larger microchip market than Japan in Autarky.

Autarky: Small Japanese market, large US market

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Trade: Small Japanese market, large US market

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Trade: Small Japanese market, large US market

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Trade: Small Japanese market, large US market

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"Lock in" and the gains from trade

- Since U.S. already had a larger microchip before opening up to trade, they take the whole world market.
  - U.S. producers were able to price below Japanese producers average costs
  - Japanese producers will not price that low since that will earn them negative profits.
  - Nobody will buy from Japan if they price at their current (autarky) average cost.
    - Industry output in Japan goes to zero, even though they "should" take over the entire market!
  - We have smaller gains from trade then we "could" have.
    - Although there are still gains from trade.

"Infant industry" argument: A case for trade protection?

Arguments based on the inefficiency of "lock-in" are sometimes be used to justify limiting free trade.

- Trade protection may be warranted if:
  - The low-cost country discovered the technology relatively late
  - The low-cost country has sufficiently large demand for the industry.
- Let's consider a world where the U.S. discovered microchips first.
  - Japan has yet to build a microchip industry, but has a natural cost advantage.

Trade equilibrium with Japan as a "new entrant"

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"Lock-in" and new entrants

- Since Japan currently does not have a developed microchip industry, their US competitors can price below their (current) average costs.
  - If Japan can shelter this industry from foreign competition, this may allow them to start moving down their average cost curve.
  - Interestingly, Japan would be better of with autarky in this case.

Gains from autarky?

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Eventual gains from trade?

- Japan is better of with autarky, compared to the free-trade equilibrium.
- Note, however, that once they reached an autarky equilibrium, there are now gains from trade!
  - Japan would now be able to out compete U.S. firms, and take over the entire market.
  - This would allow them to move even further down their average cost curve.

Eventual gains from trade

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Evaluating the Infant Industry Argument

- The "infant industry" argument is a valid case for *temporary* trade protection.
  - Greater gains both for home and the rest of world to trade liberalization once the industry is "mature."
- Larger issue is identifying when protection is actually appropriate.
  - E.g. Trade protection would not help Japan if the U.S. had a much larger market.
  - How do we know when an economy has a cost advantage?

Conclusion

What have covered today:

- Increasing returns and firm heterogeneity
  - More productive firms with self-select into exporting if it is costly.
  - Decreased export costs lead to increased competition, creating allocative gains from trade as high-cost firms exit the domestic market.
- Empirics
  - Both selection and within firm improvements matter for explaining trade induced productivity growth.
- External returns to scale.
  - Generates efficiency gains from trade due to increasing returns to scale.
  - "Lock-in" made lead to inefficiencies, which trade barriers may help alleviate.