An Essay on the Applicability of the Linder Hypothesis in Determining the Patterns of the Romanian International Trade

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Abstract. *The paper tries to shed light on the effectiveness of a previously proposed and wide accepted trade model and its consistency in developing economies such as the Romanian one. The structure and evolution of Romania's exports and imports in the last years have indicated an increase in the intra-industry trade, and concurrently, a shift towards the commerce predominantly in capital-intensive commodities. While the Linder theorem provides useful insight into the patters of international trade formation, the hypothesis that trade is proportionate with the demand and market similarities expressed by GDP per capita does not test out for the data available for Romania and its main economic and commercial partners.*
The political and economic restrictions and opportunities generated by foreign relations in the region can be attributed with the role of trade-creating forces, rather than income similarities on the markets.

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1. Introduction

Discovering the essence of trade patterns, serving in support of the ultimate goal of predicting their future evolutions, has remained a high priority for academic and company researches. The first comprehensive insight into the matter was provided by Adam Smith, through the development of the notion of absolute advantages (Smith, 1776) followed, a half-century latter, by the complementary theory of comparative advantages developed by David Ricardo (Ricardo, 1817).

The abundance of production factors and the consequent differences among nations provided the basis of the Heckscher-Ohlin theorem. This theorem characterized the trade flows as being directed from one country to another based on their particular endowment in production factors. Thus, countries with a significant stock of capital would export goods which are intensive in capital and import those intensive in labour. The initial Heckscher-Ohlin model of trade was later complemented by the Stolper-Samuelson theorem that identified the relation between changes in the prices of output goods and the relative prices of the factors used to produce them (Stolper, Samuelson, 1941), and the Rybczynski theorem that helped explain the effects of labour mobility and foreign capital investment (Rybczynski, 1955).

The existing mainstream thinking came into serious scrutiny with the work of Wassily Leontief who studied the structure of the United States foreign trade and asserted that the previous principles and assumptions did not hold. Thus, the Leontief paradox was generated, as the United States, with the greatest endowment of capital, exported mostly labour intensive goods, while importing capital intensive commodities.

A genuine and lasting possible solution to the paradox was suggested by Staffan Linder, under the hypothesis that similar demand structure determines the tendency to engage in more trade. Consequently, the trade flow is stronger between countries which have similar industries and consumption, rather than being directed by differences in production factors.

This paper strives to determine if the trade pattern experienced by Romania (Costea, 2008), in relation to other countries, falls under this latter theorem, and if not, what other model can more appropriately be employed in evaluating and predicting future trade flows.

2. Literature review

Following a long development of models that tried to construe trade based on production advantages and production factor endowment and subsequent to the onset of the Leontief paradox, the theory, first proposed by Staffan Burenstam Linder in 1961, asserted that the structure and similarities of demand found in world economies dictated larger flows of trade (Linder, 1961).

Though lacking a formal model, Linder's theorem seeks to explain the formation of trade by establishing the main trade-creating forces around the structure of the demand in individual nations, rather than a simple question of supply and relative prices (Fillat-Castejon and Serrano-sanz, 2004, p. 325).

The trade-breaking forces recognized by Linder incorporate the relative distance between the trade participants, the trade obstacles and the scarcity of certain production factors, the latter, creating a common ground between the theory and the Heckscher-Ohlin theorem. When tested for particular European economies, for data ranging from 1959 to the 1980s, the hypothesis holds firm, identifying demand as a major driving force of trade, while distance as the main stumbling block (Fillat-Castejon and Serrano-sanz, 2004, p. 344).

Systematic empirical connections have been found to exist between the share of intra-industry trade between pairs of countries and the similarity in average income, expressed in GDP per capita (Bergstrand 1990, p. 1228).

Though the trade flows are influenced by a series of economic and political factors such as tariffs, subsidies, differential exchange rates or other barriers, a single variable, in the form of income per capita, is generally considered as representative of the aggregate conditions of the economy and consequently used on its own (Blejer, 1978, p. 555).

By studying the relations between the structure of exports and the income per capita, the findings suggest that goods intensive in human and physical capital tend to replace those intensive in labour and natural resources, as the average income increases. The equivalent aspect holds true in the case of high income elasticity goods replacing low income elasticity commodities in relation to income (Blejer, 1978, p. 560). The same study indicates that the Linder theorem has a better prediction success than the Heckscher-Ohlin theory.

The particularities generated by scale economies are addressed by previous studies, stating that the size of the markets in countries dictate the exporter or importer status, seeing that, if the demand characteristics are similar, the economy with the largest domestic market will benefit from diminishing marginal costs and become the dominant exporter. Hence, the Linder theorem remains valid, in providing the general pattern for international trade (Krugman, 1980, p. 958).

Another key aspect that had to be addressed by the international trade studies was represented by the proliferation, after the early 1990s, of the regional trade agreements. These have also been taken into consideration when discussing the Linder theorem. Recent studies have indicated that the hypothesis can be successfully tested either in trade agreements between emerging economies or amid highly developed countries, forming a type of trade arrangement, with relatively insignificant differences in incomes (Tang, 2005, p. 263). Globalization and the expansion of free trade agreements, as observed in the last decades, have strengthened the Linder hypothesis, as richer and more similar countries have the tendency to trade more among themselves (Choi, 2002, p. 604).

The theory is better suited when discussing trade in differentiated products, while in the instance of homogeneous goods, the factor endowment arguments are more representative (Bohman and Nilsson, 2007, p. 16). Product differentiation is generally associated with intra-industry trade, a particular type of trade that has been assessed in certain studies as being relatively low between Western Balkan countries

and the European Union, while the contrast being true in the case of Romania and Bulgaria, under the onset of the European Agreements (Mardas and Nikas, 2008, p. 522).

By assembling the nations in groups, first, on a North-South division and second, by an East-West separation, the trade flows that were observed provide further information. The intra-industry trade, generated by similarities in demand structure, can be seen in East-West relations, whereas inter-industry trade is predominant in North-South relations (Markusen, 1986, p. 1010). Thus, the Linder theorem would prove stronger if the analysis is constructed around the first situation, while the factor endowment models would prevail in the latter.

Nevertheless, the Linder theorem has not been a perfect solution for explaining trade patterns in every region or during any period. There are several discussion points that spark questions on the applicability and the usefulness of the hypothesis. Similar countries, while they have the tendency to trade more with each other, might do so as a consequence of political and cultural closeness that determines a reduction in transaction costs and bureaucracy (Batra, 2006, p. 336). The Linder theorem was developed in the early 1960s during a significant growth in trade and cooperation (Mihoreanu et al., 2014) between the United States and the, then, newly created European Economic Community. An important criticism to this hypothesis has been that the geographical, historical and cultural proximity outweighed the similarities in demand structure and average income in establishing the direction of trade flows (Chow and Yochanan, 1999, p. 175). When the theory was tested for a region such as East-Asia, therefore, eliminating the bias generated by other possible factors, the results were weak. By using a time series stretching from 1965 to 1990, the income similarity as a factor had a very low influence on the pattern of trade formation. It seemed that as trade-partner income converged, the gains from trade systematically decreased (Chow and Yochanan, 1999, p. 179).

The Linder hypothesis has been proven to be a useful tool in determining the trade patterns among developing economies, nevertheless, the studies have not generated conclusive results for all the countries analyzed (McPherson et al., 2001, p. 655). Thus, while providing a useful insight into the way in which trade can form, before adopting its conclusions, the applicability has to be tested for each particular economy.

While Linder's findings were mostly abandoned by researchers in favour of analytical models based on the hypothesis that countries share identical preferences, authors such as Markusen (2013) and Arvis et al. (2013) consider that Linder's assumptions regarding the relationship between per-capita income and trade patters provide valuable insight in contemporary economic studies.

In the paper on trade costs, Arvis et al. (2013) present four trade models having as main components the relation between intra and international trade:

$$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{\tau_{ij}}{\Pi_i P_j} \right)^{1-\sigma} \tag{1}$$

$$X_{ji} = \frac{Y_j E_i}{Y}\left(\frac{\tau_{ji}}{\Pi_j P_i}\right)^{1-\sigma} \tag{2}$$

$$X_{ii} = \frac{Y_i E_i}{Y}\left(\frac{\tau_{ii}}{\Pi_i P_i}\right)^{1-\sigma} \tag{3}$$

$$X_{jj} = \frac{Y_j E_j}{Y}\left(\frac{\tau_{jj}}{\Pi_j P_j}\right)^{1-\sigma} \tag{4}$$

Where:
i, j represent the two countries considered for the model
X represents the trade flows between countries *i* to *j* ot *j* to *i*; or within countries (goods produces and sold in *i* and *j*)
Y represents total production in a country
Π represents the trade costs
Π and *P* represents multilateral resistance of the countries *i* and *j*

Evidence has been suggested in previous studies that the Romanian export pattern has shifted away in the last years from labour and resource intensive goods towards technology and human capital based products. As a consequence, the intra-industry trade has begun to increase (Haar 2010, p. 802). Thus, the applicability of the Linder theorem on the Romanian trade patterns remains a matter of exploration and study.

3. Research description

Establishing the evolution and pattern in the Romanian trade, and ultimately deciding on the applicability of the Linder theorem, will be addressed as a multi-pronged undertaking, first by using a descriptive statistical analysis of the trading activity, followed by an assessment of the dependency that exists between the volume of trade experienced by Romania in relation to its main economic partners and the similarities in income.

The first part of the analysis is used to determine the structure of exports and imports, by identifying the proportion of labour-intensive, resource-intensive or capital-intensive products in the overall volume of trade.

As a first step in testing the Linder theorem and concurrently averting other explanations such as the factor endowment provided by the Heckscher-Ohlin-Samuelson model or country advantages in a Ricardian manner, the structure of exports and imports should point to a predominant intra-industry trade.

Provided Romania trades with other countries based on similarities in market conditions, demand structure and, more crucially, similarities in average income, then, the exports and imports should have a relatively balanced evolution and configuration. Otherwise, if the prominent economic relations are based on inter-industry trade, by exporting labour-intensive goods and importing predominantly capital-intensive products, the factors of production are more likely to be the explanation for the formation of trade flows.

By taking into account the structure of imports and exports for the period between 2003 and 2010, as provided by the Romanian Ministry of Economy, Trade and Business Environment, the commodities have to be separated into capital-intensive on the one hand, while, labour plus resource-intensive on the other. For the purpose of this analysis, the predominant capital-intensive products are to be considered those from the machinery, automobile and electronic industry alongside those generated in the chemical and plastic industry. Therefore, the remaining products, resulting from the stone, cement and glass industry, timber and furniture industry, common metals and derivatives, agriculture and food industry, mineral extraction, leather and textile industry, are to be considered predominantly labour-intensive or resource-intensive.

The data indicate that the Romanian international trade has shifted significantly from one predominantly based on labour and resource commodities towards that of capital and technology intensive products.

Table 1. The evolution and structure of the Romanian exports and imports between 2003 and 2010

	2003	2004	2005	2006	2007	2008	2009	2010
Labour and resource intensive exports	70.2	67.3	64.8	60.6	56.0	53.2	46.6	46.4
Capital intensive exports	29.2	32.2	34.7	39.1	43.7	46.6	53.0	53.3
Labour and resource intensive imports	53.6	51.2	50.9	48.4	45.9	47.8	46.0	45.2
Capital intensive imports	46.3	48.6	48.8	51.4	53.9	52.0	53.8	54.5

Note: The values are expressed in percentages

Source: Computed based on data provided by the Romanian Ministry of Economy, Trade and Business Environment, http://www.dce.gov.ro/.

Both in imports and in exports, the percentage of the latter category of goods in overall volume of trade has surpassed 50 percentages. If the factor endowment theory would be valid in the case of Romanian trade, than the evolution of trade in recent years should have seen a divergence between the exports and imports. Since the inflow of technology and financial support would have created an advantage in capital-intensive commodities for export, a relative deficiency in labour-intensive items would emerge, ushering in an increase in imports for these particular goods. However, the data indicates that the exports and imports shifted in the same direction, as the significant correlation coefficient shows.
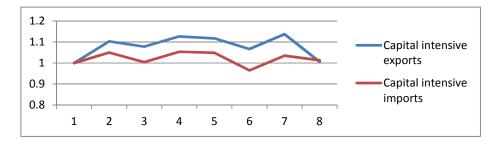
Table 2. Correlation between the labour and resource intensive commodities and the capital intensive commodities traded by Romania from 2003 to 2010

2003-2010	Labour and resource exports	Labour and resource imports
Labour and resource exports	1	
Labour and resource imports	0.407	1
2003-2010	Capital intensive exports	Capital intensive imports
Capital intensive exports	1	
Capital intensive imports	0.614	1

Source: Computed based on data provided by the Romanian Ministry of Economy, Trade and Business Environment, http://www.dce.gov.ro/.

The correlation coefficient between the capital intensive exports and the capital intensive imports, calculated for period 2003-2010, is approximately 0.6, meaning that the yearly variations of the two indicators have been interrelated.

Figure 1. The evolution of the capital intensive imports and exports after eliminating the trend component

Source: Computed based on data provided by the Romanian Ministry of Economy, Trade and Business Environment, http://www.dce.gov.ro/.
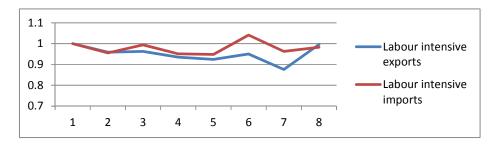
The same observation can be drawn after studying the following figures, representing the evolution of imports and exports after subtracting the trend component.

Figure 2. The evolution of the labour intensive imports and exports after eliminating the trend component

Source: Computed based on data provided by the Romanian Ministry of Economy, Trade and Business Environment, http://www.dce.gov.ro/.

This result supports the notion that the Romanian intra-industry trade has amplified in the last years, providing a good starting ground for testing the Linder theorem.

The second part of the analysis is constructed around the testing of the Linder theorem for Romanian commerce, by calculating and subsequently studying the correlation coefficient inherent to the relation between trade and income similarity. The database constructed for this undertaking incorporates the exports and imports of Romania to and from its main commercial partners, their GDP per capita and the calculated variation between this last indicator and the GDP per capita of Romania. The data is structured as a cross section, the years on which the analysis is focused, 2006 and 2007, representing the pre-crisis commerce, and afterwards, 2009 and 2010, representing the commerce during the crisis. Thus, the changes and shocks brought forward by the onset of the financial crisis would not bias the results of the trade study. The data corresponds to 38 observations for each year, corresponding to the main commercial partners of Romania, their selection and hierarchy being computed based on volume of trade, steadiness of the relation, availability of data and lack of events that would undermine the credibility of the data (Serbia and Georgia have not been included, due to relatively recent military upheaval and the subsequent lack of data).

As a necessary step to test the direct applicability of the Linder hypothesis on the international trade formation of Romania, the correlation coefficient has to be calculated among the trade flows and the similarity of income (represented by the absolute value of the variation in GDP per capita between Romania and each of its main trading partners). For the four years included in the data, the correlation coefficient resulted at 0.02, 0.01, 0.03 and -0.025 respectively, pointing to a very low relation existing between the two variables. Thus, as far as linking the commerce values to the GDP per capita, the Linder hypothesis does not apply to the Romanian foreign trade before or during the recent financial crisis.

Table 3. Correlation between the trade flows and the differences in income registered by Romania in relation to its main economic partners

2006	Trade	Income
Trade	1	
Income	0.021116	1
2007	Trade	Income
Trade	1	
Income	0.012521	1
2009	Trade	Income
Trade	1	
Income	0.038496	1
2010	Trade	Income
Trade	1	
Income	-0.025	1

Source: Computed based on data provided by the Romanian Ministry of Economy, Trade and Business environment, http://www.dce.gov.ro/ and the data provided by the WB, http://data.worldbank.org/indicator.

4. Conclusions

The theorem expressed by Linder could help predict trade in certain situations and under very different restrictions. However, in the case of Romania, the conditions ushered in by the integration into the European Union, the relative proximity of some of the largest and most dynamic markets in the world while at the same time the presence and influence in the region of one of the most important gas and oil exporters work together to create a distinct economic space, for which previous theories have to acclimatize and ultimately evolve.

Thus, one can interpret that other, stronger forces play a more crucial role in determining the direction and the volume of trade for certain countries.

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