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Fundamentals of International Economics

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CONTENTS

CHAPTER 1

Basic Models of Trade

Theory of comparative advantage

Trade occurs because of differences in prices, but why does price differ? It could be because of differences in supply and demand. Supply differs between countries because of technological differences and resource availabilities. The technological difference is explained by the Ricardo's theory of comparative advantage. The resource and endowments differences are explained by Heckscher-Ohlin model.

Assumptions of Ricardian Model

1) Two countries, denoted home and foreign.

2) Two final products, good M and good F.

3) Each good uses only one input (labor) in production. Labor is homogeneous in quality.

4) Labor is inelastically supplied in each country. 2

5) Labor is perfectly mobile within each country but internationally immobile.

6) Constant labor requirement per-unit of output.

7) Technologies differ between the two countries, i.e., per-unit input requirement differs across countries

8) No cost of transportation, no trade barriers.

9) Perfect competition in factor and product markets.

Before we examine the theory of comparative advantage let us look at absolute advantage. A country has an absolute advantage in the production of a good if that good is produced more efficiently, i.e., with lower cost per unit of production than in the other country. Suppose, we use only one input (labor) to produce two outputs manufactures (M) and food (F).

Ricardian Theory: A country exports that commodity in which it has a comparative labor-productivity advantage For absolute advantage, compare the productivity in each good across the country.

B has absolute advantage in the production of F and M. But does that mean B will only export (F and M) and will not import any goods? More specifically, in the real world, the U.S. has absolute advantage in Almost all the goods than a poor developing country such as Haiti. But does that mean the U.S. will only export? What will it do with all its export earning if it does not import? It does not make sense for a Country to keep on exporting without importing. How can a less 4efficient country such as Haiti hope to compete with other countries in the world market? Those types of questions were answered by Ricardo's theory of Comparative Advantage. Absolute advantage does not say much about trade, i.e., which commodity a country exports or imports. To understand the theory of comparative advantage we need to know two concepts:

a) Opportunity cost

b) Production possibility frontier

Opportunity costs measures the loss of output of a commodity brought out by an increase in the production of another commodity. In the above example, in country A, an increase of 1 unit of F takes 2 units of input from M and thus M production decreases by 2/3 units. Thus the opportunity cost of one additional F is 2/3 units of M. Similarly an increase in 1 unit of M takes 3 units of inputs from F and Thus F production decreases by 3/2 or 1.5 units. Thus the opportunity cost of one additional M is 1.5 units of F. In country B an increase in 1 unit of F takes 1 unit of input from M and thus M production decreases by 1/2 units. Thus the opportunity cost of one additional F is 1/2 units of M. 6 Similarly an increase in 1 unit of M takes 2 units of inputs from F, and thus, F production decreases by 2 units. Thus opportunity cost of one additional M is 2 units of F. The opportunity cost is also equal to ratio of marginal cost because marginal cost is the additional cost needed for increasing the output by one unit. This additional cost of resources is the same as the marginal cost. From the above example, relative marginal cost can be defined as the ratio of input coefficients: relative marginal cost or opportunity cost of F in A is 2/3 relative marginal cost or opportunity cost of M in A is 3/2 relative marginal cost of opportunity cost of F in B is 1/2 relative marginal cost of opportunity cost of M in B is 2/1

Production possibility Frontier represents the different combinations of outputs a country can produce for a given level of technology assuming all the resources are utilized efficiently. 7Take country A, suppose country A has a total of 60 units of inputs. With these 60 units of input, this country can produce either 30 units of F or 20 units of M or 15 units of F and 10 units of M. Thus the Production possibility frontier is to increase 1 unit of M we need to take 3 units of inputs from F, and

Thus, F decreases by 3/2 = 1.5. Thus opportunity cost or relative marginal cost of M is equal to the slope of the production possibilities frontier. Suppose country B has a total of 30 units of inputs. With this 30 units of inputs this country can produce either 30 units of F or 15 units of M or 10 units of F and 10 units of M. 8 To increase 1 unit of M we need to take 2 units of inputs from F, and thus, F decrease by 2. This opportunity cost or relative marginal cost of M is equal to the slope of the production possibilities frontier. In autarky, consumption point will be same as the production point. Autarky price will be tangent to PPF and the indifference curve. In the constant cost industry, autarky price line is same as the PPF line. Thus, autarky relative price P /P M F in A is 1.5 and in B is 2. Since opportunity cost of M in A is less than the opportunity cost of M in B, A has comparative advantage in production of M, i.e., A can produce M relatively more efficiently than B. By similar analysis B can produce F relatively more efficiently than A. For comparative advantage, get the relative productivity of two goods in each country, then compare across the countries. Also note that though B has absolute advantage in both goods, A has comparative advantage in the production of M. In both countries, PPF is straight line implying constant opportunity cost or constant cost industries. Consider country B 9 Say under autarky this country produced 10 units of F and 10 units of M. Since there is no trade, production and consumption points are same. Suppose the trade is allowed. For trade to take place the world relative price of M, i.e., M has to be different from the opportunity cost or autarky price of M (2). Suppose the opportunity cost of M is greater than the world relative price M , B will import M and export F. For these exports and imports to occur, A has to export M and import F. A will export M only if the world relative price M is greater than the opportunity cost of M in A (1.5). The relative price has to be Such that 10 Opportunity cost of M in A < M <opportunity cost of M in B Autarky rel. price of M in A.

Mill's Theorem: The world price ratio lies in the range spanned by the free-trade price ratios of the two trading nations This relative price is drawn in the above diagram starting from the autarky production point. Suppose trade takes place at point G. B will export HJ amount of F for JG amount of imports of M. The consumer possibilities have expanded. In other words for a given level of consumption of F, say at J, it can produce at H and it can obtain more M by trading than by producing domestically. The consumption possibilities can be further increased by producing more of F and less of M, say at K, and trading F for M. Trading at N it can consume more of F and M than under autarky conditions. Similarly by completing specializing, B can increase its consumption possibilities, say at point Q. Thus B gains by trade. 11 We can also show that A will also gain by trade. Also note that under autarky total world production F is 25 and M is 20. After trade and specialization total world productions of F is 30 and M is 20. Thus, specialization leads to increased total world output. Let us examine gains to both countries from trade. Take A's production possibility frontier, flip it over, and placing is upside down such that A's specialization of M and B's specialization of F meet each other. 12 Say trade takes place at point G. It is clear that both countries consume more of each good under trade than under autarky.

Gains from trade can be decomposed into gains from

1) Exchange (A to B)

2) Specialization (B to C)

Supply functions for the Ricardian model: Consider the good M In country A, the autarky relative price of M (slope of PPF) is 3/2. At this price country A can supply 0 to 20 M. This shape of the supply function is the result of constant cost industry. In country B, the autarky relative price of M (slope of PPF) is 2. At this price country B can supply 0 to 15 M. 13 The world price will be between 3/2 to 2, i.e., between autarky prices of these two countries. Note that in this Ricardian model, we can tell which country exports or imports without information about demand. However, to determine the exact world price, we need to know the demand.

There are some points to note:

1) Even though B has absolute advantage in production of both the goods, it does gain by engaging in trade

2) Trade will occur as long as the opportunity cost (autarky prices) differs across countries. i.e. slopes of production possibilities frontier are different across countries. Trade will not occur only if opportunity costs are the same.

3) If a country has absolute advantage in the production of one or more goods, then it must have a comparative advantage in the production of some goods. This is the major insight of Ricardo

4) If the opportunity cost of a good is less than the international price then it will export that good. If the opportunity cost of a good is greater than the international price then that country will import that good.

5) In Ricardo's model per unit of cost of output remains constant as production increases. This condition leads to straight line production possibilities frontier.

6) This model (the original Ricardian model) does not show that some inputs lose by engaging in trade because only one input is

Considered and this input is assumed to move freely across the industry. But this is not the case in the real world. However, Ricardian theory will still hold if we include more than one input. Differences between Ricardian and H-O model. Ricardian model explains that comparative advantage arises from productivity or technological differences. The H-O model indicates that comparative advantage arises from differences in

Factor endowments.

The original Ricardian model uses only one input. The H-O model uses two inputs. Since the original Ricardian model uses one factor and it moves freely across the industry, free trade does not hurt the factor. But in H-O model free trade benefits the abundant factor and hurts the scarce factor. Ricardian model assumes constant cost industry. The H-O model assumes increasing cost industry.

The Real Model

In this section we develop the basic real model and determine the equilibrium real- tive wage and price structure along with the efficient geographic pattern of specialization. Assumptions about technology are specified in Section IA. Section IB deals with demand. In Section IC the equilibrium is constructed and some of its properties are explored. Throughout this section we assume zero transport costs and no other im- pediments to trade.

A. Technology and Efficient Geographic Specialization The many-commodity Ricardian model assumes constant unit labor requirements For the n commodities that can be produced in the home and foreign countries, respectively. The commodities are conveniently indexed so that relative unit labor requirements are ranked in order of diminishing home count- try comparative advantage, where an asterisk denotes the foreign coun- try. In working with a continuum of goods, we similarly index commodities on an inter- val, say [O, 11, in accordance with diminish- ing home country comparative advantage. A commodity z is associated with each point on the interval, and for each commodity there are unit labor requirements in the two countries, a(z) and a*(z),with rela- tive unit labor requirement given by A(z) r a*(z) - Ar(z)<O a(z>

The relative unit labor requirement function in (1) is by strong assumption continuous, and by construction (ranking or indexing of goods), decreasing in z. The function A(z) is shown in Figure 1 as the downward slop- ing schedule. Consider now the range of commodities produced domestically and those produced abroad, as well as the relative price struc- ture associated with given wages. For that purpose we define as wand w* the domestic and foreign wages measured in any (com- mon!) unit. The home country will efficiently produce all those commodities for which domestic unit labor costs are less

than or equal to foreign unit labor costs. Accordingly, any commodity z will be pro- duced at home if

(2) a(z)w I a*(z)w* Thus (2') o 5 A(z) where (3) defines the parameter w, fundamental to Ricardian analysis, (3) w - w/w* This is the ratio of our real wage to theirs (our "double-factoral terms of trade"). It follows that for a given relative wage w the home country will efficiently produce the range of commodities (4) 0 5 z 2 2(w) where taking (2') with equality defines the borderline commodity z, for which (5 2 = A-'(w) A-'( ) being the inverse function of A( ). By the same argument the foreign country will specialize in the production of commodities in the range

(4') ?(w) I z I 1 The minimum cost condition determines the structure of relative prices. The relative price of a commodity z in terms of any other commodity z', when both goods are produced in the home country, is equal to the ratio of home unit labor cost relative price of home produced z in terms of a commodity z" produced abroad is by contrast In summarizing the supply part of the model we note that any specified relative real wage is associated with an efficient geo- graphic specialization pattern characterized by the borderline commodity i(w) as well as by a relative price structure. (The pattern is "efficient" in the sense that the world is out on, and not inside, its production-possibil- ity frontier.) B. Demand On the demand side, the simplest Mill- Ricardo analysis imposes a strong homo- thetic structure in the form of J. S. Mill or Cobb-Douglas demand functions that asso- ciate with each ith commodity a constant expenditure share, b,. It further assumes identical tastes for the two countries or uni- form homothetic demand. By analogy with the many-commodity case, which involves budget shares e therefore prescribe for the continuum case a given b(z) profile: where Y denotes total income, C demand for and P the price of commodity z. Next we define the fraction of income spent (anywhere) on those goods in which the home country has a comparative advan- tage: (9) d(i) = J ib(z)cfz > 0 where again (0,Z) denotes the range of com- modities for which the home country enjoys a comparative advantage. With a fraction 29 of each country's income, and therefore of world income, spent on home produced goods, it follows that the fraction of income spent on foreign produced commodities is C. Equilibrium Relative Wages and Specialization To derive the equilibrium relative wage and price structure and the associated pat- tern of efficient geographic specialization, we turn next to the condition of market equilibrium. Consider the home country's labor market, or equivalently the market for domestically produced commodities. With i denoting the hypothetical dividing line between domestically and foreign pro- duced commodities, equilibrium in the mar- ket for home produced goods requires that domestic labor income wL equals world spending on domestically produced goods: Equation (10) associates with each i a value of the relative wage w/w* such that market equilibrium obtains. This schedule is drawn in Figure 1 as the upward sloping locus and is obtained from (10) by rewriting the equa- tion in the form: where it is apparent from (9) that the sched- ule starts at zero and approaches infinity as Z approaches unity. To interpret the B( ) schedule we note that it is entirely a representation of the demand side; and in that respect it shows that if the range of domestically produced goods were increased at constant relative wages, demand for domestic

labor (goods) would increase as the dividing line is shifted -at the same time that demand for foreign labor (goods) would decline.' A rise in the domestic relative wage would then be required to equate the demand for domestic labor to the existing supply. An alternative interpretation of the B( ) schedule as the locus of trade balance equi- libria uses the fact that (10) can be written in the balance-of-trade form: This states that equilibrium in the trade bal- ance means imports are equal in value to exports. On this interpretation, the B( ) schedule is upward sloping because an increase in the range of commodities hypo- thetically produced at home at constant relative wages lowers our imports and raises our exports. The resulting trade imbalance would have to be corrected by an increase in our relative wage that would raise our import demand for goods and reduce our exports, and thus restore balance. The next step is to combine the demand side of the economy with the condition of efficient specialization as represented in equation (5), which specifies the competitive

margin as a function of the relative wage. Substituting (5) in (10') yields as a solution the unique relative wage G, at which the world is efficiently specialized, is in bal- lanced trade, and is at full employment with all markets clearing: The equilibrium relative wage defined in (1 1) is represented in Figure 1 at the inter- section of the A( ) and B( ) schedules.* Commodity Z denotes the equilibrium bor- derline of comparative advantage between commodities produced and exported by the home country ($0 < z < Z$), and those com- modities produced and exported by the for- eign country ($? < z < 1$). Among the characteristics of the equilibrium- rium we note that the equilibrium relative wages and specialization pattern are deter- mined by technology, tastes, and relative size (as measured by the relative labor force).' The relative price structure associated with the equilibrium at point E is defined by equations (6) and (7) once (1 1) has defined the relative wage a and the equilibrium specialization pattern Z(G). The equilibrium levels of production Q(z) and Q*(z),and employment in each industry L(z) and L*(z), can be recovered from the demand structure and unit labor requirements once the comparative advan- tage pattern has been determined. We note that with identical homothetic tastes across countries and no distortions. the relative wage Z is a measure of the well- ng of the representative person- laborer at home relative to the well-being of the representative foreign laborer. 11. Comparative Statics The unique real equilibrium in Figure 1 is determined jointly by tastes, technology, and relative size, L*/L. We can now exploit Figure 1 to examine simple comparative static questions. A. Relative Size Consider first the effect of an increase in the relative size of the rest of the

world. An increase in L*/L by (10) shifts the B( ) trade balance equilibrium schedule upward in proportion to the change in relative size and must, therefore, raise the equilibrium relative wage at home and reduce the range of commodities produced domestically. It is apparent from Figure 2 that the domestic relative wage increases proportionally less than the decline in domestic relative size. The rise in equilibrium relative wages due to a change in relative size can be thought of in the following manner. At the initial Equilibrium, the increase in the foreign relative labor force would create an excess Supply of labor abroad and an excess demand for labor at home-or, correspondingly, a trade surplus for the home country. The re- sulting increase in domestic relative wages serves to eliminate the trade surplus while at the same time raising relative unit labor costs at home. The increase in domestic relative unit labor costs in turn implies a loss of comparative advantage in marginal industries and thus a needed reduction in the range of commodities produced domestically. The welfare implications of the change in relative size take the form of an unambiguous- ous improvement in the home country's real income and (under Cobb-Douglas demand) a reduction in real income per head abroad. We observe, too, that from the definition of the home country's share in world income and (lo), we have (12) wL/(wL + w* L*) = 6(2) It is apparent, as noted above, that a reduction in domestic relative size in raising the domestic relative wage (thereby reducing the range of commodities produced domestically) must under our Cobb-Douglas demand assumptions lower the home country's share in total world income and spending- even though our per capita income rises.

CHAPTER 2

Technical Progress

To begin with, we are concerned with the effects of uniform technical progress. By equation (I), a uniform proportional reduc- tion in foreign unit labor requirements im- plies a reduction in a*(z) and therefore a proportional downward shift of the A(z) schedule in Figure I. At the initial relative wage G, the loss of our comparative advan- tage due to a reduction in foreign unit labor costs will imply a loss of some industries in the home country and a corresponding trade deficit. The resulting induced decline in the equilibrium relative wage serves to restore trade balance equilibrium, and to offset in part our decline in comparative advantage. The net effect is therefore a reduction in domestic relative wages, which must fall proportionally short of the decline in relative unit labor requirements abroad. The country's terms of trade therefore improve as can be noted by using (7) for any two commodities z and z", respectively, produced at home and abroad: where a "hat" denotes a proportional change. Domestic real income increases, as does foreign real income.~ The range of goods produced domestically declines since domestic labor, in efficiency units, is now relatively more scarce. An alternative form of technical progress that can be studied is the international transfer of the least cost technology. Such transfers reduce the discrepancies in relative unit labor requirements-by lowering them or each z in the relatively less efficient country-and therefore flatten the A(z) schedule in Figure 1. It can be shown that such harmonization of technology must benefit the innovating low-wage country, and that it may reduce real income in the high-wage country whose technology comes to be adopted. In fact, the high-wage country must lose if harmonization is complete so that relative unit labor requirements now become identical across countries and all our consumer's surplus from international trade van is he.

Demand Shifts

The case with a continuum of commodities requires a careful definition of a demand shift. For our purposes it is sufficient to ask: What is the effect of a shift from high z commodities toward low z commodities? It is apparent from Figure 2 that such a shift will cause the trade balance equilibrium

schedule B( ) to shift up and to the left. It follows that the equilibrium domestic relative wage will rise while the range of commodities produced by the home country de- clines. Domestic

labor is allocated to a narrower range of commodities that are consumed with higher density while foreign labor is spread more thinly across a larger range of goods. Welfare changes cannot be identified in this instance because tastes themselves have changed. It is true that domestic relative income rises along with the relative wage. Further we note that since ij rises, the relative well-being of home labor to foreign labor (reckoned at the new tastes) is greater than was our laborers' relative well-being (reckoned at the old tastes).

Unilateral Transfers

Suppose foreigners make a continual uni- lateral transfer to us. With uniform homothetic tastes and no impediments to trade, neither curve is shifted by the transfer since we spend the transfer exactly as oreigners would have spent it but for the transfer. The new equilibrium involves a recurring trade deficit for us, equal to the transfer, but there is no change in the terms of trade. As Bertil Ohlin argued against John Maynard Keynes, here is a case where full equilibration takes place solely as a result of the spending transfers. When we introduce non- traded goods below, Ohlin's presumption will be found to require detailed qualifications, as it also would if tastes differed geo- graphically.

One factor economy: production possibility frontier

of Good X and Good Y. If we achieve this then output combination D may become attainable. A production possibility frontier (PPF) is a curve or a boundary which shows the combinations of two or more goods and services that can be produced whilst using all of the available factor resources efficiently.

We normally draw a PPF on a diagram as concave to the origin. This is because the extra output resulting from allocating more resources to one particular good may fall. I.e. as we move down the PPF, as more resources are allocated towards Good Y, the extra output gets smaller – and more of Good X has to be given up in order to produce the extra output of Good Y. This is known as the principle of diminishing returns. Diminishing returns occurs because not all factor inputs are equally suited to producing different goods and services**.** Combinations of output of goods X and Y lying inside the PPF occur when there are unemployed resources or when the economy uses resources inefficiently. In the diagram above, point X is an example of this. We could increase total output by moving towards the production possibility frontier and reaching

any of points C, A or B.Point D is unattainable at the moment because it lies beyond the PPF. A country would require an increase in factor resources, or an increase in the efficiency (or productivity) of factor resources or an improvement in technology to reach this combination

Comparative advantage and gains from trade

Introduction Traditional international trade theory has concerned itself with these central questions:

What determines the pattern of trade? Who trades what with whom and at what prices what are the sources of gains from trade? How are the gains distributed across countries? How does trade alter the structure of production and returns to factors within each country? The first set of questions leads to the notion that the pattern of trade is based on comparative advantage. The second set of questions is addressed by the result that there are always gains from trade, and both countries will gain from trade provided the relative price under free trade differs from both country ís relative prices under autarky. The last question is concerned about redistributive consequences. Trade policies may be motivated by shifting the distribution of income within a country (or countries). Owners of a countryís relatively scarce factor (associated with the import competing sector) will lose as a result of trade, even though the country as a whole gains. We start with the Ricardian model, which nicely illustrates comparative advantage and gains from trade - where trade occurs due to technology differences across countries. We will explore distribution implications in the next chapter on factor endowment models of international trade.

Comparative advantage and gains from trade 1

Producing more of both goods would represent an improvement in our economic welfare providing that the products are giving consumers a positive satisfaction and therefore an improvement in what is called allocate efficiency Reallocating scarce resources from one product to another involves an opportunity cost. If we go back to the previous PPF diagram, if we increase our output of Good X (i.e. a movement along the PPF from point A to point B) then fewer resources are available to produce good Y. Because of the shape of the PPF the opportunity cost of switching resources increases – i.e. we have to give up more of Good Y to achieve gains in the output of good X. The PPF does not always have to be drawn as a curve. If

the opportunity cost for producing two products is constant, then we draw the PPF as a straight line. The gradient of that line is a way of measuring the opportunity cost between two goods.

Explaining Shifts in the Production Possibility Frontier

CHAPTER 3

The Production Possibility Frontier Will Shift When

There are improvements in productivity and efficiency perhaps because of the introduction of new technology or advances in the techniques of production) More factor resources are exploited perhaps due to an increase in the size of the workforce or a rise in the amount of capital equipment available for businesses In the diagram below, there is an improvement in technology which shifts the PPF outwards. As a result of this, output possibilities have increased and we can conclude (providing the good provides positive satisfaction to consumers) that there is an improvement in economic welfare.

Technology, prices and consumer welfare

Improved technology should bring market prices down and make products more affordable to the consumer. This has been the case in the market for personal computers and digital products. The exploitation of economies of scale and improvements in production technology has brought prices down for consumers and businesses.

External Costs

In the case of air pollution there is an external cost to society arising from the contamination of our air supplies. External costs are those costs faced by a third party for which no compensation is forthcoming. Identifying and then estimating a monetary value for air pollution can be a very difficult exercise – but one that is important for economists concerned with the impact of economic activity on our environment. We will consider this issue in more detail when we study externalities and market failure.

Free Goods

Not all goods have an opportunity cost. Free goods are not scarce and no cost is involved when consuming them. Is fresh air an example of a free good? Usually the answer is yes – yet we know that air can become contaminated by pollutants. And, in thousands of offices, shops and schools, air-conditioning systems cool the air before it is "consumed". With air conditioning, scarce resources are used up in providing the "product" – for example the capital machinery and technology that goes into manufacturing the air conditioning equipment; the labour involved in

its design, production, distribution and maintenance and the energy used up in powering the system. Home has Technology:

QY = 5*LY, QX = 2*LX,

Which implies PPF QY= 500 – (5/2)*QX, As we know, from the last lecture consumers' budget constraint lies right on top of Its PPF in this simple model. (This won't be true of more complicated models).

If both goods are produced in Autarky (no-trade) equilibrium, then perfect Competition implies that PX/PY=5/2.

The Gains from Trade

Consider the following thought experiment: Suppose that the country is given the opportunity to buy and sell as much as it wants at a fixed relative price PX/PY = 3. How would production in the economy respond?

1. Domestic relative prices become same as world prices, because of arbitrage.

2. Firms in the X industry want to expand because PX/PY > MPLY/MPL X.

Suppose that PX MPLX >W and PY

MPLY=W. Labor demand rises in

X sector, which drives up the wage (W) and so that PY

MPLY<W,

Which leads to a collapse of Y production and all labor moving into the X sector?

3. If the country produces exclusively X, how much Y could it afford if it traded all of its X for Y?2

QX = 200, each X buys 3 Y, so it could buy 600 units of Y.

4. The Budget constraint shifts out In this sense, the country must be better off, because it could buy more of both goods. Note that the PPF has NOT changed its location at all. It is the budget constraint that has shifted out.

Without Trade, how could the country have reached the same level of utility? Technical change If the MPL in Y were to expand to 6 from 5, then the PPF would have shifted out and since with not trade, the Budget Constraint is right on top of the PPF, it too would have shifted out. This is one sense in which

International trade is like technical change the country can afford more of both types of goods using the same resources. There is nothing special about specializing in X.Question: What would have happened if the world relative price were PX/PY = 1?

Note that PX/PY and PY/PX convey the same information!

The Principle of Comparative Advantage

Reflect on the methodology of Ricardo. Call the country that we have already analyzed HOME and add another country called FOREIGN. FOREIGN has the same labor endowment as HOME, but it is more productive in both goods than HOME. QY = 10*LY, QX = 10*LX. • Note that FOREIGN has an Absolute Advantage in both goods.3 • Note that while FOREIGN has a comparative advantage in good X, while

HOME has a comparative advantage in good Y. This is because in the autarky equilibrium, the opportunity cost of producing X is lower in

FOREIGN than in HOME.

Thought experiment: suppose that countries adjust production in favor of the good in which they have a comparative advantage. Doing so increases global output because resources are being used more efficiently. Starting from autarky equilibrium, suppose that FOREIGN expands its production of X by 1 unit, so it must cut back its production of Y by 1 unit. Now have HOME cut its production of X by 1 unit so that it may expand its production of Y by 2.5. The total amount of X being produced in the world has not changed, but the amount of Y being produced has now risen by 1½ units. These are Gains from Trade and they accrue from relocating

production to make more efficient use of the world's resources.Going from an Autarky equilibrium to a Trading Equilibrium, countries will expand the production of the good in which they have a comparative advantage and contract the production of the good in which they have a comparative

Disadvantage.

To know more about which country actually enjoys the gains from trade, we need

To know more about what the International Equilibrium looks like.

International Equilibrium

The range of relative prices, or terms of trade, that could arise in a trading equilibrium must lie in between within the two autarky relative prices in the two countries. Otherwise, both countries would want to export the same good and this would NOT be an equilibrium.4 Hence, in a trading equilibrium, we must have because only then will both goods be produced. This means that in this model, at least one country will end up specializing in the trading equilibrium (as long as the countries have comparative advantages) The Law of Comparative Advantage: A country will export the goods whose Relative price was relatively low in autarky and import the goods whose relative price was relatively high in autarky.

• Bernhofen and Brown result: opening of Japan led to the export of goods whose price was low relative to world prices and the import of the other goods.

Question: what terms of trade would FOREIGN prefer in the trading equilibrium?

Answer: Because they will export good X, they want the relative price of X to be as high as possible. FOREIGN would want exactly the opposite. While trade will not make the countries worse off, it does give rise to an inherent conflict between the two countries. Connect the terms of trade and absolute advantage to relative wages between countries.

• Define wage rate in the two different countries.

• Countries always produce the good in which they have a comparative

Advantage

• Perfect competition then implies: and .

• Dividing and reorganizing, we have

• Note the wage difference reflects two things (1) absolute advantages and (2) terms of trade.

• Plugging in the two extremes of the range of relative prices that we might have, we find

• Note that the gains from trade are not driven by wage differences between countries but by comparative advantages: it is possible to gain from trade with a country with exactly the same wage.

What determines the Terms of Trade? Relative Supply and Relative demand Here I deviate from the book, because the book can be confusing on this point. Derive the relative supply

• Range of autarky relative prices (PX/PY) on the vertical axis

• Relative supply QX/QY on the horizontal axis, where QX is the total amount of X produced by both countries and QY is the total amount of Y produced by the two countries.

• Start the economy producing only good Y consistent with any world price so that both countries want to specialize in Y.

• Now suppose that there is some production of X, FOREIGN will be the first country to supply X. In order to get it to do that if it to produce both goods (X and Y).

• Think of sliding along FOREIGN's PPF from Y to X as we slide along the relative supply curve.

• Eventually, FOREIGN is no longer able to supply any more X on its own because it has become fully specialized.

• The "kink" occurs when both countries specialized in the good in which they have a comparative advantage, in this example, FOREIGN is producing 1000 units of X, no Y. HOME is producing 0 units of X and 500 Units of Y so the kink occurs at 1000/500=2.

• To get anymore X, we need to get HOME to start producing X so the price would have to rise to.

• Then we can think about sliding along's HOME's PPF from Y to X.

To finish the analysis, we need to add relative demand curve.

• Relative demand curve is downward sloping because of substitution effect.

• Three possibilities

i. HOME specializes in Y, FOREIGN produces Y and X

ii. HOME specializes in Y, FOREIGN specializes in X

iii. HOME produces Y and X, FOREIGN specializes in X

Note A curious features of the Ricardo model is that in order to gain from trade, you cannot be producing both goods. Still willing to TRADE, however! Why

Trade? Why NOT, the nature of the equilibrium is that world supply must equal world demand and this might involve a country producing more of one good than it consumes and less of the other good than it consumes, and yet not gaining from trade.

• HOME PPF, budget constraint, Indifference curve with trade pattern

• FOREIGN PPF, budget constraint, indifference curve with trade pattern

• World RS, RD diagram Comparative Statics

1. Relative Country Sizes: Increase the size of FOREIGN – what does this do to FOREIGN's terms of trade?

2. Repeat but interpret as Migration

3. Example of Technical Progress: Suppose that gains from trade are initially being shared. Then HOME's experiences technical progress in making good X so that the slope of HOME's PPF is now one. What has

Happened to welfare in FOREIGN?

CHAPTER 4

Trade In Ricardian World: Determination of International Terms of Trade

International trade has traditionally been the cornerstone of the global economy. Historically, in as much as the community of nations have had economic interactions, it generally has been dominated by international trade. In this context, trade would include that portion of the international flow of capital used in its financing. The international flow of capital today far exceeds the amount required for international trade. Recall that the value of merchandise trade was just short of $6 trillion for year of 1998. Foreign exchange markets exceeded $1 trillion each trading day. However, it can be argued that international trade remains at the center of the global economy. Global trade patterns can be summarized in Table 1. It shows the amount of trade both in absolute (billions $) and percentage terms that occur between the industrial nations (upper left), between industrial and developing nations (upper right & lower left), and among developing nations (lower right). Typically, the commodities exported by industrial countries tend to be high value added manufactured goods. These goods require high levels of capital and/or technology in their production. This is true even in cases where in developing countries produce the same goods but in a more labor intensive fashion. A case in point is agriculture. In the industrial world, agriculture uses tremendous amounts of capital - the tractors, combines, etc. - and high levels of technology - hybrid and genetically engineered seeds. Agriculture, the mainstay of many developing nations tends to be highly labor intensive with very little capital or technology. We see that there are two distinct trade flows, those between the various industrial countries (58.5%), and those between the industrial and developing countries (34.3%=17%+17.3%). The nature of these two trade flows is very different. The trade that occurs between industrial nations tends to be dominated by similar goods. For example, the US exports and imports automobiles to and from other industrial nations. Trade that occurs between industrial and developing nations Reflects the exchange of fairly different goods. Generally, the industrial nations export advanced manufactured goods in exchange for primary products or less complicated manufactures. For example, the US exports aircraft and computers to developing nations, while importing oil and other natural resources or goods which require a lot of labor such as clothing and toys. Over the course of several weeks we will derive several economic trade models in an attempt to explain the patterns of trade. Important questions that need to be addressed include why trade occurs, which goods will different countries import and export, and

who benefits and who loses from trade. The beginning point in the discussion of trade is the concept of comparative advantage. The reason trade occurs is because countries are different from each other. Those differences offer opportunities for trade to be mutually beneficial between trading partners. On the one hand, consumers of imported goods benefit because the goods may not be available domestically, or imports may be cheaper than domestic equivalent goods, or because imports have characteristics that are appealing. Alternatively, producers export goods because they profit from exporting. Which goods should such a country export and which goods should they import? In a nutshell, a country exports those goods which it can produce more cheaply compared to other countries. Equivalently, a country imports those goods whose purchase prices abroad are less than their domestic cost of production. The main question is how to measure costs absolute advantage in production of both wine and cloth. In other words, labor in Portugal can produce both wine and cloth with less labor than England. It takes 80 hours of Portuguese labor to produce a barrel of wine, which is less than the 120 hours required in England. In the same Fashion Table 2 shows that Portuguese labor is also more productive in the production of cloth, requiring 10 hours less per yard than English labor. Is there the possibility of mutually beneficial trade since Portugal can produce both goods more cheaply than England? The answer is surprisingly "yes." To see how this can be the case, we need to calculate the opportunity costs of producing cloth and wine for both countries. In Essence, how much of one good is given up if labor is devoted to the production of the other? We can calculate these opportunity costs by asking how much of one good could have been produced if we divert from producing a unit of the other. For example a yard of cloth costs 100 hrs. to produce in England. If we divert those 100 hours to the production of wine, we could have produced 5/6 barrel.(100hours/yd) /(120 hrs/bbl) = 10/12 bbl/yd or 5/6 bbl/yd What this means is that for every yard of cloth produced in England it is giving up a little less than a barrel of wine. The labor cost of a unit of cloth in Portugal is 90 hours per yard. Since it only costs 80 hours per barrel of wine, the Portuguese give up 9/8 barrel of wine for each yard of cloth. (90 hours/yd) / (80 hrs/bbl) = 9/8 bbl/yd or 1& 1/8 bbl/yd In this case for each yard of cloth produced by Portugal it gives up a little more than a barrel of wine. We can calculate the opportunity costs of wine for both countries in the same manner. To determine the patterns of trade between the two countries, we need to compare their respective opportunity costs of producing the two goods. A country will have a comparative advantage in the production of a good if it has the lower

opportunity cost as compared to its trading partner. England has the comparative advantage in the production of cloth since its opportunity cost 5/6 barrel of wine as compared to Portugal's 9/8 barrel of wine. Note that the opportunity cost of one good is the reciprocal of the opportunity cost of the other good. Therefore, if England has the lower opportunity cost of producing cloth, then Portugal must necessarily have the lower opportunity cost of producing wine In a no-trade situation, termed autarky, the opportunity costs determine the prices of goods. In this analysis prices are in the form of relative prices. This means that the price of one good will be in terms of the other. For example, the price of cloth in England in the absence of trade is 5/6 barrel of wine per yard of cloth. In Portugal it is 9/8 barrel of wine per yard cloth. England would be better off producing cloth and trading to Portugal for wine than producing wine at home. The opposite case would hold for Portugal. Portugal gains by producing and exporting wine and purchasing its cloth from England. Of course in the process the prices of wine and cloth would change. With trade, the relative price of cloth will rise in England and fall in Portugal. This will continue until there is one set of prices called the terms of trade. Note that the terms of trade will fall somewhere between 9/8 barrel and 5/6 barrel of wine per yard of cloth. Let us arbitrarily choose the terms of trade of 1 barrel / yd. At these terms of trade, England should shift labor out the production of wine into the production of cloth. By reducing wine production by one barrel England can reallocate the 120 hrs of labor to cloth production. Cloth production would rise by 120/100 yd. or 1 & 1/5 yd. of cloth. At this point England has given up 1 bbl of wine but gains 1 & 1/5 yd. of cloth. Now, let England trade yard of cloth for 1 barrel of wine from Portugal. Overall after shifting production and trading England comes out ahead by 1/5 yd. Similarly, if Portugal shifts labor out of cloth production into wine production it would be able to produce 9/8 barrel of wine. After trading with England, Portugal would gain 1/8 barrel of wine. Trade mutually benefits both countries.

Graphical Analysis of Ricardian Model

The starting point of a graphical analysis is the construction of production possibilities frontiers. Recall that a production possibilities frontier depicts the possible combinations of goods a country can produce. These possibilities are governed by a country's available resources as well as the productivity of those resources. Suppose that Table 4 represents both the endowment of two countries labor force and their respective labor input requirements in the production of two goods. If Country A devotes all its labor to the production of cloth, it will be able to produce

9000 yd.. Should it devote all its labor to the production of wine, Country A would be able to produce 3,000 barrels. For country B, it would be able to produce 8000 yd. of cloth if it produced no wine, and would be able to produce 4000 barrels of wine if it produced no cloth. Of course both countries can produce combinations of both cloth and wine. In Country A, for each barrel of wine it produces will divert labor away from the production of three yards of cloth. The opportunity cost of wine in Country B is less at two yards per barrel. Table 5 presents the opportunity costs of cloth and wine for both countries. Graph 1 presents the PPFs for both countries. Note the x & y-intercepts. These are production choices in which the countries produce only one of the two goods. The slope of the PPFs is interpreted as the opportunity cost of wine. Note they are identical to the last column in Table 5.There is one large difference with these PPFs as compared to those in the previous file. The PPFs for this model are linear, whereas, those from last week were concave. The PPFs curvature reflects the degree in which opportunity costs rise as more of good is produced. In last week's farmer example the different quality land was the source of these increasing costs. In this week's model the opportunity costs of producing goods remains constant. For example, the opportunity cost of a barrel of wine in Country A is 3 yards of cloth whether it is the first barrel produced or the three-thousandths barrel produced. Consequently, linear PPFs are termed constant cost PPFs.The rate at which one good is traded for the other, the terms of trade must fall between the two countries' autarkic prices. Let P* denote the terms of trade, then: 3 yd / bbl > P* > 2 yd / bbl.

If this were not the case, then both countries would want to export the same good. For example, if P* > 3yd / bbl, then both Country A and Country B would specialize and export wine for cloth. Conversely, if P* < 2 yd/bbl (or its equivalent P* > 1/2 bbl/yd) both would specialize and export cloth for wine. Let us suppose that in a pre-trade or autarkic situation, Country A and B produce and consume different combinations of cloth and wine. As shown in Graph 1, Country A produces and consumes 6000 yd. of cloth and 1000 barrels of wine. Country B produces and consumes 3000 yards of cloth and 2500 barrels of wine. World production, the sum of the two countries production, would be 9000 yards of cloth and 3500 barrels of wine. Next let the two countries trade. Referring to Table 5, Country A has the comparative advantage in cloth production. The student should be sure as to why this is the case. Country B has the lower opportunity cost of producing wine and, therefore has wine production as its comparative advantage.

Specialization and Gains from Trade

Suppose the terms of trade P* is 2.5 yards/barrel. Clearly, Country B should export wine, earning 2.5 yd. of cloth for each barrel. This is a profit or gain of 1/2 yd of cloth for each barrel produced and traded. Producers in Country B profit by producing more and more wine at the expense of cloth production. Eventually, Country B would become completely specialized producing only wine, 4000 barrels worth. In Graph 2, production moves from 3000 Cloth and 2500 Wine to the bottom corner of Country B's PPF at 4000 Wine. The opposite occurs in Country A. It would be cheaper for it to buy wine at 2.5 yd/bbl than to produce it domestically at a cost of 3 yd/bbl. Consequently, producers in Country A would reduce production of wine in favor of cloth production. Again complete specialization occurs with Country A producing only cloth and no wine. Total output in Country A would be 9000 yd of cloth as shown in Graph 2 at the top corner or vertical intercept of its PPF. Note that with terms of trade of 2.5 yd/cloth both countries can now increase their consumption beyond their PPFs. In Graph 2, Country A is producing 9000 yd of cloth and then trades cloth at a rate of 2.5 yd/barrel of wine. With trade, production and consumption are now different. Consumption will occur along the dashed terms of trade line. The terms of trade line's 2.5yd/bbl slope represents the relative price of a barrel of wine in terms of cloth. For example if Country A exports 3000 yards of cloth, then they can consume the remaining 6000yds as before. However, at a price of 2.5yd/bbl, 3000 yards of cloth can purchase 1200 bbl of wine or 200 more barrels of wine than in autarky. Thus, Country A has gained 200 barrels of wine as a result of.

Specialization and trade.

Similarly, Country B is completely specialized by producing 4000 barrels of wine. At the going terms of trade it sells 1200 barrels for the 3000 yards of cloth imported from Country A. It now has as much cloth as it did in the absence of trade, but now consumes 2800 barrel of wine (4000 -1200). This is 300 barrels of wine more than in autarky. Clearly both countries have gained through specialization and trade.

Monetization of the Ricardian Model

By using a different approach to the Ricardian model we can examine several issues facing the global economy today. In order to do this, we have to introduce wages and exchange rates. As

opposed to the previous analysis where goods were exchanged for each other, i.e., barter, the introduction of prices monetizes the model. Goods are bought and sold for money. However, the basics from the previous analysis still hold. Countries will specialize in and export that good for which they have a comparative advantage. A country will export only those goods for which it will earn profits from trade. For this to be the case in our two-country world, it must be able to more cheaply produce the good than its trading partner. This can be written in equation form, where: WA and WB are the wages in Country A and Country B, respectively. Let aA1 and aB1 be the labor-input requirements for producing good 1 again in countries A and B, respectively. The aA1 and aB1 terms are the same as in Tables 2 and 4. Let e represent the exchange rate defined as country A currency/ country B currency. WA * aA1 would be the cost of producing a unit of good 1 in Country A denominated in its currency. WB * aB1 * e would be the cost of producing a unit of good 1 in Country B, but denominated in Country A's currency because the exchange rate.

If Country A exports good 1 to Country B then it must be the case that: WA * aA1 < WB * aB1 * e.What this says is that the cost of producing good 1 measured in terms of Country A's currency is Cheaper in Country A than in Country B. This equation, WA * aA1 < WB * aB1 * e, is important because it demonstrates a country's characteristics by which it competes in export markets. In this case Country A exports the good because its costs per unit are lower than Country B's. That cost per unit however depends upon not only the relative wage rates between the two countries, but also the relative labor productivities. The source of Country A's lower unit cost of producing good 1could be because of a variety of factors. Country A's wage could be lower than Country B's, or Country A's labor is more productive than Country B's labor. In this latter case it is possible that Country A's wage rate could be higher than in Country B. Some opponents to international trade in the United States, especially labor, contend that the US is exporting it jobs to countries with lower wages. In essence, the concern is that the high US wage rate makes it uncompetitive in international trade.

CHAPTER 5

Absolute Advantage: Adam Smith

Insight: Division of labor and specialization significantly increases output, e.g. pin factory (assembly line approach with 18 different specialized operations) vs. individual pin production. International division of labor, division of labor applied to global production, to increase global output and increase global standard of living.

Mercantilism – government trade policies to increase exports and discourage imports, common during Smith's time (18th century). Protectionism through tariffs, quotas, subsidies, etc. Smith criticized mercantilism (lowered a country's standard of living by discouraging or banning cheaper foreign imports) and advocated free trade policies. How does free trade promote prosperity? We return to our closed-economy model from CH 2, and extend it. Assumption 8: Factors of production (labor) cannot move between countries, to guarantee that the PPF won't change after trade. Simplifies the model, doesn't allow for immigration or MNCs. Assumption 9: No trade barriers, to allow for comparison of free trade vs. autarky. We examine trade barriers in CH 6-7. Assumption 10: Exports must pay for imports, trade must balance, X = M, rules out trade deficits and surpluses for now. Barter economy. Assumption 11: Labor is the only relevant factor of production, for simplification, and prices of goods are determined by the labor content – "labor theory of value."

Dynamics

Gains from trade are commonly described as resulting from: specialization in production from division of labor, economies of scale, scope, and agglomeration and relative availability of factor resources in types of output by farms, businesses, location and economies a resulting increase in total output possibilities trade through markets from sale of one type of output for other, more highly valued goods. Market incentives, such as reflected in prices of outputs and inputs, are theorized to attract factors of production, including labor, into activities according to comparative advantage, that is, for which they each have a low opportunity cost. The factor owners then use their increased income from such specialization to buy more-valued goods of which they would otherwise be high-cost producers, hence their gains from trade. The concept may be applied to an entire economy for the alternatives of autarky (no trade) or trade. A measure of total gains from trade is the sum of consumer surplus and producer profits or, more

roughly, the increased output from specialization in production with resulting trade. Gains from trade may also refer to net benefits to a country from lowering barriers to trade such as tariffs on imports. David Ricardo in 1817 first clearly stated and proved the principle of comparative advantage, termed a "fundamental analytical explanation" for the source of gains from trade. But from publication of Adam Smith's The Wealth of Nations in 1776, it was widely argued, that, with competition and absent market distortions, such gains are positive in moving toward free trade and away from autarky or prohibitively high import tariffs. Rigorous early contemporary statements of the conditions under which this proposition holds are found in Samuelson in 1939 and 1962. For the analytically tractable general case of Arrow-Debreu goods, formal proofs came in 1972 for determining the condition of no losers in moving from autarky toward free trade. It does not follow that no tariffs are the best an economy could do. Rather, a large economy might be able to set taxes and subsidies to its benefit at the expense of other economies. Later results of Kemp and others showed that in an Arrow-Debreu world with a system of lump-sum compensatory mechanisms, corresponding to a customs union for a given subset set of countries (described by free trade among a group of economies and a common set of tariffs), there is a common set of world' tariffs such that no country would be worse off than in the smaller customs union. The suggestion is that if a customs union has advantages for an economy, there is a worldwide customs union that is at least as good for each country in the world.

Measurement of gains from trade

Classical Economist there are two methods to measure the gains from trade: 1) international trade increases national income which helps us to get low priced imports; 2) gains are measured in terms of trade. To measure the gains from the trade comparison of cost of production between domestic and foreign countries something is required. But it is very difficult to acquire the knowledge of cost of production and cost of imports in a domestic country. Therefore terms of trade method is preferable to measure the gains from trade.

Factors affecting gains from trade

There are several factors which determine the gains from international trade:

1. Differences in cost ratio: The gains from international trade depend upon the cost ratios of differences in comparative cost ratios in the two trading countries. The smaller the difference between exchange rate and cost of production the smaller the gains from trade and vice versa.

2. Demand and supply: If a country has elastic demand and supply gains the gains from trade are higher than if demand and supply are inelastic.

3. Factor availability: International trade is based on the specialization and a country specializes depending upon the availability of factors of production. It will increase the domestic cost ratios and thereby the gains from trade.

4. Size of country: If a country is small in size it is relatively easy for them to specialize in the production of one commodity and export the surplus production to a large country and can get more gains from international trade. Whereas if a country is large in size then they have to specialize in more than one good because the excess production of only one commodity can not be exported fully to a small sized country as the demand for good will reduce very frequently. so smaller the size of the country larger is the gain from trade.

5. Terms of Trade: Gains from trade will depend upon the terms of trade. If the cost ratio and terms of trade are closer to each other more will be the gains from trade of the participating countries.

6. Productive Efficiency: An increase in the productive efficiency of a country also determines its gains from trade as it lowers the cost of production and price of the goods. As a result the country importing gains by importing cheap goods.

Resources, Comparative Advantage, and Income Distribution

Introduction

International trade theory bases its prediction on traditional sources of comparative advantage. These predictions have been challenged by two major empirical findings. Leontief (1953) finds that the US content of trade in 1947 was labor intensive when the opposite is expected from trade theory, giving birth to the Leontief paradox.1 Trefler (1995) also shows that factor service trade is much smaller than predicted by the Heckscher-Ohlin-Vanek theory, a fact known as the

missing trade mystery. This paper offers a new source of comparative advantage that reunites trade theory with Leontief and Trefler's findings. The basic intuition is that wealth alleviates financial imperfections in labor intensive sectors, typically populated by small firms. This effect offsets traditional source of comparative advantage that grant wealthier nations advantage in capital intensive sectors. I model this intuition with a two period lived overlapping generation economy where one of the sectors is characterized by an imperfection in credit markets due to moral hazard. All effects appear production avoiding demand side effects of income inequality, already studied by Hunter and Markusen (1988). I show that two economies with otherwise equal characteristics but with different wealth distributions will exhibit dissimilar comparative advantages.2 Wealthier economies have a comparative advantage to export the good produced in sectors with financial imperfections because these societies have richer entrepreneurs who are better able to overcome incentive problems in borrowing-lending relations. Wealthier entrepreneurs are less dependent on external finance and hence mitigate the agency problem in credit contracts. More incentives imply lower failure rates which translate into lower lending rates, inducing entrepreneurs to expand production in the small firm sector and then driving the country's comparative advantage. Additionally in the absence of non-convexities in production at the firm level, nations with equal per capital income but with a more egalitarian distribution of wealth will also exhibit a comparative advantage in the sector featuring financial

Imperfections.

The model builds on the idea that some sectors in the economy are typically populated by smaller firms which are more likely to be financially constrained. Many of these firms are family firms managed by their owners where the entrepreneurs' personal wealth determines the amount borrowed from banks. As the assets utilized for production often have low resale value, firms don't have enough collateral to offer, making incentive or agency issues in financial relations a central problem for their competitiveness. On the other hand when for technology reasons the scale of production at the firm level is large in a sector —like in the iron and steel industry or petroleum refinery monitoring costs per unit of output are usually much lower, alleviating the agency problem. To explore the dynamic implications of this theory generations are assumed to be linked by dynasties where parents leave bequests to their children, a feature that introduces persistence in the distribution of wealth. When technology and prices remain constant, it is

shown that it takes time for countries to converge to the steady state income distribution and production level, then passing through different phases of trade patterns in its development process. At initial stages, economies exhibit a comparative advantage in the sector characterized by no -or less- financial frictions leaning its trade pattern toward the small firm sector at more advanced stages.Wealth can explain Trefler's missing trade mystery and the Leontief paradox. Trefler (1995) shows that trade is missing unless his empirical exercise had omitted factors that are scarce in poor countries. Wealth can be that omitted factor. Leontief (1953) finds that in 1947 the US content of exports was labor intensive when the opposite is expected from a relatively labor scarce country. This theory can help explain both findings when we allow for factor neutral technological differences across countries. A better technology gives comparative advantage to capital intensive sectors as capital is allowed to move. Empirically this paper documents that the small firm sectors are indeed labor intensive. Since countries with higher total factor productivity are also wealthier, the financial source of comparative advantage offsets (at least partially) the technological one. In other words, wealthier nations exhibit a comparative advantage in the big firm sectors because of technology and at the same time, in the small firm sector due to financial reasons. Furthermore these economies will have relative capital abundance. These features square with Leontief's finding if the financial effect dominates, and with Trefler's missing trade since wealth reduces the predicted gains from trade. The model with financial frictions nests the case without them, which allows taking it to the data and testing whether wealth drives trade. I analytically derive an expression from the model demonstrating that the comparative advantage in the small firm sector is determined by technology and the degree of financial imperfections. I aggregate trade data for 28 industrial sectors (3 digit level of classification) into small and big firm sectors by country as in the model in various ways. Wage is used to capture cross country differences in total factor productivity and the average success rate exactly as suggested by the model. Loosely speaking, the empirical evidence supports the main ideas of this theory, that is:

1) wages (or total factor productivity) negatively affect the comparative advantage of the small firm sector, agreeing with the finding that they are labor intensive,

2) financial frictions matter for trade, and

3) financial failure decreases with wealth. Furthermore the results seem robust to aggregation and other issues.

This theory also offers a new insight to the traditional literature linking trade and income distribution.3

The mainstream of the literature has focused in only one way of this relation. In that view, trade and technology determine factor prices and then the distribution of income. This theory suggests an endogenous link since the distribution of wealth affects the productive performance of the economy and that drives trade. A drop in the relative price of the good produced by small firms harm entrepreneurs and delays the accumulation of wealth affecting future trade. I show that this change in prices has both a static and a dynamic adverse effect on managerial talent and makes the trade pattern lean towards sector B both on impact and in subsequent periods. While addressing the main issues in this literature requires a model with skilled and unskilled labor, this theory shows the potential of endogen zing the distribution of income for understanding the role of trade in determining the skill premia. This paper relates to other previous and contemporaneous work. Rajan and Zingales (1996) show in a study for a large number of countries that those industrial sectors which need less external finance grow disproportionately faster in countries with less developed financial markets. In the same spirit Braun (2002) argues that collateral is important for specialization and growth since industries whose assets are relatively less tangible are larger and grow faster in countries with more developed financial systems. Although these studies focus on the role of financial development in economic growth and my work is about trade, it provides us with evidence that industrial sectors with dissimilar needs for external finance exhibit different performance over time due to financial imperfections. Beck (2002) studies the link between financial development and international trade in a 30-year panel of 65 countries. Building on previous theoretical work by Kletzer and Bardhan (1987), he shows that better financial institutions can be a source of comparative advantage in sectors that rely on external finance. Although complementary, my work differs from these in that mine is not an institutional story: wealth drives a country's comparative advantage by making the degree of financial development endogenous. Fischer (1992) and Ranjan (2001) also show that the distribution of income can have dynamic effects on trade: the former by affecting the accumulation of physical capital which is mobile between industries but immobile between

countries; the latter by impacting the accumulation of human capital. But in both cases a country's comparative advantage is always driven by factor endowments, the accumulation of which is affected by income distribution dynamics. To the best of my knowledge, the closest theoretical references to the role of wealth distribution as a pattern of trade come from the development area. Most of these articles debate the relationship between credit market imperfections and economic growth, an idea stated by Schumpeter back in 1911.4

Part of this literature focuses on the income distribution dynamics along stages of economic development in closed economies with imperfect credit markets. Among this group of papers I acknowledge Lloyd-Ellis and Bernhardt (2000) who develop some very interesting tools that I utilize in the dynamic analysis. Their paper focuses on a different issue however: they want to match the Kuznet's curve and other macroeconomic regularities. Moreover, they model financial imperfections in such a way that there is no default in equilibrium. While having default is not essential for wealth to be a determinant of comparative advantage, it buys two very attractive results. First, the mass of entrepreneurs that defaults decreases over the development process, reducing intermediation costs in the economy. Second, total factor productivity in the small firm sector increases endogenously along the development path. Therefore, richer countries have a higher total factor productivity and lower intermediation costs, being both results endogenous to the process of development. This turns out to be important because then the model exhibits bigger labor than capital augmenting productivity differences across countries, agreeing with findings in Trefler's (1993) explanation of the Leontief paradox.

CHAPTER 6

Perfect Enforcement

In this section I solve the model under the assumption that effort is observable and perfectly Enforceable. When this is the case, I show that income distribution is irrelevant both for

Production and trade. Since goods A and B are assumed to be traceable and this is a small economy, prices are determined in the rest of the world. The (relative) price of good A is denoted as P A and assumed to be constant over time. At each period t total labor endowment in the economy is given by $L = 2 - \mu$, since there is a mass one of young agents with one unit of labor on average plus a fraction $1-\mu$ of the old generation with a unit labor endowment. Constant returns and free entry in sector B imply where π is the indirect profit function in the B sector. Since the interest rate is given from the rest of the world, wages of this economy are pinned down by technology in this sector. Assuming no changes in the interest rate and technology, wages will be constant (w). The agents' problem works as follows. At the beginning of each period all old agents become entrepreneurs or continue being workers, and they count on a certain inherited wealth plus labor income from youth. As workers they supply their labor endowment inelastically and invest their savings at the rate r for the period. As entrepreneurs they decide how much to invest in the firm and how much to save at the rate r. Finally at the end of the period they consume goods A and B and leave some bequest. Their demand functions are given by,

Final remarks and extensions

The model describes an economy with two sectors with different characteristics. One sector has a technology that needs management as an indivisible factor of production and operates at a small scale and where the monitoring costs of managerial activities are too big compared to the overall cost of production. In such sectors, agency problems infinancial contracts affect entrepreneurial incentives to succeed, the portability of firm and the scale of production. Incentives improve with the entrepreneurs' wealth because when they are less dependent on external finance agency problems are mitigated. The other sector is assumed to be a frictionless one: there are sectors that operate at such a big scale that monitoring costs of financial relations are negligible compared to the total cost of production, like the iron and steel industry or the

petroleum refineries sector, facilitating their access to credit markets. Because smaller firms are also labor intensive this source of comparative advantage works in the opposite direction compared with traditional sources. Wealthier nations have higher total factor productivity and capital abundance, giving them a comparative advantage in capital intensive industries (the big firm sector). But this theory argues that at the same time these countries should exhibit a comparative advantage in small firm (labor intensive) sectors because of their better access to credit, offsetting the traditional sources. Due to this offsetting effect this theory offers an explanation for Trefler's missing trade mystery and the Leontief paradox. Furthermore, since agents leave bequest to their offspring the distribution of income will Be history dependent. This feature introduces persistence in the distribution of wealth and consequently the trade pattern dynamics of the economy, endogenizing the relation between trade and income distribution. I conclude by making few additional observations for future research. Assuming constant Wages (or technology) and final prices is important for the dynamics of the model but it does not affect the main message. While the law of motion for the distribution of wealth described in Proposition 7 could be adapted, the asymptotic results of Proposition 3, 8 and 9 would not hold if there is growth in the economy. Extending the analysis in that direction while including skilled and unskilled labor could be important for the discussion on the role of trade in driving the skill premia. Additionally, the empirical analysis suggests that even though financial imperfections are important, wealth might not be the only driver. The cost of borrowing could also be driven by institutional forces such as intermediation costs or differences in bankruptcy laws. While the model can handle these differences via the parameter a, further empirical effort should be made to dissenting gle how much of the action is driven by institutions versus the nations' wealth. Finally, in the absence of convexities in production in the small firm sector the model exhibits specialization and trade traps, like in Torvik (1993), Bannered and Newman (1994) and Boyd and Smith (1997). In this environment optimal dynamic import tariffs can help a country gradually overcome the development trap. The four theorems although all four of the propositions to be discussed are an outgrowth of the seminal work of Heckscher and Ohlin, only one of these propositions bears their name explicitly**.**

The Heckscher–Ohlin Theorem states that countries export those commodities which require, for their production, relatively intensive use of those productive factors found locally in relative

abundance. The twin concepts of relative factor intensity and relative factor abundance are most easily defined in the small dimensional context in which the basic theory is usually developed. Two countries are engaged in free trade with each producing the same pair of commodities in a purely competitive setting, supported by constant returns to scale technology that is shared by both countries. Each commodity is produced separately with inputs of two factors of production that, in each country, are supplied perfectly in elastically. (For a throrough analysis of having endowments respond endogenously, see Findlay, 1995). Following the Ricardian distinction, commodities are freely traded but productive factors are internationally immobile. Although one country may possess a larger endowment of each factor than another, the presumed absence of returns to scale guarantees that only relative factor endowments are important. The home country is said to be relatively lab our abundant if the ratio of its endowment of lab our to that (say) of capital exceeds the corresponding proportion abroad. This is known as the physical version of relative factor abundance. An alternative involves a comparison of autarky relative factor prices in the two countries: the home country can be defined to be relatively labour abunda nt if its wage rate (compared with capital rentals) is lower before trade than is the foreign wage (relative to foreign capital rentals). Since autarky factor prices are determined by demand as well as supply conditions, these two versions need not correspond. In particular, if the home country is, in the physical sense, relatively lab our abundant it might nonetheless have its autarky wage rate relatively high if taste patterns at home are strongly biased towards the labor-intensive commodity compared with tastes abroad. In such a case the trade pattern reflects the autarky factor–price comparison: the home country exports the physically capital-intensive commodity. As discussed below, the link between commodity price ratios (the proximate determinant of trade flows) and factor price ratios is more direct than that between commodity price ratios and physical factor endowments. Thus the Heckscher–Ohlin theorem is more likely to hold if relative factor abundance is defined in terms of relative factor prices prevailing before trade. The procedure typically followed

Classical International Trade Theories

This chapter introduces the basic ideas and conclusions of classical international trade theories in mathematical form. Section 2.1 studies Adam Smith's trade theory with absolute advantage. Although Smith's ideas about absolute advantage were crucial for the early development of

classical thought for international trade, he failed to create a convincing economic theory of international trade. Examines the theories of comparative advantage. Ricardo showed that the potential gains from trade are far greater

Than Smith envisioned in the concept of absolute advantage. Develops a two-good, two-factor model. Different from the common dual approach to examining perfectly competitive two-factor two-sector model in the trade literature, we use profit-maximizing approach to demonstrate the most well-known theorems in the Heckscher-Ohlin trade theory. These theorems include the factor price insensitivity lemma, Samuelson' factor price equalization theorem, Stolper-Samuelson theorem, and Rybczynski's theorem. In , we illustrate the dual approach for the same economic problems as defined. examines the Heckscher-Ohlin theory which emphasizes differences between the factor endowments of different countries and differences between commodities in the intensities with which they use these factors. The basic model deals with a long-term general equilibrium in which the two factors are both mobile between sectors and the cause of trade is that different countries have different relative factor endowments. The theory is different from the Ricardian model which isolates differences in technology between countries as the basis for trade. In the Heckscher-Ohlin theory costs of production are endogenous in the sense that they are different in the trade and autarky situations, even when all countries have access to the same technology for producing each good. Introduces the neoclassical theory which holds that the determinants of trade patterns are to be found simultaneously in the differences between the technologies, the factor endowments, and the tastes of different countries. Develops a general equilibrium model for a two-country two-sector two-factor economy, synthesizing the models in the previous sectors. known generalization of the Ricardian model to encompass a continuum of goods.

CHAPTER 7

Adam Smith and Absolute Advantage

Adam Smith (1776) held that for two nations to trade with each other voluntarily, both nations must gain. If one nation gained nothing or lost, it would refuse it. According to Smith, mutually beneficial trade takes place based on absolute advantage. When one nation is more efficient than (or has an absolute advantage over) the other nation is producing a second commodity, then both nations gain by each specializing in the production of the commodity of its absolute advantage and exchanging part of its output with the other nation for the commodity of its absolute disadvantage. For instance, Japan is efficient in producing cars but inefficient in producing computers; on the other hand, the USA is efficient in producing computers but inefficient in cars. Thus, Japan has an absolute advantage over the USA in producing cars but an absolute disadvantage in producing computers. The opposite is true for the USA. Under these conditions, according to Smith, both nations would benefit if each specified in the production of the commodity of its absolute advantage and then traded with the other nation. Japan would specialize in producing cars and would exchange some of the cars for computers produced in the USA. As a result, both more cars and computers would be produced, and both Japan and the USA gain. Through free trade, resources are mostly efficiently utilized and output of both commodities will rise. Smith thus argued that all nations would gain from free trade and strongly advocated a policy of laissez-faire. Under free trade, world resources would be utilized mostly efficiently and world welfare would be maximized. To explain the concept of absolute advantage, we assume that the world consists of two countries (for instance, England and Portugal). There are two commodities (cloth and wine) and a single factor (labor) of production. Technologies of the two countries are fixed. Assume that the unit cost of production of each commodity (expressed in terms of labor) is constant. Assume that a labor theory of value is employed, that is, goods exchange for each other at home in proportion to the relative labor time embodied in them. Let us assume that the unit costs of production of cloth and wine in terms of labor are respectively 2 and 8 in England;1 while they are respectively 4 and 6 in Portugal. Applying the labor theory of value, we see that 1 unit of wine is exchanged for 4 units of cloth in England when England does not have trade with Portugal. The ratio is expressed as 1/ 4 units of cloth/per wine. The ratio is the relative quantities of labor required to produce the goods in England and can be considered as opportunity costs. The ratio is referred to as the price ratio in

autarky. Similarly, 2 units of wine is exchanged for 3 units of cloth in Portugal (3 / 2 units of cloth/per wine). England has an absolute advantage in the production of cloth and Portugal has an absolute advantage in the production of wine because to produce one unit of cloth needs less amount of labor in England than in Portugal and to produce one unit of wine needs more amount of labor in England than in Portugal. Adam Smith argued that there should be mutual benefits for trade because each country has absolute advantage in producing goods. For instance, if the two countries have free trade and each country specified in producing the good where it has absolute advantage. In this example, England is specified in producing cloth and Portugal in producing wine. Also assume that in the international market, one unit of wine can exchange for 3 units of cloth. In England in open economy one can obtain one unit of wine with 3 units of cloth, while in the autarky system one unit of wine requires 4 units of cloth, we see that trade will benefit England. Similarly, in Portugal in open economy one can obtain One unit of cloth with 1/3 unit of wine instead of 2 / 3 unit of wine as in autarky system, trade also benefits Portugal. In this example, we fixed the barter price in open economies with one unit of wine for 3 units of cloth. It can be seen that mutual gains can occur over a wide range of barter prices.

The Ricardian Trade Theory

Although Smith's ideas about absolute advantage were crucial for the early development of classical thought for international trade, it is generally agreed that David Ricardo is the creator of the classical theory of international trade, even though many concrete ideas about trade existed before his Principles (Ricardo, 1817). Ricardo showed that the potential gains from trade are far greater than Smith envisioned in the concept of absolute advantage. The theories of comparative advantage and the gains from trade are usually connected with Ricardo. In this theory the crucial variable used to explain international trade patterns is technology. The theory holds that a difference in comparative costs of production is the necessary condition for the existence of international trade. But this difference reflects a difference in techniques of production. According to this theory, technological differences between countries determine international division of labor and consumption and trade patterns. It holds that trade is beneficial to all participating countries. This conclusion is against the viewpoint about trade held by the doctrine of mercantilism. In mercantilism it is argued that the regulation and planning of economic activity are efficient means of fostering the goals of nation. In order to illustrate the theory of comparative advantage, we consider an example constructed by Ricardo. We assume that the

world consists of two countries (for instance, England and Portugal). There are two commodities (cloth and wine) and a single factor (labor) of production. Technologies of the two countries are fixed. Let us assume that the unit cost of production of each commodity (expressed in terms of labor) is constant. We consider a case in which each country is superior to the other one in production of one (and only one) commodity. For instance, England produces cloth in lower unit cost than Portugal and Portugal makes wine in lower unit cost than England. In this situation, international exchanges of commodities will occur under free trade conditions. As argued in Sect. 2.1, trade benefits both England and Portugal if the former is specified in the production of cloth and the latter in wine. This case is easy to understand. The Ricardian theory also shows that even if one country is superior to the other one in the production of two commodities, free international trade may still benefit the two countries. We may consider the following example to illustrate the point. Let us assume that the unit costs of production of cloth and wine in terms of labor are respectively 4 and 8 in England; while they are 6 and 10 in Portugal. That is, England is superior to Portugal in the production of both commodities. It seems that there is no scope for international trade since England is superior in everything. But the theory predicts a different conclusion. It argues that the condition for international trade to take place is the existence of a difference between the comparative costs. Here, we define comparative costs as the ratio between the unit costs of the two commodities in the same countries. In our example comparative costs are 4/8 = 0.5 and 6/10 = 0.6 in England and Portugal respectively. It is straightforward to see that England has a relatively greater advantage in the production of cloth than wine: the ratio of production costs of cloth between England and Portugal is 4 / 6; the ratio of production costs of wine is 8/10. It can also seen that Portugal has a relatively smaller disadvantage in the production of wine. The Riparian model predicts that if the terms of trade are greater than 0.5 and smaller than 0.6, British cloth will be exchanged for Portuguese wine to the benefit of both countries. For in in techniques of production. According to this theory, technological differences between countries determine international division of labor and consumption and trade patterns. It holds that trade is beneficial to all participating countries. This conclusion is against the viewpoint about trade held by the doctrine of mercantilism. In mercantilism it is argued that the egulation and planning of economic activity are efficient means of fostering the goals of nation.

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CHAPTER 8

Trade Theory

The Ricardian theory is concerned with technology. The theory has a single factor of production. nevertheless, economic activities involve many factors. The Heckscher-Ohlin international trade theory is concerned with factors of production. Before introducing the Heckscher-Ohlin theory in the next section, we develop a two-good, two-factor model. Different from the common dual approach to examining perfectly competitive two-factor two-sector model in the trade literature,8 we use profit-maximizing approach to demonstrate the most well-known theorems in the Heckscher- Ohlin trade theory. In Sect. 2.4, we illustrate the dual approach for the same economic problems. We are concerned with a single country. Assume that there are two factors of production, labor and capital. Their total supplies, N and K, are fixed. The economy produces two goods with the following Cobb-Douglas production functions

The Heckscher-Ohlin Theory

The classical distinction introduced by Ricardo and maintained by most of his followers has factors of production trapped within national boundaries. Only final commodities can be traded. The Heckscher-Ohlin theory shows that international trade in commodities could alleviate the discrepancy be ween countries in relative factor endowments. This takes places indirectly when countries export those commodities that use intensively the factors in relative abundance. In 1933, Ohlin, a Swedish economist, published his renowned

Interregional and International Trade. The book built an economic theory of international trade from earlier work by Heckscher (another Swedish economist, Ohlin's teacher) and his own doctoral thesis.22 the theory is now known as the Heckscher-Ohlin model, one of the standard models in the literature of international economics. Ohlin used the model to derive the socalled Heckscher-Ohlin theorem, predicting that nations would specialize in industries most able to utilize their mix of national resources efficiently. Importing commodities that would use domestic scarce factors if they were produced at home can relieve the relative scarcity of these factors. Hence, free trade in commodities could serve to equalize factor prices between countries with the same technology, even though the production inputs do not have an international market. The Ricardian model and Heckscher-Ohlin model are two basic models of trade and production. They provide the pillars upon which much of pure theory of international trade rests.

The so-called Heckscher-Ohlin model has been one of the dominant models of comparative advantage in modern Economics. The Heckscher-Ohlin theory emphasizes the differences between the factor endowments of different countries and differences between commodities in the intensities with which they use these factors. The basic model deals with a long-term general equilibrium in which the two factors are both mobile between sectors and the cause of trade is different countries having different relative factor endowments. This theory deals with the impact of trade on factor use and factor rewards. The theory is different from the Ricardian model which isolates differences in technology between countries as the basis for trade. In the Heckscher-Ohlin theory costs of production are endogenous in the sense that they are different in the trade and autarky situations, even when all countries have access to the same technology for producing each good. This model has been a main stream of international trade theory. According to Ethier (1974), this Theory has four "core proportions". In the simple case of two-commodity and two-country world economy, we have these four propositions as follows: (1) the factor-price equalization theorem by Lerner (1952) and Samuelson (1948, 1949), stating that free trade in final goods alone brings about complete international equalization of factor prices; (2) the Stolper- Samuelson theory by Stolper and Samuelson (1941), saying that an in- crease in the relative price of one commodity raises the real return of the factor used intensively in producing that commodity and lowers the real return of the other factor; (3) the Rybczynski theorem by Rybczynski (1955), stating that if commodity prices are held fixed, an increase in the endowment of one factor causes a more than proportionate increase in the output of the commodity which uses that factor relatively intensively and an absolute decline in the output of the other commodity; and (4) the Heckscher-

Ohlin theorem by Heckscher (1919) and Ohlin (1933), stating that a country tends to have a bias towards producing and exporting the commodity which uses intensively the factor with which it is relatively well-endowed. The previous section has already confirmed the factor price insensitivity lemma, Samuelson' factor price equalization theorem, Stolper-Samuelson theorem, and Rybczynski's theorem. We now confirm the Heckscher- Ohlin theorem. The original Heckscher-Ohlin model considers that the only difference between countries is the relative abundances of capital and labor. It has two commodities. Since there are two factors of production, the model is sometimes called the " 2× 2×2 model." The Heckscher-Ohlin Theorem

holds under, except the assumptions for the two-product two factor model developed in Sect. 2.3, the following assumptions:

(1) Capital and labor are not available in the same proportion in both countries;

(2) The two goods produced either require relatively more capital or relatively more labor;

(3) Transportation costs are neglected;

(4) Consumers in the world have the identical and homothetic taste.

We call the two countries as Foreign and Home. We will use the same symbol as in Sect. 2.3 and the variables for Foreign with a tilde ~. We assume that Home is labor abundant, that is, $N / K > N\sim / K\sim$. The two countries have identical technologies. We also assume that good 1 is labor intensive. Trade is balanced, that is, value of exports being equal to value of imports. Under these assumptions, the following Heckscher-Ohlin theorem holds.

(**Heckscher-Ohlin Theorem)**

Each country will export the good that uses its abundant factor intensively. The theorem implies that Home exports good 1 and foreign exports 2. In order to determine trade directions, we need mechanisms to determine prices of goods. The analytical results in Sect. 2.3 and or the dual theory in Sect. 2.4 cannot yet determine prices. To determine trade directions, we further develop the economic model in Sect. 2.3. We now introduce a utility function to determine prices in autarky. After we determine the prices in autarky, we can then determine the directions of trade flows. The consumer's utility-maximizing problem is described a

The Neoclassical Trade Theory

The Ricardian theory failed to determine the terms of trade, even though it can be used to determine the limits in which the terms of trade must lie. The Heckscher-Ohlin theory provides simple and intuitive insights into the relationships between commodity prices and factor prices, factor supplies and factor rewards, and factor endowments and the pattern of production and trade. Although the Heckscher-Ohlin model was the dominant framework for analyzing trade in the 1960s, it had neither succeeded in supplanting the Ricardian model nor had been replaced by the specific-factor trade models. Each theory has been refined within its own 'scope'. Each

theory is limited to a range of questions. It is argued that as far as general ideas are concerned, the Heckscher-Olin theory may be considered as a special case of the neoclassical theory introduced in this section as it accepts all the logical promises of neoclassical methodology. The Heckscher-Olin theory may be seen as a special case of the neoclassical trade theory in which production technology and preferences are internationally identical. It was recognized long ago that in order to determine the terms of trade, it is necessary to build trade theory which not only takes account of the productive side but also the demand side.28 The neoclassical theory holds that the determinants of trade patterns are to be found simultaneously in the differences between the technologies, the factor ndowments, and the tastes of different countries. Preference accounts for the existence of international trade even if technologies and factor endowments were com- pletely identical between countries. As an illustration of the neoclassical trade theory, we show how Mill solved the trade equilibrium problem and

how this problem can be solved with help of modern analytical tool. Mill introduced the equation of international demand, according to which the terms of trade are determined so as to equate the value of exports and the value of imports. Mill argued: "the exports and imports between the two countries (or, if we suppose more than two, between each country and the world) must in the aggregate pay for each other, and must therefore be exchanged for one another at such values as will be compatible with the equation of the international demand.30" He initiated the theory of reciprocal demand which is one of the earliest examples of general equilibrium analysis in trade theory. In Chap. 18, book 3 of his Principles, he showed

The existence of trade equilibrium, using a simplified model and explicitly solving equations in the model numerically. He assumed that there exists only one factor of production and production is subjected to constant returns to scale and requires on the demand side as follows: "Let us therefore assume, that the influence of cheapness on demand conforms to some simple law, common to both countries and to both commodities. As the simplest and most convenient, let us suppose that in both countries any given increase of cheapness produces an exactly proportional increase of consumption; or, in other words, that the value expended in the commodity, the cost incurred for the sake of obtaining it, is always the same, whether that cost affords a greater or a smaller quantity of the commodity.31" As a numerical example, consider that the world economy consists of Germany and England and the economic system has two

goods, cloth and linen. Let us assume that in Germany 10 yards of cloth was exchanged for 20 yards of linen and that England wants to sell 1,000,000 yards of cloth to Germany. If Germany wants 800,000 yards of cloth, this is equal to 1,600,000 yards of linen at German exchange ratio. Since German expended value in cloth is constant, England will receive 1,600,000 yards of linen in exchange of 1,000,000 yards of cloth, replacing Germany supply of cloth entirely. Under the assumption mentioned above and some additional requirements, Mill explicitly solved the international exchange ratio of two Commodities in terms of coefficients of production in two countries and by so doing showed the existence of trade equilibrium. Chipman pointed out that the case analyzed by Mill can be treated as a problem of non-linear.

Trade and distribution of Income, Factor Price

The second set of studies is more in line with international trade theory, in the sense that a country's relative factor endowment is set to be a determinant of the impact of trade openness on inequality. Bourguignon and Morrisson (1990), Spilimbergo et al. (1999) and Fisher (2001) are examples of this approach. While the theoretical ground used by Spilimbergo et al. (1999) is close to the one proposed by Bourguignon and Morrisson (1990), i.e. basically the HOS framework, Fisher (2001) bases his empirical work on the dynamic specific factors model of Eaton (1987). Fisher's motivation to renounce to HOS is

That this theoretical approach is inconsistent with the fact that trade liberalization affects LDC's differentially. The empirical implementation is rather close in the two recent articles mentioned above (Fisher and Spilimbergo et al.): relative factor endowments, openness and interaction term between openness and relative factor abundance are the main explanatory variables of inequality. Regarding results, in both cases 1) openness leads to more inequality; 2) trade effects undo the direct effects of endowments (i.e. interaction coefficients have an opposite sign compared to direct effects); and 3) data do not fit the theoretical models. On this last point, Spilimbergo et al. emphasize that opposite signs on endowments and trade effects of endowments is in contradiction with the HO framework. Fisher's results are neither in accordance with the underlying model once other factors, like human capital, are introduced. Furthermore, two drawbacks are worth mentioning. The first one has to do with the consistency of data on inequality. Due to data limitations, Gini coefficients based on different income definitions (income/expenditure, gross/net…) and different recipient units (individual/household…) are

used, as in most cross-country studies on inequality. Even when some adjustment is done to improve data comparability, these differences result in serious data inconsistency, as shown by Knowles (2001) about the link between growth and inequality. The second drawback concerns the econometric specification adopted in Spilimbergo et al. work, which is expressed in levels instead of changes in inequality.

Trying to explain cross-country differences in levels of inequality is a challenging task, since a number of idiosyncratic factors cannot be properly taken into account. Fiscal redistribution, labor market devices or distribution of factor ownership, for instance, are not well documented for most countries. As a consequence, econometric estimates are likely to be flawed with omitted variable bias. In addition, the interesting issue from a policy perspective is not whether countries with different degrees of openness exhibit different levels of inequality, but rather whether an increase in a country's trade openness is associated with an increase or a decrease in inequality. Even from a theoretical perspective, the predictions from the HOS framework do not refer to cross-country comparison of levels of inequality, but rather to their changes as countries open up to trade. In order to test for the sensitivity of results with regards to these issues of data consistency and econometric specification, we run the same estimation as Spilimbergo et al.,introducing two changes: we specified the econometric model in changes instead of levels; We imposed additional data consistency requirements, by using only changes computed as the difference between two Gini indices based on the same income concept and the same recipient unit. When the relationship is estimated this way, the results found by Spilimbergo et al. no longer hold Hence, while these studies appeared promising, they failed to deliver a convincing answer as to the link between openness and inequality: in addition to the gap between results and underlying theoretical models, robustness is in both cases challenged. This calls for an alternative approach. Our motivation for reconsidering this evidence is consequently to bring up improvement in three respects: theoretical approach, data consistency and econometric specification. As to the theoretical framework, we argue that the standard HOS model is too restrictive, in several ways. The assumption that the impact of liberalization on income distribution is only conditional on factor endowments implicitly or explicitly stems from the direct link between factor content of trade and factor endowment, as described by the HeckscherOhlin-Vanek relationship. Since Trefler (1995) emphasized the "case of the missing trade", a long way has been traveled toward making clear the conditions under which Vanek's

prediction is borne out by the data (see e.g. Davis and Weinstein, 2003, for a survey, and Trefler and Zhu, 2005, for a recent important contribution). Among these conditions are in particular the assumption of consumption similarity across countries, and the absence of any transaction cost (either linked to transportation or to border protection). Since we want to use a more general framework, and in particular acknowledge the potential influence of HOV relationship to hold. As a consequence, we cannot rely on factor endowments only to study the impact of foreign trade on income distribution. Another concern with the theoretical framework is dimensionality.

As already convincingly emphasized for instance by Wood (1994), we argue that three production factors are required, at least, to gain valuable insights about the distributional impact of trade in developing countries. Indeed, a large part of the labor force in poor countries does not have any education, even basic, and is employed in the traditional or craft sector. It is strongly questionable whether their output corresponds to tradable goods, as far as manufacturing industries are concerned. Moreover their mobility toward the "modern" sector is hindered by the lack of basic education. Even in an economy where the export oriented manufacturing sector is intensive in low-skilled labor, Such non-educated workers are thus unlikely to receive any direct benefit from the development of the export sector or from an increase in the price of exports. The positive impact on the relative price of unskilled labor, admittedly considered as the abundant factor for developing countries, might thus be restricted, in practice, to a fraction of unskilled workers only, namely those enjoying at least basic education, and likely to work in the "modern" sector. As soon as the share of non-educated labor in the labor force is large enough, the alleged positive impact of trade openness on unskilled (but somewhat educated) labor does not reduce inequalities. On the contrary, the deterioration of the relative position of non-educated workers would increase income inequalities. Of course, such effect is not expected to hold in more developed countries, where the share of non-educated workers is relatively small and in Poor countries only specialized in agriculture. In order to address these different issues, we adopt a general theoretical framework in which the number of goods and factors is not specified, and in which no assumption is made about the rest of the world. In particular, no assumption is made about factor price Equalization. Mainly based on the assumption of general equilibrium under perfect competition on product and factor markets, the model shows that factor price changes are correlated with an indicator of net export changes. Although this indicator can be termed a specific definition of the factor content of trade, it should be clear that this only comes out from

the analysis of the link between foreign trade and relative wages. Our purpose is not to elaborate upon the validity of Vanek prediction on the link between factor endowments and the factor content of trade. In order to derive from this model a testable relationship between foreign trade and income inequality, we then restrict the model to the case where three production factors are considered, namely two types of labor (non-educated workers and other workers), in Addition to physical capital. Assuming that non-educated workers are only employed in non-tradable goods production, we show that the change in income distribution is related to the change in an indicator of the factor content of net exports, relative to the country's factor endowments. This relationship, which is the base for subsequent econometric estimates, turns out to be conditional on the share of non-educated workers. Our model compares two equilibrium of a given economy, across which technology and consumer preferences are held constant. The nature of the shock considered is not specified explicitly, but the analysis applies to trade policy changes. As the factor content of net export changes embodies, among other things, the impact of possible trade policy changes, these trade policy changes need not be explicitly added as determinants of factor prices. The difficulty of properly measuring each country's trade policy is thus sidestepped in the empirical analysis. As pointed out for instance by Leamer (2000) though, the changes in the factor content of trade are not only related to trade policies, but also to technology or consumer taste changes (see also Deardorff, 2000, for a discussion). This means that the results should be interpreted with much care. The impact of our indicator of factor content of net export changes does not only reflect the impact of trade policies. But our approach suggests that the impact of trade policy on income distribution can be studied through its impact on the factor content of net export changes. Our theoretical and empirical approach does not make any restrictive assumption on cross-country differences in preferences, technology nor choice of technique, which have been shown to be of special relevance by recent works (Davis and Weinstein, 2003; Trifler and Zhu, 2005). The counterpart of such an approach is that it is very data demanding. In particular, we make use of a country-specific technology coefficient matrix. For countries where data on capital stock at the industry level is missing, we assume capital intensity at the sector level to be the same as in countries found to be similar in terms of capital abundance and technology in a clustering analysis. Our empirical implementation brings up improvement in two other respects. We put special emphasis on data consistency requirements for inequality index and we analyze the impact of international trade change on the change in income distribution (instead of

differences in levels of income inequality across countries due to differences in degrees of openness).Our main empirical finding is that the factor content of net export changes, expressed relatively to the country's factor endowment, does have a significant impact on income distribution, but this impact is conditional on country's income level or to the share of noneducated in the population over 15. Taking into account the sign and magnitude of the factor content of net export changes, we find that on average international trade led to a widening of income inequality both in poor and rich countries, and to a reduction in middle-income countries. While for poor countries this result runs counter to the prediction of standard trade theory, it is in accordance with the theoretical model developed here. Furthermore, it is consistent with recent empirical findings obtained in slightly different contexts (Milanovic, 2002; Barro, 2000; Lundberg and Squire, 1999; see Table 1), but, contrary to these studies, it relies on a theoretical foundation explaining how trade can lead to an increase in inequality in low-income countries. Because in manufacturing industries, exporting firms require at least some education from their workers, trade does not directly benefit workers without a any education, who account for the bulk of low-income households in most poor countries.

CHAPTER 9

Implications in a three-factor model

Let us now assume that three production factors only are used: labor without any education (UN), labor with at least basic education (L), and capital (K). The number of goods is not specified, but we will assume that goods can be classified in two categories (tradable and non-tradable), and that exportable good production does not require any uneducated labor. The rationale for these assumptions is to account for the existence in most developing countries of a traditional sector, employing non-educated labor, and roducing goods unsuited for export, and not in competition with imports. Noteworthily, this category of non-educated labor differs from the usual definition of unskilled labor, in that it is restricted to workers without any education. The assumption that the production of exportable goods does not require uneducated labor is questionable for raw material and raw agriculture. However, as far as manufactured goods are concerned, producing goods well suited for export requires matching relatively high standards of quality, which call for a certain level of skill.

EMPIRICAL EVIDENCE

According to the theoretical model, the impact of a change in the factor content of net exports is conditional on the share of households drawing their income from non-educated labor. However, data on the share of the non-educated in the population over 15 are only available at five-year intervals. Introducing it in estimations thus first requires interpolating the data. This raises serious questions about the reliability of this variable. Our estimating strategy is thus to use PPP GDP per capita instead of the share of non-educated in working age population: although it fits less closely model's predictions, PPP GDP per capita is likely to be better measured, and it is available on an annual basis. Its empirical reliability is therefore higher. Nevertheless, results using the share of the non-educated in the population will be subsequently presented with view of checking results robustness. In this case, the acknowledged measurement error for non-educated share leads us to use instrumental variable techniques. Table 2 reports results from estimating equation, using PPP GDP per capita instead of the share of the non-educated in the population. We begin (column 0) with testing a simple equation where only the factor content of trade is taken into account. No significant effect is found in this case. As suggested by equation

(18), an interaction term between the factor content of net export changes (ΔFCT) and initial PPP GDP per capita is then included in the estimation (column 1). In order to avoid co linearity, this term is calculated by interacting ΔFCT with a centered term of PPP GDP per capita, namely the difference of the log PPP GDP per capita to its mean across the sample. In this estimate, ΔFCT is still found insignificant, but the interaction term turns out to be significant, in accordance with the model's prediction. This result suggests that the influence of the factor content of net export changes on inequality growth rate would be conditional on the initial level of income per capita. For poor countries, an increase in FCT (i.e. net export changes exhibiting a higher increase in labor-content than in capital-content) increases income inequality, while it would reduce income inequality in rich countries. The threshold, for which the effect shifts sign, occurs for an income level of approximately PPP $4,700. Around this income level, the impact of ΔFCT is approximately zero. According to the model displayed above, the coefficients of the capital content and of the labor content of net exports should be opposite in sign and equal in absolute value, as is assumed when only ΔFCT is included in the equation. In order to test this assumption, the capital content and the labor content of trade are considered separately in column 2. Only variables on the labor content of net export changes are found to be significant in this case. While inconsistent with the model, the insignificance of the capital content of net export changes is not wholly surprising. Indeed, the assumption of factor immobility across countries made in the model is not realistic in the case of capital. Since capital is fairly mobile across countries, it may seem logical that the content of foreign trade in this factor should not necessarily have a significant impact on its price. For labor, the results suggest the same kind of conditional relationship as the one obtained before for FCT. The threshold for which the effect shifts signs are the same than the one found before, around $4,700 PPP GDP per capita. So far, land has not been considered, while this factor originates a substantial part of income in numerous countries. While our theoretical framework does not include this fourth factor, it is useful checking for the robustness of the analysis with regard to the inclusion of land. Estimation (3) thus extends the model by incorporating a proxy for the land content of foreign trade. This proxy is constructed assuming that the land content of production is one for agricultural sectors, and zero otherwise. This is a very crude approximation, but the lack of appropriate data prevented us from making a more precise calculation. As shown in column (3), including this variable does not alter significantly the results obtained for the other variables, although the

threshold is lower in this case. The land content of net export change turns out to have a positive and significant impact on income inequality, consistent with the fairly high concentration of land ownership observed in most countries.

The Standard Trade Model

The standard trade model combines ideas from the Ricardian model and the Heckscher-Ohlin model.

1. Differences in labor services, labor skills, physical capital, land, and technology between countries cause productive differences, leading to gains from trade.

2. These productive differences are represented as differences in production possibility frontiers, which represent the productive capacities of nations.

3. A country's PPF determines its relative supply function.

4. National relative supply functions determine a world relative supply function, which along with a world relative demand determines equilibrium under international trade

Key relationships:

1. Between the PPF and the relative supply curve

2. between relative prices and relative demand

3. The determination of world equilibrium by world relative supply and world relative demand

4. The effect of the terms of trade on a nation's welfare

Terms of trade: The price of a country's exports divided by the Price of its imports

The Value of Production

• Recall that when the economy maximizes its production possibilities, the value of output V lies

On the PPF.

• V = PCQC + PF QF describes the value of output in a two good model, ¨ and when this value is constant the equation's line is called and is value line. The slope of the is value line equals – (PC /PF), and if relative prices change the slope changes

The Value of Consumption

• The value of the economy's consumption is constrained to equal the value of the economies

Production. ¨ PC DC + PF DF = PC QC + PF QF = V

• Production choices are determined by the economy's PPF and the prices of output.

• What determines consumption choices (demand)?

• Consumer preferences and prices determine consumption choices.

• Consumer preferences are represented by indifference curves: combinations of goods that make consumers equally satisfied (indifferent).Each consumer has his or her own preferences, but we

pretend that we can represent the preferences of an average consumer that represents all consumers

Prices and the Value of Consumption

• Prices also determine the value of consumption.¨ When the price of cloth rises relative to the price of food, the economy is better off when it exports cloth: the isovalue line becomes steeper and a higher indifference curve can be reached.¨ A higher price for cloth exports means that more food

can be imported.¨ A higher relative price of cloth will also influence consumption decisions about cloth versus food: a higher relative price of cloth makes consumers willing to buy less cloth and more food.

• The change in welfare (income) when the price of one good change relative to the price of another is called the income effect.¨ the income effect is represented by moving to another

Indifference curve.

• The substitution of one good for another when the price of the good changes relative to the other is called the substitution effect. The substitution effect is represented by a moving along a given indifference curve.

Production Possibilities and relative supply

1. (a) The production possibility curve is a straight line that intercepts the apple axis at 400 (1200/3) and the banana axis at 600 (1200/2).

(b) The opportunity cost of applesin terms of bananas is 3/2.It takes three units of labor to harvest an apple but only two units of labor to harvest a banana. If one foregoes harvesting an apple, this frees up three units of labor. These 3 units of labor could then be used to harvest

1.5 bananas. (c) Labor mobility ensures a common wage in each sector and competition ensures the price of goods equals their cost of production. Thus, the relative price equals the relative costs, which equals the wage times the unit labor requirement for apples divided by the wage times the unit labor requirement for bananas. Since wages are equal across sectors, the price ratio equals the ratio of the unit labor requirement, which is 3 apples per 2 bananas. 2. (a) The production possibility curve is linear, with the intercept on the apple axis equal to 160 (800/5) and the intercept on the banana axis equal to 800 (800/1).

(b) The world relative supply curve is constructed by determining the supply of apples relative to the supply of bananas at each relative price. The lowest relative price at which apples are harvested is 3 apples per 2 bananas. The relative supply curve is flat at this price. The maximum number of apples supplied at the price of 3/2 is 400 supplied by Home while, at this price, foreign harvests 800 bananas and no apples, giving a maximum relative supply at this price of 1/2. This relative supply holds for any price between 3/2 and 5. At the price of 5, both countries would harvest apples. The relative supply curve is again flat at 5. Thus, the relative supply curve is step shaped, flat at the price 3/2 from the relative supply of 0 to 1/2, vertical at the relative quantity 1/2 rising from 3/2 to 5, and then flat again from 1/2 to infinity.

3. (a) The relative demand curve includes the points (1/5, 5), (1/2, 2), (1, 1), (2, 1/2).

(b) The equilibrium relative price of applesisfound at the intersection of the relative demand and relative supply curves. This is the point (1/2, 2), where the relative demand curve intersectsthe verticalsection of the relative supply curve. Thus the equilibrium relative price is 2.

(c) Home produces only apples, Foreign produces only bananas, and each country trades some of its product for the product of the other country.

(d) In the absence of trade, Home could gain three bananas by foregoing two apples, and Foreign could gain by one apple foregoing five bananas. Trade allows each country to trade two bananas for one apple. Home could then gain four bananas by foregoing two apples while Foreign could gain one apple by foregoing only two bananas. Each country is better off with trade.

4. The increase in the number of workers at Home shifts out the relative supply schedule such that the Corner points are at (1, 3/2) and (1, 5) instead of (1/2, 3/2) and (1/2, 5). The intersection of the relative Demand and relative supply curves is now in the lower horizontal section, at the point (2/3, 3/2).In this case, Foreign still gainsfrom trade but the opportunity cost of bananas in terms of Apples for Home is the same whether or not there istrade,so Home neither gains nor loses from trade.

5. This answer is identical to that in 3. The amount of "effective labor" has not changed since the doubling of the labor force is accompanied by a halving of the productivity of labor.

6. This statement is just an example of the pauper labor argument discussed in the chapter. The point is that relative wage rates do not come out of thin air; they are determined by comparative productivity and the relative demand for goods. The box in the chapter provides data which shows the strong connection between wages and productivity. China slow wage presumably reflect she fact that China isles productive than the United States in most industries. As the test example illustrated, a highly productive country that trades with a less productive, low-wage country will raise, not lower, its tandard of living.

7. The problem with this argument is that it does not use all the information needed for determining comparative advantage in production: this calculation involves the four unit labor requirements(for both the industry and service sectors, not just the two for the service sector). It is not enough to compare only service's unit labor requirements. If also , Home labor is more efficient than foreign labor in services. While this demonstrates that the United States has an absolute advantage in services, thesis neither a necessary nor a sufficient condition for determining comparative advantage. For this determination, the industry ratios are also required. The competitive advantage of any industry depends on both the relative productivities of the industries and the relative wages across industries.

8. While Japanese workers may earn the equivalent wages of U.S. workers, the purchasing power of their income is one-third less. This implies that although w = w

Since the United States is considerably more productive in services, service prices are relatively low.

This benefits and enhances U.S. purchasing power. However, many of these services cannot be transported and hence, are not traded. This implies that the Japanese may not benefit from the lower U.S.services costs, and do not face an international price which is lower than their domestic price.

Likewise, the price of services in United States does not increase with the opening of trade since these services are non-traded. Consequently, U.S. purchasing power is higher than that of Japan due to its lower prices on non-traded goods.

9. Gains from trade still exist in the presence of non traded goods. The gains from trade decline as the share of non traded goods increases. In other words, the higher the portion of goods which do not enter international marketplace, the lower the potential gains from trade. If transport costs were high enough so that no goods were traded then, obviously, there would be no gains from trade.

10. The world relative supply curve in this case consists of a step function, with as many "steps" (Horizontal portions) as there are countries with different unit labor requirement ratios. Any countries to the left of the intersection of the relative demand and relative supply curves export the good in which they have a comparative advantage relative to any country to the right of the intersection. If the intersection occursin a horizontal portion then the country with that price ratio produce both good.

Economic growth: shift of RS curve, growth and production possibility

Measured by PCIPF, while Foreign's are measured by PFIPC. Qc and QF are the quantities of cloth and food produced by Home: Q* and Q* are the quantities produced by Foreign. To determine PCIPF we find the intersection of world relative supply of cloth and world relative demand. The world relative supply curve (RS in Figure 5-5) is upward sloping because an increase in PCIPF leads both countries to produce more cloth and less food. The world relative demand curve (RD) is downward sloping because an increase in PCIPF leads both countries to shift their consumption mix away from cloth toward food. The intersection of the curves (point 1) determines the equilibrium relative price (PC/PF)1.

Now that we know how relative supply, relative demand, the terms of trade, and welfare are determined in the standard model, we can use it to understand a number of important issues in international economics.

Economic Growth: A Shift of the RS Curve

The effects of economic growth in a trading world economy are a perennial source of con corn and controversy. The debate revolves around two questions. First, is economic growth? in other countries good or bad for our nation? Second, is growth in a country more or less valuable when that nation is part of a closely integrated world economy? In assessing the effects of growth in other countries, commonsense arguments can be made on either side. On one side, economic growth in the rest of the world may be good for our economy because it means larger markets for our exports. On the other side, growth in other countries may mean increased competition for our exporters. Similar ambiguities seem present when we look at the effects of growth at home. On one hand, growth in an economy's production capacity should be more valuable when that country can sell some of its increased production to the world market. On the other hand, the benefits of growth may be passed on to foreigners in the form of lower prices for the country's exports rather than retained at home.

CHAPTER 10

International Trade Theory

The standard model of trade developed in the last section provides a framework that can cut through these seeming contradictions and clarify the effects of economic growth in a trading world.

Growth and the Production Possibility Frontier

Economic growth means an outward shift of a country's production possibility frontier. This growth can result either from increases in a country's resources or from improvements in the efficiency with which these resources are used. The international trade effects of growth result from the fact that such growth typically has a bias. Biased growth takes place when the production possibility frontier shifts outmode in one direction than in the other. Figure 5-6a illustrates growth biased toward cloth, and Figure 5-6b shows growth biased toward food. In each case the production possibility frontier shifts from 7T1 to TT2.

Growth may be biased for two main reasons:

1. The Riparian model of Chapter 2 shows that technological progress in one sector, of the economy will expand the economy's production possibilities more in the direction of that sector's output than in the direction of the other sector's output.

2. The specific factors model of Chapter 3 and the factor proportions model of Chap-ter 4 both showed that an increase in a country's supply of a factor of production—say, an increase in the capital stock resulting from saving and investment—will produce biased expansion of production possibilities. The bias will be in the direction of either the good to which the factor is specific or the good whose production is intensive in the factor whose supply has increased. Thus the same considerations that give rise to inter- national trade will also lead to biased growth in a trading economy. The biases of growth in Figure 5-6a and 5-6b are strong. In each case the economy is able to produce more of both goods, but at an unchanged relative price of cloth the output of food actually falls in Figure 5-6a, while the output of cloth actually falls in Figure 5-6b. Although growth is not always as strongly biased as it is in these examples, even growth that is more mildly biased toward cloth will lead, for any given

relative price of cloth, to a rise in the output of cloth relative to that of food. The reverse is true for growth biased toward food.

Relative Supply and the Terms of Trade

Suppose now that Home experiences growth strongly biased toward cloth, so that its output of cloth rises at any given relative price of cloth, while its output of food declines. Then for the world as a whole the output of cloth relative to food will rise at any given price and the world relative supply curve will shift to the right from RS1 to RS2 (Figure 5-7a). This shift results in a decrease in the relative price of cloth from (PCIPF)X to (PC/PF)2, a worsening of Home's terms of trade and an improvement in Forging's terms of trade.

Notice that the important consideration here is not which economy grows but the bias of the growth. If Foreign had experienced growth biased toward cloth, the effect on the relative supply curve and thus on the terms of trade would have been the same. On the other hand, either Home or Foreign growth biased toward food (Figure 5-7b) leads to a leftward shift of the RS curve (RS1 to RS2) and thus to a rise in the relative price of cloth from (PC/PF)1 to (PCIPF)2. This increase is an improvement in Home's terms of trade, a worsening of Foreign's. Growth that disproportionately expands a country's production possibilities in the direction of the good it exports (cloth in Home, food in Foreign) is export-biased growth. Similarly, growth biased toward the good a country imports is import-biased growth. Our analysis leads to the following general principle: Export-biased growth tends to worsen a growing country's terms of trade, to the benefit of the rest of the world; import-biased growth tends to improve a growing country's terms of trade at the rest of the world's expense.

International Effects of Growth

Using this principle, we are now in a position to resolve our questions about the internal-tional effects of growth. Is growth in the rest of the world good or bad for our country? Does the fact that our country is part of a trading world economy increase or decrease the benefits of growth? In each case the answer depends on the bias of the growth. Export- biased growth in the rest of the world is good for us, improving our terms of trade, while import-biased growth abroad worsens our terms of trade. Export-biased growth in our own

International effects of growth

Introduction

For many centuries economist simply upgrades Riccardian models and argued that free trade based on comparative advantage and according to geographical distribution of factors of production and specialization leads to efficient use of resources and increases world production frontier a "win-win" situation. While according to liberal economist trade liberalization creates faster growth there are economists who proclaimed that countries become more dependent on foreign resources which control process domestic growth and development. Recent models incorporate economies of scale, imperfect competition, R&D and assume that trade liberalization determine the geographical location of industries therefore gain from trade (Help man and Kurgan, 1985). This paper will review and contrast literatures on Old Trade theories, Post Keynesian, Endogenous Growth Models and International Trade, The New Trade Theory, Economic Geography and Theories of National Competitive Advantage.

Comparative advantage

Smith (1776) international trade makes it possible to increase extend of the market and specialization due to division of labor increases the productivity therefore economic growth. The international trade generates a dynamic force by intensifying the specialization of labor, encouraging technical innovations and the accumulation of capital, making it possible to achieve economic growth. A Laissez-faire Laissez-passer policy allowed markets to flourish encouraged division of labor, specialization, and technological development, thereby encouraging growth.Ricardo (1817) theory of comparative advantage is based on the labor theory of value and present a dynamic model of economic growth and characterized it by high savings, capital accumulation, increased production and productivity which increases demand for labor forcing wages to increase and growth. But, resources especially land are subject to diminishing returns, the production is immersed by wages in an increasing proportion, this will reduce incentive to investments, and economy will eventually reach the "stationary state."Young (1928) in Smith tradition examined how international trade increases the dimension of the market and limitation of the division of labor therefore

productivity. He further studied the inter-relation between industries and creation of new industries and technological progress in the process of economic growth.

The post Keynesian

The post Keynesian growth accounting the determinants of growth and business cycle, the first model goes back to Kalecki (1935) with many similarities to Keynesian model and develops a consumption function and assumes capitalists save all their income and labor consumes all their income therefore capital formation depends on income distribution can be expanded to a growth model. Omar's (1957) growth model productive capacity and potential output is treated as a constant multiple of stock of capital a "razor's-edge" growth path at which any deviation from exogenously fixed rate of capital output ratio, growth path would diverge from natural growth path and become unstable. The growth rate of GDP was equal to the ratio investment to GDP lagged by one year divided by the ratio of "required" investment to desired growth, the Incremental Capital Output Ratio. Harrods's (1953) fundamental equation the warranted rate of growth is a function of saving and optimal capital output ratio which is different from actual capital output ratio. Capital output ratio was treated exogenously. Harrod-Domar growth model closed economy model was path breaking in the sense they treated growth as an endogenous variable. Omar treats high unemployment rate as a given, therefore the surplus of labor will be absorbed by any additional capital formation. Domar claimed investment had two effects, adds to demand by purchase of new goods also adds to capacity, supply, but the problem was balancing aggregate demand and supply. Domtar indicated that these two effects would not necessarily be equal which could cause economy to spiral off into either to prolonged overproduction or prolonged underproduction. If actual capital output ratio does not grow at the same rate as optimal capital output ratio the gap between actual growth and optimal growth will widen and economy will never return to optimal growth path, this financial gap according to World Bank report (1993) countries will require significant amount of foreign capital inflows... "to provide sufficient resources to sustain economic growth" The literature on international trade and growth are built using absolute and comparative advantage and the Hecksher-Ohlin model, the Two by Two by Two model (two countries, two commodities, two factors). Their model makes a clear distinction between domestic and external factor mobility. Factor mobility is within the same country between domestic industries and assumed no international factor immobility takes place.

Each country for each good has the same constant returns to scale production function but their capital and labor endowments are different. In the absence of trade, the more labor abundant countries would produce labor intensive goods as would be relatively cheaper than capital intensive goods and the more capital abundant countries would produce capital intensive goods as would be relatively cheaper than labor intensive goods. After trade, countries export goods intensive in the use of their more abundant factor, and import goods intensive in the use of their scarce factor. In long run trade will equate relative prices in different countries, and relative factor prices, assuming no transportation costs, relative price and factor price will be equal. The Heckscher-Ohlin trade model is focused on the idea that a major source of comparative advantage is international differences in factor endowments, the relative factor abundance and intensity is what drives trade patterns between countries.

Leontief (1953) used United States trade data from 1947 and performed the first empirical test of the Heckscher-Ohlin theorem. The United States was capital abundant relative to the rest of the world should have been importing labor intensive goods and exporting capital intensive goods but results showed the contrary which in literature is called "Leontief's paradox." Leontief's paradox has inspired a large body of research in international trade theory, for example Romalis (2004) developed an comprehensive version of the Heckscher-Ohlin model to be consistent with empirical data by taking into account variables such as multiple countries, technology, production variation, and human capital.

The Stolper-Samuelson theorem or so called Huckster-Ohlin-Samuelson model examines the effects of international trade on employment and income, and concludes that under free trade the scarce factors of trading nations due to price equalization are to lose under free trade under, therefore in the United States since labor is considered as the scarce factor of production will not benefit from free trade. Rybczynski (1955) (Rybczynski theorem) builds on the Stolper-Samuelson theorem and "allows predictions about the resulting changes in a country's equilibrium trade volume and terms of trade. As the stock of capital grows, desired trade at given terms of trade will increase (decrease) if the country is capital-abundant (labor-abundant) relative to its trading partners. An expansion of the capital stock will thus lead to deterioration (improvement) in the country's terms of trade. Corresponding results hold for an expansion of labor with capital held constant." (Rybczynski, 1955) The quasi-Heckscher-Ohlin prediction is that "countries capture larger shares of world production and trade in

commodities that more intensively use their abundant factor."The quasi-Rybczynski effect is "countries that accumulate a factor faster than the rest of the world will see their production and export structure move towards commodities that more intensively use that factor."(Romalis, 2004) Fader (1982) developed a framework to show the impact of international trade on economic growth by presenting a dualistic growth model by dividing the economy into two productive sectors, export sector and non-export sector, and concluded that the rate grow of investment, labor and exports explains the rate of growth of economy. Further the allocation of one unit of capital to the export sector would create higher marginal value for the economy than what would be have been generated by a non-export sector.

Ram (1987) expanded Feder's model using of time-series to data for 88 countries for the years 1960-1982 and concluded there was a positive correlation between exports and economic growth for more than 80% of the countries. Coe and Help man (1993) examined the important role of domestic R&D as well as imported sum of R&D of a country's trade partner on the path of total productivity factor (TPF). They used accumulated R&D stock as a proxy for each countries stock of knowledge by using data from 22 industrialized economies for the period 1971-1990, the results showed both domestic and foreign R&D have a positive relation effect on a country's TPF. Further the more open the economy the greater the effect of the stock of external R&D on the domestic TPF and that the less developed countries benefited the most from the stocks of external R&D. Keller (1996) questioned Coe and Help man's results and since he was also able to estimate foreign R&D spillover effects using bilateral trade share rather than the actual trade shares as a country does not have to directly trade with another country such as country A to benefit from the R&D spillover as long as one of its trade partners is engaged in with trade with country A will benefit from spillover.

Endogenous growth models and international trade

Endogenous growth theories treat growth as endogenous and as a result of scale and accumulation there is a positive relation between scale and productivity which outweigh the impact of accumulation which in the neoclassical model leads to diminishing returns. Schumpeter (1942) coined the seemingly paradoxical term "creative destruction," as primary source of economic growth:"The opening up of new markets, foreign or domestic, and the organizational development from the craft shop to such concerns as U.S. Steel illustrate the

same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism." (p. 83).Schumpeter, coined the phrase "technological unemployment" the evolutionary process of growth is entrepreneurship and competition which fuel "creative destruction""The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates." Schumpeter (1942), recognized and analyzed the fluctuations in economic activity under capitalism although accepts the Say's Law, that the economy is self-correcting, in long-run equilibrium cannot be at less than full employment. He clearly distinguished between "'invention," the advancement knowledge and the "innovation," the economic activities of using that knowledge as well as capital accumulation as the cause of economic growth. Schumpeter by outlining the trajectories of creativity in five industries steel, automobiles, textiles, electric power and railroads in three countries US, UK and Germany demonstrate the significance of economies of scale and that creative destruction is the engine of capitalism which can be simplified into two terms: The contribution from entry and exit.

CHAPTER 11

The Contribution of Economies of Scale

International trade creates specialization and economies of scales therefore economic growth. Kenneth Arrow (1962) coined the term “learning by doing” and viewed the level of the "learning" coefficient is a function of collective investment. Learning was treated as a function of the absolute level of knowledge already accumulated in.“Learning by doing “ of human capital just like physical capital accumulates and is a function of the accumulated knowledge, the aggregate human capital or “technical knowledge”. There is a positive spillover of accumulation of inputs on productivity which offsets diminishing return. Arrow assumed that Ai, the technical augmentation factor, is specific to the firm as well as the total "knowledge" in the economy which arises from past cumulative investment of all firms and is easily available to all forms in the process of "learning-by-doing,” therefore is a public good and is a free good. Therefore, the "economy-wide" aggregate production function is:

$Y = A\ Ka + zL1\text{-}a$

Where z is accumulates of capital. Arrow (1962) assumed that $a + z < 1$, which implies increase of capital or labor does not lead to increasing returns, rather increasing returns arise because new knowledge is discovered in the process of investment and production and such knowledge became publicly known, external to individual firms.Barro and Sala -i-Martin (1995) assume “learning-by-doing” is through each firm’s investment, therefore there is a direct relation between a firm’s capital stock and stock of knowledge. Further assume knowledge is a public good therefore all firm could access knowledge at zero cost once discovered, a portion of knowledge spills over instantly across the whole economy. Further the existence of increasing returns to scale does not alter the distribution of the output among the factors of production, the payment of marginal products of each input as in a competitive market, there is not such a mechanism that leads to a socially optimal equilibrium the distribution of knowledge, which implies the social rate of return is greater than the private rate of return of investment. To remedy Barro and Sala-i-Marin suggest subsidizing purchase of capital good or subsidizing production to reach optimum level of investment in the economy. Paul Romer (1986) uses Arrow’s “learning by doing” and argues that the rate of growth of capital alone may yield increasing returns; that $a + z > 1$ was possible. Romer

presented an endogenous growth ode in which “technological change in which long-run growth is driven primarily by the accumulation of knowledge by forward-looking, profit-maximizing agents.” (1003) He further assumes “new knowledge is assumed to be the product of a research technology' that exhibits diminishing returns, this assumption implies that the long run rate of growth is independent of saving-investment quota. That is, given the stock of knowledge at a point in time, doubling the inputs into research will not double the amount of new knowledge produced. In addition, investment in knowledge suggests a natural externality. The creation of new knowledge by one firm is assumed to have a positive external effect on the production possibilities of other firms because knowledge cannot be perfectly patented or kept secret.” (1003) and “knowledge is a capital good with an increasing marginal product.” (1005) further “Given increasing marginal productivity of knowledge, increasing marginal productivity of a composite k would still be possible if the increasing marginal productivity of knowledge were sufficient to outweigh the decreasing marginal productivity associated with the physical capital.Romer (1990) proposed the technological progress appears with new knowledge formation, the knowledge via human capital can serve as an important production tools that like other forms of capitals which leads to increase in the national income of the advanced countries. In contrast, the developing countries with abundant manpower and capital have not reached a sustainable economic development. “The growth rate is increasing in the stock of human capital, but it does not depend on the total size of the labor force or the population. In a limiting case that may be relevant for historical analysis and for the poorest countries today, if the stock of human capital is too low, growth may not take place at all.” (77) In this model Romer treats” knowledge as no rival good makes it possible to talk sensibly about knowledge spillovers, that is, incomplete excludability.”

Romper (1990) model assumes there are four inputs labor, human capital, capital and an index of the level of the technology. Human capital is captured by such factors as education and on the job training, and final output is a function of these inputs. Under the specification of the model the economies with a larger total stock of human capital will experience faster growth and further put forward that free international trade can accelerate growth. Finally the model suggests the low growth rate in underdeveloped economies with large population can be explained by the low levels of human capital.

Spencer and Brander (1983) (1985) papers analyze the role of R&D policy on trade and conclude that R&D could play a significant role in trade. Both papers assume an international duopoly and use Cournot oligopoly model wherein a domestic firm and a foreign firm compete in a third-country market. Spencer and Brander (1983) use game theory in which a mixture of an export subsidy and R&D can increase domestic welfare by diverting profits from the foreign to the domestic firm, further R&D subsidy gives incentive to the domestic firm to increase the level of R&D, causing the foreign firm to reduce its R&D and exports, therefore home government can effectively subsidize or tax the home firm and influence the outcome of the game between firms.The significance of the linkage between R&D activities, trade and growth has been highlighted intensely in the R&D based open economy growth models of Grossman and Help man (1990, 1991). Trade leads to an increase in productivity and growth by providing a wider range of intermediate inputs. The analysis mostly focuses on the rate of innovation, which is the main source of sustained growth and how the outcomes of international trade affect innovations.Models developed by Rivera-Batiz and Romer (1991) and Young (1991) centered on the effects of knowledge spillovers and international trade on the R&D activities that stem within domestic economies. Baldwin and For slid (2000) also analyze R&D competition at international level and how this competition enhance growth by stimulating competition in the R&D sector at the global scale but they do not show how global competition of R&D affects either trade patterns or factor allocations. Housman, Hwang, and Rodrik (2007) maintain that "right" specialization permanently affects long-run growth which implies "leapfrogging" strategies aims to transfer the production of high technology products to developing economies. It is further argued that China's economic policies have led to an extensive leapfrogging in technology, and raise concern about its risk to U.S. security and commercial interests (Rodrik, 2006), (Choate and Miller, 2005) (Gomorra and Baume, 2000) and (Samuelson, 2004).Gomorra and Baume (2000) and Samuelson (2004) use the comparative advantage equilibrium theory to examine how changing patterns of global production can affect the distribution of gains from trade. They conclude that advance of trade may not be the conventional "the win- win outcomes," rather trade expansion may generate winners and losers countries. The distribution of gains that regulates the terms of trade rest on the differences of supply and demand supply such as the relative prices of exports and imports, these factors can change therefore change the gains

from trade.Samuelson (2004) analysis the economic implications effects of increase in productivity of foreign trading partners due to technology catch-up that increase in productivity of foreign trading partners such as China, through domestic innovation or by transfer of technology through U.S. firms outsourcing of production to China, may weaken the United States' share of the gains from trade. China by catching up in the production of traditionally specialized export goods by United States will increase global supply and lowers price U.S. export, worsening the United States' terms of trade while the United States gains from trade but less than prior to China catching up.

Gomory and Baumol (2000) analyze the effects of transfer of industries and loss of the industrial base to other countries. Highlighting on the fact that comparative advantage in the 21th century is created and not endowed unlike the 18th century world when trade was based on endowments natural resource which determined the pattern of comparative advantage. In today's world, technology drives comparative advantage, and technology can be significantly influenced by human actions and policies which have enormous implications for the distribution of gains from trade among countries. Their models help international trade theory to integrate the new realities of globalization.New endogenous growth models emphasize that international trade increases the rate of economic growth. Yet, less known is that if endogenous growth cans "permanently reduced rates of growth, as when trade pushes an economy to specialize in sectors with no dynamic scale or other benefits. The theoretical relationship between trade and growth is fundamentally ambiguous."

The new trade theory

Grubel and Lloyd (1975) demonstrated that, a high percentage of trade took place within intra-industry rather than inter-industry. Balassa (1967) indicated that trade within intra-industry incurred with few costs of adjustment. These papers opened the way to new trade theory.Krugman (1979 and 1981) in a Heckscher–Ohlin model of international trade model changes the traditional assumption of perfectly competitive market tomonopolistically competitive market in which specialization occurs via intra-industry trade and large scale production with lower prices and a larger selections of products is the core of new trade theory.The New Trade Theory build on the principal of old trade theory of the factor price equalization and integrates factor markets internationally, the Rybczynski and Heckscher-

Ohlin theorems, connecting factor endowments to production and patterns of trade, and the Stolper–Samuelson theorem, linking fluctuations in commodities prices to fluctuations in real factor payments.

Help man (1987) used the monopolistically competitive model with manufacturing trade data between advanced economies, and showed that its main predictions were consistent. Hummels and Levinsohn (1995) showed that the monopolistically competitive model to work equally well for trade flows between non-OECD (Organization for Economic Co-operation and Development) countries, which one would expect comparative advantage to be overriding. On the contrary Evenett and Keller (2002) empirical work support the monopolistically competitive approach since the data for countries with a greater share of intra-industry trade are a better fit.Krugman (1991) noted that the home-market effect "wholly dependent on increasing returns; in a world of diminishing returns, strong domestic demand for a good will tend to make it an import rather than an export" (p. 955). Davis and Weinstein (1999, 2002) industry production increases more than one to one with local demand for a good with convincing sign of increasing returns for manufacturing industries in both OECD countries and Japanese regions. Head and Ries (2001) find sign of similar to Davis and Weinstein for Canada and the United States. Both studies are consistent with home-market effects concluded that when technology and factor prices were similar, home-market effects were feasibly strongest.

Economic geography

The Home Market Effect is the main engine of the accumulation processes stressed by the new economic geography models. (Krugman, 1991) takes incomes as exogenous, but, in his paper titled "Increasing Returns and Economic Geography," published in the Journal of Political Economy in 1991 Krugman treats incomes as endogenous, because fully developed international factor mobility. Brander and Spencer (1985) and Krugman and Obstfeld (1992) formulate the notion of "strategic trade" assume two countries with different elasticity's of demand, with national level internal economies of scale, when countries are historically ahead of other countries in producing a good, because of capacity to produce at a lower pricedueto economies of scale, then they have an advantage over others countries at the starting strategic point.

Theory of national competitive advantage

According to Stone and Ranchhod (2006), Porter's "focus on competition or 'rivalry' is a diversion from traditional economic thinking." (284) The primary contribution of Porter's (1990) in The Competitive Advantage of Nations is to the analysis of investment and international trade, within the scope of the economic development of nations. Porter presents a model in which innovation is the focus of formation and sustainment of competitive advantage. Competitive advantage consists of strategies which matches a firm's resources to be successful in the market. Porter formulates a strategy in which firm's resource prospect is not only a function of its own previous investments, but also is a function of the positions of supply and formation of resources within its environment. Porter adopts a Schumpeterian concept of a process of dynamic change in which innovation and imitation constantly creates and destroys positions of competitive advantage. Change may be exogenous through the development of new technologies, change in demand, new industry, change in supply of resources, or changes in government regulations. On the other hand, change may be endogenous through innovation by firms, once created competitive advantage is subject to destruction.Porter (1990) identifies four classes of a country's features the "National Diamond" land, labor and capital (including human capital), and distinguishes between skilled and unskilled labor, the underlying conditions for the determination the national competitive advantage of a nation and further emphases more on demand differences than on similarities to explain the international competitiveness of countries. In his model both the size of the home demand as well as the sophistication of home country buyers matters as is the configuration of home demand that shapes country's firms production, innovation to maintain their competitive positions to meet expectations of the home buyers. Explicitly, Porter (1990, 1998) regards sophisticated and demanding buyers as the main conditions for home demand to increase the market share of that industry, this maintain the competitive position of a firm and leads international demand.

However, dissimilar demand circumstances in different countries creates different demand structures therefore the geographical location economies of increasing returns, as explained by Economic Geography theories by Krugman & Obstfeld (2003) due to a specific set of demand conditions in a geographical location determines the location of an industry with

economies of increasing returns, therefore comparative advantage is determined by demand conditions rather than differences in resource endowments. "Geographic concentrations of interconnected companies and Institutions in the particular field" (Porter, 1998) ”Clusters are not seen as fixed flows of goods and services, but rather as dynamic arrangements based on knowledge creation, increasing returns and innovation in a broad sense” (Krugman, 1991)

Conclusion

The evolution of trade theory, from old trade doctrines Smith and Riccardo to the New Trade Theory, all seem to support of the free trade. In world of inadequate demand and unemployment, strategic policies to stimulate demand through such methods as subsidies and under-valued exchange rates, home industries that benefit from economies of scale, and increasing return, could results in gain from trade at the expense of expense of other countries. Never the less, these demand policies might increase demand for global production which stimulates the global economy.Blinder discussed that “Although there are no reliable national data, fragmentary studies indicate that well under a million service-sector jobs in the United States have been lost to off shoring to date. (A million seems impressive, but in the gigantic and rapidly churning U.S. labor market, a million jobs is less than two weeks' worth of normal gross job losses.) However, constant improvements in technology and global communications virtually guarantee that the future will bring much more off shoring of "impersonal services" -- that is, services that can be delivered electronically over long distances with little or no degradation in quality.” (2006). Which raise questions about the effects of international outsourcing and transfer of technology on domestic economies. Although companies earn foreign profits, outsourcing can weaken national income if it transfers technology that increases competition for domestic exports industries. On the other hand as corporations transfer the innovation and technology to a foreign production locations it contribute to progress of innovations and advancement of technology increases global production frontier and maximizes global profit but as Samuelson (2004) pointed this might not lead to maximize national gain, there will be winners and losers.

Trade Policy

Introduction

Not so long ago, the analysis of trade policy required not just a sound knowledge of theory and analytical tools, but also familiarity with cranky software and a willingness to replace missing data with heroic assumptions. The picture has changed drastically over the last quarter-century. The availability and quality of trade statistics has improved under the combined effort of researchers and statisticians at UNCTAD, the World Bank, and others institutions. Software has also become more user-friendly, making the calculation of complex indices easy even with minimal computing skills. Thus, there is no excuse anymore for staying away from formal analysis, whether it be calculating descriptive indices or estimating statistical relationships. This paper presents a palette of tools which, taken together, enable the analyst to produce a rigorous yet "readable" picture of the policy-relevant features of a country's trade and of the consequences of trade-policy choices. All these tools have been proposed and explained in the literature. For instance, Michaely (1996), Yeats (1997), Burkhart (2002), Hummels and Klenow (2005), Hausmann, Hwang, and Rodrik (2005), Shihotori, Tumurchudur and Cadot (2010), or Cadot, Carrère and Strauss-Kahn (forthcoming) discussed the indices presented in Section 2 of this paper. Kee et al. (2004, 2006) discuss in detail the construction of trade restrictiveness indices discussed in section 3. The gravity equation has been discussed in too many papers and contexts to be counted here. The collection of essays in Francois and Reinert (1997) give a thorough analytical discussion of the ex-ante simulation tools presented in Section 4, and Jammes and Olarreaga (2006) discuss the World Bank's SMART model. But most of these readings remain difficult and leave a gap between the needs of a theoretical or classroom discussion and those of the practitioner. This paper intends to fill some of this gap by discussing practical data and implementation issues for the most widely used among those tools. Starting with the simplest descriptive methods, we will move progressively to more analytical ones, but always keeping the exposition at a level comprehensible to the nonacademic practitioner. The last part of the paper, devoted to ex-ante simulation analysis (in partial and general equilibrium), however, remains difficult. The construction of simulation models requires advanced mastery of both economic theory and appropriate programming languages such as GAMS and remains largely beyond the capability of the beginning analyst, although specialized training programs are regularly given around the world. The models are inherently complex and sensitive to assumptions, making mistakes and misinterpretations easy. Thus, our aim in that

part of the paper is limited: essentially, to enable the reader to get a feel for how these models are constructed, and to be in a better position to understand what can be asked from those models and what cannot. Given the space limitations of a survey paper, there is necessarily a trade-off between depth and breadth. We have chosen to err on the "depth" side, not by going into deep discussions of the underlying concepts −those can be found in the original papers and in standard trade textbooks− but rather by discussing practical implementation issues of relevance to the novice practitioner. The price to pay for this is that we had to limit the number of indices and approaches we cover. The paper is organized as follows. Section 2 discusses how to present a panorama of a country's trade performance, and how to present standard measures of its trade-policy stance. Section 3 presents some of the econometric techniques that can be used to assess, ex post, the effect of trade policies on trade flows and the domestic economy. Section 4 presents some of the tools used in the ex-ante assessment of trade policy, first in partial equilibrium settings, then in general-equilibrium ones.

Analyzing trade flows & policy: descriptive tools

Trade flows

The first issue the analyst must deal with is the data. What database is appropriate depends on whether the analysis is to be performed at the aggregated (total) level or at the disaggregated one (by commodity). In the former case, the IMF's Direction of Trade Statistics (DOTS) is the right source. In the latter case, it should be UNCTAD's COMTRADE database. COMTRADE is much more voluminous than the DOTS because it contains data on bilateral trade between all countries in the UN system for over 5'000 commodities.1Next, if dealing with disaggregated data, the analyst must choose between several classification systems. First and foremost is the Harmonized System (HS) in which all countries report their trade data to COMTRADE. Under revision in 2007, the HS system has four levels: 21 sections, 99 chapters (also called "HS2" because chapters are coded in two-digit codes from 01 to 99), 1'243 headings (HS4) and 5'052 sub-headings (HS6). More disaggregated levels (HS8 and HS10) are not harmonized and need considerable cleaning up before use.2 As is well known, at high levels of disaggregation (in particular HS6), the HS system has the peculiarity that it is very detailed for some sectors like textile and clothing, but much less so for others like machinery. As a result, the economic importance of

subheadings can very considerably and care should be exercised when using simple averages (more below). However this oft-mentioned bias should not be overstated: as Figure 1 shows, the share of each HS section in the total number of HS6 lines is highly correlated with its share in world trade

Measurement

One might think that trade flows are about the easiest thing to measure since merchandises must be cleared at customs. Unfortunately, the statistics that measure them are surprisingly erratic. Country A's measured imports from B seldom match B's measured exports to A, and the latter are typically reported with large errors because customs do not monitor exports very closely. Thus, whenever possible partner import data should be used in lieu of direct export data, a technique called "mirroring". sometimes, however, and in particular for poor countries, even import data are very erratic, in which case mirroring should be used using export data from source countries. Zambia's mirrored against direct import data at the HS6 level, illustrates the problem. Although the two are clearly correlated, the dispersion around the diagonal (along which they are equal, as they should be) is substantial. Moreover, direct data is not systematically under-estimated compared to mirror data: the bias seems to go either way.

Trade composition

The sect oral composition of a country's trade should be in the TS for two reasons. First, it may matter for growth if some sectors are growth drivers, although whether this is true or not is controversial.4 Second, constraints to growth may be more easily identified at the sect oral level.5 The geographical composition highlights linkages to dynamic regions of the world (or the absence thereof) and helps to think about export-promotion interventions. It is also a useful input in the analysis of regional integration, an item of rising importance in national trade policies. The simplest way of portraying the sect oral orientation of a country's exports is in the form of a "radar screen", as in Figure 1. When displaying a graph of that type, sect oral aggregates have to be selected carefully (more detail in the categories that matter for that country), and so has to be the scale. When one sector/product hugely dominates the picture, it

will be more readable on a log scale. Log transformations are often useful to prevent outliers from obfuscating the picture

Margins of expansion/diversification

Export Diversification, in terms of either products or destinations, can be at the intensive margin (a more evenly spread portfolio) or at the extensive margin (more export items). Diversification is measured (inversely) by indices like Herfindahl's concentration index (the sum of the squares of the shares) or Thiele's (more complicated but pre-programmed in State). If the indices are calculated over active export lines only, they measure concentration/diversification at the intensive margin. Diversification at the extensive margin can be measured simply by counting the number of active export lines. The first thing to observe is that, in general, diversification at both the intensive and extensive margins goes with economic development, although rich countries re-concentrate. Whether diversification is a policy objective in itself is another matter. Sometimes big export breakthroughs can raise concentration, as semiconductors did for Costa Rica. Diversification is also often justified to avoid the so-called "natural resource curse" (a negative correlation between growth and the importance of natural resources in exports), but whether the curse is real or a statistical illusion has recently become a matter of controversy. 8 So one should be careful in taking diversification as a policy objective per se. What is clear is that, in principle, diversification reduces risk, although the concept of "export riskiness" has been relatively unexplored.9 In addition, diversification at the extensive margin reflects "export entrepreneurship" and, in that sense, is useful evidence on the business climate. One drawback of measuring diversification by just counting active export lines (as in Figure 4) is that whether you diversify by starting to export crude petroleum or mules, asses & hinnies is the same: you add one export line (at a given level of product disaggregation). Hummels and Klenow (2005) have proposed a variant where new export lines are weighted by their share in world trade. Then, starting to export a million dollars worth of crude counts more than starting to export a million dollar worth of asses, because the former is more important in world trade (and therefore represents a stronger expansion potential).

Export-expansion potential

Suppose that it is easier for a producer to expand into new markets with existing products than to start exporting new products. Based on this idea, Brenton and New farmer (2009) proposed an index of export market penetration defined, at the product level, as the share of potential destination markets that the country actually reaches (i.e. the ratio of the number of i's destination countries for product k relative to the number of countries importing product k from anywhere). This type of information is useful background for trade-promotion interventions. When the issue is regional export-expansion potential (e.g. to be expected from a preferential agreement) one useful index is Michael's bilateral trade complementarity index (Michael 1996). Intuitively, it is best thought of as a correlation between country A's exports to the world with country B's imports from the world. A is likely to have a comparative advantage in products it exports a lot to the world (i.e. without the help of tariff references); if those products are those in which B has a comparative dis-advantage (because it imports a lot of it),

Well then A and B should marry. Formally, the TCI is not a statistical correlation but an (algebraic) indicator. Let be product k's share in A's imports from the world and its share in B's exports to the world; both should be at the HS6 level of disaggregation. The formula is and can easily be calculated in excel. The higher the index, the higher the scope for non-diversion (efficient) trade expansion between A and B. Note that there are two indices for each country pair, one taking A as exporter and one taking it as importer. Sometimes the two indices are quite different. The country in a bloc whose import pattern fits with its partners' exports will act as a trade engine for the bloc; the one whose export pattern fits with its partners' imports will benefit (in political-economy terms) from the agreement. Table 1 shows two illustrative configurations with three goods. In panel (a), i's offer does not match j's emand as revealed by their exports and imports respectively. Note that these exports and imports are by commodity but to the world, not to each other.

Tariff and NTB data

Developed by UNCTAD, the TRAINS database (for Trade Analysis and Information System) provides data on tariff and non-tariff barriers to trade for 140 countries since 1991. Tariffs reported in TRAINS are of two sorts. First, Most Favored Nation (MFN) tariffs −i.e. non-discriminatory tariffs applied by any WTO member to all of its partners− are reported

under the MHS code. Second, applied tariffs, which may vary across partner countries depending on preferential trade agreements, are reported under the code AHS. In both cases, tariffs are reported at the HS6 level. Information on a wide range of Non-Tariff Barriers (NTBs) is also collected and reported in TRAINS, but the only year with complete coverage is 2001. Data on NTBs is organized and reported in TRAINS in the form of incidence rates ("coverage ratios") at the HS 6 level. That is, each NTB is coded in binary form at the level at which measures are reported by national authorities (one if there is one, zero if there is none) and the incidence rate is the proportion of items with ones in each HS 6 category. UNCTAD's original (1994) coding has become obsolete, as it featured old-style measures—quantitative restrictions and the like—that have largely been phased out, while grouping into catch-all categories many measures important now, such as product standards. In 2006, UNCTAD's Group of Eminent Persons on Non-Tariff Barriers (GNTB) started working on a new classification, more appropriate to record the new forms taken by NTMs (and closer to the WTO's). The new classification, adopted in July 2009, is shown at the broadest level of aggregation (one letter) level in box 1. It provides better disaggregation of NTMS, at one letter and one digit (64 categories), one letter and two digits (121 categories), or even one letter and three digits (special cases). It covers a wide range of measures, some of which are clearly behind the border (like anti-competitive measures, which include arcane measures like compulsory national insurance). It has not been widely used yet, and some ambiguities will need to be dealt with; but it will provide the basis for the new wave of NTM data collection to replace TRAINS (under way as of 2010).

CHAPTER 12

Measuring overall openness

As is well known, Smith's and Ricardo's general prescription in favor of free trade is based on essentially static efficiency arguments. Empirically, the static welfare losses involved by trade rotection vary considerably, from large in small countries (see e.g. Connolly and de Milo eds.1994) to small in large countries (see e.g. Messerlin 2001). Perhaps more importantly, trade openness is statistically associated with higher growth (see e.g. Wackier and Welsh 2008). Thus, assessing a country's openness is crucial and, indeed, International Financial Institutions use a variety of indices of trade openness or restrictiveness. The problem is, of course, to control, as much as possible, for non-policy influences on observed openness, and that is where difficulties start. The most natural measure of a country's integration in world trade is its degree of openness. Let $i X$, $i M$ and iY be respectively country i's total exports, total imports and GDP. We will try to reserve superscripts for countries and subscripts for commodities and time throughout. Country i's openness ratio is defined as

Revisiting trade flows with the gravity equation

It has been known since the seminal work of Jan Tinbergen (1962) that the size of bilateral trade flows between any two countries follows a law, dubbed the "gravity equation" by analogy with physics, hereby countries trade more, ceteris paribus, the closer they are, the larger they are, and the more similar they are, the latter two in terms of their GDPs.19 Whereas empirics predated theory in this instance, the robustness of the gravity relationship is attributable to the fact that it is a direct implication of a model of trade based on monopolistic competition developed by Paul Krugman (1980) and which has established itself as the workhorse of trade analysis between industrial countries. Practically, the gravity equation relates the natural logarithm of the dollar value of trade between two countries to the log of their respective GDPs, a composite term measuring barriers and incentives to trade between them (typically the log of the distance between their capitals, and terms measuring barriers to trade between each of them and the rest of the world. The rationale for including these last terms, dubbed "multilateral trade resistance" (MTR) terms by Anderson and van Win coop (2003) who argued for their inclusion, is as follows. Ceteris paribus, two countries

surrounded by other large trading economies, say Belgium and the Netherlands surrounded by France and Germany, will trade less between themselves than if they were surrounded by oceans (such as Australia and New Zealand) or by vast stretches of deserts and mountains (such as Kyrgyzstan and Kazakhstan). Several alternative ways of proxying MTR terms are possible. One is to use iterative methods to construct estimates of the price-raising effects of barriers to multilateral trade (Anderson and van Wincoop 2003). A simpler alternative is to control for each country's "remoteness" by using a formula that measures its average distance to trading partners. An even simpler −and widely used− method consists of using country fixed effects for importers and exporters

Analyzing a policy's distributional effects

If the textbook treatment of trade policy is usually cast in terms of its welfare effects, policymakers are often as much if not more interested by its distributional effects. From a conceptual point of view, the distributional effects of trade have been extensively discussed as part of the so-called "trade and wages" debate, where the issue was essentially whether Stolper-Samuelson effects were responsible for the observed increase in the skill premium in Northern countries. That debate settled with the observation that most of that increase was within industries rather than across and was thus likely to be due to technical progress more than trade. More recently, a considerable literature has gone into exploring the effects of trade on poverty and inequality, especially in developing countries (see Koujiannou-Goldberg and Pavcnik 2004 for a survey). Tracing the effects of, say, trade liberalization on poor rural households is typically difficult because, even if prices were measured correctly at the border through trade unit values (which is already unlikely, see supra), the pass-through of border-price changes to changes in the domestic producer and consumer prices effectively faced by poor rural Households is difficult to assess. A very good treatment of this question can be found in Nicita (2004). Here we will illustrate something less ambitious, namely how to measure the regressivity or rogressivity of a trade policy. Whether a given trade policy has a regressive or "anti-poor" bias, i.e. whether it penalizes poor households more than rich ones is an important policy question in the context of trade reform. In general, various tools can be used to quantify the effects of trade barriers on domestic residents' incomes, some of which will be discussed in the next section. Here we will limit ourselves to a tool that is simple to

use −although its data requirements can be nontrivial− but nevertheless provides a crisp answer to the question of regressivity. Consider for instance a farming household that consumes and produces nproducts indexed by indexed by k, and stand for their respective shares in the household's expenditure and income, with the argument in parentheses meant to highlight that those shares are themselves likely to vary with income levels (goods whose budget shares go down with income are "necessities", and crops grown at lower income levels may e.g. require lower input use). Let μk be the income elasticity of good k, and observe that tariffs on goods produced by households protect them whereas tariffs on consumption goods tax them. If tariffs on production goods are positively correlated with income elasticities, they are pro-rich because they protect disproportionately the goods produced by rich households (think e.g. of crops grown redominantly by large and high-income farmers); if tariffs on consumption or intermediate goods are positively correlated with income elasticities, by contrast, they are pro-poor, because they tax disproportionately goods consumed by the rich. Formally, one can construct a production-weighted average tariff for each household as

Ex-ante assessment of Trade Policy Changes

In addition to the descriptive statistics and ex-post type of analyses described earlier, trade policy analysts also make use of ex-ante (or simulation) modelling techniques to assess or preempt the likely (overall and sectoral) impact of trade policy changes. These are tools that help analysts and policymakers evaluate and quantify the potential economic effects of various trade policy alternatives. Generally, they help answer "What if" types of questions (or counterfactual/antimonde): Using information on the observed state of the world, they ask how things will be different if a variable (usually a policy instrument) is altered. Exante models are useful distillation of economic theory that can provide a handle on the often complicated interactions between different economic variables in a consistent and tractable way. When properly designed and constructed, simulation models offer a coherent framework built upon rigorous economic theory that can provide solid empirical support (or even justification) for a chosen trade policy. Simulation models can be structured either in a partial or in a general equilibrium setting. A partial equilibrium model generally only focuses on one part or one sector of an economy and assume that changes in that sector have no, or

minimal, impact on other sectors. It takes into account neither the linkages between sectors, nor the link between income and xpenditures. In contrast, a general equilibrium analysis explicitly accounts for all the links between the different elements of a considered economy. These elements may be household, branches of activity, factors of production. Such analysis imposes a set of conditions on these elements in such a way that basic economic identities and resource constraints are always satisfied. For instance, an expansion in a given sector would be associated with a contraction in another sector since the existing factors of production will move to the expanding one and away from the contracting one. The choice of the appropriate model depends on the nature of the policy being studied, the availability of resources and information, and the variables of interest to policymakers. Whatever their exact nature however, umber of key elements are common across models and are necessary to make them useful for conducting rigorous quantitative trade policy analysis: economic theory, data (endogenous and exogenous variables), and behavioral parameters. This section briefly introduces these elements and presents the basic steps required in solving the model. It then presents the main features of the two types of simulation models typically used in trade policy analysis (partial equilibrium and computable general equilibrium models) with the modest goal of familiarizing the reader with the different concepts. Required elements for applied trade policy modeling A crucial element in a simulation model is that it should be based on solid economic theory. This is embodied in a series of mathematical representation of the different economic linkages, constraints, and behavior assumptions of the model's economic agents (market structure, profit maximization, utility optimization,) that the analyst wants to capture in the models. They will reflect the key assumptions that are used to simplify the reality into the model. Next, for the model to be a useful empirical tool, the analyst needs to use good quality real world data. An ex-ante model starts with a series of observed variables which are assumed to represent an initial equilibrium state of the world. The system is then shocked by changing one (or a few) exogenous variable and solved until it produces a new equilibrium and new values for the endogenous variables of the model.24 As will be discussed in greater details later, the choice of exogenous (vs. endogenous) variables determines the general or partial equilibrium nature of the model, in parallel with the model's economic closure. The model closure is characterized by a set of assumption about some basic identities or constraints that have to hold for the model to reach equilibrium (such as

market clearing conditions--demand equals supply, or income equals expenditures). The final key elements required in conducting ex-ante trade policy modeling are the behavioral parameters. Those parameters reflect how economic agents respond to changes in their environment (e.g., price or income). They can include various price (and cross price) elasticity's, income elasticity's, substitution elasticity's (among different goods or varieties of goods or factors), and others. These elasticity's are generally taken from the existing literature or are estimated independently by the researchers outside the framework of the model (e.g., Kee, Nicita and Olarreaga (2004) and Donnelly, Johnson, Tsigas, and Ingersoll (2004) provide a set of very useful import and substitution elasticities, respectively). Required steps for applied trade policy simulations Prior to the actual policy experiment or simulation, an ex-ante model is generally benchmarked using the observed data and the behavioral parameters—that is, the model is initially calibrated so that its equilibrium replicates observed data. This process (also called parameterization, initialization or calibration) involves using the observed data and model parameters to determine the values of a number of unobserved variables (or the calibration parameters) in the model.25 These variables are assumed to incorporate information that are not readily observable and are used as a fixed exogenous variable in the simulation steps. Given the resulting calibration parameters, a policy experiment (or other experiments) can be conducted by first assuming that the parameterized model is in equilibrium. Then the value of an exogenous (policy) variable of interest is shocked to capture the questions that the analyst would like to address. And finally, the model is solved to reach a new equilibrium--by allowing prices to adjust to satisfy some predefined equilibrium conditions. Most trade-related simulation models rely on what is called the comparative statics methodology to evaluate the impact of a policy experiment: the effect of the shock is then computed by comparing the new equilibrium values to the observed data initial equilibrium)—two equilibrium states of the world are compared.26 The impact of the trade policy experiment on any given endogenous variable is then simply measured as the difference between the initial and the final equilibrium value of that variable.

Equilibrium simulations (focused sectoral analysis) Partial-

In a partial equilibrium model, a particular commodity or market is studied, and the linkages with other sectors (income or substitution effects, or spillover) are ignored (i.e., they are assumed exogenous). Any trade policies deal with only this commodity or market. The condition for solving the model is simply to equate demand and supply in that particular market. This type of model can ideally be used when the effects on rest of the economy are small. That is, either the sector itself is small (limited income effects), or there is limited links with other parts of economy (limited backward and forward linkages). This approach has a number of attractive features. The main advantage of the partial equilibrium approach to trade policy analysis is its minimal data requirement. Usually, it requires only a few trade flow and trade policy data for the sector being studied and a set of (price or substitution) elasticities which are usually pretty easy to collect from databases like COMTRADE or TRAINS. Also, due partly to the minimal data requirement, the analysis can be conducted at a pretty disaggregated or detailed sectoral level which solves a number of the aggregation biases discussed in previous sections. For example, it allows the study of the effects of the liberalization of "brown rice" imports by adagascar, a level of aggregation that is neither convenient nor possible in the framework of a general equilibrium model. This also resolves a number of "aggregation biases." By the same logic, the partial equilibrium may allow the analysis of the likely impact of trade agreements like the Doha round more accurately, as the negotiations are conducted at a very disaggregated level. This approach also has the virtue of being transparent and relatively easy to implement and solve. In fact, a typical partial equilibrium model generally consists of a small number of equation equations representing the demand and supply sides, and solving the model simply entails allowing the price to adjust to equate demand and supply. Modeling is thus straightforward and results can usually be easily explained. The partial equilibrium approach also has a number of disadvantages that have to be kept in mind while conducting any analysis. Since it is only a "partial" model of the economy, the analysis is only done on a pre-determined number of economic variables. This makes it very sensitive to a few (wrongly estimated) Behavioral elasticities. Due to their simplicity also, partial equilibrium models may miss important interactions and feedbacks between various markets. In particular, the partial equilibrium approach tends to neglect the important intersectoral input/output (or upstream/downstream) linkages that are the basis of general equilibrium analyses. It also misses the existing constraints that apply to the various

factors of production (e.g., labor, capital, land,) and their movement across sectors. Given limitations in the data and the abstract nature of such models, the user should interpret the results with caution. The numbers that come out of the simulations should only be used to give a sense of the order of agnitude that a change in policy can mean for economic welfare or trade. However, the model has detailed commodity and country coverage and for the comparison of various policy scenarios, it can be very helpful in indicating the relative magnitudes of the effects of policy changes on welfare, trade and prices.

Computable general equilibrium models

Compared to the partial equilibrium approach, Computable General Equilibrium (CGE) models tend to be very complex and are usually not readily accessible to non-specialists. They capture complicated inter-sectoral vertical and horizontal, backward and forward economic linkages. Indeed, CGE models are based on the fact that the different markets in a given economy are linked and changes that take place in one market do have effects on other markets that should be documented as they can feed back to the original one. One of the key features distinguishing CGE from PE is the use of Social Accounting Matrix (SAM) to capture these various linkages.30 Since they can take into account cross-sectoral reallocation of factors of production, CGE models are good tools for studying economywide impact and for identifying winners and losers under a policy change. This section briefly discusses the general structure and organization of trade-related CGE models. On the production side, most CGE models are characterized in terms of the outputs, the inputs (intermediate goods and factors of production), and the production technologies. The nature of the technology that transform the inputs into the final output is captured by a number of fixed input-output coefficients (or shares), as well as some substitution elasticities among inputs and factors of production. Firms maximize their profits using price information to decide how much of each good to produce, using how much of each input—this determines the supply of (final and intermediate) goods and the demand for inputs (including both intermediate goods and factors of production) On the consumption side, the majority of CGE models focus on a representative household, which is also assumed to be the owners of factors of production (land, labour and capital). The income that it receives from rent (land), wages (labor) and interest (capital) is spent on consumption of goods (and services), on taxes collected by the

government, and/or on savings. The representative household maximizes it utility by allocating its (disposable) income among the goods and services available at the going market price. Assuming full employment, the household's endowments of factors of production are supplied to firms at the going factor market prices—this determines the supply of factors of production and the demand for goods and services. Governments, in CGE models, collect taxes and tariffs, disburse subsidies and purchase goods and services. It's in this sector, using these policy instruments, that the policy experiments are usually triggered. So far we have described the behavior of firms, consumers, and government in an economy in autarky. International trade is usually introduced in CGE models by liking the original economy with other countries with their own sets of firms, consumers, and governments. The substitutability between imports and domestic products is generally driven by the Armington assumption described earlier in the PE section: that is, goods imported from different sources, although similar, are different varieties that are imperfect substitutes. The choice of the representative consumer of how much to allocate to the purchase of each variety depends on the relative prices and the Armington substitution elasticity. Just as it imports, a country also export differentiated product(s) to other countries. Each country is the unique supplier of its differentiated variety and the amount supplied depends on the prevailing world prices (which are in turn determined by some global trade balance condition between export supply and import demand). Under these assumptions, trade policy chages in a country can affect the world prices and the terms of trade (the ratio of a country's export and import prices) thus the welfare of all other countries. The CGE model is solved by allowing the prices (including goods and factor prices) in the system to adjust so that all equilibrium conditions are satisfied: demand for goods equals their supply, demand for imports equals supply of exports, and demand for factors of production equals the available endowments. Given the new sets of prices, the new equilibrium level of different price dependent variables can be determined: consumption, production, imports, exports, factor location, tax revenues, etc. From those, in turn, some measure of the welfare impact of the trade policy experiment can be computed. While very powerful and potentially very useful, CGE models have a number of limitations that needs to be kept in mind. First, unlike partial equilibrium, CGE models tend to be resource intensive, requiring a lot of information and computing power. They tend to be very complicated and inaccessible to no experts. Their

complexity can sometimes be overwhelming and their usefulness tend to be restricted when policymakers do not have a clear understanding of what they are are, what do they do, and how their results should be interpreted. To properly interpret the results, one needs to comprehend the economic assumptions and mechanisms underlying the model, and how sensitive the results are to those. Most commonly used trade-CGE models are static in nature and fail to capture the effect of a trade policy change on the dynamic aspects of an economy. It has to be recognized though that a policy change such as the establishment of a FTA is likely to irectly affect dynamic phenomena such as capital flows, demographics, and growth rates. An effort is currently being made in the GTAP network.

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