Trade Costs, Reciprocal Dumping, the Gravity Model and Heterogeneous Firms: Chapter 13 notes

Some of the mathematics in chapter 13 of the text is pretty tough going and not worth developing in class. With these notes I'll overview the main points and highlight the primary messages to keep in mind. Also pay attention to the empirical evidence in Section 13.8, which I will email to you.

Trade Costs

So far we have assume autarky or perfectly free ("frictionless") trade. But there are many barriers to trade, which come in 3 general types:

1. Transportation costs (port costs, freight and insurance, costs of getting products to and from port)
2. Formal trade restrictions (tariffs, export taxes, non-tariff barriers)
3. Differences in standards and regulations that may limit trade, though not on purpose. These exist for some other policy reasons.

Here we focus on number 1, leaving tariffs to later.

There is one big difference between tariffs and transport costs. TARIFFS GENERATE PUBLIC REVENUE AND (IN PRINCIPLE) DO NOT USE UP RESOURCES. (AND QUOTAS GENERATE RENTS AND DO NOT USE UP RESOURCES, THOUGH THAT IS DEBATABLE.) TRANSPORT COSTS USE REAL RESOURCES IN THE ACT OF TRANSPORTING GOODS. SO THESE ARE REAL COSTS TO BE CONSIDERED IN MODELS AND WELFARE ANALYSIS.

From this point on "transport costs" and "trade costs" mean the same thing.

2 types of trade costs:

Specific dollar cost t of moving a unit of a good. So the cost of supplying foreign market is mc + t.

Proportional or "iceberg" trade costs: a percentage τ does not make it to the destination. Ship quantity X^e and only $X^m = X^e/(1+\tau)$ arrives. ("e" means exporter and "m" means importer.) Usually written as $t = (1+\tau)$ so $X^m = X^e/t$. $t = 1$ means no trade costs. (THIS IS KIND OF A WEIRD ASSUMPTION; IT'S MADE SO WE DON'T HAVE TO INCLUDE SHIPPERS AND PORT WORKERS IN THE MODEL.)

The relationship between prices is easy. If 10% of goods don't arrive the importer in effect is paying 10% more for the quantity shipped (put differently, importer would have to pay 10% more to get the same quantity).

That is, $p^m = p^e(1+\tau)$, or $p^m = p^e t$. So if p^e is the "free on board (FOB)" price received by exporter, then p^m is the "cost, insurance and freight (CIF)" price paid by importer. Example: let $p^e = \$50$ and $\tau = 0.2$ (20%). Then $p^m = \$60$.

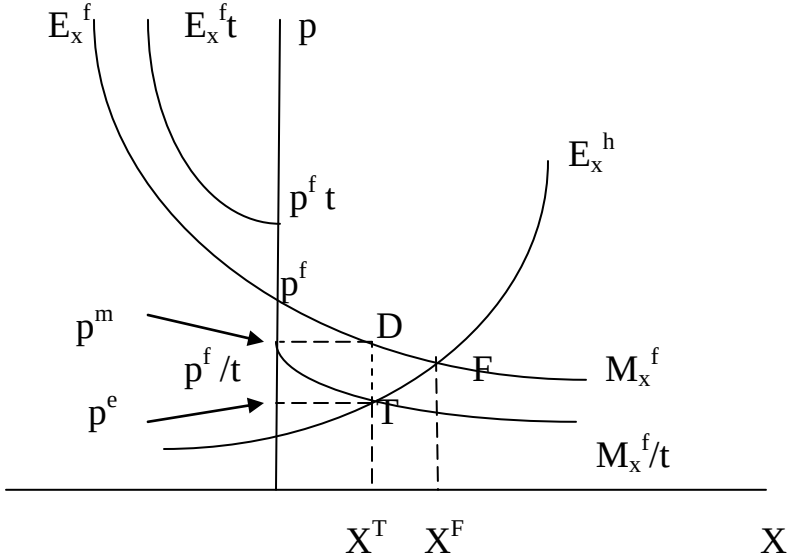
In the iceberg story, if $p^e = \$50$ and $X = 100$ then exporter revenue = \$5,000. This is what importer has to pay for 10% less X: $p^m (100/1.2) = p^m (83.3)$. So $p^m = \$5{,}000/(83.3) = \$60$.

Simple story: what do trade costs do in a simple HO world?

Consider the trade diagram on the next page where (small country) f imports X at low prices and exports X at high prices and there is a given world price p*. There are iceberg trade costs $t = (1+\tau)$. No transport costs on Y.

The country would choose not to import if $p^*t > p^f$ (for then the world price plus transport costs would be higher than domestic price). So it is indifferent to importing if $p^* = p^f/t$ and will import if p* is less than that.

The country would choose not to export if $p^* < p^f t$ (for then the world price would not be enough to compensate exporter for the trade costs). So it is indifferent to exporting if $p^* = p^f t$ and exports if p^* is higher than that. So the effect of the trade cost is to reduce both import demand and export supply behavior. It shifts import demand down by factor 1/t and shifts export supply up by factor t. The range between $p^f t$ and p^f /t become prices where f would not trade.



Something like this will be true for h also, where trade costs would distort upward its export supply curve. However, the shift in the f import-demand curve fully embodies the trade cost so we don't have to shift h's supply curve to show the impact. (In practice, there would be some sharing of these costs.)

It should be evident that:

1. Trade costs diminish the volume of trade. Without them we're at F; with them we're at T.
2. Trade costs could eliminate trade if they are high enough.
3. The trade costs drive a wedge between export price (horizontal line to axis from T) and importer price (horizontal line to axis from D). Can see that $p^m = p^e t$ (where p^m is price in f and p^e is price in h).

What can we say about welfare? Compared to free trade at F, there is a loss in "import surplus" (analogous to consumer surplus) to home and a loss in "export surplus" (analogous to producer surplus). There is no revenue generated. The deadweight loss is the area p^m p^eTFD. (Note: this area incorporates the loss in goods from shipping.)

See also Figure 13.2 in the diagram, which shows this limited trade outcome on a PPF structure where h is labor-abundant, X is labor-intensive, f is capital-abundant and Y is capital-intensive. Countries have identical and homogeneous preferences. Without trade costs, in free trade h would produce on PPF to the right of X_h (more X, less Y) and f would produce to the left of X_f (more Y, less X). So transport costs limit specialization according to comparative advantage. Also, without transport costs both would consume on some indifference curve higher than shown at a common p*. But the trade costs cause a price divergence with a higher price of X in the importer (f) and a lower price in the exporter (h). In turn, we do not get full FPE (though there is a tendency toward it because there is some specialization relative to autarky).

Question: what would happen to real labor and capital incomes in these 2 countries starting from free trade and then imposing these trade costs?

Trade Costs in a Duopoly Model

Ignore this section (13.3) for now. We will look at duopoly models and tariffs later. But for now there is an interesting result we can describe intuitively.

Suppose there are 2 identical firms in autarky without trade costs. As we know from before if you integrate the 2 markets in free trade, each of these firms will export to the other so there is "two-way trade" or "intra-industry trade" in this good. Actually such trade is not necessary, the competition alone would drive down price and get the PC gain.

Now suppose there are *specific* trade costs, so that each firm has a marginal cost of (mc) selling in its home market but a marginal cost of (mc + t) selling in the foreign market. Because these goods are homogeneous, the h good must sell in f for the same consumer price as the f good. But because of the transport cost the h firm must accept a *lower* price in f (to pay for the trade cost) than it gets at home.

That is, in equilibrium:

$p_x^{hh} > p_x^{hf}$ and $p_x^{ff} > p_x^{fh}$.

Both firms sell abroad at a price lower than they receive for the same good in their own market. This is so-called "reciprocal dumping".

It has these interesting welfare effects:

1. PC gain due to competition, benefiting consumers.
2. Loss in profits, damaging producers.
3. "Cross-hauling" trade costs, which use up resources (paid by producers so this is also lost profits).

This leads to the odd non-monotonic relationship between t and welfare in Figure 13.3. High trade costs raise profits by reducing competition (good for firms, bad for consumers). But the profit gain can outweigh the CS loss as t rises in this range, increasing welfare. Low trade costs expand competition and benefit consumers. But as t gets low the resource costs in cross-hauling go down, which can raise profits. Welfare is highest at zero trade costs (this is just the standard duopoly free trade case).

Monopolistic Competition and the Gravity Model of Trade

See Section 13.8, which I circulated.

Heterogeneous Firms in International Trade

Again, this will be an intuitive discussion only. The material in Section 13.6 in the text is halfway rigorous but the actual models are quite difficult.

First, note from Section 13.8 that exporting firms are bigger and more productive than non-exporting firms. Also the effect of trade liberalization seems to be to increase output in the larger, more productive firms while tending to shut down the smaller, less productive firms.

What kind of theory could explain this? Outlines of the famous Melitz (2003) model:

1. Suppose firms must pay some cost before deciding whether to enter a domestic and/or export market. This cost (maybe R&D) gives them the opportunity to draw a level of productivity (or size) from a random distribution. Some firms get low productivity draws, some in the middle, some get high productivity draws. Equivalently think of these as high mc, middle mc, and low mc (see Figure 13.6, where firms are arranged on a cumulative distribution function, with the lowest-cost firms on the left and the highest-cost firms on the right).
2. Suppose there is a fixed cost of selling at the home location (fc_d) and a further fixed cost of exporting (fc_x). So a firm has these choices:
    a. Don't produce.
    b. Produce only for the home market and pay fc_d.
    c. Produce for the home and foreign markets and pay ($fc_d + fc_x$).

It should be evident that the least productive (highest-cost) firms will choose a., the middle firms will choose b. and the highly productive (lowest-cost) firms will choose c. Further, if high-productivity firms are also larger (they generally are) we will observe bigger firms exporting more, and more frequently, than smaller firms. See again Figure 13.6.

Analytically, to determine which firms make which decisions we solve for "cutoff" levels of marginal costs at which the marginal firm is indifferent between one decision and the next. So mc_d is that level of marginal costs at which operating profits from selling domestically just equal fc_d and the marginal firm makes no profits. Firms with higher mc do not produce at all, firms with lower mc make profits on the domestic market. Next we define mc_x as the level of marginal costs at which operating profits from exporting just cover fixed costs of exporting. Firms with lower mc make profits on both domestic sales and exports.

So if:

- $mc > mc_d$ the firm does not produce.
- $mc_d \geq mc > mc_x$ the firm produces at home and sells at home.
- $mc_x \geq mc$ the firm produces at home and exports.

(As you might imagine others have extended this reasoning to the choice to become a multinational firm through investing abroad.)

Now analyzing the impacts of trade liberalization, or cuts in trade costs, is intuitively straightforward but technically difficult. What matters is whether the reduce variable trade costs (a lower Φ in the text) permit more firms to overcome the fixed costs of exporting.

In the most intuitive case, lower trade costs between h and f make each market more open. So more h firms will find it profitable to export to f (and vice versa). The cutoff mc_x is higher, meaning that a margin of firms that were not exporting now choose to do so.

On the other hand, with more firms exporting, each market becomes more competitive, which makes domestic production less profitable. The cutoff mc_d is lower, meaning that a margin of firms that were selling only at home now exit the market. It's in this sense that we conclude the least-productive firms are the ones pushed out of business ("rationalization" gain). Note in Figure 13.7 that there are more exporters but fewer strictly domestic firms. Note closely: although some firms that had been producing only for the home market now export, that does

not increase the number of firms in the market. But some higher-cost firms exit, so the net number of firms producing in the world goes down.

This means in turn the impact on welfare is a bit trickier. Here are the basic tradeoffs:

1. Prices are lower due to greater competition (lower price index), which benefits consumers.
2. The number of imported varieties grows but the number of domestic varieties falls (if there is one variety per firm, as assumed.) So there may or may not be a variety gain (the text considers a special case where these changes just offset each other so no variety gain). In fact, since trade opening favors expansion of larger firms there may well be a net reduction in variety.
3. The total number of firms operating is lower, generating both a gain from lower average costs (due to IRS) and a gain from rationalization (saving on fixed costs from firms that exit).

In general we would anticipate economies being better off due to the combined effect of greater productivity and lower prices. And one important caveat: if large firms tend to produce multiple products (they do) there can be a net variety gain. Further, with many countries in the world we would expect the large firms to choose to enter more markets. Here is a very important observation:

Trade cost reduction is likely to induce surviving firms to sell more output per firm of existing products (competition at the "*intensive margin*") .

But it is also likely to induce surviving firms to sell more product varieties (within their product lines) in existing markets and to enter into more markets (competition at the "*extensive margin*").

The latter is a very important source of gains from competition.

The empirical evidence in Section 13.8 shows there is evidence to support all of this, primarily the idea that trade openness raises average productivity and induces competition at both intensive and extensive margins.