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# The Nature and Significance of Intra-industry Trade

**Roy J. Ruffin**

*Intra-industry trade represents international trade within industries rather than between industries. Such trade is more beneficial than inter-industry trade because it stimulates innovation and exploits economies of scale.*

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International trade is traditionally thought to consist of each country exporting the goods most suited to its factor endowment, technology, and climate while importing the goods least suited for its national characteristics. Such trade is called *inter*-industry trade because countries export and import the products of different industries. But the top exports and imports of most industrial countries are actually similar items, such as passenger cars, electrical generators, or valves and transistors. Indeed, passenger cars are the number one export *and* import of Great Britain, Germany, and France. In the real world, international trade is largely trade within broad industrial classifications. *Intra*-industry trade occurs when a country exports and imports goods in the same industry. Intra-industry trade has been a hot topic among trade economists for several decades, but it has received scant attention among economists in general.[1] This article gives an overview of intra-industry trade for the generalist. In the debate over NAFTA, for example, commentators focused much attention on America's inter-industry trade with Mexico but none on the far more important intra-industry trade.

This article begins with a brief summary of Ricardian and factor endowment approaches to trade theory to highlight the contribution of intra-industry trade theory. Next, the article discusses the foundations of intra-industry trade theory and the significance of intra-industry trade for an economy. Finally, the U.S.–Mexico trade relationship is addressed as a pertinent example.

## STANDARD TRADE THEORY

To understand why trade economists have turned their attention to intra-industry trade, it is necessary to understand the implications of inter-industry trade. Standard trade theory involves trade in homogeneous products; hence, with perfect competition there is only inter-industry trade. David Ricardo (1817) introduced standard trade theory when he formulated what we now call the theory of comparative advantage. Ricardo highlighted the key ingredient of the theory: goods are more mobile across international boundaries than are resources (land, labor, and capital). This assumption still characterizes the theory of intra-industry trade. The theory of comparative advantage deals with all those causes of international trade that are generated by the *differences* among countries. Ricardo's contribution was not simply that he noted countries are different but that he showed how those differences resulted in all countries

being internationally competitive even though they might have higher wages (for advanced countries) or lower productivity (for developing countries) than their neighbors.

Ricardo's own subtle explanation is couched in terms of the barter of exports for imports. In the practical world, trade is conducted in terms of prices: people buy homogeneous goods where they are the cheapest. Consider a world of two countries, called home and foreign. The two homogeneous goods are apples and bananas. Suppose in the home country apples cost $1 each and bananas cost $2 each, and in the foreign country bananas cost $1 and apples cost $2. For simplicity, the two countries are mirror images. Keeping with the simple theme, but without any sacrifice of insight, imagine everyone in the world spends exactly one-half his or her income on each good. Suppose each country has income of $100. Thus, before trade, the home (foreign) country consumes fifty apples (bananas) and twenty-five bananas (apples). If trade is opened between the countries and there are zero transport costs and tariffs, people will buy the homogeneous products in the country where they are the cheapest. Thus, with free trade between the two countries, the home country will buy bananas from the foreign country, and the foreign country will buy apples from the home country. The price of each product in a competitive world will be the price in the lowest cost country. Thus, without tariffs or transport costs, the prices of apples and bananas will both be $1 in a world of perfect competition.

Clearly, both countries gain from trade. This gain can be quantified. The price of the imported good (bananas for the home country, apples for the foreign country) drops by 50 percent (from $2 to $1); since half of all income is devoted to each good, the real cost of living falls by approximately 25 percent. With an income of $100, each country now consumes fifty units of each good, including twenty-five units more of the imported good.

This example has been deliberately conducted without reference to wages and productivity, but that is in the background. The same example is consistent with widely different productivities.[2] Suppose that in the home country each worker can produce two apples or one banana. If prior to trade the price of apples is $1 and bananas $2, a worker can earn $2 in either industry. Suppose that in the foreign country each worker can produce ten apples or twenty bananas. Thus, the foreign country is five times more efficient in apples and twenty times more efficient in bananas than the home country. If once again, prior to trade, in the foreign country, bananas are $1 and apples $2 (the reverse), a worker can earn $20 in either apple or banana production. When trade is opened, apples and bananas are again $1 (as in the first example), but wages are ten times higher in the foreign country than in the home country. Since apples and bananas both sell for $1, in the home country no one wants to work in banana production, and in the foreign country no one wants to work in apple production.

Trade causes a massive relocation from industries that compete with imports to export industries. In this simple example, wages are not hurt because of the simplicity of the model: there are no learning costs, and workers are homogeneous and can easily switch from, say, apple production to banana production. Trade has no downside.

The Ricardian model of trade is designed to show that every country can profitably take advantage of any differences among countries. Whether one country has higher wages or lower productivity, the competitive wage rates that prevail in a country ensure that every country will specialize in the good in which it has a comparative advantage. In our example, the home country exports apples, the good in which its disadvantage is the smallest; and the foreign country exports bananas, the good in which its advantage is the largest.

The Ricardian trade model cannot explain how trade impacts the income distribution within a country or what determines comparative advantage. For these, trade theorists turn to the Heckscher–Ohlin model of trade (Samuelson 1948).

The Heckscher–Ohlin model (developed by Swedish economists Eli Heckscher and Bertil Ohlin) describes a world in which every country faces the same technological frontiers and has productive factors with the same qualities. The only difference between countries is in terms of the physical quantities of the factors of production, so that the Heckscher–Ohlin model is an account of trade based on factor endowments.

This theory has three fundamental features. First, each country exports goods that are intensive in the country's relatively abundant factors. Using Ricardian insights, we could express this as well by saying a country exports those goods in which its abundant factors have a comparative advantage. Thus, the United States is richly endowed with high-technology skills and farmland, so it is not surprising that we export high-tech products and agricultural

## The Stolper–Samuelson Theorem

One of the classic theorems in international trade theory is the Stolper–Samuelson theorem, named after Wolfgang Stolper and Nobel prize winner Paul Samuelson (Stolper and Samuelson 1941). The theorem is celebrated because it indicates that an increase in the price of labor-intensive goods raises the real return to labor independently of all considerations of how labor spends it income. The key is this: if the price of labor-intensive goods rises, resources will be drawn out of other industries into the labor-intensive industries. But the other industries are not labor-intensive; they may be land-intensive. If this is the case, then, relative to demand, labor becomes more scarce and land less scarce, driving up the price of labor and driving down the price of land. Moreover, for every 1 percent increase in the price of the labor-intensive good, the price of labor rises by more than 1 percent. The reason is simple: the cost of the product is made up of both land and labor. If land falls in price and labor rises in price, the wage rate must rise by more than the price of the labor-intensive good. Suppose labor is 75 percent of total costs. If the price of the labor-intensive good rises by 10 percent, the price of labor must rise by more than 10 percent to increase total costs by 10 percent.

The implication of Stolper–Samuelson is that if a country imports labor-intensive goods, international trade lowers the price of such goods and so makes laborers worse off. While the economy as a whole gains, workers lose out. If a country exports labor-intensive goods, both the economy as a whole and workers gain from more international trade.

goods. Our number one export is aircraft, which requires a great deal of technological expertise. Countries like Argentina and Australia, which are rich in land, are big exporters of beef and wool.

The second feature is that trade based on factor endowments benefits abundant factors and hurts scarce factors. When the United States exports wheat, the owners of wheat land benefit; but when the United States imports textiles, the unskilled workers in the textile industry are hurt. This is all a question of pricing. If the price of anything rises or falls, those productive factors with a comparative advantage in that product find their incomes rising or falling, respectively. (See the box entitled "The Stolper–Samuelson Theorem.")

The last feature of the Heckscher–Ohlin model is that international trade results in a tendency toward factor price equalization. This can be explained with a slight modification of the Ricardian example. Suppose the world has two types of workers, type A and type B. Type A workers can produce two apples or one banana, and type B workers can produce four bananas or two apples. It is clear that type A workers will produce apples and type B workers, bananas. Now suppose all countries are the same except that they have different numbers of type A and type B workers. When trade is established between two countries, apples and bananas will sell for, say, $1 each. Then type A workers, regardless of their location, will produce apples and earn $2; type B workers, regardless of their location, will produce bananas and earn $4. The identical production conditions around the world guarantee the same wages for A people or B people as long as apples and bananas fetch the same price. Countries will export apples or bananas, depending on whether they have relatively more A people or B people.[3]

In the Heckscher–Ohlin model, economies export the services of their abundant factors and import the services of their scarce factors. But empirical investigations of the Heckscher–Ohlin model have not had much success (Trefler 1995). In particular, it has been found that the estimated trade in factor services is less than the actual factor endowments around the world would predict (Trefler 1995, 1032).

If this is the case, we should not expect international trade to have much of an impact on income distribution. The Heckscher–Ohlin model suggests that since labor is the scarce factor in the United States, international trade should hurt labor and help capital. Table 1 presents statistics on trade and income distribution in the United States from 1972 to 1997. During this period the ratio of imports to GDP doubles from 6 percent to 13 percent. Yet the ratio of wages to national income falls insignificantly from 73 percent in 1972 to 71 percent in 1997. While this reduction may be disturbing to some, we must remember that during this period transfer payments to individuals increase substantially, from 12.4 percent to 16.3 percent of personal income (Executive Office of the President 1999, 360–61). This could account for a slight reduction in the importance of wages. However, it can be argued that international trade should help skilled workers and hurt unskilled workers since unskilled workers are the scarce factor in the United States. The average wage data do not capture this. During the same period the overall level of income inequality in the United States rises. The Gini coefficient (1 = perfect inequality; 0 = perfect equality) climbs from .401 in 1972 to .459 in 1997.[4] This change is largely due to the rising ratio of skilled to unskilled wages, which reflects not so much trends in international trade but trends toward technology that favors skilled workers (Juhn, Murphy, and Pierce 1993). Note that from 1972 to 1977, the importance of trade to the U.S. economy jumps dramatically with virtually no change in the Gini coefficient. The major changes in the Gini coefficient occur with small or no changes in the amount of trade. Thus, it is difficult to conclude that international trade has had an unfavorable impact on income distribution in the United States.

A major reason international trade does not have the predicted impact on income distri-

bution is that most international trade is intra-industry. When international trade takes place, there is not a massive reallocation of factors of production from labor-intensive industries to capital-intensive industries. Instead, factors of production are reallocated within industries, and this does not have the same impact as inter-industry trade.

Table 1
**Trade and Income Distribution**

| Year | Imports/GDP | Wages/National Income | Gini Coefficient |
|---|---|---|---|
| 1997 | .13 | .71 | .459 |
| 1992 | .11 | .73 | .451 |
| 1987 | .11 | .72 | .426 |
| 1982 | .09 | .74 | .412 |
| 1977 | .09 | .72 | .402 |
| 1972 | .06 | .73 | .401 |

SOURCE: *Economic Report of the President*; U.S. Census Bureau.

## FOUNDATIONS OF INTRA-INDUSTRY TRADE

The above description of the basic causes of inter-industry trade focuses on the differences between countries. But a great deal of international trade can take place between similar countries. Consider two countries that produce watches and radios. Let the products be homogeneous and the countries identical. But assume economies of scale so that production costs fall with greater output. Clearly, it would be beneficial if one country produced watches and the other produced radios. But this is still not intra-industry trade. A simple example involves transportation costs, or what is called border trade, where two countries share a border but some towns are best served by a nearer plant in the adjacent country because of transport costs. Now modify the economies of scale discussion. Let watches be differentiated. Wouldn't there be specialization within the category of watches, with one country producing more sports watches and another more luxury watches? Larger markets open up more possibilities of producing a larger number of varieties (think of the tremendous variety of passenger cars existing in the world today).

A monopolistically competitive industry is one that produces the same generic good. However, each firm occupies a particular position or niche by virtue of product differentiation (quality, location, color, size, and so on). There is free entry of new firms selling differentiated products, and the seller of each variety has some control over price. The automobile industry may be thought of as a prototypical monopolistically competitive industry. The number of products produced in the industry may be supposed to be equal to the number of abstract firms, although several of such firms may belong to the same conglomeration, such as Ford or General Motors. There may not be free entry for the conglomerates, but there certainly is for the niches they choose. It is relatively easy for any of the large automobile companies to produce a particular type of sport utility vehicle, for example.

Think of an industry as consisting of "resources" that must be allocated among different versions of the same generic product.[5] For simplicity, identify a firm with producing a particular variety. On the average, the number of varieties must be equal to the resources devoted to the industry divided by the average resources used by a typical firm. This is our first principle.

The second principle is that the resources used by the firm (each product) equal fixed costs plus variable costs. Fixed costs ($F$) do not vary with output ($x$), and variable costs vary with output. We suppose variable costs are proportional to output by the constant $c$. Thus, the resources used by the firm are represented by $F + cx$. The quantity $c$ is incremental or marginal cost. If the total resources devoted to an industry are denoted by $R$, the first principle implies that the number of products, $n$, is

$$n = R/(F + cx). \quad (1)$$

The third principle is that every firm in the industry exercises some monopoly power and so can charge a price above incremental or marginal cost. We simplify by supposing each firm has the same marginal cost and charges the same markup over cost. Thus, the price ($P$), where $k$ is the price markup (>1) is

$$P = kc. \quad (2)$$

The fourth principle is that firms enter the industry as long as there are economic profits; that is, the price of the product exceeds the average (opportunity) cost of producing the good. The average cost of the good is $F/x + c$, so entry occurs until the price equals average cost:

$$P = F/x + c. \quad (3)$$

If we put Equations 2 and 3 together, we can solve for $x$ since $kc = F/x + c$:

$$x = F/c\,(k - 1). \quad (4)$$

We can substitute Equation 4 into Equation 1 to solve for the number of products:

$$n = R\,(k - 1)/Fk. \quad (5)$$

The number of products in an industry rises as resources devoted to industry rise, pricing power ($k$) falls, or fixed costs fall.

Since the price of every good in this simplified case is the same, we can measure the total output of the industry as simply $nx$. Thus,

$$Q = nx = R/ck. \quad (6)$$

Equation 6 is very interesting because it shows that fixed costs do not affect total output, only the number of products. Thus, lowering fixed costs keeps output the same but spreads the output over a greater number of products, thus allowing more customization.

Now imagine we have two industries, one with resources $R_1$ and the other with resources $R_2$. Measure total resources in the economy as 1. We want to relate all this to international trade between two countries, the home and foreign (denoted by an asterisk). In the home country, $R_1 = 1 - z$ and $R_2 = z$. The foreign country is precisely the opposite, where $R_1^* = z$ and $R_2^* = 1 - z$. It follows from Equation 6 that

$$Q_1/Q_1^* = (1 - z)/z \text{ and } Q_2/Q_2^* = z/(1 - z). \quad (7)$$

In other words, the relative size of an industry across countries exactly reflects the relative amounts of industry resources across countries. This rather trivial fact follows from the assumptions that preferences are uniformly spread over all equally costly products selling at the same price.

The world resources devoted to each industry also equal 1. Moreover, each country may be thought of as having income of 1. To make things even simpler, suppose each country spends exactly half its income on the products of each industry. Since the proportion $z$ of industry 1 is produced in the foreign country and the proportion $1 - z$ in the home country and these are all different varieties of the same good, the home country is importing $(1/2)z$ of industry 1 products from the foreign country while the foreign country is importing $(1/2)(1 - z)$ of industry 1 products from the home country. The home country is simultaneously exporting $(1/2)(1 - z)$ units of industry 1 products and importing $(1/2)z$ units of industry 1 products. The same holds for industry 2 products. If $z = 1/2$, so the two countries are identical, all trade is intra-industry, and each country's exports and imports of each good are the same. If $z < 1/2$, the home country has more resources devoted to industry 1 than industry 2.[6]

The closer $z$ is to one-half, the more intra-industry trade there is; the closer $z$ is to 0 or 1, the less intra-industry trade there is. When $z = 1/2$, both countries have the same endowments of resources, and all trade is intra-industry. When $z$ is not equal to one-half, the two countries are different and some trade is inter-industry. We may measure the intra-industry trade (IIT) in industry 1 products by home exports minus home imports:

$$\text{IIT}_1 = (1/2)(1 - z) - (1/2)z = (1/2)(1 - 2z). \quad (8)$$

Clearly, if $z < 1/2$, the home country exports more industry 1 products than it imports. Its intra-industry trade in industry 2 products will be the opposite: it will import more than it exports. Thus, net exports of industry 1 are paying for net imports of industry 2. This is *inter*-industry trade.

## SIGNIFICANCE OF INTRA-INDUSTRY TRADE

In 1996, 57 percent of U.S. trade took place within rather than between four-digit Standard International Trade Classification (SITC) industries (Executive Office of the President 1998, 218). Intra-industry trade constitutes more than 60 percent of European trade and about 20 percent of Japanese trade. The preceding theory tells us Japan has less intra-industry trade because its factor endowment is significantly different from those of other advanced countries; another reason is Japan does not experience much border trade. Moreover, the ratio of population to land area is about 365 people per square kilometer, compared with, for example, 108 for France. Thus, it is not surprising that Japan imports more raw materials than do most other developed countries. With more raw materials, there are fewer differentiated manufactured products and less intra-industry trade.

The significance of intra-industry trade arises from its basic character: it need not be based on comparative advantage. To a large extent intra-industry trade arises from the facts that products are differentiated and the production of any particular product requires some fixed costs. Thus, the more sport utility vehicles Ford makes, the lower the unit cost; the more Mercedes-Benz convertibles produced, the lower the unit cost. Some elements of comparative advantage may be involved; for example, Germany may have a comparative advantage in producing high-quality cars. However, the automobile industry is now a world industry (mergers between Daimler-Benz and Chrysler, Ford and Volvo, and so forth). To the extent that comparative advantage is not involved, the pattern of trade is indeterminate. When economies of scale

are involved, who exports what can be determined by the accident of history.

One of the great benefits of intra-industry trade is that international trade need not cause the dislocations associated with inter-industry trade. The Stolper–Samuelson theorem (see box) suggests that international trade can cause a redistribution of income from scarce factors to abundant factors. But if most international trade is intra-industry, the impact on internal income distribution should be relatively minor. If trade is not based on scarce and abundant factors of production, it does not result in reduced demand for the scarce factors and increased demand for the abundant factors; thus, trade expansion need not result in large changes in the distribution of income. As pointed out earlier (*Table 1*), trade does not appear to have negative consequences for income distribution in the United States.

Intra-industry trade enhances the gains from trade through better exploitation of economies of scale—rather than through comparative advantage—as trade leads countries to concentrate on a limited number of products within any particular industry. This leads to an expansion of world output because of the saving of fixed costs.

Specialization within industrial categories may also stimulate innovation. Producing a greater variety and number of goods increases our general knowledge about technology, and greater knowledge implies smaller costs of knowledge accumulation. For example, U.S. importation of Japanese cars and trucks has led to improvements in U.S. car and truck manufacturers. Adam Smith pointed out that the division of labor itself promoted innovation:

> The invention of all those machines by which labour is so much facilitated and abridged seems to have been originally owing to the division of labour. Men are much more likely to discover easier and readier methods of attaining any object when the whole attention of their minds is directed towards that single object than when it is dissipated among a great variety of things. But in consequence of the division of labour, the whole of every man's attention comes naturally to be directed towards some one very simple object. (Smith 1937, Book I, Chapter 1).

Substantial evidence suggests international trade is more beneficial than the standard theory of inter-industry trade implies. According to standard theory, opening international trade causes an increase in the level of GDP but no long-run increase in the *rate* of economic growth. When we classify countries according to their degrees of protectionism, economies with open trade regimes appear to grow their per capita incomes from 1 percent to 2 percent faster *per year* (Gould and Ruffin 1995). This can be explained by the theory of endogenous growth: trade stimulates innovation, and innovation begets more innovation (Gould and Ruffin 1993).

Finally, intra-industry trade reduces the demands for protection because in any industry there are both exports and imports, making it difficult to achieve unanimity among those demanding protection (Marvel and Ray 1987).

Intra-industry trade need not give rise to a justification for a strategic trade policy, that is, giving export subsidies to correct for departures from perfect competition. It is true that much intra-industry trade takes place under imperfect competition, but monopolistic competition is for all practical purposes efficient. Indeed, it is easy to construct examples in which monopolistic competition provides optimal product diversity (Dixit and Stiglitz 1977). Two basic, necessary—but not sufficient—conditions for a strategic trade policy are (1) foreign monopoly or oligopoly and the ability to shift foreign profits to domestic residents and (2) externalities, in which the promotion of certain industries benefits others in a way that cannot be captured by private markets.[7] However, these are not key parts of the intra-industry story.

## U.S. TRADE WITH MEXICO

Contrary to popular belief, the top U.S. imports from Mexico are not clothing, fruits, and vegetables. These represent only 10 percent of U.S. imports. Table 2 lists the top seven exports and imports to and from Mexico for 1998. Electrical machinery and equipment (and related parts) ranks first, representing 27 percent of U.S. imports from Mexico. Vehicles rank second, and nuclear reactors, boilers, and related items are third.

Interestingly, the United States' top three exports to Mexico are these same three categories. However, only 48 percent of U.S. exports to Mexico consist of these big, capital-intensive items, compared with 57 percent for imports from Mexico. Not only are Mexico's exports to the United States quite similar to its imports (intra-industry trade), but Mexico's exports are more concentrated in those big items of intra-industry trade.

Table 2
**U.S. Trade With Mexico, 1998**

| Imports from Mexico | Billions of dollars | Percent |
|---|---|---|
| All commodities | 94.7 | 100 |
| Electrical machinery and equipment and related parts | 25.8 | 27 |
| Vehicles, other than railway | 16.7 | 18 |
| Nuclear reactors, boilers, machinery and mechanical | 11.6 | 12 |
| Mineral fuels, mineral oils | 5.3 | 6 |
| Articles of apparel and clothing accessories | 3.8 | 4 |
| Insulated wiring sets for vehicles, ships, and aircraft | 3.7 | 4 |
| Optical, photographic, cinematic, measuring | 3.3 | 3 |
| **Total for top seven imports** | **70.2** | **74** |
| **Exports to Mexico** | | |
| All commodities | 79.0 | 100 |
| Electrical machinery and equipment and related parts | 18.8 | 24 |
| Nuclear reactors, boilers, machinery and mechanical | 11.2 | 14 |
| Vehicles, other than railway | 8.0 | 10 |
| Plastics and articles thereof | 5.0 | 6 |
| Optical, photographic, cinematic, measuring | 2.3 | 3 |
| Parts and accessories for vehicles | 1.9 | 2 |
| Paper and paperboard | 1.9 | 2 |
| **Total for top seven exports** | **49.1** | **61** |

SOURCE: U.S. Department of Commerce.

The products listed in Table 2 represent 61 percent of all exports and 74 percent of all imports in U.S. trade with Mexico. Of these imports and exports, about 80 percent represent intra-industry trade—perhaps the most important point regarding U.S.–Mexico trade. The United States exports automobile parts to Mexico, where the cars are assembled, and some are shipped back. But the flow of automobile parts is actually heavier from Mexico into the United States. Indeed, vehicle parts account for only about 6 percent of U.S. exports to Mexico, whereas they make up 20 percent of U.S. imports from Mexico. These parts are assembled in the United States, and the vehicles are shipped back to Mexico.

Much U.S. trade with Mexico involves the maquiladora industries along the U.S.–Mexican border. The maquiladora ("twin plant or production sharing") program has opened the 2,000-mile border region into a rapidly developing industrial zone for American firms involved in labor-intensive manufacturing. Under the program, equipment, machinery, supplies, and raw materials can be temporarily imported into Mexico duty-free. Products are assembled and/or manufactured using inexpensive Mexican labor and exported back to the United States, where duty is paid only on the "Mexican value-added," or shipped to other foreign countries. Such trade may appear to reduce the demand for labor by U.S. industries. But molded plastics, packaging material, electronic components, and wire constitute a large part of the materials purchased by the maquiladoras. If they were purchasing the products of capital-intensive industries, the effect might be to reduce U.S. labor demand. But the maquiladoras are buying and selling labor-intensive products. Thus, U.S. trade with Mexico does not fit into a neat scarce-factor/abundant-factor explanation of trade.

## CONCLUSIONS

Intra-industry trade represents international trade within industries rather than between industries. Such trade is more beneficial than inter-industry trade because it stimulates innovation and exploits economies of scale. Moreover, since productive factors do not switch from one industry to another, but only within industries, intra-industry trade is less disruptive than inter-industry trade. About 60 percent of U.S. trade or European trade is intra-industry. By comparison, about 80 percent of U.S. trade with Mexico is intra-industry, and thus concern that trade with Mexico will harm unskilled workers is based on an erroneous view of the nature of that trade.

## NOTES

The author wishes to thank David Gould for comments. The author is responsible for all errors and omissions.

1 The classic treatise is Grubel and Lloyd (1975).

2 As Ricardo put it: "The labour of 100 Englishmen cannot be given for that of 80 Englishmen, but the produce of the labour of 100 Englishmen may be given for the produce of the labour of 80 Portuguese, 60 Russians, or 120 East Indians."

3 The setup in this paragraph follows Ruffin (1988).

4 The Gini coefficient is calculated from the Lorenz curve and is approximately the proportion by which the distribution of income differs from perfect equality.

5 The theory that follows is a simplified version of a paper by Krugman (1981), which is in turn an extension and simplification of Dixit and Stiglitz (1977).

6 This argument is in Dixit and Norman (1980) and Krugman (1981).

7 For a wide-ranging collection of articles, see Krugman (1986).

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