

Income distribution, factor endowments, and trade revisited: The role of non-tradable goods¹

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Abstract: We return to the traditional theme of the distributive consequences of international prices and trade policies, focusing on economies relatively abundant in natural resources with a large non-tradable-goods sector. Changes in international prices create an aggregate demand effect which impacts on the earnings of factors employed in the non-traded goods sector. We show that, in economies highly specialized in the production of tradable goods and where the import-competing sector is small, under standard assumptions, terms-of-trade shifts have a neutral effect on factor prices and thus lack distributive effects, quite differently from Stolper-Samuelson scenarios. In economies with sizable import-competing sectors and two “urban” productive factors (e.g., skilled and unskilled labor), changes in the terms of trade do induce distributional tensions through two channels: (i) the exogenous shift in the relative price of tradable goods, and (ii) the endogenous displacement of the demand for non-tradables. We illustrate how, according to the structure of the economy, different patterns of income distribution may arise. Next, we analyze the introduction of trade duties. Trade taxes change relative prices between tradable goods as a terms-of-trade shock does, but also introduce an additional demand mechanism, that depends on the use the government gives to the revenues. If the tax revenues are transferred back to the private sector, the resulting reallocation of spending favors those factors used intensively in the production of non-tradables.

Keywords: Income distribution, International trade, Non-tradable goods, Stolper-Samuelson effects.

JELs: F16, F13, D33

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1. Introduction

The proposition that the distributive implications of international trade are shaped by external conditions, the policy setup, and the economy's configuration in terms of production and consumption has been a matter of analytical concern for a long time, especially since the appearance of the celebrated theorem of Stolper and Samuelson (1941). Much has happened since then in terms of both foreign trade patterns and the associated theory. Instead of considering economies composed of large sectors operating in competitive markets and characterized by the intensity of their use of a possibly small set of factors of production, the recent literature stresses the heterogeneity of goods and factors, and the behavior of firms that market differentiated goods subject to a less than fully elastic demand.

The latter approach accounts for the enormous diversity of goods and services involved in cross-border exchanges and the growing importance of innovative rents as sources of income. Yet, the simple Heckscher–Ohlin–Samuelson (HOS) framework retains its usefulness for a significant array of interesting distributional problems. The argument that foreign trade tends to focus on an economy's abundant factors (whether raw materials, at one extreme, or, at the other, sophisticated skills that can be used to push out the production frontier in terms of design and technologies) seems to be a robust proposition even today. Some of the salient changes seen in the international economy in recent decades include a steep increase in the labor supply in activities that are integrated into world trade, along with an increase in the relevance of production value chains. The commodity 'super cycle' observed throughout most of the first decade of this century is another noticeable phenomenon. These developments have contributed significantly to strengthen the interest on the study of the effects of international trade and globalization on income distribution, particularly through changes in the skill premium (see for example Acemoglu, 2002, Stiglitz, 2002).

In a number of developing countries, the tensions between the owners of natural resources, industrial capital, and different types of labor have traditionally been, and continue to be, a conspicuous feature of the economic and political landscape. These distributional conflicts also help to shape attitudes towards strategic policy choices, especially regarding the role of these economies in international markets. At times tensions may become severe. The social stresses apt to arise in the event of large changes in the prices of tradable goods, even in countries benefiting from terms-of-trade improvements, sometimes reach dramatic proportions. Instances of these effects can be found for example in the commodity boom of the early 2000s. Such types of social conflicts have been recognized as potentially deleterious for economic growth (see, among others, Rodrik, 1999). Against this backdrop, our main contribution is to study the effects of world prices and trade policies on factor incomes and distributive tradeoffs in economies where exportable sectors are intensive in natural resources, paying particular attention to the role of activities producing exclusively for the domestic market.

In the simple Stolper-Samuelson setup of a small open economy with only tradable goods, demand conditions for domestic outputs are completely specified by world prices. Factor incomes vary with international prices according to factor intensities in each sector,

independently of whether they produce exportable or importable commodities. However, the existence of non-tradable goods in the economy implies that aggregate income effects have an impact as well. Factor prices are also influenced by the level of domestic spending. This induces an asymmetry between the effects of changes in the international terms of trade on real factor incomes since, for given factor intensities in traded-goods industries, there would be a complementarity between revenues in non-tradable activities and the relative prices of exportable vis-à-vis importable goods. In countries with a high degree of specialization in the production of traded goods, where import-competing sectors are relatively small and at the same time there is a sizable non-traded goods sector (the demand for which depends on the level of expenditure of producers of the exportable good), improvements in the terms of trade will result in widespread increases in real factor earnings. In the case of economies with a different type of production structure, however, stronger terms of trade need not be favorable for all social groups, since the Stolper-Samuelson effect of the relative price of tradable goods combines with the aggregate demand consequences of the rise in national real income.

For simplicity, we disregard intertemporal considerations and, hence, the analysis of accumulation and growth, as well as that of international capital movements. We pursue the discussion within a static framework which focuses on what may be considered “medium-term” effects; that is, those that would be induced after reallocations in demand and production have taken place. In our benchmark case, we also simplify the analysis by considering the standard case of unitary price elasticities of substitution, both in production and consumption. While differences in consumption patterns certainly play an important role in the distributive implications of price changes, we disregard these effects to focus on those deriving from production channels *à la* Stolper-Samuelson.

Our analysis can be adapted to economies with several different configurations. However, for the sake of concreteness and expositional clarity, we focus on the case that seems most relevant for an important group of natural-resource-abundant countries. The representation of the production structure considers three types of goods. These include (i) a primary, exportable commodity, produced using as inputs land and unskilled labor; (ii) urban non-tradable goods/services; and (iii) industrial goods produced by an import-competing manufacturing industry. Both urban activities employ unskilled and skilled labor, albeit with different relative intensities. Introducing a specific factor in the manufacturing industry (“industrial capital”) does not substantially alter the analysis.

In the simplest case, the economy produces only the exportable and non-traded goods. This setting corresponds to countries well-endowed with natural resources and very open to international trade, where urban activities related to the production of non-traded goods are supported by the demand derived from natural resource-related income, while import-competing activities are not profitable. One could also think of economies where industrial activities operate under such high levels of protection that they behave effectively as non-tradable sectors, and where imports of manufactures consist only of goods not produced locally.

For such configurations we show that, with homothetic preferences, when the economy receives a terms-of-trade shock, the effect is *neutral* in terms of income distribution. There is no distributive Stolper-Samuelson-type shift in relative factor prices, and the relative prices between locally produced goods remain unchanged. Thus, once the demand responses to international prices have taken place, a terms-of-trade shock would not trigger distributive conflicts among the different socioeconomic groups (although such conflicts may arise during the transition if the effects on spending on non-traded goods do not emerge instantaneously). This result is robust to the assumption of a representative consumer if manufactured goods are used as inputs rather than only for consumption. However, factor prices would not change in equal proportions when consumption demands are not characterized by unitary elasticities. If demand for the non-traded good were highly income elastic, however, the share of spending on that good would rise with higher export prices, increasing the earnings of skilled labor. In the latter case, following a positive shock on the price of the natural resource good, it would be possible for an “urban” factor to receive the largest increase in income.

The effects of a terms-of-trade shift are non-neutral in a diversified economy that produces all three goods, with a manufacturing sector that operates as a price taker in international markets. An increase in the relative price of good A benefits the factor used specifically in the production of the exportable good, as expected. The incomes of the “urban” factors are now subject to a Stolper-Samuelson tradeoff associated with the (endogenous) change in the relative prices of non-tradables and manufactures. The income of one urban factor declines unambiguously (in terms of the three goods). If, for example, unskilled labor is used with relative intensity in the production of manufactures (as opposed to skilled labor being used intensively in the non-tradable sector), then unskilled workers see their relative wage drop as export prices increase. Skilled labor, however, would be comparatively better-off. Seen from this angle, the skilled workers’ interests would appear to be more closely aligned with those of the natural resources-owning class rather than with those of unskilled workers. Therefore, the distributional effects of changes in international prices would hinge on the relative skill intensity of “urban” goods.

We also study the impact of a trade tax that lowers the domestic relative price of the exportable primary good, at constant international prices. In this two-sector economy, skilled workers, if employed intensively in the production of non-tradables, may favor the application of taxes to foreign trade, but only to the extent that tax revenues are spent in a way that raises the demand for the urban good. Such incentives would tend to fade away, however, if the main demand for the services that employ skilled labor comes from the spending of the landlord group. This also holds true for the case in which tax revenues are returned to the private sector in proportion to income shares. In the three-sector economy, a trade tax naturally reduces the return to the factor specific to the production of the primary good; unskilled workers gain if their labor is used intensively in the import-competing manufacturing sector and lose if their labor is used intensively in the non-tradable sector.

The rest of the paper is organized as follows. The following section puts our analytical work in perspective with the existing literature; it also presents evidence concerning the factor

intensities of different urban activities in Latin American economies, and about observed patterns of distributive changes associated with swings in international prices. Section 3 deals with the effects of terms-of-trade shifts on income distribution for the two-and three-sector economy models, while Section 4 considers the consequences of trade taxes. Finally, Section 5 concludes.

2. On previous literature and some empirical evidence

This paper is related to the traditional “dependent economy” macroeconomic literature. This body of analysis focuses on the effects of relative price shifts between traded and non-traded goods on real activity and income distribution in economies that export land-intensive primary goods (see Salter, 1959, Swan, 1960, and Diaz Alejandro, 1965). Our arguments also build on the work in economic development and international trade that explores and qualifies the traditional Stolper–Samuelson results.

Early developments of the HOS model extended the original theorems to the general case of many factors and tradable goods (see Johnson, 1957). Ethier (1984) presents a comprehensive survey of this body of literature. McDougall (1970) and Komiya (1967) made relevant contributions to this line of analysis by introducing non-tradable goods; their results were later extended by Ethier (1972). Komiya considers a small open economy that produces two tradable goods and one non-tradable good using two factors of production (capital and labor), both of which are mobile across sectors. He finds conditions under which the factor price equalization theorem, Rybczynski’s theorem, and Metzler’s theorem all hold. In connected work, Deardorff and Courant (1990) analyze conditions for factor price equalization in the presence of a non-traded good. Another relevant antecedent is Jones (1974), who studies the case of an economy with two factors of production and a single traded-good sector.

Cassing (1977) extends the 3-goods/2-factors model to the case of monopolistic non-tradable goods, while Cassing (1978) adds to the model by taking into account transport costs. More recently, Thierfelder and Robinson (2002) consider a model with two production activities, two inputs, and three commodities (exportable, importable, and non-tradable), while Beladi and Batra (2004) study the effects of traded goods prices on income distribution in a model where the exportable and the importable sectors share the same factors of production (see also Beladi and Batra, 2008). Galiani et al. (2008) also focus on the impact of spillovers from higher exports on the domestic demand for non-tradables. They argue that in land-rich economies not engaged in import substitution, growth in the value of land-intensive production activities may provide incentives for elite-controlled governments to favor public education as a means of expanding the supply of skilled labor in service sectors.

The connection between the skill premium and the process of globalization, and the potential effect of trade policies has been thoroughly discussed in Goldberg and Pavcnick (2006, 2016). In particular, they highlight the existence of differences in the impact of those policies on wages, depending on the degree of economic development (advanced vs. emerging), and features such as specific industrial configurations and the comparative mobility of labor between regions. On

his side, Acemoglu (2003) argues that the increase in the skill premium is in part a reflection of the diffusion of new technologies set in motion by globalization, which benefits skilled workers rather than the unskilled. Further evidence is presented by Williamson (2011).

The arguments of this paper correspond to the intuition that the incomes of factors used intensively in the production of non-tradables tend to move in step with the performance of the exporting sector. Coble and Magud (2010) find support for this hypothesis in the case of Chile, a quite resource-abundant economy. They document that stronger terms of trade are associated with wider wage gaps between unskilled and skilled workers and that non-tradable sectors are relatively skilled-labor-intensive (see Figures 1 and 2). This last finding is consistent with Hermida (2015) who, based on data from household surveys, points out that in Argentina in 2013 the proportion of workers with more than high-school education was 23 percent in manufacturing, compared with about 42 percent in the service sectors; a substantial difference still appears if the public administration sector is excluded from the calculation. Similar patterns are reported for Colombia and Peru.

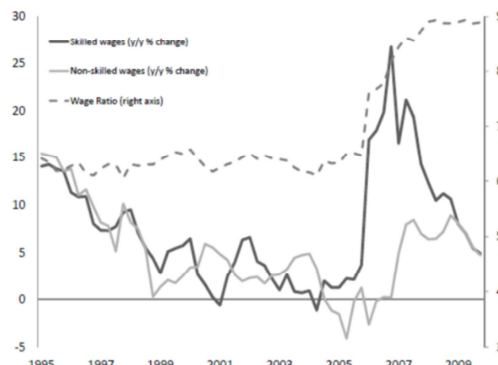
Figure 1. Terms of Trade vs. Relative Wages



Source: Coble and Magud (2010) calculations using data from Central Bank of Chile and Chile's National Bureau of Statistics

Source: Coble and Magud (2010).

Figure 2. Relative Wages



Source: Coble and Magud (2010) calculations using data from Central Bank of Chile and Chile's National Bureau of Statistics.

Source: Coble and Magud (2010).

3. Distributive Effects of Terms-of-Trade Shifts

3.1 Specialized Economies: A Simple Two-Sector Economy

We first analyze the case of economies that specialize in the production of primary goods that are intensive in the use of natural resources, and that do not have a significant import-competing sector. In these economies, the absence of a sector that produces the importable good eliminates the familiar Stolper–Samuelson effect. Thus, the standard distributional consequences that arise in the traditional model from changes in the international terms of trade are diluted, since the demand for the factors employed in the non-tradable sector depends on the revenues generated by the export sector.

Production

We consider a small, open economy that produces two goods: an agricultural good (A) and a non-traded (N) good. The quantities of output are labeled y_A and y_N , respectively. The world price of the agricultural good, p_A , is exogenously given, as is the price of the non-produced imported good M , p_M , which serves as the numeraire. Technology is represented by Cobb–Douglas production functions:

$$y_A = f(T, L) \text{ and} \quad (1)$$

$$y_N = g(H, L), \quad (2)$$

where T denotes agricultural land, L stands for raw labor, and H denotes an “urban” factor that we will assimilate with skilled labor. The price–cost equality derived from the assumption of perfect competition in all markets can be expressed in terms of proportional changes as:

$$\hat{p}_A = \theta_{TA}\hat{t} + \theta_{LA}\hat{w} \quad (3)$$

$$\hat{p}_N = \theta_{HN}\hat{h} + \theta_{LN}\hat{w}, \quad (4)$$

where a circumflex above a variable denotes a proportional change. p_N is the price of the non-traded good, t is the return to factor T , w is the wage rate, h denotes the unit earnings of factor H , and θ_{ij} stands for the share of factor i in the unit cost of the production of good j .

Factor Markets

The economy is endowed with a fixed amount of factors of production. Given competitive factor markets, the equilibrium conditions can be characterized as:

$$\hat{T} = 0 = \hat{p}_A + \hat{y}_A - \hat{t} \quad (5)$$

$$\hat{L} = 0 = \lambda_{LA}(\hat{p}_A + \hat{y}_A) + \lambda_{LN}(\hat{p}_N + \hat{y}_N) - \hat{w} \quad (6)$$

$$\hat{H} = 0 = (\hat{p}_N + \hat{y}_N) - \hat{h} \quad (7)$$

where λ_{ij} stands for the participation of sector j in the employment of factor i , i.e., $\lambda_{Li} = L_i/L$. Since the incomes of the specific factors T and H are determined by constant shares of the values of production of the goods A and N , respectively, their unit earnings vary in proportion to those prices. In the case of the mobile factor, L , wages change according to a weighted average of the values of production in relation to the importance of the sector in total employment.

Preferences and Consumption

For analytical tractability, we assume homothetic preferences, thus ignoring the effects of incomes on the composition of demand. All individuals have identical Cobb–Douglas preferences over the consumption of the agricultural good c_A , the non-traded good c_N , and the manufactured good c_M :

$$u(c_A, c_M, c_N) = c_A^{\gamma_A} c_M^{\gamma_M} c_N^{\gamma_N} \quad (8)$$

The parameters represent the constant proportions of spending allocated to the different goods. Without loss of generality, we assume that $\gamma_A + \gamma_M = 1$, so that these two coefficients measure the shares of the value of each tradable good in the total value of expenditures on traded goods. The individual's budget constraint is given by:

$$I = p_A c_A + p_N c_N + p_M c_M \quad (9)$$

where I is the income earned by the agent, as a function of factor prices w , t , and h , as well as factor endowments. Optimal consumption is such that the value of spending on each of the three goods varies proportionally. Hence, in equilibrium:

$$\hat{p}_A + \hat{c}_A = \hat{c}_M = \hat{p}_N + \hat{c}_N = \hat{p}_N + \hat{y}_N \quad (10)$$

where the price of the manufactured good is fixed by the choice of numeraire, $\hat{p}_M = 0$.

Aggregate Constraints and Equilibrium

The resource constraint for the non-traded good implies the equality of output and consumption, which is valid in levels and in terms of proportional changes:

$$\hat{y}_N = \hat{c}_N \quad (11)$$

This is a static model that disregards intertemporal effects on spending. We therefore impose the condition of a zero trade balance, implying the equality of the proportional change in the value of the production of traded goods (here composed solely of good A) with the value of the consumption of tradables:

$$\hat{p}_A + \hat{y}_A = \gamma_A(\hat{p}_A + \hat{c}_A) + \gamma_M \hat{c}_M \quad (12)$$

The equilibrium of the economy is defined as the state in which the aggregate constraints on production and consumption are satisfied, factor markets clear, and consumers and firms act optimally, as previously stated.

Results

It is straightforward to verify that, in equilibrium, the following results hold:

$$\hat{p}_A = \hat{p}_N = \hat{t} = \hat{h} = \hat{w} \quad (13)$$

$$\hat{c}_A = \hat{y}_A = \hat{y}_N = \hat{c}_N = 0 \quad (14)$$

$$\hat{c}_M = \hat{p}_A \quad (15)$$

This can be summarized in the following proposition.

Proposition 1. In the two-sector case, a positive terms-of-trade shock ($\hat{p}_A > 0$; $\hat{p}_M = 0$) is neutral in the sense that there are no changes in relative factor earnings or in the relative prices of locally produced goods. The increase in the price of good A , $\hat{p}_A > 0$, triggers an equivalent increase in the demand for non-traded goods. Thus, there are no changes in resource allocation: the quantities that are produced do not vary. The only effect is a proportional increase in the purchasing power of all factors of production with respect to imports (M); the increase in the volume of consumption of imported manufactures exactly matches the increase in purchasing power.

Proof. Directly from (13)-(15)

These results carry over when we add in another mobile factor, such as physical capital, K .

Remark 1. Effects of heterogeneous consumption baskets with homothetic preferences.

Proposition 1 assumes that all agents share the same preferences characterized by a homothetic utility function. Heterogeneity in individuals' preferences, maintaining the assumption of homotheticity, does not alter the neutrality of factor price changes. However, different preferences do affect the welfare implications of the shift in international prices.

For example, assume that individual agents own a single factor of production and that they have Cobb-Douglas utility functions which are identical within groups but differ depending on the factor that generates earnings (so that utility parameters and spending shares are $\gamma_j^i, j = A, N, M$, and $i = t, w$, and h). The change in the value of consumption of the various goods will then be determined by the aggregate expenditure functions:

$$\hat{p}_j + \hat{c}_j = \gamma_j^t \hat{t} + \gamma_j^w \hat{w} + \gamma_j^h \hat{h} \quad (16)$$

It can readily be seen that here, too, factor returns change proportionally: $\hat{t} = \hat{w} = \hat{h} = \hat{p}_A = \hat{p}_N$. Consequently, the welfare of all agents will still increase with an improvement in the international terms of trade. Nevertheless, the existence of differentiated consumption baskets

means that agents with consumption preferences biased toward good M , i.e., higher γ_M^l for $l=w, h$, and t , will benefit relatively more.

Remark 2. Imports as production inputs.

The use of good M as a production input, rather than only as a consumption good, does not alter the income-distribution neutrality of the terms-of-trade shift obtained in Proposition 1. However, the presence of importable inputs implies that the physical production of goods changes following movements in international prices. This result is detailed in Appendix A.

Remark 3. Non-unitary demand elasticities.

The result of equal proportional changes in factor earnings would not hold if consumption demands were not characterized by unitary elasticities. For example, with a highly income-elastic demand for the non-traded good, the spending share of that good would rise with higher export prices, which would tend to increase the earnings of the specific factor H . In such an economy, it would then be possible that, after a positive shock on the price of the agricultural good A , an “urban” factor could receive the largest benefits in terms of income.

Remark 4. Non-neutralities with transitional effects on demand.

In a multi-period setup, the dynamics of spending may give rise to differences between the “short-run” and “medium-run” impacts of a permanent shift in the terms of trade. If, for instance, after an increase in the international price of good A there is a delay in the rise of domestic expenditures (in this context, if the higher export prices initially induce larger savings on the part of agricultural producers, resulting in a trade surplus, until eventually the additional income gets reflected in spending), the first effect on “urban” groups will take the form of a loss of purchasing power, as the agricultural consumption good becomes more expensive while the higher incomes of group T do not raise immediately the demand for non-tradables. Thus, the result of distributive neutrality would not hold during the transition.

Remark 5. Terms-of-trade improvement: real appreciation, but no “Dutch disease.”

An increase in the international price of good A implies an unambiguous rise in the price of the non-traded good relative to an index of the consumer prices of traded goods:

$$\hat{e} = \gamma_A \hat{p}_A + \gamma_M \hat{p}_M - \hat{p}_N = -(1 - \gamma_A) \hat{p}_A < 0 \quad (17)$$

Thus, the improvement in the terms of trade brings about an appreciation of the real exchange rate (e). This reflects that the aggregate economy is relatively richer after the improvement in the terms of trade. However, in this economy there is no import-competing sector that could be affected by Dutch disease (see Gylfason (2008)). The real appreciation reflects higher incomes across sectors and factors.

3.2 Diversified Production: A Three-Sector Economy

The existence of a sector that produces the imported good, M , substantially modifies the distributional effects generated by changes in international prices and gives way to tensions between the incomes of the factors used in the traded-goods sectors.

Production

The three goods are now produced domestically. The (Cobb–Douglas) production functions are given by (1) and (2) for the agricultural (exportable) good and the non-traded good, respectively. The third sector competes with foreign products in the domestic market for M . The M industry (manufacturing) is assumed to use labor and another “urban” factor (interpreted, as before, as skilled labor). Factor L is assumed to be mobile between the three sectors, while H can shift between manufactures and the non-traded sector. The production function of M is given by:

$$y_M = s(H, L) = A_M H_M^{\theta_{HM}} L_M^{\theta_{LM}} \quad (18)$$

where H_M and L_M are the inputs of each factor in the production of good M , and the parameters θ_{iM} are the corresponding output elasticities or factor shares ($\theta_{HM} + \theta_{LM} = 1$). Under perfect competition, the price-cost equality implies, using good M as the numéraire (with equations analogous to (3) and (4) holding for the other two goods):

$$\hat{p}_M = 0 = \theta_{HM} \hat{h} + \theta_{LM} \hat{w} \quad (19)$$

In the context of the following exercises, we shall generally assume that sector N is more skilled-labor intensive than M ($\theta_{HN} > \theta_{HM}$), implying that manufacturing is comparatively unskilled-labor intensive. This corresponds, for example, to what is observed in several Latin American countries, as indicated referred to in the previous section.

As before, an exogenous terms-of-trade shock is represented by a change in the world price of agricultural goods relative to those of manufactures ($\hat{p}_A > 0, \hat{p}_M = 0$).

Factor Markets

The supply of all the factors of production is fixed, and allocated among the sectors that use them. Given the production functions in (1), (2), and (18) above, the market clearing condition for land is given by (5), while those for L and H are now:

$$\hat{L} = 0 = \lambda_{LA}(\hat{p}_A + \hat{y}_A) + \lambda_{LN}(\hat{p}_N + \hat{y}_N) + \lambda_{LM}\hat{y}_M - \hat{w} \quad (20)$$

$$\hat{H} = 0 = \lambda_{HN}(\hat{p}_N + \hat{y}_N) + \lambda_{HM}\hat{y}_M - \hat{h} \quad (21)$$

The parameters λ_{ij} represent, as before, the share of sector j in the total employment of factor i .

Preferences and Consumption

The demand side of the economy is the same as the one described in the discussion of the two-sector economy. Given preferences in (8) and the flow budget constraint in (9), we obtain the same condition for the allocation of spending as in (10).

Aggregate Constraints and Equilibrium

Condition (11), which equates production and consumption of good N , also holds in this case. The trade balance constraint or, equivalently, the equality between the value of production of traded goods and the value of consumption of those goods (in an economy without capital flows), is now given by the expression:

$$\chi_A(\hat{p}_A + \hat{y}_A) + \chi_M\hat{y}_M = \gamma_A(\hat{p}_A + \hat{c}_A) + \gamma_M\hat{c}_M \quad (22)$$

where χ_i denotes the share of traded good i of the total value of tradable production, i.e., $\chi_i = p_i y_i / (p_A y_A + p_M y_M)$. Since A is the exported good, it must be the case that $\chi_A > \gamma_A$: its share in production is larger than its share in consumption.

We define an equilibrium as a set of proportional changes in produced quantities $\{\hat{y}_A, \hat{y}_N, \hat{y}_M\}$, volumes of consumption $\{\hat{c}_A, \hat{c}_N, \hat{c}_M\}$, factor earnings $\{\hat{t}, \hat{w}, \hat{h}\}$, and the price of the non-traded good \hat{p}_N that satisfy (3), (4), (5), (10), (11), (19), (20), (21), and (22) for given changes in international prices $\{\hat{p}_A, \text{with } \hat{p}_M = 0\}$.

Results

Proposition 2. A Stolper-Samuelson distributive tradeoff arises in this economy between factors H and L (with the important proviso that, here, the change in the relative prices of both goods depend on \hat{p}_N , which itself is determined endogenously):

$$\hat{h} = \frac{\theta_{LM}}{\Delta} \hat{p}_N \quad (23)$$

$$\hat{w} = -\frac{\theta_{LM}}{\Delta} \hat{p}_N \quad (24)$$

where $\Delta = \theta_{HN} - \theta_{HM} = \theta_{LM} - \theta_{LN}$.

Proof. Directly from equations (4) and (19)

Proposition 3. If the production of the non-traded good, N , is more intensive in skilled labor (factor H) than the manufactured good, M (or equivalently, if sector M is relatively unskilled-labor-intensive), then $\Delta > 0$. In this case, an exogenous increase in the price of agricultural goods relative to manufactures results in an increase in the price of good N relative to the imported good M . Earnings of skilled workers H increase unambiguously in terms of both goods, N and M , while the return to factor L falls, also in terms of both goods.

Proof. Directly from (23) and (24).

In order to find a closed-form solution, the system can be reduced to two equations with variables \hat{t} (the proportional change in the unit rent on agricultural land) and \hat{y}_M (the proportional change in output in the import-competing sector).

$$[(\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA}]\hat{t} + (\lambda_{LM} + \lambda_{LN}\chi_M)\theta_{LA}\hat{y}_M = \hat{p}_A \quad (25)$$

$$[\lambda_{HN}\chi_A\theta_{HM}\theta_{LA} - \theta_{LM}\theta_{TA}]\hat{t} + (\lambda_{HM} + \lambda_{HN}\chi_M)\theta_{HM}\theta_{LA}\hat{y}_M = -\theta_{LM}\hat{p}_A \quad (26)$$

It can further be shown (see Appendix B) that the determinant of this system, Ω' , is unambiguously positive. Hence, we can set out the following proposition:

Proposition 4. In the three-good, three-factor economy described above, an increase in the international relative price of the agricultural good A implies:

- An unambiguous (in terms of all three goods in the economy) increase in the return to factor T , specific to the production of good A . Thus, $\hat{t} > \hat{p}_A > 0$ and $\hat{t} > \hat{p}_N$.
- A change in wages given by:

$$\Omega' \frac{\hat{w}}{\hat{p}_A} = \theta_{HM}\theta_{TA}(\lambda_{LA}(\lambda_{HM} + \lambda_{HN}\chi_M) + \chi_A(\lambda_{HM}\lambda_{LN} - \lambda_{HN}\lambda_{LM}))$$

With $\Omega' > 0$

- Production factors are reallocated such that agricultural output increases ($\hat{y}_A > 0$) while output of the import-competing sector decreases ($\hat{y}_M < 0$).

Proof. See Appendix C

Factor T naturally benefits from the increase in the price of the agricultural good. The response of the other endogenous variables depends on the structure of the economy, which can be described by the parameters of factor shares of production and the distribution of factors and output across the various activities. The change in wages is determined by two different forces, given the “dual” nature of labor as an input to both sector A and “urban” activities. Thus, the higher prices of good A tend to attract labor to that sector, which drives wages up (although the real wage in terms of A necessarily falls). The latter effect is captured by the positive term $\lambda_{LA}(\lambda_{HM} + \lambda_{HN}\chi_M)$ in the previous equation. At the same time, factors L, H are involved in a “Stolper-Samuelson interaction” in sectors M, N , due to the reallocation of resources in the urban activities. This is reflected in the term $\chi_A(\lambda_{HM}\lambda_{LN} - \lambda_{HN}\lambda_{LM})$, of ambiguous sign. For instance, if labor is used more intensively than H in the sector producing the importable manufactured good, this effect counterbalances the pull of demand from A , and may reverse the sign of the change in wages (in terms of good M). In this case, labor would be hurt unambiguously by the increase in the price of A , while factor H gains in its purchasing power over the urban goods.

It is useful to map some limit cases in order to strengthen the economic intuition of the results. One especially salient distinction is between economies with very high and very low labor use in the A sector (“agriculture”), which correspond, respectively, to values of θ_{LA} close to one or to zero. These cases could be interpreted, respectively, as economies with a “peasant” agriculture where the level of wages is basically determined by a technologically given the productivity of labor in the rural sector and, conversely, as countries where most of the population is employed in urban activities and the exportable sector is highly resource-intensive.

- Sector A is labor intensive: $\theta_{LA} \approx 1$
Here, L is the main “rural” factor, with a wage that varies more or less proportionally to the price of the A good. Consequently, labor participates fully in the income gains caused by the high price of A , while the urban factor H loses real purchasing power.
- Sector A has a very low labor intensity: $\theta_{LA} \approx 0$ and $\lambda_{LA} \approx 0$
In this case the supply of good A is fixed, and the earnings of the specific factor vary in proportion to the price of the good: $\hat{t} = \hat{p}_A$. Labor is now a purely urban factor. The value (in terms of M) of the demand for non-tradables rises; this leads to a reallocation of resources from M to N , which induces a redistribution of earnings between the factors used in these industries toward the one with a larger share in the non-traded sector (say, H); however, this does not prevent its purchasing power from falling in terms of A . The returns to the other factor (here, L) are lowered unambiguously in terms of the three goods.

4. Effects of Trade Taxes

We now turn to the case where the change in the relative domestic prices of the traded goods derives from a policy intervention (at constant international prices) in the form of the introduction of an export tax, which lowers the local price of good A . This intervention has two aspects: a change in the relative price of traded goods (which, from the point of view of economic agents, is analogous to an exogenous price shift originating in the international economy) and an appropriation of resources by the government, which can use them in different ways. The effects on production, consumption, and income distribution will depend on the use of the revenues generated by the tax. We concentrate on the case where tax proceeds are used “neutrally,” in that the government applies some or all of those resources to make lump-sum transfers to private agents in proportion to their original income levels. We allow for some part or all of those revenues to be kept as government savings (foreign asset accumulation) or to be spent directly on traded goods. The latter would reduce the demand for non-tradables relative to a situation in which all the tax revenues were transferred back to the private sector in the manner described earlier.

In a setup that continues to disregard intertemporal considerations, a trade tax with non-refunded revenues is equivalent to the terms of trade changes analyzed in the previous section. Domestic relative prices between tradable goods vary in the same fashion. The income derived from an increase in the international price of the importable good M which was previously appropriated by the foreign suppliers corresponds now to the tax revenues which, in this instance, the government is assumed to simply hold. Thus, the difference between the two cases (ToT and tax) derives from the use of the new government resources. The following discussion, consequently, focuses particularly on the effects of the tax refunds.

4.1. Trade Taxes in a Specialized Two-Sector Economy

The setup of the model is similar to the one described earlier in section 3.1, where the economy produces only goods A and N . Starting from a situation with no taxes, the government applies a proportional duty α on exports of good A , which implies $\hat{p}_A = -\alpha$. If the resulting tax revenues, τ , are expressed as a proportion of the value of output (or consumption) of traded goods, then:

$$\tau = \gamma_M \alpha \quad (27)$$

This results from the assumption of trade balance equilibrium in the original state. The value of exports of A is equal to the value of imports of M , which in this case with no local production is equivalent to the domestic consumption of this good. The system is characterized by eqs. (3) to (10), where \hat{p}_A is replaced by $-\alpha$. The economy must also satisfy a trade balance condition at international prices. A fraction $1 - \delta$ of tax revenues is “kept” by the government and is neither made available to economic agents for use in financing consumption nor spent on non-traded

goods. Therefore, the budget constraint of the private sector can be written as an equality between the value of consumption of traded goods and the value of output of the traded good A , net of the resources appropriated by the government:

$$\hat{y}_A - (1 - \delta)\alpha\gamma_M = \gamma_A\hat{c}_A + \gamma_M\hat{c}_M \quad (28)$$

The fraction δ of tax revenues is given back to private agents in proportion to their original incomes. This implies that the change in the after-transfer income of individual j is given by:

$$\hat{I}' = \hat{I}_j + \alpha\delta\gamma_M' \quad (29)$$

where \hat{I}_j denotes the proportional change in the price of the factor owned by the agent (\hat{w} or \hat{t} according to the case) and γ_M' is the share of good M in total expenditures, including expenditures on non-traded goods.⁵ Combining eqs. (5), (10), and (28), it can be seen that changes in pre-transfer factor earnings satisfy:

$$\hat{h} - \lambda_{LA}\alpha\delta\gamma_M = \hat{w} = \hat{t} + \lambda_{LN}\alpha\delta\gamma_M \quad (30)$$

Proposition 5. Changes in factor prices satisfy: $\hat{h} \geq \hat{w} \geq \hat{t}$. This implies that export taxes redistribute income in favor of the factor used intensively in the production of the non-traded good relative to labor and, especially, relative to land. However, the distributive effect depends on the spending effects of the tax revenues, and it disappears if the parameter $\delta = 0$, that is, if the use of those revenues does not bring about an increase in expenditure on the non-traded good. The redistribution would be associated with a reallocation of resources away from sector A and toward sector N .

The use of the revenues from the tax on international trade in the form of transfers has two implications: (i) an effect on market outcomes—and particularly on factor prices, via its implications for domestic demand—and (ii) a direct impact on the budget constraint of consumers. Combining those responses, changes in after-transfer earnings are given by:

$$\frac{\hat{t}'}{\alpha} = -(1 + \lambda_{LN}\theta_{LA}\delta\gamma_M) + \gamma_M'\delta \quad (31)$$

$$\frac{\hat{h}'}{\alpha} = (-1 + (1 - \lambda_{LN}\theta_{LA})\delta\gamma_M) + \gamma_M'\delta \quad (32)$$

$$\frac{\hat{w}'}{\alpha} = -(1 - \lambda_{LN}\theta_{TA}\delta\gamma_M) + \gamma_M'\delta \quad (33)$$

⁵ This can be derived as follows. Let ΔI_j and $\Delta I_j'$ be the absolute change in the pre-transfer and post-transfer incomes of agent j , which were originally at the level I_j , Y the total value of incomes at the initial state, and Y_A the value of production of the traded good. Then, the assumption of a proportional distribution of tax revenues implies $\Delta I_j' = \Delta I_j + \alpha\gamma_M Y_A(I_j/Y)$. Now, $Y_A/Y = C_T/C = (1 - \gamma_N)$, is the share of traded goods in total consumption. The expression in the text results using that $\gamma_M' = \gamma_M(1 - \gamma_N)$ and that $\hat{I}_j' = \Delta I_j' / I_j$.

Proposition 6. If all the revenues from the export tax are returned to the private sector in proportion to private agents' income shares, so that $\delta = 1$, the effects on disposable incomes would be as follows:

- For the factor specific of sector A (T): The transfer of funds to consumers raises the demand for non-tradables and tends to increase wages, which exacerbates the decline in the market earnings of factor T . The direct effect of the tax refund works in the opposite direction on the disposable incomes of this group. In some cases (in the presence of a large non-tradable sector and when the agricultural sector is labor-intensive), owners of factor T may prefer little or no refund of the tax revenues (due to their effect on factor prices) even if that means sacrificing the receipt of a direct transfer of resources.
- For the factor specific of sector N (H): The market remuneration and (*a fortiori*) the post-transfer income increase in terms of good A . The tax refund favors this factor by raising the demand for H ; however, this effect is insufficient to increase the market earnings of this factor in terms of importable goods. If production in the agricultural sector is sufficiently land-intensive (large θ_{TA}) and γ_M' is relatively large, then, by eq. (32), $\hat{h}' > 0$, and the post-transfer incomes may rise in purchasing power over M and, consequently, over all three goods.
- Market wages of the mobile factor (L) rise in terms of the exportable good. If labor is mainly an urban factor (with a small share in the A sector and a high proportion of employment going to the production of N), then this factor could increase its post-transfer earnings in terms of M .

Proof. Directly from equations (31)-(33); using the fact that $\gamma_M' = \gamma_M(1 - \gamma_N')$, and that $\frac{\hat{p}_N}{\hat{p}_A} = -1 + \delta\gamma_M(\theta_{HN}((1 - \lambda_{LN}\theta_{LA}) + \theta_{LN}\lambda_{LN}\theta_{TA})) < 0$.

Thus, in such an economy, factor H may be in favor of the levying of taxes on foreign trade, but only to the extent that, in one way or another, the use of the tax revenues boosts demand for the non-traded good. Such incentives would tend to fade away if, as is the case in the land-rich economies studied by Galiani and others (2008), the main source of demand for the services that employ skilled labor is the expenditure of the landlord group T .

4.2 Trade Taxes in a Three-Sector Economy

The aggregate budget constraint is now expressed by:

$$\chi_A \hat{y}_A + \chi_M \hat{y}_M - (1 - \delta)\alpha(\chi_A - \gamma_A) = \gamma_A \hat{c}_A + \gamma_M \hat{c}_M$$

Or:

$$\chi_A (-\alpha + \hat{y}_A) + \chi_M \hat{y}_M + \alpha \delta (\chi_A - \gamma_A) = \hat{c}_M$$

After some transformations, equations (25) and (26) can be modified as follows:

$$[(\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA}]\hat{t} + (\lambda_{LM} + \lambda_{LN}\chi_M)\theta_{LA}\hat{y}_M = -\alpha - \lambda_{LN}\delta\alpha(\chi_A - \gamma_A) \quad (34)$$

$$[\lambda_{HN}\chi_A\theta_{HM}\theta_{LA} - \theta_{LM}\theta_{TA}]\hat{t} + (\lambda_{HM} + \lambda_{HN}\chi_M)\theta_{HM}\theta_{LA}\hat{y}_M = \theta_{LM}\alpha - \lambda_{HN}\theta_{HM}\theta_{LA}\delta\alpha(\chi_A - \gamma_A) \quad (35)$$

It can be seen that the only difference between the case of the shift in international prices and that of the trade tax is the addition in the RHS of the equations of the terms in $\delta\alpha(\chi_A - \gamma_A)$, reflecting the effect of the tax refund as channeled through the economy's external budget constraint and its effect on the demand for goods.

The effect of the tax refund on the market earnings of factor T is determined by:

$$\Omega\hat{t}_{tax} = \Omega\hat{t}_{int} + \theta_{HM}\theta_{LA}(\lambda_{LM}\lambda_{HN} - \lambda_{LN}\lambda_{HM})\delta\alpha(\chi_A - \gamma_A)$$

In that expression the proportional change in the return to factor T after the application of a tax on foreign trade, \hat{t}_{tax} is equivalent to the change that would occur to that factor price if the international price of A had fallen at the rate α of the tax ($\hat{t}_{int} < 0$, as seen before), plus the effect of the tax refund on the market income received by owners of factor T , which depends on the relative factor intensities in "urban" activities.

The intuition of this result is reasonably simple. For a given price of A , the return to T varies negatively with the level of wages, w . The transfers made using these tax revenues tend to boost the demand for non-tradables. If labor is used with more intensity in the production of the importable good than in sector N , the reallocation of urban production changes factor prices in favor of H and against labor. This, in turn, lowers costs in sector A , which tends to raise land rents. Thus, larger transfers would benefit T (and certainly factor H , which is oriented toward the production of non-tradables), while pushing down wages. However, the effect of the transfer cannot offset the loss that factor T sustains as a result of the fall in the relative price of good A .

A formula similar to (35) describes the change in wages (while the market return to factor H remains linked to the level of wages through the price-cost relation in sector M)

$$\Omega\hat{w}_{tax} = \Omega\hat{w}_{int} - \theta_{HM}\theta_{TA}(\lambda_{LM}\lambda_{HN} - \lambda_{LN}\lambda_{HM})\delta\alpha(\chi_A - \gamma_A) \quad (36)$$

If L is used intensively (relative to H) in the production of the importable goods M , the effect of the refund counterbalances the direct impact of the trade tax in stimulating the activity in that

sector, and strengthens the losses that L may have experienced by the lower demand for its services in the exportable sector.

In order to better specify the effects, it is useful to consider some extreme cases

- Sector A is very labor intensive: $\theta_{LA} \approx 1$.

The change in the relative price of traded goods favors factor H and hurts L : in this extreme case, market wages vary almost proportionally to the price of good A ($\hat{w} \approx -\alpha$). The tax refund tends to raise the demand and the output of good N and to drive factor H away from the import-competing sector, which provides “urban employment” to labor, if it is used with comparative intensity in M .

- Sector A is very land intensive⁶: $\theta_{LA} \approx 0$.

When the proceeds of the trade tax are kept by the government in the form of traded goods, the distributive effects of the rise in the price of good M relative to A , which unambiguously hurts the specific factor T , operate in favor of the urban factor used intensively in sector M (L , say), whose market earnings increase in terms of the three goods. The other urban factor (H) stands in an intermediate position, with earnings higher in terms of A but lower relative to the two other goods. When the tax revenue is used for transfers to consumers, the aggregate demand channel tends to equalize the returns to the two urban factors, as it strengthens the demand for that one (H) which is used intensively in the non-traded-goods sector. The consequent increase in the price of good N reduces the purchasing power of the owners of factor T , but this group benefits from the direct effect of the transfer.

The following proposition summarizes outcomes of a tax/refund operation:

Proposition 7. In a three-good, three-factor economy, a tax on foreign trade that lowers the price of A relative to M and the revenues of which are refunded to private agents in proportion to their initial incomes will result in:

- A decrease in the market return to factor T , specific to the production of good A . The refund of the tax revenues may have a partially offsetting effect through an aggregate demand channel if, among urban factors (L and H), labor is used more intensively in the production of importable goods. However, this cannot reverse the sign of the change in unit rents.

⁶ It may be noted that, in this case, the output of the exportable good would remain fixed. The reallocation of output as a consequence of the tax would be limited to the “urban sectors” producing import-substitutes and non-tradable goods.

- Labor is negatively affected as a “rural factor” by the lower price of good A , but gains from the higher demand for its services in the import-competing sector, if it is used intensively in this activity. In this case, however, the effect of the refund on factor prices would be directed against L and in favor of H . Labor would favor the tax if there is little employment in the A sector, and much in import-competing activities, and it would perceive unfavorable effects from measures that reshuffle urban resources from M to H .
- Productive factors are reallocated in such a way that output of the import-competing sector increases ($\hat{y}_M > 0$). The refund motivates a change in the composition of urban output in favor of non-traded goods, and away from importable goods, but production of these goods would still rise.

Proof. See Appendix C

5. Conclusions

We have studied the distributive effects of shifts in international terms of trade and the introduction of export or import taxes on the basis of a conceptually simple HOS model with non-traded goods. Although the results can be generalized, we focus on land-abundant economies that export primary goods. The introduction of non-tradables enriches the analysis and gives it added relevance, since the employment of resources in production activities that cater exclusively to the local market induces a crucial association between domestic spending and factor demand and prices that is absent from the usual HOS framework. Specifically, we consider economies that could potentially produce three goods: a primary (exportable) good for which land and unskilled labor are the production inputs; a manufacturing good for which both unskilled and skilled labor are production inputs; and a non-tradable sector that also uses both unskilled and skilled labor.

In our simplest case, the two-sector economy, no distributive Stolper–Samuelson effect results from a terms-of-trade shock: all factors gain from an improvement in international export prices. In the three-sector economy, however, the effects on relative incomes depend on factor intensities. A terms-of-trade improvement benefits the factor used specifically in the production of the exportable good. Nonetheless, given the endogenous change in the relative price of non-tradables and manufactures, the incomes of the urban factors are subject to a variant of the Stolper–Samuelson tradeoff. The income of the urban factor used intensively in the tradable good production declines unambiguously in relation to all three goods.

We have also analyzed the income distribution effect of an export tax. In a two-sector economy, skilled workers (if employed intensively in the production of non-tradables) may be in favor of the application of taxes on foreign trade. However, this holds only to the extent that the use of the tax revenues ends up increasing the demand for the non-traded good, and taking

into account the income individuals receive as transfers out of the revenues collected by the government. Here, unskilled labor stands to lose from protection, since part of the demand for this type of labor originates in the agricultural sector.

The nature and intensity of distributive tensions depend on the configuration of the economy. In the case of a country with no significant import-competing activity, those conflicts would appear to be diluted, as indicated by the neutrality results. This does not hold in a three-sector economy, however, since distributional conflicts can arise not only in the traditional “rural-urban” dimension, but also between different “urban” production factors. These effects can be the outcomes of exogenous changes in international prices or they may be associated with trade policy decisions. The existence of non-traded goods implies that the redistributive consequences of those policies depend not only on the tax levels, but also on choices about spending that modify the relative price of the domestic good or, otherwise stated, operate on the value of the equilibrium exchange rate. Thus, our analysis can be used to describe the motivations and incentives of different groups in political economy games. This establishes a connection with a broader literature which emphasizes the role of international trade on domestic political cleavages and domestic policies and institutions. See, for example, Rogowski (1989) and O’Rourke and Taylor (2006); Galiani, Torrens, and Schofield (2014) present a formal political economy model for this issue.

References

Acemoglu, 2002, “Technical Change, Inequality and Labor Market,” *Journal of Economic Literature*, March, vol. 40, pp. 7–72.

Acemoglu, 2003, “Patterns of Skill Premia,” *Review of Economic Studies*, vol. 70, pp. 199–230.

Beladi, H., and R. Oladi, 2008, “Market Interconnection and Wages,” *Economic Letters*, vol. 105, pp. 117–119.

Beladi, H., and R. Batra, 2004, “Traded and Nontraded Goods and Real Wages,” *Review of Development Economics*, vol. 8, No. 1, pp. 1–14.

Cassing, J., 1977, “International Trade in the Presence of Pure Monopoly in the Non-Traded Goods Sector,” *The Economic Journal*, vol. 87, No. 347 (September), pp. 523–532.

Cassing, J., 1978, “Transport Costs in International Trade Theory: A Comparison with the Analysis of Nontraded Goods,” *The Quarterly Journal of Economics*, vol. XCII, No. 4 (November), pp. 535–550.

- Coble, D., and N. Magud, 2010, "A Note on Terms of Trade Shocks and the Wage Gap," IMF Working Paper, 10/279 (Washington: International Monetary Fund).
- Deardorff, A., and P. Courant, 1990, "On the Likelihood of Factor Price Equalization with Non-Traded Goods," *International Economic Review*, vol. 31, No. 3 (August), pp. 589–596.
- Diaz Alejandro, C., 1965, "*Exchange Rate Devaluation in a Semi-Industrialized Economy: The Experience of Argentina, 1955-1961*," (Cambridge: The MIT Press).
- Ethier, W., 1984, "Nontraded Goods and the Heckscher-Ohlin Model," *International Economic Review*, vol. 13, No. 1 (February), pp. 132–147.
- Ethier, W., 1984, "Higher Dimensional Issues in Trade Theory," chapter 3, in R. W. Jones and P. B. Kenen (eds.), *Handbook of International Economics*, vol. 1 (Amsterdam: North-Holland).
- Hermida, A., 2015, "Skill Premium y Tipo de Cambio Real: El Caso de las Economías Latinoamericanas," Documento de Trabajo No. 176, CEDLAS, January.
- Galiani, S., D. Heymann, C. Dabus and F. Tohme, 2008, "On the Emergence of Public Education in Land-Rich Economies," *Journal of Development Economics*, vol. 86, pp. 434–446.
- Galiani, S; N. Schofield and G. Torrens, 2014, "Factor endowments, democracy and trade policy convergence," *Journal of Public Economic Theory*, vol. 16, pp. 119–156.
- Goldberg, K. and N. Pavcnik, 2006, "Distributional Effects of Globalization in Developing Countries," mimeo.
- Goldberg, K. and N. Pavcnik, 2016, "The Effects of Trade Policy," NBER Working Paper 21957 (Cambridge: National Bureau of Economic Research).
- Gylfason, T., 2008, "Dutch Disease," in S. Durlauf and L. Blume (eds.), *The New Palgrave Dictionary of Economics*, McMillan.
- Johnson, Harry G., 1957, "Factor Endowments, International Trade and Factor Prices," *Manchester School*, vol. 25, No. 3.
- Jones, R. W., 1974, "Trade with Non-Traded Goods: The Anatomy of Interconnected Markets," *Economica*, vol. 41, pp. 121–37.
- Komiya, R., 1967, "Non-Traded Goods and the Pure Theory of International Trade," *International Economic Review*, vol. 8, No. 2 (June), pp. 132–152.

McDougall, I., 1970, "Non-Traded Goods and the Pure Theory of International Trade," in I. McDougall and R.N. Snape (eds.), *Studies in International Trade* (Amsterdam: North Holland).

O'Rourke, K., and A. Taylor, 2006, "Democracy and Protectionism," NBER Working Paper 12250 (Cambridge: National Bureau of Economic Research).

Rodrik, Dani, 1999, "Where Did All the Growth Go? External Shocks, Social Conflict and Growth Collapses," *Journal of Economic Growth*, vol. 4 (December), pp. 385–412.

Rogowski, R., 1989, *Commerce and Coalitions: How Trade Affects Domestic Political Alignments*, Princeton (New Jersey: Princeton University Press).

Salter, W., 1959, "Internal and External Balance. The Role of Price and Expenditure Effects," *Economic Record*, vol. 36, pp. 226–238.

Stolper, W., and Paul A. Samuelson, 1941, "Protection and Real Wages," *Review of Economic Studies*, vol. 9, pp. 58–73.

Swan, T., 1960, "Economic Control in a Dependent Economy," *Economic Record*, vol. 36, pp. 57-66.

The Economist, 2008, "When Fortune Frowned", (October 9th).

Thierfelder, K., and S. Robinson, 2002, "Trade and Tradability: Exports Imports and Factor Markets in the Stolper-Samuelson Model," TMD Discussion Paper No. 93.

Williamson, J., 2011, *Trade and Poverty: When the Third World Fell Behind*, (Cambridge: The MIT Press).

Appendix A. Imports as Production Inputs in the Two-Sector Case

Good M is now not only a consumer product but is also used as an input in the production of goods A and N . The proportional change in intermediate imports after a change in the price of A (with $\hat{p}_M=0$):

$$\hat{M} = \lambda_{MA}(\hat{p}_A + \hat{y}_A) + \lambda_{MN}(\hat{p}_N + \hat{y}_N) - \hat{p}_M$$

The supply-demand conditions for primary factors L , T and H are still given by:

$$\hat{L} = 0 = \lambda_{LA}(\hat{p}_A + \hat{y}_A) + \lambda_{LN}(\hat{p}_N + \hat{y}_N) - \hat{w}$$

$$\hat{T} = 0 = \hat{p}_A + \hat{y}_A - \hat{t}$$

$$\hat{H} = 0 = \lambda_{HN}(\hat{p}_N + \hat{y}_N) - \hat{h}$$

The trade balance condition:

$$\hat{p}_A + \hat{y}_A = (1 - m)\gamma_A(\hat{p}_A + \hat{c}_A) + (1 - m)\gamma_M\hat{c}_M + m\hat{M}$$

Cost-price equations:

$$\hat{p}_A = \theta_{TA}\hat{t} + \theta_{LA}\hat{w} + \theta_{MA}\hat{p}_M$$

$$\hat{p}_N = \theta_{LN}\hat{w} + \theta_{HN}\hat{h} + \theta_{MN}\hat{p}_M$$

It can be seen that these equations are satisfied if:

$$\hat{t} = \hat{w} = \hat{h} = \hat{p}_A + \hat{y}_A = \hat{p}_N + \hat{y}_N = \hat{c}_M = \hat{p}_A + \hat{c}_A = \hat{M} = \frac{1}{1 - \theta_{MA}}\hat{p}_A$$

and:

$$\hat{p}_N = \frac{1 - \theta_{MH}}{1 - \theta_{MA}}\hat{p}_A, \quad \hat{y}_N = \frac{\theta_{MH}}{1 - \theta_{MA}}\hat{p}_A, \quad \hat{y}_A = \frac{\theta_{MA}}{1 - \theta_{MA}}\hat{p}_A$$

The change in the price of the exportable good has, as in the case in which there are no intermediate imports, neutral effects on the returns to the domestic factors. However, now factor earnings rise more than in proportion to the price of good A because of the expanded production opportunities created by the relative reduction in the cost of international inputs.

Appendix B. Derivation of the Reduced System involving the Sign of the Determinant in the Three-Goods Case

The supply-demand equations for production factors can be written as follows:

$$\hat{L} = 0 = \lambda_{LA}(\hat{p}_A + \hat{y}_A) + \lambda_{LN}(\hat{p}_N + \hat{y}_N) + \lambda_{LM}\hat{y}_M - \hat{w}$$

$$\hat{T} = 0 = \hat{p}_A + \hat{y}_A - \hat{t}$$

$$\hat{H} = 0 = \lambda_{HN}(\hat{p}_N + \hat{y}_N) + \lambda_{HM}\hat{y}_M - \hat{h}$$

Price equations for A and M:

$$\hat{p}_A = \theta_{TA}\hat{t} + \theta_{LA}\hat{w}$$

$$\hat{p}_M = 0 = \theta_{LM}\hat{w} + \theta_{HM}\hat{h}$$

Trade balance:

$$\chi_A(\hat{p}_A + \hat{y}_A) + \chi_M\hat{y}_M = \gamma_A(\hat{p}_A + \hat{c}_A) + \gamma_M\hat{c}_M$$

Taking into account the assumed consumption demand functions and the supply-demand balance of non-tradable-goods:

$$\hat{p}_N + \hat{y}_N = \hat{p}_N + \hat{c}_N = \hat{p}_A + \hat{c}_A = \hat{c}_M$$

The system then reduces to:

$$\lambda_{LA}\hat{t} + \lambda_{LN}\hat{c}_M + \lambda_{LM}\hat{y}_M = \frac{\hat{p}_A - \theta_{TA}\hat{t}}{\theta_{LA}}$$

$$\lambda_{HN}\hat{c}_M + \lambda_{HM}\hat{y}_M = -\frac{\theta_{LM}}{\theta_{HM}} \frac{\hat{p}_A - \theta_{TA}\hat{t}}{\theta_{LA}}$$

$$\chi_A\hat{t} + \chi_M\hat{y}_M = \hat{c}_M$$

or:

$$\begin{aligned} (\lambda_{LA}\theta_{LA} + \theta_{TA})\hat{t} + \theta_{LA}\lambda_{LN}\hat{c}_M + \theta_{LA}\lambda_{LM}\hat{y}_M &= \hat{p}_A \\ -\theta_{LM}\theta_{TA}\hat{t} + \theta_{HM}\theta_{LA}\lambda_{HN}\hat{c}_M + \theta_{HM}\theta_{LA}\lambda_{HM}\hat{y}_M &= -\theta_{LM}\hat{p}_A \end{aligned}$$

$$\chi_A \hat{t} + \chi_M \hat{y}_M = \hat{c}_M$$

leading to:

$$\begin{aligned} ((\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA})\hat{t} + \theta_{LA}(\lambda_{LM} + \lambda_{LN}\chi_M)\hat{y}_M &= \hat{p}_A \\ (\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A - \theta_{LM}\theta_{TA})\hat{t} + \theta_{HM}\theta_{LA}(\lambda_{HM} + \lambda_{HN}\chi_M) &= -\theta_{LM}\hat{p}_A \end{aligned}$$

The determinant of this system is:

$$\Omega = ((\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA})(\lambda_{HM} + \lambda_{HN}\chi_M)\theta_{HM}\theta_{LA} - (\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A - \theta_{LM}\theta_{TA})(\lambda_{LM} + \lambda_{LN}\chi_M)\theta_{LA}$$

It can be seen that the only negative term is a multiple of $\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A$. Collecting the terms in λ_{HN} :

$$\begin{aligned} (\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA}\lambda_{HN}\theta_{HM}\theta_{LA}\chi_M + \lambda_{HN}\theta_{HM}\theta_{LA}\theta_{TA}\chi_M - \\ (\lambda_{LM} + \lambda_{LN}\chi_M)\theta_{HM}\theta_{LA}\lambda_{HN}\theta_{LA}\chi_A = \theta_{HM}\theta_{LA}\lambda_{HN}(\theta_{LA}((\lambda_{LA} + \lambda_{LN}\chi_A)\chi_M - \\ (\lambda_{LM} + \lambda_{LN}\chi_M)\chi_A) + \theta_{TA}\chi_M) \end{aligned}$$

This reduces to:

$$\theta_{HM}\theta_{LA}\lambda_{HN}((\theta_{LA}\lambda_{LA} + \theta_{TA})\chi_M - \lambda_{LM}\theta_{LA}\chi_A)$$

But:

$$\chi_M = \frac{p_M y_M}{p_M y_M + p_A y_A} = \frac{\frac{p_M y_M}{w L_M} \frac{w L_M}{w L}}{\frac{p_M y_M}{w L_M} \frac{w L_M}{w L} + \frac{p_A y_A}{w L_A} \frac{w L_A}{w L}} = \frac{\lambda_{LM} \theta_{LA}}{\lambda_{LM} \theta_{LA} + \lambda_{LA} \theta_{LM}} = \frac{\lambda_{LM} \theta_{LA}}{x}$$

And a similar expression for χ_A .

Then:

$$(\theta_{LA}\lambda_{LA} + \theta_{TA})\chi_M - \lambda_{LM}\theta_{LA}\chi_A = \frac{\lambda_{LM}\theta_{LA}}{x}(\theta_{LA}\lambda_{LA} + \theta_{TA} - \lambda_{LA}\theta_{LM}) = \frac{\lambda_{LM}\theta_{LA}}{x}(\theta_{TA}(1 - \lambda_{LA}) + \lambda_{LA}\theta_{HM}) > 0$$

Therefore, Ω is unambiguously positive.

Appendix C. Proof of Proposition 4 and Related Results

Proof that $\frac{\hat{t}}{\hat{p}_A} > 0$ and $\frac{\hat{y}_M}{\hat{p}_A} \leq 0$

Using the reduced system shown in Appendix B, it follows that:

$$\Omega \frac{\hat{t}}{\hat{p}_A} = \theta_{HM}\theta_{LA}(\lambda_{HM} + \lambda_{HN}\chi_M) + \theta_{LM}\theta_{LA}(\lambda_{LM} + \lambda_{LN}\chi_M) > 0$$

$$\Omega \frac{\hat{y}_M}{\hat{p}_A} = -\theta_{LM}((\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA}) - (\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A - \theta_{LM}\theta_{TA}) = -\theta_{LM}(\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} - \theta_{HM}\theta_{LA}\lambda_{HN}\chi_A < 0$$

Proof that $\frac{\hat{t}}{\hat{p}_A} \geq 1$

This result is equivalent to $\hat{p}_A + \hat{y}_A \geq \hat{p}_A$ or $\hat{y}_A \geq 0$. The system can be rearranged as:

$$\begin{aligned} ((\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA})\hat{y}_A + \theta_{LA}(\lambda_{LM} + \lambda_{LN}\chi_M)\hat{y}_M &= \hat{p}_A(1 - (\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA}) \\ (\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A - \theta_{LM}\theta_{TA})\hat{y}_A + \theta_{HM}\theta_{LA}(\lambda_{HM} + \lambda_{HN}\chi_M)\hat{y}_M &= -\hat{p}_A(\theta_{LM} + (\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A - \theta_{LM}\theta_{TA})) \end{aligned}$$

which implies:

$$\begin{aligned} \Omega \frac{\hat{y}_A}{\hat{p}_A} &= \\ (1 - ((\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA}))\theta_{HM}\theta_{LA}(\lambda_{HM} + \lambda_{HN}\chi_M) + \\ \theta_{LA}(\lambda_{LM} + \lambda_{LN}\chi_M)(\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A + \theta_{LM}\theta_{TA}) &> 0 \end{aligned}$$

because $(\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA} < 1$

Expression for \hat{w}

The system can be rearranged (taking into account that $\hat{t} = \frac{\hat{p}_A - \theta_{LA}\hat{w}}{\theta_{TA}}$) to give:

$$\begin{aligned} ((\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA})\hat{w} - \theta_{TA}(\lambda_{LM} + \lambda_{LN}\chi_M)\hat{y}_M &= \hat{p}_A(\lambda_{LA} + \lambda_{LN}\chi_A) \\ -(\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A - \theta_{LM}\theta_{TA})\hat{w} + \theta_{HM}\theta_{TA}(\lambda_{HM} + \lambda_{HN}\chi_M) &= -\hat{p}_A\lambda_{HN}\theta_{HM}\chi_A \end{aligned}$$

In a similar fashion to what was done before, it can be shown that the determinant of this system is positive:

$$\Omega' = ((\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA})\theta_{HM}\theta_{TA}(\lambda_{HM} + \lambda_{HN}\chi_M) - \theta_{TA}(\lambda_{LM} + \lambda_{LN}\chi_M)(\theta_{HM}\theta_{LA}\lambda_{HN}\chi_A - \theta_{LM}\theta_{TA}) > 0$$

Then:

$$\Omega' \frac{\hat{w}}{\hat{p}_A} = (\lambda_{LA} + \lambda_{LN}\chi_A) \theta_{HM}\theta_{TA}(\lambda_{HM} + \lambda_{HN}\chi_M) - \lambda_{HN}\theta_{HM}\chi_A\theta_{TA}(\lambda_{LM} + \lambda_{LN}\chi_M)$$

Which can be reduced to an expression with an ambiguous sign:

$$\Omega' \frac{\hat{w}}{\hat{p}_A} = \theta_{HM}\theta_{TA}(\lambda_{LA}(\lambda_{HM} + \lambda_{HN}\chi_M) + \chi_A(\lambda_{HM}\lambda_{LN} - \lambda_{HN}\lambda_{LM}))$$

Limit cases

1. Sector A labor intensive: $\theta_{LA} \approx 1$

$$\text{In the limit: } \hat{w} = \hat{p}_A, \hat{h} = -\frac{\theta_{LM}}{\theta_{HM}} \hat{p}_A$$

The value of spending on good N (in terms of M) and the volume consumption of M may increase or fall depending on the parameters. To clarify this, it is useful to rewrite the system as:

$$(\lambda_{LA} + \lambda_{LN}\chi_A)\hat{c}_M + (\chi_A\lambda_{LM} - \chi_M\lambda_{LA})\hat{y}_M = \chi_A\hat{p}_A$$

$$\theta_{HM}\lambda_{HN}\hat{c}_M + \theta_{HM}\lambda_{HM}\hat{y}_M = -\theta_{LM}\hat{p}_A$$

The determinant Ω'' can be shown to be positive. Now:

$$\Omega'' \frac{\hat{c}_M}{\hat{p}_A} = \theta_{HM}\lambda_{HM}\chi_A + \theta_{LM}(\chi_A\lambda_{LM} - \chi_M\lambda_{LA})$$

Recalling the expressions for χ_A, χ_M :

$$\Omega'' \frac{\hat{c}_M}{\hat{p}_A} = \frac{\theta_{LM}\lambda_{LA}}{x} (\theta_{HM}\lambda_{HM} + \lambda_{LM}(\theta_{LM} - \theta_{LA})) = \frac{\theta_{LM}\lambda_{LA}}{x} \theta_{HM}(\lambda_{HM} - \lambda_{LM})$$

So that the sign of \hat{c}_M depends on that of the difference in factor uses in sector: $\lambda_{HM} - \lambda_{LM}$.

2. Sector A, with very low labor intensity: $\theta_{LA} \approx 0, \lambda_{LA} \approx 0$

$$\text{Now, } \frac{\hat{t}}{\hat{p}_A} = 1, \hat{y}_A = 0$$

The system can be written:

$$\hat{w} - (\lambda_{LM} + \lambda_{LN}\chi_M) \hat{y}_M = \lambda_{LN}\chi_A \hat{p}_A$$

$$\theta_{LM} \hat{w} + \theta_{HM}(\lambda_{HM} + \lambda_{HN}\chi_M) \hat{y}_M = -\theta_{HM}\lambda_{HN}\chi_A \hat{p}_A$$

The determinant Ω''' is positive. Now,

$$\Omega''' \frac{\hat{w}}{\hat{p}_A} = \theta_{HM}\chi_A(\lambda_{LN}(\lambda_{HM} + \lambda_{HN}\chi_M) - \lambda_{HN}(\lambda_{LM} + \lambda_{LN}\chi_M))$$

Or:

$$\Omega''' \frac{\hat{w}}{\hat{p}_A} = \theta_{HM}\chi_A(\lambda_{LN}\lambda_{HM} - \lambda_{HN}\lambda_{LM}) = \theta_{HM}\chi_A(\lambda_{LN} - \lambda_{HN})$$

Then, $\frac{\hat{w}}{\hat{p}_A} > 0$ if sector N is comparatively L -intensive. However, $\frac{\hat{w}}{\hat{p}_A} < 1$ whatever the value of $\lambda_{LN} - \lambda_{HN}$.

It can also be shown that:

$$\Omega''' \frac{\hat{p}_N}{\hat{p}_A} = \theta_{LN}\Omega''' \frac{\hat{w}}{\hat{p}_A} + \theta_{HN}\Omega''' \frac{\hat{h}}{\hat{p}_A} > 0$$

That is so because:

$$\Omega''' \frac{\hat{p}_N}{\hat{p}_A} = \chi_A(\lambda_{LN} - \lambda_{HN})(\theta_{LN}\theta_{HM} - \theta_{HN}\theta_{LM}) = \chi_A(\lambda_{LN} - \lambda_{HN})(\theta_{LN} - \theta_{LM}) > 0$$

Also: $\frac{\hat{p}_N}{\hat{p}_A} < 1$ since, as indicated before, both $\frac{\hat{w}}{\hat{p}_A} < 1$ and $\frac{\hat{h}}{\hat{p}_A} < 1$.

It can also be seen that:

$$\Omega''' \frac{\hat{c}_M}{\hat{p}_A} = \chi_A(\theta_{HM}\lambda_{HM} + \theta_{LM}\lambda_{LM}) > 0$$

and:

$$\begin{aligned} \Omega''' \frac{\hat{c}_N}{\hat{p}_A} &= \chi_A((\theta_{HM}\lambda_{HM} + \theta_{LM}\lambda_{LM}) - (\lambda_{LN} - \lambda_{HN})(\theta_{LN} - \theta_{LM})) \\ &= \chi_A(\lambda_{HM}\theta_{HN} + \lambda_{LM}\theta_{LN}) > 0 \end{aligned}$$

Appendix D. Effects of the tax refund in the three-goods case

Recalling equations (34) and (35), the system that determines the effect of the trade tax and refund policy can be written as:

$$[(\lambda_{LA} + \lambda_{LN}\chi_A)\theta_{LA} + \theta_{TA}]\hat{t} + (\lambda_{LM} + \lambda_{LN}\chi_M)\theta_{LA}\hat{y}_M = -\alpha - \lambda_{LN}\delta\alpha(\chi_A - \gamma_A)$$

$$[\lambda_{HN}\chi_A\theta_{HM}\theta_{LA} - \theta_{LM}\theta_{TA}]\hat{t} + (\lambda_{HM} + \lambda_{HN}\chi_M)\theta_{HM}\theta_{LA}\hat{y}_M = \theta_{LM}\alpha - \lambda_{HN}\theta_{HM}\theta_{LA}\delta\alpha(\chi_A - \gamma_A)$$

Thus, the change of the endogenous variables \hat{t}, \hat{y}_M is a combination of the response that would hold in the case of a terms-of-trade shift of magnitude $-\alpha$, and the effect of the refund $\delta\alpha(\chi_A - \gamma_A)$:

$$\Omega\hat{t}_{tax} = \Omega\hat{t}_{int} + \theta_{HM}\theta_{LA}(\lambda_{LM}\lambda_{HN} - \lambda_{LN}\lambda_{HM})\theta_{LA}\delta\alpha(\chi_A - \gamma_A)$$

$$\Omega\hat{y}_{Mtax} = \Omega\hat{y}_{Mint} - (\theta_{HM}\lambda_{HN}\theta_{LA}(\lambda_{LA}\theta_{LA} + \theta_{TA}) + \theta_{LM}\theta_{TA}\lambda_{LN}\theta_{LA})\delta\alpha(\chi_A - \gamma_A)$$

Where Ω is the positive determinant. Similar expressions can be found for variables like \hat{w} and \hat{c}_M :

$$\Omega\hat{w}_{tax} = \Omega\hat{w}_{int} - \theta_{HM}\theta_{TA}(\lambda_{LM}\lambda_{HN} - \lambda_{LN}\lambda_{HM})\delta\alpha(\chi_A - \gamma_A)$$

$$\Omega\hat{c}_{Mtax} = \Omega\hat{c}_{Mint} + ((\lambda_{LA}\theta_{LA} + \theta_{TA})\theta_{HM}\lambda_{HM}\theta_{LA} + \theta_{LM}\theta_{TA}\theta_{LA}\lambda_{LM})\delta\alpha(\chi_A - \gamma_A)$$

It can also be verified that $\frac{\hat{t}_{tax}}{\alpha} < 0$:

$$\frac{\Omega\hat{t}_{tax}}{\alpha} = -(\lambda_{HM} + \lambda_{HN}\chi_M)\theta_{HM}\theta_{LA} - \theta_{LM}\theta_{LA}(\lambda_{LM} + \lambda_{LN}\chi_M) + \theta_{HM}\theta_{LA}(\lambda_{LM}\lambda_{HN} - \lambda_{LN}\lambda_{HM})\theta_{LA}\delta(\chi_A - \gamma_A)$$

The only positive term is proportional to $\theta_{HM}\theta_{LA}\lambda_{HN}$. Comparing the analogous terms and remembering the expressions for χ_A, χ_M

$$\theta_{HM}\theta_{LA}\lambda_{LM}\lambda_{HN}\theta_{LA}\delta(\chi_A - \gamma_A) - \theta_{HM}\theta_{LA}\lambda_{HN}\chi_M < \theta_{HM}\theta_{LA}\lambda_{HN}(\chi_A\theta_{LA}\lambda_{LM} - \chi_M) < 0$$

Also: $\frac{\hat{y}_{Mtax}}{\alpha} > 0$:

$$\frac{\hat{y}_{Mtax}}{\alpha} = \chi_A(\theta_{LM}\theta_{LA}\lambda_{LN} + \theta_{HM}\theta_{LA}\lambda_{HN}) + \theta_{LM}(\lambda_{LA}\theta_{LA} + \theta_{TA}) - \theta_{LM}\theta_{TA} - \delta(\chi_A - \gamma_A)(\lambda_{LA}\theta_{LA} + \theta_{TA})\theta_{HM}\theta_{LA}\lambda_{HN} + \theta_{LM}\theta_{TA}\theta_{LA}\lambda_{LN} > \chi_A((\theta_{LM}\theta_{LA}\lambda_{LN} + \theta_{HM}\theta_{LA}\lambda_{HN}) - (\lambda_{LA}\theta_{LA} + \theta_{TA})\theta_{HM}\theta_{LA}\lambda_{HN} - \theta_{LM}\theta_{TA}\theta_{LA}\lambda_{LN}) > 0$$