COMPARATIVE ADVANTAGE AND UNCERTAINTY IN THE INTERNATIONAL TRADE OF MEDITERRANEAN AGRICULTURAL PRODUCTS: AN EMPIRICAL ANALYSIS

ILIAS P. VLACHOS (*)

ABSTRACT

This study applied the indicators of uncertainty on the international trade of agricultural products. Proxies of uncertainty were developed using the long-term variability of two comparative advantage indicators: the Revealed Symmetric Comparative Advantage index (RSCA) and the Revealed Competitiveness Index (RC). Variability was calculated as the coefficient of variation (CV) for both RSCA and RC indices for Mediterranean basin countries over the period 1982-1997. The CV of RSCA was defined as Revealed Export Uncertainty (RXU) and the CV of RC index was defined Revealed Trade Uncertainty (RTU). Results indicate that, given certain limitations, both RXU and RTU can be used as proxies of uncertainty. Referring to Mediterranean states, RXU and RTU produced striking results of the export performance in contrast to RSCA and RC indices which exhibited low interpretability. Uncertainty indices appear to better depict the comparative position of Mediterranean basin countries.

RESUMÉ


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INTRODUCTION

International competitiveness is more often than not defined in terms of trade deficit, national productivity growth, and the sectoral decomposition of output and their determinants. However, there is considerable confusion on what is meant by the term competitiveness, particularly when it refers to a country. Haque (1995) defined international competitiveness as the ability of a country to produce goods and services that meet the demand of international markets, and simultaneously maintain and expand the real incomes of its citizens. This definition suggests that when the unit of measurement is the county, indices of competitiveness based on trade only depict the half picture of a country’s competitiveness. At the same time, the definition indirectly relates competitiveness to a government’s policy in creating the conditions to make trade more competitive, e.g. by giving export incentives, or signing international trade agreements. It is this governmental intervention which makes the measurement of competitiveness more difficult to achieve. Furthermore, this level of measurement might not reflect the competitiveness in industrial sectors such as food, where changes in the balance of trade and/or performance of the firms in the sector might determine competitiveness (Traill and Silva, 1996). For example, European Commission (1994) defines competitiveness as: “the capacity of businesses, industries regions, nations to obtain a relatively high return on the factors of production and relatively high employment levels on a sustainable basis”.

The principle of comparative advantage provides an explanation of specialization and gains from trade. Comparative advantage also provides a base to yield predictions about the direction and the terms of trade (Goldin, 1990). Ricardo was the first to advocate the notion of comparative advantage as a determinant of international trade in an attempt to explain why Portu­
guese exported wine and Britain cloth. However, according to Ricardo’s theory, comparative advantage is confined to labour productivity thus, only one factor of production is considered. According to the Heckscher-Ohlin principle, countries that are rich in certain factors will export goods that make use of those abundant factors intensively. In other words, the Heckscher-Ohlin principle states that comparative advantage arises from the different relative factor endowments of a country’s trading.

Haberler (1976, p. 4) remarked that “no sophisticated theory is necessary to explain why Kuwait exports oil, Bolivia tin, Brazil coffee and Portugal wine”, suggesting that “natural resources” determine trade patterns. Thus, natural resource trade reflects a country’s comparative advantage.

Based on the above theories, it can be assumed that trade is a proxy for comparative advantage. The assumption is based on the argument that if a country is specializing in and exporting something in a competitive market economy, this must be its comparative ad­
vantage sector (Kilkenny and Nalbarte, 2000). It can be further assumed that a country with a comparative advantage sector would struggle to create everything but uncertainty and vulnerability in the sector, conditions that might result to declining exports.

MEASURES OF COMPARATIVE ADVANTAGE

Amongst the measures of comparative advantage, net exports (exports plus imports), export growth, and the export market share can be easily computed. The Export Market Share (XMS) index is calculated as:

\[ X_{j} = 100 \times \left( \frac{X_{ij}}{X_{iw}} \right) \]  

where: \( X_{j} \) is Export Market Share of country j; \( X_{ij} \) is the value of country's y exports of product i; \( X_{iw} \) is the value of total world exports of product i.

However, XMS and its homologous indices are biased to the extent to which exports may fluctuate due to an unexpected increase (decrease) in prices, or due to a currency devaluation which will make products very attractive in the foreign markets. In such cases, XMS might not measure the comparative advantage of a specific product but the short-term attractiveness of a country's exports.

Balassa (1965) was the first to develop an index in order to "reveal" comparative advantage using export performance ratios. The index, which will be called Export-Revealed Comparative Advantage (XRCA), is a ratio with numerator a country's share of exports of a particular product to its total exports and denominator the commodity's share to world exports. Hence, XRCA is calculated by the formula:

\[ XRCA_{ij} = \frac{X_{ij}}{X_{iw}} \]  

where \( X_{ij} \) is the exports of country j of product i; \( X_{ij} \) is the sum of exports of country j; \( X_{iw} \) is the world exports of product i; \( X_{iw} \) is the World Total Exports.

The XRCA ranges between zero and unity in case a country is not specialised in exports and from one to infinity if it is specialised. Therefore, the index is static and asymmetric.

The export shares that comprise the RCA ratio are influenced by trade interventions such as protectionist barriers in export markets and anti-export bias in domestic trade policy that impose a certain bias on the reliability of the index. Particularly, the bias can be considerable when referring to agricultural trade because of the widespread application of such policy measures in international trade. Therefore, the XRCA index is more likely to depict reality better where computed for processed goods or manufactures where trade interventions to free liberation occur less frequently.

There are a number of variations to the above RCA index. For example, variations of this index can be developed by altering the denominator of the ratio substituting world by a specific group of countries (e.g. the industrial countries, OECD, Mediterranean countries, etc.). Balassa (1965) again suggested RCA indices that took into account changes in the export performance ratio over time and in order to arrive at a dynamic measure of comparative advantage. Laursen (1998) calculated the so-called symmetric RCA (RSCA) in order to overcome difficulties of using RCA values in statistical models. RSCA is given by the formula:

\[ RSCA_{ij} = \frac{1 - XRCA_{ij}}{1 + XRCA_{ij}} \]  

Laursen (1998) found that RSCA is, on balance, better than other indices. RSCA take values from \(-1\) (when XRCA tends to infinite, which indicates absolute export advantage) to \(+1\) (when XRCA is zero and exports are minimal).

Another approach to measure comparative advantage is the so-called "export-import" RCA (EIRCA), which is defined as a country's ratio of exports to imports of a particular commodity to the ratio of world exports to world imports of that commodity. In EIRCA index, a value greater than one indicates a comparative advantage.

Vollrath and Vo (1988) developed the "revealed competitiveness" (RC) index which incorporates both imports and exports. The RC is given by the formula:

\[ RC_{ij} = \frac{X_{ij}}{X_{iw}} - \frac{M_{ij}}{M_{iw}} \]  

or

\[ RC_{ij} = XRCA - \frac{M_{ij}}{M_{iw}} \]  

where \( X_{ij} \) is the exports of country j of product i; \( X_{ij} \) is the sum of exports of country j; \( X_{iw} \) is the world exports of product i; \( X_{iw} \) is the World Total Exports; \( M_{ij} \) is the imports of country j of product i; \( M_{ij} \) is the sum of imports of country j; \( M_{iw} \) is the world imports of product i; \( M_{iw} \) is the World Total Imports.

DISCUSSION OF COMPARATIVE ADVANTAGE INDICES

It is evident from the above discussion that the empiri-
cal measures of comparative advantage share some common characteristics:

- First, the variable of comparative advantage should be defined and measured in relative terms. This is consistent with Ricardian and Heckscher-Ohlin models of international trade. A country's comparative advantage has to be measured in relation to the performance of another group of countries, being either the world or a super national association to which the country shares some common characteristics (e.g., the European Union or OECD countries, etc.). For example, XRCA relates to a country’s exports to the world exports.

- Second, measures of comparative advantage are heavily dependent on the availability of data, which usually refer to export and import values and quantities. Based on the available data, a sufficient number of studies have laid the foundations for the statistical measures of comparative advantage (i.e., Haley, 1987; Perkins, 1987; Vollrath, 1987; and, Vollrath and Vo, 1988).

- Third, although comparative advantage is considered a dynamic concept, common measures of comparative advantage can only capture static instances of its evolution.

- Fourth, indicators are ex-post measures of comparative advantage. They are based on empirical data of past performance to reveal current and future performances.

**Revealed Uncertainty**

There is a pronounced overt relationship between comparative advantage and trade uncertainty. Stilwell (2000) acknowledged this adverse relationship between comparative advantage and uncertainty in a straightforward manner by entitling his study as: “Dollar Down: Uncertainty Up”. If a government’s aim is to promote international trade, one way of achieving is by sustaining the country’s comparative advantages, thus reducing uncertainty about them. For example, Ibarra (1992) found that international trading agreements have reduced the severity of uncertainty.

There is consensus that uncertainty has a negative impact on a country’s critical macroeconomic indicators. Palkhiwala (1993) found that export instability has proven to be detrimental to the economic development efforts of developing countries. Abbasi (1991) found that uncertainty associated with fluctuations in oil export earnings affect adversely the economic growth in the oil-based economies of the Middle East, through the negative effect on investment, government expenditures and domestic output. Smets (1993) and Wei (1997) found that uncertainty substantially delays and reduces foreign direct investment. Gallagher (1998) found that trade uncertainty adversely affects marketing firms and commodity trade, thus its reduction would result in improving world welfare. Ghirmay (1997) examined empirically the long-term and short-term relationships between exports and economic growth in a sample of 30 developed and developing countries and found some indications that export instability may have negative effects in developing countries by creating uncertainty in their capacity to import capital goods and intermediate inputs. Marrewijk and Bergeijk (1993) reported an even more dramatic consequence of uncertainty in international trade, an adverse specialisation of a small economy in the production of the goods in which it has a comparative disadvantage.

However, there is no consensus in the literature on how to measure uncertainty. Standard deviations and coefficients of variation are often used in order to measure volatility which appears to unveil uncertainty. For example, Edison and Melvin (1990) reviewed the literature on the impact of volatility of exchange rate on trade. The majority of proxies of volatility were the standard deviations of corresponding variables. The General AutoRegressive Conditional Heteroskedastic (GARCH) model, which is based on the assumption that the variance of the error terms is not constant over time, is an alternative to construct uncertainty proxies. For the purpose of this study, it was assumed that the volatility in a country's comparative advantage reveals its trade uncertainty. Therefore, coefficients of variation of the RCA indices were used as proxies of trade uncertainty. Two such proxies were calculated: the Revealed Trade Uncertainty (RTU) and the Revealed Export Uncertainty (RXU) based on the values of the variables RC and XRCA respectively. The CV was preferred than standard deviation for its power to compare the variability of two or more distributions when figures are of quite different orders of magnitude. For example, Yanagida and Tian (1996) used coefficient of variation to pinpoint countries with relatively stable RCA and RC indices. The RTU was calculated using the absolute values of RC in order to arrive at comparative figures. The coefficient of variation (CV) is given by the formula:

\[ CV = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100 \]  

Furthermore, as countries exported a variable number of products, the coefficients of variation were adjusted to this variable. Both RCA and RC indices were calculated using available data from FAO database. RCA index was calculated using formula (3) and RC index using the formula (6), respectively. Products with export values less than US $1,000 for the last two years (1996 and 1997) were
excluded from the analysis in order to facilitate computation tasks.

The ratio CV over the number of products was considered a better estimation of a country’s volatility, since the volatility in the comparative advantage of a single product or a product category would not signify a country’s overall trade uncertainty. Therefore, the Revealed Export Uncertainty index (RXU) was calculated as:

\[
RXU_j = \frac{\sum_{i=1}^{n} CV_{RSCA_{ij}}}{n}
\]

where RXU\(_j\) is the Revealed Export Uncertainty index of country j; CV the coefficient of variation of the index RSCA\(_j\); n the number of products exported from country j. RXU, like CV, takes values from zero (0), which indicates an absolutely certain, stable trade environment to 100% or more, which indicates high levels of exports uncertainty.

RXU was calculated as the volatility of a country’s comparative advantage, expressed by the RSCA index. Volatility in a country’s comparative advantage can be considered to indicate uncertainty in exports. For example, significant fluctuations of the RSCA index indicate instability of exports, which, to a large extent, might be attributed to an ineffective export policy. As a result, exports instability will be reflected with high values of RXU.

The Revealed Trade Uncertainty (RTU) was calculated as:

\[
RTU_j = \frac{\sum_{i=1}^{n} CV_{RCC_{ij}}}{n}
\]

where RTU\(_j\) is the Revealed Trade Uncertainty index of country j; CV the coefficient of variation of the index RCC\(_j\); n the number of products traded (imported/exported) from country j. RTU, like RXU, takes values from zero (0), which indicates no uncertainty in trade, to 100% or more, which indicates complete uncertainty in trade.

RTU is calculated as the volatility of a country’s trade competitiveness, which indicates trade uncertainty. RTU is based on the variability of RC index which incorporates imports as well exports in order to arrive at a better estimation of a country’s competitiveness.

Values of RTU and RXU were calculated for every country of the Mediterranean basin for the period 1982-1997. Having calculated RXU and RTU, it was able to rank countries according to their degree of trade uncertainty.

**RESULTS**

**Table 2** presents the export value for the Total of Agri-cultural products for the Mediterranean countries. France is by far the most export-oriented Mediterranean country with about 40 billion US $ value in 1997 followed by Italy and Spain (15 bn). Turkey is the only non-European Union (non-EU) state with export value comparative to EU countries and well above Greek and Portuguese export value. EU states and Turkey show a steady increase of their export value for the sum of agricultural products (Figure 1). Syria, Morocco, Cyprus, and the rest Mediterranean countries follow with less

![Figure 1 - Export Value of Total of Agricultural Products from EU Mediterranean countries: Value in million US dollars during the period 1982-1997.](image-url)
Based on the values of RC index, Cyprus presents the
highest revealed competitiveness among Mediterranean
countries (Table 5). Greece and Turkey follow Cyprus
with their RC values being at 1.58 and 1.42, in 1997,
respectively. Spain and France have lower but positive RC

significant exports (Table 2).

The XRCA, RSA, and RC values for the total of agricul-
tural products of all Mediterranean countries are shown
by Table 3, Table 4 and Table 5, respectively. As
shown in the values of XRCA for Cyprus are well about
the threshold of one (1) which indicates export special-
isation. The same stands true for about half of the
countries studied (Greece, Syria, Lebanon, Turkey, Morocco,
Spain, France, and Egypt, subsequently). Italy and Por-
tugal appear to have an export comparative disadvantage,
since their XRCA values were between 0.6 and 0.8
for the entire period 1982-1997 (Figure 2). RSA values
reveal the same picture as this index is based on XRCA
values (formula 3).

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with their RC values being at 1.58 and 1.42, in 1997,
respectively. Spain and France have lower but positive RC

![Figure 2 - XRCA Index of EU Mediterranean States for Total Agricultural Products: 1982-1997.](image)
Table 4: RSICA index of Total Agricultural Products: Mediterranean countries during the period 1982-1997.

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Note: Countries are ranked by RSICA index in 1997.

The values which indicate that these countries are competitive in trading agricultural products. On the contrary, Italy and Portugal appear to be less competitive, as their RC values were below zero for the entire period from 1982 to 1997 (Figure 3). From Figure 2 and Figure 3, it can be observed that XRC and RC indices produced the same rank of EU states. This is confirmed by Figure 4 which plots EU states according to their indices of XRC and RC for the total of agricultural products in 1997. Greece presents the highest values of both XRC and RC indices followed by Spain and France, while Italy and Portugal lag behind particularly regarding RC index.

Table 5 presents the ranking of Mediterranean countries according to their RXU and RTU indices. Countries in Table 5 are ordered by their RTU rank. Table 5 also presents the sum of the coefficients of variation for XR-
As shown by Table 6, the rank obtained using uncertainty indicators contrast previous rank based on XRCA and RC indices. Particularly, Spain was the Mediterranean country with the least uncertain agricultural trade given its low RTU value (0.07), a value that placed it in the 12th world position. Turkey and Italy followed with RTU values of 0.10 and 0.12 respectively. France, followed by Italy, showed the less uncertain agricultural exports with values of 0.49 and 0.68 respectively. In sharp contrast to XRCA and RC values, Greece exhibited high values of both export and trade uncertainty elements. Figure 5 plots the Mediterranean countries according to their world ranking on RXU and RTU indices. As can be seen by Figure 5, which also plots world uncertainty, Italy appeared to be in most secure position in terms of export and trade uncertainty, followed by Spain which has a little more volatile advantage in exports. France, although it presented the least volatile export advantage among Mediterranean countries, its high RTU value indicates instability in trade of agricultural products, which can be attributed to volatile imports.

**DISCUSSION**

Trade and export performance have been used as plausible indicators of competitiveness. Balassa (1965) was the first to develop the revealed comparative advantage index (RCA), which can be a proxy of a country's competitiveness. However, the initial export-performance formula (1) suffers from methodological limitations, the Revealed Symmetric Comparative Advantage index (RSCA) was developed as a better indicator of comparative advantage. Vollrath and Vo (1988) developed the Revealed Competitiveness index (RC), which is similar to GL index of intra-industry trade, incorporating equally import and export figures. In this way, the RC index divulges a country's trade pattern better than indices exclusively based on exports. Nevertheless, both RCA and RC indices suffer from threats to their validity and reliability stemming from the distortions in trade as imposed from governmental interventions, protectionism policies, etc.

Uncertainty can be considered an alternative proxy of comparative advantage since, as every policymaker would tell, it generates detrimental predictions of a country's course of trade. The long-term variability of revealed comparative advantage was used to develop indices of international trade uncertainty. Two such indices were developed: (a) the revealed Export Uncer-
tainty (RXU) and (b) the revealed Export Uncertainty (RTU). RXU was based on the CV of RSCA index, thus it was assumed to indicate export uncertainty and RTU was based on the CV of RC index, indicating trade uncertainty.

The values of XRCA and RC indices of total agricultural products present Greece the most competitive country in the Mediterranean basin, with the rest EU states to lag considerably behind. France and Italy appear to be less competitive than Greece even Cyprus. On the other hand, Spain and Portugal seem to have export disadvantage and comparative disadvantage in trading agricultural products a performance comparable to what Morocco, Malta, Tunisia, and Jordan have achieved with far less export volume.

Uncertainty indices give a more anticipated picture. Particularly, based on the RXU and RTU values, it is demonstrated that Italy has developed a stable comparative advantage which is revealed by low uncertainty terms, lower than world standards. In sharp contrast, Greek trade face considerable uncertainty in both export and overall trade terms. As a consequence, Greece, along with Syria, Egypt, and Cyprus which display similar RTU and RXU values, occupy the less favoured positions in the international trade of agricultural products amongst Mediterranean basin states.

Certain limitations constrain the interpretability of the RXU and RTU indicators. Particularly, XRCA and RC indices may produce unreliable results to the extent that trade distortions are imposed. However, the computation of uncertainty indicators over a significant number of products relaxes this reliability bias. Furthermore, it can be argued that RXU and RTU indices reveal the impact of policy intervention as one of policy objectives it to reduce uncertainty. Data availability and validity also restricts the interpretability of RXU and RTU indices.

Further research is needed in order to examine whether indicators of uncertainty could be developed using other methods like GARC and/or using other indicators of comparative advantage. Moreover, the indices of uncertainty could be tested as predictors of trade performance since uncertainty is assumed to irreversibly relate to comparative advantage.

References


