

International Trade

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Virtually all economists, liberal or conservative, believe that free (or freer) trade is a good thing: good for consumers, good for workers. Why? Because consumers are able to buy products from the cheapest vendor, and workers are able to take jobs that offer the highest wages. But if trade is such a good idea, why do non-economists find the idea so puzzling, and even dangerous? The purpose of this document is to outline the modern theory of international trade, which is a central support of the current trend toward globalization.

Ricardo's theory of trade

David Ricardo was one of the most influential economists of the early nineteenth century, but he came to economics by a circuitous route. Born in 1772 to a Jewish family recently arrived in London from Amsterdam, he broke off relations with his family (and they with him) to avoid an arranged marriage — he married a Quaker instead. He set himself up as a government securities dealer and retired at age 41 after becoming, in his own words, ‘sufficiently rich to satisfy all my desires and the reasonable desires of all those about me’. Looking for something to occupy his time, he developed the essential principles of the modern theory of international trade. He was later elected as an independent to the British Parliament and served until his death in 1823.

Many people of Ricardo's day (and ours!) regarded trade as a zero-sum activity: if you gain from trade, then I must lose. His insight was that both sides typically benefit, even if it appears that one has an *absolute productivity advantage* over the other. In his words, each country has a *comparative advantage*.

We develop Ricardo's theory in a particularly simple setting: two countries produce and consume two products, and both products are produced with labor alone. In many respects this version of the theory is unrealistic, but the lack of realism is exactly what makes the analysis simple and understandable. We'll discuss later whether the lack of realism plays an undue role in our conclusions. (For the most part, it does not).

To be specific, let us call the countries the US and Mexico and the products manufactures and services. We start by specifying the productivity levels: the quantities of product (either manufactures or services) in either country produced with one unit of labor. The values are reported in Table 1. We also assume that the labor force is the same in the two countries: $\bar{L} = 100$.

	Services	Manufactures
US	$A_S = 20$	$A_M = 10$
Mexico (country *)	$A_S^* = 5$	$A_M^* = 5$

Table 1: Productivity levels.

With the numbers listed, one unit of labor produces more in the US whether it's used to produce manufactures or services. That is, the US has an *absolute advantage* in producing either good. A number of factors might play a role here: perhaps the weather is better, labor is better educated, the distribution system is more efficient, or regulations are less intrusive.

The question is: would Mexico and the US both benefit from completely free trade, relative to a position of *autarky* (no trade at all)? The answer is yes, but let's run through the argument. Suppose Mexico had high enough tariffs or other barriers to kill off trade altogether. Then Mexico would likely produce both products. How much of each? It could produce manufactures in quantity $Y_M^* = A_M^* \bar{L} = 5 \times 100 = 500$ or services in quantity $Y_S^* = A_S^* \bar{L} = 5 \times 100 = 500$. It could also produce any combination in between, as shown in Figure 1 (the solid line). We call the solid line the *possibility frontier* for Mexico, since every point on the line represents a possible consumption combination. In this example, the line has a one-for-one tradeoff between manufactures and services, implying a *relative price* of $q = p_M/p_S = A_S^*/A_M^* = 1$.

What happens if Mexico and the US allow trade? It depends on the relative price q . Suppose Mexico can export manufactures at a relative price of $q > 1$ manufactures for each unit of services. Then Mexico will produce only manufactures. Why? Because it can produce each at the same cost ($1/5 = 0.2$ units of labor), but manufactures sell for more on the world market. As a country, it faces strictly better possibilities if it trades rather than producing both goods itself. In that case it produces only manufactures ($Y_M^* = 500$), then trades some for services at a rate of q manufactures for every unit of services, which is better than the one-for-one tradeoff it got from producing services itself. (See the dashed line in Figure 1, which is above the solid line). [As a check on your understanding: How would this work if $q < 1$? What would Mexico produce? What would its possibility frontier look like? Would Mexico still benefit from trade?]

In short, trade benefits Mexico, even though it is less productive than the US for both products. Similar reasoning shows that the US would benefit from trade, too. [Another check: What is the possibility frontier for the US if there's no trade?]

Ricardo had a rationale for these gains from trade: even though Mexico is less productive absolutely ($A_M > A_M^*$ and $A_S > A_S^*$), it is comparatively more productive in manufactures than the US ($A_M^*/A_S^* > A_M/A_S$). Conversely, the US is comparatively more productive in services. If each

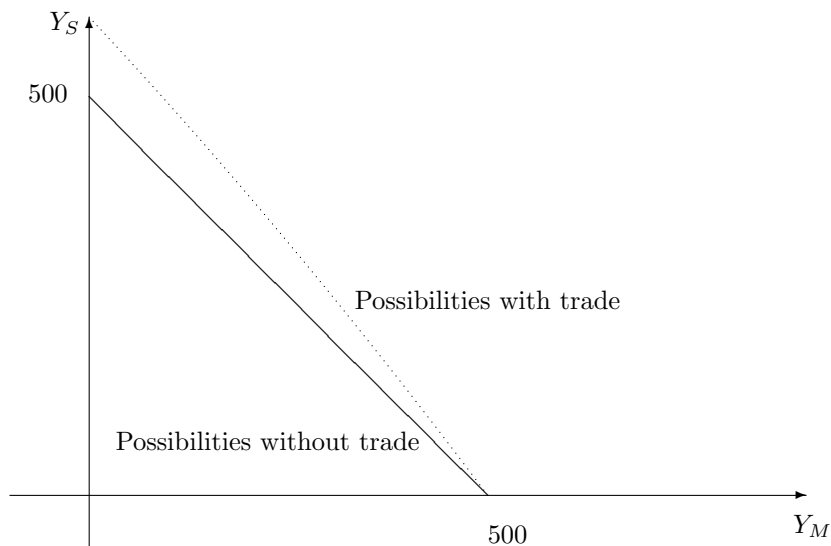


Figure 1: Gains from Trade in Mexico.

country produces the good for which it is comparatively most productive, then world productivity rises and both countries benefit. Ricardo referred to this as the theory of comparative advantage.

Digging a little deeper

Moving to free trade is similar to an increase in productivity: when you shift production to high productivity products, aggregate productivity rises. A simple analogy with capital markets may help. Countries with good capital markets allocate capital more effectively to the high-return projects and increase aggregate productivity as a result. This is a natural feature of trade models, but it takes some effort to work out the details, even in a setting as simple as our two-country example. If you're averse to math, you might skip to the next section the first time through.

Our goal is to compare production and consumption in two cases: one with no trade, and one with completely free trade (no tariffs or transportation costs). The comparison is somewhat extreme, but the hope is that it will give us the flavor of less extreme moves toward freer trade. In each case, we need to find a *competitive equilibrium*. Competitive means that consumers and producers are small, and take prices as given. (No monopolies allowed here!) Formally, a competitive equilibrium is a set of prices and quantities that satisfy three conditions:

1. Consumers are on their demand curves: they buy what they want at the given prices.
2. Producers make zero profits (the effect of competition).
3. Total production equals total consumption for each product.

Finding an equilibrium can be difficult, particularly if you have a low threshold for algebra, but we can readily verify a proposed equilibrium by checking the three conditions.

Consumers. The citizens of each country consume manufactures and services. They also work for the firms, getting a wage w for each unit of labor. Each consumer (we can index them by i) earns an income $wl(i)$ (for simplicity, we assume that $l(i)$ is given). Obviously, $\bar{L} = \sum_i l(i)$. How do consumers spend their income? Let a consumer i have demand functions for manufactures and services given by

$$\begin{aligned} c_M(i) &= \theta \frac{wl(i)}{p_M} \\ c_S(i) &= (1 - \theta) \frac{wl(i)}{p_S}. \end{aligned}$$

where θ is a parameter $0 < \theta < 1$. These demand functions imply that consumer i spends a constant fraction θ of her income $wl(i)$ on manufactures and the complementary fraction $1 - \theta$ on services. Both demands are increasing in the consumer's income. The demand for manufactures is decreasing in the price p_M of manufactures and similarly the demand for services is decreasing in p_S .

Summing across all consumers, we have the aggregate demand for manufactures and services

$$\begin{aligned} C_M &\equiv \sum_i c_M(i) = \theta \frac{w\bar{L}}{p_M} \\ C_S &\equiv \sum_i c_S(i) = (1 - \theta) \frac{w\bar{L}}{p_S}. \end{aligned}$$

which uses $\bar{L} = \sum_i l(i)$. In the numerical examples below, we'll assume that $\theta = 0.25$ in both countries.

Producers. Labor in a given country sells for w per unit, with w potentially differing across countries. A producer of manufactures (say) will hire labor at cost w per unit and sell manufactures, getting a profit of

$$\begin{aligned} \text{Profit} &= p_M Y_M - w L_M \\ &= p_M A_M L_M - w L_M. \end{aligned}$$

If $p_M A_M < w$, labor is too expensive to hire relative to the price the firm receives and so no manufactures will be produced. But if $p_M A_M > w$, labor is cheap relative to the price the firm receives. Firms that produce manufactures will make very large profits. Competition among manufacturing producers will drive the price down until $p_M A_M = w$. In short, if manufactures are produced, then the price satisfies $p_M = w/A_M$. Similarly, if services are produced, their price will

be $p_S = w/A_S$. If both manufactures and services are produced (and note: *they need not be*), their relative price will be $q \equiv p_M/p_S = A_S/A_M$.

Equilibrium. To solve the model, we need the demands of consumers and the production decisions of firms to be *mutually consistent*. We need market prices to be such that demand equals supply. If there's no trade, then each country must separately produce enough of both goods to satisfy their consumers. If there's trade, then the total production by both country's firms must equal the total consumption of both country's consumers.

No trade. If there's no trade, then each country will have to produce both products to satisfy that country's consumer demand. We can write demand equals supply in each country as

$$\begin{aligned} C_M &= Y_M \\ C_S &= Y_S. \end{aligned}$$

or using the demand functions and the production functions

$$\begin{aligned} \theta \frac{w\bar{L}}{p_M} &= A_M L_M \\ (1 - \theta) \frac{w\bar{L}}{p_S} &= A_S L_S. \end{aligned}$$

Since both goods are produced in each country, $p_M = w/A_M$ and $p_S = w/A_S$. We are free to pick one commodity — manufactures, services or labor — as a 'normalization'. Specifically, we can measure all prices relative to the wage w . Mechanically, we do this by setting $w = 1$ in both countries (but not directly comparable, because they may be measured in different local currencies, say dollars and pesos). Therefore

$$\begin{aligned} p_M &= \frac{1}{A_M} \\ p_S &= \frac{1}{A_S}. \end{aligned}$$

Given these prices, consumption and production of manufactures and services are given by

$$C_M = Y_M = A_M L_M = \theta A_M \bar{L}.$$

and

$$C_S = Y_S = A_S L_S = (1 - \theta) A_S \bar{L}.$$

where again we've used the normalization $w = 1$. To illustrate these calculations, let's run through some numbers using the example in Table 1. Since the total labor input is 100 in either country, national income is $w\bar{L} = 1 \times 100 = 100$ in both Mexico and the US. In the US, prices will be

$$\begin{aligned} p_M &= \frac{1}{A_M} = \frac{1}{10} = 0.10 \\ p_S &= \frac{1}{A_S} = \frac{1}{20} = 0.05, \end{aligned}$$

while the relative price will be

$$q = \frac{p_M}{p_S} = \frac{0.10}{0.05} = 2.$$

At these prices, consumption and production in the US are

$$\begin{aligned} C_M &= \theta A_M \bar{L} = 0.25 \times 10 \times 100 = 250 \\ C_S &= (1 - \theta) A_S \bar{L} = 0.75 \times 20 \times 100 = 1500. \end{aligned}$$

What about Mexico? Using the same method, but with $A_M^* = 5$ and $A_S^* = 5$ as in Table 1, we find that prices are

$$p_M^* = 0.20, \quad p_S^* = 0.20, \quad q^* = 1,$$

while consumption and production are

$$C_M^* = 125, \quad C_S^* = 375.$$

The numbers are summarized in Table 2 for future reference.

Free trade. If there's free trade, we first need to work out which country produces which goods. Since Mexico has a comparative advantage in manufacturing, it seems natural to suppose that Mexico specializes in manufacturing. Given this, the US will specialize in services. So both Mexico and the US will demand manufactures, but only Mexico will produce them. Similarly, both Mexico and the US will demand services, but only the US will produce them. Demand equals supply means

$$\begin{aligned} C_M^* + C_M &= Y_M^* \\ C_S^* + C_S &= Y_S. \end{aligned}$$

Since Mexico specializes in manufactures, all of its labor produces manufactures and $Y_M^* = A_M^* \bar{L}$. Similarly, the US specializes in services and $Y_S = A_S \bar{L}$. So for manufacturing we can write

$$\theta \frac{w^* \bar{L}}{p_M} + \theta \frac{w \bar{L}}{p_M} = A_M^* \bar{L}.$$

The price of manufactures is determined by Mexican conditions, $p_M = w^*/A_M^*$, so this simplifies to

$$\theta(w^* + w) = w^*,$$

or

$$w^* = \frac{\theta}{1 - \theta} w.$$

As before, we are free to pick a normalization, say $w = 1$. With this, we have $w^* = \theta/(1 - \theta)$ and so the price of manufactures is

$$p_M = \frac{\theta}{1 - \theta} \frac{1}{A_M^*}.$$

Similarly, the price of services is

$$p_S = \frac{w}{A_S} = \frac{1}{A_S},$$

and the relative price of manufactures to services is

$$q = \frac{p_M}{p_S} = \frac{\theta}{1 - \theta} \frac{A_S}{A_M^*}.$$

Since there is free international trade, consumers in both countries face the same prices p_M and p_S . With these prices solved for, we can figure out all the consumptions using the demand functions. With our usual numbers from Table 1 and $\theta = 0.25$ we have

$$w^* = \frac{1}{3}, \quad p_M = \frac{1}{15}, \quad p_S = \frac{1}{20}, \quad q = \frac{4}{3},$$

and consumptions

$$C_M^* = 125, \quad C_M = 375, \quad C_S^* = 500, \quad C_S = 1500.$$

You should check yourself that with these consumptions, $C_M^* + C_M = Y_M^*$ and $C_S^* + C_S = Y_S$ so that the world markets for manufactures and services both clear.

Why is the Mexican wage $w^* = 1/3$ lower than the US wage $w = 1$? Because the US is more productive on average than Mexico, so its citizens earn relatively higher wages. The real wage rate in each country is set by the overall level of productivity. Comparative advantage only determines which country produces which goods. Because Mexican productivity is lower, its citizens consume less of both manufactures and services than do US citizens.

Bottom line

We summarize the laborious calculations of the previous section in Table 2. The numbers make several points that extend to more general settings:

- Consumers are better off in both countries with free trade. In the US, consumption of services stays the same and consumption of manufactures increases. As a result, consumers are better off. In Mexico, consumption of manufactures does not change, but consumption of services is larger. So Mexican consumers are also better off. In more realistic models, the increases in consumption are generally small (less than one percent), but this theory predicts that consumers are better off with access to international markets than without.

	Free Trade	No Trade
US		
Price of manufactures p_M	0.067 (dollar)	0.10 (dollar)
Price of services p_S	0.050 (dollar)	0.05 (dollar)
Wage w	1.000 (dollar)	1.00 (dollar)
Consumption of manufactures C_M	375	250
Consumption of services C_S	1500	1500
Mexico		
Price of manufactures p_M	0.067 (dollar)	0.20 (peso)
Price of services p_S	0.050 (dollar)	0.20 (peso)
Wage w^*	0.333 (dollar)	1.00 (peso)
Consumption of manufactures C_M^*	125	125
Consumption of services C_S^*	500	375

Table 2: Prices and quantities with and without trade.

- Average productivity determines living standards. In this example, the US is more productive, so its wages are higher and its consumers have more of everything than do Mexican consumers. International trade makes both the US and Mexico better off than they would otherwise be, but does not raise Mexican citizens to the same standard of living as US citizens.
- Free trade changes the distribution of production. In this case, Mexico shifted out of services into manufactures, and the US did the reverse. In other models, the change in production may not be so extreme, but it's generally true that they predict that every country will stop producing some products, and import them instead. The result is a far more efficient system of production, as each country produces those goods for which its relative productivity is the highest.
- The benefits of moving to free trade show up in macroeconomic data as increases in productivity. If we were NIPA people, we might compute GDP like this: sum production of manufactures and services, valued at a consistent set of prices. In this case we'll use the free trade prices, which is similar to PPP adjustment (apply the same prices in every country). GDP at world prices is

	Free Trade	No Trade
US	100	92
Mexico	33	27

Once trade shows up in GDP, it shows up in aggregate productivity, too. We don't have capital in this model and since \bar{L} is unchanged across trade regimes, the change in GDP must reflect an increase in productivity.

- No jobs were lost — or found. In our example, every unit of labor was used whether trade was possible or not. This is only a little extreme: no trade models suggest that trade will have much impact on employment. Any effect there might be comes from the impact on labor supply of an increase in the wage. So when you read the newspaper, especially in an election year, remember: trade has an impact on what the jobs are, not on how many there are.

Winners and losers

From what we've seen, trade is a wonderful thing. Who could be against it? In fact, lots of people seem to have a passionately held view that trade and globalization are a plague on the world. What could they be thinking? What follows is a short list of arguments one might use.

Spillovers. This is a classic 'failure' of markets, the (unpriced) impact of one person's decision on another's utility. For example, a polluting producer may inflict bad air on you and reduce your welfare. When talking about trade, people often refer to positive external effects on productivity. Are there advantages to having a local industry beyond the profit and loss? Could it help others to increase their efficiency? This is a legitimate argument, but probably not a good one in most cases. Moreover, it's typically used by firms and industries looking for special deals from their governments. It was used, for example, by European car makers when seeking government protection from Japanese and Korean imports. Their argument was that the domestic producers were generating technology spillovers to the benefit of related industries.

Differences among residents of a country. We rushed over it, but built into our example was that all citizens of a country have the same tastes and the same productivity in the workplace. In practice, this is not true and trade will affect each person differently. One example: in the example summarized in Figure 1, all Mexican consumers are better off. Now suppose Mexicans differ in how much they like manufactures and services (i.e., suppose that the parameter θ is not the same across individuals). In this case, the ones who like services less and manufactures more may be worse off, since the relative price of manufactures has gone up with free trade. In short, there can be losers. What the theory says, however, is that the winners win a lot more than the losers lose — Mexicans gain on average. In principle, you could take some of the winners' gains and give them to the losers. In practice, and for a variety of reasons, compensation of this kind does not happen or does not happen to the extent necessary to fully cover the costs of the losers. Another example shows up regularly in the press: people who lose their jobs when production adjusts to trade. In this case, suppose you worked for a services firm and lost your job. The long-term answer is: get a job working for a manufacturing producer since their productivity is higher. But in the short run, there's no question you suffer a loss from losing your job. Also, if working for a

manufacturing producer requires skills that you do not have, you might have to retrain yourself. Again, the winners should be able to compensate the losers and still be better off, but in practice it rarely happens.

More importantly, perhaps, people lose jobs all the time for lots of reasons — as we'll see after the break, the size of the gross labor market flows are simply enormous. Trade is not a major cause of either job or worker reallocation.

Executive summary

1. International trade allows consumers to buy products more cheaply and workers to take jobs where their productivity is highest.
2. There can be both winners and losers from trade, but the gains outweigh the losses.

Further reading

The personal information about Ricardo comes from the New School's History of Economic Thought [web site](#), which includes profiles of many leading economists.

Doug Irwin's [Free Trade Under Fire](#) is a witty and relatively non-technical summary of the argument for free trade. His article '[History of trade policy](#)' is a short overview of two centuries of policy arguments.

Naomi Klein's [No Logo](#) is an entertaining tirade against globalization and large international corporations.