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The Terms of Trade Controversy

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Introduction

The two most basic questions about international trade are: What goods will each country export?, and what will be the ratios at which the exports of one country exchange for those of its trading partners? The first problem is related with comparative advantage of the country and the second one is related with the concept of "terms of trade", which is the subject of this essay. Comparative advantage and terms of trade are closely related concepts, as is recognized in international trade theory, that the difference in relative commodity prices between two countries is evidence of their comparative advantage and forms the basis for mutually beneficial trade. According to the classical economists (Adam smith, David Ricardo and John Stewart Mill), comparative advantage was based on the difference in the productivity of labor (because this was the only factor of production they considered) among nations, but they provided no explanation for the difference in productivity. It was the Heckscher-Ohlin (H-O) theory[1] the one that examined the basis for comparative advantage and the effect that trade has on factor earnings in the two countries. The H-O model (also referred as factor-endowment theory) explains comparative advantage by establishing that each country specializes in production and exports, of the commodity intensive in its relatively abundant and cheap factor and imports the commodity intensive in its relatively scarce and expensive factor. That is, the H-O theory postulates that the

[1] It is always useful to remember that Heckescher-Ohlin Theory can be summarized in the well known two theorems:

a) H-O Theorem: *A nation will export the commodity whose production requires the intensive use of the nation's relatively abundant and cheap factor and import the commodity whose production requires the intensive use of the nation's relatively scarce and expensive factor*. Said in other words, the relatively labor-rich country exports the relatively labor-intensive commodity and imports the relatively capital-intensive commodity. This theorem deals with and predicts the pattern of trade.

b) The Factor-Price equalization Theorem: *International trade will bring about equalization in the relative and absolute returns to homogeneous factors across nations*. This means that international trade will cause the wages of homogeneous labor to be the same, and the return to homogeneous capital to be the same, in all trading nations. This theorem deals with the effect of international trade on factor-prices.

difference in relative factor abundance and prices is the cause of the difference in relative commodity prices between two countries. These relative differences in factor and commodity prices are translated into absolute differences in factor and commodity prices in the two countries, which become the cause of trade.

The terms of trade can be defined in many ways, but the most used concept is the one that defines the terms of trade as the *relative price of the exportables (P_x), in terms of the importables (P_m): P_x/P_m*; that is, the number of units of the exportable good that a country needs to give up per unit of an imported good (this definition is also known as net barter terms of trade). Because countries usually export and import more than one good, P_x should be interpreted as a price index of the exportables, and P_m should be a price index of the importables. In this sense then, the concept of terms of trade can be interpreted as the number of baskets of exportable goods that a country gives up per basket of importable goods. This measure is routinely calculated for most countries in the world by international agencies such as the World Bank and the International Monetary Found. It should be mentioned here that the concept of terms of trade is a different one from the concept of real exchange rate (RER). The RER can be understood as the price variable that brings about equilibrium in the Balance of Payments. That is the real price that equilibrates real demand and supply for foreign currency [Guillermo, 2000]. Besides, while the terms of trade should be understood as a bilateral concept (for two countries engaged in trade), the RER must be understood as a multilateral variable because of his nature of being the real price that equilibrates the real demand and supply of foreign currency for an specific country.

In the literature, we can also find other definitions (or calculations) of the terms of trade that turn out to be very useful in understanding the welfare effects of trade. So, we have the income terms of trade, which is the ratio (expressed as a percent) of the value of exports to the price of imports. The change in the income terms of trade usually is very important for developing countries since they rely to a large extent on imported capital goods for their development. The single factorial terms of trade is the net barter terms of trade adjusted for changes in the productivity of exports (the ratio $Z_x P_x/P_m$, where Z_x is a productivity index in the country export sector). Thus, the single factorial terms of trade measures the amount of inputs a country gets per unit of domestic factors of production embodied in its exports. Finally, the double factorial terms of trade adjusts for both the productivity of exports and the productivity of imports (the ratio $Z_x P_x / Z_m P_m$, where Z_x and Z_m are the country's export and import productivity indexes respectively. Hence the double factorial terms of trade measures how many units of domestic factors embodied in the country's exports are exchanged per unit of foreign factors embodied in its imports.

What is important to realize with all these different definitions of the terms of trade (TOT) is that income TOT and single and double factorial TOT can rise even when the net barter TOT (the simple price index ratio P_x/P_m) declines. This situation can be considered as favorable to a develop-

ing country, although the most favorable situation would be the case when the different measures of TOT all increase. Also important to mention here is the limitation of the TOT concept. Terms of trade should not be used as synonymous with social welfare, or even Pareto economic welfare. Terms of trade calculations do not tell us about the volume of the countries' exports, only relative changes between countries. To understand a country's social utility changes, it is necessary to consider changes in the volume of trade, changes in productivity and resource allocation, and changes in capital flows.

The determination of the terms of trade has been considered one of the most important technical problems in the pure theory of international trade. Its importance relies on the fact that the terms of trade is an integral part of the mechanism determining the global income distribution among the countries engaged in international trade. Within a national economy, the effects of the operation of the price system on the allocation of resources and the distribution of income can be mitigated by labor mobility and redistributive fiscal measures, both of which are largely absent between nations. For many decades some important economists and people who study international trade issues, have been claiming that there is a tendency for the terms of trade to move unfavorably to developing countries, and that there is a systematic bias in the distribution of the gains from trade that runs against them. These arguments have created a great controversy around the concept of terms of trade. Given that the terms of trade play a key role in determining the gains from trade, and hence the welfare and growth of the countries, it is very important to identify and understand what its fundamental determinants are. This should be done keeping in mind the notion that changes in a country's TOT are the result of many forces at work, both domestic and in the rest of the world, and we cannot determine their net effect on the country's welfare by simply looking at the change in the country's barter TOT.

This paper is an attempt to provide a brief survey of the major theoretical approaches to the determination of the terms of trade. In the first part I will present a general historical background. In part II, I will go over the work of Raul Prebisch, Flanders, Lewis, and Ronald Findlay, whose work is considered as the most important in this field. In part III, I will briefly analyze some recent empirical evidence about the trend in the terms of trade that has been presented in studies by Grilli and Yang, and also by Cuddington.

Historical background

The first economist that provided an explicit demonstration of the determination of the terms of trade was John Stuart Mills in 1844. Mills was also the first economist who considered the effects of technical improvements on the terms of trade. Later, it was Alfred Marshall who developed the concept of the "offer curve" and who showed that the excess supplies and demands of two goods in the countries engaged in trade are functions of the terms of trade. Marshall also showed that the equilibrium value of the terms of trade is determined by setting world excess supply equal to zero. Marshall demonstrated the possibility of multiple equilibria and also established a criterion for stability of equilibrium in the form of the

so called Marshall-Lerner condition, which mentions that the sum of the import demand elasticities has to be greater than one.

In 1894 Edgeworth showed that a country could be "damnified" by a productivity increase in the sense that the consequent deterioration of the terms of trade makes it worst off than it was initially. He obtained this result in a very simple model where a country is completely specialized in the production of a single export good not domestically consumed, so that total production equals total exports, and consumption consists exclusively of a single imported good. In this case, if the elasticity of foreign demand (as a function of the terms of trade) is less than unity, then it follows immediately that an increase in productivity of domestic factors will lower the welfare since the decline in the terms of trade will more than offset the increase in the quantity of exports.

In the modern theories, it has been shown that, in addition to country endowments and technical coefficients of production, the preferences of the consumer must be introduced if one wants to determine the equilibrium values of the terms of trade. But regardless of what the terms of trade determinants are, it is quite obvious that the terms of trade influence the welfare of the economies. Haberler in 1955, mentioned that "other things been equal, an improvement in the terms of trade implies an increase in real national income". Even though this argument could seems very clear, it is important to analyze what are the causes of the changes in the terms of trade, to identify more carefully, what the consequences in welfare would be. For example, when the change in the terms of trade is a consequence of some exogenous shock, such as a change in tastes, technology or factor endowments, it is clearly erroneous to infer the total change in the country's welfare solely from the direction of change in the terms of trade.

When there are shifts in the fundamental determinants of tastes, technology and factor endowments, the welfare effects of such changes can be broken into two parts:

— the effect at unchanged terms of trade, and
— the effects of the associated change in terms of trade.

The net effect on welfare may thus be positive or negative, and need not to correspond with the direction of the change in the terms of trade. Following Edgeworth's idea, Bhagwati (1958) established the possibility that the net effect on welfare of the country experiencing economic growth, can be negative, a phenomenon that he named "*immiserizing growth*". The context of his model is much more general than the Edgeworth's model, since Bhagwati does not constraint the country in question to be specialized in either, production or consumption.

Finally, some economists have argued that the terms of trade could be considered as a policy variable or a target. This is the case when the country has some degree of monopoly power in international markets. Hence under this situation, and also ignoring the possibility of retaliation, the result would be to restrict trade to such an extent as to equate the marginal benefit from the improvement in the terms of trade, with the marginal loss of welfare resulting from the decline in the volume of trade. This is the famous "optimum tariff" argument, the level of which varies inversely with the elasticity of foreign demand for imports.

Prebisch-Singer and the deterioration of the terms of trade in developing countries

The thesis that there is a systematic bias in the distribution of the gains from trade against the developing countries, revealed by an adverse tendency in their terms of trade, is most closely associated with the names of Hans Singer[2] and Raul Prebisch. Prebisch's idea is discussed basically in his 1950 and 1959 papers. The original formulation of the thesis that TOT deteriorate in "peripheral" (developing) countries combines two complementary hypotheses [Ocampo, 2003]. The first one suggests a negative effect of the income elasticity of the demand for primary goods or raw materials (primary commodities) on the developing countries' TOT (see the appendix for an example of the effect of growth on the TOT). Here, the pressure towards a deterioration in real primary goods prices is generated in the goods market (i.e. on barter TOT). The second hypothesis suggests a negative effect of the asymmetries in the functioning of the labor markets on the developing countries' TOT. In this case, the pressure towards deterioration in real commodity prices is generated in factor markets (i.e. factorial TOT) and then affects the barter TOT only indirectly through the effects on production costs.

According to Prebisch the spread of technical progress has been uneven, and this has contributed to the division of the world economy into industrial centers and the countries engaged basically in primary production (those called by Prebisch "peripheral countries"), with the consequent differences in income growth. But also, he recognizes that this division has been gradually disappearing as consequence of the spread of technical progress into the periphery.

So, we can say that, according to Prebisch, the uneven way in which technical progress is spread around the countries is one of the causes of the deterioration of the terms of trade of the primary production countries. For Prebisch, if we assume a world without such disparities, there won't be any reason to find a tendency of deterioration in the terms of trade. To explain these ideas, he assumes two countries: country A, which is concentrated in industrial production, and country B, which is concentrated in primary commodities production. Also, he assumes that the wage rate is the same and trade is in equilibrium at a point where marginal productivity is the same for both countries; there are no technological disparities, and no disparities in elasticities. The demand for goods is equally divided between primary commodities and industrial products. So, given these assumptions, there is no reason for deterioration in the terms of trade working against primary production. Indeed, demand for primary products grows at the same pace as industrial demand, and productivity improves at the same rate in A and B, so that there is no differential productivity from this source to be transferred from one country to another.

From Prebisch point of view, the problem arises when we start introducing disparities among the countries. So, if we assume now that income elasticity of demand for industrial products is higher than for prima-

[2] Hans Singer is another Prebisch's contemporaneous economist, who defended the argument regarding the long-run tendency for the commodity terms of trade of the developing countries to deteriorate. In fact, this hypothesis is well known as the Prebisch - Singer hypothesis.

ry commodities, and if the labor market is closed, the only way of increasing the industrialization level in country A, would be by transferring workers from primary activities to industrial activities within the country. The same happens in country B, where primary activities have comparative advantage. But here in country B, the reallocation of employment from the primary to the industrial sector, where the productivity is not favorable, generates a fall in productivity and in wage rate also (the wages in country B fall relative to those of country A). In the process of this adjustment, export prices will fall, transferring income to country A. The contrary happens in country A, since in response to a higher rate of industrial demand, workers will flow from primary sector, to industry, where productivity is more favorable, so the wages in this country will be higher relative to those in country B. The tendency to deterioration will be accentuated if, in addition to disparities in elasticities, we introduce disparities in technological densities. Hence, assuming that the technology in the industrial sector for country B, is less productive than in country A, the industrialization process in the industrial sector (explained before) has worst consequences now for B, since the level of wages has to drop more steeply in country B, and therefore the income transfer to country A is greater. This is one of the important characteristics of the Prebisch's peripheral countries.

Said in other words, the reasons for expecting the TOT of developing (peripheral) countries to deteriorate (Prebisch-Singer hypothesis) are basically two. The first one is that developing countries' demand for manufactured exports from developed (*center*[3]) countries tends to grow much faster than the latter's demand for primary (or agricultural) products. This is due to much higher elasticity of demand for industrial (manufactured) products than for primary commodities, and also due to the differences in productivities within each country's productive sectors. The second reason of TOT deterioration in developing countries is the way in which productivity increases are distributed among factors of production and consumers. The majority of productivity increases that take place in industrial (center) countries are passed on to their workers in the form of higher wages and income, while most (or all) of the productivity increases that take place in peripheral countries are reflected in lower prices. Therefore, industrial countries can have the best of all when they engage in trade:

> *The pressure upon export prices and the corresponding tendency towards deterioration in the terms of trade in the peripheral process of growth, subject to the unrestricted play of the market forces, is the result of disparities in income elasticity of demand and the uneven form in which technical progress has spread into the world economy, bringing very great disparities in technological densities.*
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> The center is in a better position to retain the fruits of its general increase in productivity... general improvements in productivity tend to be fully reflected in the increment of the wage rate at the center,

[3] This is the term what Prebisch uses to make reference to those countries which have comparative advantage in industrial production, and hence are prevailingly industrial.

> while at the periphery a part of the fruits of this improvements is transferred through the fall of export prices and the corresponding deterioration in the terms of trade.
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> Prebisch [1959]

So, we can say that, in view of Prebisch and Singer, the combination of disparities in income elasticities of demand and disparities in the way that fruits of productivity changes are distributed, put the peripheral countries in a weaker position vis-a-vis the industrial countries, as regards of the terms of trade.

Furthermore, for Prebisch, protection in industrial countries gives additional force to the peripheral tendency towards deterioration in the terms of trade. If there is free trade, some marginal primary activities might disappear in industrial countries, because of competition from increased peripheral exports at lower prices. But if these marginal activities are protected in industrial countries, the possibility of increasing exports in periphery will be less, and consequently a greater excess supply of labor would have to seek employment in industrial activities, which would entail a further decrease of the wage level in foreign currency, with a further deterioration of the terms of trade.

The tendency of the terms of trade at the periphery to deteriorate in a process of spontaneous growth may be offset by compensatory market forces. For example, the terms of trade may improve for the periphery if there is growing demand for the primary products. But on the other hand, interference with the market forces may also counteract the tendency to deterioration. This is the effect of protective duties or export taxes. Combinations to restrict or eliminate competition in export activities may have similar effects. Moreover, labor union action to increase wages in export activities may maintain the terms of trade. Also, a policy to reduce or eliminate primary protection in industrial countries, through the expansion of primary exports, would generate a greater absorption of the increment of labor force at the periphery, and then, alleviating the tendency towards deterioration of the terms of trade.

With these arguments Prebisch suggests that protection plays an important role as an instrument to diminish the effects of the deterioration in the terms of trade. However, as he pointed out, protection has different meanings in the peripheral countries as compared with the industrial countries. In the former, protection is an important instrument for correcting the effects of the disparity in income elasticity of demand for exports of primary commodities, and for imports of industrial goods. Viewed in this way, this does not harm the rate of growth of the world trade. In the industrial centers by contrast, protection of primary production, accentuates the disparity and tends to depress peripheral development and to decrease the rate of growth of the world trade.

According to Prebisch, the reduction or elimination of protection at the centers, has an implicit element of reciprocity, since the resultant increase in exports of primary commodities from peripheral countries, will be followed by a corresponding increase in its imports of industrial goods, in respond to their high income elasticity of demand, and there is no need for any reduction or elimination of duties to obtain this result.

On the other side, although protection in

peripheral countries can be an instrument for correcting effects of disparity in income elasticity in relation to industrial countries, it should be taken into account that it creates new disparities in the opposite sense, and the industrial countries are forced to adopt defensive protective measures to maintain their own rates of growth:

> Industrialization needs a dynamic policy for protection, which should be continually adapted as to introduce new changes in import composition as economy develops and disparities in income elasticity of demand play their role. Trade treaties should not try to crystallize existing situations, but should be flexible enough to promote this changes in import composition in an orderly, selective and rational way.
>
> Prebisch [1959]

With this argument Prebisch suggests a certain degree of protection in developing countries, which should be continuously adjusted as long as the disparities between countries begin to disappear. Moreover, in another part of his papers, he recommends an import substitution policy in these countries in order to avoid the great outflow of foreign exchange, that could create a higher pressure to devaluate the exchange rate, which also creates incentive to increase the exports of primary commodities, and hence accentuates the deterioration of the terms of trade effects.

Although the early exponents of the Prebisch approach were often criticized for recommending imports substituting industrialization as main policy conclusion, another equally logical policy conclusion would be exports substituting industrialization to get exports away from the deteriorating primary commodities. However, the fact that some of the explanation for deteriorating terms of trade now relates to the characteristics of countries rather than commodities, means that even the exports substituting industrialization (that is, a shift away from primary commodities to manufactures in the exports of developing countries) has not disposed of the problem against developing countries. The type of manufactures exported by developing countries in relation to the different type of manufactures exported by the industrial countries shared some of the disadvantages pointed out by Prebisch for primary commodities in relation to manufactures. Empirical works have shown that during the period 1954-72, while the terms of trade for manufactures improved, they did so less for the manufactures in developing countries than those of industrial countries. According to Hans Singer, the deterioration of the terms of trade of developing countries during this period can be attributed to three distinct factors:

1) the rate of deterioration in prices in their primary commodities compared with those of primary commodities exported by industrial countries;
2) a fall in prices of the manufactures exported by developing countries relative to the manufactures exported by industrial countries; and
3) their higher proportion of primary commodities in the exports of developing countries which means that the deterioration of primary commodities in relation to manufactures affected them more than the industrial countries.

M. June Flanders (1964) makes a severe

critique to Prebisch hypothesis. He does not agree with the idea that the long-run deterioration of the terms of trade should be counteracted through tariffs on industrial imports. In his paper he tries to reveal what would tend to cause the deterioration in the periphery's terms of trade in the context of Prebisch model. Additionally, Flanders tries to find the connection between the declining terms of trade and the protectionism proposed by Prebisch. In other words, he tries to find the expected benefits for the periphery that can be reaped from such a protectionism.

As we already mentioned, in the Prebisch model the high income elasticity of demand for imports into the periphery combined with the low income elasticity of demand for imports into the center (industrial countries), will force the periphery to achieve balance of payments equilibrium by either of the unattractive alternatives: growing more slowly than the center or restraining its demand for imports (preferably by imposing tariffs). For Flanders, the latter alternative is less unpleasant, but a tariff system designed to ration scarce foreign exchange, not to decrease the total demand for imports, cannot be expected to cause an improvement in the terms of trade. At best, it might slow down future deterioration in the terms of trade. Although Prebisch argues that the benefit from protectionism is to prevent further deterioration of the terms of trade, and that this protectionism should be highly selective, Flanders points out that, if this is the case, then the industrial product (or products) to be protected will be different in each peripheral country. Hence the "countervailing" effects of the tariffs will be defused among many industries in many industrial countries, so will be less likely to influence the prices of industrial imports.

Under Flanders' view, the past deterioration of the terms of trade of the periphery is attributed in large measure to the downward inflexibility of prices and wages in industrial countries as contrasted with the periphery. If this is so, a downward shift in the periphery's demand function for imports from industrial countries (as consequence of tariffs), will result in making central countries worse off through unemployment, without making the periphery better off through the improvement in the terms of trade. In fact, by lowering the income and unemployment levels in the center this would actually hurt the periphery by reducing the demand for its exports.

Another important Prebisch's argument, is the one that mentions that the benefits of technical progress[4] are distributed alike through out the world, and then peripheral countries, like in Latin America, would have achieved the same productive efficiency as the industrial countries. But Flanders does not agree with this way of thinking. He says that Prebisch's argument is based on the factor- price equalization theorem, and at the same time, one of the basic assumptions taken by him, is the existence of only one factor of production in the world, which is labor, and this is the reason why income and wages are misinterpreted concepts[5]. So, if this is the case, the factor-price equaliza-

[4] Notice that here, the fact that benefits from technical progress are spread equally around the countries, does not mean that technology is the same in all countries.

[5] Given that in Prebisch model there is only one factor of production (labor), he seems to take wages as synonymous of income.

tion theorem is not relevant. Even if we consider the alternative possibility of two factors of production, the theorem is valid only when both countries produce both commodities. Obviously this is a difficult assumption to make when one country is the periphery and the other is an industrial one.

In Flanders' words, Prebisch makes two important arguments that for many economists are highly questionable. First, Prebisch argues that technical progress[6] just "happens" and is not the result of an increase in any other input. Hence, the benefit derived from such progress is analogous to "unearned" land rent. Secondly, from the point of view of "justice and equity in distribution", such unearned benefits should be distributed equally throughout the world. Again Flanders criticizes these arguments. He says that neither of the propositions follows naturally from the traditional theory of comparative advantage and international specialization, as Prebisch claims. For Flanders, opportunity cost of technical progress is by no means negligible, even if we include the direct outlay for research and development made by private business in industrial countries. Therefore, we should not ignore the benefits that the industrial countries' progress has and which are on the interest of peripheral countries, because this is translated into declining prices of final products. Hence, there is no theoretical support to say that the benefits of technical progress should be equally distributed through out the world.

The explanation made by Prebisch to the stylized fact of declining terms of trade against developing countries, is related to the economic cycle. He argues that during the cyclical upswing, prices of primary goods rise more sharply than those of finished goods, but during the cyclical downswing, the fall in prices (in the periphery as compared with industrial countries) is greater than the relative rise in the upswing (in the industrial center as compared with the periphery). This is what explains the long-run effect in terms of trade.

The support of the previous argument is located in the wage mechanism. As we should remember, the assumption in Prebisch model is a downward rigid wage system in industrial countries, so that in the downswing period of the cycle, the price of raw materials are forced down by more than the previous rise. On the other hand, peripheral countries don't have downward rigidity in wages, so the income in this countries decrease by means of lower prices, rather than by the means of unemployment, as is the case of industrial centers.

We can conclude this analysis of Prebisch's theory saying that, in his first arguments[7], the process of transfer of real income through the deterioration in terms of trade is explained in terms of the differences in market structure between the periphery and the industrial centers. By contrast, in his 1959 paper, Prebisch attributes deterioration of the terms of trade to the differences in productivity ratios and technology.

The Prebisch-Singer hypothesis was based on a study that showed that the barter

[6] Prebisch's definition of technical progress is: an increase in productivity per man.

[7] Cf. Prebisch, Raul. *The Economic Development of Latin America and its Principal Problems*. Economic Commission for Latin America . United Nations, Department of Economics Affairs, 1950.

TOT of the United Kingdom significantly rose from 1870 to 1938 (which implies a significant decline on developing countries' TOT). During that period, the United Kingdom exported manufactured goods and imported food and raw materials while developing countries exported food and raw materials and imported manufactured goods. Dominick Salvatore (1995), presents a good analysis about the caveats on Prebisch-Singer's work. First of all, Prebisch and Singer based their study on import and export prices that were measured at dockside in the United Kingdom during the period 1870-1938. But most of the food and raw material imports of the United Kingdom reflected the sharp decline in the cost of ocean transportation that occurred over this period and not lower relative prices received by exporting nations. Second, the higher relative prices received by the United Kingdom for its manufactured exports reflected the greater quality improvements in manufactured goods relative to those in primary commodities, and these quality changes were not taken into account in the price series. Third, there is evidence that, during the period under study, industrial (or developed) countries also exported some primary commodities, and developing countries also exported some manufactured goods. Consequently, measuring the TOT of developing countries as the price of traded primary commodities divided by the price of traded manufactured goods is not the best way of showing what was (and is) happening with the terms of trade between two nations. Finally, the study ends in a depression year when prices of primary commodities were abnormally low, hence implying abnormally high TOT for the United Kingdom. All these criticisms stimulated other empirical studies that aimed to show some evidence on the Prebisch-Singer hypothesis.

The Lewis Model

In 1969, W.A. Lewis presents a simple framework for the determinants of the terms of trade between the products of the 'temperate' and 'tropic zones', which we may identify as industrial and developing countries respectively. Unlike the Prebisch discussion, Lewis puts forward a specific model, which makes the task of interpretation much easier. However, he does not formulate his model within an explicit general equilibrium framework. Let us then analyze what are the basic assumptions in this model.

The industrial countries produce two goods, which Lewis calls steel and food, and the peripheral countries produce also two goods, coffee and food. Each country consumes all three goods. The industrial countries export steel to the periphery, but the direction of trade in food is left open. Labor is the only input into production in both type of countries, and there is a fixed technical coefficient for the production of each good in each country, so that industrial countries have a linear transformation curve between steel and food, and peripheral countries a similar curve between coffee and food. The relative prices of steel and food and of coffee and food, are determined purely by the slopes of the linear transformation curves in each region. Arbitrage therefore fixes the relative prices of steel and coffee, which Lewis identifies with the terms of trade. The profit maximization process by competitive producers, is what determines the equilibrium in this model, and gives us the two price

ratios also determined by the slopes of the transformation curves. If tastes are specified, the demand by each country for each product is determined in conjunction with the price ratios and budget equations.

Comparative statics on this model helps us to analyze the effects of a uniform increase in productivity in both sectors in industrial countries: the countries' transformation curve shifts out but leaves its slope unchanged. With positive income elasticities for both goods in both regions assumed, the expansion of real income in the industrial countries, leads to an increase in coffee demand, so that production and export of this commodity is increased in peripheral countries by the same amount, with the consequent reduction in the output of food in this same region. The exports of steel in industrial countries remain unchanged, since relative prices and real income in the periphery are unchanged. The additional coffee imports of the industrial centers are matched either by an increase in food exports or a decline of food imports, depending on the direction of trade in that commodity, so as to leave food consumption in the periphery unchanged. The industrial countries therefore don't lose any of the fruits of its expansion in a deterioration of its terms of trade, and welfare in the periphery is unaffected by the productivity increase in the industrial countries. This means that there is no "spillover" effect on the periphery through better terms of trade. Exactly symmetrical conditions would hold if the uniform technical improvement were to have taken place in the periphery.

This model therefore gives different predictions in comparison with the Prebisch model, where the terms of trade must turn against the expanding region if its income elasticity of demand for imports is positive. It is the presence of food production on the periphery and the assumption of the linearity of its transformation curve that prevents the industrial countries' growth from raising the price of coffee relative to that of steel. It is also clear that the periphery's terms of trade would be improved by growth in the industrial countries if the marginal cost of coffee were increasing instead of remaining constant in terms of food, that is, if the transformation curve were concave instead of linear.

The Findlay Model

Ronald Findaly (1981) develops a dynamic model for the determination of the terms of trade. In his model there are two countries, the North and the South. The economy of the North is depicted by a Solow-type growth model with labor and capital where one good is produced: manufactures. Also, the capital stock consists of a stock of manufactures. The labor force is growing over time at a constant rate and labor-augmenting technical progress is taking place. The South produces only primary goods, with labor and a stock of capital that consists of manufactures. Here, labor has a perfectly elastic supply at the given wage. The growth rate of the southern economy depends on how large a part of profits are saved and profits themselves are a function of the terms of trade. The two economies are linked together by trade and at the steady state equilibrium, the growth rates of the two outputs, manufactures and primary products, should be equal.

Findlay starts by studying the steady state characteristics of the economies. The

author derives an expression for the steady state solution to the terms of trade which depends only on four factors: the growth rate of the labor force in the North, the saving rate, the given wage in the South, and the production function for the South:

$$\theta^* = n \; / \; [\, \sigma \, \pi'(k^*_s) \,]$$

where θ^* represents the terms of trade (the ratio of the price of primary products to the price of manufactures).

n is the growth rate of labor force

σ is the saving rate (proportion of the profits saved)

$\pi'(k^*_s)$ is the marginal productivity of capital in the South[8].

Findlay studies the dynamics of convergence in this model and finds that the model has the same kind of stability conditions as the Solow model. The dynamic formulation of the model gives new insights into the fundamental determinants of the terms of trade. One interesting aspect of the model is that it shows how productivity increases may influence national incomes and per capita incomes asymmetrically in the two countries. We recall that this was one of the assertions of the Prebisch thesis.

Technical progress in the North will lead to an improvement in both, the total income and the per capita income in the North. It will also lead to an increase in the total income in the South. Moreover, the relation between total incomes in North and South will be unchanged because of technical progress in the North. This depends on the fact that the impact effect of such growth will be to improve the terms of trade of the South, which will trigger off a dynamic accumulation with expansion of employment. This process will lead to new steady states with relative incomes between the North and South being the same as at the starting point. The North however, will be able to keep its entire productivity gain.

From the above equation we can also observe that technological improvement in the South in the form of an increase in the productivity of capital will have a different effect, since it will lead to a fall in per capita income of the South, while total income in this region may either fall or rise. The explanation to this result is that technical progress of this type in the South, will lead to deteriorating terms of trade.

Some researchers interpret the Findlay model as a kind of model that can help to explain why the developing countries should be more careful about the prospects of productivity increases than the industrial countries.

Some Empirical Evidence

In 1988 Enzo R. Grilli and Maw Cheng Yang presented a paper in which they revisit the empirical foundation of the alleged secular decline in the prices of primary commodities relative to those of manufactures. They constructed an index of commodity prices, and modified two indexes of manufactured good prices, and found that from 1900 to 1986 the relative prices of all primary commodities fell on trend by 0.5 percent a year and those of nonfuel primary com-

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[8] The profit maximization condition for production of primary products in the South is given by:

$\pi(k_s) - \pi'(k_s) k_s = w$

where w is the fixed real wage rate in terms of primary products.

modities by 0.6 percent a year. They thus present some evidence to confirm the sign, but not the magnitude, of the trend implicit in the work of Prebisch. They show that the evolution of the terms of trade of nonfuel primary commodities is not the same as that of the net barter terms of trade of non-oil-exporting developing countries.

Grilli and Yang focused on the shortcomings of commodity price indices used in earlier empirical work. Their paper make a major contribution by constructing several new indices using free-market commodity price quotations compiled by the World Bank, covering the period 1900-1983; each nominal price is deflated by a manufacture unit value (MVU) index. Using this improved commodity price indices, they estimated several simple log-linear models, correcting for first order serial correlation, and concluded that there has been a significant downward trend in the terms of trade over this period.

Later, in 1989 Cuddington and Urzúa re-examined the Grilli and Yang index, paying special attention to the possible existence of unit roots, higher order serial correlation and structural breaks in the data series. They conclude that the Grilli-Yang price index exhibits a change in the mean in 1920, but no secular downward trend is evident.

Cuddington, in his 1992 paper uses time series techniques to re-examine again what is called the Prebisch-Singer hypothesis, which proclaimed a structural tendency for the terms of trade of developing countries to deteriorate in their dealings with industrial countries. Instead of using price indices, he considers 26 individual commodity prices, over the period 1900-1983. This avoids possible aggregation and interpretation problems associated with the use of aggregate indices. The study finds that 16 of the 26 prices have no trend, 5 have significant negative trends, and the remaining 5 have positive trends. Coddington concludes that the Prebisch-Singer hypothesis should not be considered a universal phenomenon or "stylized fact".

Coddington's work is based on the following model:

$$\log (y_t) = a + \beta t + e_t$$

where y_t is the price of the good and the error term e_t follows an ARMA process like:

$$(1 \quad \rho(L))\, \mathbf{A}(L)\, e_t = \mathbf{B}(L)\, u_t$$

and u_t is assumed to be a white noise process.

Cuddington pays special attention to the possibility of a unit root problem in the error term process because the existence of a unit root ($\rho = 1$) in the model, implies that the error process is non-stationary, and then, although the OLS estimator of $\hat{a}$ is unbiased the associated statistic $t_{\hat{a}}$, diverges. Thus, the presence of a unit root in the error process e_t, in which tests of the Prebisch-Singer hypothesis are based, would lead to misleading statistical inferences. In particular, he claims that it is extremely likely that the researchers would conclude that the commodity prices exhibit trends even if in fact no trends exist. So, as result of Cuddington's work, we can conclude that not all primary commodities prices face a declin-

ing trend, and by including modern time series techniques, this results can be taken as more reliable than those applying ordinary least squares analysis.

In a more recent study, Ocampo and Parra [2003], updated to 2000 Grilli and Yang price indices of 24 non-oil commodities. Like Cuddington and Urzúa, Ocampo and Parra's study suggests that, instead of discussing whether or not there was a long term downtrend in the barter TOT for raw materials during the twentieth century, it is more appropriate to talk about the particular dynamics and evolution of prices of individual products. Although the Prebisch-Singer hypothesis has been traditionally associated with a secular or continuous declining trend in the TOT of developing countries, Ocampo and Parra's study considers the hypothesis that this deterioration occurred in steps. Their analysis then is carried out using aggregate price indices and individual commodity prices. They applied several time series techniques to analyze the data series in order to find some evidence of the existence of trends (deterministic or random), and/or structural breaks in the individual prices and price indices. However, Ocampo and Parra's results do not provide evidence of a secular or continuous trend towards the deterioration of the TOT in general. Only nine (out of 24) commodity prices showed a decline, while eight commodities revealed the presence of a unit root and high volatility, and no significant (although negative) drift. On the other hand, four commodity prices followed an upward trend and three others showed no statistically significant deterministic trend.

Additionally, the econometric analysis followed by these authors confirmed the presence of structural breaks in the price data. In particular, all non-oil indices showed evidence of two structural breaks. According to the authors, the first abrupt downward shift seems to have taken place around 1920 and was related to the major economic changes produced by the First World War. The second structural break seems to have occurred around 1980 in the wake of the world economic slowdown. In regard to individual prices, they followed a more positive trend before the First World War, and there is no clear evidence of a significant trend in commodity prices between the 1920's and 1970's.

Conclusions

Long- term trends and cyclical movements in primary commodity prices have important consequences for both, producer and consumer countries, and there is no doubt regarding the fact that economic activity in industrial and developing countries is affected by changing primary commodity prices. This is the reason why the controversy about the tendency in the terms of trade is still an important topic for discussion today.

One of the most widely discussed theories concerning the terms of trade in developing countries is the Prebisch-Singer hypothesis, which proclaimed a structural tendency for the terms of trade of these countries to deteriorate in their dealings with industrial countries. Although the Prebishc-Singer hypothesis has been very criticized by many economists like Flanders, Prebisch's ideas have represented the starting point for the development of other models which main objective is to find what the determinants of the terms of trade are. In this essay, Lewis and Findlay models were

analyzed. In general, the Prebisch-Singer conclusion has been seriously challenged on several grounds and it has fostered perhaps more empirical studies than any other hypothesis in development economics. Recent works like those from Grilli and Yang show divergent conclusions compared to those obtained by Cuddington and Ocampo and Parra, basically because Grilli and Yang do not consider the possibility of structural breaks in the price series. Hence, most of the empirical evidence seems to contradict the Prebisch-Singer hypothesis, and some other evidence seems to support it.

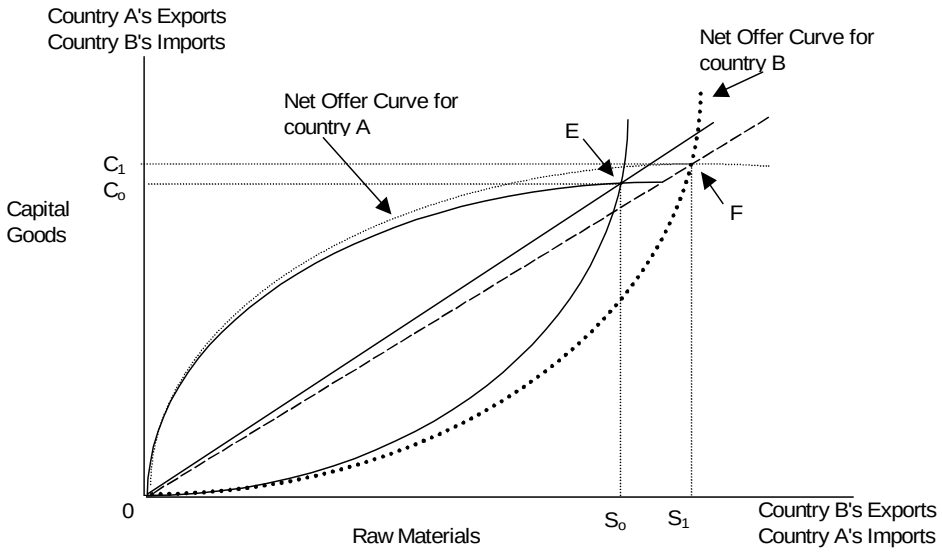
It appears, that an important part of the controversy at this point in time, has been basically focused on the different statistical techniques used to prove the Prebisch-Singer hypothesis. Some recent studies have emphasized that the empirical conclusions regarding the hypothesis, depend importantly on the choice of the "correct" price index for capturing the developing countries' terms of trade, since it seems that a number of aggregation and interpretation problems arise as one moves from individual commodity prices to indices. In the light of these problems, some studies have taken the option of applying time series techniques, in order to analyze the behavior of the individual price series as well as price indices. In general, the results of these studies have shown NO evidence of a secular or continuous trend towards the deterioration of the TOT in developing countries. However, there is still more work to do on this issue. The application of time series techniques (like the ones used by Coddington and Urzúa, Ocampo and Parra) to the different TOT definitions would be very useful in understanding the movements and behavior of this important variable, and the welfare effects of trade for the country in question.

Apendix

The Effect of Growth on Barter Terms of Trade.

Assume that country A is a center (industrial) country having comparative advantage in capital goods production. Country B then is a peripheral (developing) country having comparative advantage in raw materials production. Given these characteristics, the net offer curve for each country is represented in the graph below. Suppose also that at the initial equilibrium point E, the barter TOT is given by TT_0 = Price of raw materials / Price of capital goods. At point E, country A exports C_0 of capital goods to country B, and country B exports S_0 of raw materials to country A. Additionally, assume that country A experiences relatively less growth[9] than country B, and the growth process increases the trade volume for both A and B. The new equilibrium point will be given at point F, where the TOT is $TT_1 < TT_0$. This represents a deterioration of the TOT in the peripheral country B.

[9] Note that the analysis can also lead to the same conclusion even if we assume no growth at all in country A, but country B grows and there is a trade volume increase.


Country A's Exports
Country B's Imports
Net Offer Curve for
country B
Net Offer Curve for
country A
E
C1
Co
Capital
Goods
F
0
So
S1
Country B's Exports
Country A's Imports
Raw Materials

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